Llywodraeth Cymru
Welsh Government

Welsh National Marine Plan

Habitats Regulations Assessment

October 2017

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amec foster wheeler

Report for

Welsh Government
Cathays Park
Cardiff
CF10 3NQ

Main contributors

Mike Frost

Issued by



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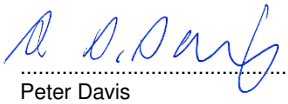
Mike Frost

Approved by



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Peter Davis

Amec Foster Wheeler

Canon Court
Abbey Lawn
Abbey Foregate
Shrewsbury SY2 5DE
United Kingdom
Tel +44 (0) 1743 342 000

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Document revisions

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Executive Summary

The Welsh National Marine Plan (WNMP)

The Welsh National Marine Plan (WNMP) is currently being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA)[1]. The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales. Plans for both regions will be presented in a single document, the WNMP.

Building on the UK Marine Policy Statement[2] (UK MPS), the WNMP will enable the Welsh Government to plan for, and guide, the management of marine activities in a sustainable way; integrating economic, social and environmental considerations and engaging with communities to help shape the future of the plan area. As part of the preparation of the WNMP, consultation is being undertaken on a draft marine plan (the WNMP).

Habitats Regulations Assessment

Regulation 61 of the Conservation of Habitats and Species Regulations 2010 (as amended) (the 'Habitats Regulations') states that if a plan or project "*(a) is likely to have a significant effect on a European site[3] or a European offshore marine site[4] (either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of the site*" then the plan-making authority must "*…make an appropriate assessment of the implications for the site in view of that site's conservation objectives*" before the plan is given effect. The process by which Regulation 61 is met is known as Habitats Regulations Assessment (HRA)[5]. An HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of a plan's implementation (either on its own or 'in combination' with other plans or projects) and, if so, whether these effects will result in any adverse effects on the site's integrity. Regulation 25 of *Offshore Marine Regulations 2007* applies the same provisions to "*…any consent, permission or other authorisation for, a plan or project which…is to be carried out on or in any part of the waters or on or in any part of the seabed or subsoil comprising the offshore marine area, or on or in relation to an offshore marine installation…*"

This report enables the Welsh Government to meet its obligations under the Habitats Regulations. It documents the assessment of the WNMP against the requirements of the Habitats Regulations, summarising the HRA process and its application to the WNMP, and detailing the results of the assessment.

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[1] HM Government (2009) *Marine and Coastal Access Act 2009*. Available from http://www.legislation.gov.uk/ukpga/2009/23/pdfs/ukpga_20090023_en.pdf [Accessed December 2016].

[2] HM Government (2011) *UK Marine Policy Statement*. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf [Accessed December 2016].

[3] Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the UK Government. However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the 'new wild birds directive') apply; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied as a matter of UK Government policy when considering development proposals that may affect them. "European site" is therefore used in this report in its broadest sense, as an umbrella term for all of the above designated sites (it therefore covers both terrestrial sites and areas that would be defined as 'European Marine Sites' under the Regulations).

[4] 'European offshore marine sites' are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters over 12 nautical miles from the coast.

[5] The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more usually termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process; see also Box 1.

HRA of the WNMP

The key components of the WNMP, from an HRA perspective, are as follows:

- **The General Cross-cutting Policies**: cross-cutting policies that support the delivery of the plan objectives, and which include various protective policies; these policies have no spatial component (beyond applying to the WNMP area).
- **The Sector Policies**: sector-specific policies that will apply to, or inform, decisions related to particular activities e.g. aggregates, dredging, fishing and aquaculture. These policies are broadly categorised as either 'supporting policies' (which encourage the submission of proposals for particular activities) or 'safeguarding' policies (which aim to prevent conflicts between activities). The policies have a clear spatial component where they relate to Strategic Resource Areas (SRAs).
- **The Supporting Maps**, which identify Resource Areas (RAs) and SRAs to which sector policies will apply.

These are the aspects that are most likely to influence or in some way guide future activities in marine areas and hence determine the overall effects of the WNMP with regard to European sites.

Essentially, therefore, the WNMP suggests broad areas that are thought to have the greatest potential to support the growth of a particular sector (the SRAs); provides policies that safeguard those areas from sterilisation by inappropriate activities; and supports the submission of proposals for appropriate activities within the SRAs that meet the requirements of the plan (including the protective requirements set out by the general cross-cutting policies, for example the protection of European sites), as well as wider statutory processes and requirements. However, the WNMP does not:

- identify or support specific schemes;
- dictate where certain activities or schemes should go; or
- preclude activities or schemes outside of the SRAs.

There is little specific guidance on the application of HRA to high-level national plans and policy documents, particularly as many high-level policy documents are excluded from the HRA process[6]; the HRA of the WNMP is therefore based on case-practice established through the HRAs of similar national-level policy documents. It involves screening both the policies and the relevant European sites (as far as achievable at this level). Appropriate assessment is completed where spatially-specific outcomes are identified and effects are uncertain.

The approach involves the following steps:

i. Review the intended plan outcomes to identify a reasonable 'zone of influence' for the plan and the potential mechanisms or pathways by which European sites or interest features could be affected.

ii. Identify those European sites and features that are potentially vulnerable (i.e. both exposed and sensitive) to the likely outcomes of the plan (i.e. those sites within or near the marine plan area; or mobile interest features that may utilise the marine plan area during their life-cycle), and those sites that will not or cannot (based on available information) be affected by the plan outcomes.

iii. Identify those WNMP sectors and policies that should be excluded from more detailed examination within the HRA of the WNMP, for example because:

[6] EC guidance on the application of Article 6(3) (*Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive 92/43/EEC* (EC, 2000) states that "…*a distinction needs to be made with 'plans' which are in the nature of policy statements, i.e. policy documents which show the general political will or intention of a ministry or lower authority. An example might be a general plan for sustainable development across a Member State's territory or a region. It does not seem appropriate to treat these as 'plans' for the purpose of Article 6(3), particularly if any initiatives deriving from such policy statements must pass through the intermediary of a landuse or sectoral plan. However, where the link between the content of such an initiative and likely significant effects on a Natura 2000 site is very clear and direct, Article 6(3) should be applied.*"

- they cannot have an effect or a negative effect (e.g. don't promote a change; protective policies; etc); or
- they provide no additional clarity on the location, scale etc. of future development (essentially, sectors or aspects with no SRAs), where the assessment must be deferred to a lower tier; or
- they reflect or incorporate external plans or programmes that have been subject to HRA (e.g. oil and gas licensing).

iv. Review the plan policies and sectors to ensure that those that are excluded from more detailed examination are suitably drafted and that significant or significant adverse effects are avoidable for schemes that benefit from policy support.

v. Assess the potential for 'screened in' sectors and policies (principally those with spatial components) to adversely affect 'screened in' European sites, as far as achievable at the strategy-level (appropriate assessment). This is completed in sector-specific chapters which incorporate policy reviews to ensure that any recommended changes suitably reflect the assessment conclusions.

The specific methods, criteria and protocols used for the screening the European sites and policies are set out in Sections 4 and 5. Sections 6 – 10 then provide appropriate assessments of the potential effects of specific sectors that are not excluded by the screening process.

Screening of European Sites

Most environmental assessments employ source-pathway-receptor models (or similar) to identify potential environmental changes and the risk of consequent effects on ecological receptors. Due to the scope of the WNMP, and the absence of specific schemes (etc.), it is appropriate to adopt a broad approach to the identification of potential sources and pathways, and hence likely effect on European sites and features. As a result, this HRA uses the JNCC's *Marine activities and pressures evidence* database (JNCC 2016) as a basis for the identification of potential effect pathways. This provides:

- a standard UK list of marine activities and their definitions; and
- a list of marine pressures and their definitions (as agreed by the OSPAR Intercessional Correspondence Group on Cumulative Effects).

The activities and pressures identified by the JNCC are summarised in **Tables 4.1** and **4.2**; a summary matrix is provided in **Appendix F**, which shows which pressures may occur as a result of specific activities. The standard activity and pressure definitions (from JNCC) are provided in **Appendix F**.

The screening process for European sites uses the JNCC pressure and applies a set of criteria to identify those sites and interest features that **will not** be affected by the WNMP outcomes (i.e. no significant effects). Essentially, a suitably precautionary 'zone of environmental influence' is defined for the activities supported by the WNMP, based on a broad range of existing case studies and examples from delivered projects, where environmental changes are possible as a result of the plan. Interest features are considered to be potentially exposed to the effects of the WNMP (as a whole) if they coincide with this estimated zone of influence. Additional screening is undertaken where particular sectors with defined SRAs are taken forward for assessment.

In summary, the following features (and their corresponding sites) were screened in to the assessment:

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Interest feature groups that coincide with, or potentially use or transit the zone of influence

Feature Group	Interest features screened into assessment
Terrestrial habitats within 2km	See Appendix B – note, the terrestrial features within the 'zone of influence' are not listed here as (unlike marine habitats) they will not be systematically exposed to the outcomes of the WNMP (i.e. any effects are likely to be secondary or 'in combination' effects associated with specific projects which are not defined at this level).
Subtidal and intertidal habitats	Sandbanks which are slightly covered by sea water all the time Estuaries Mudflats and sandflats not covered by seawater at low tide Large shallow inlets and bays Reefs Submarine structures made by leaking gases Salicornia and other annuals colonizing mud and sand *Spartina* swards (*Spartinion maritimae)* Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* Submerged or partially submerged sea caves Plus marine aspects of Ramsar criteria: Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path
Coastal and supralittoral habitats	Coastal lagoons Annual vegetation of drift lines Perennial vegetation of stony banks Vegetated sea cliffs of the Atlantic and Baltic Coasts Mediterranean and thermo-Atlantic *halophilous* scrubs (*Sarcocornetea fruticosi)* Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Fixed coastal dunes with herbaceous vegetation ("grey dunes") Atlantic decalcified fixed dunes (*Calluno-Ulicetea)* Dunes with *Hippopha rhamnoides* Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)* Humid dune slacks Coastal dunes with *Juniperus* spp. Petalwort *Petalophyllum ralfsii* Shore dock *Rumex rupestris*
Bats	Lesser horseshoe bat *Rhinolophus hipposideros* Greater horseshoe bat *Rhinolophus ferrumequinum* Barbastelle *Barbastella barbastellus* Bechstein`s bat *Myotis bechsteini*
Marine mammals	Bottlenose dolphin *Tursiops truncatus* Harbour porpoise *Phocoena phocoena* Otter *Lutra lutra* Grey seal *Halichoerus grypus* Common seal *Phoca vitulina*
Diadromous fish (plus freshwater pearl mussel)	Atlantic salmon *Salmo salar* Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Freshwater pearl mussel *Margaritifera margaritifera* Twaite shad *Alosa fallax*

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Feature Group	Interest features screened into assessment
Pelagic seabirds (breeding and wintering)	Northern fulmar *Fulmarus glacialis* Manx shearwater *Puffinus puffinus* European storm-petrel *Hydrobates pelagicus* Leach's storm-petrel *Oceanodroma leucorhoa* Northern gannet *Morus bassanus* Great cormorant *Phalacrocorax carbo* European shag *Phalacrocorax aristotelis* Black (common) scoter *Melanitta nigra* Velvet scoter *Melanitta fusca* Arctic skua *Stercorarius parasiticus* Great skua *Catharacta skua* Mediterranean gull *Larus melanocephalus* Little gull *Larus minutus* Black-headed gull *Larus ridibundus* Mew gull *Larus canus* Lesser black-backed gull *Larus fuscus* Herring gull *Larus argentatus* Great black-backed gull *Larus marinus* Black-legged kittiwake *Rissa tridactyla* Sandwich tern *Sterna sandvicensis* Roseate tern *Sterna dougallii* Common tern *Sterna hirundo* Arctic tern *Sterna paradisaea* Little tern *Sterna albifrons* Common guillemot *Uria aalge* Razorbill *Alca torda* Atlantic puffin *Fratercula arctica* Red-throated diver *Gavia stellata*

Feature Group	Interest features screened into assessment
Wildfowl and waders (breeding and wintering)	Black-throated diver *Gavia arctica* Great crested grebe *Podiceps cristatus* Slavonian grebe *Podiceps auritus* Great bittern *Botaurus stellaris* Little egret *Egretta garzetta* Mute swan *Cygnus olor* Tundra swan *Cygnus columbianus bewickii* Whooper swan *Cygnus cygnus* Taiga bean goose *Anser fabalis fabalis* Pink-footed goose *Anser brachyrhynchus* Greylag goose *Anser anser* [Iceland/UK/Ireland] Greylag goose *Anser anser* [North-western Scotland] Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland] Common shelduck *Tadorna tadorna* Eurasian wigeon *Anas penelope* Gadwall *Anas strepera* Eurasian teal *Anas crecca* Mallard *Anas platyrhynchos* Northern pintail *Anas acuta* Garganey *Anas querquedula* Northern shoveler *Anas clypeata* Common pochard *Aythya ferina* Tufted duck *Aythya fuligula* Greater scaup *Aythya marila* Common eider *Somateria mollissima* Long-tailed duck *Clangula hyemalis* Common goldeneye *Bucephala clangula* Red-breasted *merganser Mergus serrator* Goosander *Mergus merganser* Spotted crake *Porzana porzana* Corn crake *Crex crex* Common coot *Fulica atra* Eurasian oystercatcher *Haematopus ostralegus* Pied avocet *Recurvirostra avosetta* Ringed plover *Charadrius hiaticula* Eurasian dotterel *Charadrius morinellus* European golden plover *Pluvialis apricaria* Grey plover *Pluvialis squatarola* Northern lapwing *Vanellus vanellus* Red knot *Calidris canutus* Sanderling *Calidris alba* Purple sandpiper *Calidris maritima* Ruff *Philomachus pugnax* Common snipe *Gallinago gallinago* Bar-tailed godwit *Limosa lapponica* Whimbrel *Numenius phaeopus* Eurasian curlew *Numenius arquata* Common redshank *Tringa totanus* Common greenshank *Tringa nebularia* Wood sandpiper *Tringa glareola* Ruddy turnstone *Arenaria interpres* Red-necked phalarope *Phalaropus lobatus* Greater white-fronted goose *Anser albifrons albifrons* Greenland white-fronted goose *Anser albifrons flavirostris* Dunlin *Calidris alpina schinzii* Black-tailed godwit *Limosa limosa limosa* Black-tailed godwit *Limosa limosa islandica* red knot *Calidris canutus islandica* Dunlin *Calidris alpina alpina* Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland] Dark-bellied brent goose *Branta bernicla bernicla* **Ramsar criteria**: Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity Crit. 5 - regularly supports 20,000 or more waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
'Typical species'	All species not identified above which may be associated with specific site habitats.

Policy Screening

The screening test (as applied to policies) segregates 'no significant effect' policies from policies where effects are uncertain or likely to be significant, so that the latter can be considered in detail through appropriate assessment.

When considering the likely effects of a policy, it is recognised that

- some policy 'types' cannot result in negative impacts on any European sites (e.g. a policy advocating the protection of European sites); and
- that some policies or plan aspects should not or cannot be assessed by the HRA of the plan within which they sit (even though a theoretical effect pathway exists) as there is no practical way of completing a meaningful assessment (i.e. they are 'screened in' but assessment must be deferred to a lower tier).

Different guidance documents suggest various classification and referencing systems to help identify the types of policy that can be 'screened out', although the general characteristics are summarised below.

Policy 'types' that can typically be screened out

Broad Policy Type	Notes
General statements of policy / aspiration	The European Commission recognises* that plans or plan components that are general statements of policy or political aspirations cannot have significant effects; for example, general commitments to sustainable development or support for renewable energy (i.e. the policies have no spatially definable components (below the scale of the plan itself) and do not direct, influence or clarify the nature and location of activities).
General design / guidance criteria or policies that cannot lead to or trigger development	A general 'criteria based' policy expresses the tests or expectations of the plan-making body when it comes to consider proposals, or relates to design or other qualitative criteria which do not themselves lead to development (e.g. controls on design); however, policies with criteria relating to specific proposals or allocations should not be screened out. With regard to the WNMP, 'safeguarding' policies are considered in this category as although they help provide a framework for the supportive policies to function they do not themselves support or trigger development.
External plans / projects subject to HRA	Plans or projects that are proposed or defined by other plans subject to HRA (e.g. Sectoral Plans such as the Round 3 Offshore Windfarm leasing), which are referred to for completeness, and where the assessed plan does not provide greater clarity on the delivery of the proposals. For example, offshore oil and gas licensing is driven by a separate planning and consenting process, itself subject to HRA, which the WNMP reflects; however, the WNMP does not provide direction, influence or further clarity on the nature and location of these activities.
Environmental protection policies	Policies designed to protect the natural or built environment will not usually have signifcant or adverse effects (although they may often require modification if relied on to provide sufficient safeguards for other policies).
Policies which could have no conceivable effect	Policies or proposals which cannot affect a European site (no impact pathways and hence no effect; for example, proposals for new cycle path several kilometres from the nearest European site) or which cannot undermine the conservation objectives, either alone or in combination, if impact pathways exist (no significant effect).

* EC, 2000, Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC April 2000 at 4.3.2

In summary, all of the **general cross-cutting policies** in the WNMP are considered to be 'no significant effect' policies as they are invariably 'General statements of policy / aspiration', 'General design / guidance criteria or policies that cannot lead to or trigger development' or 'Environmental protection policies'.

With regard to the **sector policies,** the policies were reviewed in the context of the objectives for the sector and hence intended outcomes, along with the screening criteria above, to identify those where more detailed appropriate assessment at the WNMP level is considered necessary. For many of the sector policies, detailed assessment of outcomes cannot be undertaken at the WNMP level as the policies provide no additional clarity on the location, scale etc. of future development (essentially, sectors or aspects with no

SRAs); in these instances it is accepted that 'significant effects' cannot always be definitively excluded but that appropriate assessment must be deferred to a lower planning tier or the project level. In summary, four policy areas have been identified as requiring appropriate assessment; these are:

- Aggregates (SRAs are identified and policies will replace the 2004 Interim Marine Aggregates Dredging Policy (iMADP));
- Aquaculture (SRAs are identified and the sector has not previously been subject to HRA);
- Ports and Shipping - (SRAs are identified); and
- Energy – Low Carbon (excluding wind); SRAs are identified for tidal stream, wave, and tidal lagoons, which have not been subject to previous strategy-level HRA[7]; with regard to wind, the WNMP does not refine locations (e.g. through SRAs) and so simply reflects existing leasing.

The remaining sectors either have policies that are purely safeguarding (e.g. Defence, Surface Water and Wastewater Treatment and Disposal); policies which do not direct, influence or clarify the nature and location of activities that are promoted or supported by the policy; or policies which reflect or incorporate external plans or programmes subject to HRA. Whilst these policies are not subject to a more detailed assessment **at this level,** the policy text has been reviewed in the context of the general cross-cutting policies to ensure that the WNMP does not provide unmoderated or unequivocal support for developments that might benefit from them (for example, by providing a 'presumption in favour' that is not framed by the need to protect European sites). This approach is consistent with existing case-practice (e.g. Scottish Marine Plan HRA; East of England Marine Plan HRA; South Marine Plan HRA). 'Significant effects' cannot necessarily be excluded for most sectors where the policies do not direct, influence or clarify the nature and location of activities; in these instances 'down-the-line' assessment at a lower planning tier will be required.

Appropriate Assessment

The appropriate assessments of the sector policies (Aggregates, Aquaculture, Ports and Shipping; and Energy – Low Carbon (excluding wind)) concluded that whilst the WNMP does not explicitly exclude the possibility of adverse effects occurring, there is nothing inherent in the scale of the activities or the locations / extents of the proposed SRAs that would make adverse effects unavoidable at the project level, given the safeguards contained within the general cross-cutting protective policies within the WNMP. These policies will act to safeguard European sites and features during the future assessment of schemes that are supported by this policy and through down-the-line assessment of individual projects.

The exception to this is Policy ELC_01 as it relates to **tidal lagoons.** Whilst the tidal lagoon element of Policy ELC_01 is consistent with the other sector policies, and does not specify any scale for tidal lagoon schemes, there is arguably a greater risk of significant or significant adverse effects that cannot be avoided than there is with the other sectors. It is anticipated that most tidal lagoon proposals will be inherently large-scale projects with limited or no opportunity for the scope or extent to be significantly moderated to avoid effects (in contrast to, say, a wind farm scheme which may have multiple location options); and any large-scale tidal lagoon is likely to have far-field effects, ensuring that there are few (if any) areas around the Welsh coast where a tidal lagoon could be sited without European sites or features being exposed to these effects. It may be difficult to accommodate any large-scale tidal lagoon project without significant or significant adverse effects, and a policy supporting them to any degree may therefore have unavoidable adverse effects. Furthermore, the policy provisions and 'down-the-line' measures that can be relied on for other sectors/types of development are not considered appropriate in this instance due to the inherent scale of anticipated tidal lagoon proposals.

A more detailed assessment of the tidal lagoons component was therefore considered appropriate to the potential effects of this policy. In summary, this assessment concluded that adverse effects could not be excluded at the plan-level for the following feature groups:

- Intertidal habitats;
- Fish;

[7] Although note that part of the wave SRA has been leased by TCE, and was subject to HRA in 2014.

- Pelagic seabirds;
- Wildfowl and waders.

The assumed inherent scale of most tidal lagoons ensures that significant adverse effects would appear to be a 'likely' outcome for any developments coming forward under the policy as potential adverse effects cannot obviously be avoided through siting or established project-level avoidance and mitigation measures.

As a result, the Welsh Government has considered alternatives solutions to the proposed renewable energy 'supporting' policy which contains in principle support for tidal lagoons in line with the requirements of Article 6(4) of the Habitats Directive (Council Directive 92/43/EEC[8]) as implemented in the UK by the Conservation of Habitats and Species Regulations, 2010[9]. Welsh Government's conclusions, as to whether alternative solutions to the policy meet the relevant objectives are set out followed by a case for Imperative Reasons of Overriding Public Interest (IROPI) and consideration of appropriate compensatory measures

Assessment of Alternatives

The assessment of alternatives considered the following alternatives for the tidal lagoon policy:

i. No specific reference to tidal lagoons in policy ELC_01, i.e. explicit exclusion of reference to tidal lagoons
ii. Consider other forms of tidal range generation (other than lagoons)
iii. No SRA for tidal lagoons
iv. Alternative or smaller SRAs
v. Use of European site safeguarding criteria or exclusions
vi. Policy support for further sector investigation only

It has been concluded that these alternatives are either not appropriate for the WNMP; or would not provide any additional certainty that adverse effects on European sites can be avoided or reduced, compared to the proposed policy (particularly given the nature of tidal lagoons.

The potential scale of any lagoon works and the potential for effects on mobile species – means that there is a risk of unavoidable effects wherever a lagoon is sited. So, the identification of tidal lagoon SRAs, describing the known extent of exploitable tidal range, serve as a benefit to decision-makers and marine users rather than presenting an additional risk to the integrity of European Sites (since proposals will come forward in any case). The absence of any policy in relation to tidal lagoons would arguably create a policy vacuum where none of the benefits of strategic marine planning would be realised, without any additional certainty that effects on European sites could be avoided. As a result, Welsh Government has considered whether there are Imperative Reasons of Overriding Public Importance (IROPI) for adopting the WMNP with Policy ELC_01 including support for tidal lagoons.

IROPI and Compensatory Measures

In setting out the basis for IROPI consideration of ELC_01, the following is considered relevant in the context of the above requirements:

- why we need electrical energy;
- why new renewable generating capacity is imperative and in the public interest; and
- why tidal lagoon generating capacity as part of the Welsh renewable energy mix is imperative and in the public interest.

[8] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

[9] http://www.legislation.gov.uk/uksi/2010/490/contents/made

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These requirements have been reviewed and it has been concluded that tidal range power schemes (through lagoon or barrage technology) have the potential to significantly increase the proportion of electrical energy coming from low carbon / renewable sources owing to the scale of developments that may be deployed, and that it would be inappropriate not to not offer support for renewable energy or for tidal lagoons within the draft WNMP given future climate change risks. The potential for adverse effects arising on the integrity of European Sites (set out above) has been considered against the imperative reasons of overriding public interest set out above. Welsh Government considers that on the grounds of human health; public safety; and overriding beneficial consequences of primary importance for the environment, there is a compelling IROPI case to proceed with the plan policy. A range of possible compensatory measures are considered, which could be applied depending on the specific circumstances of any projects that may come forward.

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1. Introduction

The Welsh Government is preparing the Welsh National Marin Plan (WNMP) to support the sustainable development in the marine area. The WNMP is subject to the *Conservation of Habitats and Species Regulations 2010* (as amended) and *Offshore Marine Regulations 2007*, requiring assessment of the potential effects of the plan on certain designated sites.

1.1 Overview

1.1.1 The Welsh National Marine Plan (WNMP) is currently being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA)[10]. The purpose of marine planning under the MCAA is to help achieve sustainable development in the marine area. Welsh Ministers are the Marine Planning Authority under the MCAA, responsible for creating marine plans for both the inshore region (0-12 nautical miles) and offshore region (beyond 12 nautical miles) of Wales. Plans for both regions will be presented in a single document, the WNMP.

1.1.2 Building on the UK Marine Policy Statement[11] (UK MPS), the WNMP will enable the Welsh Government to plan for, and guide, the management of marine activities in a sustainable way; integrating economic, social and environmental considerations and engaging with communities to help shape the future of the plan area. As part of the preparation of the WNMP, consultation is being undertaken on a draft marine plan (the WNMP).

1.1.3 In developing the WNMP, the Welsh Government has taken account of relevant evidence on the state and current use of Welsh seas and potential opportunities for future use alongside the views of stakeholders through a process of continuous engagement as set out in the Statement of Public Participation (SPP). The Welsh Government has also undertaken a range of assessments to inform the developing plan, including this Habitats Regulations Assessment and a Sustainability Appraisal (SA).

1.2 Habitats Regulations Assessment

1.2.1 Regulation 61 of the Conservation of Habitats and Species Regulations 2010 (as amended) (the 'Habitats Regulations') states that if a plan or project "*(a) is likely to have a significant effect on a European site[12] or a European offshore marine site[13] (either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of the site*" then the plan-making authority must "*…make an appropriate assessment of the implications for the site in view of that site's conservation objectives*" before the plan is given effect. The

[10] HM Government (2009) *Marine and Coastal Access Act 2009*. Available from http://www.legislation.gov.uk/ukpga/2009/23/pdfs/ukpga_20090023_en.pdf [Accessed December 2016].

[11] HM Government (2011) *UK Marine Policy Statement*. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf [Accessed December 2016].

[12] Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the UK Government. However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the 'new wild birds directive') apply; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied as a matter of UK Government policy when considering development proposals that may affect them. "European site" is therefore used in this report in its broadest sense, as an umbrella term for all of the above designated sites (it therefore covers both terrestrial sites and areas that would be defined as 'European Marine Sites' under the Regulations).

[13] 'European offshore marine sites' are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters over 12 nautical miles from the coast.

process by which Regulation 61 is met is known as Habitats Regulations Assessment (HRA)[14]. An HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of a plan's implementation (either on its own or 'in combination' with other plans or projects) and, if so, whether these effects will result in any adverse effects on the site's integrity. Regulation 25 of *Offshore Marine Regulations 2007* applies the same provisions to "…*any consent, permission or other authorisation for, a plan or project which…is to be carried out on or in any part of the waters or on or in any part of the seabed or subsoil comprising the offshore marine area, or on or in relation to an offshore marine installation*…"

1.3 Purpose of this Report

1.3.1 This report enables the Welsh Government to meet its obligations under the Habitats Regulations. It documents the assessment of the WNMP against the requirements of the Habitats Regulations, summarising the HRA process and its application to the WNMP, and detailing the results of the assessment.

1.3.2 The HRA of the WNMP has been undertaken at a strategic level, based on the assumptions set out in the WNMP. It does not remove the need for developers or competent authorities to consider the potential effects on European sites of specific future projects, or set any precedent regarding the acceptability of future proposals that may affect European sites. This is because the plan is high-level and strategic and does not identify specific projects that will be progressed or which are encouraged. Further, there may be a range of changes between the time of adoption of the WNMP (and timing of this assessment) and the design and submission of any proposal that would be considered for authorisation in accordance with relevant policy set out in the WNMP. New impact pathways, which are not present or evident at the moment, may become apparent. The HRA may help inform the assessment of subsequent projects, but the screening of any future projects or activities should be completed on their own merit and the HRA of the WNMP does not prejudice such an assessment.

1.3.3 In addition, Schedule 6 (10) of the MCAA requires that the Welsh Government carry out an appraisal of sustainability of its proposals for inclusion in the WNMP and to publish a report of the results of the appraisal. The Sustainability Appraisal (SA) ensures that the likely environmental and socio-economic effects of the WNMP are identified, described and evaluated. In meeting its requirement to undertake an SA of the WNMP, the Welsh Government has determined that the SA, required under the MCAA, should incorporate an assessment in accordance with the requirements of the European Union Directive 2001/42/EC on the Assessment of the Effects of Certain Plans and Programmes on the Environment[15], more commonly known as the SEA Directive. The SA for the WNMP is reported separately from this HRA report, although the conclusions of the HRA have helped to inform the appraisal process.

1.4 Report Structure

1.4.1 The report is structured as follows:

- **Section 2** provides a summary of the WNMP;
- **Section 3** provides an overview of the HRA approach and those factors or plan aspects that are relevant to assessment;

[14] The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more usually termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process; see also Box 1.

[15] Available from http://ec.europa.eu/environment/eia/sea-legalcontext.htm [Accessed December 2016].

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- **Section 4** provides a summary of the screening process that has been applied to identify European sites[16] that are potentially exposed and sensitive to the likely outcomes of the WNMP
- **Section 5** provides a summary of the screening process as applied to the policies of the WNMP. It identifies those policies that should be excluded from further assessment, either because they can have no significant effect or because assessment by the HRA of the WNMP is not appropriate.
- **Sections 6 – 10** provide more detailed appropriate assessments of the likely effects of those policies and sectors that are not excluded in **Section 5**, with recommendations for amendments to policies or supporting text made to ensure that adverse effects will not occur as a result of WNMP delivery;
- **Section 11** summarise the review of other plans and projects for potential 'in combination' effects with the policy components of the WNMP;
- **Section 12** provides a summary of the appropriate assessment and the main conclusions;
- **Section 13** considers alternatives to Policy ELC_01 of the WNMP**;**
- **Section 14** outlines the Welsh Government's consideration of the imperative reasons of overriding public interest for adoption of the WNMP and sets out the strategic framework for compensatory measures.

[16] The HRA considers all European sites (see footnotes 3 and 4) rather than just those considered European Marine Sites due to the potential for offshore activities to affect some onshore habitats or mobile species.

2. The Welsh National Marine Plan

The content, scope and planning approach of the Draft Welsh National Marine Plan is critical to the scope and approach used for the HRA. This section provides an overview of the plan and identifies those aspects that will shape the likely outcomes, and hence the scope of the HRA.

2.1 Marine Planning and the UK Marine Policy Statement

2.1.1 Marine plans form part of a new plan-led regulatory system for marine activities introduced in Europe by the Maritime Spatial Planning Directive (EU Directive 89/2014)[17] and in the UK by the MCAA in 2009. The purpose of marine planning under the Maritime Spatial Planning Directive and MCAA is to help achieve sustainable development in the marine area.

2.1.2 The UK MPS is the overarching framework for preparing marine plans and taking decisions affecting the marine environment. It was adopted by all four UK administrations in March 2011. The UK MPS provides the high-level policy context within which national and sub-national marine plans are to be developed, implemented, monitored and amended and ensures appropriate consistency in marine planning across the UK marine area. The UK MPS also sets the direction for marine licensing and other relevant authorisation systems.

2.1.3 The UK MPS sets out that the process of marine planning will:

- achieve integration between different objectives;
- recognise that the demand for use of our seas and the resulting pressures on them will continue to increase;
- manage competing demands on the marine area, taking an ecosystem-based approach;
- enable the co-existence of compatible activities wherever possible; and
- integrate with terrestrial planning.

2.1.4 The vision for the marine environment, as set out in Section 2.1 of the UK MPS, is for "*clean, healthy, safe, productive and biologically diverse oceans and seas*". The UK High Level Marine Objectives (HLMOs) published in April 2009 set the broad outcomes for the marine area, and reflect the principles of sustainable development. These objectives are themed as follows:

- achieving a sustainable marine economy;
- ensuring a strong, healthy and just society;
- living within environmental limits;
- promoting good governance; and
- using sound science responsibly.

2.1.5 The aim of marine planning is therefore to ensure a sustainable future for the UK's seas through managing and balancing the many activities, resources and assets in the marine environment. In this context, marine plans will inform and guide regulation, management, use and protection of the marine plan areas. Section 58 of the MCAA requires that all public authorities taking authorisation or enforcement decisions which may affect the UK marine area (e.g. on an approval, confirmation, consent, licence, permission) must do so in accordance with marine policy documents (marine

[17] Available from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0089&from=EN [Accessed January 2017].

plans and the UK MPS) unless relevant considerations indicate otherwise[18]. Any other decisions that may affect the area should also have regard to the UK MPS and marine plans. Together, the UK MPS and WNMP (when adopted) form the marine planning documents for Welsh seas.

2.2 The Requirement to Prepare a Welsh National Marine Plan

2.2.1 The UK MPS and marine plans form a new plan-led system for marine activities. Section 1.3 of the UK MPS sets out the expectation that, together, the MPS and marine plans will "*provide for greater coherence in policy and a forward-looking, proactive and spatial planning approach to the management of the marine area, its resources, and the activities and interactions that take place within it.*"

2.2.2 On adoption of the UK MPS, the MCAA placed a duty on the Welsh Government to ensure that marine plans are prepared for the Welsh marine area. The Welsh Ministers are therefore the relevant Marine Planning Authority (MPA) for the Welsh inshore and offshore regions and responsible for preparing marine plans for these regions. The Welsh marine area is shown in **Figure 2.1**.

2.2.3 The Welsh Government consulted on the approach to marine planning for Wales in February 2011 through the consultation 'Sustainable Development for Welsh seas: Our Approach to Marine Planning in Wales'[19]. Having considered the responses to this consultation, the Welsh Government confirmed its intention, consistent with the MCAA duty, to put in place a national system of marine planning and to develop a WNMP.

2.2.4 The Welsh Government will review and report at least every three years on the effects of policies in the WNMP and their effectiveness at securing the plan objectives. The planning process is iterative; in accordance with the MCAA, future plans will be developed using experience and understanding gained from previous planning processes.

2.2.5

[18] An exception is decisions on applications for development consent for nationally significant infrastructure projects (NSIPs) under the Planning Act 2008 where a decision should also have regard to any relevant marine plan.

[19] Welsh Government (2011) *Sustainable Development for Welsh Seas: Our Approach to Marine Planning in Wales*. Available from http://gov.wales/docs/desh/consultation/110216marineconsultationen.pdf [Accessed January 2017].

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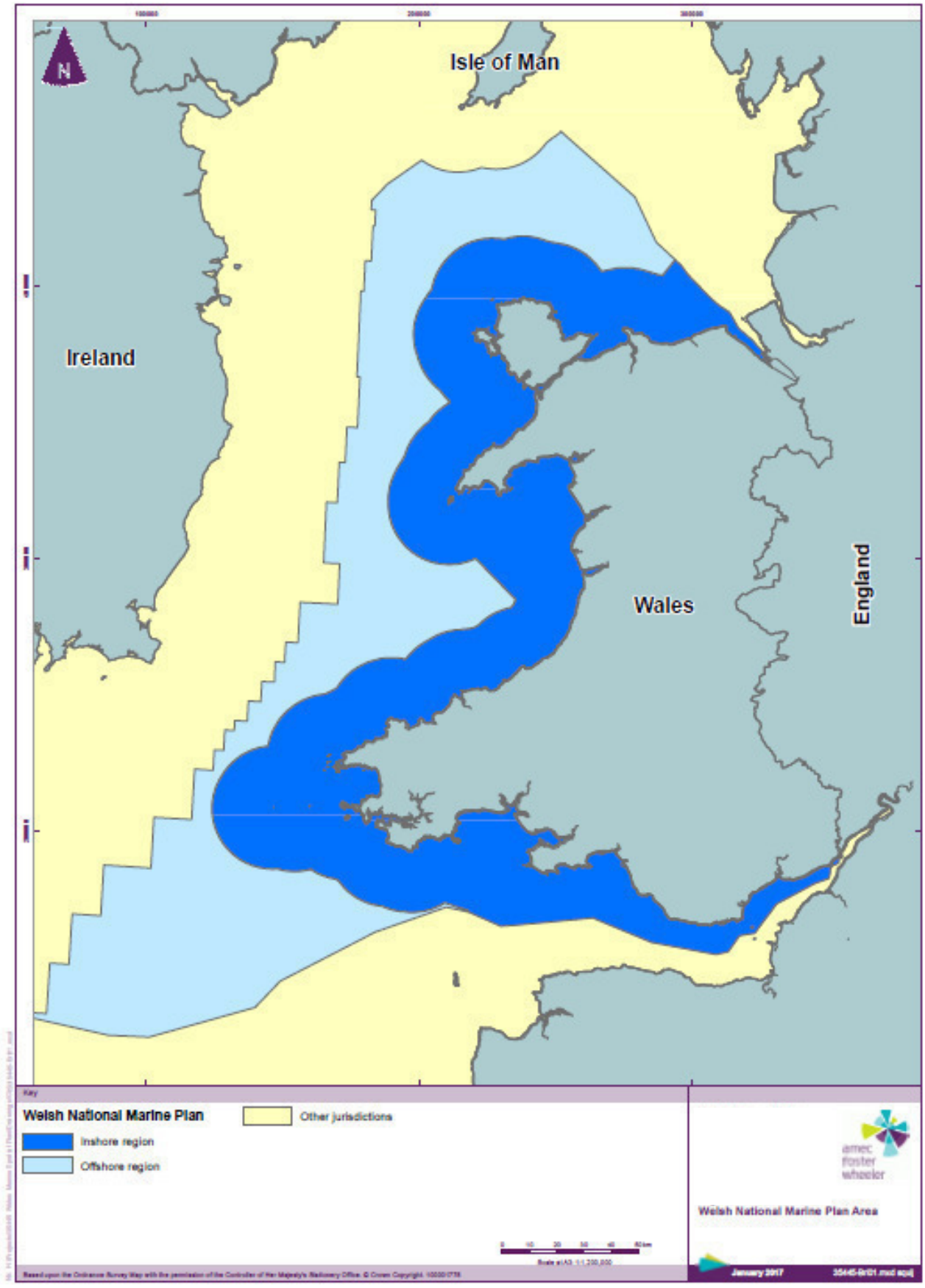
Figure 2.1 Welsh National Marine Plan Area



2.3 The Scope of the Welsh National Marine Plan

Purpose

2.3.1 The UK MPS (section 2.2) states that marine plans should "*set out how marine resources can best be managed in order to achieve the plan outcomes, policies and objectives. Marine Plans will provide a clear, spatial and locally-relevant expression of policy, implementation and delivery. They will ensure that different and potentially competing activities are managed in such a way that they contribute to the achievement of sustainable development. A key principle will be to promote compatibility and reduce conflict. Monitoring of implementation will ensure that activities within a marine plan area contribute to the delivery of the MPS, as well as its future revisions.*" Article 5 (2) of the Maritime Spatial Planning Directive, meanwhile, sets out that marine spatial plans should "aim to contribute to the sustainable development of energy sectors at sea, of maritime transport, and of the fisheries and aquaculture sectors, and to the preservation, protection and improvement of the environment, including resilience to climate change impacts."

2.3.2 The WNMP is the first marine plan for Wales and represents the start of a process of shaping Wales' seas through marine planning to support economic, social and environmental objectives. It will implement the UK MPS at the national level, guiding the sustainable development of Wales' seas by setting out how applicants should shape licence applications and how proposals will be considered by decision makers including, in particular, the consenting authorities. The WNMP is also being developed in the context of the Well-being of Future Generations (Wales) Act 2015 and Environment (Wales) Act 2016.

Geographic scope

2.3.3 The Welsh marine area consists of around 32,000 km^2 of sea, as well as 2,120 km of coastline. The WNMP will cover both the Welsh inshore region (from high water and the landward extent out to 12 nautical miles from shore) and offshore region (beyond 12 nautical miles) in a single document.

Functional scope

2.3.4 The management of activities in Welsh waters is split between devolved functions which are the responsibility of Welsh Ministers, and reserved functions which are retained by UK Government. The Welsh Government has set out that the WNMP will include policy relating the exercise of both devolved and reserved functions and therefore requires the agreement of the Secretary of State.

- The balance of retained and devolved functions may change with time.

Duration and review

2.3.5 The WNMP takes a 20-year view whilst recognising that certain activities may need to be planned for beyond this time period and that others are likely to change significantly during the lifetime of the plan.

2.3.6 Monitoring and reporting are important steps in the planning process to ensure that the WNMP and its policies are effectively contributing to achieving the plan's objectives. The Welsh Government will review and report at least every three years on the effects of policies in the WNMP and their effectiveness at securing the plan objectives. The planning process is iterative; in accordance with the MCAA, future plans will be developed using experience and understanding gained from previous planning processes.

2.4 The Draft Welsh National Marine Plan

2.4.1 The WNMP comprises the following key plan components:

- Vision;

- Plan objectives;
- General cross-cutting policies;
- Sector objectives; and
- Sector policies (including mapping).

2.4.2 These key plan components are discussed in-turn below.

Vision and Plan Objectives

2.4.3 The WNMP sets out the following vision for the Welsh inshore and offshore marine area over the 20-year view taken by the plan:

"*Welsh seas are clean, healthy, safe, productive and biologically diverse:*

- *Through an ecosystem approach, our seas are healthy and resilient and support a sustainable and thriving economy.*
- *Through access to and enjoyment of the marine environment, health and well-being are improving.*
- *Through Blue Growth[20] more jobs and wealth are being created which is helping coastal communities become more resilient, prosperous and equitable with a vibrant culture.*
- *Through the responsible deployment of low carbon technologies, the Welsh marine area is making a strong contribution to energy security and climate change emissions targets.*

Our vision is being achieved through an integrated, evidenced and plan-led approach that respects established uses and interests whilst securing the benefits from new opportunities, recognising the importance of ecosystem resilience, the value of biodiversity and the imperative to adapt to climate change."

2.4.4 The WNMP vision outlined above is underpinned by 13 plan objectives. The plan objectives are a clear statement of desired outcomes that the WNMP is seeking to achieve in order to realise the vision. The objectives are set out in **Table 2.1** under the HLMO themes used in the UK MPS.

Table 2.1 WNMP Plan Objectives

HLMO	Plan Objective	
Overarching	1	Support the sustainable development of the Welsh marine area by contributing across Wales' well-being goals, ensuring the Sustainable Management of Natural Resources (SMNR) by taking account of the cumulative effects of all uses of the marine environment.
Achieving a sustainable marine economy	2	Contribute to a thriving Welsh economy by encouraging economically productive activities and profitable and sustainable businesses that create long term employment at all skill levels.
	3	Maximise the opportunity to sustainably develop marine renewable energy resources, helping to achieve the UK's energy security and carbon reduction objectives, whilst fully considering other interests and ecosystem resilience.
	4	Provide space to support existing and future sustainable economic activity through managing multiple uses, encouraging the co-existence of compatible activities, the mitigation of conflicts between users and, where possible, by reducing displacement of existing activities.
Ensuring a strong, healthy and just society	5	Reduce poverty and support the development of vibrant, more equitable, culturally distinct, cohesive and resilient coastal communities.

[20] Blue Growth concerns sustainable economic growth in marine and maritime sectors.

HLMO	Plan Objective	
	6	Support enjoyment and stewardship of our coast and seas and their resources by encouraging equitable and safe access to the marine environment, whilst protecting and promoting valuable landscapes, seascapes and heritage assets.
	7	Improve understanding and enable action supporting climate change adaptation and mitigation.
Living within environmental limits	8	Support the achievement and maintenance of Good Environmental Status (GES).
	9	Protect, conserve, restore and enhance marine biodiversity to halt and reverse its decline.
	10	Maintain and enhance the resilience of marine ecosystems and the benefits they provide in order to meet the needs of present and future generations.
Promoting good governance	11	Support proportionate, consistent and integrated decision making through implementing forward-looking policies as part of a plan-led, precautionary, risk-based and adaptive approach to managing Welsh seas.
	12	Apply the Sustainable Development (SD) principle and the principles of Sustainable Management of Natural Resources (SMNR) to decision making as part of a plan-led approach delivered in line with ecosystem approach principles.
Using sound science responsibly	13	Develop a shared, accessible marine evidence base to support use of sound evidence and provide a mechanism for the unique characteristics and opportunities of the Welsh Marine Area to be better understood.

General Cross-cutting Policies

2.4.5 The general cross-cutting policies of the WNMP potentially apply to all sectors and activities and support the delivery of the plan objectives, ensuring that socio-economic and environmental considerations are part of the decision making process. The WNMP contains 25 general cross-cutting policies that are set out by HLMO theme in addition to two general overarching policies. These are listed in **Table 2.2**.

Table 2.2 WNMP General Cross-cutting Policies

HLMO	General Cross-cutting Policies
Overarching planning policy	GEN_01, GEN_02
Achieving a sustainable marine economy	ECON_01, ECON_02
Ensuring a strong, healthy and just society	SOC_01, SOC_02, SOC_03, SOC_04, SOC_05, SOC_06, SOC_07, SOC_08, SOC_09, SOC_10, SOC_11, SOC_12
Living within environmental limits	ENV_01, ENV_02, ENV_03, ENV_04, ENV_05, ENV_06
Promoting good governance	GOV_01, GOV_02
Using sound science responsibly	SCI_01

Sector Objectives, Policies and Strategic Resource Areas

2.4.6 Sector objectives and policies operate alongside the plan objectives and general cross-cutting policies and apply to decisions related to a particular activity. They include supporting policies (to support development of a given sector) and safeguarding policies (to protect a given sector's current or potential future activities from negative impacts from other activities). These objectives and policies are grouped across 11 sectors that operate in Welsh seas. For each sector, objective(s), policies and supporting information are presented.

2.4.7 The information for some sectors is accompanied by one or more maps to spatially define the sector policies or for illustrative purposes. In order to describe the distribution of resources, the WNMP identifies Resource Areas (RAs) for certain sectors. These are broad areas that describe the distribution of a particular resource that has the potential to be used or is used by certain marine sectors (e.g. aggregates, aquaculture or marine energy). In order to indicatively allocate space and focus future use, the WNMP also identifies Strategic Resource Areas (SRAs) for certain sectors. These are areas considered to be of good opportunity for **potential** future use by a particular sector over the plan period and beyond.

2.4.8 SRAs lie within the related RA and are considered to have the greatest potential to support the growth of a particular sector, although it is important to note that the SRAs are intentionally broad reflecting the early nature of marine planning and the limits of current knowledge. Local issues and constraints that relate to the general policies that have a spatial dimension will be taken into account when considering individual proposals, and it should be noted that the Habitats Directive will apply to all projects as normal (this is supported by policy ENV_02).

2.4.9 Marine planning spatial policies (those aligned to SRAs) may change as marine planning develops and the Welsh Government's understanding improves. Identification of an SRA through the WNMP will support a process of collating and developing further evidence and understanding to inform decision making at the local scale. All maps in the WNMP are therefore indicative. For this reason, the SRAs are not restrictive in the manner of, say, a land-use plan allocation.

2.4.10 **Table 2.3** reproduces the 12 objectives and lists the 30 policies for the sectors. For each sector, the table indicates whether SRAs have been identified and illustrates the applicability of the general cross-cutting policies. Mapping is contained in the WNMP.

Table 2.3 WNMP Sector Objectives and Policies

Sector	Sector Objective(s)	Sector Policies	SRA(s) Identified?	Relevant General Cross-cutting Policies
Aggregates	To continue to use marine aggregates resources at a rate and in locations which best meet our current and future needs by ensuring adequate reserves are provided for through long-term licences.	AGG_01 AGG_02 AGG_03 AGG_04	Yes	All
Aquaculture	To double production by 2020, and to further increase production over the lifetime of this plan. Specifically, by 2020 increase: • Marine finfish to 2,000 tonnes (761 Tonnes in 2012); • Shellfish, especially mussels, to 16,000 tonnes (from 8,376 tonnes in 2012).	AQU_01 AQU_02 AQU_03	Yes	All
Defence	To contribute to the defence of the nation by ensuring that Defence and National Security activities are not compromised.	DEF_01	No	All
Dredging and Disposal	To maintain safe and effective navigational access for shipping, fishing and leisure craft and support future growth and increases in port facilities and vessel size whilst promoting the optimal sustainable use of dredged material and ensuring adequate disposal facilities are available.	D&D_01 D&D_02 D&D_03	No	All

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Sector	Sector Objective(s)	Sector Policies	SRA(s) Identified?	Relevant General Cross-cutting Policies
Energy – Low Carbon	To contribute significantly to the decarbonisation of our economy and blue growth by increasing the amount of low-carbon marine energy generated, by: • Supporting the development and demonstration of tidal stream and wave energy technologies over the next 5-10 years; • Increasing the number of devices deployed in commercial scale developments over the next 10-20 years; • Supporting further commercial development of offshore wind over the next 3-5 years taking advantage of any favourable UK Government financial mechanisms under the Contract for Difference; • Promote evidence gathering and research on tidal lagoon development to support the sustainable development and deployment of tidal lagoon technology; • Supporting the nuclear energy sector. To develop Wales as an exemplar of marine renewable energy technology by developing the essential skill base and technical knowledge to support the growth of the industry over the next 20 years.	ELC_01 ELC_02 ELC_03 ELC_04	Yes	All
Energy – Oil and Gas (including Gas Unloading and Storage and Carbon Dioxide Capture and Storage)	Optimising the economic development and recovery of UK oil and gas resource in order to provide Welsh and wider UK businesses and consumers with a secure and resilient supply of fossil fuels.	O&G_01 O&G_02 O&G_03 O&G_04	No	All
Fisheries	To support and safeguard a diversified and profitable fishing sector including promoting sustainable capture fisheries and optimising the economic value of fish caught as a supply of sustainable protein.	FIS_01 FIS_02 FIS_03	No	All
Ports and Shipping	To safeguard established shipping routes and support sustainable growth in the shipping and ports sector.	P&S_01 P&S_02 P&S_03	Yes	All
Subsea Cabling	To support the optimal distribution of electricity and better global communications through the growth of digital communication networks.	CAB_01 CAB_02	No	All
Surface Water and Wastewater Treatment and Disposal	To safeguard the capacity to safely and effectively treat and discharge surface water runoff and wastewater.	SWW_01	No	All
Tourism and Recreation	To contribute to sustainable growth, supporting the "Wales Tourism Strategy" target to grow tourism earnings in Wales by 10% or more by 2020, by protecting and promoting access to the coast and improving the quality of the visitor experience thereby increasing Wales' reputation as a world class sustainable marine tourism and recreation destination.	T&R_01 T&R_02	No	All

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2.5 Summary

2.5.1 The key components of the WNMP, from an HRA perspective, are as follows:

- **The General Cross-cutting Policies**: cross-cutting policies that support the delivery of the plan objectives, and which include various protective policies; these policies have no spatial component (beyond applying to the WNMP area).
- **The Sector Policies**: sector-specific policies that will apply to, or inform, decisions related to particular activities. These policies are broadly categorised as either 'supporting policies' (which encourage the submission of proposals for particular activities) or 'safeguarding' policies (which aim to prevent conflicts between activities). The policies have a clear spatial component where they relate to SRAs.
- **The Supporting Maps**, which identify RAs and SRAs to which sector policies will apply.

2.5.2 These are the aspects that are most likely to influence or in some way guide future activities in marine areas and hence determine the overall effects of the WNMP with regard to European sites.

2.5.3 Essentially, therefore, the WNMP suggests broad areas that are thought to have the greatest potential to support the growth of a particular sector (the SRAs); provides policies that safeguard those areas from sterilisation by inappropriate activities; and supports the submission of proposals for appropriate activities within the SRAs that meet the requirements of the plan (including the protective requirements set out by the general cross-cutting policies, for example the protection of European sites), as well as wider statutory processes and requirements. However, the WNMP does not:

- identify or support specific schemes;
- dictate where certain activities or schemes should go; or
- preclude activities or schemes outside of the SRAs.

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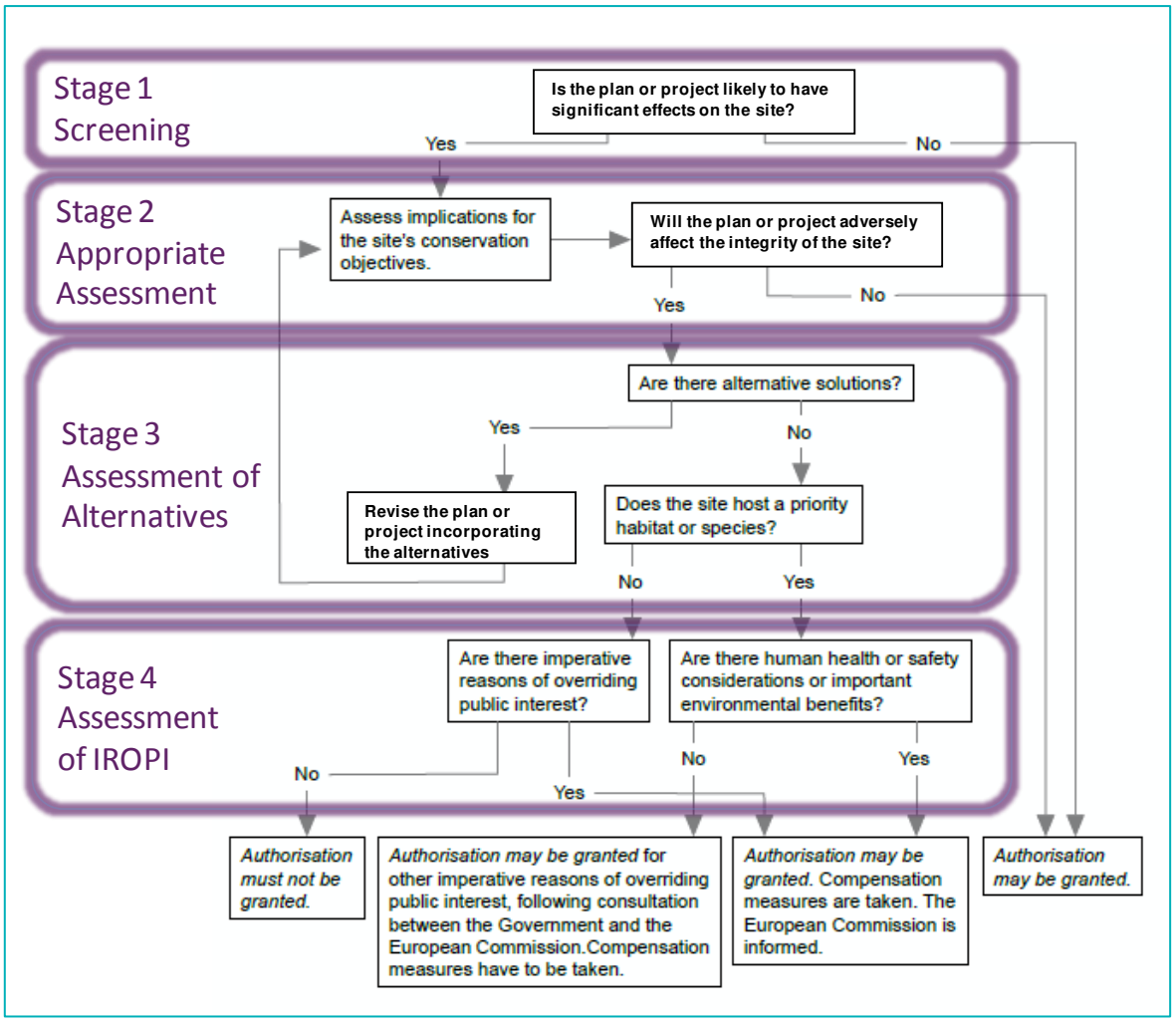
3. HRA of the Welsh National Marine Plan

HRA of strategic policy documents can be complex, often resulting in the identification of theoretical risks that cannot necessarily be qualified or quantified in detail with the information available at the strategy-level, requiring novel policy-based approaches to provide certainty regarding plan effects. This section provides an overview of the HRA approach and those factors or plan aspects that are relevant to this.

3.1 HRA of Strategic Plans

3.1.1 The requirements of Regulation 61 are usually addressed through a staged process with sequential tests. The current EC guidance[21] suggests a four-stage process for HRA; these stages, and the assessment process, are summarised in **Figure 3.1** below:

Figure 3.1 Summary of HRA process and stages



[21] *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).

3.1.2 There is little specific guidance on the application of HRA to high-level national plans and policy documents, particularly as many high-level policy documents are excluded from the HRA process[22]; the HRA of the WNMP is therefore based on case-practice established through the HRAs of similar national-level policy documents.

3.1.3 At the screening stage, the plan should be considered 'likely' to have an effect if the competent authority (in this case, the Welsh Government) is unable on the basis of objective information to exclude the possibility that it could have significant effects on any European site, either alone or in combination with other plans or projects; an effect will be 'significant' if it could undermine the site's conservation objectives. The 'test of significance' is therefore a relatively low bar: 'significant effects' can generally be interpreted as any negative effects that are not negligible or inconsequential; 'likely' is interpreted as a simple question of whether the plan or project concerned is capable of having an effect[23].

3.1.4 If 'no significant effect' cannot be established then 'appropriate assessment' is required. What constitutes an 'appropriate' assessment is not defined by the Regulations or the Habitats Directive; however, the assessment must provide a robust, objective, scientific basis for determining whether the integrity of a site is likely to be affected, which is proportional to the nature of plan being assessed and the complexity, scale and risk of effects. If the competent authority cannot determine that there will be no adverse effects on the integrity of a site then it must consider alternative solutions for delivering the objectives of the plan or project (Regulation 62); if no alternatives are available, then a case for authorising the plan or project may be made for Imperative Reasons of Overriding Public Interest (IROPI), subject to the identification of suitable compensatory measures.

3.1.5 Regulation 61 essentially provides a test that the final plan must pass; there is no statutory requirement for HRA to be undertaken on draft plans or similar developmental stages (e.g. issues and options; preferred options). However, as with Strategic Environmental Assessment (SEA), it is accepted best-practice for the HRAs of strategic plans or policy documents to be run as an iterative process alongside their development. This is the process followed with the WNMP. Therefore, it is important to recognise that the process of strategic HRA is as much about guiding the development of the plan (and demonstrating that effects on European sites have been considered appropriately) as it is about (ultimately) assessing its effects. The broad aim of this process is to avoid as many potential significant effects as possible through the plan development process.

3.2 Issues for the HRA of the WNMP

Assessing the likely outcomes and effects of the WNMP

3.2.1 The Sector Objectives of the WNMP (see **Table 2.3**) are the intended (and so arguably 'likely') outcomes of the WNMP; these outcomes are guided, supported and moderated by the plan policies, individually and collectively as well as wider relevant current legislation, policy and regulatory practice. The WNMP therefore promotes or supports proposals for activities, and provides planning guidance for lower-tier decision-making that should support the delivery of proposals. It is therefore important to try to ensure that the WNMP does not impose policies or planning constraints that are likely to make the avoidance of adverse effects on European sites unachievable at the project-level.

[22] EC guidance on the application of Article 6(3) (*Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive 92/43/EEC* (EC, 2000) states that "…*a distinction needs to be made with 'plans' which are in the nature of policy statements, i.e. policy documents which show the general political will or intention of a ministry or lower authority. An example might be a general plan for sustainable development across a Member State's territory or a region. It does not seem appropriate to treat these as 'plans' for the purpose of Article 6(3), particularly if any initiatives deriving from such policy statements must pass through the intermediary of a landuse or sectoral plan. However, where the link between the content of such an initiative and likely significant effects on a Natura 2000 site is very clear and direct, Article 6(3) should be applied.*"

[23] Case C-258/11: Judgment of the Court (Third Chamber) of 11 April 2013 and Opinion of the Advocate General dated 22nd November 2012. Peter Sweetman and Others v An Bord Pleanála. Reference for a preliminary ruling: Supreme Court - Ireland.

3.2.2 However, the WNMP is a high-level policy-led plan for guiding activities in the marine environment over the next 20 years; due to its breadth of coverage, wide geographic scale, high-level and long-term outlook there are inevitably a large number of uncertainties associated with its likely outcomes, particularly regarding its likely effects on European sites, which can make clear 'no significant effect' or 'no adverse effect' conclusions difficult.

3.2.3 In particular, whilst potential effect pathways can be readily identified at the plan level, there will often be no way of concluding that an effect will not occur (or will not be adverse) solely through an objective technical assessment of the effect scenario (as would be the case with a project-level assessment), given the numerous circumstances that could be envisaged.

3.2.4 Using tidal energy as an example: many tidal energy schemes will arguably have the potential to affect mobile interest features (e.g. marine mammals, through collisions with subtidal turbines), and so a policy broadly supporting tidal energy has a potential effect pathway. However, the actual effects of any schemes that come forward (that may be related to the policy) will depend on a wide range of aspects that cannot be established above the project level. For example, many of the specific technologies and detailed designs for tidal schemes are still in development. Attempting to undertake a detailed analysis of how each site or feature might be affected by a hypothetical sector activity or project is neither feasible or, arguably, meaningful – the uncertainties over the final outcomes are too great.

3.2.5 As noted, the SRAs are essentially those broad areas that are thought to have the greatest potential to support the growth of a particular sector. The WNMP therefore

i. provides policies that safeguard those areas from sterilisation by inappropriate activities; and

ii. supports the submission of proposals for appropriate activities within the SRAs that meet the requirements of the plan (including the protective requirements set out by the general cross-cutting policies, for example the protection of European sites).

3.2.6 Therefore, one of the intentions of the WNMP is that certain activities be directed toward their respective SRAs (which are safeguarded accordingly) where appropriate. The SRAs proposed in the WNMP therefore provide additional spatial refinement (over RAs or non-spatial policies) that is intended to facilitate the planning and delivery of certain activities and proposals in these areas. However, the SRAs are not directly analogous to allocations in typical land use plans and in this regard it is important to note the policy caveats included on the SRA maps themselves and in supporting policy, specifically that:

- an SRA is only indicative of possible sector activity and does not preclude sector development activity outside of an SRA subject to the necessary consents being obtained;
- there can be no presumption that an application within the respective sector SRA will be successful; and
- further refinement of the RAs and SRAs will occur through marine planning as future supporting work provides a better understanding of spatial constraints and opportunities.

3.2.7 Therefore, the WNMP does not identify or support specific schemes; nor dictate where certain activities or schemes should go; nor preclude activities or schemes outside of the SRAs. The HRA of the WNMP is consequently, and necessarily, a high-level assessment that aims to identify potential effect pathways, exclude them if possible, and manage any residual uncertainty through the WNMP policy framework.

Mitigating uncertainty and 'down the line' assessment

3.2.8 With strategy-level HRAs, uncertainty is usually addressed by including bespoke caveats and 'avoidance measures' or mitigation within the policy text to ensure that significant or adverse effects will not occur. This is possible because the key planning tools of the strategic plan (i.e. the policies) are inherently flexible and can be revised, removed or added to, if required.

3.2.9 Guidance[24] indicates that it is appropriate and acceptable for some assessment to be undertaken 'down-the-line' at a lower tier in the planning hierarchy, if:

- the higher tier plan appraisal cannot reasonably predict the effects on a European site in a meaningful way; whereas;
- the lower tier plan or project, which will identify more precisely the nature, scale or location of development, and thus its potential effects, retains enough flexibility within the terms of the higher tier plan over the exact location, scale or nature of the proposal to enable an adverse effect on site integrity to be avoided; and
- Habitats Regulations Appraisal of the plan at the lower tier is required as a matter of law or Government policy.

3.2.10 Given the strategic nature of the WNMP it is likely that the plan delivery will need to be facilitated by the completion of appropriate HRAs of future schemes or activities – and so the identification of this requirement in the WNMP will help mitigate the risk of adverse effects occurring.

3.2.11 It is also important that the WNMP policies do not create a constraining framework that inadvertently ensures that significant or significant adverse effects cannot be avoided by lower-tier plans or projects.

In combination uncertainties

3.2.12 The Habitats Regulations requires that the potential effects of a plan on European sites must also be considered 'in combination with other plans or projects'. Consideration of 'in combination' effects is not a separate assessment, but is integral to the screening and appropriate assessment stages and the development of avoidance/ mitigation measures. There is limited guidance available on the scope of the 'in combination' element, particularly which plans should be considered for high level strategies. However, the assessment should not necessarily be limited to plans at the same level in the planning hierarchy and there is consequently a wide range of plans that could have potential 'in combination' effects with the WNMP.

3.2.13 Due to the strategic nature of the HRA of the WNMP, the uncertainties associated with any in combination assessment are considerable, and multiply the uncertainties associated with the WNMP. In particular, the WNMP could (in theory) interact with any strategic plan affecting marine areas (or sites supporting species reliant on marine areas). Attempting to identify specific potential effects on marine areas or sites associated with activities that may arise from the WNMP and other plans is therefore not practicable and such an assessment would not provide any meaningful results that would allow specific mitigation to be identified. For example, housing allocations in every local plan could have theoretical 'in combination' effects on water resources and hence diadromous fish, which could interact with factors affecting the fish in the marine environment. The number and variety of these interactions is obviously huge, and any assessment would be largely generic; how this would translate into policy is not clear, other than equally generic policy statements requiring that 'in combination' effects do not occur.

3.2.14 As specific 'in combination' effects are not identifiable in any meaningful way, it is therefore important to ensure that the WNMP does not include any measures that would obviously constrain the mitigation options available for future activities, or direct activities such that conflict with other plans is inevitable, or contain policies or objectives that would allow protective measures included in other plans to be over-ridden or ignored.

[24] Tyldesley D, (2010). *Draft Guidance for Plan Making Authorities in Wales: The Appraisal of Plans Under the Habitats Directive*. David Tyldesley and Associates, for the Countryside Council for Wales.

3.3 Screening and Appropriate Assessment Approach

The approach adopted for screening and appropriate assessment of the WNMP is consistent with that used for other high-level policy-based plans, taking into account the issues outlined in **Section 3.2**. It involves screening both the policies and the relevant European sites (as far as achievable at this level). Appropriate assessment is completed where spatially-specific outcomes are identified and effects are uncertain.

The approach involves the following steps:

i. Review the intended plan outcomes to identify a reasonable 'zone of influence' for the plan and the potential mechanisms or pathways by which European sites or interest features could be affected.

ii. Identify those European sites and features that are potentially vulnerable (i.e. both exposed and sensitive) to the likely outcomes of the plan (i.e. those sites within or near the marine plan area; or mobile interest features that may utilise the marine plan area during their life-cycle), and those sites that will not or cannot (based on available information) be affected by the plan outcomes.

iii. Identify those WNMP sectors and policies that should be excluded from more detailed examination within the HRA of the WNMP, for example because:

- they cannot have an effect or a negative effect (e.g. don't promote a change; protective policies; etc); or
- they provide no additional clarity on the location, scale etc. of future development (essentially, sectors or aspects with no SRAs), where the assessment must be deferred to a lower tier; or
- they reflect or incorporate external plans or programmes that have been subject to HRA (e.g. oil and gas licensing).

iv. Review the plan policies and sectors to ensure that those that are excluded from more detailed examination are suitably drafted and that significant or significant adverse effects are avoidable for schemes that benefit from policy support.

v. Assess the potential for 'screened in' sectors and policies (principally those with spatial components) to adversely affect 'screened in' European sites, as far as achievable at the strategy-level (appropriate assessment). This is completed in sector-specific chapters which incorporate policy reviews to ensure that any recommended changes suitably reflect the assessment conclusions.

The specific methods, criteria and protocols used for the screening the European sites and policies are set out in Sections 4 and 5. Sections 6 – 10 then provide appropriate assessments of the potential effects of specific sectors that are not excluded by the screening process. Section 11 presents the in-combination assessment of effects whilst Sections 13 and 14 present the consideration of alternatives solutions and the case for Imperative Reasons of Overriding Public Interest (IROPI) and appropriate compensatory measures for one policy, where adverse effects on integrity could not be ruled out.

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4. European Sites Screening

This section provides a summary of the screening process that has been applied to the European sites, which identifies the activities, pathways and effects that have been considered in the screening.

4.1 Overview of Plan Outcomes and Effect Pathways

The Sector Objectives (see **Table 2.3**) are the intended (and so arguably 'likely') outcomes of the WNMP; these outcomes are guided, supported and moderated by the policies, individually and collectively. The WNMP therefore promotes or supports proposals for activities and provides planning guidance for lower-tier decision-making. The intended effect of this is therefore the facilitation and delivery of sustainable activities and development within the marine area – for example, aggregate extraction, tidal energy or aquaculture schemes. However, the range of activities that might benefit or result from the WNMP is extensive, and the strategic nature of the WNMP ensures that the assessment of activities and outcomes is necessarily generic.

Most environmental assessments employ source-pathway-receptor models (or similar) to identify potential environmental changes and the risk of consequent effects on ecological receptors. Due to the scope of the WNMP, and the absence of specific schemes (etc.), it is appropriate to adopt a broad approach to the identification of potential sources and pathways, and hence likely effect on European sites and features. As a result, this HRA uses the JNCC's *Marine activities and pressures evidence* database (JNCC 2016) as a basis for the identification of potential effect pathways. This provides:

- a standard UK list of marine activities and their definitions; and
- a list of marine pressures and their definitions (as agreed by the OSPAR Intercessional Correspondence Group on Cumulative Effects).

The activities and pressures identified by the JNCC are summarised in **Tables 4.1** and **4.2** below; a summary matrix is provided in **Appendix F**, which shows which pressures may occur as a result of specific activities. The standard activity and pressure definitions (from JNCC) are provided in **Appendix F**.

It should be noted that the WNMP will have limited or no direct influence over many of the activities noted in **Table 4.1**, particularly where they are permitted 'operational' activities outside the remit of a spatial planning policy document (and its associated HRA). For example, fishing is not a function or a responsibility of marine planning, but a consideration of it; similarly with defence activities, or shipping, or sewage disposal. Unless there is a proposal for a capital scheme or similar, requiring permitting and hence consideration of the WNMP policies, then the WNMP has few mechanisms for influencing these aspects and cannot direct, influence or clarify the nature and location of particular activities through its policies. This is noted in **Table 4.1** and explored in more detail in **Section 5.1** (Policy Screening).

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Table 4.1 Activities with the potential to affect marine receptors, based on the *Marine activities and pressures evidence* database (JNCC 2016), with the potential for WNMP influence; definitions in Appendix F.

Activity	WNMP influence on activities?
Coastal defence & land claim protection (incl. beach replenishment)	Partial
Coastal docks, ports & marinas	Yes
Waste gas emissions	No
Industrial & agricultural liquid discharges	Partial
Sewage disposal	Partial
Waste disposal - munitions (chemical & conventional)	Partial
Power stations - thermal effluent and nuclear discharge	Partial
Fishing – demersal trawling	No
Fishing – dredging	No
Fishing – pelagic trawling	No
Fishing – traps (potting/creeling)	No
Fishing – recreational	No
Fishing – nets (static)	No
Fishing – lines	No
Fishing - seines (encircling)	No
Harvesting - seaweed and other sea-based food (bird eggs, shellfish, etc.)	No
Extraction of genetic resources e.g. bioprospecting & maerl (blue technology)	Partial
Aquaculture - fin-fish	Yes
Aquaculture – shellfish	Yes
Aquaculture – macro-algae	Yes
Extraction – sand and gravel (aggregates)	Partial
Extraction – rock/ mineral (coastal quarrying)	No
Extraction – navigational dredging (capital & maintenance)	Yes
Dredge & spoil disposal	Yes
Extraction – water (abstraction)	Partial
Renewable energy – wind (not including cables)	Yes
Renewable energy – wave (not including cables)	Yes
Renewable energy - tidal (not including cables)	Yes
Marine hydrocarbon extraction (not including pipelines)	Partial
Shipping – port operations (mooring, beaching, launching etc.)	Partial
Shipping – general (at sea)	No

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Activity	WNMP influence on activities?
Coastal tourist sites (public beaches & resorts)	Partial
Recreational activities (e.g. boating, yachting, diving, etc.)	No
Marine research activities (incl. physical sampling and remote sensing)	Partial
Military activities	No
Submarine cable and pipeline operations	Yes
Gas storage operations (carbon capture & natural gas storage)	Partial
Artificial reefs and other environmental structures	Yes
Cultural & heritage sites/structures (e.g. wrecks, sculptures, foundations etc.)	Yes

4.1.1 The pressures noted in **Table 4.2** are grouped according to the broad pressure themes identified in the UK Marine SAC Project (2001) and used in the Regulation 33/35 advice documents[25] for ease of reference, although these themes have been amended a little to better reflect the range of potential sensitivities and effects associated with the WNMP[26]:

- Hydrodynamic changes (and hence potential geomorphological effects; e.g. alterations to tidal flows and currents; alterations to wave action);
- Toxic contamination (e.g. through intentional, incidental or accidental discharges of contaminants; or mobilisation of contaminated sediments);
- Non-toxic contamination and physio-chemical changes (e.g. nutrient enrichment; temperature changes; salinity changes);
- Direct physical loss of habitats (e.g. from direct removal or smothering and hence change to another seabed type; land reclamation; etc);
- Direct physical damage of habitats (e.g. from partial removal by aggregate extraction; abrasion; changes in siltation rates; etc.);
- Other physical pressures (e.g. litter; noise and vibration; visual disturbance; collisions);
- Biological Disturbance (e.g. from introduction of microbial pathogens, the introduction of invasive non-native species, or from selective extraction of selected species).

4.1.2 The sensitivity of various European features to these pressures is considered later in the report (see **Section 3.3**). The *Marine activities and pressures evidence* database also provides detailed information on the impact pathways and the evidence collected; **note that this is not reproduced in this report due to its size, although it is referenced as appropriate and is freely available online.**

[25] Advice originally provided by SNCBs pursuant to Regulation 33 of *The Conservation (Natural Habitats, &C.) Regulations 1994* (now Regulation 35 of the *Conservation of Habitats and Species Regulations 2010* (as amended)).
[26] It should also be noted that the Regulation 33/35 advice themes do not precisely match those used in the JNCC's *Marine activities and pressures evidence* matrix (JNCC 2013) although this does not affect the assessment process or outcomes.

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Table 4.2 Pressures with the potential to affect marine receptors, based on the *Marine activities and pressures evidence* database (JNCC 2016); full definitions in Appendix F.

Regulation 33/35 theme	JNCC-identified pressures
Hydrodynamic changes	Water flow (tidal current) changes
	Emergence regime changes
	Wave exposure changes
Toxic contamination	Non-synthetic compound contamination (general)
	Non-synthetic compound contamination - Transition elements & organo-metals
	Non-synthetic compound contamination - Hydrocarbon & Polycyclic Aromatic Hydrocarbon (PAH) Contamination
	Synthetic compound contamination
	Radionuclide contamination
Non-toxic contamination and physio-chemical changes	Temperature changes
	Salinity changes
	Introduction of other substances (solid, liquid or gas)
	De-oxygenation
	Nutrient enrichment
	Organic enrichment
Physical loss	Physical loss (to land or freshwater habitat)
	Physical change (to another seabed type)
Physical damage	Habitat structure changes - removal of substratum (extraction)
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)
	Penetration and/or disturbance of the substrate below the surface of the seabed- Surface
	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface
	Changes in suspended solids
	Siltation rate changes
Other physical changes	Litter
	Electromagnetic changes
	Noise and vibration changes
	Introduction of light
	Barrier to species movement
	Death or injury by collision
	Visual disturbance
Biological changes	Genetic modification & translocation of indigenous species

Regulation 33/35 theme	JNCC-identified pressures
	Introduction or spread of non-indigenous species
	Introduction of microbial pathogens
	Removal of target species
	Removal of non-target species

4.1.3 A summary matrix is provided in **Appendix F**, which shows which pressures may occur as a result of specific activities.

4.2 Exposure of Sites and Features to WNMP Outcomes

4.2.1 Most European site interest features will be sensitive to one or more of the pressures noted in **Section 4.1**. However, for an interest feature (and hence a European site) to be potentially affected by the outcomes of the WNMP it must be exposed to those outcomes also. The actual exposure of an interest feature to a pressure as the result of an activity will depend on a range of factors, most of which cannot be identified or defined at the strategy level, since they will depend heavily on the precise nature of the specific activities, including any mitigation or avoidance measures that are implemented. However, it is possible to determine the potential for features to be exposed, based on the location of the European sites, the characteristics of the interest features (particularly the behavioural characteristics of mobile species), and the presence (or not) of any functional linkages. It is not generally appropriate to employ 'arbitrary' screening criteria, but the considered use of suitably precautionary criteria does help rationalise any assessment. This is particularly relevant to the WNMP, due to the scale of the WNMP area and the correspondingly large number of European sites.

4.2.2 Therefore, the screening process for European sites applies a set of criteria to identify those sites and interest features that **will not** be affected by the WNMP outcomes (i.e. no significant effects). Essentially, a suitably precautionary 'zone of environmental influence' is defined for the activities supported by the WNMP, based on a broad range of existing case studies and examples from delivered projects, where environmental changes are possible as a result of the plan. Interest features are considered to be potentially exposed to the effects of the WNMP (as a whole) if they coincide with this estimated zone of influence. Additional screening is undertaken where particular sectors with defined SRAs are taken forward for assessment (see **Section 5**; and **Sections 6 - 9**).

Zone of influence

4.2.3 At this stage the 'zone of influence' (ZoI) relates to the WNMP as a whole, without distinctions for individual sectors. This is partly to simplify the screening process and partly to ensure that there is no risk of features or sites being excluded inappropriately. The zone of environmental influence has the following components.

i. **The WNMP area**. The entirety of the WNMP area is included as (in theory at least) one or more of the activities supported by the plan could occur anywhere within this area. In practice the picture is more nuanced, as most areas will be unsuitable for most activities, and certain areas are safeguarded for particular activities by the policies, but the WNMP contains no over-riding exclusionary policies that would prevent any type of activity in a particular area.

ii. **A 50km buffer around the WNMP, in marine environments**. The habitat features of designated sites will be sensitive to physio-chemical changes associated with pressures such as the Physical Loss/Gain of Habitat; Physical Damage to Habitat; Toxic Contamination; or Non-Toxic Contamination; and Biological Disturbance. Sites and habitats within the WNMP area are potentially exposed to direct effects (e.g. habitat loss due to construction) as well as indirect effects (e.g. from the dispersal of contaminants); however, effects outside the WNMP area due to activities within it will depend on

hydrodynamics (etc.) and more distant areas are less likely to be exposed to effects due to natural attenuation. 50km is considered to be a suitably precautionary zone of environmental influence in the marine environment based on a broad range of existing case studies and informal consultation responses from Natural Resources Wales (NRW) on an earlier draft of the HRA. For example:

- Based on evidence from plume studies, sediment mobilised from offshore activities tends to become re-deposited within the distance of one tidal ellipse, which NRW suggest is around 30km in the Severn Estuary and 21km in the Liverpool Bay area; the Anglian Marine Aggregate Regional Environmental Assessment (MAREA) (Emu 2012) suggests a maximum extent for secondary sediment effects as 500m for deposition to the sea bed (smothering) and 0.25km to 4km for fine sediment dispersal.
- Similarly, modelling and monitoring has demonstrated that various offshore discharges (e.g. waste water) are typically attenuated within a few kilometres of the source, and typically much less.
- Modelling information from DECC (2010) suggests that some tidal range schemes could have effects that extend across the Irish Sea.

iii. **A 2km inland buffer**. Activities supported or managed by the WNMP may affect onshore environments, through a range of direct and indirect mechanisms (e.g. aggregate extraction could affect beach recharge and hence the dynamics of associated sand dunes; planned cable-landing points may have no effect on marine receptors but could (in conjunction with onshore planning) affect onshore sites). However, it is considered that the maximum inland range for physical effects that could reasonably be connected to activities supported by the WNMP is 2km, and the plan will have little or no direct influence over associated developments occurring in terrestrial areas away from the coast.

4.2.4 The ZoI is illustrated on **Figure 4.4 at the end of this chapter**.

Screening

Geographical screening

4.2.5 All sites within the ZoI (the WNMP area; a 50km marine buffer; and 2km inland of the Welsh Coast) are considered to be potentially exposed to the effects of the WNMP. Sites outside this zone are therefore 'screened out', **except** where they support mobile species that may make use of habitats in the ZoI during their life cycle (see below). The sites within the ZoI are listed in **Appendix B**.

Habitats screening

4.2.6 Application of a geographical screening can throw up anomalies; for example, a river designated for the feature '*Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*' is likely to be partly within 2km of the WNMP boundary but the feature is self-evidently not exposed to the likely effects due to its location within the site and the consequent absence of impact pathways. The habitat interest features of terrestrial sites within 2km of the WNMP boundary are therefore examined, with features that are evidently outside the 2km buffer excluded where there is no realistic impact pathway (e.g. environmental or geomorphological process) associated with activities supported by the plan.

4.2.7 Note, the conservation status for natural habitats is defined in Article 1(e) of the Habitats Directive as "… the sum of influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species". The conservation status of habitats is taken as 'favourable' when, inter alia, the conservation status of its typical species is favourable. The habitats screening therefore accounts for 'typical species' as far as is achievable (see 'Feature distributions within the WNMP area', below).

Mobile species screening

4.2.8 The exposure of mobile species, particularly some of the wide-ranging species found in marine environments, is substantially more difficult to determine due to the patchiness of the data. In many instances it is not possible to exclude the possibility that mobile species from a particular site will use or transit the WNMP area. This is a particular issue for migratory waterbirds and seabirds (see below). However, the following principles are applied when determining the potential for mobile species groups to be affected.

Bats

4.2.9 The main UK Annexe II bat species (Lesser horseshoe bat *Rhinolophus hipposideros*; Greater horseshoe bat *Rhinolophus ferrumequinum*; Barbastelle *Barbastella barbastellus*; and Bechstein's bat *Myotis bechsteinii*.) commonly migrate 20 – 30km between summer and winter roost sites. They have been recorded on offshore islands around Wales but are not thought to make significant migrations over open sea (e.g. from UK to Ireland or continental Europe). Mouse-eared bat *Myotis myotis* is thought to be migrate between the UK and mainland Europe, but is considered to be effectively extinct in the UK at the moment (although individuals have been recorded in Sussex) and there is no credible pathway for effects on distant sites supporting this species. Therefore sites designated for these species that are over 20km from the WNMP area are not considered likely to be affected by the outcomes of the WNMP, and are screened out. The sites included in this category are identified in **Appendix C**.

Marine mammals

4.2.10 IAMMWG (2015) "*Management Units for Cetaceans in UK Waters*" and Evans (2012) "*Recommended Management Units for Marine Mammals in Welsh Waters"* identify Marine Management Units (MMUs) for marine mammals associated with UK and Irish European sites (Bottlenose dolphin *Tursiops truncates*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; and Harbour seal *Phoca vitulina*). European sites that coincide with these MMUs are assumed to be the 'core sites' for those species' populations and are therefore considered to be potentially exposed to the outcomes of the plan. Mammals from sites beyond this may periodically use or transit the WNMP area but almost certainly not in sufficient numbers for effects on site integrity to be significant. These sites are therefore excluded from explicit assessment; however, it should be noted that any measures considered sufficient to safeguard mammals from the screened in sites will certainly be sufficient to safeguard mammals from more distant sites also. The sites included in this category are identified in **Appendix C**; note, this includes sites within a 50km buffer around each MMU as a precaution although effects at this distance are likely to be weak.

Diadromous fish (plus Freshwater pearl mussel)

4.2.11 The movements of diadromous fish associated with European sites (Atlantic salmon; Sea lamprey; River lamprey; Allis shad; Twaite shad; and (for Ramsar sites) European eel) when away from their natal rivers is not well-established except in broad terms, although Malcolm *et al.* (2010) provide a useful synopsis of the known data for salmon and eels using rivers in Scotland.

4.2.12 The dominant sea currents around the British Isles are the North Atlantic Drift and the Shelf Edge Current (which runs up the west coast of Ireland) and so migration routes or staging areas in the WNMP area are likely to be predominantly used by fish associated with rivers that discharge to the Celtic and Irish Seas (rather than from SACs that are further afield). All European sites designated for Atlantic salmon; Sea lamprey; River lamprey; Allis shad; Twaite shad; and Freshwater pearl mussel (which is dependent on salmon for part of its life-cycle) which discharge into the Irish or Celtic Seas are therefore screened in, since these populations are most likely to be exposed to the likely outcomes of the plan. Sites outside this area (i.e. rivers that discharge from: the north and east coast of Scotland; the south and east coast of England; the west coast of Ireland; and the Atlantic and channel coasts of France) are not explicitly considered in the screening as the exposure of fish populations from these sites to activities in the WNMP area is considered likely to

be sufficiently low to have not significant effect on these populations, based on likely migration patterns. The sites included in this category are identified in **Appendix C**.

Resident and migrant terrestrial birds

4.2.13 SPAs which support exclusively terrestrial species that are unlikely to cross or use the WNMP area are not considered to be exposed to the potential outcomes of the plan. This includes those sites designated for largely sedentary species (e.g. golden eagle) as well as sites designated for terrestrial migratory species where their migration route is unlikely to cross the WNMP area (e.g. nightjar, Dartford warbler). The determination of migration routes and risk is based on the information provided in Wright *et al.* (2012) for the BTO (*Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas*) moderated by an analysis of SPA locations in the UK and Ireland (e.g. all sites designated for nightjar are in the south and east of England). In practice, all terrestrial SPA interest features associated with UK and Irish SPAs that are over 20km from the WNMP area are screened out.

Pelagic seabirds

4.2.14 NRW (the Statutory Nature Conservation Body in Wales) has indicated that the screening should take account of available studies on seabird seasonal migrations and behaviours, including Thaxter *et al.* (2012) (foraging distances), NE (2015) (Biologically Defined Minimum Population Scale (BDMPS)) and the BTO GIS model for assessing risks due to offshore windfarms (Wright *et al.* 2012).

4.2.15 Applying screening rules to sites supporting seabirds is difficult due to the complexities of their seasonal migrations and behaviours. In particular, although the WNMP ZoI will be beyond the maximum foraging range of many breeding seabirds associated with particular SPAs, these species will disperse to offshore areas or migrate once breeding has finished, which may involve transit or use of the WNMP area. For example:

- The maximum foraging range of razorbill, based on Thaxter *et al.* (2012) is 95km, which would exclude most Scottish seabird SPAs from consideration including (for example) Mingulay and Berneray SPA; however, the NE (2015) report '*Non-breeding season populations of seabirds in UK waters*' suggests that razorbill from this SPA contribute to the wintering population in the "UK western waters" Biologically Defined Minimum Population Scale (BDMPS), which includes the Irish and Celtic seas (and hence the WNMP area).
- Kittiwake associated with the Flamborough Head and Bempton Cliffs SPA (east coast of England) are very unlikely to use the WNMP area when breeding, but reasonable proportions of the population (20% or more) are thought likely to use the "UK western waters" BDMPS on spring or autumn migration.

4.2.16 Data from the NE (2015) report '*Non-breeding season populations of seabirds in UK waters*' has been used to identify the various BDMPS for European site features that overlap with the WNMP ZoI, with European sites considered potentially exposed to the effects of the plan where more than 1% of a site's population is thought to contribute the wintering population in the relevant BDMPS. In practice, this would exclude 10 species associated with 44 European sites, predominantly from north eastern Scotland and the east coast of England. However, the BDMPS is not necessarily useful for high-level strategic assessments of plans such as the WNMP.

4.2.17 Furthermore, application of the BTO GIS model for assessing the risk of offshore windfarms to migratory birds (Wright *et al.* 2012) suggests that most of these species transit the Irish Sea, although this work does not allow the risk to individual European site populations to be identified.

4.2.18 As a result, it is difficult to categorically exclude the possibility of effects on the majority of species at most seabird SPAs if these protocols are employed, since most appear likely to use the marine areas within the WNMP ZoI at some stage in their life cycle, be it breeding, wintering or migrating. Therefore all seabird sites in the UK are considered to be potentially exposed to the outcomes of the WNMP, although for most sites and species the potential for significant or adverse effects will be very low.

Wildfowl and waders

4.2.19 Wintering waders and wildfowl can be fairly sedentary once they arrive in their wintering areas, often only moving short distances between roosting and feeding areas. However, longer-distance movements of individuals and flocks between sites are common, typically in association with changing weather conditions, which may involve transit or use of the WNMP area. The risk of wildfowl and waders crossing the WNMP area has been assessed using the information provided in Wright *et al.* (2015) for the BTO (*Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas*), based on advice from NRW; this theoretically allows species that may be exposed to the outcomes of the plan to be identified. However, it should be noted that whilst this allows some species with restricted migrations (and hence some sites) to be objectively excluded[27], for most species and sites this is not possible, and the application of the BTO model to the WNMP assessment scenario arguably has limited value (in theory, all European sites in the UK and Ireland supporting wintering bird species that could migrate across the WNMP area would be considered potentially exposed (see **Appendix E**))[28]. The assessment therefore focuses on those European sites which are within the WNMP ZoI as (i) wintering birds from other sites are most likely to be exposed the effects of the plan if they use these sites; (ii) additional effects on more distant sites would not be expected; and (iii) it is considered that any policy-based measures employed to avoid or mitigate effects on features from sites within the study area will also safeguard the same or similar features associated with more distant European sites.

Feature distributions within the WNMP area

4.2.20 The broad screening criteria noted above are used to identify those European sites with features that may be exposed to the likely outcomes of the WNMP. However, the distribution of interest features within the WNMP obviously varies, and some features may be more or less exposed to particular activities or outcomes. Unfortunately, distribution evidence for many interest features is patchy, even within European site boundaries, and so the information below is used primarily to guide the assessment of the policies and provide a framework for identifying features or sites that are more likely to be vulnerable affected by the plan outcomes

Habitats

4.2.21 The habitat interest features will coincide with the sites themselves. The Regulation 33/35 advice for some sites contains information on the approximate distribution of some habitat interest features within the sites, which can potentially be used to identify those features that are more (or less) exposed to an activity in a particular area. However, this exercise is more appropriate for project-scale HRAs, where the specific parameters of a scheme are known and hence the potential for features to be affected can be more reliably judged.

Typical species

4.2.22 NRW Regulation 33/35 advice for marine sites defines the 'typical species' as "species that are, from time to time, associated with a specified habitat within the site; i.e. all species that contribute to the biodiversity of the specified habitat within the site"[29]. It is important to note that this refers to "…the specified habitat" rather than the biodiversity of the site as a whole: in general 'typical species' are taken as those that are a representative or intrinsic component of the designated

[27] For example, the Dark-bellied brent goose spends the winter in southern and south-eastern parts of Britain.

[28] It is recognised that the logical extension of this approach is that the breeding SPAs of wintering species must also be considered theoretically exposed to the effects of the plan; this would arguably require that SPAs in (for example) Scandinavia or the Baltic be considered also where they use UK sites in the winter. This linkage would be extremely difficult to explore in any meaningful way, and it must therefore be assumed that if the plan can avoid significant or significant adverse effects on interest features when using UK SPAs and habitats, then this will also ensure that there are no effects (as a result of the plan) on more distant, breeding SPAs. This is an appropriate mechanism for dealing with effect scenarios that are imaginable but unlikely.

[29] E.g. CCW (2009) *Cardigan Bay European Marine Site: Advice Provided by the Countryside Council For Wales in Fulfilment of Regulation 33 of the Conservation (Natural Habitats, &C.) Regulations 1994*.

habitat feature; or which are otherwise important to its maintenance and ecological functioning; or which are perhaps dependent on the particular characteristics of that habitat. It is not usually taken to mean 'any species that may use the site' or similar.

4.2.23 However, there are no definitive lists of 'typical species' for particular sites or habitats. Whilst the Regulation 33/35 advice documents provides some guidance on the 'typical species' associated with the various habitat features, this is not intended to be exhaustive and in practice the complexity of most marine habitats and ecological interactions means that a very wide range of species and species groups might be considered 'typical'[30] under the above definition (indeed, few marine taxa could be excluded).

4.2.24 The information available on 'typical species' is therefore highly variable, and it is difficult to provide substantive information on the distributions of typical species that might be useful for assessments undertaken at the plan- or policy-level. Many species are mobile for all or part of their life-cycle[31] and so (as with mobile species features) potential effect pathways are not limited to the geographical extent of the site; however, the species will be directly associated or co-located with the habitat features of the site in question at some point and so the sites themselves are likely to be the key areas for the vast majority of typical species.

Bats

4.2.25 There are 11 European sites with bats as a feature within 20km of the ZoI. As noted, UK bat species have been recorded on offshore islands around Wales but significant excursions over open sea are not thought to occur. Any risk to bats would generally come from developments in coastal and close inshore areas. The main exception to this may be around the Severn Estuary and (to a lesser extent) the Bristol Channel, where bat sites are present on both the English and Welsh sides of the estuary and the open water distance is less than 20km. Bats have been recorded crossing the estuary and so it is perhaps more likely that bats may be encountered several kilometres from the coast in these areas, particularly during migration periods.

Marine mammals

Harbour porpoise

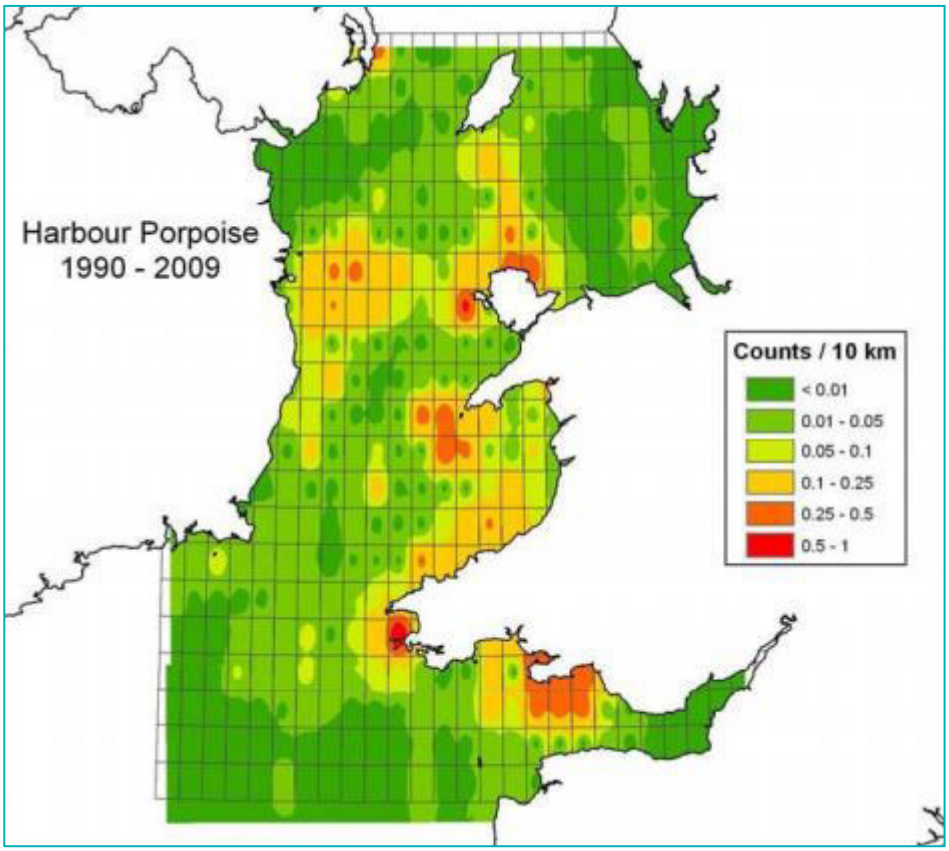
4.2.26 Harbour porpoise is the commonest and most widespread cetacean species in Welsh waters. Harbour porpoise utilise the entire continental shelf waters and not just coastal areas, although 'hotspots' of activity have been identified off North and West Anglesey; the southwest coast of the Lleyn Peninsula; southern Cardigan Bay; and in the Bristol Channel. The species is known to use tidal conditions for foraging and often occurs in areas of high tidal energy around headlands and channels.

4.2.27 The *Atlas of the Marine Mammals of Wales* (Baines & Evans 2012) provides a useful analysis of the temporal and spatial distribution and relative abundance of marine mammal species in the Irish and Celtic seas, based on a range of survey datasets and studies. The variability the source data and recording techniques ensures that there are some analysis constraints, and the mapping should be used cautiously; however, the study notes that maps show consistency across time periods, giving "*some confidence at least at a gross level*" (Baines & Evans 2012). The inverse distance weighted (IDW) interpolated distribution map for harbour porpoise is provided below (**Figure 4.1**).

[30] So, for example, basking sharks are frequently recorded within Cardigan Bay SAC but might not necessarily be considered as a 'typical species' of the habitat features (Reefs, Submerged or partially submerged sea caves, Sandbanks which are slightly covered by seawater all the time); however, these features (or the associated geomorphology) are likely to be factors influencing feeding opportunities in the area, so there may be some functional association that would warrant consideration in any HRA.

[31] For example, many benthic invertebrate species have planktonic juvenile stages and are likely to be at least partly dependant on recruitment from outside the site.

Figure 4.1 IDW interpolated map of harbour porpoise distribution (*from Baines & Evans 2012*)



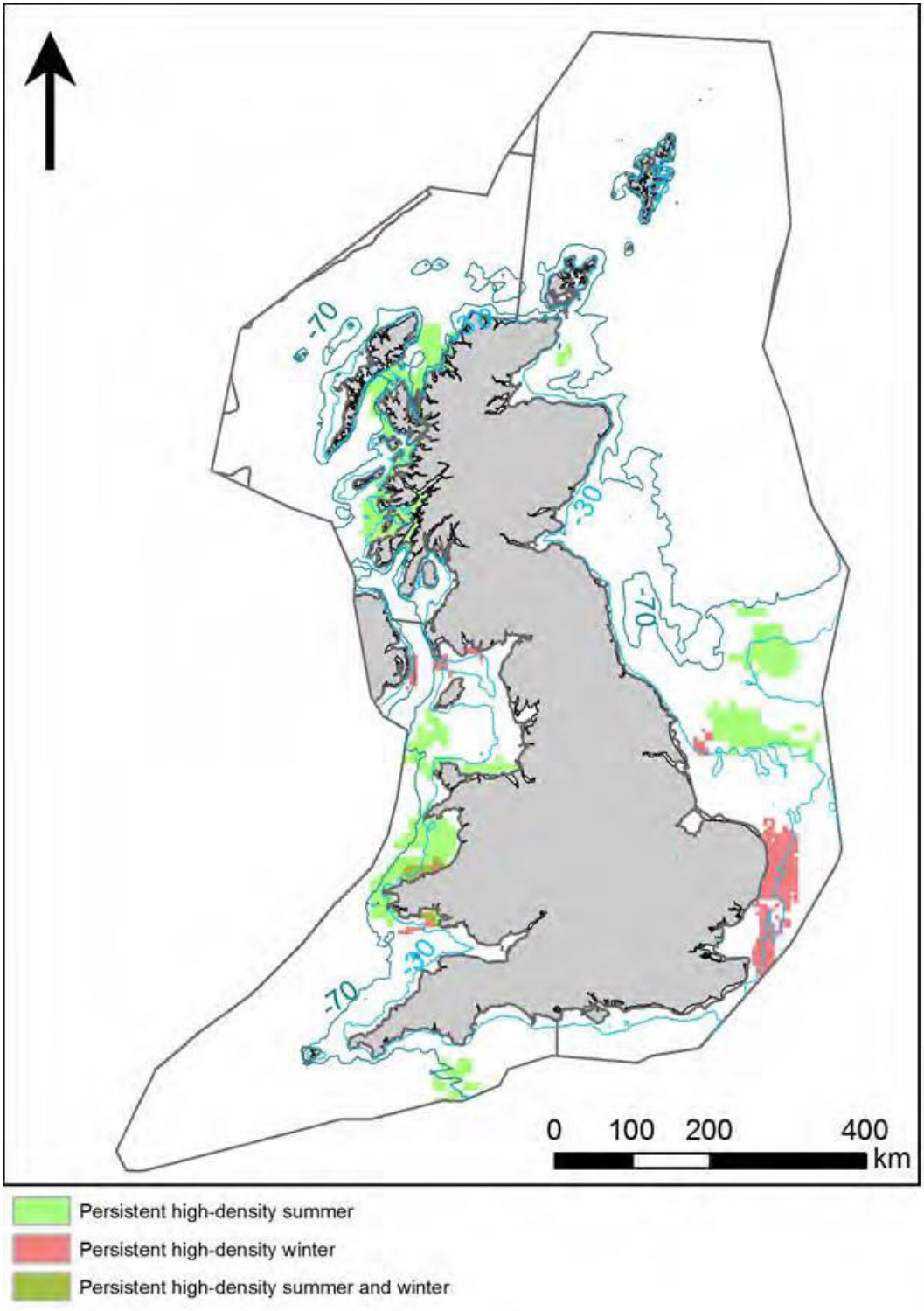
4.2.28

4.2.29

4.2.30 More recent modelling has been completed by Heinänen and Skov (2015). This used the Joint Cetacean Protocol (JCP)[32] data to build a distribution model of porpoise density based on their relationships with environmental parameters, such seabed type and the presence of upwelling, fronts and eddies, and was the primary evidence base for the proposed harbour porpoise SACs around the WNMP area (North Anglesey Marine / Gogledd Môn Forol cSAC; West Wales Marine / Gorllewin Cymru Forol cSAC; Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC; and North Channel cSAC). **Figure 4.2** (from Heinänen and Skov (2015)) shows the persistent high-density areas of harbour porpoise around the UK coast. These data are used when considering the potential effects of the WNMP, particularly the SRAs.

[32] http://jncc.defra.gov.uk/page-5657

Figure 4.2 Persistent high-density areas of harbour porpoise with survey effort from three or more years (from Heinänen and Skov (2015))



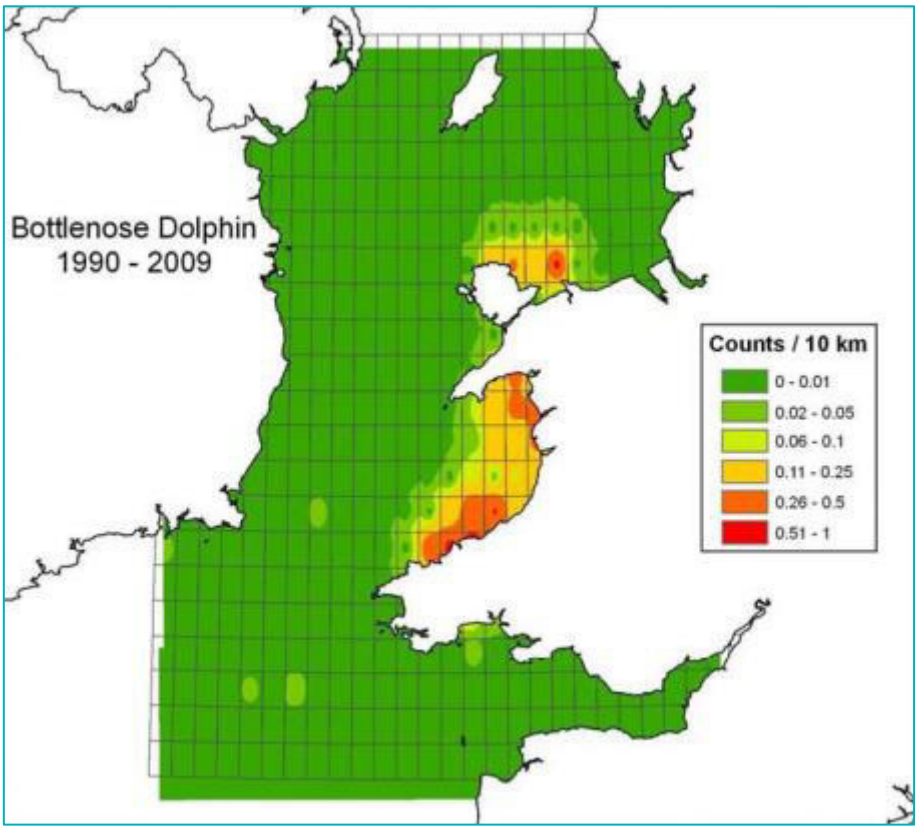
Bottlenose dolphin

4.2.31 Bottlenose dolphins have a predominantly inshore distribution, particularly around Cardigan Bay which is particularly attractive for the species, possibly due to the shallow benthic areas. However, it is evident (Feingold & Evans 2014) that some individuals range more extensively along the coast and in the Irish Sea, although the main sighting areas for this species are from inshore areas around southern Cardigan Bay into Tremadog Bay in the north. It also occurs frequently off the north coast, particularly north and east of Anglesey, and low densities have been recorded in

offshore areas around St. George' Channel. The species may form small groups in the summer, centred on Cardigan Bay, before dispersing more widely in winter.

4.2.32 The inverse distance weighted (IDW) interpolated distribution map (Baines & Evans 2012) for bottlenose dolphin is provided below (**Figure 4.3**).

Figure 4.3 IDW interpolated map of bottlenose dolphin distribution (*from Baines & Evans 2012*)



Grey seal

4.2.33 Grey seals are widely distributed around Wales (although in low densities compared to Scottish populations, for example), typically using secluded or inaccessible areas of the coast for breeding particularly in Pembrokeshire, southern Ceredigion, the Lleyn and Anglesey. These areas are also used outside the breeding season for moulting, feeding and haul-out sites, along with other areas around the coast (e.g. offshore sandbanks, such as the West Hoyle Sandbank in the Dee Estuary).

4.2.34 Westcott & Stringell (2004) identify several haul-out sites in North Wales that appear particularly important (Ynys Dulas, Ynys Seiriol/Puffin Island, the West Hoyle Sandbank and Ynys Enlli/Bardsey Island in winter; and West Hoyle Sandbank, Ynys Enlli/Bardsey Island, the Tudwals and Ynysoedd y Moelrhoniaid/The Skerries in the summer). The principal sites in south Wales are around Ramsey and Skomer. However, a substantial proportion of the population use cryptic and isolated sites, and any areas with undisturbed rocky island shores or sea cave sites near tidal races are likely to be used.

4.2.35 Furthermore, only limited information is available on movements away from haulout sites. Grey seals are generalist feeders and forage predominantly on the sea bed at depths of up to 100m, although they are probably capable of feeding at all the depths found across the UK continental shelf (SCOS, 2016). SCOS (2015) notes that "*tracking of individual seals has shown that most foraging probably occurs within 100km of a haulout site although they can feed up to several hundred kilometres offshore*". The species is present year-round within the Irish Sea and is known to regularly travel between southeast Ireland and southwest Wales (Lidgard *et al.*, 2000). Analysis of grey seal movements indicate that they have homogeneous usage near-shore, transit between

haul-out sites in large-scale interconnected networks and spend 15% of their time far-offshore (Russell and McConnell, 2014).

Common seal

4.2.36 Baines & Evans (2012) provide no information on common seal distributions; this species is not thought to breed in Wales and the nearest sites designated for common seal are in Northern Ireland and Ireland. The species will use the Irish Sea periodically but significant agglomerations are not thought to occur in the region.

Diadromous fish (plus Freshwater pearl mussel)

4.2.37 As noted, the movements of diadromous fish associated with European sites (Atlantic salmon; Sea lamprey; River lamprey; Allis shad; Twaite shad; and (for Ramsar sites) European eel) when away from their natal rivers is not well-established except in broad terms. In broad summary:

- Sea lamprey migrate from the sea to the lower reaches of rivers in April and May to spawn; the adults do not feed in freshwater and die after spawning. The larval form remain in rivers for around 5 years before metamorphosing to the adult form and migrating to the sea, usually in the autumn (although the timing varies between rivers). Relatively little is known about the precise habitats occupied by adult sea lampreys, although estuaries are likely to be used during migration and development (although the species appears to be more marine than the river lamprey).
- River lamprey are behaviourally similar to Sea lamprey, although the main upstream migration period is during the winter. However, the species appears to make greater use of estuaries than sea lamprey, growing to maturity in these areas. River lamprey are also a feature of the River Wye SAC.
- Twaite and Allis shad gather in estuaries in early summer (April and May) before moving upstream to spawn from mid-May to mid-July. Suitable estuarine habitat is likely to be very important for shad, both for passage of adults and as a nursery ground for juveniles, although the precise distribution of these species within the estuary and marine environment is uncertain.
- Atlantic salmon migrate from the sea to their natal river in the late summer / autumn to breed, with juvenile fish migrating seaward in the spring. After a period of one to six years spent in freshwater the young salmon undergo physiological and behavioural changes to become smolts and migrate downstream to the sea. The smolts spend time in estuaries to acclimatise to the salinity of the sea water and to a change of diet before migrating to coastal waters, and then to the Norwegian Sea or North Atlantic. Salmon live in the sea for between one and four years, mostly near the surface or in midwater.

4.2.38 It is therefore difficult to identify particular areas within the WNMP ZoI that may be especially important or well-used by these species, other than estuarine areas which are known to be used by all species for a proportion of their life-cycle.

Pelagic seabirds

4.2.39 As noted above, determining distribution information (and hence potential exposure) for seabirds is difficult due to the complexities of their seasonal migrations and behaviours; whilst it may be possible to exclude the possibility of some species from some sites being affected during breeding on the basis of Thaxter *et al.* (2012), this cannot necessarily be extended to the same species / sites for the winter period, based on the BDMPS assessments. More detailed data on distributions is not generally available, particularly for species that winter in offshore areas, and so further refinement of the risk to these features is not necessarily possible.

Wintering waders and wildfowl

4.2.40 As noted, wintering waders and wildfowl can be fairly sedentary, typically moving relatively short distances between roosting and feeding areas unless undertaking longer-distance movements in

response to changing conditions. As a result, the largest concentrations of wintering wildfowl and waders will be associated with the European sites themselves, and with any non-designated functionally linked areas (e.g. nearby fields which are used for roosting or foraging at high tide). Activities are therefore more likely to result in significant effects if they are in close proximity to these areas.

4.3 Effect Pathways and Feature Sensitivities

4.3.1 The initial screening provides a long list of sites and features that are potentially exposed to the likely outcomes of the WNMP (see **Appendices B – E**). In order to rationalise the screening it is appropriate to sort interest features into groups with similar characteristics, behaviours and sensitivities. The principal habitat and species groups used are:

- Terrestrial habitats within 2km of WNMP area (excl. supralittoral habitats);
- Subtidal and intertidal habitats;
- Coastal and supralittoral habitats;
- Bats;
- Marine mammals;
- Diadromous fish (plus freshwater pearl mussel);
- Pelagic seabirds (breeding and wintering);
- Wildfowl and waders (breeding and wintering);

4.3.2 In addition, the potential for 'typical species' to be affected is considered. This is obviously a hugely diverse category but the subdivision of this into specific groups or taxa is not practicable at this level in the plan or assessment hierarchy. It is therefore important that 'typical species' are appropriately considered in any 'down-the-line' HRAs.

4.3.3 The interest features that coincide with, or potentially use or transit the ZoI are listed in **Table 4.3**. The sensitivity of these feature groups to the pressures identified in **Table 4.2** is then summarised in **Table 4.4**. Note that **Table 4.4** focuses on the pressures occurring in the marine environment and so terrestrial habitats within 2km of the WNMP area are not explicitly considered in this table as effects are only likely to be secondary or in combination effects from the onshore component of any prospective development (which the WNMP ultimately has limited influence over).

4.3.4 The potential for these feature groups to be affected by the general and sector policies of the WNMP is considered in the **Section 5**.

Table 4.3 Interest feature groups that coincide with, or potentially use or transit the zone of influence

Feature Group	Interest features screened into assessment
Terrestrial habitats within 2km	See Appendix B – note, the terrestrial features within the 'zone of influence' are not listed here as (unlike marine habitats) they will not be systematically exposed to the outcomes of the WNMP (i.e. any effects are likely to be secondary or 'in combination' effects associated with specific projects which are not defined at this level).
Subtidal and intertidal habitats	Sandbanks which are slightly covered by sea water all the time Estuaries Mudflats and sandflats not covered by seawater at low tide Large shallow inlets and bays Reefs Submarine structures made by leaking gases Salicornia and other annuals colonizing mud and sand *Spartina* swards (*Spartinion maritimae)* Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* Submerged or partially submerged sea caves Plus marine aspects of Ramsar criteria: Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path
Coastal and supralittoral habitats	Coastal lagoons Annual vegetation of drift lines Perennial vegetation of stony banks Vegetated sea cliffs of the Atlantic and Baltic Coasts Mediterranean and thermo-Atlantic *halophilous* scrubs (*Sarcocornetea fruticosi)* Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") Fixed coastal dunes with herbaceous vegetation ("grey dunes") Atlantic decalcified fixed dunes (*Calluno-Ulicetea)* Dunes with *Hippopha rhamnoides* Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)* Humid dune slacks Coastal dunes with *Juniperus* spp. Petalwort *Petalophyllum ralfsii* Shore dock *Rumex rupestris*
Bats	Lesser horseshoe bat *Rhinolophus hipposideros* Greater horseshoe bat *Rhinolophus ferrumequinum* Barbastelle *Barbastella barbastellus* Bechstein`s bat *Myotis bechsteini*
Marine mammals	Bottlenose dolphin *Tursiops truncatus* Harbour porpoise *Phocoena phocoena* Otter *Lutra lutra* Grey seal *Halichoerus grypus* Common seal *Phoca vitulina*
Diadromous fish (plus freshwater pearl mussel)	Atlantic salmon *Salmo salar* Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Allis shad *Alosa alosa* Freshwater pearl mussel *Margaritifera margaritifera* Twaite shad *Alosa fallax*

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Feature Group	Interest features screened into assessment
Pelagic seabirds (breeding and wintering)	Northern fulmar *Fulmarus glacialis* Manx shearwater *Puffinus puffinus* European storm-petrel *Hydrobates pelagicus* Leach's storm-petrel *Oceanodroma leucorhoa* Northern gannet *Morus bassanus* Great cormorant *Phalacrocorax carbo* European shag *Phalacrocorax aristotelis* Black (common) scoter *Melanitta nigra* Velvet scoter *Melanitta fusca* Arctic skua *Stercorarius parasiticus* Great skua *Catharacta skua* Mediterranean gull *Larus melanocephalus* Little gull *Larus minutus* Black-headed gull *Larus ridibundus* Mew gull *Larus canus* Lesser black-backed gull *Larus fuscus* Herring gull *Larus argentatus* Great black-backed gull *Larus marinus* Black-legged kittiwake *Rissa tridactyla* Sandwich tern *Sterna sandvicensis* Roseate tern *Sterna dougallii* Common tern *Sterna hirundo* Arctic tern *Sterna paradisaea* Little tern *Sterna albifrons* Common guillemot *Uria aalge* Razorbill *Alca torda* Atlantic puffin *Fratercula arctica* Red-throated diver *Gavia stellata*

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Feature Group	Interest features screened into assessment
Wildfowl and waders (breeding and wintering)	Black-throated diver *Gavia arctica* Great crested grebe *Podiceps cristatus* Slavonian grebe *Podiceps auritus* Great bittern *Botaurus stellaris* Little egret *Egretta garzetta* Mute swan *Cygnus olor* Tundra swan *Cygnus columbianus bewickii* Whooper swan *Cygnus cygnus* Taiga bean goose *Anser fabalis fabalis* Pink-footed goose *Anser brachyrhynchus* Greylag goose *Anser anser* [Iceland/UK/Ireland] Greylag goose *Anser anser* [North-western Scotland] Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland] Common shelduck *Tadorna tadorna* Eurasian wigeon *Anas penelope* Gadwall *Anas strepera* Eurasian teal *Anas crecca* Mallard *Anas platyrhynchos* Northern pintail *Anas acuta* Garganey *Anas querquedula* Northern shoveler *Anas clypeata* Common pochard *Aythya ferina* Tufted duck *Aythya fuligula* Greater scaup *Aythya marila* Common eider *Somateria mollissima* Long-tailed duck *Clangula hyemalis* Common goldeneye *Bucephala clangula* Red-breasted *merganser Mergus serrator* Goosander *Mergus merganser* Spotted crake *Porzana porzana* Corn crake *Crex crex* Common coot *Fulica atra* Eurasian oystercatcher *Haematopus ostralegus* Pied avocet *Recurvirostra avosetta* Ringed plover *Charadrius hiaticula* Eurasian dotterel *Charadrius morinellus* European golden plover *Pluvialis apricaria* Grey plover *Pluvialis squatarola* Northern lapwing *Vanellus vanellus* Red knot *Calidris canutus* Sanderling *Calidris alba* Purple sandpiper *Calidris maritima* Ruff *Philomachus pugnax* Common snipe *Gallinago gallinago* Bar-tailed godwit *Limosa lapponica* Whimbrel *Numenius phaeopus* Eurasian curlew *Numenius arquata* Common redshank *Tringa totanus* Common greenshank *Tringa nebularia* Wood sandpiper *Tringa glareola* Ruddy turnstone *Arenaria interpres* Red-necked phalarope *Phalaropus lobatus* Greater white-fronted goose *Anser albifrons albifrons* Greenland white-fronted goose *Anser albifrons flavirostris* Dunlin *Calidris alpina schinzii* Black-tailed godwit *Limosa limosa limosa* Black-tailed godwit *Limosa limosa islandica* red knot *Calidris canutus islandica* Dunlin *Calidris alpina alpina* Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland] Dark-bellied brent goose *Branta bernicla bernicla* **Ramsar criteria**: Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity Crit. 5 - regularly supports 20,000 or more waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
'Typical species'	All species not identified above which may be associated with specific site habitats.

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Table 4.4 Sensitivity of interest feature groups to pressures occurring in the marine environment (Y – directly sensitive; S – sensitive to consequent or secondary effects; note, does not include terrestrial features)

Pressure	Marine and Intertidal Habitats	Supralittoral habitats	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
Emergence regime changes - local	Y	Y			S	Y	Y	Y
Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
Non-synthetic compound contamination - Transition elements & organo-metals	Y	Y		Y	Y	Y	Y	Y
Non-synthetic compound contamination - Hydrocarbon & PAH Contamination	Y	Y		Y	Y	Y	Y	Y
Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
Radionuclide contamination	Y	Y		Y	Y	Y	Y	Y
Temperature changes - local	Y	Y		Y	S	S	S	Y
Salinity changes - local*	Y	Y		Y	S	S	S	Y
Introduction of other substances (solid, liquid or gas)	Y	Y		Y	Y	S	S	Y
De-oxygenation	Y			Y	S	S	S	Y
Nutrient enrichment	Y	Y		Y	S	S	S	Y
Organic enrichment	Y	Y		Y	S	S	S	Y
Physical loss (to land or freshwater habitat)	Y			Y	S	S	S	Y
Physical change (to another seabed type)	Y			Y	S	S	S	Y
Habitat structure changes - removal of substratum (extraction)	Y			Y	S	S	S	Y

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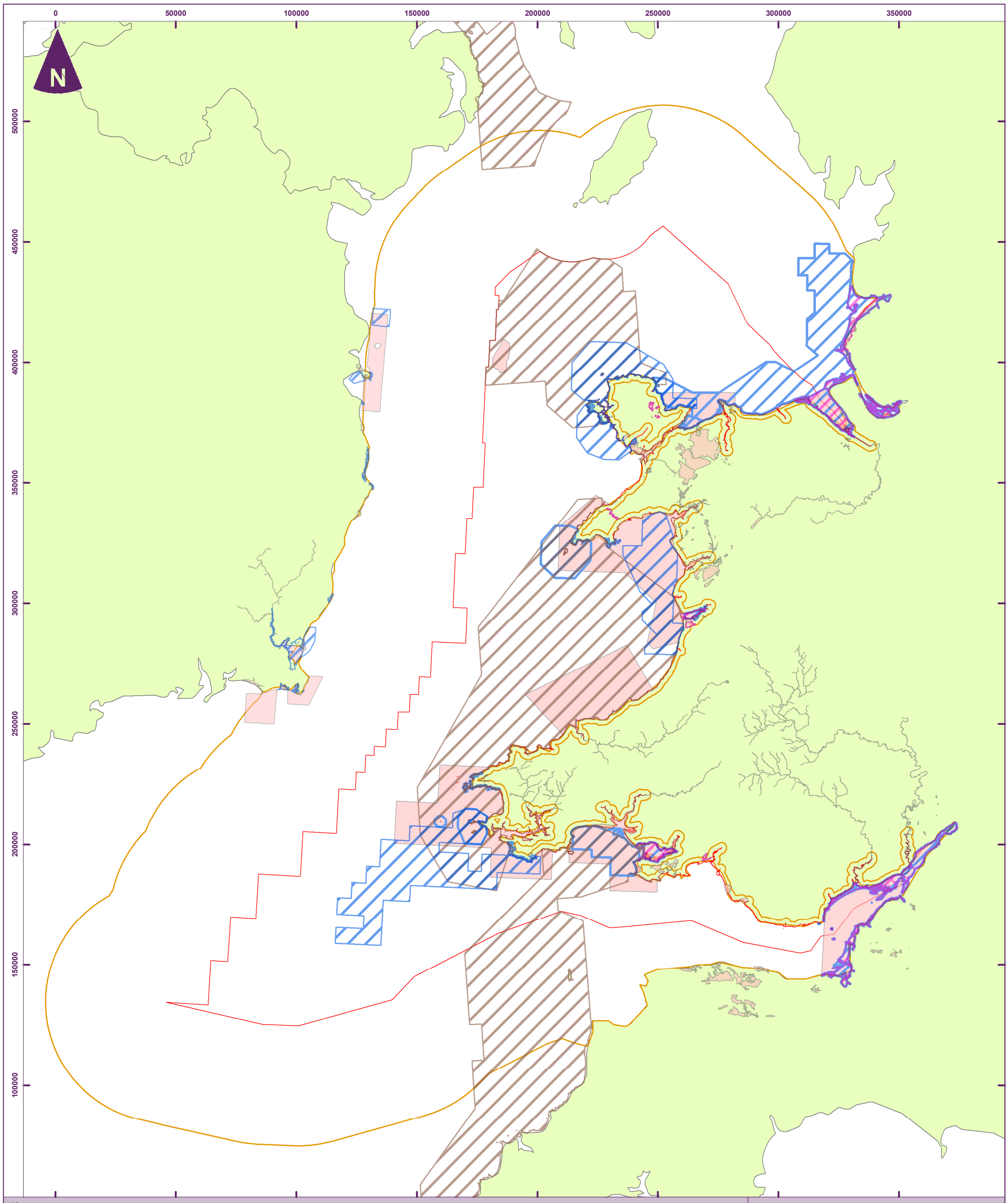
Pressure	Marine and Intertidal Habitats	Supralittoral habitats	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y							Y
Penetration and/or disturbance of the substrate below the surface of the seabed- Surface	Y							Y
Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y							Y
Changes in suspended solids	Y			Y	S	S	Y	Y
Siltation rate changes	Y			Y	S	Y	S	Y
Litter	Y	Y		Y	Y	Y	Y	Y
Electromagnetic changes				Y	Y		S	Y
Underwater noise changes				Y	Y	Y	S	Y
Introduction of light			Y	Y	Y	Y	Y	Y
Barrier to species movement				Y	Y	Y	Y	Y
Death or injury by collision			Y	Y	Y	Y	Y	Y
Visual disturbance				Y	Y	Y	Y	Y
Genetic modification & translocation of indigenous species	Y			Y				Y
Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
Introduction of microbial pathogens				Y	Y	Y	Y	Y
Removal of target species				Y	S	Y	Y	Y
Removal of non-target species				Y	Y	Y	Y	Y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Based upon the Ordnance Survey Map with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright. 100001776
Welsh National Marine Plan
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Figure 4.4
European sites within WNMP area and zone of influence
October 2017
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5. Welsh National Marine Plan Policy Screening

This section provides a summary of the screening process as applied to the general and sector specific policies of the WNMP. It identifies those policies that should be excluded from further assessment, either because they can have no significant effect or because assessment by the HRA of the WNMP is not appropriate.

5.1 Policy Screening

5.1.1 The policies of the WNMP are designed to provide general cross-cutting guidance (the General Policies); and support for the various Sector Objectives (Sector Policies). If the Objectives are the intended outcome of the WNMP then the policies that relate to these are the mechanisms by which these objectives are delivered. Assessment of the policies is therefore an important component of the HRA process.

5.1.2 The screening test (as applied to policies) segregates 'no significant effect' policies from policies where effects are uncertain or likely to be significant, so that the latter can be considered in detail through appropriate assessment. However, for most high-level strategic plans the screening stage fulfils a slightly broader function, by providing an opportunity to review the performance of 'no significant effect' policies to see whether they can be improved; and (potentially) an opportunity to amend some 'significant effect' policies to ensure that those effects will not occur.

5.1.3 When considering the likely effects of a policy, it is recognised that

- some policy 'types' cannot result in negative impacts on any European sites (e.g. a policy advocating the protection of European sites); and
- that some policies or plan aspects should not or cannot be assessed by the HRA of the plan within which they sit (even though a theoretical effect pathway exists) as there is no practical way of completing a meaningful assessment (i.e. they are 'screened in' but assessment must be deferred to a lower tier).

5.1.4 Different guidance documents suggest various classification and referencing systems to help identify the types of policy that can be 'screened out', although the general characteristics are summarised in **Table 5.1**.

Table 5.1 Policy 'types' that can typically be screened out

Broad Policy Type	Notes
General statements of policy / aspiration	The European Commission recognises* that plans or plan components that are general statements of policy or political aspirations cannot have significant effects; for example, general commitments to sustainable development or support for renewable energy (i.e. the policies have no spatially definable components (below the scale of the plan itself) and do not direct, influence or clarify the nature and location of activities).
General design / guidance criteria or policies that cannot lead to or trigger development	A general 'criteria based' policy expresses the tests or expectations of the plan-making body when it comes to consider proposals, or relates to design or other qualitative criteria which do not themselves lead to development (e.g. controls on design); however, policies with criteria relating to specific proposals or allocations should not be screened out. With regard to the WNMP, 'safeguarding' policies are considered in this category as although they help provide a framework for the supportive policies to function they do not themselves support or trigger development.

Broad Policy Type	Notes
External plans / projects subject to HRA	Plans or projects that are proposed or defined by other plans subject to HRA (e.g. Sectoral Plans such as the Round 3 Offshore Windfarm leasing), which are referred to for completeness, and where the assessed plan does not provide greater clarity on the delivery of the proposals. For example, offshore oil and gas licensing is driven by a separate planning and consenting process, itself subject to HRA, which the WNMP reflects; however, the WNMP does not provide direction, influence or further clarity on the nature and location of these activities.
Environmental protection policies	Policies designed to protect the natural or built environment will not usually have signifcant or adverse effects (although they may often require modification if relied on to provide sufficient safeguards for other policies).
Policies which could have no conceivable effect	Policies or proposals which cannot affect a European site (no impact pathways and hence no effect; for example, proposals for new cycle path several kilometres from the nearest European site) or which cannot undermine the conservation objectives, either alone or in combination, if impact pathways exist (no significant effect).

* EC, 2000, Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC April 2000 at 4.3.2

5.1.5 The WNMP policies were reviewed with these broad classifications in mind, although it must be noted that it is inappropriate to apply a policy classification tool uncritically to all policies of a certain type; or to consider a policy in isolation, without reference to its broader intent, context or objectives. There will obviously be some occasions when a policy or similar may have potentially significant effects despite it being of a 'type' that would normally be screened out, and many policies (particularly protective policies) can be enhanced to improve their performance in the context of the Habitats Regulations.

5.1.6 Beyond the 'screened out' aspects, as a general rule a policy or sector must have some component that directs, influences or clarifies the nature and location of lower-tier activities in order to be 'assessable' at the plan-level. Where there is no practical way of completing a meaningful assessment it is accepted that significant effects cannot necessarily be excluded at the WNMP-level in the planning hierarchy and that the assessment must be deferred to a lower tier (e.g. the project level). These aspects are also excluded from appropriate assessment within this HRA, although it should be noted that the review and assessment of the cross-cutting policies ensures that plan-level safeguards and protections are incorporated in the WNMP.

5.2 Screening Summary

5.2.1 **Tables 5.2** and **5.3** provide the outcome of the screening of the WNMP policies, informed by the screening criteria.

5.2.2 In summary, all of the general cross-cutting policies in the WNMP (see **Table 2.2**) are considered to be 'no significant effect' policies as they are invariably 'General statements of policy / aspiration', 'General design / guidance criteria or policies that cannot lead to or trigger development' or 'Environmental protection policies'. Recommendations for policy enhancements made through the iterative policy development process are summarised in **Appendix A**, for information (this is particularly relevant to the environmental protection policies, which are partially relied on (as cross-cutting policies) to safeguard European sites where sector policies provide support or safeguarding without any spatial component).

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Table 5.2 General cross-cutting policies screening summary with appropriate assessment (AA) recommendation

Policy	Screening Summary	Screening criteria	Examine further (AA)?
GEN_01	Overarching planning policy with presumption in favour of sustainable development in accordance with national planning policy.	General statements of policy / aspiration.	N
GEN_02	Overarching planning policy; requires that authorities take a proportionate, risk-based approach to decision making.	General statements of policy / aspiration.	N
ECON_01	General statement of support for proposals for economically sustainable activities. No spatial component. Encourages proposals that contribute to "the sustainable management of natural resources thereby supporting ecosystem resilience".	General statements of policy / aspiration.	N
ECON_02	General statement of support for proposals that consider opportunities for coexistence with other compatible sectors. No spatial component.	General statements of policy / aspiration.	N
SOC_01	Requires that proposals maintain or enhance access to the marine environment. No spatial component.	General statements of policy / aspiration.	N
SOC_02	Supports proposals that contribute to the well-being of coastal communities. No spatial component.	General statements of policy / aspiration.	N
SOC_03	Requires that proposals minimise their risk of marine pollution incidents. Primarily safeguarding with no spatial component; supporting text notes need to consider risks of enhanced access, including environmental risks.	General statements of policy / aspiration / environmental protection policies.	N
SOC_04	Supports proposals that contribute to the conservation and promotion of Welsh language. No spatial component.	General statements of policy / aspiration.	N
SOC_05	Policy protecting historic assets and settings. No spatial component.	Environmental protection policy.	N
SOC_06	Policy requiring proposals consider / are compatible with National Parks or AoNBs. No spatial component.	General statements of policy / aspiration / Environmental protection policy.	N
SOC_07	Policy providing safeguarding for seascapes and criteria in this regard. No spatial component.	General statements of policy / aspiration / Environmental protection policy.	N
SOC_08	Proposals should demonstrate how they are resilient to coastal change and flooding over their lifetime. No spatial component.	General statements of policy / aspiration / Environmental protection policy.	N
SOC_09	Encourages proposals that have no significant effects on coastal processes / coastal flooding / meet the Shoreline Management Plan requirements (note, the SMPs have also been subject to HRA). No spatial component.	General statements of policy / aspiration / Environmental protection policy.	N
SOC_10	Policy to minimise greenhouse gas emissions. No spatial component.	General statements of policy / aspiration / Environmental protection policy.	N
SOC_11	Requires that proposals demonstrate how they have considered / will adapt to climate change. No spatial component.	General statements of policy / aspiration / Environmental protection policy.	N
SOC_12	Requires that decision making authorities should support proposals that contribute towards climate change adaptation and/or mitigation. No spatial component.	General statements of policy / aspiration.	N

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Policy	Screening Summary	Screening criteria	Examine further (AA)?
ENV_01	Requires that proposals demonstrate how they contribute to the protection, restoration and/or enhancement of marine ecosystems. No spatial component.	Environmental protection policy.	N
ENV_02	Policy setting out requirements regards marine protected areas. No spatial component.	Environmental protection policy; note, this has been modified to ensure that terrestrial sites are also covered.	N
ENV_03	Requires that proposals include biosecurity measures to reduce the risk of introducing and spreading invasive non-native species. No spatial component.	Environmental protection policy.	N
ENV_04	Requires that proposals demonstrate how they will minimise litter generation / dispersal. No spatial component.	Environmental protection policy.	N
ENV_05	Sequential policy safeguarding the marine environment against noise. No spatial component.	Environmental protection policy.	N
ENV_06	Sequential policy safeguarding the air and water quality in the marine environment. No spatial component.	Environmental protection policy.	N
GOV_01	Requires that proposals consider cumulative effects and demonstrate how the avoidance hierarchy has been employed. No spatial component.	Environmental protection policy.	N
GOV_02	Requires that authorities make decisions in accordance with the sustainable development principle. No spatial component.	Environmental protection policy.	N
SCI_01	Relevant public authorities should make decisions using sound evidence and a risk-based approach. Where appropriate they should apply the precautionary principle and consider opportunities to apply adaptive management.	General statements of policy / aspiration / Environmental protection policy.	N

5.2.3

5.2.4 **Table 5.3** presents the outcome the screening of the sector policies. The policies were reviewed in the context of the objectives for the sector and hence intended outcomes, along with the screening criteria presented in **Table 5.1**, to identify those where more detailed appropriate assessment at the WNMP level is considered necessary.

5.2.5 For many of the sector policies, detailed assessment of outcomes cannot be undertaken at the WNMP level as the policies provide no additional clarity on the location, scale etc. of future development (essentially, sectors or aspects with no SRAs); in these instances it is accepted that 'significant effects' cannot always be definitively excluded but that appropriate assessment must be deferred to a lower planning tier or the project level.

Table 5.3 Summary of sector policy screening with appropriate assessment (AA) recommendation

Sector	Policies	Screening summary	Screening Criteria	Examine further (AA)?
Aggregates	AGG_01 AGG_02 AGG_03 AGG_04	The aggregates policies are intended to replace the Interim Marine Aggregates Dredging Policy (iMADP, 2004), which applied primarily to extraction in the Bristol Channel. The policies therefore extend the spatial extent of aggregates policy in Wales beyond the iMADP, including the identification of new SRAs. iMADP contained some relatively strong policy wording in respect of European sites. As a result Policy AGG_01 influences the location of future activities, and has not been subject to strategy-level HRA through external plans (etc). Policies AGG_02 – AGG_04 are safeguarding policies that will not drive any changes to existing conditions or patterns of usage. They are intended to facilitate aggregate developments but do not in themselves promote development so need to be interpreted in the context of Policy AGG_01.	Policies which make provision for change and which could have a conceivable effect.	Yes
Aquaculture	AQU_01 AQU_02 AQU_03	SRAs for aquaculture are identified from a broader resource area derived from ABPMer (2015) "*A spatial assessment of the potential for aquaculture in Welsh waters*". Policy AQU_01 encourages proposals for aquaculture in these areas; the likely outcome of the policy is therefore an increase in the number of aquaculture proposals, typically within the SRAs; and ideally, as a consequence, the implementation of those proposals. The proposed SRA arguably influences the location of future activities, and has not been subject to strategy-level HRA through external plans (etc). Policies AQU_02 and AQU_03 are safeguarding policies that will not drive any changes to existing conditions or patterns of usage. They are intended to facilitate aquaculture developments but do not in themselves promote development so need to be interpreted in the context of Policy AQU_01.	Policies which make provision for change and which could have a conceivable effect.	Yes
Defence	DEF_01	The policy that relates to the Defence Sector is a simple safeguarding policy, reflecting the existing use of the WNMP area for defence purposes. The WNMP is therefore entirely neutral in this respect and will not result in any changes to existing conditions or patterns of usage. On this basis, the policy and the defence sector can be excluded from further assessment as part of the WNMP HRA (no significant effects).	General statements of policy / aspiration.	No
Dredging and Disposal	D&D_01 D&D_02 D&D_03	The policies relating to the dredging sector, including the 'supporting' Policy D&D_01, are intended to safeguard existing consented operations and provide some surety for operators that these will be maintained. The maps associated with the policy do not therefore identify proposed or potential dredging or disposal areas, only areas where operations are currently undertaken. The likely outcome of the plan is therefore the safeguarding of the existing consented operations, and of any potential areas that may be identified at some point in the future by the relevant authorities. As a result, whilst the policy framework supports proposals that may result in changes to existing conditions, it is considered that the sector and policies should be excluded from further assessment as part of the WNMP HRA as: ▸ the policies have no spatial element below the scale of the WNMP area, nor are specific projects (etc.) identified (i.e. the policies do not direct, influence or clarify the nature and location of activities); ▸ the existing operations and consents are subject to HRA. Therefore, the policy has been reviewed to identify further opportunities to enhance its contributions to sustainable resource management, but additional detailed assessment is not required. It should be noted that the supporting text notes that "*New disposal activities should only be supported where they can demonstrate there is no alternative option for use of the waste material and that is not counter to the other policies of this plan*".	Policy / sector cannot be assessed at WNMP level.	No – defer to project level.

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Sector	Policies	Screening summary	Screening Criteria	Examine further (AA)?
Energy – Low Carbon	ELC_01 ELC_02 ELC_03 ELC_04	Policies ELC_02 – 04 are safeguarding policies that will not drive any changes to existing conditions or patterns of usage. They are intended to facilitate delivery of low carbon energy but do not in themselves promote development so need to be interpreted in the context of Policy ELC_01. The intent of Policy ELC_01 is to encourage proposals for renewable energy schemes that comply with the other policies of the plan. The likely outcome of the policy is therefore an increase in the number of renewable energy scheme proposals; and ideally, as a consequence, the implementation of renewable energy schemes. This is likely to result in changes to existing conditions and has clear effect pathways. Despite this, the spatial scope of the various sectors is not necessarily explicit, and nor is the current consenting position. In particular: ▶ Policy ELC_01 directs proposals to existing test and demonstration zones, although these may not necessarily have been subject to HRA (see below); ▶ Policy ELC_01 also directs proposals to SRAs for tidal stream, wave energy, and tidal lagoons but provides no spatial direction for any other sectors (notably wind proposals). Therefore, regards directing, influencing or clarifying the nature and location of future activities: ▶ for tidal stream, proposals are encouraged in SRAs and previously identified test and demonstration zones; ▶ for wave energy, proposals are encouraged in SRAs and previously identified test and demonstration zones (although these have been subject to strategic HRA through The Crown Estate (TCE) leasing process (2014), which concluded no adverse effect). ▶ for tidal lagoons, proposals are encouraged in SRAs; ▶ for wind, proposals are encouraged in areas identified by TCE as part of various leasing rounds, which were subject to HRA previously, but no SRAs are identified; the WNMP therefore notes the Key Resource Areas (KRA) identified by TCE but the supporting policies do not relate specifically to this (i.e. wind proposals in this area are no more or less likely as a result of the WNMP). Based on the screening criteria, this would suggest that those aspects that are not spatially explicit (i.e. wind); or which have been included on the basis of plans or policies outside the WNMP (e.g. existing wave lease areas) should be excluded from further assessment as part of the WNMP HRA. However, it should be noted that although wind lease areas have been subject to HRA (e.g. as part of the Round 3 leasing), TCE specifically notes that "*As part of designing the leasing, we have engaged with the Statutory Nature Conservation Bodies (SNCBs) in relation to our duties as Competent Authority under the Conservation of Habitats and Species Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats) Regulations 2007 (as amended) (jointly referred to as the "Habitats Regulations"). We do not consider that offering the opportunity to access seabed for wave or tidal projects of up to 3 MW across the UK constitutes a 'plan' under the Habitats Regulations because we do not know the number of applications which will be submitted or the locations of any proposed sites. Therefore, at this stage, we have not undertaken a plan-level Habitats Regulations Assessment (HRA). We will keep this position under review as applications are received and will continue to work closely with the SNCBs.*"	Policies which make provision for change and which could have a conceivable effect.	Yes (tidal stream, tidal range and wave only)

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Sector	Policies	Screening summary	Screening Criteria	Examine further (AA)?
Energy – Oil and Gas (including CCS)	O&G_01 O&G_02 O&G_03 O&G_04	Policies O&G_03 – 04 are safeguarding policies that do not support or promote development, and which will not drive any changes to existing conditions or patterns of usage. Policies O&G_01 – 02 are supporting policies for offshore Oil and Gas and Carbon Capture and Storage (CCS) respectively; strictly, these policies simply encourage proposals for O&G and CCS development, although the intended outcome of the policy is the development of these resources. With regard to Policy O&G_01, whilst this is likely to result in changes to existing conditions and has clear effect pathways, it is considered that the sector and policies should be excluded from further assessment as part of the WNMP HRA since: ▶ specific areas for targeting these developments are not proposed by the WNMP; ▶ for oil and gas exploration and production activities, the identification of Resource Areas and the refinement of areas (blocks) for licensing will be determined through the OESEA and Seaward Licensing Rounds; and ▶ these have already been subject to strategic HRA through the licensing process[33] (which concluded no adverse effects[34]) and any assessment of the WNMP policies would necessarily reflect this as no further information on specific proposals or likely effects is available[35]. Therefore, the policy has been reviewed to identify further opportunities to enhance its contributions to sustainable resource management, but additional detailed assessment is not required. With regard to CCS, whilst Policy O&G_02 is supportive of CCS proposals this is a far more speculative position than that advocated by Policy O&G_01. Where offshore CCS is being explored currently (e.g. the North Sea) it invariably relies on the utilisation of existing offshore oil and gas infrastructure, which is almost entirely absent from the WNMP area at the moment (other than that associated with the Douglas field in Liverpool Bay – the field is outside Welsh waters but a pipeline reaches shore at Point of Ayr on the North Wales coast). The OGA oversees the licensing of carbon storage and the carbon storage public register, BEIS oversees the policy and supports the development of CCS in the UK and OPRED assesses and determines the environmental applications associated with CCS. Therefore, further assessment of this is not possible at this stage.	External plans / projects subject to HRA. Policy / sector cannot be assessed at WNMP level.	No – defer to project level.

[33] For example: DECC (2015), Offshore Oil & Gas Licensing 28th Seaward Round: Irish Sea and St George's Channel, Habitats Regulations Assessment: Stage 2 - Appropriate Assessment

[34] It should be noted that the HRAs of the license blocks were carried out at a relatively high level but were generally block-specific, with specific impacts on specific sites considered as far as is achievable at that stage. The HRAs invariably concluded 'no adverse effects', largely by deferring some aspects of the assessment to the project level and taking into account the 'mitigation measures' that can be imposed through existing permitting mechanisms on the planning and conduct of activities (i.e. the licenses did not include specific exclusions that would guarantee that 'adverse effect' proposals would be refused).

[35] Note, the oil and gas licensing HRAs did not identify any specific 'residual effects' for consideration at the project-level, or in combination with other plans.

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Sector	Policies	Screening summary	Screening Criteria	Examine further (AA)?
Fisheries	FIS_01 FIS_02 FIS_03	Policies FIS_02 – 03 are safeguarding policies that do not support or promote development, and which will not drive any changes to existing conditions or patterns of usage. Policy FIS_01 encourages "*proposals that support and enhance sustainable fishing activities*" but does not specify where such proposals would be supported since (in part) the policy also directs the relevant authorities to identify SRAs for fishing activities. Whilst the policy encourages proposals and may result in changes to existing conditions, it is considered that the sector and policies should be excluded from further assessment as part of the WNMP HRA as: ▶ fishing activity (etc.) is not a function or a responsibility of marine planning, but a consideration of it; and ▶ the policies have no spatial element below the scale of the WNMP area, nor are specific projects (etc.) identified (i.e. the policies do not direct, influence or clarify the nature and location of activities). Therefore, the policy has been reviewed to identify further opportunities to enhance its contributions to sustainable resource management, but additional detailed assessment is not required.	Policy / sector cannot be assessed at WNMP level.	No
Ports and Shipping	P&S_01 P&S_02 P&S_03	Policy P&S_03 is safeguarding policy intended to protect the current functioning of navigation channels, anchorages, piloting areas and ports and as such does not have any provision for change (i.e. the SRAs associated with this element simply reflect current operational practice); therefore, this policy should be excluded from further assessment as part of the WNMP HRA. Policies P&S_01and P&S_02 are slightly more complicated by the current status of planning policy around port development and the extent to which the WNMP influences or controls this. These policies support port development in SRAs, although these SRAs are essentially the existing ports; therefore, the potential for substantial change is arguably limited. In this regard, the policy does not direct, influence or clarify the nature and location of activities that are promoted or supported by it. Furthermore, ports policy is currently not devolved in Wales except for small fishing and recreation harbours, with the framework for decisions on new port development in the England and Wales provided by the National Policy Statement for Ports (NPS). However, this is likely to change and the Welsh Government has responsibility for many related functions including transport and land use planning.	Policies which make provision for change and which could have a conceivable effect.	Yes – SRA identified
Subsea Cabling	CAB_01 CAB_02	Policy CAB_01 encourages "*proposals that facilitate the growth of digital communications networks and/or the optimal distribution of electricity*"; Policy CAB_02 safeguards existing and potential future cable installations. These policies have no spatial element below the scale of the WNMP area, nor are specific projects (etc.) identified (i.e. the policies do not direct, influence or clarify the nature and location of future activities), and so it is considered that the sector and policies should be excluded from further assessment as part of the WNMP HRA.	Policy / sector cannot be assessed at WNMP level.	No – defer to project level.
Surface Water and Wastewater Treatment and Disposal	SWW_01	Policy SWW_01 safeguards existing and potential future locations for Surface Water and Wastewater Treatment and Disposal installations. The policy does not direct, influence or clarify the nature and location of future activities, and so it is considered that the sector and policies should be excluded from further assessment as part of the WNMP HRA.	Policy / sector cannot be assessed at WNMP level.	No – defer to project level.
Tourism and Recreation	T&R_01 T&R_02	The policies are intended to support and safeguard tourism and recreation but do not have any spatial element below the scale of the WNMP area. The policy does not direct, influence or clarify the nature and location of future activities, and so it is considered that the sector and policies should be excluded from further assessment as part of the WNMP HRA	Policy / sector cannot be assessed at WNMP level (no spatial reference).	No – defer to project level.

5.2.6 In summary, four policy areas have been identified as requiring appropriate assessment; these are:

- Aggregates (SRAs are identified and policies will replace the 2004 Interim Marine Aggregates Dredging Policy (iMADP));
- Aquaculture (SRAs are identified and the sector has not previously been subject to HRA);
- Ports and Shipping - (SRAs are identified); and
- Energy – Low Carbon (excluding wind); SRAs are identified for tidal stream, wave, and tidal lagoons, which have not been subject to previous strategy-level HRA[36]; with regard to wind, the WNMP does not refine locations (e.g. through SRAs) and so simply reflects existing leasing.

5.2.7 The remaining sectors either have policies that are purely safeguarding (e.g. Defence, Surface Water and Wastewater Treatment and Disposal); policies which do not direct, influence or clarify the nature and location of activities that are promoted or supported by the policy; or policies which reflect or incorporate external plans or programmes subject to HRA. Whilst these policies are not subject to a more detailed assessment **at this level,** the policy text has been reviewed in the context of the general cross-cutting policies to ensure that the WNMP does not provide unmoderated or unequivocal support for developments that might benefit from them (for example, by providing a 'presumption in favour' that is not framed by the need to protect European sites). This approach is consistent with existing case-practice (e.g. Scottish Marine Plan HRA; East of England Marine Plan HRA; South Marine Plan HRA). 'Significant effects' cannot necessarily be excluded for most sectors where the policies do not direct, influence or clarify the nature and location of activities; in these instances 'down-the-line' assessment at a lower planning tier will be required.

5.2.8 The appropriate assessments of the four policy areas (aggregates, aquaculture, ports and shipping and energy – low carbon) are set out in the following sections. It should be noted that the approach and methods used for the appropriate assessments are largely consistent between sectors, although it has been appropriate to employ a slightly different assessment approach for the aspects of ELC_01 related to tidal lagoons, due to the greater uncertainty associated with this aspect of the policy.

[36] Although note that part of the wave SRA has been leased by TCE, and was subject to HRA in 2014.

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6. Aggregates

6.1 Screening Summary

6.1.1 Policies AGG_01 – AGG_04 provide the supporting framework for future aggregate proposals. Policies AGG_02 – AGG_04 are safeguarding policies, protecting the identified aggregate SRAs from sterilisation. Policy AGG_01 provides support for aggregates proposals as follows:

Proposals for aggregate extraction in Strategic Resource Areas are encouraged within any permitted tonnage limits that may be defined for that area.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

- ***aggregate Strategic Resource Areas; and***
- ***wider marine aggregate natural resources;***

in order to support the sustainable growth of the aggregate sector through marine planning.

6.1.2 The intent of the policy is to encourage investigation and hence proposals for aggregate extraction in defined areas. The policy focuses on four Aggregate SRAs which are located in Liverpool Bay; south and west of the Gower; south of Barry Head; and within the Inner Bristol Channel and Severn Estuary. The Bristol Channel / Severn Estuary SRA reflects the existing aggregates extraction areas and licences, and potential areas for extraction[37]; the remaining SRAs are 'new' areas that may be suitable for aggregates extraction. Having said that, the policy does not restrict proposals to these areas.

6.1.3 Aggregates extraction schemes, whilst well understood, have the potential to affect the interest features of European sites and therefore a policy promoting these activities could result in significant effects if not appropriately designed. On this basis, significant effects cannot necessarily be excluded and the policies have been subject to further assessment.

6.1.4 It should be noted that the aggregates policies and SRAs are proposed to replace the provisions of the 2004 *Interim Marine Aggregates Dredging Policy* (iMADP), which was published in response to a series of lease applications in the Severn Estuary and Bristol Channel area. This was produced due to the absence, at that time, of a statutory licensing regime and included annual and area caps on extraction tonnages. It applied to the Severn Estuary and Bristol Channel area only; the WNMP will extend aggregates policy beyond the Bristol Channel region to the whole of the Wales marine area. Many of the controls introduced by iMADP are now covered by the marine licensing process (under MaCAA, 2009). It is important to note that the HRA can only assess the WNMP and the likelihood of its outcomes affecting European sites; it cannot and should not assess the 'revocation' of the iMADP or try to compare the relative merits of the WNMP and iMADP.

6.2 Appropriate Assessment

Sites and features

6.2.1 NRW has indicated that it considers that the ZoI for aggregates activities should be around 30km in marine areas in informal consultation comments; this has been used to identify sites that are most likely to be exposed to effects of activities taking place within the SRAs. A 2km terrestrial ZoI is also used to identify purely terrestrial habitats that may be vulnerable to the activities within the SRAs sites.

[37] Note, the Severn Estuary SRA includes already licenced areas (e.g. Bedwyn Sands) although these are subject to a higher level of safeguarding and different policies apply in this regard.

6.2.2 There are 48 European sites within the marine and terrestrial ZoIs of the proposed SRAs. These are summarised in **Table 6.1** and illustrated on **Figure 6.1**.

Table 6.1 European sites within the aggregates SRAs, or within the marine or terrestrial zones of influence

Site	Features	Location
Anglesey Terns / Morwenoliaid Ynys Môn SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*; Roseate tern *Sterna dougalli*	Within ZoI
Bae Caerfyrddin/ Carmarthen Bay SPA	*Melanitta nigra*	Within ZoI
Braunton Burrows SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Mudflats and sandflats not covered by seawater at low tide; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	Within ZoI
Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC	Harbour porpoise *Phocoena phocoena*	In SRA
Burry Inlet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
Burry Inlet SPA	*Anas acuta*; *Anas clypeata*; *Anas crecca*; *Anas penelope*; *Arenaria interpres*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Numenius arquata*; *Pluvialis squatarola*; *Tadorna tadorna*; *Tringa totanus*	Within ZoI
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time	In SRA
Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Vertigo angustior*	Within ZoI
Castlemartin Coast SPA	*Pyrrhocorax pyrrhocorax*	Within ZoI
Coedwigoedd Penrhyn Creuddyn/ Creuddyn Peninsula Woods SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Taxus baccata* woods of the British Isles; *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Coedydd Aber SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	Within ZoI
Corsydd Môn a Llyn/ Anglesey and Llyn Fens Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	Within ZoI
Corsydd Môn/ Anglesey Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; *Vertigo geyeri*	Within ZoI
Crymlyn Bog Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	Within ZoI

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Site	Features	Location
Crymlyn Bog/ Cors Crymlyn SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Transition mires and quaking bogs	Within ZoI
Dee Estuary/ Aber Dyfrdwy SAC	Annual vegetation of drift lines; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Embryonic shifting dunes; Estuaries; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petalophyllum ralfsii*; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Eryri/ Snowdonia SAC	Alkaline fens; Alpine and Boreal heaths; Alpine and subalpine calcareous grasslands; Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*; Blanket bogs; Calcareous rocky slopes with chasmophytic vegetation; Depressions on peat substrates of the *Rhynchosporion*; *Drepanocladus* (*Hamatocaulis) vernicosus*; European dry heaths; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; *Luronium natans*; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; Petrifying springs with tufa formation (*Cratoneurion)*; Siliceous alpine and boreal grasslands; Siliceous rocky slopes with chasmophytic vegetation; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*; Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	Within ZoI
Exmoor Heaths SAC	Alkaline fens; Blanket bogs; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Gower Ash Woods/ Coedydd Ynn Gwyr SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Gower Commons/ Tiroedd Comin Gwyr SAC	*Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; European dry heaths; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*	Within ZoI
Great Orme`s Head/ Pen y Gogarth SAC	European dry heaths; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Kenfig/ Cynffig SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*	Within ZoI
Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	Caves not open to the public; European dry heaths; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); *Gentianella anglica*; *Petalophyllum ralfsii*; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Submerged or partially submerged sea caves; Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Liverpool Bay / Bae Lerpwl SPA	*Gavia stellata*; *Melanitta nigra*	In SRA
Mendip Limestone Grasslands SAC	Caves not open to the public; European dry heaths; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Mersey Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
Mersey Estuary SPA	*Anas acuta*; *Anas crecca*; *Anas penelope*; *Calidris alpina alpina*; *Charadrius hiaticula*; *Limosa limosa islandica*; *Numenius arquata*; *Pluvialis apricaria*; *Pluvialis squatarola*; *Podiceps cristatus*; *Tadorna tadorna*; *Vanellus vanellus*	Within ZoI

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Site	Features	Location
Mersey Narrows and North Wirral Foreshore Ramsar	Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
Mersey Narrows and North Wirral Foreshore SPA	*Calidris alba*; *Calidris alpina alpina*; *Calidris canutus islandica*; *Haematopus ostralegus*; *Larus minutus*; *Limosa lapponica*; *Phalacrocorax carbo*; *Pluvialis squatarola*; *Tringa totanus*	Within ZoI
Mwyngloddiau Fforest Gwydir/ Gwydyr Forest Mines SAC	Calaminarian grasslands of the *Violetalia calaminariae*; *Rhinolophus hipposideros*	Within ZoI
North Anglesey Marine / Gogledd Môn Forol cSAC	Harbour porpoise *Phocoena phocoena*	Within ZoI
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	Red-throated diver *Gavia stellata*	Within ZoI
Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Lutra lutra*; *Rhinolophus ferrumequinum*; *Rhinolophus hipposideros*	Within ZoI
Pembrokeshire Marine/ Sir Benfro Forol SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; *Rumex rupestris*; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves	Within ZoI
Ribble and Alt Estuaries Ramsar	Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
Ribble and Alt Estuaries SPA	*Anas acuta*; *Anas crecca*; *Anas penelope*; *Anser brachyrhynchus*; *Aythya marila*; *Calidris alpina alpina*; *Calidris canutus*; *Charadrius hiaticula*; *Cygnus columbianus bewickii*; *Cygnus cygnus*; *Haematopus ostralegus*; *Larus fuscus*; *Larus ridibundus*; *Limosa lapponica*; *Limosa limosa islandica*; *Melanitta nigra*; *Numenius arquata*; *Numenius phaeopus*; *Phalacrocorax carbo*; *Philomachus pugnax*; *Pluvialis apricaria*; *Pluvialis squatarola*; *Sterna hirundo*; *Tadorna tadorna*; *Vanellus vanellus*	Within ZoI
River Usk/ Afon Wysg SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
River Wye/ Afon Gwy SAC	*Alosa alosa*; *Alosa fallax*; *Austropotamobius pallipes*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Transition mires and quaking bogs; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Sefton Coast SAC	Atlantic decalcified fixed dunes (*Calluno-Ulicetea)*; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Triturus cristatus*	Within ZoI
Severn Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds; Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path	In SRA

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Site	Features	Location
Severn Estuary SPA	*Anas strepera*; *Anser albifrons albifrons*; *Calidris alpina alpina*; *Cygnus columbianus bewickii*; *Tadorna tadorna*; *Tringa totanus*	In SRA
Severn Estuary/ Môr Hafren SAC	*Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time	In SRA
Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	Storm petrel *Hydrobates pelagicus*; lesser black-backed gull *Larus fuscus*; Manx shearwater *Puffinus puffinus*; Atlantic puffin *Fratercula arctica*; Breeding seabird assemblage;	Within ZoI
The Dee Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
The Dee Estuary SPA	*Anas acuta*; *Anas crecca*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Limosa lapponica*; *Limosa limosa islandica*; *Numenius arquata*; *Pluvialis squatarola*; *Sterna albifrons*; *Sterna hirundo*; *Sterna sandvicensis*; *Tadorna tadorna*	Within ZoI
Traeth Lafan/ Lavan Sands, Conway Bay SPA	*Haematopus ostralegus*; *Mergus serrator*; *Numenius arquata*; *Podiceps cristatus*; *Tringa totanus*	Within ZoI
West Wales Marine / Gorllewin Cymru Forol cSAC	Harbour porpoise *Phocoena phocoena*	Within ZoI
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC	Large shallow inlets and bays; Mudflats and sandflats not covered by seawater at low tide; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves	Within ZoI

6.2.3 In addition, it is important to note that all of the more distant sites with mobile species that may be functionally linked to the WNMP area (see Appendices C - E) are also considered to be potentially vulnerable (i.e. sensitive, and potential exposed) to the outcomes of Policy AGG_01 (i.e. all marine mammal sites associated with the relevant MMUs; all seabird sites where Thaxter *et al.* (2012) or the BDMPS suggest that the feature ranges may intersect with the ZoI during breeding or wintering; all sites with wintering bird species that may use or cross the ZoI).

6.2.4 There are few purely terrestrial habitats within the ZoI of the SRAs and these will not be directly exposed to the likely effects of activities within the SRAs; the only risk to these would be through project-specific scenarios (rather than systematic exposure) that cannot be predicted at this level; potential effects on these are therefore excluded from assessment in respect of the SRAs.

6.2.5 The interest feature groups considered to be potentially vulnerable to the aggregates sector SRAs and policies are therefore:

- Subtidal and intertidal habitats (plus typical species);
- Supralittoral habitats and species (plus typical species);
- Bats;
- Marine mammals;
- Diadromous fish;
- Pelagic seabirds;
- Wildfowl and waders.

Potential effect pathways

6.2.6 The likely or intended outcome of the aggregates policy is the ongoing provision of extraction opportunities and hence schemes to meet market demand. The scale or type of extraction supported by the policy is not defined, nor are specific schemes or locations identified (although the policies make proposals within the SRA more likely, partly through direct promotion and partly as a consequence of safeguarding from other sector activity).

6.2.7 Having said that, aggregate extraction (in contrast to, say, tidal energy) is a well-established industry with much available literature on best practice and mitigation approaches (etc.)[38] and generally a clear appreciation of the likely effects and recovery times. Some substantial aggregates extraction studies have been produced (for example, the *Anglian Marine Aggregate Regional Environmental Assessment* (MAREA) Emu (2012)) and whilst this level of detail is not necessarily achievable for the WNMP SRAs at this point, or appropriate for the assessment of the WNMP proposals, it provides a clear basis for assessing the potential outcomes of the WNMP policies and the need for any additional safeguards.

6.2.8 Emu (2012) and Newell & Woodcock (2013) provides a useful summary of the primary and secondary effects most likely as a result of aggregate extraction. These include:

- Direct damage or loss of habitats through dredging;
- Increased turbidity and generation of sediment plumes from the overflow and screening processes (usually within 4km);
- Toxic contamination; this may include toxic contaminants associated directly with marine activities (e.g. oils etc.) but is more likely to involve the release of contaminants in sediments through excavation;
- Hydrodynamic changes: aggregates schemes alter the sea bed morphology and are known to result in hydrodynamic changes such as alteration of wave patterns and tidal flows, with consequential effects on sediment transport.
- Effects on mobile species: aggregates schemes can result in disturbance, displacement, mortality and barrier effects through a variety of mechanisms, including:
  - changes in habitat or prey distributions due to the physical and physio-chemical changes noted above;
  - underwater noise and vibration due to turbine operation, particularly for fish and marine mammals;
  - collisions with vessels and structures, particularly for marine mammals;
  - introduction of lighting (although generally not likely to be substantial);
  - changes in foraging success / predation risk as a result of effects on prey distributions.

6.2.9 The sensitivity of the interest feature groups to the potential pressures associated with aggregates schemes are summarised in **Table 6.2**. Note that only the pressures that JNCC (2016) identify as being associated with aggregates extraction are included in **Table 6.2**.

[38] For example,
- The Crown Estate / Minerals Planning Association (2017) *Good Practice Guidance: Extraction by Dredging of Aggregates from England's Seabed*. TCE / BMPA, London.
- The Crown Estate / Minerals Planning Association (2013) *Marine aggregate dredging and the coastline: a guidance note: Best practice guidance for assessment, evaluation and monitoring of the possible effects of marine aggregate extraction on the coast – a Coastal Impact Study*. TCE / BMPA, London

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Table 6.2 Sensitivity of the interest feature groups to the potential pressures associated with aggregates schemes *(note, pressures are not included if they are not associated with aggregates extraction (see Appendix F for justification for justification); Y – directly sensitive; S – sensitive to consequent or secondary effects)*

Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Water flow (tidal current) changes – local	Y	Y		Y	Y	S	S	Y
Wave exposure changes – local	Y	Y		Y	S	Y	Y	Y
Non-synthetic compound contamination – overall	Y	Y		Y	Y	Y	Y	Y
Non-synthetic compound contamination - Transition elements & organo-metals	Y	Y		Y	Y	Y	Y	Y
Non-synthetic compound contamination - Hydrocarbon & PAH Contamination	Y	Y		Y	Y	Y	Y	Y
Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
Radionuclide contamination	Y	Y		Y	Y	Y	Y	Y
De-oxygenation	Y			Y	S	S	S	Y
Nutrient enrichment	Y	Y		Y	S	S	S	Y
Organic enrichment	Y	Y		Y	S	S	S	Y
Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
Physical change (to another seabed type)	Y			S	S	S	S	Y
Habitat structure changes - removal of substratum (extraction)	Y			S	S	S	S	Y
Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y					Y	Y	Y
Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y					Y	Y	Y
Changes in suspended solids	Y			Y	S	S	Y	Y

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Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Siltation rate changes	Y			S	S	Y	S	Y
Underwater noise changes				Y	Y	Y	S	Y
Barrier to species movement				Y	Y	Y	Y	Y
Death or injury by collision			Y	Y	Y	Y	Y	Y
Visual disturbance				Y	Y	Y	Y	Y
Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
Removal of non-target species				Y	Y	Y	Y	Y

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Site / feature exposure

6.2.10 Four SRAs are identified by the WNMP (see **Figure 6.1**):

- Liverpool Bay SRA;
- Gower / Carmarthen SRA;
- Inner Bristol Channel SRA; and
- Severn Estuary SRA.

6.2.11 **Tables 6.3** – **6.5** summarise the potential for future supported activities within these SRAs to affect the European site interest feature groups, with the European sites that are likely to be particularly exposed to activities occurring within the SRA identified. In essence, these 'high exposure' sites are those that are within the 30km marine ZoI around each SRA, plus those where the SRA is likely to coincide with a potentially notable component of a mobile species' habitat requirements.

6.2.12 **Tables 6.3** – **6.5** also references those far-field sites with features that will be exposed to activities within the SRA based on their mobile species (for example, all sites associated with the marine mammal MMUs) – although it is recognised that for some species (particularly marine mammals) any future assessments of effects will need to be undertaken at the MMU scale (i.e. effects will not necessarily be 'less' on far-field sites).

6.2.13 Where possible, the assessments aim to identify those sites or features where adverse effects can be excluded based on objective information that is available on feature distributions and behaviours (see also **Section 4**). However, it should be recognised that an objective data-led assessment at the plan level will not always be able to exclude the possibility of effects on many sites or features, and that the content and mitigation principles of the WNMP (see **Section 6.4**) must also be factored into any any assessment.

6.2.14 Note, the Inner Bristol Channel and Severn Estuary SRAs are grouped together for assessment due to their proximity and degree of connectivity (both in terms of coastal process and ecological functioning).

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Table 6.3 Summary of the potential for effects on those European sites / features that are most exposed to the **Liverpool Bay Aggregate SRA** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Anglesey Terns / Morwenoliaid Ynys Môn SPA Dee Estuary/ Aber Dyfrdwy SAC Great Orme`s Head/ Pen y Gogarth SAC **Liverpool Bay / Bae Lerpwl SPA** Mersey Estuary Ramsar Mersey Estuary SPA Mersey Narrows and North Wirral Foreshore Ramsar Mersey Narrows and North Wirral Foreshore SPA North Anglesey Marine / Gogledd Môn Forol cSAC Ribble and Alt Estuaries Ramsar Ribble and Alt Estuaries SPA Sefton Coast SAC The Dee Estuary Ramsar The Dee Estuary SPA Traeth Lafan/ Lavan Sands, Conway Bay SPA Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC Ynys Seiriol / Puffin Island SPA	This SRA partly overlaps with the **Liverpool Bay SPA**, which has a range of habitats (particularly subtidal and intertidal sandbars) supporting the interest features that may be vulnerable to direct effects or any changes in coastal processes resulting from large-scale aggregate extraction within the SRA. Whilst aggregate extraction from within or near a European site does not necessarily result in adverse effects this cannot be objectively determined at this level and so adverse effects cannot be excluded. Furthermore, the geomorphology and coastal processes of the bay area are heavily linked to the surrounding coastal habitats. There are a number of number of designated sites around Liverpool Bay with habitat features that will also be vulnerable to changes in coastal processes, particular regards sediment transport (etc); these include the **Dee Estuary SAC / SPA / Ramsar;** the **Ribble and Alt Estuary SPA / Ramsar**; the **Sefton Coast SAC** (dune systems); and **Traeth Lafan/ Lavan Sands, Conway Bay SPA** (offshore sandbanks). The net longshore drift direction is west to east and so any extraction could disrupt coastal sediment inputs to these areas with potential consequent effects on features that are used by mobile species (e.g. sandbanks for seal haul outs) or prey species. However, the proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	No other marine sites are within 30km of this SRA and so direct effects on the habitats of other sites can be excluded. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species away from their 'home site' do not occur.
Bats	There are no SACs designated for their bat populations within 20km of this SRA, and so effects would not be expected.	-	-

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC Pembrokeshire Marine/ Sir Benfro Forol SAC Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI North Anglesey Marine / Gogledd Môn Forol cSAC West Wales Marine / Gorllewin Cymru Forol cSAC Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	This SRA is near an area of higher bottlenose dolphin distribution around the Great Orme, east of Anglesey (see Figure 5.1); these dolphins are likely to be associated with **Cardigan Bay/ Bae Ceredigion SAC** and **Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC**.  The SRA is also close to some significant grey seal haul-out areas within the Dee Estuary, and whilst these are not designated it is likely that seals associated with designated sites in the Irish Sea (particularly **Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC; The Maidens SCI; Cardigan Bay/ Bae Ceredigion SAC; Lambay Island SAC;** and perhaps **Pembrokeshire Marine/ Sir Benfro Forol SAC and Saltee Islands SAC**) make regular use of this area outside the breeding season. There is less evidence for potentially significant agglomerations of harbour porpoise and common seal in the immediate vicinity of the SRA although these are obviously wide-ranging species that are likely to be exposed at some point to any activities promoted within the SRA. Evidence from other areas (e.g. the North Sea and UK east coast) suggests that significant effects can generally be avoided through planning, or do not occur due to species behavioural resilience. In addition, the effects of specific schemes on marine mammals is likely to be relatively local, and the species commonly travel and forage alone or in small groups, and so impacts are not likely to affect large proportions of their regional populations at any one time. However, the proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst adverse effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered that they can be avoided as part of the normal project-level consenting process.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	Dee Estuary/ Aber Dyfrdwy SAC The Dee Estuary Ramsar	This SRA is largely outside estuarine areas and so significant conflicts with diadromous fish are less likely than for some SRAs, although fish associated with the **Dee Estuary/ Aber Dyfrdwy SAC and The Dee Estuary Ramsar** will obvious pass through this area regularly so may be exposed to effects as a result of activities. Direct effects as a result of aggregate extraction activities are likely to be limited, due to the limited areas affected, although secondary effects that result in substantial geomorphological changes to inshore sandbanks (etc) may affect the distribution of prey species in these areas. However, evidence from other areas suggests that significant effects can generally be avoided through planning or do not occur due to species behavioural resilience. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Pelagic seabirds	Anglesey Terns / Morwenoliaid Ynys Môn SPA **Liverpool Bay / Bae Lerpwl SPA** Traeth Lafan/ Lavan Sands, Conway Bay SPA Ynys Seiriol / Puffin Island SPA Ynys Feurig, Cemlyn Bay and The Skerries SPA	This SRA partly coincides with the **Liverpool Bay SPA**, which is proposed for extension to take in areas that are important for little gull in winter, and foraging little and common terns in the breeding season (cormorant and red breasted *merganser* will also be identified as assemblage species in the new citation). This site is also designated for its wintering populations of common scoter and red-throated diver. These species rely on relatively shallow water (0 – 20m deep) for foraging, with their location and abundance influenced by their prey species. For example, red-throated divers rely on small fish that are associated with the sandbanks of Liverpool Bay, and so any disruption to the sandbanks would have consequent effects on the species. In addition, both species are fairly sensitive to disturbance, with evidence suggesting that some developments (e.g. windfarms) result in displacements of several kilometres. The SRA is also near seabird breeding sites on and near Anglesey (e.g. **Anglesey Terns / Morwenoliaid Ynys Môn SPA; Puffin Island SPA; Ynys Feurig, Cemlyn Bay and The Skerries SPA Cemlyn Bay SPA**, although this is over 20km from the SRA) which have features that may use the SRA for foraging during the breeding season. The effects of any developments will depend on the scale and nature of particular projects. As with diadromous fish, direct effects as a result of aggregate extraction activities are likely to be limited, due to the limited areas affected, although secondary effects that result in substantial geomorphological changes to inshore sandbanks (etc) may affect the distribution of prey species in these areas. However, evidence from other areas, including existing aggregates extraction, indicates that adverse effects are not inevitable or unavoidable, particularly as the scale of any primary effects is relatively small. The effects of any developments on this site will depend on the scale and nature of the project, although direct effects through displacement would generally be unlikely due to the relative locations of most of the SPA and the SRA. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Effects on some sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) but the BDMPS does not allow effects to be easily excluded for wintering birds.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Wildfowl and Waders	Mersey Estuary Ramsar Mersey Estuary SPA Mersey Narrows and North Wirral Foreshore Ramsar Mersey Narrows and North Wirral Foreshore SPA Ribble and Alt Estuaries Ramsar Ribble and Alt Estuaries SPA The Dee Estuary Ramsar The Dee Estuary SPA Traeth Lafan/ Lavan Sands, Conway Bay SPA	There are a number of sites designated for their wildfowl and waders near the proposed SRA, although these are invariably several kilometres from the SRA and the behavioural characteristics of these species will ensure that direct effects (e.g. displacement due to noise etc) are unlikely to occur. Effects are more likely through secondary processes (i.e. effects on supporting habitats due to impacts on coastal processes) but the likelihood of this will depend on the parameters of any project than comes forward and evidence from other areas (e.g. north sea and east coast) suggests that significant effects can generally be avoided through planning. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely, although indirect pathways are present particularly when on passage.

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Table 6.4 Summary of the potential for effects on those European sites / features that are most exposed to the **Gower / Carmarthen Aggregate SRA** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Bae Caerfyrddin/ Carmarthen Bay SPA **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** Burry Inlet Ramsar Burry Inlet SPA **Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC** Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC Castlemartin Coast SPA Dunraven Bay SAC Kenfig/ Cynffig SAC Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC Lundy SAC Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA Pembrokeshire Marine/ Sir Benfro Forol SAC West Wales Marine / Gorllewin Cymru Forol cSAC	This SRA partly overlaps with the **Carmarthen Bay and Estuaries SAC**, and so the habitat features of this site will be particularly vulnerable to direct effects (although the offshore habitats will be relatively dynamic in any case and have a reasonable degree of resilience). The SRA also overlaps with the **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** (although this is not designated for its habitats). NRW have indicated that there are current concerns regarding the transport of sediment from deeper water to the Carmarthen Bay sand sheet which in turn supplies sediment to the Burry inlet and Three Rivers estuary. This has been raised previously through the licensing process for marine mineral Area 476 with the applicant agreeing to undertake bathymetric surveys in order to be able to identify any large scale changes in sediment transport towards the SAC and it is likely that any future applications within the SRA would also require a similar monitoring regime. Furthermore, the geomorphology and coastal processes of the bay area are heavily linked to the surrounding coastal habitats. There are several designated sites around Liverpool Bay with habitat features that will also be vulnerable to changes in coastal processes, particular regards sediment transport (etc); these include the estuaries near the SRA as well as some SACs designated for their supralittoral habitats (e.g. **Kenfig SAC**). Whilst aggregate extraction from within or near a European site does not necessarily result in adverse effects this can only be confirmed at the project-level. Critically, the proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	No other marine sites are within 30km of this SRA and so direct effects on the habitats of these can be excluded. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species do not occur.
Bats	Limestone Coast of South West Wales SAC	The **Limestone Coast of South West Wales SAC** supports greater horseshoe bats, although the SRA is over 3km offshore at its closest point and significant interaction with bats from this site would not be expected due to the limited scale of any works.	None.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC Pembrokeshire Marine/ Sir Benfro Forol SAC Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI North Anglesey Marine / Gogledd Môn Forol cSAC West Wales Marine / Gorllewin Cymru Forol cSAC **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	This SRA partly overlaps with an area of higher harbour porpoise distribution and the **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** which may suggest that significant or adverse effects are more likely for schemes in this area; the precise effect of this can only be determined at the scheme level, although evidence from other areas (e.g. north sea and east coast) suggests that significant effects can generally be avoided through planning or do not occur due to species resilience. In addition, aggregate extraction is time bound and specific in footprint which further reduces the risk of effects on wide-ranging mobile species. It should be noted that the designation process for the harbour porpoise cSACs and NRW's associated post-consultation report did not suggest that existing aggregate extraction activities would need to stop once the SAC was designated, recognising that potential effects could almost certainly be managed through established and achievable operational measures. Therefore, it is reasonable to assume that project-level measures can successfully avoid adverse effects occurring. There are also a number of sites designated for grey seal and it is likely that seals associated with designated sites in the Irish Sea (particularly **Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC; The Maidens SCI; Cardigan Bay/ Bae Ceredigion SAC; Lambay Island SAC;** and perhaps **Pembrokeshire Marine/ Sir Benfro Forol SAC and Saltee Islands SAC**) make regular use of this area. There is less evidence for potentially significant agglomerations of bottlenose dolphin and common seal in the immediate vicinity of the SRA although these are obviously wide-ranging species that are likely to be exposed at some point to any activities promoted within the SRA. The effects of specific schemes on marine mammals is likely to be relatively local, and the species commonly travel and forage alone or in small groups, and so impacts are not likely to affect large proportions of their regional populations at any one time. However, effects can only be accurately determined at the project-level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst adverse effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered that they can be avoided as part of the normal project-level consenting process.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	**Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC** Pembrokeshire Marine/ Sir Benfro Forol SAC	This SRA is largely outside estuarine areas and so significant conflicts with diadromous fish are perhaps less likely than for some SRAs, although fish associated with the **Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC** are likely to pass through this area regularly so are more likely to be exposed to effects as a result of activities. Direct effects as a result of aggregate extraction activities are likely to be limited, due to the limited areas affected, although secondary effects that result in substantial geomorphological changes to inshore estuarine habitats (etc) may affect the distribution of prey species in these areas. However, evidence from other areas, including existing aggregates extraction in the Bristol Channel, indicates that adverse effects are not inevitable or unavoidable, and these species are generally adapted to dynamic estuarine environments. Any extraction is also likely to be relatively discrete compared to amount of available habitat, and evidence suggests that diadromous fish populations are more sensitive to changes in natal rivers rather than estuarine systems. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA although there is nothing within the SRA designation that would suggest that adverse effects cannot be avoided through normal project controls and HRA.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Pelagic seabirds	Grassholm SPA Skokholm and Skomer SPA Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	This SRA is within the foraging ranges of most species associated with **Grassholm SPA** and **Skokholm and Skomer SPA**, which may be vulnerable to changes in prey distribution or accessibility as a result of extraction activities. It is likely that some foraging takes place within the SRA area as the presence of sandbanks (etc) is likely to influence prey distribution, although it is worth noting that seabird tracking studies for species from these sites (e.g. Guildford *et al.* 2008, looking at manx shearwater from Skomer; the Grassholm gannet tracking project) indicate that most foraging trips takes place west and north of the sites into the Irish Sea, rather than towards the SRA. This would suggest that the SRA is not occupying areas that are currently of critical importance for foraging seabirds from these sites. The **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA** is designated primarily for the rafting behaviour of some manx shearwater and puffin in these areas – there may be a small risk of disturbance here due to activities in the SRA. There is little information in winter distributions, although species from these sites may utilise the SRA area. The effects of any developments will depend on the scale and nature of particular projects. Direct effects as a result of aggregate extraction activities are likely to be limited, due to the limited areas affected, although secondary effects that result in substantial geomorphological changes to inshore sandbanks (etc) may affect the distribution of prey species in these areas. Evidence from other studies suggests some species may be disturbed or displaced by extraction activities although this is most appropriately addressed at the scheme level. Current evidence does not suggest that effects are unavoidable if activities take place in the SRA. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Effects on some sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) but the BDMPS does not allow effects to be easily excluded for wintering birds. Therefore, all of the sites identified in the scoping are potentially exposed – although realistically most other sites can probably be excluded in the breeding season (particularly taking into account the behaviour of the long-distance foragers (e.g. gannet, manx shearwater) from the closest sites (Grassholm etc).

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Wildfowl and Waders	Bae Caerfyrddin/ Carmarthen Bay SPA Burry Inlet Ramsar Burry Inlet SPA	There are a number of sites designated for their wildfowl and waders near the proposed SRA, although these are invariably several kilometres from the SRA and the behavioural characteristics of these species will ensure that direct effects (e.g. displacement due to noise etc) are unlikely to occur. Effects are more likely through secondary processes (i.e. effects on supporting habitats due to impacts on coastal processes) but the likelihood of this will depend on the parameters of any project than comes forward and evidence from other areas (e.g. North Sea and east coast) suggests that significant effects can generally be avoided through planning. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely, although indirect pathways are present particularly when on passage.

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Table 6.5 Summary of the potential for effects on those European sites / features that are most exposed to the **Bristol Channel / Severn Estuary Aggregates SRAs** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Dunraven Bay SAC Kenfig/ Cynffig SAC River Usk/ Afon Wysg SAC River Wye/ Afon Gwy SAC **Severn Estuary Ramsar** **Severn Estuary SPA** **Severn Estuary/ Môr Hafren SAC**	This SRA partly overlaps with the **Severn Estuary Ramsar, Severn Estuary SPA and Severn Estuary/ Môr Hafren SAC** and so the habitat features of these sites will be particularly vulnerable to direct effects from aggregate extraction. Having said that, the Severn Estuary is one location in Welsh waters where designated features are currently dredged directly, and so a reasonably body of practice and evidence exists regarding the sustainability of these activities. The Severn Estuary is considered to be sensitive to aggregate extraction as there is no known significant modern source of sand sized sediment to replenish that which is extracted, although sandbanks in the Inner Bristol Channel may source of sediment for the Severn Estuary under certain conditions. Over time, this may have an impact on the extent and morphology of the sand-bank features. In terms of the environmental impact of extraction in the Severn Estuary and Inner Bristol Channel, the current licences have all been through due regulatory process including Environmental Impact Assessment and Habitats Regulations Assessment, and recent work for the Welsh Government[39] suggests that activities are currently being managed within environmental limits in relation to habitats and species. Each of the licences also includes a comprehensive programme of monitoring to manage any residual risk of morphological change (and subsequent impacts on features), which includes topographic and bathymetric surveys across the whole bank system, undertaken jointly by the operators. However, it should also be noted that the intention of the WNMP is to encourage the exploitation of resources away from the Severn Estuary, and in the inner Bristol Channel instead. There are a number of number of designated sites around area with habitat features that will also be vulnerable to changes in coastal processes, particular regards sediment transport (etc); these include the river near the SRA as well as some SACs designated for their supralittoral habitats (e.g. **Kenfig SAC**). Whilst aggregate extraction from within or near a European site does not necessarily result in adverse effects, the adverse effects as a result of activities supported by the plan cannot necessarily be excluded. However, the proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	No other marine sites are within 30km of this SRA and so direct effects on the habitats of these can be excluded. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species do not occur.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Bats	Exmoor and Quantock Oakwoods SAC Mendip Limestone Grasslands SAC North Somerset and Mendip Bats SAC Wye Valley and Forest of Dean Bat Sites/ Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC Wye Valley Woodlands/ Coetiroedd Dyffryn Gwy SAC	These SRAs partly coincide with the Severn Estuary, which is known to be crossed by bats that may be associated with SACs in England and Wales. Significant effects are very unlikely based on the likely scale of any extraction activities, however.	None.
Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC Pembrokeshire Marine/ Sir Benfro Forol SAC Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI North Anglesey Marine / Gogledd Môn Forol cSAC West Wales Marine / Gorllewin Cymru Forol cSAC Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	The Severn Estuary and Inner Bristol Channel are not identified as particularly significant areas for marine mammals although these are obviously wide-ranging species that are likely to be exposed at some point to any activities promoted within the SRA; individuals may be vulnerable to the primary and secondary effects of any extraction however, it is unlikely that extraction within these SRAs would significantly affect the populations associated with any SACs.	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered it is unlikely that extraction within these SRAs would significantly affect the populations associated with any SACs and any effects can be avoided as part of the normal project-level consenting process.

[39] HR Wallingford (2016) Review of Aggregate Dredging off the Welsh Coast. Report for Cefas, Ref. DDM7582-RT001-RT05-00. Available at http://gov.wales/docs/drah/publications/161024-fisheries-review-of-aggregate-dredging-off-welsh-coast-oct-2016-en.pdf.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	River Usk/ Afon Wysg SAC River Wye/ Afon Gwy SAC **Severn Estuary Ramsar** **Severn Estuary/ Môr Hafren SAC**	These SRAs include part of the Severn Estuary SAC, which is designated for its diadromous fish populations, and is in close proximity to the estuaries of the River Wye SAC and River Usk SAC. The effects of any extraction scheme on diadromous fish will depend on its scale, type and location, although species will obviously be vulnerable to the typical primary and secondary effects of such schemes. Having said that, evidence from other areas, including existing aggregates extraction in the estuary, indicates that adverse effects are not inevitable or unavoidable, and these species are generally adapted to dynamic estuarine environments. Any extraction is also likely to be relatively discrete compared to amount of available habitat, and evidence suggests that diadromous fish populations are more sensitive to changes in natal rivers rather than estuarine systems. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA although there is nothing within the SRA designation that would suggest that adverse effects cannot be avoided through normal project controls and HRA; realistically, if adverse effects are not currently occurring for species associated with the River Usk/ Afon Wysg SAC, River Wye/ Afon Gwy SAC, Severn Estuary Ramsar or Severn Estuary/ Môr Hafren SAC then far field effects on fish from other sites would seem very unlikely.
Pelagic seabirds	Grassholm SPA Skokholm and Skomer SPA Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	These SRAs are within the foraging ranges of most species associated with **Grassholm SPA** and **Skokholm and Skomer SPA**, although it is worth noting that seabird tracking studies for species from these sites (e.g. Guildford *et al.* 2008, looking at manx shearwater from Skomer; the Grassholm gannet tracking project) indicate that most foraging trips takes place west and north of the sites into the Irish Sea, rather than towards the SRA. This would suggest that the SRA is not occupying areas that are currently of critical importance for foraging seabirds from these sites. There is little information in winter distributions, although species from these sites may utilise the SRA area. Overall, however, whilst bird species may use the estuarine areas at some points, any extraction will be relatively discrete compared to amount of available habitat. The effects of any developments will depend on the scale and nature of particular projects. Direct effects as a result of aggregate extraction activities are likely to be limited, due to the limited areas affected, although secondary effects that result in substantial geomorphological changes to inshore sandbanks (etc) may affect the distribution of prey species in these areas. Evidence from other studies suggests some species may be disturbed or displaced by extraction activities although this is most appropriately addressed at the scheme level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Effects on some sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) but the BDMPS does not allow effects to be easily excluded for wintering birds. Therefore, all of the sites identified in the scoping are theoretically exposed – although realistically most other sites can probably be excluded in the breeding season (particularly taking into account the behaviour of the long-distance foragers (e.g. gannet, manx shearwater) from the closest sites (Grassholm etc).

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Wildfowl and Waders	**Severn Estuary Ramsar** **Severn Estuary SPA**	These SRAs partly overlaps with the **Severn Estuary Ramsar and Severn Estuary** and so the bird features of these sites will be particularly vulnerable to direct effects from aggregate extraction (noise, disturbance, etc). Effects are also possible through secondary processes (i.e. effects on supporting habitats due to impacts on coastal processes) but the likelihood of this will depend on the parameters of any project than comes forward. Having said that, evidence from other areas, including existing aggregates extraction in the estuary, indicates that adverse effects are not inevitable or unavoidable, and any disturbance effects as a result of extraction are likely to be relatively discrete compared to amount of available habitat. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from aggregate extraction elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely, although indirect pathways are present particularly when on passage.

Policy review

6.2.15 The intent of Policy AGG_01 is the support of future aggregate extraction, although this support is not unequivocal and is contingent on the performance of a proposed development against the other policies in the WNMP (including the protective general cross-cutting policies). There is no 'presumption in favour' and the policy does not constrain the delivery of future schemes such that adverse effects cannot be avoided. It is also noted that the policy requires that "*Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of…*" aggregates within and outside SRAs.

6.2.16 Policy AGG_01 also allows for permitted tonnage limits to be defined for an area. Subject to sustainability criteria, and the undertaking of necessary assessment through the decision-making processes, not more than 800,000 tonnes (exclusive of licensed roll-over tonnage) of annual licensed aggregate will be allowed from Welsh waters in the Severn Estuary – this is consistent with the existing iMADP provisions and is understood to be sustainable based on HRAs (etc.) of existing licences for this SRA.

6.2.17 The aggregates policy does not identify or promote specific development proposals, nor restrict how future schemes might be delivered. Schemes are arguably more likely within the SRAs as a result of the plan policies, but are not necessarily restricted to these areas. The likelihood of specific effects occurring on specific sites or features that are potentially exposed cannot be quantified without detailed modelling, particularly for secondary effects such as changes to sediment and hydrodynamic regimes (although assessment may be possible with substantial modelling and additional analysis along the lines of the MAREA analysis).

6.2.18 Specific mitigation measures for future schemes cannot be determined or outlined at the plan-level, although it is clear from the aggregate extraction elsewhere, including in the Bristol Channel, that a range of mitigation measures are available, achievable and likely to be effective and that significant adverse effects remain avoidable with an identified SRA for aggregates. In terms of plan-level mitigation, it should be recognised that various controls and safeguards are woven through the general cross-cutting policies; in addition:

- All aggregates proposals will be subject to project level HRA as part of the consenting procedure.
- The three-yearly WNMP review process provides a mechanism for the monitoring and review of policy performance, which will be based on accumulated evidence from project- and strategic studies, and hence ensures that effects that cannot currently be assessed as part of a plan-level HRA are appropriately captured and addressed.
- The WNMP includes provision for tonnage caps to be applied, should evidence suggest that this is appropriate.

6.3 Conclusion

6.3.1 Policy AGG/01 is intended to promote and support the development of aggregate schemes within the SRAs. Due to the location of the SRAs, and proximity of some sites with features that are sensitive to the primary and secondary effects of aggregate extraction, it is arguably not possible to exclude the possibility of significant effects or significant adverse effects as result of activities covered by the policy. However, as there is nothing inherent in aggregate extraction that makes adverse effects inevitable, it is considered that the policy is sufficiently caveated and flexible to ensure that adverse effects are entirely avoidable at the project-level, for the following reasons:

i. Whilst the policy identifies areas that are likely to be suitable for aggregate extraction (which are safeguarded in this respect), based on existing data, this is not equivalent to a land-use plan allocation. Importantly, it does not identify or promote specific development proposals, nor restrict how future schemes might be delivered (indeed, the policy does not

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restrict delivery to the SRAs (see supporting map)[40]). As a result, sufficient flexibility is retained within the scope of the policy to ensure that future schemes could be delivered without adverse effects.

ii. The general cross-cutting protective policies within the WNMP will provide safeguards for European sites (although it is recognised that these do not categorically exclude any schemes that may have adverse effects since this would exceed the provisions of the Habitats Regulations).

iii. Evidence from existing aggregate extraction schemes, including in the Severn Estuary and Bristol Channel, suggests that project-level mitigation and avoidance measures are available, achievable and likely to be effective.

iv. All schemes coming forward under this policy would require project-level HRA.

v. The WNMP review process will ensure that SRAs can be modified over time to reflect the best evidence available.

6.3.2 Due to the nature of the plan and policy, specific measures to mitigate specific effects on specific sites cannot be identified. It is therefore necessary, in part, to rely on the implementation of the general cross-cutting protective policies within the WNMP to safeguard European sites and features during the future assessment of schemes that are supported by this policy and down-the-line assessment of individual projects. It is, however, considered that this policy will not result in adverse effects on any European sites based on the measures that are in place.

[40] Although it is recognised that schemes outside this area may be more difficult to advance due to the safeguarding measures provided for other sectors by the WNMP.

100000 150000 200000 250000 300000 350000 400000

N

450000 400000 350000 300000 250000 200000 150000 100000

Key

- cSAC
- Ramsar
- SPA
- SAC
- WNMP Area
- Aggregates SRAs
- 50km Zone of Influence

0 20 40 60 80 100 km

Scale at A3: 1:1,250,000

Based upon the Ordnance Survey Map with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright. 100001776

Welsh National Marine Plan
Habitats Regulations Assessment

amec foster wheeler

Figure 6.1
Aggregates SRAs

October 2017

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7. Aquaculture

7.1 Screening Summary

7.1.1 Policy AQQ_01 provides the supporting framework for aquaculture schemes as follows:

Proposals for aquaculture activities in Strategic Resource Areas are encouraged.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

a. aquaculture Strategic Resource Areas; and

b. wider natural resources that provide aquaculture potential;

in order to support the sustainable growth of the aquaculture sector through marine planning.

7.1.2 As with other supporting policies, the likely outcome of the policy is an increase in the number of aquaculture proposals, ideally within the SRAs (of which there are around 40 distributed around much of the coast, reflecting existing and potential future areas for aquaculture). Development is more likely to be located within the SRAs and proposals for schemes outside these areas would not necessarily benefit from the policy, although the policy does not restrict proposals to SRAs.

7.1.3 Aquaculture schemes have the potential to affect the interest features of European sites and therefore a policy promoting these could result in significant effects if proposals are not appropriately designed, although it is recognised that most aquaculture schemes are relatively small-scale. On this basis, significant effects cannot necessarily be excluded and the policies have been subject to further assessment.

7.1.4 There is no presumption in favour of aquaculture proposals.

7.2 Appropriate Assessment

Sites and features

7.2.1 A 30km ZoI around the SRAs has been used for aquaculture activities to identify sites that are most likely to be exposed to effects of activities taking place within the SRAs; this is based on advice from NRW. A 2km terrestrial ZoI is also used to identify purely terrestrial habitats that may be vulnerable to the activities associated with the SRAs.

7.2.2 There are 79 European sites within the marine and terrestrial ZoIs of the proposed SRAs, which have features that are potentially exposed to the likely outcomes of the sector policies. These are summarised in **Table 7.1** and illustrated on **Figure 7.1**. However, it is worth noting that virtually all of the SRAs are located within or overlap European sites, reflecting the current extent of areas of aquaculture potential around Wales. It is also worth noting that future aquaculture activities are less likely to be constrained to the SRAs, in comparison with other sectors, due to uncertainties regarding the sector requirements making the potential impact of the SRAs more limited compared to other sector SRAs.

7.2.3

7.2.4

Table 7.1 European sites within the Aquaculture SRAs or within marine or terrestrial zones of influence

Site	Features	Location
Afon Eden - Cors Goch Trawsfynydd SAC	Active raised bogs; *Luronium natans*; *Lutra lutra*; *Margaritifera margaritifera*; *Salmo salar*	Within ZoI
Afon Gwyrfai a Llyn Cwellyn SAC	*Luronium natans*; *Lutra lutra*; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	In SRA
Afon Teifi/ River Teifi SAC	*Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Luronium natans*; *Lutra lutra*; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	In SRA
Afon Tywi/ River Tywi SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*	Within ZoI
Afonydd Cleddau/ Cleddau Rivers SAC	Active raised bogs; Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Anglesey Terns / Morwenoliaid Ynys Môn SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*; Roseate tern *Sterna* dougalli	Within ZoI
Bae Caerfyrddin/ Carmarthen Bay SPA	*Melanitta nigra*	In SRA
Bae Cemlyn/ Cemlyn Bay SAC	Coastal lagoons; Perennial vegetation of stony banks	Within ZoI
Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC	Harbour porpoise *Phocoena phocoena*	Within ZoI
Burry Inlet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	In SRA
Burry Inlet SPA	*Anas acuta*; *Anas clypeata*; *Anas crecca*; *Anas penelope*; *Arenaria interpres*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Numenius arquata*; *Pluvialis squatarola*; *Tadorna tadorna*; *Tringa totanus*	In SRA
Cadair Idris SAC	Alkaline fens; Blanket bogs; Calcareous rocky slopes with chasmophytic vegetation; *Drepanocladus* (*Hamatocaulis) vernicosus*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; European dry heaths; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; Siliceous rocky slopes with chasmophytic vegetation; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*	Within ZoI
Cardigan Bay/ Bae Ceredigion SAC	*Halichoerus grypus*; *Lampetra fluviatilis*; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves; *Tursiops truncatus*	In SRA
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time	In SRA

Site	Features	Location
Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Vertigo angustior*	In SRA
Castlemartin Coast SPA	*Pyrrhocorax pyrrhocorax*	In SRA
Clogwyni Pen Llyn/ Seacliffs of Lleyn SAC	Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Coed Cwm Einion SAC	*Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Coedwigoedd Penrhyn Creuddyn/ Creuddyn Peninsula Woods SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Taxus baccata* woods of the British Isles; *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Coedydd Aber SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	Within ZoI
Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Bog woodland; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; *Rhinolophus hipposideros*; *Tilio-Acerion* forests of slopes, screes and ravines; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Cors Fochno and Dyfi Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types	In SRA
Cors Fochno SAC	Active raised bogs; Degraded raised bogs still capable of natural regeneration; Depressions on peat substrates of the *Rhynchosporion*	Within ZoI
Corsydd Llyn/ Lleyn Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Vertigo geyeri*; *Vertigo moulinsiana*	Within ZoI
Corsydd Môn a Llyn/ Anglesey and Llyn Fens Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	Within ZoI
Corsydd Môn/ Anglesey Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; *Vertigo geyeri*	Within ZoI
Crymlyn Bog Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	Within ZoI
Crymlyn Bog/ Cors Crymlyn SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Transition mires and quaking bogs	Within ZoI
Dee Estuary/ Aber Dyfrdwy SAC	Annual vegetation of drift lines; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Embryonic shifting dunes; Estuaries; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petalophyllum ralfsii*; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
Deeside and Buckley Newt Sites SAC	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; *Triturus cristatus*	Within ZoI
Dyfi Estuary / Aber Dyfi SPA	*Anser albifrons flavirostris*	In SRA

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Site	Features	Location
Eryri/ Snowdonia SAC	Alkaline fens; Alpine and Boreal heaths; Alpine and subalpine calcareous grasslands; Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*; Blanket bogs; Calcareous rocky slopes with chasmophytic vegetation; Depressions on peat substrates of the *Rhynchosporion*; *Drepanocladus* (*Hamatocaulis) vernicosus*; European dry heaths; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; *Luronium natans*; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; Petrifying springs with tufa formation (*Cratoneurion)*; Siliceous alpine and boreal grasslands; Siliceous rocky slopes with chasmophytic vegetation; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*; Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	Within ZoI
Exmoor Heaths SAC	Alkaline fens; Blanket bogs; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA	*Puffinus puffinus*	In SRA
Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; Mudflats and sandflats not covered by seawater at low tide; Salicornia and other annuals colonizing mud and sand	In SRA
Glannau Ynys Gybi/ Holy Island Coast SAC	European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
Glannau Ynys Gybi/ Holy Island Coast SPA	*Pyrrhocorax pyrrhocorax*	In SRA
Glynllifon SAC	*Rhinolophus hipposideros*	Within ZoI
Gower Ash Woods/ Coedydd Ynn Gwyr SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Gower Commons/ Tiroedd Comin Gwyr SAC	*Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; European dry heaths; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*	Within ZoI
Great Orme`s Head/ Pen y Gogarth SAC	European dry heaths; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
Kenfig/ Cynffig SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*	Within ZoI
Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	Caves not open to the public; European dry heaths; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); *Gentianella anglica*; *Petalophyllum ralfsii*; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Submerged or partially submerged sea caves; Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
Liverpool Bay / Bae Lerpwl SPA	*Gavia stellata*; *Melanitta nigra*	In SRA
Mendip Limestone Grasslands SAC	Caves not open to the public; European dry heaths; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Mersey Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI

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Site	Features	Location
Mersey Estuary SPA	*Anas acuta*; *Anas crecca*; *Anas penelope*; *Calidris alpina alpina*; *Charadrius hiaticula*; *Limosa limosa islandica*; *Numenius arquata*; *Pluvialis apricaria*; *Pluvialis squatarola*; *Podiceps cristatus*; *Tadorna tadorna*; *Vanellus vanellus*	Within ZoI
Mersey Narrows and North Wirral Foreshore Ramsar	Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
Mersey Narrows and North Wirral Foreshore SPA	*Calidris alba*; *Calidris alpina alpina*; *Calidris canutus islandica*; *Haematopus ostralegus*; *Larus minutus*; *Limosa lapponica*; *Phalacrocorax carbo*; *Pluvialis squatarola*; *Tringa totanus*	Within ZoI
Morfa Harlech a Morfa Dyffryn SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Humid dune slacks; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	In SRA
Mwyngloddiau Fforest Gwydir/ Gwydyr Forest Mines SAC	Calaminarian grasslands of the *Violetalia calaminariae*; *Rhinolophus hipposideros*	Within ZoI
Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA	*Pyrrhocorax pyrrhocorax*	In SRA
North Anglesey Marine / Gogledd Môn Forol cSAC	Harbour porpoise *Phocoena phocoena*	In SRA
North Channel cSAC	Harbour porpoise *Phocoena phocoena*	Within ZoI
North West Pembrokeshire Commons/ Comins Gogledd Orllewin Sir Benfro SAC	European dry heaths; *Luronium natans*; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; Transition mires and quaking bogs	Within ZoI
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	Red-throated diver *Gavia stellata*	In SRA
Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Lutra lutra*; *Rhinolophus ferrumequinum*; *Rhinolophus hipposideros*	In SRA
Pembrokeshire Marine/ Sir Benfro Forol SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; *Rumex rupestris*; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves	In SRA
Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; Reefs; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves; *Tursiops truncatus*	In SRA
Ramsey and St David`s Peninsula Coast SPA	*Pyrrhocorax pyrrhocorax*	In SRA
Ribble and Alt Estuaries Ramsar	Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI

Site	Features	Location
Ribble and Alt Estuaries SPA	*Anas acuta*; *Anas crecca*; *Anas penelope*; *Anser brachyrhynchus*; *Aythya marila*; *Calidris alpina alpina*; *Calidris canutus*; *Charadrius hiaticula*; *Cygnus columbianus bewickii*; *Cygnus cygnus*; *Haematopus ostralegus*; *Larus fuscus*; *Larus ridibundus*; *Limosa lapponica*; *Limosa limosa islandica*; *Melanitta nigra*; *Numenius arquata*; *Numenius phaeopus*; *Phalacrocorax carbo*; *Philomachus pugnax*; *Pluvialis apricaria*; *Pluvialis squatarola*; *Sterna hirundo*; *Tadorna tadorna*; *Vanellus vanellus*	Within ZoI
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	*Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Luronium natans*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	In SRA
River Usk/ Afon Wysg SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
River Wye/ Afon Gwy SAC	*Alosa alosa*; *Alosa fallax*; *Austropotamobius pallipes*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Transition mires and quaking bogs; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Sefton Coast SAC	Atlantic decalcified fixed dunes (*Calluno-Ulicetea)*; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Triturus cristatus*	Within ZoI
Severn Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds; Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path	In SRA
Severn Estuary SPA	*Anas strepera*; *Anser albifrons albifrons*; *Calidris alpina alpina*; *Cygnus columbianus bewickii*; *Tadorna tadorna*; *Tringa totanus*	In SRA
Severn Estuary/ Môr Hafren SAC	*Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time	In SRA
Skokholm and Skomer SPA	*Asio flammeus*; *Fratercula arctica*; *Hydrobates pelagicus*; *Larus fuscus*; *Puffinus puffinus*; *Pyrrhocorax pyrrhocorax*	In SRA
Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	Storm petrel *Hydrobates pelagicus*; lesser black-backed gull *Larus fuscus*; Manx shearwater *Puffinus puffinus*; Atlantic puffin *Fratercula arctica*; Breeding seabird assemblage;	In SRA
St David`s / Ty Ddewi SAC	European dry heaths; *Luronium natans*; Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
The Dee Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	In SRA
The Dee Estuary SPA	*Anas acuta*; *Anas crecca*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Limosa lapponica*; *Limosa limosa islandica*; *Numenius arquata*; *Pluvialis squatarola*; *Sterna albifrons*; *Sterna hirundo*; *Sterna sandvicensis*; *Tadorna tadorna*	In SRA
Traeth Lafan/ Lavan Sands, Conway Bay SPA	*Haematopus ostralegus*; *Mergus serrator*; *Numenius arquata*; *Podiceps cristatus*; *Tringa totanus*	In SRA

Site	Features	Location
West Wales Marine / Gorllewin Cymru Forol cSAC	Harbour porpoise *Phocoena phocoena*	In SRA
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC	Large shallow inlets and bays; Mudflats and sandflats not covered by seawater at low tide; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves	In SRA
Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation; *Petalophyllum ralfsii*; *Rumex rupestris*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	In SRA
Ynys Feurig, Cemlyn Bay and The Skerries SPA	*Sterna dougallii*; *Sterna hirundo*; *Sterna paradisaea*; *Sterna sandvicensis*	Within ZoI

7.2.5 In addition, it is important to note that all of the more distant sites with mobile species that may be functionally linked to the WNMP area (see Appendices C - E) are also considered to be potentially vulnerable (i.e. all marine mammal sites associated with the relevant MMUs; all seabird sites where Thaxter *et al.* (2012) or the BDMPS suggest that the feature ranges may intersect with the ZoI during breeding or wintering; all sites with wintering bird species that may use or cross the ZoI).

7.2.6 There are few purely terrestrial habitats within the ZoI of the SRAs and these will not be directly exposed to the likely effects of activities within the SRAs; the only risk to these would be through project-specific scenarios (rather than systematic exposure) that cannot be predicted at this level; potential effects on these are therefore excluded from assessment in respect of the SRAs.

7.2.7 The interest feature groups considered are therefore:

- Subtidal and intertidal habitats (plus typical species);
- Supralittoral habitats and species (plus typical species);
- Bats;
- Marine mammals;
- Diadromous fish;
- Pelagic seabirds;
- Wildfowl and waders.

Potential effect pathways

7.2.8 The likely or intended outcome of Policy AQU_01 is an increase in the number of aquaculture proposals; and, ideally as a consequence, the implementation of those schemes. The scale or type of scheme supported by the policy is not defined or restricted, nor are specific schemes or locations identified (although the aquaculture policies make proposals within the SRA more likely, partly through direct promotion and partly as a consequence of safeguarding from other sector activity). It should also be noted that the objective to double current output is modest, given the current footprint of aquaculture activities in Wales.

7.2.9 There are essentially four main types of aquaculture that are likely to be commercially viable around Wales:

- Seabed or bottom culture: this typically involves the collection of wild shellfish spat, usually by dredging areas of seabed (some of which may be prepared for this purpose), and the relocation of these to seabed grow-out sites in areas of shallow, richer water. The shellfish are subsequently harvested when they reach commercial size, again usually by dredging.

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- Off-bottom culture (trestle or rope): these methods are less extensive than bottom culture and involve the growing of shellfish on trestles (usually oysters) or rope lines suspended in the water column (usually mussels), which are then harvested.
- Cages: this typically involves the cultivation of finfish species (e.g. salmon) in cages or pens, which are floating or fixed in the sea.
- On-land systems: where tanks and infrastructure are largely on land, with seawater abstracted and discharged to the sea

7.2.10 In broad summary, the principal aspects and pathways are likely to be as follows.

Construction

7.2.11 All interest features noted above will be theoretically vulnerable (i.e. sensitive and potentially exposed, depending on the mitigation or avoidance measures that can be employed) to one or more of the pressures that are typically associated with construction schemes in the marine environment (e.g. direct damage to, or loss of, habitats; indirect damage to, or loss of, habitats due to secondary effects; toxic contamination; barrier effects and disturbance, displacement or mortality of mobile species etc). However, it is important to note that construction requirements for virtually all aquaculture installations are small-scale only, and so will usually have only limited potential for significant or significant adverse effects on European sites as a result of construction activities.

Operation

7.2.12 Operational effects will depend heavily on the scale and type of development proposed, and the technologies that are used at the point of delivery. Evidence from existing aquaculture installations (many of which are in European sites) indicates that effects as a result of operation are typically local to the installation only (e.g. substantial secondary effects on distant habitats due to hydrodynamic changes do not occur). Effects as a result of the following pressures are therefore most likely:

- **Hydrodynamic changes**: structures or beds associated with aquaculture can alter local hydrodynamics (e.g. by slowing tidal currents around them) resulting in increased siltation locally. More wide ranging changes are possible, depending on the size of any structures but are generally unlikely based on evidence from existing schemes.
- **Physical loss / changes**: Physical loss or damage to habitats may occur directly, as a result of structure installation, or as a secondary effect of (for example) hydrodynamic changes causing increased sedimentation. Operational activities (e.g. collection of spat or harvesting by dredging; management of substrates) can result in the removal associated habitats and species, or lead to damage through sediment mobilisation and smothering. Moorings (etc.) can result in abrasion damage, depending on scales.
- **Toxic contamination**: toxic contamination may occur as the result of spillages (etc.) during operations, or (particularly for finfish) the introduction of non-synthetic and synthetic compounds (e.g. feed pellets; parasite treatments; etc.). Toxic contaminants in sediments that may be released through dredging.
- **Non-toxic contamination and physio-chemical changes**: Local physio-chemical changes may occur in conjunction with the hydrodynamic changes, as tidal currents and fluxes are altered; fish farming in particular generates large amounts of organic waste products which may affect surrounding habitats and can result in reduced dissolved oxygen levels locally.
- **Biological changes**: there are a number of potential mechanisms for biological effects as a result of aquaculture, including:
  - the introduction or transfer of pathogens or parasites from cultured to wild populations;
  - the direct introduction of non-native species for commercial exploitation;

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- the introduction of new bare surfaces which may allow non-native species to colonise an area more easily, in the absence of competition from established native species (assuming spread is limited to some extent by existing regime and absence of new substrates);
- translocation or introduction of indigenous species to new areas resulting in genetic shifts in populations (e.g. through fish escapes and interbreeding);
- alterations in predator behaviours in response to aquaculture installations, bringing them into conflict with operations.

7.2.13 Significant direct disturbance, displacement, mortality and barrier effects on mobile species would not generally be expected due to the scale of most operations, although changes may occur through changes in habitat or prey distributions due to the physical and physio-chemical changes noted above; or the introduction of new structures creating new habitat (particularly for fish, which often aggregate around structures, but conceivably for birds which may use structures for perching and nesting).

7.2.14 The sensitivity of the interest feature groups to the potential pressures associated with aquaculture schemes are summarised in **Table 7.2**.

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Table 7.2 Sensitivity of the interest feature groups to the potential pressures associated with aquaculture schemes *(note, pressures are not included if they are not associated with aquaculture activities (see Appendix F for justification); Y – directly sensitive; S – sensitive to consequent or secondary effects)*

Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Aquaculture - fin-fish	Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
	Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
	Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
	Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
	De-oxygenation	Y			Y	S	S	S	Y
	Nutrient enrichment	Y	Y		Y	S	S	S	Y
	Organic enrichment	Y	Y		Y	S	S	S	Y
	Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
	Physical change (to another seabed type)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- Surface	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y			S	S	S	S	Y
	Changes in suspended solids	Y			Y	S	S	Y	Y
	Siltation rate changes	Y			S	S	Y	S	Y
	Litter	Y	Y		Y	Y	Y	Y	Y
	Underwater noise changes				Y	Y	Y	S	Y
	Introduction of light			Y	Y	Y	Y	Y	Y

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Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
	Barrier to species movement				Y	Y	Y	Y	Y
	Death or injury by collision			Y	Y	Y	Y	Y	Y
	Visual disturbance				Y	Y	Y	Y	Y
	Genetic modification & translocation of indigenous species	Y			Y				Y
	Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
	Introduction of microbial pathogens	Y			Y	Y	Y	Y	Y
	Removal of target species				Y	S	Y	Y	Y
	Removal of non-target species				Y	Y	Y	Y	Y
Aquaculture - shellfish	Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
	Emergence regime changes - local	Y	Y			S	Y	Y	Y
	Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
	Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
	Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
	De-oxygenation	Y			Y	S	S	S	Y
	Nutrient enrichment	Y	Y		Y	S	S	S	Y
	Organic enrichment	Y	Y		Y	S	S	S	Y
	Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
	Physical change (to another seabed type)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y							Y

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Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
	Penetration and/or disturbance of the substrate below the surface of the seabed- Surface	Y							Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y							Y
	Changes in suspended solids	Y			Y	S	S	Y	Y
	Siltation rate changes	Y			S	S	Y	S	Y
	Litter	Y	Y		Y	Y	Y	Y	Y
	Underwater noise changes				Y	Y	Y	S	Y
	Introduction of light			Y	Y	Y	Y	Y	Y
	Barrier to species movement				Y	Y	Y	Y	Y
	Death or injury by collision			Y	Y	Y	Y	Y	Y
	Visual disturbance				Y	Y	Y	Y	Y
	Genetic modification & translocation of indigenous species	Y			Y				Y
	Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
	Introduction of microbial pathogens				Y	Y	Y	Y	Y
	Removal of target species				Y	S	Y	Y	Y
	Removal of non-target species				Y	Y	Y	Y	Y
Aquaculture – macro-algae	Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
	Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
	Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
	Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y

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Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
	De-oxygenation	Y			Y	S	S	S	Y
	Nutrient enrichment	Y	Y		Y	S	S	S	Y
	Organic enrichment	Y	Y		Y	S	S	S	Y
	Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
	Physical change (to another seabed type)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y							Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y							Y
	Changes in suspended solids	Y			Y	S	S	Y	Y
	Siltation rate changes	Y			S	S	Y	S	Y
	Underwater noise changes				Y	Y	Y	S	Y
	Introduction of light			Y	Y	Y	Y	Y	Y
	Visual disturbance				Y	Y	Y	Y	Y
	Genetic modification & translocation of indigenous species	Y			Y				Y
	Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
	Introduction of microbial pathogens				Y	Y	Y	Y	Y
	Removal of target species				Y	S	Y	Y	Y
	Removal of non-target species				Y	Y	Y	Y	Y

Site / feature exposure

7.2.15 Policy AQU_01 does not identify or promote specific development proposals, nor restrict how future schemes might be delivered. Schemes are arguably more likely within the SRAs as a result of the plan policies, but are not necessarily restricted to these areas. As a result, the likelihood of specific effects occurring on specific sites or features that are potentially exposed cannot be determined, and will depend entirely on the nature of the schemes that come forward under the WNMP policies; this is particularly relevant to aquaculture schemes as the effects are generally unlikely to operate regionally and therefore strategy-scale assessment can have limited benefits. In addition, there are a number of large aquaculture schemes around Wales taking place within or immediately adjacent to European sites (for example, near the Menai Straits SAC) without adverse effects on the sites occurring, and so scheme-level measures (design, mitigation, etc.) are clearly achievable.

7.2.16 Due to the number of aquaculture SRAs, the typical scale of individual projects, and the consequent variability in the potential effects, it is not considered appropriate to attempt to analyse the potential for individual SRAs to affect particular European sites or feature groups (as any such assessment would be entirely generic and would provide no clarity on whether particular SRAs should be modified or abandoned). Therefore, it is accepted that: all interest features will be sensitive to one or more of the likely outcomes of aquaculture proposals; exposure cannot be determined at this level; effects may occur as a result of individual projects; but that this can only be meaningfully addressed at the application stage. As a result, the assessment focuses on the intent and controls within the WNMP, which should ensure that project-level effects do not occur.

Policy review

7.2.17 The intent of Policy AQU_01 is the support of aquaculture proposals schemes, although this support is conditional and contingent on the performance of schemes against the other policies in the plan (including the protective general cross-cutting policies). There is no 'presumption in favour' and the policy does not constrain the delivery of future schemes such that adverse effects cannot obviously be avoided.

7.2.18 Furthermore, the consenting process for any aquaculture scheme is set out in the supporting text, which notes that "*As a condition of granting any SO* [Several Order]*, WG put in place conditions that reflect the outcome of the environmental assessment and over-see their monitoring to ensure that the granting of the SO will not likely have a significant adverse impact upon the designated features of any conservation site*". Therefore, HRA will take place at the project level as part of any SOs.

7.2.19 The policy does not identify or promote specific development proposals, nor restrict how future schemes might be delivered. Schemes are arguably more likely within the SRAs as a result of the plan policies, but are not necessarily restricted to these areas.

7.2.20 Specific mitigation measures for future schemes cannot be determined or outlined at the plan-level, although it is clear from existing aquaculture schemes around Wales that measures are available and adverse effects are not an inevitable outcome (even within European site boundaries). In terms of plan-level mitigation, it should be recognised that various controls and safeguards are woven through the cross-cutting policies; in addition:

- All SOs will be subject to project level HRA as part of the consenting procedure.
- The three-yearly WNMP review process provides a mechanism for the monitoring and review of policy performance, which will be based on accumulated evidence from project- and strategic studies, and hence ensures that effects that cannot currently be assessed as part of a plan-level HRA are appropriately captured and addressed.

7.3 Conclusion

7.3.1 Policy AQU_01 is intended to promote and support the development of schemes within the SRAs. Whilst the precise scale, location and nature of proposals cannot be determined at this stage, it is

considered that the policy is sufficiently caveated and flexible to ensure that adverse effects are not an unavoidable or inevitable outcome of its implementation, for the following reasons:

i. Whilst the policy identifies SRAs, it does not identify or promote specific development proposals, nor restrict how future schemes might be delivered (indeed, the policy does not restrict delivery to the SRA (see supporting map)[41]). As a result, sufficient flexibility is retained within the scope of the policy to ensure that future schemes can be delivered without adverse effects.

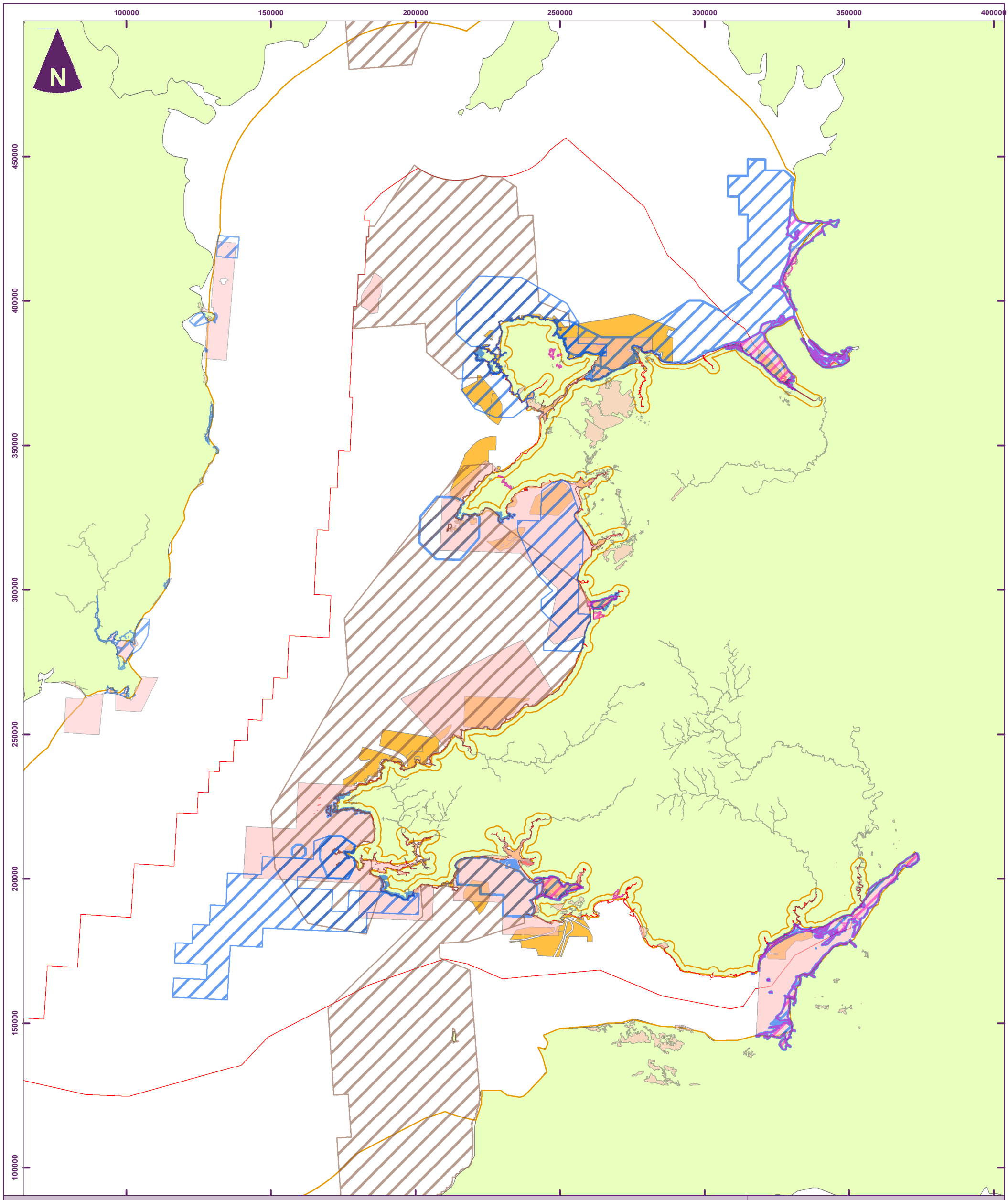
ii. Evidence from existing aquaculture schemes suggests that project-level mitigation and avoidance measures are available, achievable and likely to be effective.

iii. All schemes coming forward under this policy would require project-level HRA.

iv. The WNMP review process will ensure that SRAs can be modified to reflect the best evidence available.

7.3.2 Due to the nature of the plan and policy, specific measures to mitigate specific effects on specific sites cannot be identified. It is therefore necessary, in part, and appropriate to rely on the implementation of the general cross-cutting protective policies within the WNMP to safeguard European sites and features during the future assessment of schemes that are supported by this policy. It is, however, considered that this policy will not result in adverse effects on any European sites.

[41] Although it is recognised that schemes outside this area may be more difficult to advance due to the safeguarding measures provided for other sectors by the WNMP.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WNMP Area
Aquaculture SRAs
50km Zone of Influence
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20
40
60
80
100 km
Scale at A3: 1:1,250,000
Based upon the Ordnance Survey Map with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright. 100001776
Welsh National Marine Plan
Habitats Regulations Assessment
amec foster wheeler
Figure 7.1
Aquaculture SRAs
October 2017
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8. Ports and Shipping

8.1 Screening Summary

8.1.1 Policies P&S_01 and P&S_02 provide the supporting framework for ports and shipping. The specific supporting policies are as follows:

P&S_01: Ports and shipping (supporting)

Proposals for ports, harbours and shipping activities in Strategic Resource Areas (SRAs) are encouraged.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of port and shipping Strategic Resource Areas in order to support the sustainable growth of the ports and shipping sector through marine planning

P&S_02: Ports and shipping (supporting)

Proposals that provide for the maintenance, repair, development and diversification of port and harbour facilities are encouraged

8.1.2 The objective for the sector is "*To safeguard established shipping routes and support sustainable growth in the shipping and ports sector*". However, it is important to note that the SRAs do not identify 'new' areas for development proposals, but simply the locations of the existing ports and established shipping lanes, i.e. areas where existing port and shipping operations are already ongoing.

8.1.3 It is also important to note that the WNMP will have only limited influence on activities associated with these areas; for example, it will have no direct influence over the use of shipping lanes, and a substantial proportion of port activity will be land-side and so subject to separate planning regimes.

8.1.4 There are approximately 41 ports and harbours in Wales. These include the many smaller harbours and facilities that may lie within, but are more frequently outside of, port boundaries. Therefore, although the SRAs simply reflect the status quo, it is arguable that the sector policies have a spatial component since ports and shipping lanes are identified; in consequence, these are subject to further assessment. However, it is worth noting that the policies do not restrict port development to the SRAs and so the development of new port (etc.) facilities could arguably take place anywhere around the coast where conditions are suitable.

8.1.5 The ports and shipping sector SRA includes the current shipping lanes; these are not considered in detail here as they are determined and regulated outside the control of the WNMP.

8.2 Appropriate Assessment

Sites and features

8.2.1 A 30km marine 'zone of influence' is used for port development (2km inland). There are 79 European sites within these zones, and every Welsh port has a European site within these distances. These sites are the same as those for aquaculture (see **Table 7.1** and **Figure 7.1**).

8.2.2 In addition, it is important to note that all of the more distant sites with mobile species that may be functionally linked to the WNMP area (see Appendices C - E) are also considered to be potentially vulnerable (i.e. all marine mammal sites associated with the relevant MMUs; all seabird sites where Thaxter *et al.* (2012) or the BDMPS suggest that the feature ranges may intersect with the ZoI during breeding or wintering; all sites with wintering bird species that may use or cross the ZoI).

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8.2.3 The interest feature groups considered to be potentially vulnerable to the ports sector SRAs and policies are therefore:

- Subtidal and intertidal habitats (plus typical species);
- Supralittoral habitats and species (plus typical species);
- Bats;
- Marine mammals;
- Diadromous fish;
- Pelagic seabirds;
- Wildfowl and waders.

Potential effect pathways

8.2.4 The policies are intended to support port development, should proposals be brought forward, although specific schemes or even types of scheme are not identified. The potential range of developments that might benefit from the sector policies is therefore vast. Port development schemes can obviously result in a range of complex and interdependent pathways by which European sites or features could potentially be affected. In broad summary, however, the principal aspects and pathways are likely to be as follows.

Construction

8.2.5 Most interest features will be potentially vulnerable (i.e. sensitive and potentially exposed, depending on the mitigation or avoidance measures that can be employed) to one or more of the pressures that are generated by large and small-scale construction schemes in the marine environment. These would typically include:

- direct damage to, or loss of, habitats through dredging and structure installation;
- indirect damage to, or loss of, habitats due to changes to coastal processes (e.g. erosion, deposition, sediment regimes and littoral drift patterns);
- toxic contamination; this may include toxic and non-toxic contaminants associated directly with construction (e.g. alkali concrete leachate; silts; etc.) or contaminants in sediments that may be liberated through excavation (e.g. oils and other organic contaminants);
- non-toxic pollution and physio-chemical changes;
- barrier effects and disturbance, displacement or mortality of mobile species (through the above mechanisms, plus noise and vibration, visual and intrusion physical intrusion, collisions with structures, lighting, etc.).

Operation

8.2.6 The operational effects of port development will depend entirely on the scale and type of development proposed, and the technologies that are used at the point of delivery; however, effects as a result of the following pressures are most likely:

- **Hydrodynamic changes**: marine structures can alter tidal and hence emergence regimes, the tidal currents, and wave exposure.
- **Physio-chemical changes**: physio-chemical changes would be expected in conjunction with the hydrodynamic changes, as tidal currents and fluxes are altered; the extent would depend on the scale of the scheme, but may result in pressures such as localised changes in salinity or temperature, or accumulation of nutrients where dispersal is limited.

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- **Physical loss / changes**: the hydrodynamic changes are likely to result in the physical loss of some habitats and maintenance dredging is a likely operational requirement due to increased siltation within and around any structure.
- **Toxic contamination**: from maintenance vessels and operations.
- **Air quality changes**: associated with variations in port capacity.
- **Pressures on mobile species**: schemes can result in disturbance, displacement, mortality and barrier effects through a variety of mechanisms, including:
  - changes in habitat or prey distributions due to the physical and physio-chemical changes noted above;
  - underwater noise and vibration, particularly for fish and marine mammals;
  - electromagnetic changes (e.g. associated with the generation and transfer of electricity), particularly for fish (some marine mammals may also be sensitive in certain situations, although this is thought to be less notable);
  - collisions with structures or vessels, particularly for marine mammals;
  - temporary or permanent barrier effects, particularly for marine mammals and fish;
  - the introduction of new structures creating new habitat (particularly for fish, which often aggregate around structures, but conceivably for birds and other features);
  - introduction of lighting;
- **Biological changes**, particularly through:
  - the introduction of non-native invasive species;
  - changes in foraging success / predation risk as a result of effects on prey distributions.

8.2.7 There may also be a range of indirect and incidental effects; for example, construction of harbours or sea walls may increase opportunities for recreational fishing or provide aquaculture opportunities. The sensitivity of the interest feature groups to the potential pressures associated with port schemes are summarised in **Table 8.1**, although the range of potential activities that might be supported by the policies is such that the pressure tables from most sectors could potentially be applied.

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Table 8.1 Sensitivity of the interest feature groups to the potential pressures associated with coastal docks, ports & marinas *(note, pressures are not included if they are not associated with these schemes (see Appendix F for justification); Y – directly sensitive; S – sensitive to consequent or secondary effects)*

Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Temperature changes - local	Y	Y		Y	S	S	S	Y
Salinity changes - local*	Y	Y		Y	S	S	S	Y
Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
Emergence regime changes - local	Y	Y			S	Y	Y	Y
Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
Non-synthetic compound contamination - Transition elements & organo-metals	Y	Y		Y	Y	Y	Y	Y
Non-synthetic compound contamination - Hydrocarbon & PAH Contamination	Y	Y		Y	Y	Y	Y	Y
Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
Radionuclide contamination	Y	Y		Y	Y	Y	Y	Y
Introduction of other substances (solid, liquid or gas)	Y	Y		Y	Y	S	S	Y
De-oxygenation	Y			Y	S	S	S	Y
Nutrient enrichment	Y	Y		Y	S	S	S	Y
Organic enrichment	Y	Y		Y	S	S	S	Y
Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
Physical change (to another seabed type)	Y			S	S	S	S	Y
Habitat structure changes - removal of substratum (extraction)	Y			S	S	S	S	Y

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Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y			Y	Y	Y	Y	Y
Penetration and/or disturbance of the substrate below the surface of the seabed- Surface	Y			Y	Y	Y	Y	Y
Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y			Y	Y	Y	Y	Y
Changes in suspended solids	Y			Y	S	S	Y	Y
Siltation rate changes	Y			S	S	Y	S	Y
Litter	Y	Y		Y	Y	Y	Y	Y
Electromagnetic changes				Y	Y		S	Y
Underwater noise changes				Y	Y	Y	S	Y
Introduction of light			Y	Y	Y	Y	Y	Y
Barrier to species movement				Y	Y	Y	Y	Y
Death or injury by collision			Y	Y	Y	Y	Y	Y
Visual disturbance				Y	Y	Y	Y	Y
Genetic modification & translocation of indigenous species	Y			Y				Y
Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
Introduction of microbial pathogens				Y	Y	Y	Y	Y
Removal of target species				Y	S	Y	Y	Y
Removal of non-target species				Y	Y	Y	Y	Y

Site / feature exposure

8.2.8 As noted, there are around 41 ports and harbours in Wales, each of which has several European sites within the theoretical marine and terrestrial zones of influence. Furthermore, the range of activities or proposals that might arise through the future operation or development of these is substantial and unspecified. As a result, it is not considered appropriate to try and analyse the potential for hypothetical developments at individual SRAs to affect particular European sites or feature groups (as any such assessment would be entirely generic and would provide no clarity on whether particular port SRAs should be included or not). Therefore, it is accepted that all of the sites listed in **Table 8.1**, and their interest features, are potentially exposed to the outcomes of the policy; that effects may occur as a result of individual projects; but that this can only be meaningfully addressed at the application stage. As a result, the assessment focuses on the intent and controls within the plan, which should ensure that project-level effects do not occur.

Policy review

8.2.9 The intent of the policies is to support future port development (where this is identified in future) although this support is not unequivocal and is contingent on the performance of schemes against the other policies in the WNMP (including the protective general cross-cutting policies).

8.2.10 The policies do not identify or promote specific development proposals, nor restrict how future schemes might be delivered. Schemes are arguably more likely within the SRAs (i.e. around the existing ports) as a result of the plan policies, but are not necessarily restricted to these areas. As a result, the likelihood of specific effects occurring on specific sites or features that are potentially exposed cannot be determined, and will depend entirely on the nature of the schemes that come forward and are assessed against the WNMP policies.

8.2.11 Specific mitigation measures for future schemes cannot be determined or outlined at the plan-level, although it is clear from existing port operations and developments around Wales that mitigation measures are available and likely to be effective for most activities, and that adverse effects are not an inevitable outcome of port development. In terms of plan-level mitigation, it should be recognised that various controls and safeguards are woven through the general cross-cutting policies; in addition:

- All port development that affects the marine environment will be subject to project level HRA as part of the consenting procedure.
- The three-yearly WNMP review process provides a mechanism for the monitoring and review of policy performance, which will be based on accumulated evidence from project- and strategic studies, and hence ensures that effects that cannot currently be assessed as part of a plan-level HRA are appropriately captured and addressed.

8.3 Conclusion

8.3.1 The ports and shipping policies are intended to promote and support the development of schemes within the SRAs, but do not specify the precise scale, location and nature of future schemes. It is considered that the policies are sufficiently caveated and flexible to ensure that adverse effects are not an unavoidable or inevitable outcome of its implementation, for the following reasons:

i. Whilst the policies identify SRAs, they do not identify or promote specific development proposals, nor restrict how future schemes might be delivered (indeed, the policies do not restrict delivery to the SRA (see supporting map). As a result, sufficient flexibility is retained within the scope of the policies to ensure that future schemes can be delivered without adverse effects

ii. The general cross-cutting protective policies within the WNMP will provide safeguards for European sites (although it is recognised that these cannot categorically exclude any schemes that may have adverse effects since this would exceed the provisions of the Habitats Regulations).

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iii. Evidence from existing port operations and developments (and other developments in the marine environment) suggests that project-level mitigation and avoidance measures are available, achievable and likely to be effective.

iv. All schemes benefitting from the policies would require project-level HRA.

v. The WNMP review process will ensure that SRAs can be modified to reflect the best evidence available.

8.3.2 Due to the nature of the plan and policies, specific measures to mitigate specific effects on specific sites cannot be identified. It is therefore necessary, in part, to rely on the implementation of the general cross-cutting protective policies within the WNMP to safeguard European sites and features during the future assessment of schemes that are supported by these policies, and down-the-line assessment of individual projects. It is, however, considered that the policies will not result in adverse effects on any European sites based on the mitigation measures that are in place.

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9. Energy – Low Carbon (Wave and Tidal Stream)

9.1 Screening Summary

9.1.1 This section assesses the potential effects of Policy ELC_01 as it relates to wave and tidal stream proposals; potential effects associated with tidal lagoons are considered in **Section 10**. Please note that those aspects of the policy that relate to wind energy have been screened out, as detailed in **Table 5.3**.

9.1.2 Policy ELC_01 provides the supporting framework for wave and tidal stream schemes as follows:

Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:

a) in corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and

b) in corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

a) renewable energy Strategic Resource Areas; and

b) wider natural resources that provide renewable energy potential;

in order to support the sustainable growth of the renewable energy sector through marine planning.

9.1.3 The intent of the policy is to encourage investigation and hence proposals for schemes, to help meet the broader objective for renewables ("*To contribute significantly to the decarbonisation of our economy and blue growth by increasing the amount of renewable energy generated…*"). The likely outcome of the policy is therefore an increase in the number and potentially size of wave and tidal stream proposals; and, ideally as a consequence, the implementation of these schemes.

9.1.4 The policy focuses on the test and demonstration zones, which have been subject to TCE lease (but not HRA[42]) and the proposed wave and tidal energy SRAs of which there are four broad areas (tidal stream north and west of Anglesey; St. David's Head; and the Bristol Channel south and west of Barry; and wave in the Bristol Channel Approaches). Development is most likely to be located within the SRAs as proposals for schemes outside these areas would not necessarily benefit from the policy, although the policy does not restrict proposals to these areas.

9.1.5 Wave and tidal stream schemes have the potential to affect the interest features of European sites and therefore a policy promoting these could result in significant effects if not appropriately designed. Furthermore, the novel nature of some technologies increases the likelihood that as yet undefined or undeveloped mitigation measures will be required. On this basis, significant effects cannot necessarily be excluded and the wave and tidal stream element of Policy ELC_01 has been subject to further assessment.

[42] It is worth noting TCE's statement on this aspect on its website, which notes that "*As part of designing the leasing, we have engaged with the Statutory Nature Conservation Bodies (SNCBs) in relation to our duties as Competent Authority under the Conservation of Habitats and Species Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats) Regulations 2007 (as amended) (jointly referred to as the "Habitats Regulations"). We do not consider that offering the opportunity to access seabed for wave or tidal projects of up to 3 MW across the UK constitutes a 'plan' under the Habitats Regulations because we do not know the number of applications which will be submitted or the locations of any proposed sites. Therefore, at this stage, we have not undertaken a plan-level Habitats Regulations Assessment (HRA). We will keep this position under review as applications are received and will continue to work closely with the SNCBs*".

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9.2 Appropriate Assessment

Sites and features

9.2.1 A precautionary 50km marine ZoI for wave and tidal stream proposals has been used to identify sites that are most likely to be exposed to effects of activities taking place within the SRAs; this is based on tidal stream modelling for the Bristol Channel (e.g. Neill 2013) which suggests that sediment dynamics may be influenced up to 50km from the point of energy extraction (although it should be noted that far-field effect distances are likely to be above average in the Bristol Channel). A 2km terrestrial ZoI is also used to identify purely terrestrial habitats that may be vulnerable to the activities connected with the SRAs sites. These are summarised in **Table 9.1** and illustrated on **Figure 9.1**.

Table 9.1 European sites within the wave or tidal stream SRAs, or the marine and terrestrial zones of influence

Site	Features	Location
Afon Gwyrfai a Llyn Cwellyn SAC	*Luronium natans*; *Lutra lutra*; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Afon Teifi/ River Teifi SAC	*Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Luronium natans*; *Lutra lutra*; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Afon Tywi/ River Tywi SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*	Within ZoI
Afonydd Cleddau/ Cleddau Rivers SAC	Active raised bogs; Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Anglesey Terns / Morwenoliaid Ynys Môn SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*; Roseate tern *Sterna* dougalli	In SRA
Bae Caerfyrddin/ Carmarthen Bay SPA	*Melanitta nigra*	Within ZoI
Bae Cemlyn/ Cemlyn Bay SAC	Coastal lagoons; Perennial vegetation of stony banks	In SRA
Braunton Burrows SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Mudflats and sandflats not covered by seawater at low tide; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	Within ZoI
Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC	Harbour porpoise *Phocoena phocoena*	In SRA
Burry Inlet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	Within ZoI
Burry Inlet SPA	*Anas acuta*; *Anas clypeata*; *Anas crecca*; *Anas penelope*; *Arenaria interpres*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Numenius arquata*; *Pluvialis squatarola*; *Tadorna tadorna*; *Tringa totanus*	Within ZoI

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Site	Features	Location
Cardigan Bay/ Bae Ceredigion SAC	*Halichoerus grypus*; *Lampetra fluviatilis*; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves; *Tursiops truncatus*	Within ZoI
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time	Within ZoI
Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Vertigo angustior*	Within ZoI
Castlemartin Coast SPA	*Pyrrhocorax pyrrhocorax*	Within ZoI
Clogwyni Pen Llyn/ Seacliffs of Lleyn SAC	Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Coedwigoedd Penrhyn Creuddyn/ Creuddyn Peninsula Woods SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Taxus baccata* woods of the British Isles; *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Coedydd Aber SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	Within ZoI
Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Bog woodland; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; *Rhinolophus hipposideros*; *Tilio-Acerion* forests of slopes, screes and ravines; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Corsydd Llyn/ Lleyn Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Vertigo geyeri*; *Vertigo moulinsiana*	Within ZoI
Corsydd Môn a Llyn/ Anglesey and Llyn Fens Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	Within ZoI
Corsydd Môn/ Anglesey Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; *Vertigo geyeri*	Within ZoI
Crymlyn Bog Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	Within ZoI
Crymlyn Bog/ Cors Crymlyn SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Transition mires and quaking bogs	Within ZoI

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Site	Features	Location
Eryri/ Snowdonia SAC	Alkaline fens; Alpine and Boreal heaths; Alpine and subalpine calcareous grasslands; Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*; Blanket bogs; Calcareous rocky slopes with chasmophytic vegetation; Depressions on peat substrates of the *Rhynchosporion*; *Drepanocladus* (*Hamatocaulis) vernicosus*; European dry heaths; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; *Luronium natans*; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; Petrifying springs with tufa formation (*Cratoneurion)*; Siliceous alpine and boreal grasslands; Siliceous rocky slopes with chasmophytic vegetation; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*; Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	Within ZoI
Exmoor Heaths SAC	Alkaline fens; Blanket bogs; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA	*Puffinus puffinus*	Within ZoI
Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; Mudflats and sandflats not covered by seawater at low tide; Salicornia and other annuals colonizing mud and sand	Within ZoI
Glannau Ynys Gybi/ Holy Island Coast SAC	European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
Glannau Ynys Gybi/ Holy Island Coast SPA	*Pyrrhocorax pyrrhocorax*	In SRA
Glynllifon SAC	*Rhinolophus hipposideros*	Within ZoI
Gower Ash Woods/ Coedydd Ynn Gwyr SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Gower Commons/ Tiroedd Comin Gwyr SAC	*Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; European dry heaths; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*	Within ZoI
Great Orme`s Head/ Pen y Gogarth SAC	European dry heaths; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Kenfig/ Cynffig SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*	Within ZoI
Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	Caves not open to the public; European dry heaths; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); *Gentianella anglica*; *Petalophyllum ralfsii*; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Submerged or partially submerged sea caves; Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI
Liverpool Bay / Bae Lerpwl SPA	*Gavia stellata*; *Melanitta nigra*	Within ZoI
Mendip Limestone Grasslands SAC	Caves not open to the public; European dry heaths; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Tilio-Acerion* forests of slopes, screes and ravines	Within ZoI
Mwyngloddiau Fforest Gwydir/ Gwydyr Forest Mines SAC	Calaminarian grasslands of the *Violetalia calaminariae*; *Rhinolophus hipposideros*	Within ZoI

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Site	Features	Location
North Anglesey Marine / Gogledd Môn Forol cSAC	Harbour porpoise *Phocoena phocoena*	In SRA
North Channel cSAC	Harbour porpoise *Phocoena phocoena*	Within ZoI
North West Pembrokeshire Commons/ Comins Gogledd Orllewin Sir Benfro SAC	European dry heaths; *Luronium natans*; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; Transition mires and quaking bogs	Within ZoI
Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	Red-throated diver *Gavia stellata*	Within ZoI
Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Lutra lutra*; *Rhinolophus ferrumequinum*; *Rhinolophus hipposideros*	Within ZoI
Pembrokeshire Marine/ Sir Benfro Forol SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; *Rumex rupestris*; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves	In SRA
Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; Reefs; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves; *Tursiops truncatus*	Within ZoI
Ramsey and St David`s Peninsula Coast SPA	*Pyrrhocorax pyrrhocorax*	In SRA
River Usk/ Afon Wysg SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	Within ZoI
Severn Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds; Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path	Within ZoI
Severn Estuary SPA	*Anas strepera*; *Anser albifrons albifrons*; *Calidris alpina alpina*; *Cygnus columbianus bewickii*; *Tadorna tadorna*; *Tringa totanus*	Within ZoI
Severn Estuary/ Môr Hafren SAC	*Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time	Within ZoI
Skokholm and Skomer SPA	*Asio flammeus*; *Fratercula arctica*; *Hydrobates pelagicus*; *Larus fuscus*; *Puffinus puffinus*; *Pyrrhocorax pyrrhocorax*	Within ZoI
Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	Storm petrel *Hydrobates pelagicus*; lesser black-backed gull *Larus fuscus*; Manx shearwater *Puffinus puffinus*; Atlantic puffin *Fratercula arctica*; Breeding seabird assemblage;	Within ZoI
St David`s / Ty Ddewi SAC	European dry heaths; *Luronium natans*; Vegetated sea cliffs of the Atlantic and Baltic Coasts	In SRA
Tintagel-Marsland-Clovelly Coast SAC	European dry heaths; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Vegetated sea cliffs of the Atlantic and Baltic Coasts	Within ZoI

Site	Features	Location
Traeth Lafan/ Lavan Sands, Conway Bay SPA	*Haematopus ostralegus*; *Mergus serrator*; *Numenius arquata*; *Podiceps cristatus*; *Tringa totanus*	Within ZoI
West Wales Marine / Gorllewin Cymru Forol cSAC	Harbour porpoise *Phocoena phocoena*	In SRA
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC	Large shallow inlets and bays; Mudflats and sandflats not covered by seawater at low tide; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves	Within ZoI
Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation; *Petalophyllum ralfsii*; *Rumex rupestris*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	Within ZoI
Ynys Feurig, Cemlyn Bay and The Skerries SPA	*Sterna dougallii*; *Sterna hirundo*; *Sterna paradisaea*; *Sterna sandvicensis*	In SRA

9.2.2 In addition, it is important to note that all of the more distant sites with mobile species that may be functionally linked to the WNMP area (see Appendices C - E) are also considered to be potentially vulnerable (i.e. all marine mammal sites associated with the relevant MMUs; all seabird sites where Thaxter *et al.* (2012) or the BDMPS suggest that the feature ranges may intersect with the ZoI during breeding or wintering; all sites with wintering bird species that may use or cross the ZoI).

9.2.3 There are few purely terrestrial habitats within the ZoI of the SRAs and these will not be directly exposed to the likely effects of activities within the SRAs; the only risk to these would be through project-specific scenarios (rather than systematic exposure) that cannot be predicted at this level; potential effects on these are therefore excluded from explicit assessment in respect of the SRAs.

9.2.4 The interest feature groups considered to be potentially vulnerable to the wave and tidal stream sector SRAs and Policy ELC_01 are therefore:

- Subtidal and intertidal habitats (plus typical species);
- Supralittoral habitats and species (plus typical species);
- Bats;
- Marine mammals;
- Diadromous fish;
- Pelagic seabirds;
- Wildfowl and waders.

Potential effect pathways

9.2.5 The likely or intended outcome of Policy ELC_01 is an increase in the number of wave and tidal stream proposals; and, ideally as a consequence, the implementation of those schemes. The scale or type of scheme supported by the policy is not defined or restricted, nor are specific schemes or locations identified (although the policies make proposals within the SRA more likely, partly through direct promotion and partly as a consequence of safeguarding in other sectors).

9.2.6 There are a range of technologies that can be used to exploit tidal currents. The most common are broadly similar to submerged wind turbines, although other technologies such as tidal kites (where a kite 'flies' within a tidal stream, increasing stream velocities over an attached turbine) or enclosed turbines with concentrators have good potential in certain conditions. These technologies are typically installed where currents are magnified by topographical features, such as headlands,

inlets and straits, or subsurface channels, although more areas are likely to become exploitable as technologies mature.

9.2.7 Similarly, wave energy exploitation is a novel sector with similarly varied technologies, including various floating or semi-fixed devices that effectively 'ride' the wave surface, submerged oscillators that are pushed by the wave surge, and large fixed structures that force waves (or air) through turbines among many technologies.

9.2.8 The potential effects of these technologies are equally variable, and cannot be assessed to any great extent at the plan level. However, commercially viable schemes are likely to be large scale, involving the installation of large structures in the water column and on the seabed, and associated subsea cables. In broad summary, the principal aspects and pathways are likely to be as follows.

Construction and Decommissioning

9.2.9 All interest features noted above will be potentially vulnerable (i.e. sensitive and potentially exposed, depending on the mitigation or avoidance measures that can be employed) to one or more of the pressures that are generated by large-scale construction schemes in the marine environment. These would typically include:

- direct damage to, or loss of, habitats through dredging and structure / cable installation, abrasion etc.;
- indirect damage to, or loss of, habitats due to changes in coastal processes (e.g. erosion, deposition, sediment regimes and littoral drift patterns);
- toxic contamination; this may include toxic and non-toxic contaminants associated directly with construction (e.g. alkali concrete leachate; silts; etc.) or contaminants in sediments that may be liberated through excavation (e.g. oils and other organic contaminants);
- barrier effects and disturbance, displacement or mortality of mobile species (through the above mechanisms, plus noise and vibration, visual and physical intrusion, collisions with structures, lighting, etc.).

Operation

9.2.10 Operational effects will depend heavily on the scale and type of development proposed, and the technologies that are used at the point of delivery. However, effects as a result of the following pressures are most likely:

- **Hydrodynamic changes**: tidal schemes have the potential to result in local hydrodynamic changes (e.g. resulting in scour around structures, or increased sedimentation) and conceivably more wide-ranging changes if structures or arrays are of sufficient scale for sediment dynamics and coastal processes to be altered. Neill & Crouch (2011) note that "*relatively small changes to the residual flow field caused by exploitation of the tidal stream resource could have a significant influence on the residual sediment transport pathways*".
- **Physical loss / changes**: the hydrodynamic changes may result in the physical loss of some habitats, or localised changes.
- **Toxic contamination**: from maintenance vessels and operations.
- **Pressures on mobile species**: schemes deploying large structures can result in disturbance, displacement, mortality and barrier effects through a variety of mechanisms, including:
  - changes in habitat or prey distributions due to the physical and physio-chemical changes noted above;
  - underwater noise and vibration due to operation, particularly for fish and marine mammals;

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- electromagnetic changes associated with the generation and transfer of electricity, particularly for fish (some marine mammals may also be sensitive in certain situations, although this is thought to be less notable);
- collisions with moving structures or entanglement, particularly for marine mammals;
- the introduction of new structures creating new habitat or reef effects (particularly for fish, which often aggregate around structures, but conceivably for birds and other features).

- **Biological changes**, particularly through:
  - the introduction of non-native invasive species;
  - changes in foraging success / predation risk as a result of effects on prey distributions.

Additional context

9.2.11 It should be noted that wave and tidal stream are novel development technologies and the range of potential devices (and hence effects) is large. The range of uncertainties over impacts is therefore equally large. Work undertaken by the Natural Environment Research Council (NERC) for TCE (TCE, 2014) identifies a number of recommended research areas and priority research projects to help fill known gaps in the understanding of the likely effects of tidal energy schemes, but it is clear that adverse effects on sites or features cannot, at the strategy level, necessarily be excluded on the basis of available objective data alone; in reality, the complexity of any interactions will ensure that bespoke investigation is possible at the project-level only. Furthermore, there are few operational commercial-scale schemes to provide examples of best-practice or mitigation measures.

9.2.12 Notwithstanding this, there is little evidence of significant adverse effects from existing schemes and HRAs for commercial and test schemes have largely demonstrated or concluded that adverse effects are not unavoidable at the project level, even in areas close to European sites (for example, the Torr Head Tidal Energy Array (Tidal Ventures 2015); or the Deep Green Holyhead Deep Project (Minesto 2016)). The key caveat here, though, is scale particularly for the test schemes; it is clear that adverse effects can be avoided by small-scale or test schemes but the extent to which adverse effects could be avoided at a larger scale is less certain. It is therefore likely that adverse effects can be avoided at the project-level, but that this can only be reliably determined at that point. With regard to the Policy ELC_01, therefore, it is important to note that the SRAs simply represent areas of potential for wave and tidal stream, which are safeguarded accordingly and for which proposals are encouraged; there is no presumption in favour and no suggestion that these are ‘allocated’ areas that are entirely free for exploitation to their geographic limits.

9.2.13 The sensitivity of the interest feature groups to the potential pressures associated with wave and tidal stream schemes is summarised in **Table 9.2**.

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Table 9.2 Sensitivity of the interest feature groups to the potential pressures associated with tidal energy schemes and associated cabling *(note, pressures are not included if they are not associated with tidal schemes (see Appendix F for justification); Y – directly sensitive; S – sensitive to consequent or secondary effects)*

Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
Renewable energy - tidal (not including cables)	Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
	Emergence regime changes - local	Y	Y			S	Y	Y	Y
	Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
	Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
	Non-synthetic compound contamination - Hydrocarbon & PAH Contamination	Y	Y		Y	Y	Y	Y	Y
	Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
	Temperature changes - local	Y	Y		Y	S	S	S	Y
	Salinity changes - local*	Y	Y		Y	S	S	S	Y
	De-oxygenation	Y			Y	S	S	S	Y
	Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
	Physical change (to another seabed type)	Y			S	S	S	S	Y
	Habitat structure changes - removal of substratum (extraction)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- Surface	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y			S	S	S	S	Y

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Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
	Changes in suspended solids	Y			Y	S	S	Y	Y
	Siltation rate changes	Y			S	S	Y	S	Y
	Electromagnetic changes				Y	Y		S	Y
	Underwater noise changes				Y	Y	Y	S	Y
	Introduction of light			Y	Y	Y	Y	Y	Y
	Barrier to species movement				Y	Y	Y	Y	Y
	Death or injury by collision				Y	Y	Y	Y	Y
	Visual disturbance				Y	Y	Y	Y	Y
	Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
Submarine cable and pipeline operations	Water flow (tidal current) changes - local	Y	Y		Y	Y	S	S	Y
	Wave exposure changes - local	Y	Y		Y	S	Y	Y	Y
	Non-synthetic compound contamination - overall	Y	Y		Y	Y	Y	Y	Y
	Synthetic compound contamination	Y	Y		Y	Y	Y	Y	Y
	Temperature changes - local	Y	Y		Y	S	S	S	Y
	Organic enrichment	Y	Y		Y	S	S	S	Y
	Physical loss (to land or freshwater habitat)	Y			S	S	S	S	Y
	Physical change (to another seabed type)	Y			S	S	S	S	Y
	Habitat structure changes - removal of substratum (extraction)	Y			S	S	S	S	Y
	Penetration and/or disturbance of the substrate below the surface of the seabed- (Overall abrasion)	Y							Y

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Sector	Pressure	Marine and Intertidal Habitats	Supralittoral habitats and plants	Bats	Diadromous fish	Marine mammals	Wildfowl and waders	Pelagic seabirds	Typical species
	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Y							Y
	Changes in suspended solids	Y			Y	S	S	Y	Y
	Siltation rate changes	Y			S	S	Y	S	Y
	Litter	Y	Y		Y	Y	Y	Y	Y
	Electromagnetic changes				Y	Y		S	Y
	Underwater noise changes				Y	Y	Y	S	Y
	Death or injury by collision				Y	Y	Y	Y	Y
	Visual disturbance				Y	Y	Y	Y	Y
	Introduction or spread of non-indigenous species	Y	Y		Y	S	Y	Y	Y
	Introduction of microbial pathogens				Y	Y	Y	Y	Y
	Removal of non-target species				Y	Y	Y	Y	Y

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Site / feature exposure

9.2.14 Three groups of tidal stream SRAs are identified by the WNMP (see **Figure 9.1**):

- North & West Anglesey SRAs;
- St. David's Head SRA; and
- Outer Bristol Channel SRAs.

9.2.15 In addition, there is one wave SRA in the Bristol Channel Approaches.

9.2.16 **Tables 9.3** – **9.6** summarise the potential for future supported activities within these SRAs to affect the European site interest feature groups, with the European sites that are likely to be particularly exposed to activities occurring within the SRA identified. In essence, these 'high exposure' sites are those that are within the 50km marine ZoI around each SRA, plus those where the SRA is likely to coincide with a potentially notable component of a mobile species' habitat requirements.

9.2.17 **Tables 9.3** – **9.6** also reference those far-field sites with features that will be exposed to activities within the SRAs based on their mobile species (for example, all sites associated with the marine mammal MMUs), although it is recognised that for some species (particularly marine mammals) any future assessments of effects will need to be undertaken at the MMU scale (i.e. effects will not necessarily be 'less' on far-field sites).

9.2.18 Where possible, the assessments aim to identify those sites or features where adverse effects can be excluded based on objective information that is available on feature distributions and behaviours (see also **Section 4**). However, it should be recognised that an objective data-led assessment at the plan level will not be able to exclude the possibility of effects on many sites or features without also considering the content and mitigation principles of the WNMP (see **Section 9.4**).

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Table 9.3 Summary of the potential for effects on those European sites / features that are most exposed to the **North & West Anglesey Tidal Stream SRA** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Afon Gwyrfai a Llyn Cwellyn SAC **Anglesey Terns / Morwenoliaid Ynys Môn SPA** **Bae Cemlyn/ Cemlyn Bay SAC** Clogwyni Pen Llyn/ Seacliffs of Lleyn SAC Croker Carbonate Slabs SCI Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC Glannau Ynys Gybi/ Holy Island Coast SAC Glannau Ynys Gybi/ Holy Island Coast SPA Liverpool Bay / Bae Lerpwl SPA **North Anglesey Marine / Gogledd Môn Forol cSAC** Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Traeth Lafan/ Lavan Sands, Conway Bay SPA West Wales Marine / Gorllewin Cymru Forol cSAC Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC **Ynys Feurig, Cemlyn Bay and The Skerries SPA** Ynys Seiriol / Puffin Island SPA	This SRA partly overlaps with the **Anglesey Terns / Morwenoliaid Ynys Môn SPA, Ynys Feurig, Cemlyn Bay and The Skerries SPA** and **North Anglesey Marine / Gogledd Môn Forol cSAC,** which have a range of subtidal habitats that supporting the interest features (tern species and harbour porpoise respectively) and their prey species. These habitats may be vulnerable to direct effects (physical loss etc) or any changes in marine / coastal processes resulting from tidal stream developments within the SRA. It also partly overlaps with the **Bae Cemlyn/ Cemlyn Bay SAC** which will also be vulnerable to changes in geomorphological process as a result of any arrays. Furthermore, the geomorphology and coastal processes of the area are heavily linked to the surrounding coastal habitats and a number of number of designated sites nearby with habitat features that may be vulnerable to changes in coastal processes depending on the scale of any developments, including **Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC**; **Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC**; and **Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC**. The likelihood of adverse effects on habitats will depend on the scale and type of any developments that come forward, and it is worth noting that many of the subtidal habitats within the area of the **Anglesey Terns / Morwenoliaid Ynys Môn SPA, Ynys Feurig, Cemlyn Bay and The Skerries SPA** or **North Anglesey Marine / Gogledd Môn Forol cSAC** will not be particularly important for maintaining the conservation status of the interest features. The footprint of any developments is also likely to be a relatively small component of these sites. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. A number of tidal stream schemes have been installed in or near offshore SPAs or SACs (particularly in Scotland) and so it is likely that effects can be avoided at the project level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	No other marine sites are within 50km of this SRA and so direct effects on the habitats of these can be excluded. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species away from their 'home site' do not occur.
Bats	There are no SACs designated for their bat populations within 20km of this SRA, and so effects would not be expected.	-	-

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC Pembrokeshire Marine/ Sir Benfro Forol SAC Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI **North Anglesey Marine / Gogledd Môn Forol cSAC** West Wales Marine / Gorllewin Cymru Forol cSAC Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	This SRA largely coincides with areas of higher harbour porpoise activity around north and west Anglesey (for which the **North Anglesey Marine / Gogledd Môn Forol cSAC** is designated), and is near an area of higher bottlenose dolphin distribution around the Great Orme, east of Anglesey. This is not coincidental, as harbour porpoise in particular are known to use tidal conditions for foraging and often occur in areas of high tidal energy around headlands and channels. This in itself would indicate a heightened risk of interactions between these species and any tidal stream structures. The area of the SRA is also likely to be well-used by grey seal, which are common around the Anglesey coast and are an interest feature of the **Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC**. There is less evidence for potentially significant agglomerations common seal in the immediate vicinity of the SRA although these are obviously wide-ranging species that are likely to be exposed at some point to any activities promoted within the SRA. All of the marine mammals will therefore be exposed and sensitive to a range of potential effects that may occur as the result of tidal stream installations, including collisions and mortality; and displacement, either directly due to noise and physical avoidance (etc) or as a consequence of secondary effects (e.g. hydrodynamic change and prey displacement). Determining the likely effects of this at the strategy scale is not simple; HRAs of specific tidal range developments have attempted to estimate the proportions of the regional populations associated with the MMUs that may be affected, although these calculations rely on several assumptions and scheme-specific information, and are difficult to meaningfully scale to an SRA. However, the general conclusion of these assessments, for harbour porpoise and bottlenose dolphin, is that these are wide-ranging species that are likely to have sufficient alternative foraging resources available to not impact the population; that the effects of specific schemes on marine mammals is likely to be relatively local; and that species commonly travel and forage alone or in small groups, and so impacts are not likely to affect large proportions of their regional populations at any one time (e.g. Tidal Ventures 2015; Minesto 2016). Evidence from existing installations suggests that significant effects can be avoided through planning or do not occur due to species behavioural resilience. However, this is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst adverse effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered that they can be avoided as part of the normal project-level consenting process.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	Afon Gwyrfai a Llyn Cwellyn SAC	Tidal stream studies have indicated that the risk of direct effects on diadromous fish (principally collisions) is low although they may be susceptible to displacement due to altered hydrodynamics, noise, or electromagnetic fields from cable connections; they may also act as aggregating devices. This SRA is a substantial distance from any estuarine areas associated with SACs designated for diadromous fish and so proximal risks of effects are low and it is unlikely that the SRA provides a unique or otherwise significant marine resource for these species; any effects would therefore be local to any schemes only. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA.
Pelagic seabirds	**Anglesey Terns / Morwenoliaid Ynys Môn SPA** **Bae Cemlyn/ Cemlyn Bay SAC** Liverpool Bay / Bae Lerpwl SPA Traeth Lafan/ Lavan Sands, Conway Bay SPA **Ynys Feurig, Cemlyn Bay and The Skerries SPA** Ynys Seiriol / Puffin Island SPA	This SRA partly overlaps with the **Anglesey Terns / Morwenoliaid Ynys Môn SPA,** and the **Ynys Feurig, Cemlyn Bay and The Skerries SPA,** which have a range of subtidal habitats supporting the interest features (tern species) and their prey. Terns from these sites are known to forage in the inshore waters around Anglesey (based on recent studies for the new nuclear build at Wyfla), with some favoured foraging areas coinciding with the SRA. However, tern species are not thought to be particularly vulnerable to direct interactions with subsurface tidal devices (Furness *et al.* 2012) as they do not undertake deep dives during foraging, although displacement of prey species may be possible if there are significant hydrodynamic (etc.) changes. None of the seabirds identified by Furness *et al.* (2012) as having a high or moderate vulnerability index regards collision with tidal stream devices are associated with SPAs within foraging range, although obviously birds may be more vulnerable in winter. However, Furness *et al.* (2012) note that "*there is a very strong consensus in the published literature that these wet renewables technologies are unlikely to represent as great a hazard to seabirds as posed by offshore wind farms*". The SRA also partly overlaps with the **Bae Cemlyn/ Cemlyn Bay SAC**. The likelihood of adverse effects on habitats will depend on the scale and type of any developments that come forward. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. A number of tidal stream schemes have been installed in or near offshore SPAs (particularly in Scotland) and so it is likely that effects can be avoided at the project level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Furness *et al.* (2012) identify "…*black guillemot, razorbill, European shag, common guillemot, great cormorant, divers and Atlantic puffin as the species most vulnerable to adverse effects from tidal turbines*…". Effects on some sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) but the BDMPS does not allow effects to be easily excluded for wintering birds.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Wildfowl and Waders	Traeth Lafan/ Lavan Sands, Conway Bay SPA	There are few sites designated for their wildfowl and waders near the proposed SRA, and the characteristics of the SRA area are not particularly attractive to wading (etc) birds. As a result, direct effects (e.g. displacement due to noise etc) are unlikely to occur. Effects are possible through secondary processes (i.e. effects on supporting habitats due to impacts on coastal processes) but the likelihood of this will depend on the parameters of any project than comes forward and evidence from other areas (e.g. North Sea and east coast) suggests that significant effects can generally be avoided through planning. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely given the likely types of development concerned. Any effects can only be meaningfully identified in association with specific projects.

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Table 9.4 Summary of the potential for effects on those European sites / features that are most exposed to the **St David's Tidal Stream SRA** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Afon Teifi/ River Teifi SAC Afonydd Cleddau/ Cleddau Rivers SAC Bae Caerfyrddin/ Carmarthen Bay SPA Cardigan Bay/ Bae Ceredigion SAC Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC Castlemartin Coast SPA Grassholm SPA Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC North West Pembrokeshire Commons/ Comins Gogledd Orllewin Sir Benfro SAC Pembrokeshire Marine/ Sir Benfro Forol SAC Ramsey and St David`s Peninsula Coast SPA **Skokholm and Skomer SPA** **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Penfro SPA** St David`s / Ty Ddewi SAC **West Wales Marine / Gorllewin Cymru Forol cSAC**	This SRA partly overlaps with the **Skokholm and Skomer SPA** and **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Penfro SPA;** and the **West Wales Marine / Gorllewin Cymru Forol cSAC.** These sites which have a range of subtidal habitats that support the interest features and their prey species that may be vulnerable to direct effects (physical loss etc) or any changes in marine / coastal processes resulting from tidal stream developments within the SRA. The likelihood of adverse effects on habitats will depend on the scale and type of any developments that come forward, and it is worth noting that many of the subtidal habitats within the SRA will not be particularly important for maintaining the conservation status of the interest features of the above sites (for example, the **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA** is designated primarily for the rafting behaviour of some manx shearwater and puffin in these areas – with evidence suggesting that most foraging occurs further out in the Irish Sea. The footprint of any developments is also likely to be a relatively small component of these sites. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. A number of tidal stream schemes have been installed in or near offshore SPAs or SACs (particularly in Scotland) and so it is likely that effects can be avoided at the project level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	No other marine sites are within 30km of this SRA and so direct effects on the habitats of these can be excluded. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species away from their 'home site' do not occur.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Bats	Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	The SRA is near the Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC; effects are very unlikely based on the anticipated characteristics of future activities, although project-specific effects are conceivable (e.g. from cable access points and associated infrastructure; from lighting during construction; etc). However, these can almost certainly be avoided through the normal project-level consenting process.	None

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Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC **Pembrokeshire Marine/ Sir Benfro Forol SAC** Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI North Anglesey Marine / Gogledd Môn Forol cSAC **West Wales Marine / Gorllewin Cymru Forol cSAC** Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	This SRA largely coincides with areas of higher harbour porpoise activity around south west Wales (for which the **West Wales Marine / Gorllewin Cymru Forol cSAC** is designated), and is close to areas of higher bottlenose dolphin activity in the Bristol Channel and around the **Cardigan Bay/ Bae Ceredigion SAC.** This is not coincidental, as harbour porpoise in particular are known to use tidal conditions for foraging and often occur in areas of high tidal energy around headlands and channels. This in itself would indicate a heightened risk of interactions between these species and any tidal stream structures. The area of the SRA is also likely to be well-used by grey seal, which are common around the Pembrokeshire coast and are an interest feature of the **Pembrokeshire Marine/ Sir Benfro Forol SAC.** There is less evidence for potentially significant agglomerations of common seal in the immediate vicinity of the SRA although these are obviously wide-ranging species that are likely to be exposed at some point to the types of activity promoted by this SRA. All of the marine mammals will therefore be exposed and sensitive to a range of potential effects that may occur as the result of tidal stream installations, including collisions and mortality; and displacement, either directly due to noise and physical avoidance (etc) or as a consequence of secondary effects (e.g. hydrodynamic change and prey displacement). Determining the likely effects of this at the strategy scale is not simple; HRAs of specific tidal range developments have attempted to estimate the proportions of the regional populations associated with the MMUs that may be affected, although these calculations rely on several assumptions and scheme-specific information, and are difficult to meaningfully scale to an SRA. However, the general conclusion of these assessments, for harbour porpoise and bottlenose dolphin, is that these are wide-ranging species that are likely to have sufficient alternative foraging resources available to not impact the population; that the effects of specific schemes on marine mammals is likely to be relatively local; and that species commonly travel and forage alone or in small groups, and so impacts are not likely to affect	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst adverse effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered that they can be avoided as part of the normal project-level consenting process.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
		large proportions of their regional populations at any one time (e.g. Tidal Venture 2014; Minesto 2016)). Evidence from existing installations suggests that significant effects can be avoided through planning or do not occur due to species behavioural resilience. However, this is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	Afon Teifi/ River Teifi SAC Afonydd Cleddau/ Cleddau Rivers SAC **Pembrokeshire Marine/ Sir Benfro Forol SAC**	Tidal stream studies have indicated that there is a risk of direct effects on diadromous fish (principally collisions) although they may be susceptible to displacement due to altered hydrodynamics, noise, or electromagnetic fields from cable connections; or from reef effects. This SRA coincides with the **Pembrokeshire Marine/ Sir Benfro Forol SAC** and is near to the **Afonydd Cleddau/ Cleddau Rivers SAC** and **Afon Teifi/ River Teifi SAC** so there is clearly a risk to fish species from these sites in particular due to their proximity. Having said that, the diadromous fish of these sites are likely to be more heavily associated with the estuarine areas rather than the areas of high tidal energy around headlands and channels that the SRA covers. The effects of any development will depend on its scale, type and location, although species will obviously be vulnerable to the typical primary and secondary effects of such schemes. Evidence from existing installations suggests that significant effects can be avoided through planning or do not occur due to species behavioural resilience. However, this is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA.

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Pelagic seabirds	Grassholm SPA **Skokholm and Skomer SPA** **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA**	This SRA overlaps with the **Skokholm and Skomer SPA** and the **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA,** and is within the foraging range of the species associated with **Grassholm SPA**. It is therefore likely that the SRA area is well-used by the interest features of these sites, although it is likely to form a small proportion of the total foraging areas (particularly for the wider ranging species associated with these sites). There is little information in winter distributions, although species from these sites may utilise the SRA area based on the BDMPS. Furness *et al.* (2012) suggest that puffins will have a 'moderate vulnerability' to tidal turbines, manx shearwater and gannets 'low vulnerability', and storm-petrels and lesser black-backed gull 'very low vulnerability'. However, some of the assemblage species associated with **Skokholm and Skomer SPA** have a 'high vulnerability' based on Furness *et al.* (2012) notably common guillemot and razorbill. There is therefore a potentially significant risk of interactions due to the proximity of the European site and the relative importance of nearby feeding areas for species with shorter foraging ranges. Furness *et al.* (2012) note that "*there is a very strong consensus in the published literature that these wet renewables technologies are unlikely to represent as great a hazard to seabirds as posed by offshore wind farms*" and the likelihood of adverse effects will depend on the scale and type of any developments that come forward. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. A number of tidal stream schemes have been installed in or near offshore SPAs (particularly in Scotland) and so it is likely that effects can be avoided at the project level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Furness *et al.* (2012) identify "…*black guillemot, razorbill, European shag, common guillemot, great cormorant, divers and Atlantic puffin as the species most vulnerable to adverse effects from tidal turbines*…". Effects on some sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) but the BDMPS does not allow effects to be easily excluded for wintering birds.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Wildfowl and Waders	None	There are few sites designated for their wildfowl and waders near the proposed SRA, and the characteristics of the SRA area are not particularly attractive to wading (etc) birds. As a result, direct effects (e.g. displacement due to noise etc) are unlikely to occur. Effects are possible likely through secondary processes (i.e. effects on supporting habitats due to impacts on coastal processes) but the likelihood of this will depend on the parameters of any project than comes forward and evidence from other areas suggests that significant effects can generally be avoided through planning. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely given the likely types of development concerned and the location and habitats of the SRA and surrounding areas. Any effects can only be meaningfully identified in association with specific projects.

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Table 9.5 Summary of the potential for effects on those European sites / features that are most exposed to the **Bristol Channel Tidal Stream SRAs** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC Crymlyn Bog Ramsar Crymlyn Bog/ Cors Crymlyn SAC Dunraven Bay SAC Exmoor and Quantock Oakwoods SAC Exmoor Heaths SAC Gower Ash Woods/ Coedydd Ynn Gwyr SAC Gower Commons/ Tiroedd Comin Gwyr SAC Kenfig/ Cynffig SAC Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC Mendip Limestone Grasslands SAC Severn Estuary Ramsar Severn Estuary SPA Severn Estuary/ Môr Hafren SAC	This SRA does not overlap with any European sites and therefore any effects on habitats as a result of development will be indirect or consequential (e.g. through alterations to local hydrodynamics and coastal processes; or through associated infrastructure such as cabling). The most exposed sites are likely to be the **Severn Estuary sites** and the closest supralittoral sites (**Kenfig SAC** (dunes) and **Dunraven Bay SAC** (shore dock), which may be exposed to any local changes in sediment dynamics as a result of tidal energy harvesting. Habitats from the other sites within 30km are unlikely to be particularly exposed given their location, although some modelling for the Bristol Channel (e.g. Neill 2013) suggests that sediment dynamics may be influenced up to 50km from the point of energy extraction. The likelihood of adverse effects on habitats will depend on the scale and type of any developments that come forward. This is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude the possibility adverse effects on the basis of objective data alone, particularly without any scheme parameters. Some modelling of tidal stream arrays in this area of the Bristol Channel has been undertaken (e.g. Willis *et al.* 2010; Ahmadian *et al.* 2012) which suggests that effects on sediment dynamics may be significant depending on the siting of turbines and tidal asymmetry, but the environmental consequences of this in a dynamic high-sediment environment are less clear. A number of tidal stream schemes have been installed in or near offshore SPAs or SACs (particularly in Scotland) and there is some confidence that effects can be avoided at the project level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Habitats from the other sites within 30km are unlikely to be particularly exposed given their location, although some modelling for the Bristol Channel (e.g. Neill 2013) suggests that sediment dynamics may be influenced up to 50km from the point of energy extraction. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species away from their 'home site' do not occur.
Bats	Exmoor and Quantock Oakwoods SAC Mendip Limestone Grasslands SAC North Somerset and Mendip Bats SAC Wye Valley and Forest of Dean Bat Sites/ Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC Wye Valley Woodlands/ Coetiroedd Dyffryn Gwy SAC	These SRAs site within the Bristol Channel; bats from English and Welsh SACs are known to cross the Severn Estuary, although the estuary is fairly wide at the SRA point (~20km). Tidal stream developments themselves will not affect bats, although effects from associated development (e.g. cable connections) are possible depending on the parameters of individual schemes. However, there is no reason to expect that these cannot be avoided with normal best practice measures.	None.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC Pembrokeshire Marine/ Sir Benfro Forol SAC Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI North Anglesey Marine / Gogledd Môn Forol cSAC West Wales Marine / Gorllewin Cymru Forol cSAC Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	This SRA is not far from areas of higher harbour porpoise activity around the Gower (based on Baines & Evans 2012) although this area does not form part of the cSAC suite for this species. As with other areas, this is not coincidental, as harbour porpoise in particular are known to use tidal conditions for foraging and often occur in areas of high tidal energy around headlands and channels. This in itself would indicate a heightened risk of interactions between these species and any tidal stream structures. There is less evidence for potentially significant agglomerations of the other marine mammals species in this area, although these are obviously wide-ranging species that are likely to be exposed at some point to the types of activity promoted by this SRA. All of the marine mammals will therefore be exposed and sensitive to a range of potential effects that may occur as the result of tidal stream installations, including collisions and mortality; and displacement, either directly due to noise and physical avoidance (etc) or as a consequence of secondary effects (e.g. hydrodynamic change and prey displacement). Determining the likely effects of this at the strategy scale is not simple; HRAs of specific tidal range developments have attempted to estimate the proportions of the regional populations associated with the MMUs that may be affected, although these calculations rely on several assumptions and scheme-specific information, and are difficult to meaningfully scale to an SRA. However, the general conclusion of these assessments, for harbour porpoise and bottlenose dolphin, is that these are wide-ranging species that are likely to have sufficient alternative foraging resources available to not impact the population; that the effects of specific schemes on marine mammals is likely to be relatively local; and that species commonly travel and forage alone or in small groups, and so impacts are not likely to affect large proportions of their regional populations at any one time (e.g. Tidal Ventures 2015; Minesto 2016). Evidence from existing installations suggests that significant effects can be avoided through planning or do not occur due to species behavioural resilience. However, this is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst adverse effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered that they can be avoided as part of the normal project-level consenting process.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	River Usk/ Afon Wysg SAC River Wye/ Afon Gwy SAC Severn Estuary Ramsar Severn Estuary/ Môr Hafren SAC	Tidal stream studies have indicated that there is a risk of direct effects on diadromous fish (principally collisions) although they may be susceptible to a range of other effects (e.g. displacement due to altered hydrodynamics, noise, or electromagnetic fields from cable connections; or from reef effects). This SRA is just outside the **Severn Estuary Ramsar** and **Severn Estuary/ Môr Hafren SAC**, and is on the migration route of fish associated with the **River Usk/ Afon Wysg SAC** and the **River Wye/ Afon Gwy SAC**; therefore, there is clearly a risk to fish species from these sites in particular due to the location of the SRA. Furthermore, tidal stream developments in this SRA may (based on modelling studies, e.g. Neill 2009) have significant effects on the sediment dynamics of the estuarine areas, which may have consequent effects on diadromous fish. Evidence from existing installations suggests that significant effects can be avoided through planning or do not occur due to species behavioural resilience. However, this is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Pelagic seabirds	Grassholm SPA Skokholm and Skomer SPA Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	This SRA is within the foraging ranges of most species associated with **Grassholm SPA, Skokholm and Skomer SPA** and **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA**. Furness *et al.* (2012) suggest that puffins will have a 'moderate vulnerability' to tidal turbines, manx shearwater and gannets 'low vulnerability', and storm-petrels and lesser black-backed gull 'very low vulnerability'. However, some of the assemblage species associated with **Skokholm and Skomer SPA** have a 'high vulnerability' based on Furness *et al.* (2012) notably common guillemot and razorbill. However, it is worth noting that seabird tracking studies for species from these sites (e.g. Guildford *et al.* 2008, looking at manx shearwater from Skomer; the Grassholm gannet tracking project) indicate that most foraging trips takes place west and north of the sites into the Irish Sea, rather than towards this SRA. This would suggest that the SRA is not occupying areas that are currently of critical importance for foraging seabirds from these sites, although they might theoretically use the estuarine areas at some points. There is little detailed information in winter distributions, although there is little evidence of significant use of the inner Bristol Channel by wintering seabirds from these sites, and this area is likely to be relatively well observed in this regard. Furness *et al.* (2012) note that "*there is a very strong consensus in the published literature that these wet renewables technologies are unlikely to represent as great a hazard to seabirds as posed by offshore wind farms*" and the likelihood of adverse effects will depend on the scale and type of any developments that come forward. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. Tidal stream schemes have been installed near offshore SPAs (particularly in Scotland) and so it is likely that effects can be avoided at the project level. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process. It is also likely that pelagic seabirds will have a low exposure to effects of developments in this SRA.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Furness *et al.* (2012) identify "*…black guillemot, razorbill, European shag, common guillemot, great cormorant, divers and Atlantic puffin as the species most vulnerable to adverse effects from tidal turbines…*". Effects on most seabird sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) due to the location of this SRA but the BDMPS does not allow effects to be easily excluded for wintering birds (although there is little evidence of significant use of the inner Bristol Channel by wintering seabirds, and this areas is likely to be relatively well observed).

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Wildfowl and Waders	Severn Estuary Ramsar Severn Estuary SPA	This SRA is relatively close to the **Severn Estuary Ramsar** and **Severn Estuary SPA.** Species from these sites will not be particularly vulnerable to direct effects (e.g. collisions, displacement due to surface structures, etc) but will potentially be exposed to a number of secondary effects depending on the location (etc) of individual schemes. In particular, tidal stream developments in this SRA may (based on modelling studies, e.g. Neill 2009) have significant effects on the sediment dynamics of the estuarine areas, which may have consequent effects on wintering birds using the intertidal mud and sandflats of the SPA / Ramsar. The scale and likelihood of this will depend on the parameters of any project than comes forward. However, this is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation (from an SRA perspective) will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely given the likely types of development concerned and the location and habitats of the SRA and surrounding areas. Any effects can only be meaningfully identified in association with specific projects.

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Table 9.6 Summary of the potential for effects on those European sites / features that are most exposed to the **Bristol Channel Approaches Wave SRA** and hence outcomes of policy

Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Habitats	Afon Tywi/ River Tywi SAC Afonydd Cleddau/ Cleddau Rivers SAC Bae Caerfyrddin/ Carmarthen Bay SPA Braunton Burrows SAC **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** Burry Inlet Ramsar Burry Inlet SPA Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC **Pembrokeshire Marine/ Sir Benfro Forol SAC** Ramsey and St David`s Peninsula Coast SPA Skokholm and Skomer SPA **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Penfro SPA** St David`s / Ty Ddewi SAC Tintagel-Marsland-Clovelly Coast SAC **West Wales Marine / Gorllewin Cymru Forol cSAC**	This SRA overlaps with the **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** and is close to **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Penfro SPA;** and the **West Wales Marine / Gorllewin Cymru Forol cSAC.** These sites which have a range of subtidal habitats that support the interest features and their prey species that may be vulnerable to direct effects (physical loss etc) or any changes in marine / coastal processes resulting from wave energy developments within the SRA. The likelihood of adverse effects on habitats will depend on the scale and type of any developments that come forward, and it is worth noting that many of the subtidal habitats within the SRA will not be particularly important for maintaining the conservation status of the interest features of the above sites (for example, the **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA** is designated primarily for the rafting behaviour of some manx shearwater and puffin in these areas – with evidence suggesting that most foraging occurs further out in the Irish Sea. The footprint of any developments is also likely to be a relatively small component of these sites. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. There are few examples of wave energy devices and the likely effects are entirely dependent on the technology employed, and so adverse effects (in the absence of mitigation) cannot be excluded at the strategy level (although they can almost certainly probably be avoided as part of the normal project-level consenting process, which the policy supports).	No other marine sites are within 50km of this SRA and so direct effects on the habitats of these can be excluded. However, all habitat features of SACs within the study area are theoretically exposed depending on the nature of the **typical species** and their precise relationship with areas potentially affected by activities within this SRA. This cannot be characterised or assessed at this point and so 'down-the-line' HRA must be relied on to ensure that adverse effects on typical species away from their 'home site' do not occur.
Bats	Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	The SRA is approximately 15km from the near the **Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC** although effects are very unlikely based on the anticipated characteristics of future activities, although project-specific effects are conceivable (e.g. from cable access points and associated infrastructure; from lighting during construction; etc). However, these can almost certainly be avoided through the normal project-level consenting process.	None

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Marine mammals	All sites associated with the MMUs are potentially exposed, although those around the Irish Sea are likely to be particularly vulnerable to activities in this SRA, notably: Cardigan Bay/ Bae Ceredigion SAC Lundy SAC Murlough SAC **Pembrokeshire Marine/ Sir Benfro Forol SAC** Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC Strangford Lough SAC The Maidens SCI North Anglesey Marine / Gogledd Môn Forol cSAC **West Wales Marine / Gorllewin Cymru Forol cSAC** **Bristol Channel Approaches / Dynesfeydd Môr Hafren cSAC** North Channel cSAC Lambay Island SAC Rockabill to Dalkey Island SAC Saltee Islands SAC Slaney River Valley SAC	This SRA largely coincides with areas of higher harbour porpoise activity around south west Wales (for which the **West Wales Marine / Gorllewin Cymru Forol cSAC** and **Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC** are designated. This in itself would indicate a heightened risk of interactions between these species and any wave energy structures. The area of the SRA is also likely to be well-used by grey seal, which are common around the Pembrokeshire coast and are an interest feature of the **Pembrokeshire Marine/ Sir Benfro Forol SAC.** There is less evidence for potentially significant agglomerations common seal in the immediate vicinity of the SRA although these are obviously wide-ranging species that are likely to be exposed at some point to the types of activity promoted by this SRA. All of the marine mammals will therefore be exposed and sensitive to a range of potential effects that may occur as the result of wave energy installations, including collisions and mortality; and displacement, either directly due to noise and physical avoidance (etc) or as a consequence of secondary effects (e.g. hydrodynamic change and prey displacement). Determining the likely effects of this at the strategy scale is not simple, particularly as wave energy schemes are novel and the effects will be very heavily dependent on the type of installation used (which is not specified by the policy). This is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All other sites within the relevant MMUs (see Appendix C) are potentially exposed to activities in this SRA. Whilst adverse effects (in the absence of mitigation) cannot be excluded at the strategy level it is considered that they can be avoided as part of the normal project-level consenting process.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Diadromous fish	Afon Tywi/ River Tywi SAC Afonydd Cleddau/ Cleddau Rivers SAC **Pembrokeshire Marine/ Sir Benfro Forol SAC**	The effects of wave energy devices on diadromous fish is uncertain. Their location within offshore areas is likely to reduce the potential for exposure for many species, particularly those that tend to favour inshore and estuarine areas (e.g. river lamprey) and the risk of direct effects (e.g. through collision etc.) will depend entirely on the type of device used. They may be susceptible to displacement due to altered hydrodynamics, noise, or electromagnetic fields from cable connections; or from reef effects. This SRA is near the **Pembrokeshire Marine/ Sir Benfro Forol SAC** and **Afonydd Cleddau/ Cleddau Rivers SAC** and **Afon Tywi/ River Tywi SAC** and so there is a risk to fish species from these sites in particular due to their proximity. Having said that, the diadromous fish of these sites are likely to be more heavily associated with the estuarine areas the offshore areas. The effects of any development will depend on its scale, type and location, although species will obviously be vulnerable to the typical primary and secondary effects of such schemes. Determining the likely effects of this at the strategy scale is not simple, particularly as wave energy schemes are novel and the effects will be very heavily dependent on the type of installation used (which is not specified by the policy). This is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	All of the sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area, are potentially exposed to activities in this SRA.

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Feature group	High exposure sites (sites within SRA in bold)	Summary	Other sites where effects cannot be excluded
Pelagic seabirds	Grassholm SPA Skokholm and Skomer SPA **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA**	This SRA is close to the **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA,** and is within the foraging range of the species associated with **Skokholm and Skomer SPA** and **Grassholm SPA**. It is therefore likely that the SRA area is well-used by the interest features of these sites, although it is likely to form a small proportion of the total foraging areas (particularly for the wider ranging species associated with these sites). Species from these sites may utilise the SRA area in winter, based on the BDMPS. There is little information on the vulnerability of seabirds to wave energy schemes, and in reality this will be entirely dependent on the technologies employed. However, the **Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA** is designated primarily for the rafting behaviour of some manx shearwater and puffin in these areas – and so there is a risk of disturbance or displacement of these species here due to activities in the SRA. Furness *et al.* (2012) note that "*there is a very strong consensus in the published literature that these wet renewables technologies are unlikely to represent as great a hazard to seabirds as posed by offshore wind farms*" and the likelihood of adverse effects will depend on the scale and type of any developments that come forward. Having said that, this is a novel development area and the range of potential devices (and hence effects) is large, and it is therefore difficult to exclude significant effects on the basis of objective data alone. This is clearly an area where (a) data is lacking and (b) effects will be highly dependent on the technologies employed so some mitigation will have to come through the WNMP review process. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Seabirds from more distant sites could be affected by proposals in this SRA, depending on their behavioural preferences. Effects on some sites and species during breeding can be excluded through analysis of Thaxter *et al.* (2012) but the BDMPS does not allow effects to be easily excluded for wintering birds.
Wildfowl and Waders	Bae Caerfyrddin/ Carmarthen Bay SPA Burry Inlet Ramsar Burry Inlet SPA	There are few sites designated for their wildfowl and waders near the proposed SRA, and the SRA itself will not be used by these species. As a result, direct effects (e.g. displacement due to noise etc) are unlikely to occur. Effects are possible likely through secondary processes (i.e. effects on supporting habitats due to impacts on coastal processes) but the likelihood of this will depend on the parameters of any project than comes forward. The proposed policy and SRA does not create a risk of adverse effects that cannot be avoided through accepted project-level controls, and based on evidence from schemes elsewhere it is clear that adverse effects can be avoided as part of the normal project-level consenting process.	Adverse effects on wildfowl and waders from other sites are extremely unlikely given the likely types of development concerned and the location and habitats of the SRA and surrounding areas. Any effects can only be meaningfully identified in association with specific projects.

Policy review

9.2.19 The intent of Policy ELC_01 is the support of wave energy and tidal stream schemes although this support is not unequivocal and is contingent on the performance of schemes against the other policies in the WNMP (including the protective general cross-cutting policies).

9.2.20 The policy does not identify or promote specific development proposals, nor restrict how future schemes might be delivered. Schemes are arguably more likely within the SRAs as a result of the plan policies, but are not necessarily restricted to these areas. As a result, the likelihood of specific effects occurring on specific sites or features that are potentially exposed cannot be determined, and will depend entirely on the nature of the schemes that come forward under the WNMP policies. Having said that, the following points should be noted in particular:

- The factors that ensure areas are hydrodynamically suitable for tidal stream schemes also may make these areas attractive to some species for foraging; in particular, harbour porpoise are known to use tidal conditions for foraging and often occur in areas of high tidal energy around headlands and channels. Similarly, some pelagic seabirds take advantage of tidal currents and upwellings when foraging. This is a particular issue for the Anglesey and St David's SRAs.
- Far-field effects as a result of changes to sediment dynamics are possible, and modelling work has suggested that these might extend up to 50km from the point of energy extraction in the Bristol Channel (Neill, 2013); estuarine sites and their dependent species may be particularly vulnerable to this effect pathway. This is likely to be a particular issue for the Bristol Channel SRA.

9.2.21 As noted, wave and tidal stream are novel technologies and the range of potential devices (and hence effects) is large. Adverse effects on sites or features cannot, at the strategy level, necessarily be excluded on the basis of the currently available objective data alone and therefore assessment must be deferred to the scheme level to some extent, with a reliance on plan-level controls.

9.2.22 Nevertheless, there is little evidence of significant adverse effects from existing tidal stream schemes, and HRAs for commercial and test schemes have largely demonstrated or concluded that adverse effects can be avoided at the project level, even in areas close to European sites (for example, the Torr Head Tidal Energy Array (Tidal Ventures 2015); or the Deep Green Holyhead Deep Project (Minesto 2016)). There are fewer wave energy case studies to rely on, but ultimately, the policy (in conjunction with the other policies in the WNMP) does not fundamentally constrain the delivery of future wave and tidal stream schemes such that adverse effects are unavoidable, and contains safeguards that will ensure that normal project-level controls, including HRA, are met.

9.2.23 In terms of plan-level mitigation, it should be recognised that various controls and safeguards are woven through the general cross-cutting policies; in addition:

- All proposals will be subject to project level HRA as part of the consenting procedure.
- The three-yearly WNMP review process provides a mechanism for the monitoring and review of policy performance, which will be based on accumulated evidence from project and strategic studies, and hence ensures that effects that cannot currently be assessed as part of a plan-level HRA are appropriately captured and addressed in future revisions of the policy or the SRA. The WNMP also encourages investigation and feedback through Policy ELC_01.

9.3 Conclusion

9.3.1 The wave and tidal stream component of Policy ELC_01 is intended to promote and support the development of schemes within the SRAs, but does not specify the precise scale, location and nature of future schemes. It is considered that the policy is sufficiently caveated and flexible to ensure that adverse effects are not an unavoidable or inevitable outcome of its implementation, for the following reasons:

i. Whilst the policy identifies areas that are likely to be suitable for wave and tidal stream schemes, based on existing data, this is primarily an indication of 'areas of potential' planned to minimise conflict with other sectors. It is not equivalent to a land-use plan allocation. Importantly, it does not identify or promote specific development proposals, nor restrict how future schemes might be delivered (indeed, the policy does not restrict delivery to the SRA (see supporting map)[43]). As a result, sufficient flexibility is retained within the scope of the policy to ensure that future schemes can be delivered without adverse effects.

ii. The general cross-cutting protective policies within the WNMP will provide safeguards for European sites (although it is recognised that these cannot categorically exclude any schemes that may have adverse effects since this would exceed the provisions of the Habitats Regulations).

iii. Evidence from existing tidal schemes (albeit small scale) and cable works suggests that project-level mitigation and avoidance measures are available, achievable and likely to be effective.

iv. All schemes coming forward under this policy would require project-level HRA.

v. The WNMP review process will ensure that SRAs can be modified to reflect the best evidence available.

9.3.2 Due to the nature of the plan and policy, specific measures to mitigate specific effects on specific sites cannot be identified. It is therefore necessary, in part, to rely on the implementation of the general cross-cutting protective policies within the WNMP to safeguard European sites and features during the future assessment of schemes that are supported by this policy and down-the-line assessment of individual projects. It is, however, considered that the wave and tidal stream aspects of Policy ELC_01 will not result in adverse effects on any European sites based on the mitigation measures that are in place.

[43] Although it is recognised that schemes outside this area may be more difficult to advance due to the safeguarding measures provided for other sectors by the WNMP.

100000 150000 200000 250000 300000 350000 400000

450000 400000 350000 300000 250000 200000 150000 100000

N

Key

- cSAC
- Ramsar
- SPA
- SAC
- WNMP Area
- Tidal Stream SRAs
- Wave SRAs
- 50km Zone of Influence

0 20 40 60 80 100 km

Scale at A3: 1:1,250,000

Welsh National Marine Plan
Habitats Regulations Assessment

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Figure 9.1
Wave and Tidal Stream SRAs

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10. Energy – Low Carbon (Tidal Lagoons)

10.1 Screening Summary

10.1.1 Policy ELC_01 provides the supporting framework for tidal lagoon schemes. The specific tidal lagoon element of the policy is as follows:

Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:

a) in corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and

b) in corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

a) renewable energy Strategic Resource Areas; and

b) wider natural resources that provide renewable energy potential.

10.1.2 The policy therefore encourages tidal lagoon proposals within the corresponding SRA (although it does not specify any scale), to help meet the broader objective for renewables ("*To contribute significantly to the decarbonisation of our economy and blue growth by increasing the amount of renewable energy generated, by…Supporting the development and deployment of tidal range technology*"). The likely outcome of the policy is therefore an increase in the number of tidal lagoon proposals; and, ideally as a consequence, the implementation of tidal lagoon schemes.

10.1.3 The policy focuses on the SRAs (principally as these are the areas that are physically suitable for tidal lagoon schemes) and so any development is more likely to be located in these areas, since proposals for schemes outside the resource area would not necessarily benefit from the policy. Having said that, the policy does not restrict proposals to these areas. Tidal lagoon schemes have the potential to affect the interest features of European sites and therefore a policy promoting these could result in significant effects if not appropriately designed.

10.2 Appropriate Assessment

Approach

10.2.1 Whilst the tidal lagoon element of Policy ELC_01 is consistent with the other sector policies, and does not specify any scale for tidal lagoon schemes, there is arguably a greater risk of significant or significant adverse effects that cannot be avoided than there is with the other sectors. It is anticipated that most tidal lagoon proposals will be inherently large-scale projects with limited or no opportunity for the scope or extent to be significantly moderated to avoid effects (in contrast to, say, a wind farm scheme which may have multiple location options); and any large-scale tidal lagoon is likely to have far-field effects, ensuring that there are few (if any) areas around the Welsh coast where a tidal lagoon could be sited without European sites or features being exposed to these effects. It may be difficult to accommodate any large-scale tidal lagoon project without significant or significant adverse effects, and a policy supporting them to any degree may therefore have unavoidable adverse effects. Furthermore, the policy provisions and 'down-the-line' measures that can be relied on for other sectors/types of development are not considered appropriate in this instance due to the inherent scale of anticipated tidal lagoon proposals.

10.2.2 Consequently, the appropriate assessment of the tidal lagoons aspect of Policy ELC_01 is more involved than the assessment of the other WNMP policy areas (which is considered 'appropriate' to the complexities of this component of the policy) and three technical assessments of the tidal

lagoon element of Policy ELC_01 have been undertaken to inform the assessment. These detailed assessments concern:

- marine mammals (**Appendix G**)[44];
- fish and marine habitats (**Appendix H**)[45]; and
- birds (**Appendix I**)[46].

10.2.3 Effects on bats are not considered in these reports, but are briefly considered in the summary below.

10.2.4 These technical assessments consider the likely outcomes of a policy with two SRAs, one in Liverpool Bay and one in South Wales. To ensure consistency and completeness, some of the aspects of the screening process are repeated or revisited within these documents, with additional data bought to bear (where possible) to allow sites to be screened out and hence ensure that the detailed assessment is appropriately focused.

Summary

Marine mammals

10.2.5 The marine mammals appropriate assessment identifies 21 sites with marine mammal interest features where significant effects cannot not be excluded, as follows:

Table 10.1 'Screened in' sites with marine mammals

European site	Country	Harbour porpoise	Bottlenose dolphin	Grey Seal	Otter
Afon Gwyrfai a Llyn Cwellyn SAC	UK				✓*
Afon Tywi/ River Tywi SAC	UK				✓
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC	UK	✓			
Cardigan Bay/ Bae Ceredigion SAC	UK		✓	✓*	
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	UK				✓*
Isles of Scilly Complex SAC	UK			✓*	
Lundy SAC	UK			✓*	
North Anglesey Marine / Gogledd Mon Forol cSAC	UK	✓			
North Channel cSAC	UK	✓			
Pembrokeshire Marine/ Sir Benfro Forol SAC	UK			✓	✓*
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC	UK		✓*	✓*	✓*
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	UK				✓*
River Usk/ Afon Wysg SAC	UK				✓
River Wye/ Afon Gwy SAC	UK				✓

[44] Royal HaskoningDHV (2017) Draft Welsh National Marine Plan - Plan Level Habitats Regulation Assessment for Tidal Lagoon Policy – Marine Mammals.
[45] ABPMer and THA Aquatic (2017) *Plan Level HRA of Welsh National Marine Plan Tidal Lagoon Policy: Fish and Supporting Environs.*
[46] Institute of Estuarine and Coastal Studies University of Hull (2017) Plan Level HRA of the Welsh National Marine Plan Tidal Lagoon Policy: Bird Features. Report to the Welsh Government.

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European site	Country	Harbour porpoise	Bottlenose dolphin	Grey Seal	Otter
West Wales Marine / Gorllewin Cymru Forol cSAC	UK	✓			
Roaringwater Bay and Islands SAC	Eire	✓			
Rockabill to Dalkey Island SAC	Eire	✓			
Abers - Cotes des Legendes SAC	France	✓			
Baie de Morlaix SAC	France	✓			
Cote de Granit rose-Sept-Iles SAC	France	✓			
Ouessant-Molene SAC	France	✓			

* Qualifying feature only (UK sites)

10.2.6 No sites supporting **harbour seal** are considered to be exposed to the potential effects of the policy.

10.2.7 The assessment has examined the potential effects of the tidal lagoon element of Policy ELC_01 on these sites in more detail, focusing on those sites within the ZoI of the proposed SRAs (this is on the basis that, for wide-ranging species associated with multiple sites, if there are no significant or no significant adverse effects on the closest high-value marine areas (i.e. the SACs) then far-field effects on more distant sites would not be expected).

10.2.8 The conclusions are noted in **Table 10.2**; in summary, the assessment concludes that adverse effects (alone) cannot not be excluded for:

- **harbour porpoise** associated with Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC and North Anglesey Marine / Gogledd Mon Forol cSAC; and
- **otter** associated with Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC.

In addition, adverse effects 'in combination' cannot not be excluded for:

- **bottlenose dolphin** associated with Cardigan Bay/ Bae Ceredigion SAC and Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC;
- **harbour porpoise** associated with West Wales Marine / Gorllewin Cymru Forol cSAC;
- **grey seal** associated with Cardigan Bay/ Bae Ceredigion SAC; Isles of Scilly Complex SAC; Lundy SAC; Pembrokeshire Marine/ Sir Benfro Forol SAC; and Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC.

It should be noted that in most instances, the 'in combination' effects were not related to specific known developments, rather to the possibility of effects with future developments, depending on the projects that come forward.

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Table 10.2 Summary of appropriate assessment for sites with marine mammals

European site	Feature	Potential adverse effects at plan or project level?
Afon Gwyrfai a Llyn Cwellyn SAC	Otter	No
Afon Tywi/ River Tywi SAC	Otter	No
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC	Harbour porpoise	No effects at plan level. Project level assessment required for some residual uncertainties (disturbance from underwater noise; Collision risk with vessels; Collision risk with operational turbines; Barrier effects to movements; changes to prey availability; In-combination effects) but these effects likely to be avoidable.
Cardigan Bay/ Bae Ceredigion SAC	Bottlenose dolphin Grey seal	No No
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	Otter	No effects at plan level. Project level assessment required for some residual uncertainties (Changes in habitat; Changes in water quality; Increase in suspended sediment; Collision risk with operational turbines; changes to prey availability; In-combination effects) but these effects likely to be avoidable.
Isles of Scilly Complex SAC	Grey seal	No
Lundy SAC	Grey seal	No
North Anglesey Marine / Gogledd Mon Forol cSAC	Harbour porpoise	No effects at plan level. Project level assessment required for some residual uncertainties (disturbance from underwater noise; Collision risk with vessels; Collision risk with operational turbines; Barrier effects to movements; changes to prey availability; In-combination effects) but these effects likely to be avoidable.
North Channel cSAC	Harbour porpoise	No
Pembrokeshire Marine/ Sir Benfro Forol SAC	Otter Grey seal	No No
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC	Bottlenose dolphin Otter Grey seal	No No No
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	Otter	No
River Usk/ Afon Wysg SAC	Otter	No
River Wye/ Afon Gwy SAC	Otter	No
West Wales Marine / Gorllewin Cymru Forol cSAC	Harbour porpoise	No

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European site	Feature	Potential adverse effects at plan or project level?
Roaringwater Bay and Islands SAC	Harbour porpoise	No
Rockabill to Dalkey Island SAC	Harbour porpoise	No
Abers - Cotes des Legendes SAC	Harbour porpoise	No
Baie de Morlaix SAC	Harbour porpoise	No
Cote de Granit rose-Sept-Iles SAC	Harbour porpoise	No
Ouessant-Molene SAC	Harbour porpoise	No

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Fish and habitats

10.2.9 The fish and habitats appropriate assessment identifies 39 sites with features for which significant effects cannot not be excluded, as follows:

Table 10.3 'Screened in' sites with fish or marine / coastal habitat interest features

Site	Marine / coastal habitat	Fish species
Afon Gwyrfai a Llyn Cwellyn SAC		✓
Afon Tywi/River Tywi SAC		✓
Anglesey Terns/Morwenoliaid Ynys Mon SPA	✓	
Bae Caerfyrddin/Carmarthen Bay SPA	✓	
Bae Cemlyn/Cemlyn Bay SAC	✓	
Braunton Burrows SAC	✓	
Burry Inlet SPA	✓	
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	✓	✓
Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC	✓	
Dee Estuary SPA	✓	
Dee Estuary/Aber Dyfrdwy SAC	✓	✓
Exmoor Heaths SAC	✓	
Glannau Mon: Cors heli/ Anglesey Coast: Saltmarsh SAC	✓	
Glannau Ynys Gybi/Holy Island Coast SPA	✓	
Great Orme`s Head/Pen y Gogarth SAC	✓	
Kenfig/Cynffig SAC	✓	
Limestone Coast of SW Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	✓	
Liverpool Bay/Bae Lerpwl Extension SPA	✓	
Liverpool Bay/Bae Lerpwl SPA	✓	
Mersey Estuary SPA	✓	
Mersey Narrows and North Wirral Foreshore SPA	✓	
Pembrokeshire Marine/ Sir Benfro Forol SAC	✓	✓
Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC	✓	
Ribble and Alt Estuaries SPA	✓	
River Dee and Bala Lake/ SAC		✓
River Usk/Afon Wysg SAC		✓
River Wye/Afon Gwy SAC		✓
Sefton Coast SAC	✓	

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Site	Marine / coastal habitat	Fish species
Severn Estuary Ramsar	✓	✓
Severn Estuary SPA	✓	
Severn Estuary/Môr Hafren SAC	✓	✓
Shell Flat and Lune Deep SCI	✓	
Somerset Levels and Moors SPA	✓	
The Dee Estuary Ramsar	✓	
Traeth Lafan/Lavan Sands, Conway Bay SPA	✓	
Walmore Common SPA	✓	
Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC	✓	
Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC	✓	
Ynys Seiriol/Puffin Island SPA	✓	

* The habitat interest features of the Pembrokeshire Marine/ Sir Benfro Forol SAC were screened out due to the distance from the SRAs.

10.2.10 The assessment has examined the potential effects of the tidal lagoon element of Policy ELC_01 on these sites in more detail. In summary, the assessment concludes that adverse effects (alone and / or in combination) cannot not be excluded at the plan level due to the inherent uncertainties, including:

- the location of tidal lagoon activities (both within and outside the SRA);
- the scale of tidal lagoon development;
- the proposed technologies to be used and future advances in these technologies;
- the scale of the effects arising via some of the defined impact pathways;
- the detailed baseline ecology of the development locations;
- the sensitivities of species to impacts; and
- the efficacy of some project-level mitigation options.

10.2.11 The key impact pathways for which it might not be possible to avoid adverse effects are identified as:

- direct changes in habitat extent, type and quality;
- indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction);
- barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species; and
- collision risk (including vessels and static/ rotating structures).

Birds

10.2.12 The birds appropriate assessment identifies 56 SPA and Ramsar sites with interest features potentially exposed to the effects of the tidal lagoon element of Policy ELC_01, where significant effects cannot not be excluded. This is based on the spatial and functional attributes of the sites, and their component interest features, together with a high-level indication of likely pressures acting on these features directly or indirectly from a tidal lagoon development policy. The impact

assessment is based on those pressure pathways identified by Natural England in NECR213 and used in their revised 'Advice on Operations for Marine Sites - Tidal Lagoon/impoundment: During Construction and Tidal Lagoon/impoundment: Operation and Maintenance operations and sensitivity advice'. This takes the form of a standardised set of pressures rated as medium to high risk and low risk, with the low risk pressures screened out.

10.2.13 The assessment concludes that the potential for adverse effects on European sites designated for their bird interest features cannot not be excluded for any of the European sites subject to the detailed assessment.

Bats

10.2.14 There are no SACs designated for their bat populations within 20km of the Liverpool Bay SRA, and so no effects will occur as a result of any lagoons within this SRA. The South Wales SRA partly coincides with the Severn Estuary, which is known to be crossed by bats that may be associated with SACs in England and Wales. Significant effects on bat species are very unlikely although there may be a small risk depending on the precise location and nature of any proposed schemes (e.g. if lighting is required etc.); however, any effects can clearly be avoided with normal and established project-level mitigation.

Priority Features

10.2.15 A sub-set of the Annexe I habitat types are defined as being 'priority' because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union (Article 1d). The importance of these priority habitat types is emphasised at several places in the Directive (Articles 4 and 5 and Annexe III), not only in terms of the selection of sites, but also in the measures required for site protection (Article 6) and surveillance (Article 11), and the presence of priority features is an important consideration if a plan is progressed due to IROPI where adverse effects cannot be ruled out.

10.2.16 Of the priority habitats and species within the UK, the following are potentially exposed to the effects of ELC_01 as it relates to tidal lagoons:

Table 10.4 Priority habitats and species potentially exposed to the effects of ELC_01

Priority Habitat	Sites	Likely exposure
Coastal lagoons	▶ Bae Cemlyn/ Cemlyn Bay SAC ▶ Pembrokeshire Marine/ Sir Benfro Forol SAC ▶ Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC	Low – all lagoons are located some distance from the proposed SRAs (particularly the lagoon associated with Pen Llŷn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC) and their geomorphological characteristics are likely to limit their sensitivity (although effects cannot be categorically ruled out at the plan-level).
Fixed dunes with herbaceous vegetation ("grey dunes")	▶ Dee Estuary/ Aber Dyfrdwy SAC ▶ Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC ▶ Kenfig/ Cynffig SAC ▶ Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC ▶ Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC ▶ Sefton Coast SAC	Low for most sites except Dee Estuary/ Aber Dyfrdwy SAC and Sefton Coast SAC (likely to be exposed to effects should a lagoon be sited in the North Wales SRA and sediment supply to Liverpool Bay is disrupted); and Kenfig/ Cynffig SAC (although the exposure of this is likely to depend on the progress of the Swansea Bay lagoon scheme). Effects cannot be categorically excluded at the plan-level

Priority Habitat	Sites	Likely exposure
Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)	▶ Sefton Coast SAC	Likely to be exposed to effects should a lagoon be sited in the North Wales SRA likely to be exposed to effects should a lagoon be sited in the North Wales SRA and sediment supply to Liverpool Bay is disrupted. Effects cannot be categorically excluded at the plan-level.

10.2.17 The other priority features will not be exposed to the effects of the policy.

Policy review

10.2.18 The intent of Policy ELC_01 is the support of tidal lagoon schemes although this support is not unequivocal and is contingent on the performance of schemes against the other policies in the plan (including the protective general cross-cutting policies ENV_02 and GOV_01).

10.2.19 The policy does not identify or promote specific development proposals, nor restrict how future schemes might be delivered; nor does it imply a scale for, or number of, any tidal lagoon developments. Schemes are arguably more likely within the SRAs as a result of the policy, but are not necessarily restricted to these areas. As a result, the likelihood of specific effects occurring on specific sites or features that are potentially exposed cannot be determined, and will depend entirely on the nature of the schemes that come forward.

10.2.20 In terms of plan-level mitigation, it should be recognised that various controls and safeguards are woven through the general cross-cutting policies; in addition:

- All proposals will be subject to project level HRA as part of the consenting procedure.
- The three-yearly WNMP review process provides a mechanism for the monitoring and review of policy performance, which will be based on accumulated evidence from project- and strategic studies, and hence ensures that effects that cannot currently be assessed as part of a plan-level HRA are appropriately captured and addressed in future revisions of the policy or the SRA. The WNMP also encourages investigation and feedback through Policy ELC_01.

10.2.21 Having said that, the WNMP does not explicitly exclude the possibility of a development with adverse effects benefitting from Policy ELC_01; and currently, unlike other policy sectors (e.g. tidal stream) the assumed inherent scale of most tidal lagoons ensures that significant adverse effects would appear to be a 'likely' outcome for any developments coming forward under the policy since potential adverse effects cannot obviously be avoided through siting or established project-level avoidance and mitigation measures. It should be noted that whilst the Swansea Bay Tidal Lagoon proposal provides some indication that project-level measures can be identified to ensure that adverse effects do not occur, it is also clear that the lagoon is proposed for one of the better locations around the Welsh coast regards avoidance of potential impacts on European sites and it should not be interpreted as evidence that effects from similar tidal schemes could always be avoided.

10.3 Conclusion

10.3.1 The tidal lagoon component of Policy ELC_01 is intended to promote and support the development of schemes within the SRAs, but does not specify the precise scale, location and nature of future schemes. Whilst the policy is caveated by other policies within the WNMP and project level controls that are in place to safeguard European sites, it is considered that the nature of tidal lagoons ensures that adverse effects on European sites or interest features, particularly habitats, fish and birds, cannot clearly be avoided at the project level, regardless of the policy controls or known project-level measures.

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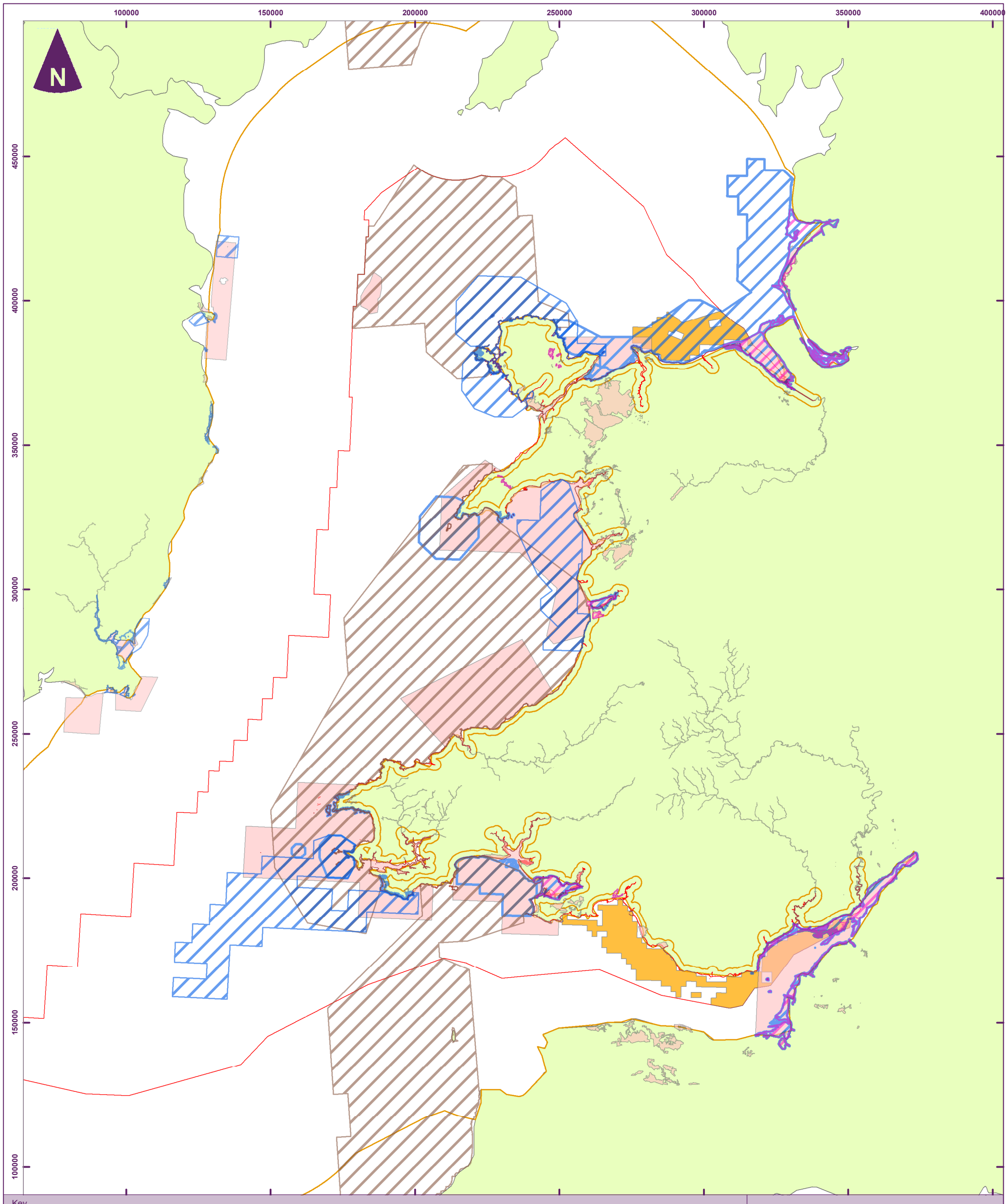
10.3.2 In an 'adverse effect' scenario it would generally be appropriate to alter or discard the policy. However, the Welsh Government believes that the absence of a policy for this rapidly developing sector would have several disadvantages for marine planning in general (particularly regards safeguarding), and that some form of tidal lagoon supporting policy is essential for a long-term plan (20 years horizon).

10.3.3 Regulation 103(1) of the Habitats Regulations states that "If the plan-making authority are satisfied that, there being no alternative solutions, the land use plan must be given effect for imperative reasons of overriding public interest [IROPI]…they may give effect to the land use plan notwithstanding a negative assessment of the implications for the European site or the European offshore marine site…". As the Welsh Government believes that a tidal lagoons policy is necessary and appropriate, the policy alternatives are examined in **Section 13**.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Based upon the Ordnance Survey Map with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright. 100001776
Welsh National Marine Plan
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Figure 10.1
Tidal Range SRAs
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11. 'In Combination' Effects

11.1 Overview

11.1.1 The Habitats Regulations requires that the potential effects of a plan on European sites must also be considered 'in combination with other plans or projects'. Consideration of 'in combination' effects is not a separate assessment, but is integral to the screening and appropriate assessment stages and the development of avoidance/ mitigation measures.

11.1.2 As noted, due to the strategic nature of the WNMP, the uncertainties associated with any in combination assessment are considerable. It is therefore important to ensure that the WNMP does not include any measures that would obviously constrain the mitigation options available for future activities, or direct activities such that conflict with other plans is inevitable, or contain policies or objectives that would allow protective measures included in other plans to over-ridden.

11.1.3 The following sections summarise the review of other plans and projects for potential 'in combination' effects with the policy components of the WNMP.

11.2 General Cross-cutting Policies

11.2.1 All of the general cross-cutting policies in the WNMP (see **Table 4.2**) are considered to be 'no significant effect' policies as they are invariably 'General statements of policy / aspiration', 'General design / guidance criteria or policies that cannot lead to or trigger development' or 'Environmental protection policies' (see **Table 5.2**). It is considered that these policies will not have any significant effects 'in combination' with other plans (etc.) for the same reasons; where there are potential interactions the WNMP defers to existing plans (for example, Policy SOC_09 explicitly encourages proposals that "…*align with the relevant Shoreline Management Plan*").

11.2.2 It should be noted that some of the general cross-cutting policies will provide plan-level safeguards and mitigation for 'in combination' effects. In particular, Policy GOV_01 specifically requires that "*Proposals should demonstrate that they have assessed potential cumulative effects*".

11.3 Sector-specific Plans and HRAs

11.3.1 **Table 11.1** summarises the strategic planning measures that are in place for the specific sectors identified by the WNMP. It also notes where HRA has been undertaken for these plans, and the broad conclusions of these documents; generally, this was 'no adverse effects', but the assessments invariably considered the requirement for project-level HRA and hence the deferral of some assessment 'down-the-line'.

11.3.2 In many cases, there is no specific strategy or plan shaping sector activities, with HRAs therefore undertaken on individual schemes at the consenting stage. It is not possible to examine all of the existing consents and permissions potentially affecting the WNMP area to determine possible residual effects that may operate with the sector policies.

Table 11.1 Sector-specific plans

Sector	Existing Strategies and HRAs
Aggregates	Strategic planning in the aggregates sector principally occurs when the Crown Estate conducts tender rounds to offer interested parties the opportunity to bid for rights to prospect the seabed in some or all regions under mineral management. A plan-level HRA was undertaken by The Crown Estate for aggregate option areas in 2015 (not available on line). The aggregates policies are intended to replace the Interim Marine Aggregates Dredging Policy (iMADP, 2004), which applied primarily to extraction in the Bristol Channel, although this was not subject to HRA. Regulation of aggregate extraction is devolved to The Welsh Ministers for the inshore plan region. The management of aggregate dredging is undertaken under a marine licence which NRW Permitting Service issue on behalf of the Welsh Ministers, and HRAs are therefore undertaken at the licensing stage.
Aquaculture	There are no aquaculture-specific strategic plans; individual proposals are subject to HRA as part of the SO process. However, the commercial fisheries sector is considered as a plan or project under the Habitats Regulations, and Defra has consequently altered its approach to the management of fisheries in European Marine Sites (essentially by using a high-level risk based assessment approach that prevents use of certain gear in an EMS without specific assessment (Defra 2013).
Defence	Defence is not subject to a strategic plan, with HRA addressed at the project / consent level rather than as part of strategic planning document.
Dredging and Disposal	Dredging and disposal activities are not subject to a strategic plan, with HRA issues addressed at the project / consent level rather than as part of strategic planning document.
Energy – Low Carbon	Wind lease areas have been identified by TCE with plan level HRA undertaken (e.g. Entec 2009). These concluded no adverse effects with deferred assessment for projects. With regard to wave and tidal, the Crown Estate has agreed seabed rights for new wave and tidal demonstration zones and new wave and tidal current sites. However, it has not undertaken HRA, specifically noting that "*As part of designing the* [wave and tidal] *leasing, we have engaged with the Statutory Nature Conservation Bodies (SNCBs) in relation to our duties as Competent Authority under the Conservation of Habitats and Species Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats) Regulations 2007 (as amended) (jointly referred to as the "Habitats Regulations"). We do not consider that offering the opportunity to access seabed for wave or tidal projects of up to 3 MW across the UK constitutes a 'plan' under the Habitats Regulations because we do not know the number of applications which will be submitted or the locations of any proposed sites. Therefore, at this stage, we have not undertaken a plan-level Habitats Regulations Assessment (HRA). We will keep this position under review as applications are received and will continue to work closely with the SNCBs.*" Tidal lagoons are not subject to a strategic plan, with HRA issues addressed at the project / consent level rather than as part of strategic planning document.
Energy – Oil and Gas (including CCS)	Some aspects of oil and gas have been examined at the strategy level through the block licensing process[47], which concluded no adverse effects. The HRAs of the license blocks were carried out at a relatively high level but were generally block-specific, with specific impacts on specific sites considered as far as achievable at that stage. The HRAs invariably concluded 'no adverse effects', largely by deferring some aspects of the assessment to the project level and taking into account the 'mitigation measures' that can be imposed through existing permitting mechanisms on the planning and conduct of activities (i.e. the licenses did not include specific exclusions that would guarantee that 'adverse effect' proposals would be refused). The HRAs did not identify any specific 'residual effects' for consideration at the project-level, or in combination with other plans. There are no CCS schemes and any proposals would likely be addressed on a project-by-project basis rather than through a strategic plan (particularly as the siting is likely to be dependent on existing oil and gas infrastructure).
Fisheries	The commercial fisheries sector is considered as a plan or project under the Habitats Regulations. Defra has consequently altered its approach to the management of fisheries in European Marine Sites, essentially by using a high-level risk based assessment approach that prevents use of certain gear in an EMS without specific assessments (Defra 2013); this is not a strategic resource assessment however.
Subsea Cabling	Subsea cabling is not subject to a strategic plan itself but will obviously be a component of various other sector strategies or programmes (e.g. Offshore Wind Licensing) as well as individual projects in other sectors.

[47] For example: DECC (2015), Offshore Oil & Gas Licensing 28th Seaward Round: Irish Sea and St George's Channel, Habitats Regulations Assessment: Stage 2 - Appropriate Assessment

Sector	Existing Strategies and HRAs
Surface Water and Wastewater Treatment and Disposal	Wastewater operators are currently producing catchment-scale drainage strategies to improve the management of wastewater and demonstrate how a water and sewerage company intends to deliver its statutory functions over the long term within a particular area in a sustainable and economic manner. It is unclear whether these will be subject to HRA, although it would seem likely. At the moment, however, Surface Water and Wastewater Treatment and Disposal is managed through individual consents and legislative requirements, which are subject to HRA.
Tourism and Recreation	The Welsh government "Partnership for Growth: The Welsh Government Strategy for Tourism 2013 – 2020' (Welsh Government (2013)) sets out broad principals for tourism growth but this is not a planning document and not subject to HRA; individual projects will be subject to HRA as required.
Ports and Shipping	The National Policy Statement for Ports provides a framework for port development but is not a strategic planning document; it requires HRA for DCO proposals as part of the policy. There is no strategic plan for port development although ports may produce Port Masterplans which outline future development proposals; these may be subject to HRA but more typically HRA is addressed at the project / consent level rather than as part of strategic planning document.

11.4 Marine Plans

11.4.1 In combination effects are possible with the other marine plans, principally where the plans' zones of influence overlap geographically[48] or if mobile species are affected by separate activities taking place at different points in their range or life-cycle[49]. Significant in combination effects are perhaps most likely to be possible with the neighbouring marine plans, and these have been reviewed accordingly (see **Table 11.2**); the range of some mobile species ensures that far-field effects are conceivable (if unlikely, given the plan safeguards).

11.4.2 In summary, the different development timetables for the marine plans means that they cannot all be reviewed in detail to inform the assessment. However, the WNMP includes mitigating provisions within it that will minimise the risk of 'in combination' effects, notably:

- the need for activities (etc.) to consider the overall coherence of the marine protected area network;
- the requirement for proposals to assess potential cumulative effects (GOV_01);
- the requirement to have regard to any relevant policies in other land-use and marine plans (GOV_02);
- the requirements for project level HRA; and
- the three-yearly review process, which will allow for potential 'in combination' effects to be identified and mitigated with the benefit of new data.

11.4.3 These provisions (or similar) are also included in the drafts of the neighbouring plans that are currently available (see **Table 11.2**).

Table 11.2 Neighbouring marine plans most likely to operate 'in combination' with the WNMP

Plan	Status	Interaction with WNMP
Marine Plan for Northern Ireland	In preparation – no policy information available	The Marine Plan for Northern Ireland is currently in preparation and so potential in combination effects cannot be identified.

[48] i.e. a 100km zone around the plan boundary (assuming the ZoIs of all plans is assumed to be 50km).
[49] For example, activities affecting breeding seabirds at the colony and then when wintering elsewhere.

Plan	Status	Interaction with WNMP
North West Marine Plan	In preparation – draft policies available	Draft sector policies are available for: ▶ Aggregates; ▶ Cables; ▶ Climate Change; ▶ Defence; ▶ Dredging and Disposal; ▶ Economic; ▶ Energy; ▶ Environment; ▶ Fishing and Aquaculture; ▶ Governance; ▶ Ports and Shipping; ▶ Social and Cultural; ▶ Tourism and Recreation. These policies have been reviewed for possible interactions with the WNMP, although SRAs (or similar) are not currently available. In summary, most policies are 'safeguarding' policies that do not themselves advocate activities; there are some supporting policies, specifically in aquaculture and tourism although the spatial aspect of these is not currently available. In addition, protective policy NW-MPA-1 states that "*Proposals must take account of any adverse impacts on the objectives of marine protected areas and the coherence of the overall marine protected area network, with due regard given to any current agreed advice on an ecologically coherent network*". This effectively requires that proposals consider in combination effects on the MPA network and provides that mitigation for the risk of project stage in combination effects.
South West Marine Plan	In preparation – draft policies available	As for the North West Marine Plan
Integrated Marine Plan for Ireland	Adopted	"Harnessing Our Ocean Wealth" sets out the Irish Government's high-level strategy for putting in place appropriate marine policy and governance; however, the document is not a spatial plan and so potential 'in combination' effects cannot be identified or assessed.
Isle of Man Marine Plan	In preparation – no policy information available	The Isle of Man Marine Plan is currently in preparation and so potential in combination effects cannot be identified.

11.5 Other Plans

11.5.1 There are a number of other strategic plans that could interact with the WNMP. These are primarily terrestrial sector plans and so 'in combination' effects are most likely on the coast and within inshore areas where zones of influence of the plans (or specific associated activities) potentially overlap. The key plans considered for potential in combination effects with the WNMP are summarised in **Table 11.3**, although it should be noted that this list is unlikely cover all 'in combination' eventualities and scheme-specific assessments will be required at the project level.

11.5.2 In summary, specific 'in combination' effects cannot be readily identified at the plan-level due to the absence of detail on the location (etc) of projects likely to come forward under the WNMP and (in most cases) under the other plans identified. This is true for the SRAs also, where no additional information on activities is provided. As a result, the interactions between the WNMP-supported activities and activities promoted or supported by other plans can only be reasonably characterised at the project level.

11.5.3 It is also worth noting that the HRAs of some plans (e.g. the Shoreline Management Plans) have been unable to conclude 'no adverse effects' and have been adopted for IROPI; it is arguable that

this also means that it is not possible to be certain that there will be no in combination effects where the ZoIs of these plans overlap.

11.5.4 Having said that, most sector plans, programmes and licensing activities have been subject to HRA and most of these will have complementary policy protections which should help ensure that the risk of adverse effects at the project-level is limited. It is difficult to be certain that the outcomes of the WNMP will have no adverse effects in combination; however, as noted, the WNMP includes mitigating provisions within it that will minimise the risk of 'in combination' effects, notably:

- the need for activities (etc.) to consider the overall coherence of the marine protected area network;
- the requirement for proposals to assess potential cumulative effects (GOV_01);
- the requirements for project level HRA; and
- and the three-yearly review process, which will allow for potential 'in combination' effects to be identified and mitigated with the benefit of new data.

Table 11.3 Other plans with potential in combination effects with WNMP and supported activities

Other Plans and Progammes	Interaction with WNMP
Wales Spatial Plan	The Wales Spatial Plan provides the framework for future collaborative action between the Welsh Assembly Government and its partners to achieve sustainable economic growth across the whole of Wales. The Plan emphasises the need for coordinated action at national, regional and local levels. The Plan should assist with the comprehensive management of the environment so that it contributes to sustainable development, and is reflected in the development of the marine plan. Specific in combination effects cannot be idenitifed.
Local Development Plans / Core Strategies (Various)	Allocations and policies within local development plans, depending on location, may affect European sites. Activities arising from local development plans could affect European sites through disturbance during construction, adverse effects from encroachment on habitats or species displacement, or indirect effects such as alterations to drainage, increased surface water run-off and diffuse / point source pollution, or increased visitor pressure. Welsh Government has reviewed all relevant plans including LDPs and English local plans for marine components although in detailed assessment of potential future in combination effects can only be undertaken at the project level.
Shoreline Management Plans (SMPs): ▸ **SMP 18 Hartland Point to Anchor Head (North Devon & Somerset) Lead: North Devon District Council** ▸ **SMP 19 Anchor Head to Lavernock Point (Severn Estuary) Lead: Monmouthshire Council** ▸ **SMP 20 Lavernock Point to St Ann's Head (South Wales) Lead: Carmarthenshire Council** ▸ **SMP 21 St Ann's Head to Great Ormes Head (West of Wales) Lead: Pembrokeshire Council** ▸ **SMP 22 Great Ormes Head to Scotland**	Shoreline Management Plans provide a large-scale assessment of the risks associated with coastal evolution and present a policy framework to address these risks to people and the developed, historic and natural environment in a sustainable manner. They generally set policy prescriptions for sections of coast, typically Hold the Line (HTL); Maintain or Upgrade; Advance the Line (ATL); Managed Realignment (MR); No Active Intervention (NAI); or Generic Mitigation. Some of the SMPs will have adverse effects on some European sites, principally where a HTL approach is required resulting in coastal squeeze. The WNMP complements / defers to the SMPs (Policy SOC_09 explicitly encourages proposals that "…*align with the relevant Shoreline Management Plan*) and so 'additional' in combination effects would not be expected.

Other Plans and Progammes	Interaction with WNMP
River Basin Management Plans (RBMPs): ▸ **Severn river basin district RBMP** ▸ **Western Wales RBMP** ▸ **Dee RBMP** ▸ **South West RBMP** ▸ **North West RBMP**	Under the EU Water Framework Directive (WFD) a management plan is required for each River Basin District (RBD). The purpose of this management plan is to protect and improve the water environment for the wider benefits to people and wildlife. In order to achieve this, the plan includes a summary of the Programme of Measures needed to achieve the objectives of the WFD together with the predicted environmental outcomes over the plan period (six years). Whilst the locations of the measures are broadly defined in the RBMP (the water bodies are identified, but the specific project locations are not), the specific activities that are likely to take place are not always known and the HRAs of the RBMPs generally defer assessment to the project level. Effects with the WNMP are possible, but can only be determined at a lower tier.
Catchment Flood Management Plans (CFMPs): ▸ **Bristol Avon CFMP** ▸ **Severn Tidal Tributaries CFMP** ▸ **River Severn CFMP** ▸ **Wye and Usk CFMP** ▸ **Taff and Ely CFMP** ▸ **Ogmore to Tawe CFMP** ▸ **Loughor to Taf CFMP** ▸ **Pembrokeshire and Ceredigion Rivers CFMP** ▸ **North West Wales CFMP** ▸ **Conwy and Clwyd CFMP** ▸ **River Dee CFMP**	Catchment flood management plans (CFMPs) are primarily concerned with inland flooding from rivers, groundwater, surface water and tidal flooding (SMPs deal with flooding from the sea) and so potential in combination effects are likely to be geographically limited. The CFMPs essentially provide broad policy prescriptions for managing flooding in difference catchments or reaches but do not identify specific schemes. As a result, it is not possible to identify or assess any in combination effects with the CFMPs. Effects with the WNMP are possible, but can only be determined at a lower tier or project level.
Flood Risk Management Plans (FRMPs): ▸ **Western Wales River Basin District FRMP** ▸ **Severn River Basin District FRMP** ▸ **Dee River Basin District CFMP**	The FRMPs plan and prioritise actions depending upon the Community at Risk register and also encourage more joined up planning and management of the water environment (alongside RBMPs). The FRMPs essentially identify measures proposed to help manage the risk of flooding to a community, which are fairly broad and not scheme-specific (for example, “design and construction of flood risk asset improvements”). As a result, it is not possible to identify or assess any in combination effects with the FRMPs. Effects with the WNMP are possible, but can only be determined at a lower tier or project level.
Regional Waste Plans: ▸ **North Wales Region** ▸ **South East Wales Region** ▸ **South Wales Region**	The regional waste plans are revised every three years and contain various policies and proposals for waste management; they are intended to assist which assists local authorities to allocate sites in their Local Development Plans for new waste management facilities. Systematic in combination effects are therefore unlikely; specific proposals would be addressed at the LDP stage with effects on European sites considered then.
Water Resources Management Plans: ▸ **Welsh Water** ▸ **Severn Trent Water** ▸ **United Utilities** ▸ **Bristol Water** ▸ **Wessex Water**	Water companies in England and Wales are required to produce a Water Resources Management Plan that sets out how they aim to maintain water supplies over a 25-year period. The current Water Resources Management Plans were published in 2014, and are in the process of being revised. The current WNMPs do not have any adverse effects on European sites. The revised plans explicitly account for any reductions in abstraction that are required to safeguard European sites and for the growth predicted by LPAs. However, the schemes advocated by the WRMP may interact with the WNMP (for example, a possible source of ‘new water’ is an aquifer beneath the Severn Estuary).

11.6 Projects

11.6.1 With regard to projects, it is not possible to produce a definitive list of existing (minor) planning applications near the WNMP area and in reality the timescales for delivery of these means that generating a list at this stage would be of little value. It is likely that most current developments will

be completed by the time that the WNMP is adopted and activities associated with this come forward. It is possible that there will be 'in combination' scheme-specific construction effects associated with future planning applications, although this can only be assessed nearer the time of construction.

11.6.2 The exception to this is Nationally Significant Infrastructure Projects (NSIPs), and known large-scale projects. NSIPs currently identified on the Planning Inspectorate (PINS) website have been reviewed for their potential to interact with the WNMP or future activities associated with this (see **Table 11.4**), along with known large-scale marine projects. However, a detailed assessment of possible 'in combination' effects between the NSIPs and future activities associated with the WNMP cannot be completed at the plan level, and therefore 'down the line' assessment will need to be relied on. As before, the mitigating provisions within the WNMP (requirement to protect the coherence of the marine protected area network; requirement for project-level HRA; the requirement for proposals to assess potential cumulative effects (GOV_01); and the three-yearly review process) will minimise the risk of 'in combination' effects).

Table 11.4 Current NSIPs and known large-scale projects with the potential to operate in combination with the marine plan or future activities

Project	Status	Summary	Interaction with WNMP
Walney Extension Offshore Wind Farm	Under construction	Offshore wind farm with up to 207 turbines and grid connection; site within ZoI of WNMP; effects on European sites within marine plan area considered by HRA.	HRA concluded no adverse effects on sites within the WNMP ZoI (including Liverpool Bay SPA; Ribble and Alt Estuaries SPA / Ramsar; Morecambe Bay SPA / Ramsar; Morecambe Bay SAC; Aberdaron Coast and Bardsey Island SPA; Copeland Islands SPA; Skokholm and Skomer SPA). Residual effects with future projects supported by the WNMP possible but cannot be assessed at the strategy level. Site due to be completed in 2018 so will arguably form part of the baseline at that point.
Burbo Bank Extension offshore wind farm	Under construction	Offshore wind farm west of the operational Burbo Bank offshore wind farm in Liverpool Bay, around 12.2 km from the Point of Ayr on the Welsh coast; cable connection to north Wales coast.	HRA concluded no adverse effects on sites within the WNMP ZoI (including Liverpool Bay SPA; Ribble and Alt Estuaries SPA / Ramsar; Morecambe Bay SPA / Ramsar; Morecambe Bay SAC; Aberdaron Coast and Bardsey Island SPA; Copeland Islands SPA; Skokholm and Skomer SPA). Residual effects with future projects supported by the WNMP possible but cannot be assessed at the strategy level. Site due to be completed in 2017 so will arguably form part of the baseline at that point.
Minesto Deep Green Holyhead Deep*	Decided	0.5MW tidal kite test development to prove functionality and power production performance in commercial scale. Commissioning of the demonstrator is planned for 2018.	HRA concluded no adverse effects on sites within the WNMP ZoI, including the sites within the proposed tidal stream SRA (Anglesey Terns / Morwenoliaid Ynys Môn SPA; Bae Cemlyn/ Cemlyn Bay SAC; North Anglesey Marine / Gogledd Môn Forol cSAC; Ynys Feurig, Cemlyn Bay and The Skerries SPA). Residual effects with future projects supported by the WNMP possible but cannot be assessed at the strategy level. Site due to be completed in 2018 so will arguably form part of the baseline at that point.
Internal Power Generation Enhancement for Port Talbot Steelworks	Decided	Potential effects on terrestrial sites within 2km of WNMP area, principally through air quality changes, notably Kenfig SAC.	HRA concluded no significant effects for Kenfig; residual in combination effects with WNMP unlikely.

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Project	Status	Summary	Interaction with WNMP
Tidal Lagoon Swansea Bay	Decided	Potentially substantial changes to marine habitats around Swansea bay during construction and operation; impacts on mobile species; etc.	HRA concluded no adverse effects although this is currently being re-explored in relation to salmon as part of the marine licensing. Residual effects from this in combination with other projects will need to be considered at the project level; possibility of lagoon accounted for in WNMP. Would be covered by WNMP provisions so in combination effects with WNMP unlikely.
South Hook Combined Heat & Power Station	Decided	Potential effects to sites within the WNMP zone of influence through surface and process waste water impacting on features within the Pembrokeshire Marine SAC; aerial emissions from the Project impacting on sensitive SAC and SPA features in the vicinity of the Project; impacts on greater horseshoe bats foraging, commuting and roosting from disturbance.	HRA concluded no adverse effects on the integrity of the Cleddau Rivers Special Area of Conservation; Limestone Coast of South and West Wales Special Area of Conservation; Pembrokeshire Bat Sites and Bosherston Lakes Special Area of Conservation; Pembrokeshire Marine Special Area of Conservation; Castlemartin Coast Special Protection Area through airborne emissions or aqueous discharges in view of this mitigation and the protection secured by the Environmental Permitting regime. Residual effects from this in combination with other projects will need to be considered at the project level.
Preesall Saltfield Underground Gas Storage	Decided	Underground gas storage facility to store / extract / inject gas into caverns formed by solution halite mining; requires discharges of hypersaline brine to the Irish sea.	HRA concluded 'no significant effects'; residual effects with projects supported by the WNMP possible but cannot be assessed at the strategy level and may form part of the baseline at that point if development completed.
Hinkley Point C New Nuclear Power Station	Decided	New nuclear power station in Somerset; significant construction / operational effects likely; zone of influence will overlap with ZoI of WNMP area; HRA completed.	HRA concluded no adverse effects on any European sites. WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.
North Wales Connection	Pre-Application	Grid connection on Anglesey, involving Menai Straight crossing; construction / operational effects on sites possible.	Menai crossing would be covered by WNMP provisions so in combination effects with WNMP unlikely.
Wylfa Newydd Nuclear Power Station	Pre-Application	New nuclear power station on Anglesey; significant construction / operational effects likely on habitats etc in the WNMP area; HRA ongoing.	New nuclear power station requiring construction in the WNMP area and abstractions / discharges. Would be in accordance with the New Nuclear NPS rather than the WNMP, which would require assessment of in combination effects at that time.
Tidal Lagoon Newport	Pre-Application	Tidal lagoon within Severn Estuary SAC / SPA / Ramsar approximately 1km from the River Usk; the furthest offshore extent is up to 8km from the foreshore towards the centre of the Severn Estuary. Significant construction and operational effects likely.	Tidal lagoons are supported by policy within WNMP. Would be covered by WNMP provisions so in combination effects with WNMP unlikely.
Tidal Lagoon Cardiff	Pre-Application	Tidal lagoon within Severn Estuary SAC / SPA / Ramsar between Cardiff Bay and the Usk; the furthest offshore extent is up to 8km from the foreshore towards the centre of the Severn Estuary. Significant construction and operational effects likely.	Tidal lagoons are supported by policy within WNMP. Would be covered by WNMP provisions so in combination effects with WNMP unlikely.

Project	Status	Summary	Interaction with WNMP
NuGens Moorside Project in West Cumbria	Pre-Application	New nuclear power station in Cumbria; significant construction / operational effects likely; zone of influence likely to overlap with ZoI of WNMP area; HRA ongoing.	New nuclear power station requiring construction outside the WNMP area and abstractions / discharges. Would be in accordance with the New Nuclear NPS, which would require assessment of in combination effects at that time. WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.
North West Coast Connections Project - N Grid	Pre-Application	New grid connection involving crossing of Morcambe Bay; zone of influence likely to overlap marginally with ZoI of WNMP area; HRA ongoing.	Would be outside the direct influence of the WNMP so in combination effects possible depending on projects that come forward (principally on mobile species that may use both areas). Would be covered by NPS, which requires project level HRA. WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.
Oldbury New Nuclear Power Station	Pre-Application	New nuclear power station in Gloucestershire, likely to affect Severn Estuary. Significant construction / operational effects likely; zone of influence will overlap with WNMP area; project parameters not certain.	Would be outside the direct influence of the WNMP so in combination effects possible depending on projects that come forward (principally on mobile species that may use both areas). Would be covered by NPS, which requires project level HRA. WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.
Avon Power Station 950 MW output	Pre-Application	New gas power station in Gloucestershire, likely to affect Severn Estuary. Significant construction / operational effects likely; zone of influence will overlap with WNMP area; project parameters not certain.	Would be outside the direct influence of the WNMP so in combination effects possible depending on projects that come forward (principally on mobile species that may use both areas). Would be covered by NPS, which requires project level HRA. WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.
The West Somerset Tidal Lagoon	Pre-Application	Tidal lagoon on north Somerset coast; Significant construction / operational effects likely; zone of influence will overlap with WNMP area; project parameters not certain.	Would be outside the direct influence of the WNMP so in combination effects possible depending on projects that come forward (principally on mobile species that may use both areas). WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.

Project	Status	Summary	Interaction with WNMP
Seabank 3 CCGT	Pre-Application	New Combined Cycle Gas Turbine (CCGT) power station immediately adjacent to the existing Seabank Power Station; within 400m of Severn Estuary. Significant construction / operational effects likely; zone of influence will overlap with WNMP area; project parameters not certain. HRA ongoing.	Would be outside the direct influence of the WNMP so in combination effects possible depending on projects that come forward (principally on mobile species that may use both areas). Would be covered by NPS, which requires project level HRA. WNMP requires projects to comply with Habitats Regulations, including in combination assessment, so mechanism for avoiding effects in place; in combination effects with projects supported by the WNMP possible but cannot be assessed at the strategy level.
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	Pre-application	Proposed array of tidal stream devices, although Tidal Energy Ltd. is in administration and no further information on the scheme is available. The proposal has interactions with the Severn Estuary and may share receptors linked to far field effects.	Tidal Energy Ltd. is in administration and no further information on the scheme is available, although it would fall within the SRAs if progressed.
Minesto Deep Green Holyhead Deep – 80MW	Pre-application	Proposed extension of Holyhead Deep tidal kite array to increase capacity of 80MW; site intended to be developed in three phases as part of a deploy-and-monitor approach. Minesto has submitted a scoping report to UK consenting authorities Marine Management Organisation (MMO) and Natural Resources Wales (NRW), asking for their scoping opinion for development of an 80 MW site in Holyhead Deep.	Would be covered by WNMP provisions so in combination effects with WNMP unlikely.

11.7 Summary

11.7.1 The Habitats Regulations requires that the potential effects of a plan on European sites must also be considered 'in combination with other plans or projects'. Whilst 'within plan' in combination effects can be considered as part of the general assessment, the wide range of external plans and programmes, and their varied approaches to HRA, ensures that attempting to define and assess specific effects at a strategic scale is not practicable to any meaningful extent. This aspect is complicated further by the fact that many activities (for example fishing) are not subject to the HRA process.

11.7.2 The review of plans and projects for 'in combination' effects was necessarily high level due to the strategic nature of the marine plan and the uncertainties inherent within it. 'In combination' effects will therefore need to be revisited and addressed in a more comprehensive manner at the project-level when more detailed information is available. However, the WNMP includes appropriate plan-level mitigating provisions within it that will minimise the risk of 'in combination' effects as a result of activities within the WNMP area.

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12. Conclusion of Screening and Appropriate Assessment

12.1 Overview

12.1.1 The WNMP is a high-level policy-led plan for guiding marine decision making over the next 20 years. Due to its wide geographic scale, high-level and long-term outlook there are inevitably a large number of uncertainties inherent within it. In particular, whilst it is a spatial planning document, the extent to which it determines or controls where activities may take place is variable, and limited. Whilst the WNMP identifies SRAs for some sectors, the associated sector policies do not preclude activities outside of the SRAs nor dictate how proposals may be delivered within an SRA.

12.1.2 With regard to HRA, the spatial nature of the plan means that potential effects on specific European sites are easy to envisage (due to the specific nature of the SRAs and the known 'sensitivities' of the interest features), but much harder to accurately identify, quantify and assess (due to the strategic nature of the plan and the absence of detailed information on any activities). The strategic nature of the WNMP is therefore reflected in the HRA of the WNMP, which is necessarily a strategic assessment.

12.1.3 It is important that the WNMP does not impose policies or planning constraints that are likely to make the avoidance of adverse effects unachievable at the project-level, if projects remain in accordance with the plan. It is therefore necessary, within the limitations established, for the HRA to identify potential pathways for effects to occur, and to ensure that the policies do no create a framework that ensures those effects are likely or unavoidable.

12.2 Screening

12.2.1 The screening assessment had two principal components:

- A screening of European sites to identify those that will not be affected by the outcomes of the WNMP (alone or in combination) and those with features that are vulnerable (i.e. exposed and sensitive) to the potential outcomes of the WNMP; and
- A screening of the WNMP policies to determine those which:
  - cannot result in negative impacts on any European sites (e.g. a policy advocating the protection of European sites); and
  - should not or cannot be assessed by the HRA of the WNMP (even though a theoretical effect pathway exists) as there is no practical way of completing a meaningful assessment (i.e. they are 'screened in' but assessment must be deferred to a lower tier in the planning hierarchy).

12.2.2 The screening of the European sites was based on the anticipated physical 'zone of influence' of the WNMP (50km beyond the WNMP boundary in marine areas, and 2km inland). Essentially, all European sites within the ZoI were considered to be potentially exposed to the outcomes of the WNMP, along with sites supporting mobile species that may be dependent on habitats (etc) within the ZoI or which could otherwise be affected by activities within the WNMP area. This effectively included:

- all European sites associated with the MMUs for marine mammals using the ZoI;
- all bat sites within 20km;
- all European sites designated for diadromous fish that discharge into the Irish or Celtic Seas;

- all UK and Irish seabird SPAs (principally due to uncertainties over the use of the Irish Sea in winter, since many sites / species could be excluded during the breeding season based on Thaxter *et al.* (2012) foraging distances);
- European sites in the UK and Ireland supporting wintering wildfowl and waders birds that could migrate across the WNMP area, based on Wright *et al.* (2015).

12.2.3 With regard to the screening of the WNMP policies:

- All of the general cross-cutting policies in the WNMP (see **Table 2.2**) are considered to be 'no significant effect' policies as they are invariably 'General statements of policy / aspiration', 'General design / guidance criteria or policies that cannot lead to or trigger development' or 'Environmental protection policies'; these have been screened out from further assessment.
- Many of the sector policies either provide no additional clarity on the location, scale etc. of future development (essentially, sectors or aspects with no SRAs), or reflect or incorporate external plans or programmes that have been subject to HRA (e.g. oil and gas licensing). In these instances, it is accepted that the possibility of significant effects cannot be definitively excluded but that assessment must be deferred to a lower planning tier or the project level.
- The sector policies with SRAs were not screened out and were subject to additional assessment to determine whether the designation of the SRAs is likely to result in significant adverse effects.

12.3 Appropriate Assessment

12.3.1 The appropriate assessment stage focused on those sectors with SRAs, specifically aggregates, aquaculture, ports and shipping and energy – low carbon (wave, tidal stream and tidal lagoons). This assessment identified those European sites likely to be exposed to WNMP-supported activities taking place within the SRAs (based on the screening criteria noted above) and, where possible, assessed whether these activities would adversely affect the conservation status of the interest features. This took account of the various measures available to help prevent adverse effects occurring, including the requirements for project level HRA and the general cross-cutting protective policies within the WNMP.

12.3.2 The SRAs primarily identify areas of potential growth for each sector; investigations and proposals for the designated activities within these areas are then encouraged by the policies, and the SRAs safeguarded accordingly. However, the related sector policies are not prescriptive and do not provide further clarity or control on the scale, nature or precise location of future activities or developments within the SRAs; nor is the overall scale of future activity implied or set at the plan-level[50].

12.3.3 Whilst potential impact pathways can be identified for sector activities, the inherent uncertainties ensure that a plan-level HRA cannot necessarily exclude the possibility of significant or significant adverse effects on many European sites solely through the technical analysis of anticipated outcomes and scenarios – the data are too partial to allow reasonable assessment. These uncertainties are inevitable in broad multi-sectoral marine planning where the regime is in its infancy and are best addressed by policy safeguards within the plan; a requirement for project-level HRA; and regular review of the plan to ensure it reflects the best available current knowledge.

12.3.4 However, whilst the WNMP does not explicitly exclude the possibility of adverse effects occurring, there is nothing inherent in the scale of the activities or the locations / extents of the proposed SRAs that would make adverse effects unavoidable at the project level, given the safeguards contained within the WNMP. It is evident from existing projects in the marine environment (including offshore windfarms, aggregates extraction, cable and pipeline laying, aquaculture schemes, marine renewables etc.) that adverse effects are avoidable, and that project-level mitigation and avoidance measures are available, achievable and likely to be effective in preventing adverse effects on European sites from occurring. Furthermore, the WNMP does not

[50] In contrast to allocations in a land use plan, where (for example) anticipated housing numbers may be set.

restrict how future schemes might be delivered (indeed, the policies do not restrict delivery to the SRAs identified) and so sufficient flexibility is retained within the scope of the policies to ensure that future schemes can be delivered without adverse effects. Mitigation and avoidance measures are also provided at the plan-level. All proposals will be subject to project level HRA as part of the consenting procedure, and the general cross-cutting protective policies within the plan will provide safeguards for European sites. The three-yearly WNMP review process will also provide a mechanism for monitoring and reviewing policy performance; this will be based on accumulated evidence from future project- and strategic studies, and hence ensures that effects that cannot currently be assessed as part of a plan-level HRA can be appropriately captured and addressed in future revisions of the policies or the SRAs.

12.3.5 Overall, whilst the plan-level HRA is reliant, at least in part, upon project-level HRA, it is considered that the measures within the WNMP will ensure that there will be no adverse effect on the integrity of any European sites, alone or in combination, in relation to the aggregates, aquaculture, ports and shipping, wave and tidal stream policies.

12.3.6 The exception to the above is the tidal lagoon supporting policy element of Policy ELC_01. Policy ELC_01 does not explicitly exclude the possibility of a development with adverse effects benefitting from the policy and, unlike other policy sectors (e.g. tidal stream), the assumed inherent scale of most tidal lagoons ensures that significant adverse effects would appear to be a 'likely' outcome for any developments coming forward under the policy as potential adverse effects cannot obviously be avoided through siting or established project-level avoidance and mitigation measures. Whilst the policy is caveated by other policies within the plan, it is considered that the nature of tidal lagoons ensures that adverse effects on European sites or interest features, particularly habitats, fish and birds, cannot clearly be avoided at the project level, regardless of the policy controls or known project-level measures.

12.3.7 Regulation 103(1) of the Habitats Regulations states that "If the plan-making authority are satisfied that, there being no alternative solutions, the land use plan must be given effect for imperative reasons of overriding public interest [IROPI]…they may give effect to the land use plan notwithstanding a negative assessment of the implications for the European site or the European offshore marine site…". The policy alternatives are examined in **Section 13**.

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13. Assessment of Alternative Solutions, IROPI and Compensatory Measures

13.1 Introduction

13.1.1 The Appropriate Assessment undertaken in relation to policy support for tidal lagoons (plan policy ELC_01) (see **Section 10**) has concluded that it is not possible to rule out the possibility that one or more adverse effects on site integrity may arise as a consequence of this plan policy. Therefore, in relation to the tidal lagoon supporting text in Policy ELC_01, a case for adopting the plan under the provisions afforded by Article 6(4) of the Habitats Directive is set out below. Whilst a case for adopting the WNMP under Article 6(4) is established for the draft WNMP, this is a high level, strategic document and accordingly, this HRA also clearly sets out that any tidal project proposed must itself be assessed in accordance with and comply with the requirements of the Habitats Directive. The Article 6(4) case set out here in no way affects the level of detail, rigour or scrutiny that must be applied to the determination of an individual project proposal.

13.1.2 This section of the HRA report summarises the assessment of alternatives solutions to the proposed renewable energy 'supporting' policy which contains in principle support for tidal lagoons in line with the requirements of Article 6(4) of the Habitats Directive (Council Directive 92/43/EEC[51]) as implemented in the UK by the Conservation of Habitats and Species Regulations, 2010[52]. Welsh Government's conclusions, as to whether alternative solutions to the policy meet the relevant objectives, are set out followed by a case for Imperative Reasons of Overriding Public Interest (IROPI) and consideration of appropriate compensatory measures.

13.2 Overview

13.2.1 The Welsh National Marine Plan (WNMP) is currently being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA) and the UK Marine Policy Statement (MPS). The MPS is the framework for the UK marine planning systems. It provides the high-level policy context within which national and sub-national Marine Plans will be developed, implemented, monitored, amended and will ensure appropriate consistency in marine planning across the UK marine area.

13.2.2 As set out in the MPS[53], marine plans will 'provide for greater coherence in policy and a forward-looking, proactive and spatial planning approach to the management of the marine area, its resources, and the activities and interactions that take place within it.' and will 'provide detailed policy and spatial guidance for an area and help ensure that decisions within a plan area contribute to delivery of UK, national and any area specific policy objectives'[54].

13.2.3 The Draft WNMP sets out policy supporting future use by various sectors operating in Welsh seas including marine renewable energy. In relation to marine renewable energy, the MPS states that "*A secure, sustainable and affordable supply of energy is of central importance to the economic and social well being of the UK. The marine environment will make an increasingly major contribution to the provision of the UK's energy supply and distribution. This contribution includes the oil and gas sectors which supply the major part of our current energy needs, and a growing contribution from renewable energy and from other forms of low carbon energy supply in response*

[51] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31992L0043&from=EN

[52] http://www.legislation.gov.uk/uksi/2010/490/contents/made

[53] MPS para 1.1.1 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

[54] MPS para 1.1.3

to the challenges of tackling climate change and energy security. Contributing to securing the UK's energy objectives, while protecting the environment, will be a priority for marine planning."[55]

13.2.4 It also states that "The UK faces a significant challenge in achieving a secure, affordable low carbon energy supply. The Climate Change Act 2008 and Climate Change (Scotland) Act 2009 established a long-term framework to cut greenhouse gas emissions by at least 80% below 1990 levels by 2050, and the Climate Change Committee recommended that the electricity sector needed to be largely decarbonised by 2030. As part of our move to a low carbon energy economy, the UK must meet a legally binding EU target for 15% of energy consumption to come from renewable sources by 2020"[56] and that "A significant part of the renewable energy required to meet these targets and objectives will come from marine sources"[57].

13.2.5 The MPS goes on to state that "When developing Marine Plans, marine plan authorities should identify how these will contribute to delivery of national targets and priorities, including legally binding commitments entered into under the Renewable Energy Directive (Directive 2009/28/EC) and our domestic binding target to reduce greenhouse gas emissions by 80% by 2050. This will include taking account of preferred areas for development of different energy sources, generation and distribution infrastructure and, if appropriate, setting out potential new opportunities, taking into account the most sensitive areas for biodiversity and considering carefully areas with competing and incompatible uses."[58]

13.2.6 In line with the MPS, the draft WNMP identifies areas of future potential development for some sectors. It does not set or quantify the scale of future growth, but provides a combination of general and sector specific policies to encourage and guide decisions on the future sustainable use of the marine area. It does not 'allocate' areas for future development (in the manner of a Local Plan) but includes mapped RAs and SRAs that set out the extent of a resource (such as renewable energy, aggregates or aquaculture) and smaller area(s) (the SRA(s)) that may be suitable for future development of that sector; the draft plan seeks to safeguard these resources for potential future use.

13.2.7 The draft WNMP SRAs do not imply that any project coming forward in such an area will automatically be consented nor that any project outside of an SRA will not be appropriate. Individual projects that come forward in the marine plan area will each be subject, as a matter of statutory requirement (e.g. Regulation 61 of the Conservation of Habitats and Species Regulations 2010), to project level Habitats Regulation Assessment (HRA) and other considerations as appropriate.

13.2.8 The Habitats Regulations Assessment of the emerging WNMP has concluded that most proposed policy areas will have no significant effects or no significant adverse effects on integrity of European sites. Where policies have a spatial context, in most instances the plan level HRA identified that because the areas identified as potentially being suitable for future use are so broad there is sufficient scope for mitigation at the project level to enable the plan-level HRA to conclude no likely adverse effect.

13.2.9 The exception to the above is the 'supporting' policy ELC_01 in the draft WNMP associated with marine renewable energy, where this makes reference to tidal lagoons (see box). Policy ELC_01 strongly encourages all types of marine renewable energy generation (wind, tidal and wave energy) … *especially: in corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas*.

13.2.10

[55] MPS para 3.3.1
[56] MPS para 3.3.2
[57] MPS para 3.3.3
[58] MPS para 3.5.5

Policy ELC_01

Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:
a) in corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and
b) in corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

- **renewable energy Strategic Resource Areas; and**
- **wider natural resources that provide renewable energy potential;**

in order to support the sustainable growth of the renewable energy sector through marine planning.

13.2.11

13.2.12 The draft WNMP also has a wide range of general policies that guide projects and decision makers including policy ENV_02 which relates to safeguarding Marine Protected Areas including European Sites:

13.2.13

Policy ENV_02

Proposals should demonstrate how they:

- **avoid adverse impacts to individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; and**
- **have regard to the measures to manage MPAs.**

13.2.14

13.2.15 Notwithstanding policy ENV_02 of the draft WNMP, the Habitats Directive applies to all plans and projects that may have an adverse effect upon a European Sites. All project applications requiring authorisation must be compliant with the requirements of the Directive.

13.2.16 Having considered the evidence, the plan level HRA was unable to conclude that policy ELC_01 as it relates to tidal lagoons was not likely to have a significant effect upon European sites (A6(2)), and as a consequence it has been necessary to proceed to Appropriate Assessment (AA) (A6(3)). A more detailed Appropriate Assessment has therefore been carried out with respect to that part of ELC_01 policy relating to tidal lagoons.

13.3 Summary of the Appropriate Assessment (AA) of Policy ELC_01 in relation to tidal lagoons

13.3.1 In order to understand the implications of tidal lagoon policy in ELC_01 upon European Sites, a more detailed Appropriate Assessment (AA) has been undertaken. The AA looks at whether a significant adverse effect is likely on the European site(s) in line with their conservation objectives.

13.3.2 The AA of policy ELC-01 has concluded (see Sections 10.3 and 12.3, and Appendices G - I) that at plan level, it has not been possible to rule out an adverse effect on integrity of those sites supporting migratory fish, intertidal habitats and intertidal habitats that may support feeding and / or roosting of birds. More specifically this relates to the following habitats and / or species:

- Estuarine habitats (estuary, intertidal mudflats and sandflats, subtidal sandbanks, Atlantic salt-meadow, reefs);
- Impacts on birds through the loss or reduction in foraging and roosting/resting potential via direct habitat loss and/or changes to habitat composition, and via increases in energy budget deficits, through loss of foraging quality and time, increased competition and disturbance. In particular, for waders and many duck species the main impacts are the reduction of supporting

intertidal mudflat habitat and for other species of duck, divers and some seabirds through changes to the subtidal supporting habitat, although with other potential effects through collision mortality.

- Migratory and estuarine fish species (Allis shad, Twaite shad, river lamprey, sea lamprey, Atlantic salmon) through presenting a barrier to movement, collision risk, and construction noise dependent on species. Some sensitivities to habitat change during construction were also identified.

13.3.3 The Mammals AA, however, has concluded no adverse effects on mammal species, including otter.

13.3.4 The main impact pathways which potentially impact these features during the construction and operation of tidal lagoons are considered to be:

- Construction: establishment of the sea wall, piling, dredging and disposal, collision risk, noise, vibration, light, discharges and non-native introduction.
- Operation: presence (formation of a barrier, hydrodynamic processes), water impoundment and release (hydrodynamic processes), turbine operation, electro-magnetic fields, noise, light, and non-native introduction.

13.3.5 The main potential adverse effects are changes in the depositional environment (and suspended solids), changes in water quality, species disturbance or that of their prey, loss or change to habitat, fragmentation of habitat, direct damage to species (turbines), barriers to movement, and changes to predation.

13.3.6 However, the AA also acknowledges that actual impacts may be reduced to the point of them being not adverse or even not significant through the application of avoidance and mitigation measures put in place at project level, at which time the precise locations of interest may be determined and the nature of the development is known and such measures can be deployed to address and reduce environmental impacts.

13.3.7 Based upon the Appropriate Assessment (AA) findings, Welsh Government considers it is reasonable to conclude that avoidance, mitigation or compensatory measures available at project level may be sufficient to avoid and / or mitigate the adverse effects on the integrity of European Sites identified in the HRA. However, it seems likely for certain locations or large scale or multiple lagoons in the SRAs and / or outside of the SRAs, the available avoidance and or mitigation measures may not be effective in ensuring the avoidance of all adverse effects upon the integrity of European Sites. The AA therefore concludes that it has not been possible to rule out the possibility that one or more adverse effects on site integrity may arise as a consequence of this plan policy.

13.3.8 In practice, the relevance and effectiveness of any avoidance, mitigation or compensatory measures identified can only be identified with confidence through the HRA process at the project level, where the specific details of developments and specific data sources will be available.

13.3.9 If policy ELC_01 in its current form is to form part of the draft WNMP, then Welsh Government needs to consider the merit and applicability of applying the Article 6(4) IROPI process.

13.4 The Article 6(4) IROPI process

13.4.1 Where, upon assessment, it cannot be excluded on the basis of objective information that the policy supporting tidal lagoons in SRAs in the draft WNMP will have a significant adverse effect upon European Sites, then either the plan or policy must be amended or (if appropriate) the plan be taken forwards under derogation procedures afforded by Article 6(4).

13.4.2 The derogation process allows such plans or projects to be approved provided three specific and sequential tests are met:

- there are no feasible alternative solutions to the plan or project which are less damaging;

- there are "imperative reasons of overriding public interest" (IROPI) for the plan or project to proceed; and
- compensatory measures are secured to ensure that the overall coherence of the network of European sites is maintained.

13.4.3 The remainder of this section explains on what basis Article 6(4) of the Habitats Directive has been applied to inform a decision as to whether to, or on what basis to, proceed with the draft WNMP that contains ELC_01 policy which is supportive in principle of the development of tidal lagoons in an SRA.

13.4.4 The following sections provide the statement of case for the application of A6(4).

13.5 Habitats Directive Article 6(4) - Assessment of Alternatives

13.5.1 The purpose of the alternative solutions consideration is to determine whether there are any other feasible ways to deliver the overall objective **of the plan or project** which will be less damaging to the integrity of the European site(s) affected – in this instance the draft WNMP policy that is supportive of the development of marine renewable energy generally (and as it relates to tidal lagoons within the defined SRA). The plan or project (i.e. Policy ELC_01 of the WNMP and which is set out in the context of the narrative of section ELC of the plan as a whole) can only proceed to be considered in relation to IROPI if there are no alternative solutions. An alternative solution should be financially, technically and legally feasible and have a lesser effect on the integrity of the European site(s) affected by the proposals. The following assessment considers the options to resort to an alternative solution which better respects the integrity of the European Sites in question.

13.5.2 In keeping with European Commission guidance[59] and UK Government's interpretation of the requirements of Regulation 103 (Defra 2012)[60] there is a requirement to identify a range of possible alternative ways of achieving the objectives of the project or plan and these alternatives can then be assessed against their likely impact upon the conservation objectives of the Natura 2000 site.

13.5.3 This assessment therefore only relates to consideration of options on tidal range and does not include alternatives to policy on renewable energy or other energy sources. It focuses on ways in which the WNMP Policy ELC_01could be drafted or delivered in a way which would be less damaging to the integrity of the European sites affected whilst still fulfilling the policy objectives set out below. It also includes the assessment of the 'do nothing' alternative.

Purpose of the tidal lagoon policy ELC_01

13.5.4 In order to assess alternative options, the objectives of the policy are a relevant consideration.

13.5.5 In response to the drivers and evidence referred to in Annexe 1 (Appendix J), and support sustainable development through decarbonsation of the economy and supporting energy security the WNMP seeks to "*Maximise the opportunity to sustainably develop marine renewable energy resources, helping to achieve the UK's energy security and carbon reduction objectives, whilst fully considering other's interests and ecosystem resilience*"

13.5.6 Given the abundant, predictable and reliable tidal energy natural resource in the WNMP area, Welsh Government considers that tidal energy has an important role to play in the energy mix and that tidal range captured through tidal lagoon technology should be encouraged as part of the energy mix where projects can be shown to be sustainable (further detail in Annexe 1, Appendix J). The draft WNMP therefore includes the sector-specific marine renewable energy objective:

[59] EC Assessment of plans and projects significantly affecting Natura 2000 sites – Methodological Guidance to A6(3) & 6(4); http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

[60] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69622/pb13840-habitats-iropi-guide-20121211.pdf

13.5.7 "To contribute significantly to the decarbonisation of our economy and blue growth by increasing the amount of low-carbon marine energy generated, by:

- *Supporting the development and demonstration of tidal stream and wave energy technologies over the next 5-10 years;*
- *Increasing (where appropriate) the number of generation devices deployed in commercial scale developments over the next 10-20 years;*
- *Supporting (where appropriate) further commercial development of offshore wind and tidal lagoon technologies over the next 5 – 10 years taking advantage of any favourable UK Government financial mechanisms under the Contract for Difference;*
- *Promote evidence gathering and research on tidal range development to support the sustainable development and deployment of the technology; and*
- *Supporting the nuclear energy sector.*"

13.5.8 The policy objectives have been applied in the context of the overall approach to the WNMP (Section 1) which is:

- The proposed supporting and safeguarding policies (ELC-01 & ELC_02) of the draft WNMP recognise the significance of the tidal range resource around Wales and its potential contribution to long-term renewable energy generation.
- The supporting policy (ELC_01) which is being considered under Article 6(4) is intended to signal Welsh Governments desire to see successful tidal lagoon projects come forwards in areas considered to offer the greatest potential for successful deployment thereby contributing meaningfully to draft WNMP objectives.

Scope of Assessment of Alternatives

13.5.9 The alternatives assessed for the tidal lagoon policy by Welsh government are:

i. No specific reference to tidal lagoons in policy ELC_01, i.e. explicit exclusion of reference to tidal lagoons

ii. Consider other forms of tidal range generation (other than lagoons)

iii. No SRA for tidal lagoons

iv. Alternative or smaller SRAs

v. Use of European site safeguarding criteria or exclusions

vi. Policy support for further sector investigation only

Assessment of Alternatives

Exclusion of reference to tidal lagoons whilst supporting other marine renewable technologies

13.5.10 Under this alternative, tidal lagoons would be explicitly excluded from this policy whilst there is policy support for other types of marine renewable technologies.

13.5.11 ELC_01 refers to several renewable energy technologies: wave, tidal stream and tidal lagoon and there is support in the overall policy for all types of marine renewable technologies. It is the inclusion of reference of in principle support for tidal lagoons that has prompted this 6(4) case in the HRA.

13.5.12 As stated above, the policy contains no pre-conceptions or pre-determinations on licence decisions and the supporting narrative emphasises that such determinations must be subject to rigorous statutory assessments of potential environmental impacts. The WNMP supports this wider regulatory regime. The policy support for tidal lagoon development is not therefore unequivocal

and is contingent on the other policies in the plan (including in relation to sustainability), as well as statutory processes.

13.5.13 The absence of any reference in the policy to tidal lagoons would not reduce the likelihood of such schemes being proposed. Tidal lagoon technologies have already been proposed in the WNMP area and there is no reason to assume that this will not continue with or without a policy in place; investigations are already underway for lagoons at Cardiff and Newport and potentially in relation to north Wales and the Swansea Bay Tidal Lagoon project is under determination for a marine license having already received Development Consent from the Secretary of State. Clearly, therefore, tidal lagoon projects may be proposed in the plan area with or without a tidal lagoon policy in the WNMP. The presence of the policy would not mean that such proposals were more or less likely to be made nor that they were more or less likely to be authorised.

13.5.14 The absence of a policy for this rapidly developing sector would have several disadvantages for marine planning in general (particularly regards safeguarding). Not having some form of tidal lagoon supporting policy for a long-term plan (20 years horizon) is considered untenable; further, not including tidal lagoon policy does not help deliver the objectives of the draft WNMP set out above.

13.5.15 As set out in Appendix J, there is an imperative need to decarbonise the economy and Welsh Government considers that marine energy must be an important part of that mix in order to achieve the relevant policy objectives. Marine renewable energy alternatives to tidal energy under this alternative have been considered. However, tidal range energy represents a significant resource around the Welsh coast which has the potential to contribute significantly to our decarbonisation objectives. Tidal lagoon technology, which has potential to capture this technology during the lifetime of the WNMP therefore needs to be part of the marine renewable energy mix alongside tidal stream, wave and wind technologies because of its potential scale coupled with advantages over other technologies such as predictability and reliability.

13.5.16 Not referring to tidal lagoons in the policy for renewable energy is therefore considered inappropriate, because the alternative in effect creates a policy vacuum which is inconsistent with the Welsh Government's objectives for a low-carbon economy, including the objective to promote marine renewable energy technologies including energy from tidal range through tidal lagoons.

13.5.17 Even in the absence of policy ELC_01 with regards tidal lagoons, it is likely that some projects, including some that may have adverse effects, would be brought forward for consideration in any event, so even not having the policy would not rule out such projects. Therefore, this alternative solution would not perform better than the proposed policy, or be less likely to result in significant effects, or be less damaging to the integrity of any European site(s) that may ultimately be affected.

13.5.18 This alternative, therefore, does not achieve the objectives set out above nor does it result in greater protection for European sites.

Consider alternative forms of tidal range generation (other than lagoons)

13.5.19 Under this option, Tidal Barrage technology (i.e. impoundment of a water course by developing a fixed structure between 2 points e.g. of a river estuary mouth) would be presented as an alternative to capturing the tidal range energy and contributing to the Welsh Governments objectives of increasing marine renewable energy and capturing tidal range power.

13.5.20 A substantial amount of work was undertaken in relation to reviewing strategic barrage and lagoon tidal range options for the Severn estuary, including the large cross-Severn tidal barrage (Severn Tidal Feasibility Study, STFS, 2010).[61] Whilst Welsh Government does not rule out other tidal range options in line with the findings of the STPFS, it believes that tidal lagoon technologies have the greatest immediate potential to deliver marine renewable related energy generation objectives at a scale and pace appropriate to the relevant objectives and drivers to secure a low carbon economy.

61 https://www.gov.uk/government/collections/severn-tidal-power-feasibility-study-conclusions

13.5.21 Compared to a barrage, the environmental implications of lagoons, whilst they may not be insignificant in some locations, nevertheless are considered to be less than the barrage options presented as part of the STFS and are comparable (when scaled to the energy outputs) to other forms of renewable energy development.

13.5.22 This alternative does potentially achieve the objectives set out above but it may result in greater damage to European sites and is therefore discounted as an option relative to the policy expressing support for tidal lagoons.

No SRA for tidal lagoons

13.5.23 Under this alternative, there is in principle support for tidal lagoon developments under the ELC_01 policy but no specific SRA related to the policy.

13.5.24 The draft WNMP has been developed in conformity with the UK MPS to reflect and guide current and likely future use of the Welsh marine panning area. In terms of including spatial policy, the MPS states that *'Marine Plans will set out how the MPS will be implemented in specific areas. They will provide detailed policy and spatial guidance for an area and help ensure that decisions within a plan area contribute to delivery of UK, national and any area specific policy objectives'.* The purpose of identifying Strategic Resource Areas in the draft WNMP for tidal lagoons is consistent with the MPS, the wider approach for other sectors and appropriate to support delivery of the plan vision and objectives by taking a spatial approach to policy.

13.5.25 The tidal lagoon SRA helps to focus the supporting and safeguarding policies at a strategic level. Given the potential scale and significance of tidal lagoons it is appropriate to identify broad areas for potential future use to provide a strategic policy context for decision making. Doing so ensures that these areas are clearly identified and appropriately safeguarded and will assist the scoping and assessment of alternatives at project level.

13.5.26 The alternative of no spatial policy for tidal lagoons in the draft WNMP is considered inappropriate because the area where there is tidal range resource is relatively well understood. The extent of the resource is a key determinant of the locations likely to be viable options for a potential project.

13.5.27 Not having an SRA for tidal lagoons in the policy for marine renewable energy is therefore considered inappropriate, because this alternative leaves greater uncertainty in terms of the areas potential suitable for consideration for tidal lagoons. The alterative does not deliver against the objectives set out above.

13.5.28 Even in the absence of policy ELC_01 with regards tidal lagoons, it is likely that some projects, including some that may have adverse effects, would be brought forward for consideration in any event, so even not having the policy would not rule out such projects. Therefore, this alternative solution would not perform better than the proposed policy, or be less likely to result in significant effects, or be less damaging to the integrity of any European site(s) that may ultimately be affected.

13.5.29 This alternative, therefore, does not achieve the objectives set out above nor does it result in greater protection for European sites.

Alternative or smaller SRAs.

13.5.30 Under this alternative, the spatial areas related to tidal lagoons under policy ELC_01 are reduced in scale taking into account potential adverse effects at the plan scale. Alternative SRAs may mean, for example, not including one of the SRA areas; smaller SRAs may mean smaller areas covered by the SRAs.

13.5.31 The WNMP is a long-term plan (20-year view) and the tidal lagoons sector is at an early stage of development and is changing rapidly. It would be inappropriate to be overly prescriptive, based upon current information and to refine SRAs further at this stage. Allowing a greater flexibility for the sector to develop (i.e. retaining larger areas that relate to policy ELC_01) should support sustainable development by allowing appropriately detailed location decisions to be taken at the project level. This would enable projects to have the flexibility to avoid or mitigate adverse effects upon European Sites wherever possible. Further, there is no guarantee that providing a greater

level of prescription by focusing on smaller areas based on partial information would result in a lesser potential for effect on European sites given the uncertainty arising from limited evidence available at the local scale, the number of potential receptors involved (species and habitats) and number of impact routes coupled with the developmental nature of the sector.

13.5.32 The level of understanding of potential impacts and the ability of projects to reduce these impacts by mitigation and avoidance is not known at smaller scale to be able to refine SRAs. Such ability to offer refinement comes at project level not at plan level assessment i.e. by way of project application. There is also the risk of unintended consequences – of trying to provide greater prescription with limited information which whilst intended to avoid adverse impacts may result in unforeseen impacts upon an alternative site feature. Retaining broad SRAs provides support for further sector specific planning and project level appraisal to ensure the right development in the right place.

13.5.33 The alternative of no SRA off the South Wales coast is inappropriate given the extent of the tidal resource in this area and the possibility of developing a sustainable project of some scale within this SRA area. The alternative of no SRA off the North Wales coast is considered inappropriate given the extent of the tidal resource in this area and the possibility of developing a sustainable project of some scale within this SRA area. Potential adverse effects could occur across both SRAs and which would need to be managed at the project scale. No SRA alternative obviously has fewer or lesser impacts upon European sites.

13.5.34 This alternative is discounted because it would be inappropriate, at the plan level, to reduce the area covered by the SRA, given the objective to maximise marine renewable energy. Furthermore, the likely scale of tidal lagoons and the potential exposure of wide-ranging mobile species to significant effects ensures that no alternative (or smaller) SRA would be able to avoid the same potential effects. Therefore, the 'alternative SRA' or 'smaller SRA' alternatives would not perform better than the proposed policy, or be less likely to result in significant effects, or be less damaging to the integrity of any European site(s) that may ultimately be affected.

13.5.35 This alternative, therefore, does not achieve the objectives set out above nor does it result in greater protection for European sites.

Use of European site safeguarding criteria or exclusions within SRAs.

13.5.36 Many plans and policy documents use safeguarding criteria or policies that provide a plan level control over certain aspects of developments (e.g. scale, location or timing). Such plan level protective measures are intended to ensure certain receptors, understood to be at particular risk, are not affected. Safeguarding criteria may be of an overarching nature, generic or specific.

13.5.37 Safeguarding criteria or policies in the WNMP might therefore be achieved through, for example:

- an overarching policy precluding development that would have adverse effects on any European site (this is sometimes employed in plans using caveats such as '*development proposals will only be in accordance with this plan and will only be permitted if there are no adverse effects on the integrity of…*' etc.);
- the identification of generic but precautionary criteria e.g. exclusion areas, based on the typical sensitivities of the interest features of every site that is potentially vulnerable (e.g. '*no development will be permitted within 50km of an SAC designated for its harbour porpoise populations…*'); or
- the identification of bespoke site-specific criteria, e.g. exclusion areas, based on specific analysis of every site that is potentially vulnerable (e.g. '*no development will occur within 50km of* [x] *SAC…*').

13.5.38 Having considered the potential to include safeguarding criteria, this alternative has been rejected for the following reasons:

- Overarching criteria:

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- This approach would exceed the provisions of the Habitats Directive, which allows developments to take place where they are able to meet the requirements of the Article 6(4) derogation. The approach would be disproportionately restrictive for the WNMP and reduce opportunities to meet the objectives set out above.

- Generic criteria (e.g. locational):
  - This alternative is impractical because there is insufficient detail and evidence available at this time about potential individual projects to be able to pre-determine appropriate high level or bespoke exclusions or conditions, without potentially undermining the objectives of the plan policy.
  - Further, the use of exclusion areas, based upon incomplete evidence, may prematurely exclude some areas from detailed consideration and / or result in unintended consequences.
- Bespoke criteria (e.g. locational):
  - This alternative is impractical because there is insufficient detail and evidence available at this time about potential individual projects to be able to pre-determine appropriate high level or bespoke exclusions or conditions, without potentially undermining the objectives of the plan policy.
  - Further, the use of exclusion areas, based upon incomplete evidence, may prematurely exclude some areas from detailed consideration and / or result in unintended consequences.

13.5.39 In summary, the current evidence base provides insufficient information for the development of meaningful or defensible safeguarding criteria or exclusions at the plan level. Much of the evidence that would be needed to identify such criteria needs to come from project level environmental impacts assessments and in the absence of this resolution of information and the high-level nature of the proposed policy it would be inappropriate for Welsh Government to set such criteria at the plan-level at this stage.

13.5.40 Overall, therefore, this alternative is discounted because i) it is considered that overarching criteria would exceed the provisions of the Habitats Directive and ii) in relation to generic or bespoke safeguarding criteria there is insufficient detail and evidence available at this time to allow the identification of appropriate generic and safeguarding criteria.

13.5.41 Therefore, this alternative would not perform better than the proposed policy, or be less likely to result in significant effects, or be less damaging to the integrity of any European site(s) that may ultimately be affected.

13.5.42 This alternative, therefore, does not achieve the objectives set out above nor does it result in greater protection for European sites.

Policy support for further sector investigation only

13.5.43 Under this option, support for tidal lagoons under ELC_01 is removed but relevant public bodies and others with an interest are encouraged to proactively gather information to support strategic planning for the sector.

13.5.44 The purpose of investigation would be to gather and make available more detailed evidence on the feasibility of future proposals. As such, making a weaker statement in the WNMP, without any other policy related to tidal lagoons, does not indicate the Welsh Ministers policy support for tidal lagoons. Current and potential tidal lagoon projects should be progressed under an appropriate policy framework. ELC_01 provides this framework, therefore, we do not see that this is a meaningful alternative.

13.5.45 This alternative does not achieve the objectives set out above nor does it result in greater protection for European sites.

Conclusion of assessment of alternatives

13.5.46 We conclude that the six alternatives identified in this review would not achieve the objectives set out above nor would they result in greater protection for European sites for the reasons set out above.

13.6 Habitats Directive Article 6(4) - Imperative Reasons of Overriding Public interest

13.6.1 If it can be established that there are no feasible alternative solutions, and the competent authority considers it appropriate to proceed with the plan or project, it must next be able to show that there are "imperative reasons of overriding public interest" (IROPI) that justify the plan or project despite the environmental damage it will cause if the plan policy is to proceed. This requires consideration of the objective of the plan or project as determined in the alternatives test.

13.6.2 For European sites designated under the Habitats Directive, the IROPI grounds on which a plan or project can proceed depends on the nature of the site that will be affected. Where a plan or project will negatively affect a "priority feature"[62] the competent authority can normally only consider reasons relating to human health, public safety, or beneficial consequences of primary importance to the environment. Other imperative reasons of overriding public interest can only be considered having obtained and had regard to the opinion of the European Commission.

13.6.3 In all other cases the competent authority can consider other imperative reasons of overriding public interest including those relating to social or economic benefit in addition to those of human health, public safety, or beneficial consequences of primary importance to the environment. This would include cases where priority habitats and species are present on a European site but they would not be affected by the proposal.

13.6.4 In the absence of alternative solutions and where adverse effects on European sites remain, or cannot be ruled out, it is necessary to establish Imperative Reasons of Overriding Public Interest (IROPI) as the basis for retaining tidal lagoons SRA support in policy ELC_01 in the draft WNMP before then proceeding to identify compensation requirements for any residual adverse impacts upon site integrity.

13.6.5 Defra (2012) notes that when identifying IROPI a competent authority should consider the different defining elements of the term:

- **Imperative**: it must be essential (whether urgent or otherwise), weighed in the context of the other elements below, that the plan or project proceeds
- **Overriding**: the interest served by the plan or project outweighs the harm (or risk of harm) to the integrity of the site as identified in the appropriate assessment
- **Public Interest**: a public benefit must be delivered rather than a solely private interest.
- **Long term**: not merely short-term benefit.

13.6.6 The AA of the tidal lagoon policy set out in Section 10 identifies those sites with priority features that may be exposed to the effects of policy ELC_01 as it relates to tidal lagoons (see Table 10.4). Whilst effects on many priority features can be objectively excluded, it has not been possible at the plan level of the AA to rule out potential adverse effects on the integrity of some European sites which host priority features and so it is necessary to comply with the requirements of Article 6(4) of the Habitats Directive and consider the following reasons:

- Human health;

[62] Some Annexe I habitats and Annexe II species are defined as being 'priority' because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union. The importance of these priority habitat types is emphasised at several places in the Directive (Articles 4 and 5 and Annexe III), not only in terms of the selection of sites, but also in the measures required for site protection (Article 6) and surveillance (Article 11).

- Public safety; and
- Overriding beneficial consequences of primary importance for the environment.

13.6.7 Because the IROPI arguments put forward in this case only relate to these considerations it is not necessary to seek the opinion of the European Commission in relation to the IROPI case (as would be required if socio-economic reasons formed the IROPI).

13.6.8 In setting out the basis for IROPI consideration of ELC_01, the following is considered relevant in the context of the above requirements:

- why we need electrical energy
- why new renewable generating capacity is imperative and in the public interest; and
- why tidal lagoon generating capacity as part of the Welsh renewable energy mix is imperative and in the public interest.

Why we need electrical energy

13.6.9 For civilised society to function effectively we need sources of energy. Electrical energy underpins almost every aspect of our way of life. It provides heat and light; it powers the production, storage and transport of the food that sustains us; it powers the distribution of essential water supplies that keeps us alive and safely removes our waste. It allows us to safely travel around the country and the world for work and for leisure by powering our traffic management systems (e.g. air traffic control, lighting our roads and pumping supplies of fuel).

13.6.10 Electricity is generated through the operation of a number of power stations of various types and technologies that are situated around the UK. The main current sources of electric power generation in the UK are from Nuclear, fossil fuels (natural gas and coal), hydro (pump storage) and renewables (offshore and onshore wind, tidal stream, biomass, and solar). Other mixed sources make up a tiny proportion of overall generation and include oil (a fossil fuel), hydro (stream) and wave.

13.6.11 Electric current is distributed to even the remotest of locations through the National grid, a network of cables of decreasing power rating regulated by transmission sub-stations.

13.6.12 Demand for electrical energy continues to grow and modelling suggests the trend will continue e.g. see 2050 Pathways Analysis [63]. This is despite efforts towards better energy conservation and improvements in energy efficiency e.g. in producing low energy electrical appliances. The National Policy Statement on Energy NPS (EN-1)[64] states "Looking further ahead, the 2050 pathways show that the need to electrify large parts of the industrial and domestic heat and transport sectors could double demand for electricity over the next forty years. It makes sense to switch to electricity where practical, as electricity can be used for a wide range of activities (often with better efficiency than other fuels) and can, to a large extent, be scaled up to meet demand. To meet emissions targets, the electricity being consumed will need to be almost exclusively from low carbon sources." The Future Energy Scenarios presented by the National Grid also conclude greater generation of electricity will be required.[65]

13.6.13 The regular, reliable and guaranteed supply of electrical energy throughout the day is essential to maintain the full range of critical services that modern society relies upon – from hospitals to food production, from cash machines to data storage. To reduce climate change impacts and the environmental consequences arising from this, it is increasingly necessary that this energy supply comes from low carbon sources. In recent years, this has been thought of in terms of the energy trilemma – security of supply, affordability and low carbon, which can now be most correctly

[63] The 2050 Pathways Analysis was published as part of a call for evidence in July 2010 http://econsultation.decc.gov.uk/decc-executive/2050_pathways/consult_view.

[64] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

[65] http://fes.nationalgrid.com/fes-document/fes-2017/

summarised as being security of supply, low-carbon in the most affordable ways, with a new added emphasis on wider UK economic, industrial and employment impacts.

13.6.14 As we entirely rely upon electricity it is difficult to overestimate the extent to which human health and public safety, the quality of the environment and our quality of life is dependent on having long term access to adequate electrical energy supplies and this is reflected in the NPS (EN-1) and EU, National and Welsh policies (Annexe 1 – see Appendix J).

13.6.15 In order to maintain standards in civil society including human health and public safety, it is necessary to meet this growing demand with further energy production. The UK continues to need baseload generation – power that can be guaranteed to provide the minimum levels of electricity supply the country needs. As more power from renewables comes on stream, it also requires flexible elements either to manage demand more effectively at times of lower generation, or to provide extra supply at times of greater demand.

Why new renewable generating capacity is required

13.6.16 Looking forward, we know that we will see the full closure of all coal plants by 2025 (under UK Government policy). The UK currently has eight operational nuclear plants with a combined capacity of 8.9 GW, and all but one of these is scheduled to close by 2030.

13.6.17 Notwithstanding the substantial progress that can be (and has been) made with energy efficiency and demand management/demand-side response, the UK still needs significant new generating capacity to be provided.

13.6.18 To achieve carbon commitments and renewable energy targets, there needs to be a further step change in the power that we obtain from low carbon sources.

13.6.19 Climate change is predicted to also have far reaching effects upon the environment and biodiversity which may also have implications for human health and public safety.

13.6.20 The UK overarching NPS for energy EN-1 explains the two key policy goals that drive the need for new electricity generation. The first is the need to decarbonise the economy. The second is that it is critical that the UK continues to have secure and reliable supplies of electricity as we make the transition to a low carbon economy.

13.6.21 NPS (EN-1) states that “Continuation of global emissions, including greenhouse gases like carbon dioxide, at current levels could lead average global temperatures to rise by up to 6°C by the end of this century. This would make extreme weather events like floods and droughts more frequent and increase global instability, conflict, public health-related deaths and migration of people to levels beyond any recent experience. Heat waves, droughts, and floods would affect the UK. To avoid the most dangerous impacts of climate change, the increase in average global temperatures must be kept to no more than 2°C, and that means global emissions must start falling as a matter of urgency. To drive the transition needed the Government has put in place the world’s first ever legally binding framework to cut emissions by at least 80% by 2050, that will deliver emission reductions through a system of five-year carbon budgets that will set a trajectory to 2050”.

13.6.22 The long-term decarbonisation of the economy and a reduction in greenhouse gases is therefore critical in order to secure ecosystem resilience (identified as a priority in Wales’ Natural Resources Policy[66]) and thereby provide overriding beneficial consequences of primary importance for the environment.

13.6.23 In line with International, UK and Welsh policy commitments to reduce carbon emissions to slow down or avert climate change (Annexe 1 – see Appendix J) the proportion of energy from renewables sources has steadily been increasing. For instance, Welsh Government announced a policy (September 2017) to target Wales to generate 70 per cent of its electricity consumption from renewable energy by 2030.

[66] Welsh Government (2017) *Natural Resources Policy* [online]. Available at http://gov.wales/docs/desh/publications/170821-natural-resources-policy-en.PDF.

13.6.24 Government polices reflect both the need for more electricity and the growing role and expectation that renewables will form an increasingly large proportion of the component energy mix.

13.6.25 Continuity and reliability of supply are also important considerations in the context of energy security which requires provision of a diverse and reliable energy mix to provide for energy security over the long-term. To meet UK Government's objective to maintain or enhance levels of energy security[67], there is therefore a clear need to deploy renewable technologies including marine technologies.

13.6.26 There is a need (see above) to replace electricity energy capacity as well as to meet expected increases in demand for electricity generation. This is a long-term action and the path of climate change cannot be turned overnight. The option of not doing so is not tenable because of the harmful impacts on human health and public safety as a result of interruptions to electricity supply.

13.6.27 In order to meet the very challenging statutory decarbonisation targets in Wales, to maintain security of energy supply and reduce the potential harmful impacts on human health and public safety resulting from interruptions to electricity supply (and from climate change), it is important that no viable renewable technology is ruled out and that developing renewable sectors are afforded appropriate, clear policy support.

13.6.28 Tidal range power schemes (through lagoon or barrage technology) have the potential to significantly increase the proportion of electrical energy coming from low carbon / renewable sources owing to the scale of developments that may be deployed.

Why tidal lagoon generating capacity is required as part of the renewable energy mix

13.6.29 As set out above, in order to meet the very challenging statutory decarbonisation targets to deliver Governments objectives of decarbonising the economy and energy security it is important that no viable renewable technology is ruled out and that developing renewable sectors are afforded appropriate policy support.

13.6.30 The sea area around Wales offers a widespread, abundant and reliable natural energy resource that can be potentially exploited as a source of renewable energy, including wind, wave, tidal stream and tidal range. This strategically significant energy resource is located in different areas and requires different technologies to exploit it. These are in different stages of development and are subject to different constraints (see draft WNMP – section: ELC - Low carbon).

13.6.31 Wales has a high average tidal range, and in the Severn estuary this is the second highest in the world (second only to the Bay of Fundy, Nova Scotia). Areas of highest wave height lie off Pembrokeshire (facing the Atlantic where the "fetch" is longer). Average wind speeds show less variability and are at a high average across Wales, although are higher further offshore and away from the sheltering influences of the land (e.g. see WG marine planning portal[68]).

13.6.32 The deployment of tidal lagoon technology has several (potential) advantages in addition to other renewable technologies:

- The tides (and the energy developed from them) are substantial and predictable.
- Tidal production cycles offer generation of the order of 16 - 20 hours in every 24-hour period (two tide cycles per day).
- The tidal oscillation is phased across Wales. This means that for a lagoon network deployed across both north and south SRAs, there is no "slack" period of non-generation. Production baseload is therefore reliable and delivered around the clock.
- The (turbine) technology is proven and shows high indicative reliability.

[67] DECC (2011) Overarching National Policy Statement for Energy (EN-1) [online]. Available at https://www.gov.uk/government/publications/national-policy-statements-for-energy-infrastructure
[68] http://lle.gov.wales/apps/marineportal/

- Replacement / repair of failed parts is easier than for some alternatives (e.g. wave, stream or offshore wind).
- They are not especially at risk to storm events (and therefore electricity generation is largely unaffected by the weather e.g. sun, wave or wind).
- Costs are competitive (depending upon initial CfD calculations, the project term used and economies of scale if lagoon technology is rolled out). TLP quote £60 per MWh for Cardiff Tidal Lagoon, similar to the TCE auction for offshore wind (September 2017), albeit over different scheme periods.
- They have a very long-term life of 120 years (or beyond if turbines and housing structures are replaced).
- Tidal lagoons may afford some additional benefits e.g. protection of coastal communities from flooding by severe storm events.

13.6.33 The above is not intended to be an exhaustive comparison with other renewable energy types, all of which have their individual merits. Besides which, as stated above, Welsh Government do not see lagoons as an alternative to other forms of renewable energy, but as part of the overall energy mix, a significant and growing element of which ought to come from renewable sources.

13.6.34 A Government commissioned review by Charles Hendry of the potential role of tidal lagoons (Hendry, 2016[69]) recommended that the Swansea Bay Tidal Lagoon project be progressed as a "pathfinder" (partly to offer an ability to develop greater understanding on lagoons) and on a "no regrets basis" (Annexe 1 – see Appendix J). The review stated that "*power from tidal lagoons could make a strong contribution to UK energy security, as an indigenous and completely predictable form of supply*."

13.6.35 Welsh Government shares that stated view for tidal lagoons and believes that tidal lagoons (subject to meeting environmental safeguards and to securing the necessary permissions and financing) can play an important role in decarbonising our electricity energy production, and in producing a secure and diverse supply of electricity which significantly contributes to our renewable energy targets.

13.6.36 Welsh Government considers that the development of renewable energy sources has an important role to play in the energy mix and that tidal range captured through tidal lagoon technology should be encouraged as part of the energy mix where projects can be shown to be sustainable. The tidal range resource is well understood and has been mapped as a Resource Area, and within this two areas of Strategic Resource (SRAs – in the north and south) which offer potential for development have been identified. Although there is scope to improve our understanding of environmental interactions we believe that appropriate deployment of tidal lagoon technologies in SRAs is possible provided that the environment is safeguarded, particularly at the project level.

13.6.37 The supporting and safeguarding policies of the draft WNMP recognise the significance of the tidal range resource around Wales and its potential contribution to long-term renewable energy generation. Accordingly, as set out in the analysis of alternatives, it would be inappropriate not to not offer support for renewable energy or for tidal lagoons within the draft WNMP.

13.6.38 The above considerations in relation to human health and public safety benefits as well as overriding beneficial consequences of primary importance for the environment are considered to apply equally to tidal lagoon generation, in particular the long-term benefits that are expected to derive from such technologies. Tidal lagoon deployment has the advantage over other renewable energy sources in that it is entirely predictable and could constitute a strategically significant proportion of the energy mix.

69 https://hendryreview.wordpress.com/

IROPI conclusion

13.6.39 The potential for adverse effects arising on the integrity of European Sites (set out above) has been considered against the imperative reasons of overriding public interest set out above. Welsh Government considers that on the grounds of human health; public safety; and overriding beneficial consequences of primary importance for the environment, there is a compelling IROPI case to proceed with the plan policy.

13.6.40 As part of the HRA process therefore, having determined IROPI, the plan may only proceed if there are compensatory measures to ensure that the overall coherence of the network of European sites is maintained, the case for which is considered in the section below.

13.7 Compensatory Measures

13.7.1 The Habitats Directive seeks to create and safeguard a coherent ecological network of European protected sites known as Natura 2000. Therefore, where, in spite of a negative assessment on European Site integrity, the plan making authority proceeds with the plan on the basis of IROPI, any necessary compensatory measures are secured to offset the plan or project and ensure that the overall coherence of the Natura 2000 network is maintained.

13.7.2 Compensatory measures identified at the project level will need to be:

- Appropriate for the area and the loss caused by the project;
- Capable of protecting the overall coherence of the Natura 2000 network;
- Capable of implementation;
- Ensure that, the European site is not irreversibly affected by the project before the compensation is in place;
- Directed in measurable proportions to the habitats and species negatively affected;
- Related to the same biogeographical region (within the UK) and should be as close as possible to the habitat that has been negatively affected;
- Serving functions that are comparable to those that motivated the original area's submission for designation; and
- Clearly defined, with implementation goals and managed so that the compensatory measures can achieve the goal of maintaining the overall coherence of Natura 2000.

13.7.3 According to Commission guidance[70] compensatory measures appropriate to adverse effects on Natura 2000 sites consist of:

- **restoration** – restoring the habitat to ensure the maintenance of its conservation value and compliance with the conservation objectives of the site;
- **creation** – creating a new habitat on a new site or through the enlargement of the existing site;
- **enhancement** – improving the remaining habitat proportional to that which is lost due to the project or plan;
- **preservation of habitat stock** – measures to prevent further erosion of the coherence of the Natura 2000 network.

13.7.4 These compensatory measures need to be assessed to ensure that they:

- are **appropriate** to the site and the loss caused by the project or plan;

[70] Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC (January 2007) and EC Assessment of plans and projects significantly affecting Natura 2000 sites – Methodological Guidance to A6(3) & 6(4)

- have the ability to **maintain or enhance** the overall coherence of Natura 2000;
- are **feasible**;
- can be **operational** by the time the damage to the site is effected (unless this can be proved unnecessary in the circumstances of the case).

Plan and project level compensatory measure considerations

13.7.5 The draft WNMP is a high-level, strategic policy document. Therefore, the level of detail possible in this assessment, in terms of the nature of adverse effect, is high level and the consideration of compensatory measures is comparably high-level due to:

- the strategic nature of the HRA process for the tidal lagoon component of the renewable energy policy in the draft WNMP;
- the inherent uncertainties within the AA conclusions and the wide range of potential scenarios that may occur as the plan (WNMP) is implemented;
- the uncertainties at this early stage of the scale of development and the forward plans of the tidal lagoon sector; and
- the uncertainties in the type, location and scale that the specific features of Natura 2000 sites might be impacted.

13.7.6 Given the high level nature of the plan it is not possible to determine what specific compensatory measures may be appropriate at any individual site, or whether they would be sufficient. However, having considered the range of possible adverse effects from projects that may be brought forward, there are a range of possible compensatory measures that could be considered, depending on the specific circumstances of a given project. It cannot be ruled out at this stage that such measures, or other compensatory measures, would be sufficient to meet the requirements of the Habitats Directive.

13.7.7 The AA undertaken (see Section 10 and Appendices G - I) identifies a range of possible significant and significant adverse effects on designated site features. The AA indicates the extent to which project level mitigation and avoidance measures are likely to be successful, and where some residual impacts may remain to be considered.

13.7.8 The high-level conclusions of the AA are as follows:

- No adverse effects are likely (therefore no compensatory measures are necessary) for mammals including otter.
- Compensatory measures may be necessary for loss of intertidal mudflats and salt meadow – both as a habitat in itself and as a supporting feeding / roosting habitat for some bird assemblages (in particular waders, duck, divers and some seabirds). The respective AA reports note that the success of such habitat compensation measures will depend upon the scale of the feature affected by any lagoon(s) operation and that it may be challenging to adequately compensate at large or multiple lagoon scales.
- Compensatory measures may be necessary for some migratory fish species in particular where the operation of any lagoon may present a partial or total barrier to fish movement and / or potentially causes (turbine) collision damage. The extent and success of the available compensatory measures align closely to the particular species involved and the scale, location and mode of operation of the lagoon development in consideration of what avoidance and mitigation measures had already been implemented.

13.7.9 In accordance with the findings of the plan level AA of policy ELC_01, possible project level compensation measures have been identified. In practice, effective compensation will depend upon a number of factors including on the type of feature and the nature of impact mechanism and could potentially include:

- Saltmarsh reconstruction;
- Artificial tidal flats reconstruction;
- Sediment feeding, management and monitoring;
- Managed realignment of coast to create inter-tidal habitats (as e.g. bird breeding/feeding grounds);
- Littoral habitat (re)creation (beaches and dunes) may include managed realignment; regulated tidal exchange (RTE); sediment recharge; and manipulation of natural processes;
- Submerged habitats creation;
- Creation of marine/river reserves;
- Enlargement/extension of habitat areas, for example, through enhancement of or restoration of adjacent, surrounding or linked land;
- Restoration wetland areas, for example, through flooding of existing crop/pasture land;
- Fish stock enhancement, fish spawning habitat enhancement, predator control;
- Fish stock translocation (transferring fish from potentially affected sites to other sites);
- Identification of additional sites for inclusion in SAC list.

13.7.10 These measures are indicative as actual compensation measures can only be effectively determined at a project level stage through the findings of detailed, site specific Appropriate Assessments focused on the requirements of the Habitats Directive.

13.7.11 Whilst the application of avoidance or mitigation measures at project level has the potential to remove adverse effects in many cases, this might not be possible in all circumstances. In such cases an application for a permission or licence to the relevant authority would not succeed. In which case, a project may either decide not to proceed, may modify its proposal to avoid adverse effects or consider whether to make an application at project level for IROPI under A6(4). In any such application the effective delivery of compensatory measures will need to be considered for any residual adverse effects upon site integrity.

13.7.12 Whilst this plan level HRA identifies potential compensatory measures, it is important to note that securing compensation for some site feature(s) that meets the necessary requirements may represent a considerable challenge depending upon the specific nature of a particular project proposal. In some case, projects may not be viable because adequate and satisfactory compensation cannot be secured.

Monitoring & delivery

13.7.13 While monitoring in relation to plans or projects is not specified by the Habitats Directive, it is good practice and guidance suggests that monitoring the effects of plan implementation in relation to the issues identified through HRA is undertaken.

13.7.14 Compensatory measures require that a sound legal and financial basis be established for long-term implementation and for their protection, monitoring and maintenance be secured in advance of impacts upon habitats and/or species occur.

13.7.15 The programme of compensatory measures needs to include detailed monitoring during implementation to ensure effectiveness in the long term (e.g. on the effectiveness of the compensation ratios).

13.7.16 Monitoring programmes need to be established for the whole life of the project, including stating objectives (such as reporting schedules based on progress indicators according to the conservation objectives), responsible bodies, resources needs and on reporting to the Commission.

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13.8 Overall conclusions in applying Article (6) of the Habitats Directive in relation to tidal lagoon supporting policy as part of ELC_01 of the draft WNMP.

13.8.1 In applying Article 6 of the Habitats Directive to the draft WNMP in the context of the tidal lagoon supporting policy ELC_01:

i. Policy ELC_01 of the draft WNMP, under Article 6(2), was identified as requiring more detailed Habitats Regulations Assessment because it was not possible to rule out a risk of an adverse effect(s) upon designated European sites.

ii. An Appropriate Assessment of ELC_01 was undertaken under Article 6(3) which was unable to conclude no adverse effect upon the integrity of European site (AEoI) for a range of features despite having considered appropriate avoidance and mitigation measures.

iii. Potential adverse effects were identified for European sites containing migratory fish species, some intertidal habitats and intertidal habitats that may support feeding and / or roosting of birds (see Section 10 and Appendices G – I).

iv. Alternative solutions to the policy were considered under Article 6(4) (Section 13.5). No clear alternatives to the tidal lagoon policy (including having no plan and/or no tidal lagoon policy) were identified that would meet the Government's decarbonisation, environmental and energy security objectives and have a lesser effect upon European sites.

v. An IROPI case is set out in accordance with Article 6(4) (Section 13.6). The statement of case sets out that there are significant human health, public safety and overriding benefits to the environment (by helping to limit the scale of climate change) to merit proceeding with the plan. The Welsh Government is therefore satisfied that there are IROPI to support Policy ELC_01 including support for tidal lagoons even though potential adverse impacts on European sites cannot be ruled out at the plan level.

vi. Compensatory measures pursuant to Article 6(4) are considered (Section 13.7). Given the potential for residual impacts identified in the AA, considerations for compensation are set out. Given the high-level nature of the plan it is not possible to determine what specific compensatory measures may be appropriate at any individual site, or whether they would be sufficient. However, having considered the range of possible adverse effects from projects that may be brought forward, there are a range of possible compensatory measures that could be considered, depending on the specific circumstances of a given project. Detailed considerations are set out in Section 13.7.

13.8.2 Welsh Government is satisfied that the requirements of the Habitats Directive have been satisfied and on this basis will proceed with the inclusion of Policy ELC_01 in the WNMP.

13.8.3

13.8.4

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Appendix A
Review of Early Draft WNMP Policies

Table A.1 General cross-cutting policies review

Policy	Screening Summary	Recommendations
ECON/01	General statement of support for proposals for economically sustainable activities. No spatial component.	None
ECON/02	General statement of support for proposals that consider opportunities for coexistence with other compatible sectors. No spatial component.	None
SOC/01	Requires that proposals minimise their risk of marine pollution incidents. No spatial component.	None
SOC/02	Requires that proposals maintain or enhance access to the marine environment. No spatial component.	None
SOC/03	Supports proposals that contribute to the well-being of coastal communities. No spatial component.	None
SOC/04	Supports proposals that contribute to the conservation and promotion of Welsh language. No spatial component.	None
SOC/05	Policy protecting historic assets and settings. No spatial component.	None
SOC/06	Supports proposals that enhance the aesthetic qualities / character / experience etc. of Wales' marine areas. No spatial component.	None
SOC/07	Policy requiring proposals consider / are compatible with National Parks or AoNBs. No spatial component.	None
SOC/08	Policy providing safeguarding for seascapes and criteria in this regard. No spatial component.	None
SOC/09	Requires that proposals demonstrate how they are resilient to coastal change and flooding over their lifetime. No spatial component.	None
SOC/10	Supports proposals that have no significant effects on coastal processes / coastal flooding / meet the Shoreline Management Plan requirements. No spatial component.	None
SOC/11	Policy to minimise greenhouse gas emissions. No spatial component.	None
SOC/12	Requires that proposals demonstrate how they have considered / will adapt to climate change. No spatial component.	None
SOC/13	Requires that decision making authorities should support proposals that contribute towards climate change adaptation and/or mitigation. No spatial component.	None
ENV/01	Requires that proposals demonstrate how they contribute to the protection, restoration and/or enhancement of marine ecosystems. No spatial component.	None
ENV/02	Policy setting out requirements regards marine protected areas. No spatial component.	This policy should be should be modified to refer to European sites (rather than MPAs) to ensure that terrestrial sites are also covered by the protective elements of the policy.

Policy	Screening Summary	Recommendations
ENV/03	Requires that proposals include biosecurity measures to reduce the risk of introducing and spreading invasive non-native species. No spatial component.	None
ENV/04	Requires that proposals demonstrate how they will minimise litter generation / dispersal. No spatial component.	None
ENV/05	Sequential policy safeguarding the marine environment against noise. No spatial component.	None
ENV/06	Sequential policy safeguarding the air and water quality in the marine environment. No spatial component.	None
GOV/01	Requires that proposals consider cumulative effects and demonstrate how the avoidance hierarchy has been employed. No spatial component.	None
GOV/02	Requires that authorities make decisions in accordance with the sustainable development principle. No spatial component.	None

Table A.2 Summary of sector policies review

Sector	Policies	Notes
Aggregates	AGG/01 AGG/02 AGG/03 AGG/04	Recommendations within main document text
Aquaculture	AQU/01 AQU/02 AQU/03	Recommendations within main document text
Defence	DEF/01	None
Dredging and Disposal	D&D/01 D&D/02 D&D/03	None
Energy – Low Carbon	ELC/01 ELC/02 ELC/03 ELC/04	Recommendations within main document text
Energy – Oil and Gas (including CCS)	O&G/01 O&G/02 O&G/03 O&G/04	None
Fisheries	FIS/01 FIS/02 FIS/03	None
Subsea Cabling	CAB/01 CAB/02	None
Surface Water and Wastewater Treatment and Disposal	SWW/01	None
Tourism and Recreation	T&R/01 T&R/02	None

Sector	Policies	Notes
Ports and Shipping	P&S/01 P&S/02 P&S/03	None

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Appendix B
UK European Sites and European Marine sites within the Geographical Zone of Influence

These tables list the sites that are within the predicted zone of influence (the WNMP area; a 50km marine buffer; and 2km inland); sites considered for their mobile species are summarised in Appendices C - E.

Site Code	Site Name	Interest Features
UK0030075	Afon Eden - Cors Goch Trawsfynydd SAC	Active raised bogs; *Luronium natans*; *Lutra lutra*; *Margaritifera margaritifera*; *Salmo salar*
UK0030046	Afon Gwyrfai a Llyn Cwellyn SAC	*Luronium natans*; *Lutra lutra*; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
UK0012670	Afon Teifi/ River Teifi SAC	*Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Luronium natans*; *Lutra lutra*; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
UK0013010	Afon Tywi/ River Tywi SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*
UK0030074	Afonydd Cleddau/ Cleddau Rivers SAC	Active raised bogs; Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*); *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
TBC	Anglesey Terns / Morwenoliaid Ynys Môn SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*; Roseate tern *Sterna* dougalli
UK9014091	Bae Caerfyrddin/ Carmarthen Bay SPA	*Melanitta nigra*
UK0030114	Bae Cemlyn/ Cemlyn Bay SAC	Coastal lagoons; Perennial vegetation of stony banks
UK0012570	Braunton Burrows SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*); Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Mudflats and sandflats not covered by seawater at low tide; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
UK0030396	Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC	Harbour porpoise *Phocoena phocoena*
UK14001	Burry Inlet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK9015011	Burry Inlet SPA	*Anas acuta*; *Anas clypeata*; *Anas crecca*; *Anas penelope*; *Arenaria interpres*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Numenius arquata*; *Pluvialis squatarola*; *Tadorna tadorna*; *Tringa totanus*
UK0030104	Cadair Idris SAC	Alkaline fens; Blanket bogs; Calcareous rocky slopes with chasmophytic vegetation; *Drepanocladus* (*Hamatocaulis*) *vernicosus*; *Euphydryas* (*Eurodryas, Hypodryas*) *aurinia*; European dry heaths; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*); Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; Siliceous rocky slopes with chasmophytic vegetation; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*)
UK0012712	Cardigan Bay/ Bae Ceredigion SAC	*Halichoerus grypus*; *Lampetra fluviatilis*; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves; *Tursiops truncatus*
UK0020020	Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); Estuaries; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time

Site Code	Site Name	Interest Features
UK0020019	Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*); Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Vertigo angustior*
UK9014061	Castlemartin Coast SPA	*Pyrrhocorax pyrrhocorax*
UK0030271	Clogwyni Pen Llyn/ Seacliffs of Lleyn SAC	Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK0030117	Coed Cwm Einion SAC	*Tilio-Acerion* forests of slopes, screes and ravines
UK0030124	Coedwigoedd Penrhyn Creuddyn/ Creuddyn Peninsula Woods SAC	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Taxus baccata* woods of the British Isles; *Tilio-Acerion* forests of slopes, screes and ravines
UK0030118	Coedydd Aber SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
UK0014789	Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Bog woodland; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; *Rhinolophus hipposideros*; *Tilio-Acerion* forests of slopes, screes and ravines; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
UK14004	Cors Fochno and Dyfi Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types
UK0014791	Cors Fochno SAC	Active raised bogs; Degraded raised bogs still capable of natural regeneration; Depressions on peat substrates of the *Rhynchosporion*
UK0030187	Corsydd Llyn/ Lleyn Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Vertigo geyeri*; *Vertigo moulinsiana*
UK14005	Corsydd Môn a Llyn/ Anglesey and Llyn Fens Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK0012884	Corsydd Môn/ Anglesey Fens SAC	Alkaline fens; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; *Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; *Vertigo geyeri*
UK0030381	Croker Carbonate Slabs SCI	Submarine structures made by leaking gases
UK14006	Crymlyn Bog Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK0012885	Crymlyn Bog/ Cors Crymlyn SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Transition mires and quaking bogs
UK0030131	Dee Estuary/ Aber Dyfrdwy SAC	Annual vegetation of drift lines; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Embryonic shifting dunes; Estuaries; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petalophyllum ralfsii*; *Petromyzon marinus*; Salicornia and other annuals colonizing mud and sand; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK0030132	Deeside and Buckley Newt Sites SAC	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; *Triturus cristatus*
UK0030139	Dunraven Bay SAC	*Rumex rupestris*
UK9020284	Dyfi Estuary / Aber Dyfi SPA	*Anser albifrons flavirostris*

Site Code	Site Name	Interest Features
UK0012946	Eryri/ Snowdonia SAC	Alkaline fens; Alpine and Boreal heaths; Alpine and subalpine calcareous grasslands; Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*; Blanket bogs; Calcareous rocky slopes with chasmophytic vegetation; Depressions on peat substrates of the *Rhynchosporion*; *Drepanocladus* (*Hamatocaulis) vernicosus*; European dry heaths; Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; *Luronium natans*; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*; Petrifying springs with tufa formation (*Cratoneurion)*; Siliceous alpine and boreal grasslands; Siliceous rocky slopes with chasmophytic vegetation; Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*; Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)
UK0030040	Exmoor Heaths SAC	Alkaline fens; Blanket bogs; European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK9013121	Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA	*Puffinus puffinus*
UK0020025	Glannau Môn: Cors heli / Anglesey Coast: Saltmarsh SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Estuaries; Mudflats and sandflats not covered by seawater at low tide; Salicornia and other annuals colonizing mud and sand
UK0013046	Glannau Ynys Gybi/ Holy Island Coast SAC	European dry heaths; Northern Atlantic wet heaths with *Erica tetralix*; Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK9013101	Glannau Ynys Gybi/ Holy Island Coast SPA	*Pyrrhocorax pyrrhocorax*
UK0012661	Glynllifon SAC	*Rhinolophus hipposideros*
UK0030157	Gower Ash Woods/ Coedydd Ynn Gwyr SAC	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*; *Tilio-Acerion* forests of slopes, screes and ravines
UK0012685	Gower Commons/ Tiroedd Comin Gwyr SAC	*Coenagrion mercuriale*; *Euphydryas* (*Eurodryas, Hypodryas) aurinia*; European dry heaths; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*
UK9014041	Grassholm SPA	*Morus bassanus*
UK0014788	Great Orme`s Head/ Pen y Gogarth SAC	European dry heaths; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK0012566	Kenfig/ Cynffig SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; Humid dune slacks; *Liparis loeselii*; *Petalophyllum ralfsii*
UK0014787	Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	Caves not open to the public; European dry heaths; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); *Gentianella anglica*; *Petalophyllum ralfsii*; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); Submerged or partially submerged sea caves; Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK9020294	Liverpool Bay / Bae Lerpwl SPA	*Gavia stellata*; *Melanitta nigra*
UK0030203	Mendip Limestone Grasslands SAC	Caves not open to the public; European dry heaths; *Rhinolophus ferrumequinum*; Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites); *Tilio-Acerion* forests of slopes, screes and ravines
UK11041	Mersey Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK9005131	Mersey Estuary SPA	*Anas acuta*; *Anas crecca*; *Anas penelope*; *Calidris alpina alpina*; *Charadrius hiaticula*; *Limosa limosa islandica*; *Numenius arquata*; *Pluvialis apricaria*; *Pluvialis squatarola*; *Podiceps cristatus*; *Tadorna tadorna*; *Vanellus vanellus*
UK11042	Mersey Narrows and North Wirral Foreshore Ramsar	Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Site Code	Site Name	Interest Features
UK9020287	Mersey Narrows and North Wirral Foreshore SPA	*Calidris alba*; *Calidris alpina alpina*; *Calidris canutus islandica*; *Haematopus ostralegus*; *Larus minutus*; *Limosa lapponica*; *Phalacrocorax carbo*; *Pluvialis squatarola*; *Tringa totanus*
UK0013027	Morecambe Bay SAC	Atlantic decalcified fixed dunes (*Calluno-Ulicetea)*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Estuaries; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Large shallow inlets and bays; Mudflats and sandflats not covered by seawater at low tide; Perennial vegetation of stony banks; Reefs; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Triturus cristatus*
UK0030049	Morfa Harlech a Morfa Dyffryn SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*; Embryonic shifting dunes; Humid dune slacks; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
UK0030161	Mwyngloddiau Fforest Gwydir/ Gwydyr Forest Mines SAC	Calaminarian grasslands of the *Violetalia calaminariae*; *Rhinolophus hipposideros*
UK9020282	Mynydd Cilan, Trwyn y Wylfa ac Ynysoedd Sant Tudwal SPA	0
UK0030398	North Anglesey Marine / Gogledd Môn Forol cSAC	Harbour porpoise *Phocoena phocoena*
UK0030399	North Channel cSAC	Harbour porpoise *Phocoena phocoena*
UK0030229	North West Pembrokeshire Commons/ Comins Gogledd Orllewin Sir Benfro SAC	European dry heaths; *Luronium natans*; *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*; Northern Atlantic wet heaths with *Erica tetralix*; Transition mires and quaking bogs
TBC	Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	Red-throated diver *Gavia stellata*
UK0014793	Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; *Lutra lutra*; *Rhinolophus ferrumequinum*; *Rhinolophus hipposideros*
UK0013116	Pembrokeshire Marine/ Sir Benfro Forol SAC	*Alosa alosa*; *Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; *Lampetra fluviatilis*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; *Rumex rupestris*; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves
UK0013117	Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*; Coastal lagoons; Estuaries; *Halichoerus grypus*; Large shallow inlets and bays; *Lutra lutra*; Mudflats and sandflats not covered by seawater at low tide; Reefs; Salicornia and other annuals colonizing mud and sand; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves; *Tursiops truncatus*
UK9014062	Ramsey and St David`s Peninsula Coast SPA	*Pyrrhocorax pyrrhocorax*
UK11057	Ribble and Alt Estuaries Ramsar	Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK9005103	Ribble and Alt Estuaries SPA	*Anas acuta*; *Anas crecca*; *Anas penelope*; *Anser brachyrhynchus*; *Aythya marila*; *Calidris alpina alpina*; *Calidris canutus*; *Charadrius hiaticula*; *Cygnus columbianus bewickii*; *Cygnus cygnus*; *Haematopus ostralegus*; *Larus fuscus*; *Larus ridibundus*; *Limosa lapponica*; *Limosa limosa islandica*; *Melanitta nigra*; *Numenius arquata*; *Numenius phaeopus*; *Phalacrocorax carbo*; *Philomachus pugnax*; *Pluvialis apricaria*; *Pluvialis squatarola*; *Sterna hirundo*; *Tadorna tadorna*; *Vanellus vanellus*
UK0030252	River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	*Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Luronium natans*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
UK0013007	River Usk/ Afon Wysg SAC	*Alosa alosa*; *Alosa fallax*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation

Site Code	Site Name	Interest Features
UK0012642	River Wye/ Afon Gwy SAC	*Alosa alosa*; *Alosa fallax*; *Austropotamobius pallipes*; *Cottus gobio*; *Lampetra fluviatilis*; *Lampetra planeri*; *Lutra lutra*; *Petromyzon marinus*; *Salmo salar*; Transition mires and quaking bogs; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
UK0013076	Sefton Coast SAC	Atlantic decalcified fixed dunes (*Calluno-Ulicetea*); Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*); Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; *Petalophyllum ralfsii*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); *Triturus cristatus*
UK11081	Severn Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds; Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path
UK9015022	Severn Estuary SPA	*Anas strepera*; *Anser albifrons albifrons*; *Calidris alpina alpina*; *Cygnus columbianus bewickii*; *Tadorna tadorna*; *Tringa totanus*
UK0013030	Severn Estuary/ Môr Hafren SAC	*Alosa fallax*; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*); Estuaries; *Lampetra fluviatilis*; Mudflats and sandflats not covered by seawater at low tide; *Petromyzon marinus*; Reefs; Sandbanks which are slightly covered by sea water all the time
UK0030376	Shell Flat and Lune Deep SCI	Reefs; Sandbanks which are slightly covered by sea water all the time
UK9014051	Skokholm and Skomer SPA	*Asio flammeus*; *Fratercula arctica*; *Hydrobates pelagicus*; *Larus fuscus*; *Puffinus puffinus*; *Pyrrhocorax pyrrhocorax*
TBC	Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	Storm petrel *Hydrobates pelagicus*; lesser black-backed gull *Larus fuscus*; Manx shearwater *Puffinus puffinus*; Atlantic puffin *Fratercula arctica*; Breeding seabird assemblage;
UK0013045	St David`s / Ty Ddewi SAC	European dry heaths; *Luronium natans*; Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK11082	The Dee Estuary Ramsar	Crit. 1 - sites containing representative, rare or unique wetland types; Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK9013011	The Dee Estuary SPA	*Anas acuta*; *Anas crecca*; *Calidris alpina alpina*; *Calidris canutus*; *Haematopus ostralegus*; *Limosa lapponica*; *Limosa limosa islandica*; *Numenius arquata*; *Pluvialis squatarola*; *Sterna albifrons*; *Sterna hirundo*; *Sterna sandvicensis*; *Tadorna tadorna*
UK0013047	Tintagel-Marsland-Clovelly Coast SAC	European dry heaths; Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; Vegetated sea cliffs of the Atlantic and Baltic Coasts
UK9013031	Traeth Lafan/ Lavan Sands, Conway Bay SPA	*Haematopus ostralegus*; *Mergus serrator*; *Numenius arquata*; *Podiceps cristatus*; *Tringa totanus*
UK0030397	West Wales Marine / Gorllewin Cymru Forol cSAC	Harbour porpoise *Phocoena phocoena*
UK0014794	Wye Valley and Forest of Dean Bat Sites/ Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	*Rhinolophus ferrumequinum*; *Rhinolophus hipposideros*
UK0012727	Wye Valley Woodlands/ Coetiroedd Dyffryn Gwy SAC	*Asperulo-Fagetum* beech forests; *Rhinolophus hipposideros*; *Taxus baccata* woods of the British Isles; *Tilio-Acerion* forests of slopes, screes and ravines
UK0030202	Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay SAC	Large shallow inlets and bays; Mudflats and sandflats not covered by seawater at low tide; Reefs; Sandbanks which are slightly covered by sea water all the time; Submerged or partially submerged sea caves
UK0020021	Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes SAC	Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*); Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Humid dune slacks; Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation; *Petalophyllum ralfsii*; *Rumex rupestris*; Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
UK9013061	Ynys Feurig, Cemlyn Bay and The Skerries SPA	*Sterna dougallii*; *Sterna hirundo*; *Sterna paradisaea*; *Sterna sandvicensis*
UK9020285	Ynys Seiriol / Puffin Island SPA	*Phalacrocorax carbo*

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Appendix C
SACs (etc.) with Potentially Exposed Mobile Species

The following table summarises those SACs and associated designations (pSAC, cSAC, SCI; plus corresponding Ramsar sites / fetaures) that are designated for mobile species that are potentially exposed and sensitive to the outcomes of the plan. Note, only those interest features of each that are considered to be potentially exposed and sensitive are listed. In summary these sites are:

- sites designated for bats within 20km of the zone of influence;
- sites designated for diadromous fish within the Irish and Celtic seas, or which discharge to this area;
- sites supporting marine mammals that are within 50km of the relevant Marine Management Units;
- UK sites designated for otters within the zone of influence;

Site Ref	SAC Site Name	SAC Mobile Interest Features Screened In
UK0030384	The Maidens SAC	Grey seal *Halichoerus grypus*
UK0030383	Skerries and Causeway SAC	Harbour porpoise *Phocoena phocoena*
UK0030227	North Pembrokeshire Woodlands/ Coedydd Gogledd Sir Benfro SAC	Barbastelle *Barbastella barbastellus*
UK0030203	Mendip Limestone Grasslands SAC	Greater horseshoe bat *Rhinolophus ferrumequinum*
UK0030161	Mwyngloddiau Fforest Gwydir/ Gwydyr Forest Mines SAC	Lesser horseshoe bat *Rhinolophus hipposideros*
UK0030148	Exmoor and Quantock Oakwoods SAC	Barbastelle *Barbastella barbastellus*; Bechstein`s bat *Myotis bechsteini*
UK0030131	Dee Estuary/ Aber Dyfrdwy SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*
UK0030052	North Somerset and Mendip Bats SAC	Lesser horseshoe bat *Rhinolophus hipposideros*; Greater horseshoe bat *Rhinolophus ferrumequinum*
UK0020020	Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Otter *Lutra lutra*
UK0016618	Strangford Lough SAC	Common seal *Phoca vitulina*
UK0016612	Murlough SAC	Common seal *Phoca vitulina*
UK0014794	Wye Valley and Forest of Dean Bat Sites/ Safleoedd Ystlumod Dyffryn Gwy a Fforest y Ddena SAC	Lesser horseshoe bat *Rhinolophus hipposideros*; Greater horseshoe bat *Rhinolophus ferrumequinum*
UK0014793	Pembrokeshire Bat Sites and Bosherston Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherston SAC	Lesser horseshoe bat *Rhinolophus hipposideros*; Greater horseshoe bat *Rhinolophus ferrumequinum*
UK0014789	Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC	Lesser horseshoe bat *Rhinolophus hipposideros*
UK0014787	Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC	Greater horseshoe bat *Rhinolophus ferrumequinum*
UK0013694	Isles of Scilly Complex SAC	Grey seal *Halichoerus grypus*
UK0013117	Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau SAC	Bottlenose dolphin *Tursiops truncatus*; Otter *Lutra lutra*; Grey seal *Halichoerus grypus*
UK0013116	Pembrokeshire Marine/ Sir Benfro Forol SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Otter *Lutra lutra*; Grey seal *Halichoerus grypus*
UK0013114	Lundy SAC	Grey seal *Halichoerus grypus*
UK0013030	Severn Estuary/ Môr Hafren SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Twaite shad *Alosa fallax*
UK0013025	Solway Firth SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*

Site Ref	SAC Site Name	SAC Mobile Interest Features Screened In
UK0013007	River Usk/ Afon Wysg SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Atlantic salmon *Salmo salar*; Otter *Lutra lutra*
UK0012727	Wye Valley Woodlands/ Coetiroedd Dyffryn Gwy SAC	Lesser horseshoe bat *Rhinolophus hipposideros*
UK0012712	Cardigan Bay/ Bae Ceredigion SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Bottlenose dolphin *Tursiops truncatus*; Grey seal *Halichoerus grypus*
UK0012670	Afon Teifi/ River Teifi SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Atlantic salmon *Salmo salar*; Otter *Lutra lutra*
UK0012661	Glynllifon SAC	Lesser horseshoe bat *Rhinolophus hipposideros*
UK0012642	River Wye/ Afon Gwy SAC	Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Atlantic salmon *Salmo salar*; Otter *Lutra lutra*
UK0030398	North Anglesey Marine / Gogledd Môn Forol cSAC	Harbour porpoise *Phocoena phocoena*
UK0030397	West Wales Marine / Gorllewin Cymru Forol cSAC	Harbour porpoise *Phocoena phocoena*
UK0030396	Bristol Channel Approaches / Dynesfeydd Môr Hafren possible cSAC	Harbour porpoise *Phocoena phocoena*
UK0030399	North Channel cSAC	Harbour porpoise *Phocoena phocoena*
IE0002172	BLASKET ISLANDS SAC	Harbour porpoise *Phocoena phocoena*
IE0002170	BLACKWATER RIVER (CORK/WATERFORD) SAC	Freshwater pearl mussel *Margaritifera margaritifera*; Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Atlantic salmon *Salmo salar*; Otter *Lutra lutra*
IE0002162	RIVER BARROW AND RIVER NORE SAC	Freshwater pearl mussel *Margaritifera margaritifera*; Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Atlantic salmon *Salmo salar*; Otter *Lutra lutra*
IE0002158	KENMARE RIVER SAC	Common seal *Phoca vitulina*
IE0000781	SLANEY RIVER VALLEY SAC	Freshwater pearl mussel *Margaritifera margaritifera*; Sea lamprey *Petromyzon marinus*; River lamprey *Lampetra fluviatilis*; Allis shad *Alosa alosa*; Twaite shad *Alosa fallax*; Atlantic salmon *Salmo salar*; Otter *Lutra lutra*; Common seal *Phoca vitulina*
IE0000707	SALTEE ISLANDS SAC	Grey seal *Halichoerus grypus*
IE0000204	LAMBAY ISLAND SAC	Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
IE0000101	ROARINGWATER BAY AND ISLANDS SAC	Harbour porpoise *Phocoena phocoena*; Otter *Lutra lutra*; Grey seal *Halichoerus grypus*
IE0000090	GLENGARRIFF HARBOUR AND WOODLAND SAC	Common seal *Phoca vitulina*
FR5302008	ROCHES DE PENMARCH SAC	Harbour porpoise *Phocoena phocoena*
FR5302007	CHAUSSÉE DE SEIN SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR5302006	CÔTES DE CROZON SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR5300066	BAIE DE SAINT-BRIEUC - EST SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR5300052	COTE DE CANCALE A PARAME SAC	Bottlenose dolphin *Tursiops truncatus*
FR5300049	DUNES ET COTES DE TREVIGNON SAC	Harbour porpoise *Phocoena phocoena*
FR5300046	RADE DE BREST, ESTUAIRE DE L'AULNE SAC	Common seal *Phoca vitulina*
FR5300023	ARCHIPEL DES GLENAN SAC	Harbour porpoise *Phocoena phocoena*
FR5300020	CAP SIZUN SAC	Bottlenose dolphin *Tursiops truncatus*; Grey seal *Halichoerus grypus*
FR5300019	PRESQU'ILE DE CROZON SAC	Grey seal *Halichoerus grypus*
FR5300018	OUESSANT-MOLENE SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*

Site Ref	SAC Site Name	SAC Mobile Interest Features Screened In
FR5300017	ABERS - CÔTES DES LEGENDES SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR5300015	BAIE DE MORLAIX SAC	Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR5300011	CAP D'ERQUY-CAP FREHEL SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*
FR5300010	TREGOR GOËLO SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR5300009	COTE DE GRANIT ROSE-SEPT-ILES SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*
FR3102005	BAIE DE CANCHE ET COULOIR DES TROIS ESTUAIRES SAC	Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR3102003	RECIFS GRIS-NEZ BLANC-NEZ SAC	Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR3102002	BANCS DES FLANDRES SAC	Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR3100482	DUNES DE L'AUTHIE ET MOLLIERES DE BERCK SAC	Common seal *Phoca vitulina*
FR3100474	DUNES DE LA PLAINE MARITIME FLAMANDE SAC	Common seal *Phoca vitulina*
FR2502021	BAIE DE SEINE ORIENTALE SAC	Bottlenose dolphin *Tursiops truncatus*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2502020	BAIE DE SEINE OCCIDENTALE SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2502019	ANSE DE VAUVILLE SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2502018	BANC ET RÉCIFS DE SURTAINVILLE SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2500088	MARAIS DU COTENTIN ET DU BESSIN - BAIE DES VEYS SAC	Common seal *Phoca vitulina*
FR2500084	RÉCIFS ET LANDES DE LA HAGUE SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2500080	LITTORAL OUEST DU COTENTIN DE BREHAL A PIROU SAC	Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2500079	CHAUSEY SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2500077	BAIE DU MONT SAINT-MICHEL SAC	Bottlenose dolphin *Tursiops truncatus*; Harbour porpoise *Phocoena phocoena*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2300139	LITTORAL CAUCHOIS SAC	Bottlenose dolphin *Tursiops truncatus*; Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*
FR2300121	ESTUAIRE DE LA SEINE SAC	Grey seal *Halichoerus grypus*; Common seal *Phoca vitulina*

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Appendix D
Seabird Sites

Site Code	Site	Features (excl. non seabird features)
UK9001011	North Rona and Sula Sgeir SPA	Northern fulmar *Fulmarus glacialis*; European storm-petrel *Hydrobates pelagicus*; Leach's storm-petrel *Oceanodroma leucorhoa*; Northern gannet *Morus bassanus*; Great black-backed gull *Larus marinus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001021	Flannan Isles SPA	Northern fulmar *Fulmarus glacialis*; Leach's storm-petrel *Oceanodroma leucorhoa*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001031	St Kilda SPA	Northern fulmar *Fulmarus glacialis*; Manx shearwater *Puffinus puffinus*; European storm-petrel *Hydrobates pelagicus*; Leach's storm-petrel *Oceanodroma leucorhoa*; Northern gannet *Morus bassanus*; Great *skua Catharacta skua*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001041	Shiant Isles SPA	Northern fulmar *Fulmarus glacialis*; European shag *Phalacrocorax aristotelis*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001071	Monach Isles SPA	Little tern *Sterna albifrons*
UK9001082	South Uist Machair and Lochs SPA	Little tern *Sterna albifrons*
UK9001121	Mingulay and Berneray SPA	Northern fulmar *Fulmarus glacialis*; European shag *Phalacrocorax aristotelis*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001131	Pentland Firth Islands SPA	Arctic tern *Sterna paradisaea*
UK9001181	North Caithness Cliffs SPA	Northern fulmar *Fulmarus glacialis*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001182	East Caithness Cliffs SPA	Northern fulmar *Fulmarus glacialis*; Great cormorant *Phalacrocorax carbo*; European shag *Phalacrocorax aristotelis*; Herring gull *Larus argentatus*; Great black-backed gull *Larus marinus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001231	Cape Wrath SPA	Northern fulmar *Fulmarus glacialis*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9001241	Handa SPA	Northern fulmar *Fulmarus glacialis*; Arctic skua *Stercorarius parasiticus*; Great *skua Catharacta skua*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*
UK9001261	Priest Island SPA	European storm-petrel *Hydrobates pelagicus*
UK9001341	Rum SPA	Manx shearwater *Puffinus puffinus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9001431	Canna and Sanday SPA	European shag *Phalacrocorax aristotelis*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Atlantic puffin *Fratercula arctica*
UK9001623	Cromarty Firth SPA	Common tern *Sterna hirundo*
UK9001624	Inner Moray Firth SPA	Common tern *Sterna hirundo*
UK9002011	Hermaness, Saxa Vord and Valla Field SPA	Northern fulmar *Fulmarus glacialis*; Northern gannet *Morus bassanus*; European shag *Phalacrocorax aristotelis*; Great *skua Catharacta skua*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Atlantic puffin *Fratercula arctica*
UK9002021	Ramna Stacks and Gruney SPA	Leach's storm-petrel *Oceanodroma leucorhoa*
UK9002031	Fetlar SPA	Northern fulmar *Fulmarus glacialis*; Arctic skua *Stercorarius parasiticus*; Great *skua Catharacta skua*; Arctic tern *Sterna paradisaea*
UK9002041	Ronas Hill - North Roe and Tingon SPA	Great *skua Catharacta skua*
UK9002051	Papa Stour SPA	Arctic tern *Sterna paradisaea*
UK9002061	Foula SPA	Northern fulmar *Fulmarus glacialis*; Leach's storm-petrel *Oceanodroma leucorhoa*; European shag *Phalacrocorax aristotelis*; Arctic skua *Stercorarius parasiticus*; Great *skua Catharacta skua*; Black-legged kittiwake *Rissa tridactyla*; Arctic tern *Sterna paradisaea*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*

Site Code	Site	Features (excl. non seabird features)
UK9002081	Noss SPA	Northern fulmar *Fulmarus glacialis*; Northern gannet *Morus bassanus*; Great *skua Catharacta skua*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Atlantic puffin *Fratercula arctica*
UK9002091	Fair Isle SPA	Northern fulmar *Fulmarus glacialis*; Northern gannet *Morus bassanus*; European shag *Phalacrocorax aristotelis*; Arctic skua *Stercorarius parasiticus*; Great *skua Catharacta skua*; Black-legged kittiwake *Rissa tridactyla*; Arctic tern *Sterna paradisaea*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9002101	West Westray SPA	Northern fulmar *Fulmarus glacialis*; Arctic skua *Stercorarius parasiticus*; Black-legged kittiwake *Rissa tridactyla*; Arctic tern *Sterna paradisaea*; Common guillemot *Uria aalge*; Razorbill *Alca torda*
UK9002111	Papa Westray (North Hill and Holm) SPA	Arctic tern *Sterna paradisaea*
UK9002121	Marwick Head SPA	Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9002141	Hoy SPA	Northern fulmar *Fulmarus glacialis*; Arctic skua *Stercorarius parasiticus*; Great *skua Catharacta skua*; Great black-backed gull *Larus marinus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Atlantic puffin *Fratercula arctica*
UK9002151	Copinsay SPA	Northern fulmar *Fulmarus glacialis*; Great black-backed gull *Larus marinus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9002181	Sule Skerry and Sule Stack SPA	European storm-petrel *Hydrobates pelagicus*; Leach's storm-petrel *Oceanodroma leucorhoa*; Northern gannet *Morus bassanus*; European shag *Phalacrocorax aristotelis*; Common guillemot *Uria aalge*; Atlantic puffin *Fratercula arctica*
UK9002211	Loch of Strathbe.g. SPA	Sandwich tern *Sterna sandvicensis*
UK9002221	Ythan Estuary, Sands of Forvie and Meikle Loch SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9002271	Fowlsheugh SPA	Northern fulmar *Fulmarus glacialis*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*
UK9002361	Mousa SPA	European storm-petrel *Hydrobates pelagicus*; Arctic tern *Sterna paradisaea*
UK9002371	Rousay SPA	Northern fulmar *Fulmarus glacialis*; Arctic skua *Stercorarius parasiticus*; Arctic tern *Sterna paradisaea*; Common guillemot *Uria aalge*
UK9002381	Auskerry SPA	European storm-petrel *Hydrobates pelagicus*; Arctic tern *Sterna paradisaea*
UK9002431	Calf of Eday SPA	Northern fulmar *Fulmarus glacialis*; Great cormorant *Phalacrocorax carbo*; Great black-backed gull *Larus marinus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9002471	Troup, Pennan and Lion's Heads SPA	Northern fulmar *Fulmarus glacialis*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*
UK9002491	Buchan Ness to Collieston Coast SPA	Northern fulmar *Fulmarus glacialis*; European shag *Phalacrocorax aristotelis*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9002511	Sumburgh Head SPA	Northern fulmar *Fulmarus glacialis*; Black-legged kittiwake *Rissa tridactyla*; Arctic tern *Sterna paradisaea*; Common guillemot *Uria aalge*
UK9002811	Tips of Corsemaul and Tom Mor SPA	Mew gull *Larus canus*
UK9003041	Treshnish Isles SPA	European storm-petrel *Hydrobates pelagicus*
UK9003057	Rinns of Islay SPA	Black (common) scoter *Melanitta nigra*
UK9003091	Ailsa Craig SPA	Northern gannet *Morus bassanus*; Lesser black-backed gull *Larus fuscus*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9003171	North Colonsay and Western Cliffs SPA	Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*
UK9003211	Glas Eileanan SPA	Common tern *Sterna hirundo*
UK9004111	Loch Leven SPA	Great cormorant *Phalacrocorax carbo*
UK9004121	Firth of Tay and Eden Estuary SPA	Great cormorant *Phalacrocorax carbo*; Black (common) scoter *Melanitta nigra*; Velvet scoter *Melanitta fusca*; Little tern *Sterna albifrons*
UK9004171	Forth Islands SPA	Northern fulmar *Fulmarus glacialis*; Northern gannet *Morus bassanus*; Great cormorant *Phalacrocorax carbo*; European shag *Phalacrocorax aristotelis*; Lesser black-backed gull *Larus fuscus*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Sandwich tern *Sterna sandvicensis*; Roseate tern *Sterna dougallii*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*; Common guillemot *Uria aalge*; Razorbill *Alca torda*; Atlantic puffin *Fratercula arctica*
UK9004271	St Abb's Head to Fast Castle SPA	European shag *Phalacrocorax aristotelis*; Herring gull *Larus argentatus*; Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*

Site Code	Site	Features (excl. non seabird features)
UK9004411	Firth of Forth SPA	Great cormorant *Phalacrocorax carbo*; Black (common) scoter *Melanitta nigra*; Velvet scoter *Melanitta fusca*; Sandwich tern *Sterna sandvicensis*
UK9004451	Imperial Dock Lock, Leith SPA	Common tern *Sterna hirundo*
UK9005031	Duddon Estuary SPA	Sandwich tern *Sterna sandvicensis*
UK9005081	Morecambe Bay SPA	Sandwich tern *Sterna sandvicensis*
UK9005103	Ribble and Alt Estuaries SPA	Great cormorant *Phalacrocorax carbo*; Black (common) scoter *Melanitta nigra*; Black-headed gull *Larus ridibundus*; Lesser black-backed gull *Larus fuscus*; Common tern *Sterna hirundo*
UK9005151	Bowland Fells SPA	Lesser black-backed gull *Larus fuscus*
UK9006011	Lindisfarne SPA	Black (common) scoter *Melanitta nigra*; Roseate tern *Sterna dougallii*; Little tern *Sterna albifrons*
UK9006021	Farne Islands SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*
UK9006031	Coquet Island SPA	Sandwich tern *Sterna sandvicensis*; Roseate tern *Sterna dougallii*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*
UK9006061	Teesmouth and Cleveland Coast SPA	Great cormorant *Phalacrocorax carbo*; Sandwich tern *Sterna sandvicensis*; Little tern *Sterna albifrons*
UK9006101	Flamborough Head and Bempton Cliffs SPA	Black-legged kittiwake *Rissa tridactyla*
UK9006111	Humber Estuary SPA	Little tern *Sterna albifrons*
UK9006131	Northumbria Coast SPA	Little tern *Sterna albifrons*
UK9008021	The Wash SPA	Black (common) scoter *Melanitta nigra*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9008022	Gibraltar Point SPA	Little tern *Sterna albifrons*
UK9008041	Ouse Washes SPA	Great cormorant *Phalacrocorax carbo*
UK9009031	North Norfolk Coast SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9009101	Minsmere-Walberswick SPA	Little tern *Sterna albifrons*
UK9009112	Alde-Ore Estuary SPA	Lesser black-backed gull *Larus fuscus*; Sandwich tern *Sterna sandvicensis*; Little tern *Sterna albifrons*
UK9009121	Stour and Orwell Estuaries SPA	Great cormorant *Phalacrocorax carbo*
UK9009131	Hamford Water SPA	Little tern *Sterna albifrons*
UK9009141	Abberton Reservoir SPA	Great cormorant *Phalacrocorax carbo*
UK9009181	Breydon Water SPA	Common tern *Sterna hirundo*
UK9009243	Colne Estuary (Mid-Essex Coast Phase 2) SPA	Little tern *Sterna albifrons*
UK9009245	Blackwater Estuary (Mid-Essex Coast Phase 4) SPA	Little tern *Sterna albifrons*
UK9009246	Foulness (Mid-Essex Coast Phase 5) SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9009271	Great Yarmouth North Denes SPA	Little tern *Sterna albifrons*
UK9009291	Benacre to Easton Bavents SPA	Little tern *Sterna albifrons*
UK9010111	Poole Harbour SPA	Mediterranean gull *Larus melanocephalus*; Common tern *Sterna hirundo*
UK9011011	Chichester and Langstone Harbours SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9011061	Solent and Southampton Water SPA	Mediterranean gull *Larus melanocephalus*; Sandwich tern *Sterna sandvicensis*; Roseate tern *Sterna dougallii*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9012031	Medway Estuary and Marshes SPA	Great cormorant *Phalacrocorax carbo*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9012041	Pagham Harbour SPA	Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9012071	Thanet Coast and Sandwich Bay SPA	Little tern *Sterna albifrons*
UK9012091	Dungeness to Pett Level SPA	Mediterranean gull *Larus melanocephalus*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9013011	The Dee Estuary SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Little tern *Sterna albifrons*
UK9013061	Ynys Feurig, Cemlyn Bay and The Skerries SPA	Sandwich tern *Sterna sandvicensis*; Roseate tern *Sterna dougallii*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*

Site Code	Site	Features (excl. non seabird features)
UK9013121	Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA	Manx shearwater *Puffinus puffinus*
UK9014041	Grassholm SPA	Northern gannet *Morus bassanus*
UK9014051	Skokholm and Skomer SPA	Manx shearwater *Puffinus puffinus*; European storm-petrel *Hydrobates pelagicus*; Lesser black-backed gull *Larus fuscus*; Atlantic puffin *Fratercula arctica*
UK9014091	Bae Caerfyrddin/ Carmarthen Bay SPA	Black (common) scoter *Melanitta nigra*
UK9020011	Rathlin Island SPA	Black-legged kittiwake *Rissa tridactyla*; Common guillemot *Uria aalge*; Razorbill *Alca torda*
UK9020021	Sheep Island SPA	Great cormorant *Phalacrocorax carbo*
UK9020042	Larne Lough SPA	Sandwich tern *Sterna sandvicensis*; Roseate tern *Sterna dougallii*; Common tern *Sterna hirundo*
UK9020091	Lough Neagh and Lough Beg. SPA	Common tern *Sterna hirundo*
UK9020111	Strangford Lough SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*
UK9020161	Carlingford Lough SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*
UK9020271	Outer Ards SPA	Arctic tern *Sterna paradisaea*
UK9020285	Ynys Seiriol / Puffin Island SPA	Great cormorant *Phalacrocorax carbo*
UK9020287	Mersey Narrows and North Wirral Foreshore SPA	Great cormorant *Phalacrocorax carbo*; Little gull *Larus minutus*
UK9020288	Isles of Scilly SPA	European storm-petrel *Hydrobates pelagicus*; Lesser black-backed gull *Larus fuscus*
UK9020291	Copeland Islands SPA	Manx shearwater *Puffinus puffinus*; Arctic tern *Sterna paradisaea*
UK9020294	Liverpool Bay / Bae Lerpwl SPA	Black (common) scoter *Melanitta nigra*
UK9020296	Upper Nene Valley Gravel Pits SPA	Great cormorant *Phalacrocorax carbo*
UK9020298	West Inverness-shire Lochs SPA	Black (common) scoter *Melanitta nigra*
UK9013061	Anglesey Terns / Morwenoliaid Ynys Môn SPA	Sandwich tern *Sterna sandvicensis*; Common tern *Sterna hirundo*; Arctic tern *Sterna paradisaea*; Roseate tern *Sterna* dougalli
UK9020327	Northern Cardigan Bay / Gogledd Bae Ceredigion SPA	Red-throated diver *Gavia stellata*
UK9014051	Skomer, Skokholm and the seas off Pembrokeshire / Sgomer, Sgogwm a moroedd Benfro SPA	Storm petrel *Hydrobates pelagicus*; lesser black-backed gull *Larus fuscus*; Manx shearwater *Puffinus puffinus*; Atlantic puffin *Fratercula arctica*; Breeding seabird assemblage;

Appendix E
Wildfowl and Wintering Bird Sites

Site Ref	Site Name	Interest features screened in
UK11001	Abberton Reservoir Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11002	Alde–Ore Estuary Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11004	Arun Valley Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds
UK11005	Avon Valley Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11006	Benfleet and Southend Marshes Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11007	Blackwater Estuary (Mid-Essex Coast Phase 4) Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11008	Breydon Water Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11010	Broadland Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11012	Chesil Beach and The Fleet Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11013	Chichester and Langstone Harbours Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11014	Chippenham Fen Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11015	Colne Estuary (Mid-Essex Coast Phase 2) Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11017	Deben Estuary Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11018	Dengie (Mid-Essex Coast Phase 1) Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11021	Dorset Heathlands Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity

Site Ref	Site Name	Interest features screened in
UK11022	Duddon Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11025	Exe Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11026	Foulness (Mid-Essex Coast Phase 5) Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11027	Gibraltar Point Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11028	Hamford Water Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11030	Holburn Lake and Moss Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11031	Humber Estuary Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11032	Irthinghead Mires Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11033	Isles of Scilly Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11034	Lee Valley Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11036	Lindisfarne Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11037	Lower Derwent Valley Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11039	Martin Mere Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11040	Medway Estuary and Marshes Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11041	Mersey Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11042	Mersey Narrows and North Wirral Foreshore Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11045	Morecambe Bay Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Site Ref	Site Name	Interest features screened in
UK11046	Nene Washes Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11047	The New Forest Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11048	North Norfolk Coast Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11049	Northumbria Coast Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11051	Ouse Washes Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11052	Pagham Harbour Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11053	Pevensey Levels Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11054	Poole Harbour Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11055	Portsmouth Harbour Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11056	Redgrave and South Lopham Fens Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11057	Ribble and Alt Estuaries Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11058	Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11061	Roydon Common Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11062	Rutland Water Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11063	Solent and Southampton Water Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11064	Somerset Levels and Moors Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11065	South West London Waterbodies Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11067	Stour and Orwell Estuaries Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11068	Teesmouth and Cleveland Coast Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Site Ref	Site Name	Interest features screened in
UK11069	Thames Estuary and Marshes Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11070	Thanet Coast and Sandwich Bay Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11071	The Swale Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11072	The Wash Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11074	Thursley and Ockley Bog Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK11076	Walmore Common Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11079	Upper Solway Flats and Marshes Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11081	Severn Estuary Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11082	The Dee Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK11083	Upper Nene Valley Gravel Pits Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12002	Belfast Lough Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12004	Carlingford Lough Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12012	Killough Bay Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12013	Larne Lough Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12014	Lough Foyle Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12016	Lough Neagh and Lough Beg. Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12018	Outer Ards Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK12021	Strangford Lough Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Site Ref	Site Name	Interest features screened in
UK12024	Upper Lough Erne Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13001	Bridgend Flats, Islay Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13003	Caithness and Sutherland Peatlands Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13004	Caithness Lochs Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13005	Cameron Reservoir Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13006	Castle Loch, Lochmaben Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13007	Claish Moss Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK13008	Coll Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13009	Cromarty Firth Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13010	Din Moss – Hoselaw Loch Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13011	Dornoch Firth and Loch Fleet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13013	East Sanday Coast Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13014	Eilean na Muice Duibhe (Duich Moss), Islay Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13015	Fala Flow Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13017	Firth of Forth Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13018	Firth of Tay & Eden Estuary Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13021	Gladhouse Reservoir Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13022	Greenlaw Moor Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13023	Gruinart Flats, Islay Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13024	Inner Clyde Estuary Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13025	Inner Moray Firth Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Site Ref	Site Name	Interest features screened in
UK13027	Kintyre Goose Roosts Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13028	Lewis Peatlands Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13031	Loch Eye Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13032	Loch Ken and River Dee Marshes Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13033	Loch Leven Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13034	Loch Lomond Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13037	Loch of Inch and Torrs Warren Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13038	Loch of Kinnordy Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13039	Loch of Lintrathen Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13040	Loch of Skene Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13041	Loch of Strathbe.g. Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13042	Loch Ruthven Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK13043	Loch Spynie Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13046	Montrose Basin Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13048	Moray and Nairn Coast Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13049	Muir of Dinnet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13050	North Uist Machair and Islands Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13052	Rinns of Islay Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13053	River Spey – Insh Marshes Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13056	Sléibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13057	South Tayside Goose Roosts Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Site Ref	Site Name	Interest features screened in
UK13058	South Uist Machair and Lochs Ramsar	Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13060	Westwater Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK13061	Ythan Estuary and Meikle Loch Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK14001	Burry Inlet Ramsar	Crit. 5 - regularly supports 20,000 or more waterbirds; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK14003	Cors Caron Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity; Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds
UK14005	Corsydd Môn a Llyn/ Anglesey and Llyn Fens Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK14006	Crymlyn Bog Ramsar	Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity
UK9001041	Shiant Isles SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]
UK9001051	North Uist Machair and Islands SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]; Corn crake *Crex crex*; Ruddy turnstone *Arenaria interpres*; Dunlin *Calidris alpina schinzii*
UK9001071	Monach Isles SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]
UK9001082	South Uist Machair and Lochs SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]; Corn crake *Crex crex*; Sanderling *Calidris alba*; Dunlin *Calidris alpina schinzii*
UK9001083	Kilpheder and Smerclate, South Uist SPA	Corn crake *Crex crex*
UK9001151	Caithness and Sutherland Peatlands SPA	Red-throated diver *Gavia stellata*; Black-throated diver *Gavia arctica*; European golden plover *Pluvialis apricaria*; Wood sandpiper *Tringa glareola*; Dunlin *Calidris alpina schinzii*
UK9001171	Caithness Lochs SPA	Whooper swan *Cygnus cygnus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Greenland white-fronted goose *Anser albifrons flavirostris*
UK9001211	North Sutherland Coastal Islands SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]
UK9001341	Rum SPA	Red-throated diver *Gavia stellata*
UK9001501	Mointeach Scadabhaigh SPA	Red-throated diver *Gavia stellata*; Black-throated diver *Gavia arctica*
UK9001511	Inverpolly, Loch Urigill and nearby Lochs SPA	Black-throated diver *Gavia arctica*
UK9001531	Loch Maree SPA	Black-throated diver *Gavia arctica*
UK9001551	Loch Ruthven SPA	Slavonian grebe *Podiceps auritus*
UK9001552	Loch Knockie and nearby Lochs SPA	Slavonian grebe *Podiceps auritus*
UK9001553	North Inverness Lochs SPA	Slavonian grebe *Podiceps auritus*
UK9001554	Loch Ashie SPA	Slavonian grebe *Podiceps auritus*
UK9001571	Lewis Peatlands SPA	Red-throated diver *Gavia stellata*; Black-throated diver *Gavia arctica*; European golden plover *Pluvialis apricaria*; Common greenshank *Tringa nebularia*; Dunlin *Calidris alpina schinzii*
UK9001591	Assynt Lochs SPA	Black-throated diver *Gavia arctica*
UK9001611	Lairg and Strath Brora Lochs SPA	Black-throated diver *Gavia arctica*

Site Ref	Site Name	Interest features screened in
UK9001621	Loch Eye SPA	Whooper swan *Cygnus cygnus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9001622	Dornoch Firth and Loch Fleet SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]; Eurasian wigeon *Anas penelope*; Bar-tailed godwit *Limosa lapponica*
UK9001623	Cromarty Firth SPA	Whooper swan *Cygnus cygnus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Bar-tailed godwit *Limosa lapponica*
UK9001624	Inner Moray Firth SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]; Red-breasted *merganser Mergus serrator*; Bar-tailed godwit *Limosa lapponica*; Common redshank *Tringa totanus*
UK9001625	Moray and Nairn Coast SPA	Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Common redshank *Tringa totanus*
UK9001631	Beinn Dearg SPA	Eurasian dotterel *Charadrius morinellus*
UK9001641	Ben Wyvis SPA	Eurasian dotterel *Charadrius morinellus*
UK9001691	Loch Flemington SPA	Slavonian grebe *Podiceps auritus*
UK9001701	Achanalt Marshes SPA	Wood sandpiper *Tringa glareola*
UK9001711	Wester Ross Lochs SPA	Black-throated diver *Gavia arctica*
UK9001721	Loch Shiel SPA	Black-throated diver *Gavia arctica*
UK9001741	Ness and Barvas, Lewis SPA	Corn crake *Crex crex*
UK9001751	Aird and Borve, Benbecula SPA	Corn crake *Crex crex*
UK9001761	Eoligarry, Barra SPA	Corn crake *Crex crex*
UK9002011	Hermaness, Saxa Vord and Valla Field SPA	Red-throated diver *Gavia stellata*
UK9002031	Fetlar SPA	Whimbrel *Numenius phaeopus*; Red-necked phalarope *Phalaropus lobatus*; Dunlin *Calidris alpina schinzii*
UK9002041	Ronas Hill - North Roe and Tingon SPA	Red-throated diver *Gavia stellata*
UK9002061	Foula SPA	Red-throated diver *Gavia stellata*
UK9002141	Hoy SPA	Red-throated diver *Gavia stellata*
UK9002161	Creag Meagaidh SPA	Eurasian dotterel *Charadrius morinellus*
UK9002201	Loch Spynie SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9002211	Loch of Strathbe.g. SPA	Whooper swan *Cygnus cygnus*; Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Eurasian teal *Anas crecca*; Common goldeneye *Bucephala clangula*
UK9002221	Ythan Estuary, Sands of Forvie and Meikle Loch SPA	Pink-footed goose *Anser brachyrhynchus*
UK9002231	River Spey - Insh Marshes SPA	Whooper swan *Cygnus cygnus*; Spotted crake *Porzana porzana*; Wood sandpiper *Tringa glareola*
UK9002241	Cairngorms SPA	Eurasian dotterel *Charadrius morinellus*
UK9002261	Loch of Skene SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]; Common goldeneye *Bucephala clangula*; Goosander *Mergus merganser*
UK9002281	Lochnagar SPA	Eurasian dotterel *Charadrius morinellus*
UK9002301	Drumochter Hills SPA	Eurasian dotterel *Charadrius morinellus*
UK9002311	Orkney Mainland Moors SPA	Red-throated diver *Gavia stellata*
UK9002331	East Sanday Coast SPA	Purple sandpiper *Calidris maritima*; Ruddy turnstone *Arenaria interpres*
UK9002551	Ben Alder SPA	Eurasian dotterel *Charadrius morinellus*
UK9002651	Lochs of Spiggie and Brow SPA	Whooper swan *Cygnus cygnus*
UK9002751	Loch Vaa SPA	Slavonian grebe *Podiceps auritus*; Common goldeneye *Bucephala clangula*
UK9002791	Muir of Dinnet SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9002891	Switha SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]

Site Ref	Site Name	Interest features screened in
UK9002941	Otterswick and Graveland SPA	Red-throated diver *Gavia stellata*
UK9003021	Loch Lomond SPA	Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003031	Coll SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]; Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003032	Sléibhtean agus Cladach Thiriodh (Tiree Wetlands and Coast) SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]; Eurasian oystercatcher *Haematopus ostralegus*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Greenland white-fronted goose *Anser albifrons flavirostris*; Dunlin *Calidris alpina schinzii*
UK9003033	Coll (corncrake) SPA	Corn crake *Crex crex*
UK9003034	Tiree (corncrake) SPA	Corn crake *Crex crex*
UK9003041	Treshnish Isles SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]
UK9003051	Gruinart Flats, Islay SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]; Greenland white-fronted goose *Anser albifrons flavirostris*; Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9003052	Bridgend Flats, Islay SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]
UK9003053	Laggan, Islay SPA	Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]; Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003054	Eilean na Muice Duibhe (Duich Moss), Islay SPA	Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003057	Rinns of Islay SPA	Whooper swan *Cygnus cygnus*; Corn crake *Crex crex*; Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003061	Inner Clyde Estuary SPA	Common redshank *Tringa totanus*
UK9003071	Kintyre Goose Roosts SPA	Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003111	Loch Ken and River Dee Marshes SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]; Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003121	Loch of Inch and Torrs Warren SPA	Greenland white-fronted goose *Anser albifrons flavirostris*
UK9003191	Castle Loch, Lochmaben SPA	Pink-footed goose *Anser brachyrhynchus*
UK9003221	Black Cart SPA	Whooper swan *Cygnus cygnus*
UK9003261	Muirkirk and North Lowther Uplands SPA	European golden plover *Pluvialis apricaria*
UK9003301	Knapdale Lochs SPA	Black-throated diver *Gavia arctica*
UK9004011	Caenlochan SPA	Eurasian dotterel *Charadrius morinellus*
UK9004021	Rannoch Lochs SPA	Black-throated diver *Gavia arctica*
UK9004031	Montrose Basin SPA	Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Eurasian oystercatcher *Haematopus ostralegus*; Red knot *Calidris canutus*; Common redshank *Tringa totanus*
UK9004051	Loch of Kinnordy SPA	Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9004061	Loch of Lintrathen SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9004111	Loch Leven SPA	Whooper swan *Cygnus cygnus*; Pink-footed goose *Anser brachyrhynchus*; Gadwall *Anas strepera*; Eurasian teal *Anas crecca*; Northern shoveler *Anas clypeata*; Common pochard *Aythya ferina*; Tufted duck *Aythya fuligula*; Common goldeneye *Bucephala clangula*

Site Ref	Site Name	Interest features screened in
UK9004121	Firth of Tay and Eden Estuary SPA	Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Common shelduck *Tadorna tadorna*; Common eider *Somateria mollissima*; Long-tailed duck *Clangula hyemalis*; Common goldeneye *Bucephala clangula*; Eurasian oystercatcher *Haematopus ostralegus*; Grey plover *Pluvialis squatarola*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*; Common redshank *Tringa totanus*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*
UK9004131	Cameron Reservoir SPA	Pink-footed goose *Anser brachyrhynchus*
UK9004231	Gladhouse Reservoir SPA	Pink-footed goose *Anser brachyrhynchus*
UK9004241	Fala Flow SPA	Pink-footed goose *Anser brachyrhynchus*
UK9004251	Westwater SPA	Pink-footed goose *Anser brachyrhynchus*
UK9004281	Greenlaw Moor SPA	Pink-footed goose *Anser brachyrhynchus*
UK9004291	Din Moss - Hoselaw Loch SPA	Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9004401	South Tayside Goose Roosts SPA	Pink-footed goose *Anser brachyrhynchus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Eurasian wigeon *Anas penelope*
UK9004411	Firth of Forth SPA	Red-throated diver *Gavia stellata*; Great crested grebe *Podiceps cristatus*; Slavonian grebe *Podiceps auritus*; Pink-footed goose *Anser brachyrhynchus*; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Mallard *Anas platyrhynchos*; Greater scaup *Aythya marila*; Common eider *Somateria mollissima*; Long-tailed duck *Clangula hyemalis*; Common goldeneye *Bucephala clangula*; Red-breasted *merganser Mergus serrator*; Eurasian oystercatcher *Haematopus ostralegus*; Ringed plover *Charadrius hiaticula*; European golden plover *Pluvialis apricaria*; Grey plover *Pluvialis squatarola*; Northern lapwing *Vanellus vanellus*; Red knot *Calidris canutus*; Bar-tailed godwit *Limosa lapponica*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Dunlin *Calidris alpina alpina*
UK9004441	Slamannan Plateau SPA	Taiga bean goose *Anser fabalis fabalis*
UK9005012	Upper Solway Flats and Marshes SPA	Whooper swan *Cygnus cygnus*; Pink-footed goose *Anser brachyrhynchus*; Barnacle goose *Branta leucopsis* [Eastern Greenland/Scotland/Ireland]; Common shelduck *Tadorna tadorna*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Northern shoveler *Anas clypeata*; Greater scaup *Aythya marila*; Common goldeneye *Bucephala clangula*; Eurasian oystercatcher *Haematopus ostralegus*; European golden plover *Pluvialis apricaria*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Dunlin *Calidris alpina alpina*
UK9005031	Duddon Estuary SPA	Northern pintail *Anas acuta*; Red knot *Calidris canutus*; Common redshank *Tringa totanus*
UK9005081	Morecambe Bay SPA	Pink-footed goose *Anser brachyrhynchus*; Common shelduck *Tadorna tadorna*; Northern pintail *Anas acuta*; Eurasian oystercatcher *Haematopus ostralegus*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Bar-tailed godwit *Limosa lapponica*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Dunlin *Calidris alpina alpina*
UK9005091	Leighton Moss SPA	Great bittern *Botaurus stellaris*

Site Ref	Site Name	Interest features screened in
UK9005103	Ribble and Alt Estuaries SPA	Tundra swan *Cygnus columbianus bewickii*; Whooper swan *Cygnus cygnus*; Pink-footed goose *Anser brachyrhynchus*; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Greater scaup *Aythya marila*; Eurasian oystercatcher *Haematopus ostralegus*; Ringed plover *Charadrius hiaticula*; European golden plover *Pluvialis apricaria*; Grey plover *Pluvialis squatarola*; Northern lapwing *Vanellus vanellus*; Red knot *Calidris canutus*; Ruff *Philomachus pugnax*; Bar-tailed godwit *Limosa lapponica*; Whimbrel *Numenius phaeopus*; Eurasian curlew *Numenius arquata*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*
UK9005111	Martin Mere SPA	Tundra swan *Cygnus columbianus bewickii*; Whooper swan *Cygnus cygnus*; Pink-footed goose *Anser brachyrhynchus*; Eurasian wigeon *Anas penelope*; Northern pintail *Anas acuta*
UK9005131	Mersey Estuary SPA	Great crested grebe *Podiceps cristatus*; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Ringed plover *Charadrius hiaticula*; European golden plover *Pluvialis apricaria*; Grey plover *Pluvialis squatarola*; Northern lapwing *Vanellus vanellus*; Eurasian curlew *Numenius arquata*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*
UK9006011	Lindisfarne SPA	Whooper swan *Cygnus cygnus*; Greylag goose *Anser anser* [Iceland/UK/Ireland]; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Common eider *Somateria mollissima*; Long-tailed duck *Clangula hyemalis*; Red-breasted *merganser Mergus serrator*; Ringed plover *Charadrius hiaticula*; European golden plover *Pluvialis apricaria*; Grey plover *Pluvialis squatarola*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*; Common redshank *Tringa totanus*; Dunlin *Calidris alpina alpina*; Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9006041	Holburn Lake and Moss SPA	Greylag goose *Anser anser* [Iceland/UK/Ireland]
UK9006061	Teesmouth and Cleveland Coast SPA	Common shelduck *Tadorna tadorna*; Eurasian teal *Anas crecca*; Northern shoveler *Anas clypeata*; Red knot *Calidris canutus*; Sanderling *Calidris alba*; Common redshank *Tringa totanus*
UK9006092	Lower Derwent Valley SPA	Tundra swan *Cygnus columbianus bewickii*; Eurasian wigeon *Anas penelope*; Eurasian teal *Anas crecca*; Northern shoveler *Anas clypeata*; European golden plover *Pluvialis apricaria*; Ruff *Philomachus pugnax*
UK9006111	Humber Estuary SPA	Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Mallard *Anas platyrhynchos*; Eurasian teal *Anas crecca*; Common pochard *Aythya ferina*; Greater scaup *Aythya marila*; Common goldeneye *Bucephala clangula*; Eurasian oystercatcher *Haematopus ostralegus*; European golden plover *Pluvialis apricaria*; Northern lapwing *Vanellus vanellus*; Ruff *Philomachus pugnax*; Bar-tailed godwit *Limosa lapponica*; Whimbrel *Numenius phaeopus*; Eurasian curlew *Numenius arquata*; Common greenshank *Tringa nebularia*; Ruddy turnstone *Arenaria interpres*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9006131	Northumbria Coast SPA	Purple sandpiper *Calidris maritima*; Ruddy turnstone *Arenaria interpres*
UK9006161	North York Moors SPA	European golden plover *Pluvialis apricaria*
UK9006171	Hornsea Mere SPA	Mute swan *Cygnus olor*; Gadwall *Anas strepera*
UK9006272	North Pennine Moors SPA	European golden plover *Pluvialis apricaria*
UK9007021	Peak District Moors (South Pennine Moors Phase 1) SPA	European golden plover *Pluvialis apricaria*
UK9007022	South Pennine Moors Phase 2 SPA	European golden plover *Pluvialis apricaria*

Site Ref	Site Name	Interest features screened in
UK9007051	Walmore Common SPA	Tundra swan *Cygnus columbianus bewickii*
UK9008021	The Wash SPA	Tundra swan *Cygnus columbianus bewickii*; Pink-footed goose *Anser brachyrhynchus*; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Gadwall *Anas strepera*; Northern pintail *Anas acuta*; Common goldeneye *Bucephala clangula*; Eurasian oystercatcher *Haematopus ostralegus*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9008022	Gibraltar Point SPA	Grey plover *Pluvialis squatarola*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*
UK9008031	Nene Washes SPA	Tundra swan *Cygnus columbianus bewickii*; Eurasian wigeon *Anas penelope*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Garganey *Anas querquedula*; Black-tailed godwit *Limosa limosa limosa*
UK9008041	Ouse Washes SPA	Mute swan *Cygnus olor*; Tundra swan *Cygnus columbianus bewickii*; Whooper swan *Cygnus cygnus*; Eurasian wigeon *Anas penelope*; Mallard *Anas platyrhynchos*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Garganey *Anas querquedula*; Common pochard *Aythya ferina*; Tufted duck *Aythya fuligula*; Common coot *Fulica atra*; Ruff *Philomachus pugnax*; Black-tailed godwit *Limosa limosa limosa*
UK9008051	Rutland Water SPA	Great crested grebe *Podiceps cristatus*; Mute swan *Cygnus olor*; Eurasian wigeon *Anas penelope*; Gadwall *Anas strepera*; Eurasian teal *Anas crecca*; Northern shoveler *Anas clypeata*; Tufted duck *Aythya fuligula*; Common goldeneye *Bucephala clangula*; Goosander *Mergus merganser*; Common coot *Fulica atra*
UK9009031	North Norfolk Coast SPA	Great bittern *Botaurus stellaris*; Pink-footed goose *Anser brachyrhynchus*; Eurasian wigeon *Anas penelope*; Red knot *Calidris canutus*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009101	Minsmere-Walberswick SPA	Great bittern *Botaurus stellaris*; Eurasian teal *Anas crecca*; Pied avocet *Recurvirostra avosetta*; Greater white-fronted goose *Anser albifrons albifrons*
UK9009112	Alde-Ore Estuary SPA	Ruff *Philomachus pugnax*; Common redshank *Tringa totanus*
UK9009121	Stour and Orwell Estuaries SPA	Great crested grebe *Podiceps cristatus*; Mute swan *Cygnus olor*; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Gadwall *Anas strepera*; Northern pintail *Anas acuta*; Greater scaup *Aythya marila*; Common goldeneye *Bucephala clangula*; Pied avocet *Recurvirostra avosetta*; European golden plover *Pluvialis apricaria*; Grey plover *Pluvialis squatarola*; Northern lapwing *Vanellus vanellus*; Red knot *Calidris canutus*; Eurasian curlew *Numenius arquata*; Ruddy turnstone *Arenaria interpres*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009131	Hamford Water SPA	Common shelduck *Tadorna tadorna*; Eurasian teal *Anas crecca*; Pied avocet *Recurvirostra avosetta*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Common redshank *Tringa totanus*; Black-tailed godwit *Limosa limosa islandica*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009141	Abberton Reservoir SPA	Great crested grebe *Podiceps cristatus*; Mute swan *Cygnus olor*; Eurasian wigeon *Anas penelope*; Gadwall *Anas strepera*; Eurasian teal *Anas crecca*; Northern shoveler *Anas clypeata*; Common pochard *Aythya ferina*; Tufted duck *Aythya fuligula*; Common goldeneye *Bucephala clangula*; Common coot *Fulica atra*

Site Ref	Site Name	Interest features screened in
UK9009171	Benfleet and Southend Marshes SPA	Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009181	Breydon Water SPA	Tundra swan *Cygnus columbianus bewickii*; Pied avocet *Recurvirostra avosetta*; European golden plover *Pluvialis apricaria*; Northern lapwing *Vanellus vanellus*; Ruff *Philomachus pugnax*
UK9009242	Dengie (Mid-Essex Coast Phase 1) SPA	Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009243	Colne Estuary (Mid-Essex Coast Phase 2) SPA	Common pochard *Aythya ferina*; Ringed plover *Charadrius hiaticula*; Common redshank *Tringa totanus*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009244	Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) SPA	Dark-bellied brent goose *Branta bernicla bernicla*
UK9009245	Blackwater Estuary (Mid-Essex Coast Phase 4) SPA	Common pochard *Aythya ferina*; Grey plover *Pluvialis squatarola*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009246	Foulness (Mid-Essex Coast Phase 5) SPA	Eurasian oystercatcher *Haematopus ostralegus*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Bar-tailed godwit *Limosa lapponica*; Common redshank *Tringa totanus*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009253	Broadland SPA	Great bittern *Botaurus stellaris*; Tundra swan *Cygnus columbianus bewickii*; Whooper swan *Cygnus cygnus*; Eurasian wigeon *Anas penelope*; Gadwall *Anas strepera*; Northern shoveler *Anas clypeata*; Ruff *Philomachus pugnax*
UK9009261	Deben Estuary SPA	Pied avocet *Recurvirostra avosetta*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9009291	Benacre to Easton Bavents SPA	Great bittern *Botaurus stellaris*
UK9010031	Somerset Levels and Moors SPA	Tundra swan *Cygnus columbianus bewickii*; Eurasian teal *Anas crecca*; European golden plover *Pluvialis apricaria*; Northern lapwing *Vanellus vanellus*
UK9010041	Chew Valley Lake SPA	Northern shoveler *Anas clypeata*
UK9010081	Exe Estuary SPA	Slavonian grebe *Podiceps auritus*; Eurasian oystercatcher *Haematopus ostralegus*; Pied avocet *Recurvirostra avosetta*; Grey plover *Pluvialis squatarola*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9010091	Chesil Beach and The Fleet SPA	Dark-bellied brent goose *Branta bernicla bernicla*
UK9010111	Poole Harbour SPA	Common shelduck *Tadorna tadorna*; Pied avocet *Recurvirostra avosetta*; Black-tailed godwit *Limosa limosa islandica*
UK9010141	Tamar Estuaries Complex SPA	Little egret *Egretta garzetta*; Pied avocet *Recurvirostra avosetta*
UK9011011	Chichester and Langstone Harbours SPA	Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Northern shoveler *Anas clypeata*; Red-breasted *merganser Mergus serrator*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9011051	Portsmouth Harbour SPA	Red-breasted *merganser Mergus serrator*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9011061	Solent and Southampton Water SPA	Eurasian teal *Anas crecca*; Ringed plover *Charadrius hiaticula*; Black-tailed godwit *Limosa limosa islandica*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9011091	Avon Valley SPA	Tundra swan *Cygnus columbianus bewickii*; Gadwall *Anas strepera*

Site Ref	Site Name	Interest features screened in
UK9012011	The Swale SPA	Gadwall *Anas strepera*; Eurasian teal *Anas crecca*; Eurasian oystercatcher *Haematopus ostralegus*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9012021	Thames Estuary and Marshes SPA	Pied avocet *Recurvirostra avosetta*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Common redshank *Tringa totanus*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*
UK9012031	Medway Estuary and Marshes SPA	Red-throated diver *Gavia stellata*; Great crested grebe *Podiceps cristatus*; Tundra swan *Cygnus columbianus bewickii*; Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Mallard *Anas platyrhynchos*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Northern shoveler *Anas clypeata*; Common pochard *Aythya ferina*; Eurasian oystercatcher *Haematopus ostralegus*; Ringed plover *Charadrius hiaticula*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Common greenshank *Tringa nebularia*; Ruddy turnstone *Arenaria interpres*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9012041	Pagham Harbour SPA	Ruff *Philomachus pugnax*; Dark-bellied brent goose *Branta bernicla bernicla*
UK9012071	Thanet Coast and Sandwich Bay SPA	European golden plover *Pluvialis apricaria*; Ruddy turnstone *Arenaria interpres*
UK9012091	Dungeness to Pett Level SPA	Tundra swan *Cygnus columbianus bewickii*; Northern shoveler *Anas clypeata*
UK9012111	Lee Valley SPA	Great bittern *Botaurus stellaris*; Gadwall *Anas strepera*; Northern shoveler *Anas clypeata*
UK9012121	Stodmarsh SPA	Great bittern *Botaurus stellaris*; Eurasian wigeon *Anas penelope*; Mallard *Anas platyrhynchos*; Northern shoveler *Anas clypeata*; Common pochard *Aythya ferina*; Tufted duck *Aythya fuligula*; Water rail *Rallus aquaticus*; Northern lapwing *Vanellus vanellus*; Common snipe *Gallinago gallinago*; Greater white-fronted goose *Anser albifrons albifrons*
UK9012171	South West London Waterbodies SPA	Gadwall *Anas strepera*; Northern shoveler *Anas clypeata*
UK9013011	The Dee Estuary SPA	Common shelduck *Tadorna tadorna*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Eurasian oystercatcher *Haematopus ostralegus*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Bar-tailed godwit *Limosa lapponica*; Eurasian curlew *Numenius arquata*; Black-tailed godwit *Limosa limosa islandica*; Dunlin *Calidris alpina alpina*
UK9013031	Traeth Lafan/ Lavan Sands, Conway Bay SPA	Great crested grebe *Podiceps cristatus*; Red-breasted *merganser Mergus serrator*; Eurasian oystercatcher *Haematopus ostralegus*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*
UK9015011	Burry Inlet SPA	Common shelduck *Tadorna tadorna*; Eurasian wigeon *Anas penelope*; Eurasian teal *Anas crecca*; Northern pintail *Anas acuta*; Northern shoveler *Anas clypeata*; Eurasian oystercatcher *Haematopus ostralegus*; Grey plover *Pluvialis squatarola*; Red knot *Calidris canutus*; Eurasian curlew *Numenius arquata*; Common redshank *Tringa totanus*; Ruddy turnstone *Arenaria interpres*; Dunlin *Calidris alpina alpina*
UK9015022	Severn Estuary SPA	Tundra swan *Cygnus columbianus bewickii*; Common shelduck *Tadorna tadorna*; Gadwall *Anas strepera*; Common redshank *Tringa totanus*; Greater white-fronted goose *Anser albifrons albifrons*; Dunlin *Calidris alpina alpina*
UK9020031	Lough Foyle SPA	Whooper swan *Cygnus cygnus*; Bar-tailed godwit *Limosa lapponica*; Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]

Site Ref	Site Name	Interest features screened in
UK9020042	Larne Lough SPA	Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9020051	Pettigoe Plateau SPA	European golden plover *Pluvialis apricaria*
UK9020071	Upper Lough Erne SPA	Whooper swan *Cygnus cygnus*
UK9020091	Lough Neagh and Lough Be.g. SPA	Tundra swan *Cygnus columbianus bewickii*; Whooper swan *Cygnus cygnus*; Common pochard *Aythya ferina*; Tufted duck *Aythya fuligula*; Common goldeneye *Bucephala clangula*
UK9020101	Belfast Lough SPA	Common redshank *Tringa totanus*
UK9020111	Strangford Lough SPA	Red knot *Calidris canutus*; Common redshank *Tringa totanus*; Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9020161	Carlingford Lough SPA	Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9020221	Killough Bay SPA	Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9020271	Outer Ards SPA	Ringed plover *Charadrius hiaticula*; European golden plover *Pluvialis apricaria*; Ruddy turnstone *Arenaria interpres*; Light-bellied brent goose *Branta bernicla hrota* [Canada/Ireland]
UK9020281	Arun Valley SPA	Tundra swan *Cygnus columbianus bewickii*
UK9020284	Dyfi Estuary / Aber Dyfi SPA	Greenland white-fronted goose *Anser albifrons flavirostris*
UK9020287	Mersey Narrows and North Wirral Foreshore SPA	Eurasian oystercatcher *Haematopus ostralegus*; Grey plover *Pluvialis squatarola*; Sanderling *Calidris alba*; Bar-tailed godwit *Limosa lapponica*; Common redshank *Tringa totanus*; red knot *Calidris canutus islandica*; Dunlin *Calidris alpina alpina*
UK9020289	Marazion Marsh SPA	Great bittern *Botaurus stellaris*
UK9020290	Belfast Lough Open Water SPA	Great crested grebe *Podiceps cristatus*
UK9020294	Liverpool Bay / Bae Lerpwl SPA	Red-throated diver *Gavia stellata*
UK9020296	Upper Nene Valley Gravel Pits SPA	Great crested grebe *Podiceps cristatus*; Great bittern *Botaurus stellaris*; Eurasian wigeon *Anas penelope*; Gadwall *Anas strepera*; Mallard *Anas platyrhynchos*; Northern shoveler *Anas clypeata*; Common pochard *Aythya ferina*; Tufted duck *Aythya fuligula*; Common coot *Fulica atra*; European golden plover *Pluvialis apricaria*; Northern lapwing *Vanellus vanellus*
UK9020298	West Inverness-shire Lochs SPA	Black-throated diver *Gavia arctica*
UK9020299	Oronsay and South Colonsay SPA	Corn crake *Crex crex*
UK9020309	Outer Thames Estuary SPA	Red-throated diver *Gavia stellata*

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Appendix F
JNCC-defined Activities and Pressures

This appendix provides a copy of the JNCC's *Marine activities and pressures evidence* matrix (JNCC 2016); the standard UK list of marine activities and their definitions; and the list of marine pressures and their definitions (as agreed by the OSPAR Intercessional Correspondence Group on Cumulative Effects).

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Activity	Temperature changes - local	Salinity changes - local*	Water flow (tidal current) changes - local	Emergence regime changes - local	Wave exposure changes - local	Non-synthetic compound contamination - overall	Non-synthetic compound contamination - Transition elements & organo-metals	Non-synthetic compound contamination - Hydrocarbon & PAH Contamination	Synthetic compound contamination	Radionuclide contamination*	Introduction of other substances (solid, liquid or gas)	De-oxygenation	Nutrient enrichment	Organic enrichment	Physical loss (to land or freshwater habitat)	Physical change (to another seabed type)	Habitat structure changes - removal of substratum (extraction)	Penetration and/or disturbance of the substrate below the surface of the seabed (Overall abrasion)	Penetration and/or disturbance of the substrate below the surface of the seabed- Surface	Penetration and/or disturbance of the substrate below the surface of the seabed- Subsurface	Changes in suspended solids	Siltation rate changes	Litter	Electromagnetic changes	Noise and vibration changes	Introduction of light	Barrier to species movement	Death or injury by collision	Visual disturbance	Genetic modification & translocation of indigenous species	Introduction or spread of non-indigenous species	Introduction of microbial pathogens	Removal of target species	Removal of non-target species
Coastal defence & land claim protection (incl. beach replenishment)	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y		Y	Y	Y	Y		Y	Y	Y			Y		Y		Y					Y
Coastal docks, ports & marinas	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	Y	Y			Y	Y	Y	Y	Y		Y	Y		
Waste gas emissions						Y	Y	Y	Y	Y											Y	Y												
Industrial & agricultural liquid discharges	Y	Y	Y			Y	Y	Y	Y	Y		Y	Y	Y		Y					Y	Y	Y									Y		
Sewage disposal	Y	Y	Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	Y					Y	Y	Y									Y	Y		
Waste disposal - munitions (chemical & conventional)						Y	Y	Y	Y	Y						Y		Y			Y	Y						Y	Y			Y		
Power stations - thermal effluent and nuclear discharge	Y	Y	Y			Y	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y			Y	Y	Y		Y			Y	Y			Y		
Fishing – demersal trawling						Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y	Y			Y	Y	Y
Fishing – dredging						Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y	Y			Y	Y	Y
Fishing – pelagic trawling						Y			Y				Y	Y									Y		Y			Y	Y			Y	Y	Y
Fishing – traps (potting/creeling)														Y		Y		Y	Y			Y	Y		Y		Y	Y	Y			Y		Y	Y
Fishing – recreational																		Y	Y				Y		Y		Y	Y	Y			Y		Y	Y
Fishing – nets (static)			Y						Y					Y				Y	Y				Y		Y		Y	Y	Y			Y		Y	Y
Fishing - lines							P	P		P	P	P						Y	Y				Y			P		Y	Y			Y		Y	Y
Fishing - seines (encircling)							P	P		P	P	P						Y	Y				Y			P		Y	Y			Y		Y	Y
Harvesting - seaweed and other sea-based food (bird eggs, shellfish, etc.)			Y	Y	Y				Y			Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y			Y	Y	Y
Extraction of genetic resources e.g. bioprospecting & maerl (blue technology)			Y									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y			Y	Y	Y
Aquaculture - fin-fish			Y		Y	Y			Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Aquaculture - shellfish			Y	Y	Y	Y			Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Aquaculture – macro-algae			Y		Y	Y			Y			Y	Y	Y	Y	Y		Y		Y	Y	Y			Y	Y			Y	Y	Y	Y	Y	Y
Extraction – sand and gravel (aggregates)			Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	Y	Y			Y		Y	Y	Y		Y			Y
Extraction – rock/ mineral (coastal quarrying)		Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	Y	Y			Y		Y		Y					
Extraction – navigational dredging (capital & maintenance)		Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y		Y		Y	Y	Y		Y			Y
Dredge & spoil disposal			Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y			Y	Y			Y			Y	Y		Y			
Extraction – water (abstraction)	Y	Y	Y	Y	Y	Y			Y			Y	Y	Y		Y	Y					Y			Y			Y						Y
Renewable energy – wind (not including cables)			Y		Y	Y	Y	Y	Y						Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y		
Renewable energy – wave (not including cables)			Y	Y	Y	Y		Y	Y			Y			Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y		
Renewable energy - tidal (not including cables)	Y	Y	Y	Y	Y	Y		Y	Y			Y			Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y		
Marine hydrocarbon extraction (not including pipelines)			Y			Y	Y	Y	Y	Y		Y	Y		Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		
Shipping – port operations (mooring, beaching, launching etc.)			Y	Y		Y	Y	Y	Y				Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	
Shipping – general (at sea)			Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	
Coastal tourist sites (public beaches & resorts)			Y	Y		Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y		Y	Y	Y	Y
Recreational activities (e.g. boating, yachting, diving, etc.)			Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y
Marine research activities (incl. physical sampling and remote sensing)					Y	Y	Y	Y	Y	Y			Y		Y	Y	Y	Y			Y	Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y
Military activities				Y	Y	Y	Y	Y	Y	Y					Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y	Y		Y	Y		
Submarine cable and pipeline operations	Y		Y		Y	Y			Y					Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y			Y	Y		Y	Y		Y
Gas storage operations (carbon capture & natural gas storage)		Y				Y	P	P	Y						Y	Y		Y			Y	Y	Y		Y			Y						
Artificial reefs and other environmental structures			Y	Y	Y	Y	Y	Y	Y			Y	Y		Y	Y		Y	Y		Y	Y			Y				Y		Y			
Cultural & heritage sites/structures (e.g. wrecks, sculptures, foundations etc.)						Y	Y	Y	Y		P	Y	Y	P	P	Y	Y	Y	P	P	Y	Y	P	P	Y	P	Y	P	Y	P				

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Appendix G
Appropriate Assessment – Marine Mammals

REPORT

Draft Welsh National Marine Plan - plan level Habitats Regulation Assessment (HRA) for Tidal Lagoon (TL) policy - Marine Mammals

WNMP HRA TL – Marine Mammals

Client: The Welsh Government

Reference: I&BPB7082R001F01

Revision: 01/Final

Date: 29 September 2017

HASKONINGDHV UK LTD.

Stratus House
Emperor Way
Exeter
EX1 3QS
Industry & Buildings
VAT registration number: 792428892

+44 1392 447999 **T**
+44 1392 446148 **F**
info.exeter@uk.rhdhv.com **E**
royalhaskoningdhv.com **W**

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Author(s):	Gemma Starmore and Jennifer Learmonth
Drafted by:	Gemma Starmore and Jennifer Learmonth
Checked by:	Caroline Price
Date / initials:	CP 29/09/2017
Approved by:	Frank Fortune
Date / initials:	FF 29/09/2017

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Executive Summary

This plan-level HRA for the WNMP Tidal Lagoon Policy has determined the potential for adverse effect of the Tidal Lagoon Policy (alone or in-combination) on the integrity of the screened in European Designated Sites (SACs, cSACs or pSACs) where marine mammals are a qualifying feature, in relation of the sites conservation objectives.

The assessment determined that there are currently no European Designated Sites where marine mammals, including otters, are a qualifying feature, that are located within or overlap with the marine area Strategic Resource Areas (SRA) that could be impacted by any direct habitat loss.

Three European Designated Sites (Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise; North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise; and Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter) are located within the maximum potential impact range for any changes in habitat extent, type or quality. Although further assessment would be required for each Tidal Lagoon project to determine any potential impacts, including impacts on supporting habitats, such as sandbanks, and upon prey availability. The plan-level assessment determined that there would be no potential for any significant adverse effects on the integrity of any European Designated Sites in relation to their conservation objectives, especially when taking into account the natural variation across the range of marine mammals, otters and their prey.

The three European Designated Sites are also located within the maximum potential impact range for any changes in water quality. However, taking into account the embedded mitigation and best practice, the assessment determined that there should be no potential for any significant adverse effects on the integrity of any SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal, harbour seal or otter, as a result of any changes in water quality.

The high level plan assessment determined that, taking into account (i) the temporary nature of any disturbance from underwater during construction; (ii) the mitigation measures that could be implemented to reduce the potential impact range of disturbance from underwater noise; and (iii) the relatively small area that could be temporarily affected compared to the range of marine mammals within the management units and designated sites, that the potential for any long term significant effects is unlikely. However further assessment is required at the project level to determine the potential disturbance from underwater noise during construction on marine mammals.

Any potential disturbance of the grey seal haul-out site close to the northern SRA could be reduced by implementing mitigation measures such as establishment of a minimum distance that vessels can safely pass haul-out sites without disturbance, especially during sensitive periods, such breeding and the moult period for grey seal. Therefore for the plan-level assessment, with the proposed mitigation in place, there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for grey seal, as a result of disturbance from vessels passing haul-out sites.

The assessment indicates that there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for otter, as a result of any visual disturbance or airborne noise associated with Tidal Lagoons in the SRAs.

The number of marine mammals the could be potentially be at increased collision risk with vessels is likely to be relatively low, taking into account the condensed vessel activity in the vicinity of the Tidal Lagoons, the relatively slow travelling speeds of the vessels and the relatively small increase in the numbers of vessel in comparison to the vessel density in the wider area.

For the plan-level assessment, taking into account the implementation of effective mitigation measures, there should be very little potential for any significant collision risk with operational turbines and any adverse effects on the integrity of European Designated Sites. However, further assessment would be required at the project level.

A better understanding of the movements of marine mammals along coastal areas in the SRAs, and the positioning of any Tidal Lagoons outwith areas that could result in any potential barrier effects to the movements of marine mammals, would reduce and limit the potential for any adverse effects on designated sites.

Taking into account the implementation of effective mitigation measures, the plan-level assessment determined that there should be little potential for significant changes to prey availability that could result in adverse effects on the integrity of European Designated Sites designated for marine mammals. However, further assessment would be required for each Tidal Lagoon project to determine the potential for any adverse effects on the prey species of marine mammals.

There are a number of potential mitigation measures and approaches, such as the implementation of an Environmental Monitoring and Adaptive Management Plan (EMAMP) and Marine Mammal Mitigation Plan (MMMP) which could be used to reduce the risks to marine mammals.

The successful execution of compensatory measures for marine mammals will be challenging, therefore the best option would be to maintain or improve prey species availability and usability of seal haul-out sites.

The information within this report should be sufficient for the ‘Competent Authority’ to conduct an Appropriate Assessment.

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Abbreviations

Abbreviation	Meaning
AA	Appropriate Assessment
CCW	Countryside Council for Wales
CV	Coefficient of Variation
CI	Confidence Interval
CO	Conservation Objectives
cSAC	Candidate Special Area of Conservation
EMAMP	Environmental Monitoring and Adaptive Management Plan
EN	English Nature
ELC	Energy Low Carbon
EC	European Commission
EMF	Electromagnetic fields
EPS	European Protected Species
EU	European Union
HRA	Habitats Regulation Assessment
IAMMWG	Inter-Agency Marine Mammal Working Group
INNS	Introduced Non-Native Species
JNCC	Joint Nature Conservation Committee
Km	Kilometre
LSE	Likely Significant Effect
MCAA	Marine and Coastal Access Act
HHWS	Mean High Water Spring tide
MMMP	Marine Mammal Mitigation Plan
MMMU	Marine Mammal Management Unit
MU	Management Unit
Nm	nautical miles
NE	Natural England
NRW	Natural Resources Wales
PTS	Permanent Threshold Shift
SCOS	Special Committee on Seals
SNH	Scottish Natural Heritage
SAC	Special Areas of Conservation
SMRU	Sea Mammal Research Unit
SNCBs	Statutory Nature Conservation Bodies
SRA	Strategic Resource Area
TL	Tidal Lagoon
TTS	Temporary Threshold Shift
UK MPS	UK Marine Policy Statement
UK	United Kingdoms
WMNP	Welsh Marine National Plan
ZOI	Zone of Influence

1 Introduction

The draft Welsh National Marine Plan is in the process of being completed in accordance with the Marine and Coastal Access Act 2009. As part of the drafting of the Plan, there is a requirement to complete a Habitats Regulation Assessment (HRA) for designated Natura 2000 sites. Prior to the completion of this report, it was determined that Likely Significant Effects (LSE) due to the Tidal Lagoon Policy (as part of the Energy Low Carbon Policy) to European Designated Sites cannot be ruled out. This report, therefore, will determine the potential for any adverse effects on the integrity of designated Natura 2000 sites for marine mammal species in relation to the Tidal Lagoon Policy.

1.1 The Welsh National Marine Plan

1 The Welsh Government is currently preparing the Welsh Marine National Plan (WMNP) to support sustainable development in the marine area in accordance with the Marine and Coastal Access Act 2009 (MCAA; HM Government, 2009). The purpose of the Marine Plan is to provide a strategic approach to development within the marine environment of the United Kingdom (UK) and to provide a guide to developers on the most appropriate areas for specific marine development and industries.

2 The European Marine Spatial Planning Directive (European Union (EU), 2014) requires that all member states have Marine Plans in place and in use by 2012 and will cover a time period of 20 years. There are a total of 11 Marine Plan areas in England and Wales, with Wales being one, with both inshore (up to 12 nautical miles (nm) offshore) and offshore regions (more than 12nm offshore).

3 Currently in place and in use is the UK Marine Policy Statement (UK MPS) (HM Government, 2011) which provides an interim policy on the strategic and sustainable planning of the UK's marine environment. The UK MPS provides guidance on the management of marine activities integrating economic, environmental and social concerns and ensuring stakeholder and community engagement to make each Marine Plan appropriate to the area's specific needs and considerations.

4 The draft WNMP will take the UK MPS and build upon it to make it relevant for the Welsh marine environments. The draft plan takes account of the current and potential future uses of the marine environment and the views of the stakeholders and communities.

5 The Marine Plan includes 'General Policies' which apply to all sectors and activities within the marine plan area and support the overall plan objectives. These 'General Policies' also ensure that socio-economic and environmental considerations are part of any decision making process.

6 'Sector Objectives and Policies' focus on specific marine development and activity. Each 'Sector Policy' includes both a 'Supporting Policy' (to provide support to the given sector) and a 'Safeguarding Policy' (to ensure a sector is given protection from current or future negative impacts of other activities).

1.2 The Tidal Lagoon Policy

As part of the draft Welsh National Marine Plan, there are a set of policies concerning the development of industry within the marine environment. Within this set of 'Sector Policies' is a policy for marine renewable energies (the Energy Low Carbon Policy) which includes the development of Tidal Lagoons.

7 The European Low Carbon (ELC) policy includes the development of energy sources such as wind, tidal and wave energy. The draft ELC-01 policy, which includes Tidal Lagoons, is included in **Box 1**. Any activity within Strategic Resources Areas (SRAs) identified in ELC_01 would also have to comply with the WNMP policies ENV_02 and GOV_01 (**Box 1**).

Draft Policy ELC-01 states:

Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:

a) in corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and
b) in corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

a) renewable energy Strategic Resource Areas; and
b) wider natural resources that provide renewable energy potential;

in order to support the sustainable growth of the renewable energy sector through marine planning.

Any support for marine renewable energy generation under this policy is conditional upon statutory process being followed and significant adverse effects on the integrity of European marine sites being effectively avoided or mitigated or, in the case of any developments that might take place under A6(4) IROPI provision, are fully compensated for.

In order to understand future opportunities for **offshore wind** development, strategic planning for the sector is encouraged. Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to:

- collect evidence to support understanding of environmental and social constraints and opportunities
- support understanding of the optimal siting of offshore wind developments across Wales.

Relevant public authorities should make relevant evidence widely available to support planning and decision making.

Draft Policy ENV_02 states*:*
Proposals should demonstrate how they:

- *avoid adverse impacts to individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; and*
- *have regard to the measures to manage MPAs.*

Draft Policy GOV_01 states:
Proposals should demonstrate that they have assessed potential cumulative effects and, in order of preference:

- *avoid adverse effects; and/or*
- *minimise effects where they cannot be avoided; and/or*
- *mitigate effects where they cannot be minimised.*

If significant adverse effects cannot be adequately addressed, proposals should present the case for proceeding.

Proposals that contribute to positive cumulative effects are encouraged.

Box 1: Draft text for the ELC Policy, including Tidal Lagoons.

1.2.1 Sector Objective

8 The objective of the ELC policy is to provide a level of support to the development of marine renewable projects within the Welsh marine environment.

9 It should be noted that this does not mean that all Tidal Lagoon projects will be granted consent within the Strategic Resource Area (SRA – see below) as the ELC_01 Policy states that *"any support for marine renewable energy generation under this policy is conditional upon statutory process being followed and significant adverse effects on the integrity of European marine sites being effectively avoided or mitigated or, in the case of any developments that might take place under A6(4) IROPI provision, are fully compensated for."*

10 The 'Safeguarding Policy' for Tidal Lagoons is intended to protect the potential resource from interference from other sector developments. This 'Safeguarding Policy' will not be assessed further as part of this HRA.

1.2.2 Strategic Resource Area

11 The policy for ELC (which includes the Tidal Lagoon Policy) has an associated SRA. SRAs have been developed as part of the Marine Plan process in order to spatially define areas suitable for specific marine activity and development (although locally specific issues should be taken into account for each planned development). The SRA for Tidal Lagoons includes areas to the Bristol Channel west of Cardiff (on the south coast of Wales) and north of Llandudno (north coast of Wales) (see **Plate 1**).

12 Whilst Tidal Lagoon power development projects are encouraged within the SRA, it is not suggested that all Tidal Lagoon projects seeking consent within this area will automatically be permitted. Equally, the establishment of the SRA does not seek to restrict the development of Tidal Lagoon projects outside of this area.

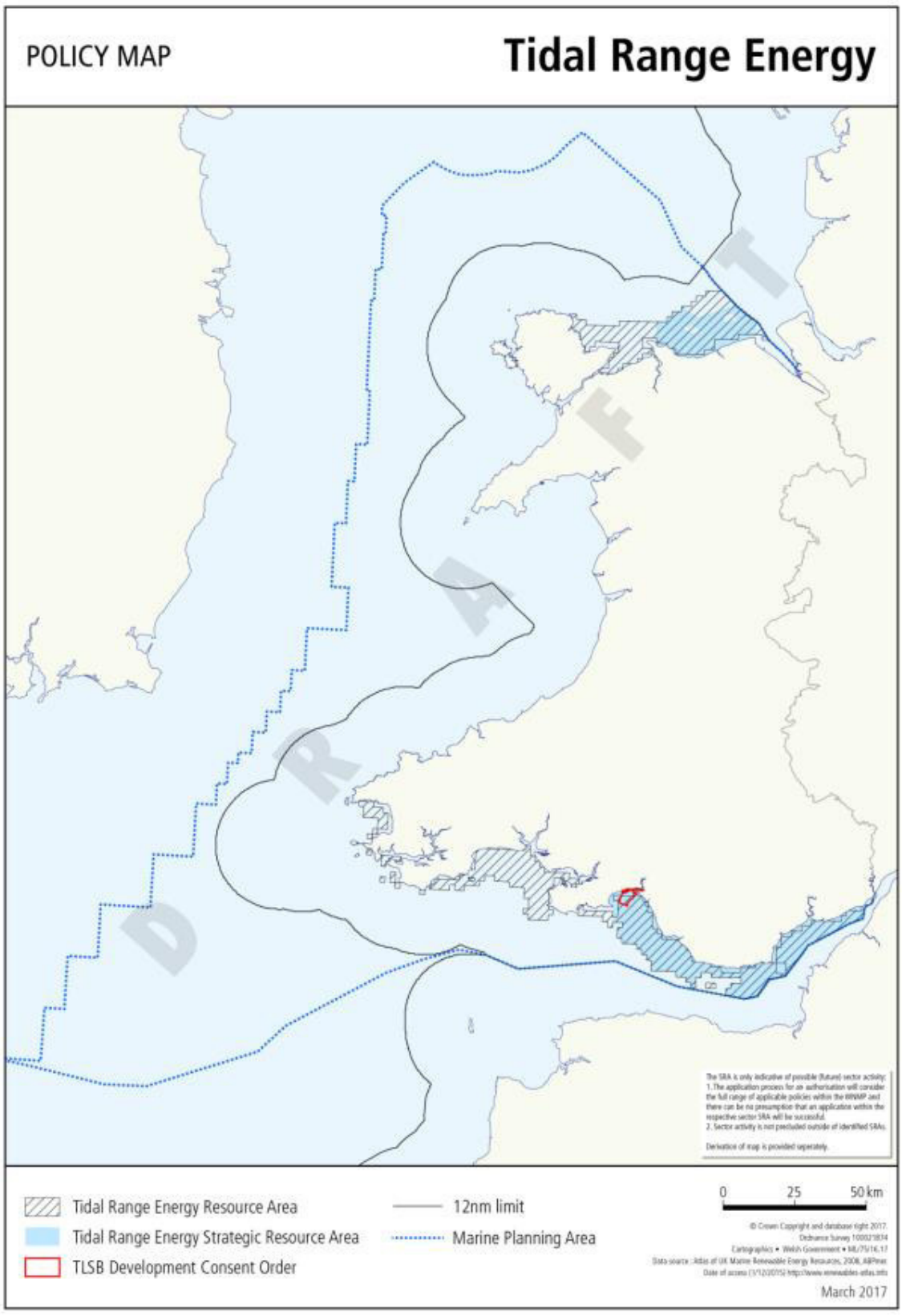


Plate 1: the extent of the Tidal Lagoon Strategic Resource Area (shaded light blue) within the wider Resource Area for Tidal Energy

1.3 Requirements of the Habitats Regulations Assessment

13 European Union (EU) obligations in respect of habitats and species are met through Council Directive 92/43/EEC (the Habitats Directive) on the conservation of natural habitats and of wild fauna and flora, which requires Member States to schedule important wildlife sites through the European Community as Special Areas of Conservation (SACs) and to give protection to habitats and species listed in the Directive as being threatened or of Community Interest.

14 The Habitats Directive protects all species of cetaceans under Annex IV as European Protected Species (EPS), being classed as endangered, vulnerable or rare, and grey and harbour seals are protected under Annex V which requires their exploitation or removal from the wild to be subject to management measures. Harbour porpoise, bottlenose dolphin and both seal species are listed under Annex II, which requires member states to designate sites, identified as being key areas for their life and reproduction.

15 The Habitats Directive is transposed into English and Welsh legislation by the Conservation of Habitats and Species Regulations 2010 (as amended) and the Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended); here after referred to as the 'Habitats Regulations'.

16 The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive (replicated in Regulation 61(1)) which states that any plan or project, that is not directly connected with or necessary to the management of an European site, but would be *likely to have a significant effect* on such a site, either on its own or in-combination with other plans or projects, will be subject to an '*Appropriate Assessment*' (AA) of its implications for the European site in view of its conservation objectives. In light of the conclusions of that assessment and subject to the provisions of Article 6(4) of the Habitats Directive, the 'competent authority' will agree to the plan or project only having ascertained (beyond reasonable scientific doubt) that it will not adversely affect the integrity of the site(s) concerned. The Welsh Government is the Competent Authority undertaking the AA.

17 Article 6(4) provides that if, in spite of a negative assessment of the implications for the site, and in the absence of alternative solutions, the plan or project must nevertheless be undertaken for Imperative Reasons of Overriding Public Interest (IROPI), the Member State will take all compensatory measures necessary to ensure that the overall *Natura 2000* sites are protected. Together SACs and Special Protection Areas (SPAs) form a network of protected areas known as *Natura 2000* sites. In the UK, these requirements also extend to the consideration of effects on sites that are proposed for designation and inclusion in the Natura 2000 network, this includes candidate and possible SACs (cSACs and pSACs).

18 There is no explicit definition of LSE in the legislation and in the context of HRA it is typically taken as any effect that reasonably may be predicted as a consequence of the project that may undermine the European site's conservation objectives (Welsh Assembly Government, 2009). That is, the term "likely" infers the presence of a risk that a significant effect could occur. By definition, this assessment is based on the consideration of a number of factors, for example, the spatial extent and duration of an identified effect, and other considerations such as the availability of appropriate mitigation. When considering such effects, a precautionary approach is adopted.

19 In general, according to The Planning Inspectorate (2016), if a large amount of evidence and data gathering is necessary to determine LSE, it is assumed that a LSE could arise and 'appropriate assessment' is required.

20 The conservation status of a natural habitat, as defined in the Habitats Directive, means the "*sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2*". The conservation objectives for a SAC or SPA are considered when identifying LSE. The conservation status of a natural habitat is taken as 'favourable' when:

- its natural range and area it covers within that range are stable or increasing;
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- the conservation status of its typical species is favourable.

21 The HRA process typically follows a four staged approach:

I. **Screening**: The process of identifying potentially relevant European sites, and whether the likely impacts of a project upon the qualifying features of the site, either alone or in-combination with other plans and projects, are likely to be significant. If it is concluded at this stage that there is no potential for LSE, there is no requirement to carry out subsequent stages of the HRA.

II. **Appropriate Assessment**: The consideration of the potential impacts on the integrity of the site(s), either alone or in-combination with other plans and projects, with regard to the site's structure and function and its conservation objectives. Where there are adverse impacts, an assessment of mitigation options is carried out to determine adverse effect on the integrity of the site. If these mitigation options cannot avoid adverse effects then development consent can only be given if the tests set out in Stages 3 and 4 can be passed.

III. **Assessment of Alternative Solutions**: Examining alternative ways of achieving the objectives of the project to establish whether there are solutions that would avoid or have a lesser effect on the site(s).

IV. **Imperative reasons of over-riding public interest**: Where no alternative solution exists and where an adverse effect on site integrity remains, the next stage of the process is to assess whether the development is necessary for IROPI and, if so, the identification of compensatory measures needed to maintain site integrity or the overall coherence of the designated site network.

22 All four stages of the process are referred to cumulatively as the Habitats Regulations Assessment (HRA), to clearly distinguish the whole process from the step within it referred to as the Appropriate Assessment (AA).

23 In respect of Stage 2, the integrity of a site is defined as the coherence of the site's ecological structure and function, across its whole area, which it enables it to sustain the habitat, complex of

habitats and/or populations of species for which the site has been designated. An adverse effect on integrity, therefore, is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of designation.

1.4 The Purpose of this Report

24 In developing the draft WNMP, the Welsh Government has undertaken a range of assessment to inform the developing plan, including an HRA. The HRA for the draft WNMP (AMEC Foster Wheeler, 2017) determined that LSE due to the Tidal Lagoon Policy could not be ruled out at the plan level and in particular, in the event that several Tidal Lagoon projects are developed within the identified Strategic Resource Area (SRA) during the lifetime of the WNMP.

25 The purpose of this report is therefore to provide further information on marine mammals to support the WNMP Plan Level HRA for the Tidal Lagoon Policy, this includes further assessment of the potential effects related to the Tidal Lagoon Policy on European Designated Sites for:

- Harbour porpoise *Phocoena phocoena*
- Bottlenose dolphin *Tursiops truncatus*
- Grey seal *Halichoerus grypus*
- Harbour (or common) seal *Phoca vitulina*
- Otter *Lutra lutra*

26 The main aim is to determine any LSE of the Tidal Lagoon Policy on marine mammals within or associated with European Designated Sites. This report collates and assesses marine mammal related evidence and will form a substantive component of the AA for the Tidal Lagoon Policy within the WNMP. This work is in conjunction with the other ecological assessments of the HRA, including birds and the fish and associated habitat appraisal.

27 The Plan Level HRA will identify and assess (at high level and at an appropriate level of detail) the potential for any adverse effect of the Tidal Lagoon Policy (alone or in-combination with other plans and projects) on the integrity of the screened in European Designated Sites (SACs, cSACs or pSACs) where marine mammals are a qualifying feature, in relation of the sites conservation objectives.

1.4.1 Report Structure

28 The report has been structured as follows:

- **Section 2** provides baseline information for harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter that is relevant to the HRA. It is important to have background information on these species in the area of the SRA in order to determine the possible importance of some areas relative to other areas in their range, as well as prey species and sensitivities. For the purposes of this HRA, the baseline information focuses specifically on marine mammal features of European Designated Sites and the information relevant to the assessment of the potential effects associated with the Tidal Lagoon Policy. The aim of this

section is to describe the baseline conditions in a relevant level of detail to enable the Appropriate Assessment with regard to marine mammals.

- **Section 3** is the screening stage which reviews in detail the pre-supplied list from the Welsh Government of SACs and protected marine mammal species, screened into the assessment, for which the Tidal Lagoon Policy may have an adverse impact, and amends that list as necessary. This review further refined that list, taking into account possible new sites and the views of the Welsh Government, in liaison with Natural Resources Wales (NRW), Natural England (NE) and the Joint Nature Conservation Committee (JNCC). The aim of this stage is to determine whether the Tidal Lagoon Policy is likely to have a significant impact on the relevant European Designated Sites for marine mammals. The approach is to determine the potential for any connectivity between individual marine mammal species from European Designated Sites / populations and demonstration of a clear source-pathway-receptor relationship. This will take into account relevant Management Units (MU also referred to as Marine Mammal Management Units (MMMU)) for each marine mammal species, , as well as any other relevant information from the baseline information in Section 2, such as foraging ranges, any migration and movements between areas.
- **Section 4** is a plan-level assessment of the Tidal Lagoon Policy to determine any potential for LSE on the SACs and cSACs, where marine mammals are qualifying features that have been screened in, with respect to their Conservation Objectives. The assessment considers all aspects relating to the ecological requirements of marine mammals in or associated with European Designated Sites. The assessment also takes into account the potential to affect species that are qualifying interest features of SACs or cSACs, but which are present beyond the boundaries of the designation (e.g. marine mammals that rely on habitats beyond the designation for some part of their life cycle or ecological requirements, referred to a functionally-linked or supporting habitat to the designation).
- **Section 5** is an in-combination assessment which considers the potential for any likely significant effect of the Tidal Lagoon Policy in-combination with other relevant plans and projects.
- **Section 6** outlines the possible avoidance options and / or suitable mitigation measures that could be used to reduce any potential risk to marine mammals and minimise any potential effects of the Tidal Lagoon Policy, alone or in-combination with other plans or projects.
- **Section 7** provides a record of the assessment, including table of outcome for designates sites: qualifying features, Conservation Objectives, vulnerabilities (including any pressures and trends), predicted impacts, potential in-combination effects, likelihood of significant effects, possible avoidance or mitigation measures and conclusion.
- **Section 8** gives consideration to the applicability of the A6(4) IROPI process, and the extent to which compensatory measures might reasonably be delivered.
- **Section 9** provides an overall conclusion to the report.

29 The following Appendices support this report:

- **A1** Annexed table of Site Features
- **A2** Annexed table of HRA

2 Baseline Information

The following sections summarise available information for harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter including information on their distributions and abundancies in Welsh waters, preferred habitats and prey, and their use of the identified north and south Wales Strategic Resource Areas for the Tidal Lagoon Policy.

2.1 Harbour porpoise (*Phocoena phocoena)*

2.1.1 Distribution and occurrence of harbour porpoise in Wales

30 Harbour porpoise are widely distributed around the coast of the UK, including in the Celtic and Irish Sea, throughout most months of the year (Reid *et al.*, 2003; Baines and Evans, 2012; Hammond *et al.*, 2013, 2017). Within the seas around Wales, there are hotspots of harbour porpoise populations. These are the south-west coast of the Llŷn Peninsula, southern Cardigan Bay, in the vicinity of Strumble Head and the west and north Pembrokeshire Coast and Islands (Skomer and Ramsey), in the Bristol Channel off the south coast of Wales around the Gower Peninsula and in Swansea Bay (Baines and Evans, 2012; Evans *et al.*, 2015). There are additional localised hotspots off the north and north-west coast of Anglesey, in particular around Point Lynas and South Stack, including Holyhead Deep (Baines and Evans, 2012; Evans *et al.*, 2015).

31 For conservation and management purposes, it is useful to consider marine mammal populations around the UK as smaller MU. MUs provide an indication of the spatial scales at which the effects of plans and projects alone and in-combination need to be assessed for the key cetacean species in UK waters, with consistency across the UK (Inter-Agency Marine Mammal Working Group (IAMMWG), 2015). The MU for the SRA areas for the Tidal Lagoon Policy is the Celtic and Irish Sea (CIS) which has an estimated harbour porpoise abundance of 104,695 (Coefficient of Variation (CV) = 0.32; 95% Confidence Interval (CI) = 56,774-193,065) (IAMMWG, 2015).

32 For the north Wales SRA, there are predominantly low interpolated long-term sightings rates of harbour porpoise with less than 0.05 per 10km of effort, however there is a small area of higher densities approximately 19km offshore from Colwyn Bay, with a rate of 2.5-5 counts per 10km effort (Baines and Evans, 2012). For the south Wales SRA, there are largely low long-term sightings rates of less than 0.05 per 10km of effort, however, within the Swansea Bay area and stretching south offshore, this rises to more than 10 per 10km of effort (see **Plate 2**). Harbour porpoise are likely to be present at these locations throughout the year, with little seasonal variation (Baines and Evans, 2012; Evans *et al.*, 2015; **Plate 2**).

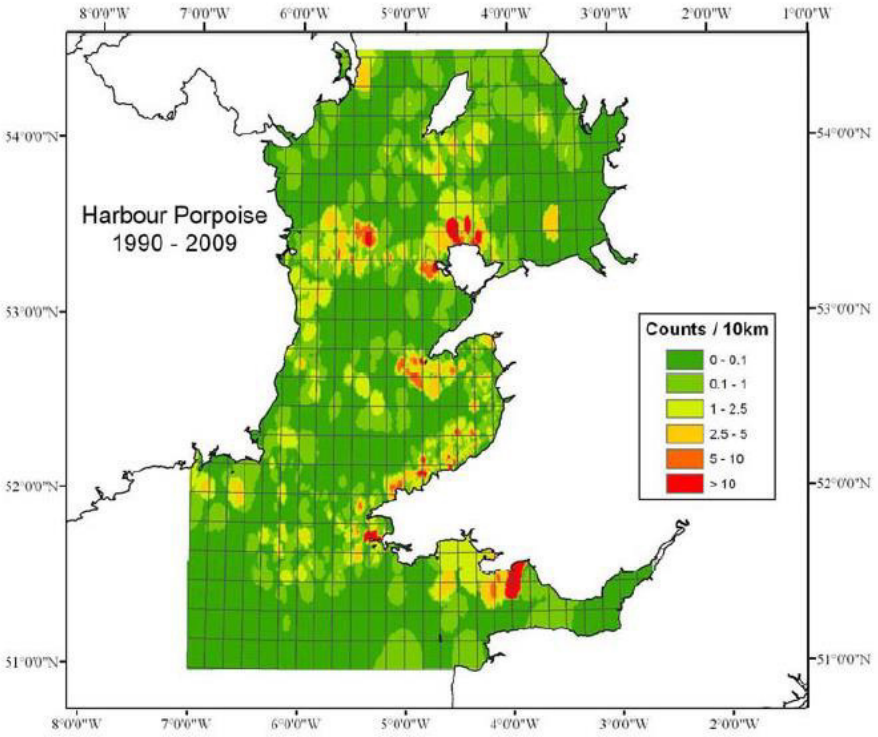


Plate 2: Interpolated long-term sighting's rates (counts per 10km of effort) of harbour porpoise counts per 10km of effort, taken from Baines and Evans, 2012.

33 The Joint Cetacean Protocol (JCP) provides a robust and detailed analysis of 18 years of harbour porpoise survey and sightings data. Heinänen and Skov (2015) used this to model persistent high density areas of harbour porpoise usage around the UK's coasts and seas. Within the report it is stated that the most important factor for the probability of detecting harbour porpoise within the CIS MU are the increase in current speeds (up to 0.4m/s) with increasing eddy activity in the summer. The same is true for winter, although there are lower probabilities with higher current speeds (Heinänen and Skov, 2015). The report also revealed that harbour porpoise are more likely to occur in water depths of less than 40m, with high densities in the summer often associated with sandy-gravelly sediments (Heinänen and Skov, 2015).

34 The Heinänen and Skov (2015) report shows high-density areas based on the 90th percentile based on the number of years that high densities were predicted in an area, and how recent the area was predicted to have high densities. The resultant maps of the CIS MU (as shown in **Plate 3**) show that there are areas of persistent high-density around the coast of Wales, both in summer and winter periods (Heinänen and Skov, 2015).

35 The north Wales SRA is mostly highlighted as a persistent high-density area of harbour porpoise in the summer months only, with a further area identified along the north Anglesey coast. There are no identified areas of high-densities in the winter period along the north Wales coast. Within the south Wales SRA, there are no persistent high-density areas in winter, and similarly to the Baines and Evans (2012) report, a small area within Swansea Bay identified as having a persistent high-density in summer (Heinänen and Skov, 2015).

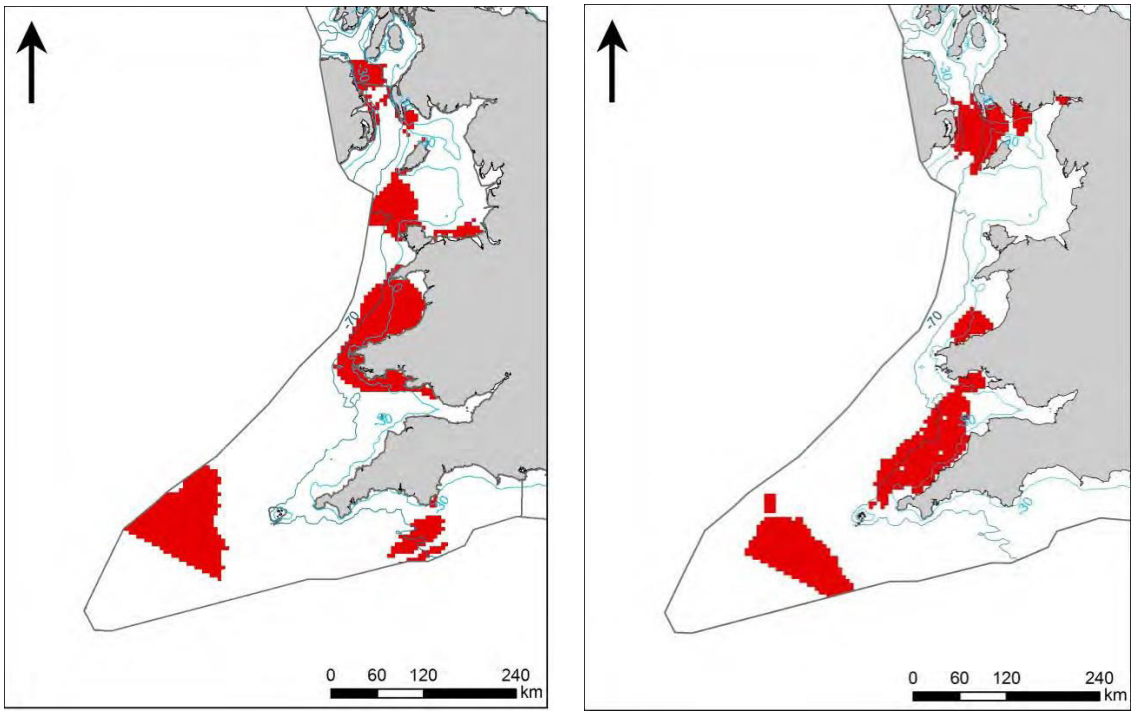


Plate 3: Persistent high-density areas identified and selected within the Celtic and Irish Sea Management Unit. Red indicates areas with where persistent high densities as defined by the upper 90th percentile have been identified. Map A shows high density areas in Summer, and Map B indicates high density areas in Winter (maps taken from Heinänen and Skov, 2015).

36 In July 2005, SCANS-II surveyed the entire EU Atlantic continental shelf to generate robust estimates of harbour porpoise alongside other cetacean species. For the entire SCANS-II survey area, harbour porpoise abundance in the summer of 2005 was estimated to be 375,358 (CV = 0.197; Hammond *et al.*, 2013). The SCANS-II survey estimated that the abundance of harbour porpoise in survey block O which is located in the Irish Sea and includes the north Wales SRA for Tidal Lagoons, was 15,230 individuals and the density was estimated to be 0.335 harbour porpoise per km^2 (CV = 0.35; Hammond *et al.*, 2013). The south Wales SRA is within Block P which covers an area encompassing the Celtic Sea and continuing to the south west French coast. SCANS-II survey Block P had an estimated abundance of 72,309 harbour porpoise and the density was estimated to be 0.367 harbour porpoise per km^2 (CV = 0.53; Hammond *et al.*, 2013).

37 SCANS-III was undertaken in the summer of 2016 covering all European Atlantic waters from the Strait of Gibraltar in the south to 62°N in the north and extending west to the 200 nautical miles (nm) limits of all EU Member States (**Plate 4**; Hammond *et al.*, 2017). For the entire SCANS-III survey area, harbour porpoise abundance in the summer of 2016 was estimated to be 466,569 (CV = 0.154; 95% CI = 345,306-630,417; Hammond *et al.*, 2017). The survey area was not the same as for SCANS-II.

38 In the Celtic and Irish Seas ICES Assessment Unit (partial coverage only) during the SCANS-III survey the harbour porpoise abundance was estimated to be 26,700 (CV = 0.25; 95% CI = 16,055-42,128; Hammond *et al.*, 2017). The SCANS-III survey estimated that the abundance of

harbour porpoise in survey block F, which is located in the eastern Irish Sea and includes the north Wales SRA site, was 1,056 harbour porpoise, with an estimated density of 0.086/km^2 and mean group size of 1.00 (CV = 0.38; 95% CI = 342-2,010; Hammond *et al.*, 2017). The SCANSIII survey did not cover the area of the south Wales SRA site (**Plate 4**; Hammond *et al.*, 2017).

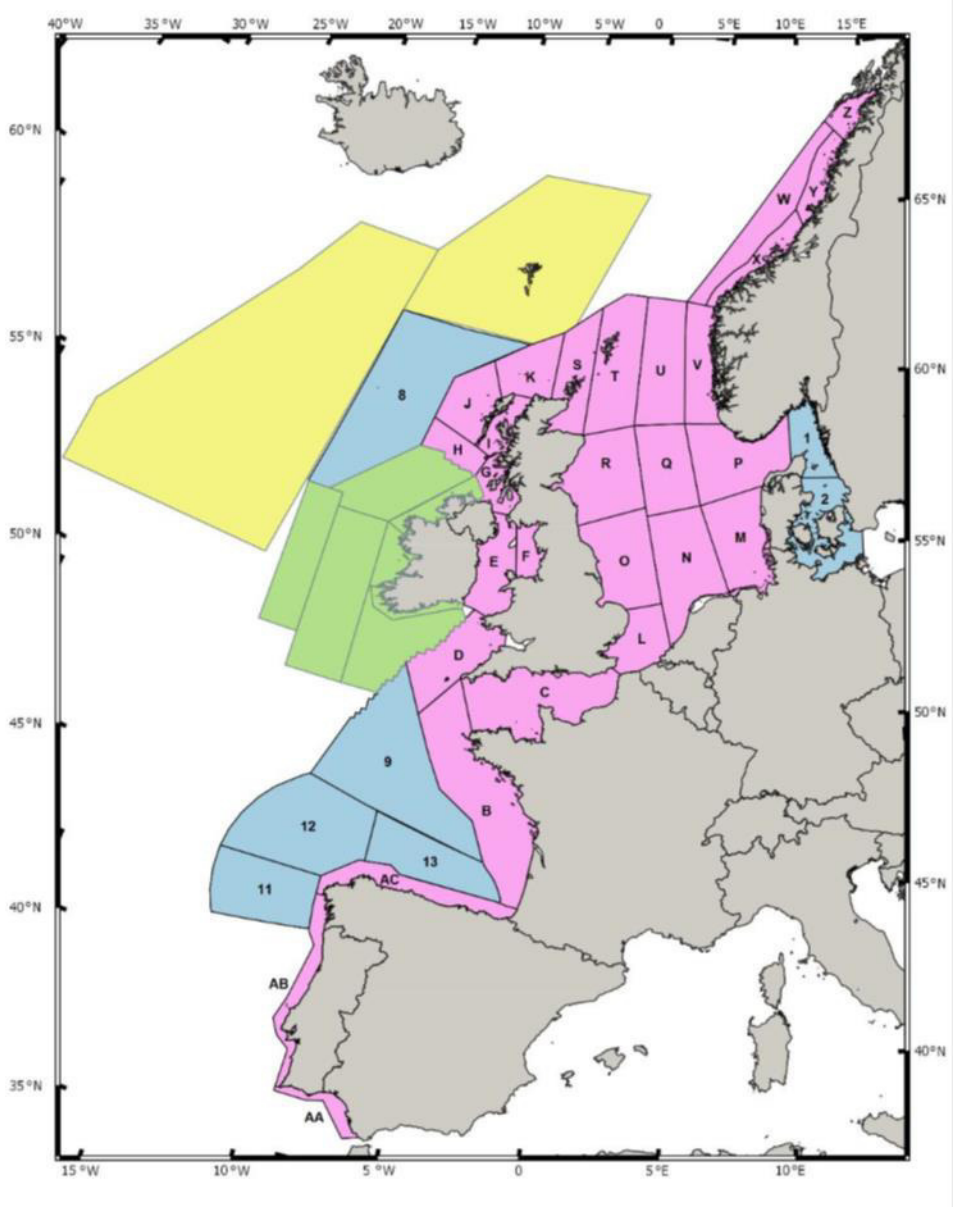


Plate 4: Area covered by SCANS-III and adjacent surveys
(SCANS-III = pink lettered blocks were surveyed by air; blue numbered blocks were surveyed by ship. Adjacent survey = blocks coloured green to the south, west and north of Ireland which were surveyed by the Irish ObSERVE project and blocks coloured yellow which were surveyed by the Faroe Islands as part of the North Atlantic Sightings Survey in 2015; taken from Hammond et al., 2017)

2.1.2 Habitat

39 In coastal waters, harbour porpoise are often associated with areas of strong tidal features, such as headlands, sounds, areas with upwelling currents, tidal races and rips, and close to reefs and islands, where prey are probably concentrated into patches providing favourable foraging conditions (Gaskin, 1992; Read and Westgate, 1997; Pierpoint, 2001; Pierpoint, 2008; Marubini *et al*., 2009; Shucksmith *et al*., 2009).

2.1.3 Diet

40 Prey species for harbour porpoise includes a wide variety of fish. Pelagic schooling fish, demersal and benthic species, particularly Gadoids, Clupeids and Ammodytes are often common in the diet of harbour porpoise. The main prey items within the Irish Sea for harbour porpoise are typically whiting *Merlangius merlangus*, herring *Clupea harengus*, sprat *Sprattus sprattus*, cod *Gadus morhua*, haddock *Melanogrammus aeglefinus*, saithe *Pollachius virens*, pollack *Pollachius pollachius*, Norway pout *Trisopterus esmarkii* as well as flatfish such as flounder *Platichthys flesus* and sole *Solea solea* (Rogan and Berrow, 1996; Reid *et al*., 2003; Santos and Pierce, 2003; Santos *et al*., 2004; Evans and Baines, 2010).

41 Harbour porpoise tend to concentrate their movements in small focal regions (Johnston *et al*., 2005), which often approximate to particular topographic and oceanographic features and are associated with prey aggregations (Raum-Suryan and Harvey, 1998; Johnston *et al*., 2005; Keiper *et al*., 2005; Tynan *et al*., 2005).

42 Harbour porpoise have relatively high daily energy demands and need to consume between 4% and 9.5% of their body weight in food per day (Kastelein *et al*., 1997). If a harbour porpoise does not capture enough prey to meet its daily energy requirements it has been estimated that it can only rely on stored energy (primarily blubber) for three to five days, depending on body condition (Kastelein *et al*., 1997). A recent study by Wisnlewska *et al*. (2016) using high-resolution movement and prey echo recording tags on five wild harbour porpoise has shown that porpoises forage nearly continuously day and night, attempting to meet their metabolic demands foraging on small prey.

2.1.4 Movements and seasonal occurrence

43 The seasonal movements and migratory patterns of harbour porpoise are not well understood. Harbour porpoise may reside within an area for an extended period of time, although onshore / offshore migrations and movements parallel to the shore are also thought to occur (Northridge *et al*., 1995; Bjørge and Tolley, 2002).

44 Harbour porpoise are highly mobile and satellite telemetry work in Danish waters has shown an individual moving more than 1,000km from Danish waters to east of the Shetland Islands (Teilmann *et al*., 2004). In Danish waters, harbour porpoise have been shown to concentrate their movements in relatively large areas, ranging from approximately 400 to 1,600km^2 (Teilmann *et al*., 2004). In the western North Atlantic, individuals are known to range over quite large areas, covering as much as 11,289 km^2 within a single month (Johnston *et al*., 2005).

45 Although harbour porpoise are highly mobile and utilise extensive areas over which they range, they tend to occupy small core areas or focal regions for short periods and then make rapid movements over periods of hours to days across larger scales to other restricted areas (Johnston *et al.*, 2005; Fontaine *et al.*, 2007), which often correspond with reliable feeding opportunities (Marubini *et al.*, 2009).

46 In many coastal localities there can be distinct seasonal peaks in harbour porpoise sightings. The sightings of harbour porpoise in the Irish Sea typically peak during the summer months (in particular June to August) (Evans *et al.*, 2015).

47 The seasonal movements and temporal changes in distributional patterns of harbour porpoise are likely to reflect the changes in preferred prey availability and life history (e.g. breeding and calving seasons).

2.1.5 Life history

48 The calving period for harbour porpoise is primarily between May and July, when sea temperatures are increasing (Read, 1990; Sørensen and Kinze, 1994; Lockyer, 1995; Bandomir-Krischack 1996; Börjesson and Read 2003; Learmonth *et al.*, 2014). It is difficult to determine if some areas of the harbour porpoise range is more important than others, and there is currently no evidence of specific habitat requirements for the mating and calving of harbour porpoise in UK waters (JNCC, 2017a).

2.1.6 Conservation status

49 The current conservation status of the harbour porpoise, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2013), is '*favourable*' (JNCC, 2013).

2.2 Bottlenose dolphin (*Tursiops truncatus*)

2.2.1 Distribution and occurrence of bottlenose dolphin

50 In UK waters, inshore individuals are frequently reported off north-east and south-west Scotland, in the Irish Sea, and in the western English Channel (DECC, 2016; IAMMWG, 2015). There are two main areas of UK territorial waters where there are semi-resident groups of bottlenose dolphins: Cardigan Bay in Wales and the Moray Firth on the north-east coast of Scotland. Both of these areas have been designated SAC for bottlenose dolphins (JNCC, 2017b). There are also smaller populations of bottlenose dolphins off south Dorset and around Cornwall (JNCC, 2017b).

51 In the Irish Sea, bottlenose dolphin has a predominantly coastal distribution, with higher concentrations off west Wales (particularly Cardigan Bay) and off the coast of County Wexford in south-east Ireland. They are also regularly sighted in summer off the Galloway coast of south-west Scotland and around the Isle of Man (Hammond *et al.*, 2005, Baines and Evans, 2012; DECC, 2016).

52 In Welsh waters, the inshore population is centred on Cardigan Bay, although bottlenose dolphin are also regularly observed in the coastal waters between Cardigan Bay and Anglesey, with

concentrations in south Cardigan Bay, south of the Llŷn Peninsula and off Anglesey (Pesante *et al*., 2008a; Pesante *et al*., 2008b; Baines and Evans, 2012). There are also regular sightings in the coastal waters to the east of Anglesey around Bull Bay and towards the Llandudno coast (Evans *et al*., 2015). Bottlenose dolphin are most commonly seen in Cardigan Bay within 10 miles of the coast and particularly within two miles; sightings are greatest in the southern portion of the bay (Feingold and Evans, 2014a).

53 A number of inshore groups of bottlenose dolphin have been identified in UK and Irish waters and there appears to be limited interchange between these groups (Robinson *et al*., 2012; Cheney *et al*., 2013; ICES, 2014; IAMMWG, 2015). IAMMWG (2015) currently recognise seven MUs for bottlenose dolphin in UK waters: (1) Coastal West Scotland and the Hebrides (CWSH, to 12nm); (2) Coastal East Scotland (CES, to 12nm); (3) Greater North Sea (GNS); (4) the Offshore Channel and SW England (OCSW); (5) Coastal West Channel (CWC, to 12nm); (6) Irish Sea (IS); and (7) Oceanic Waters (OW). The north Wales SRA for Tidal Lagoons is within the Irish Sea MU which has an estimated abundance of 397 bottlenose dolphin (CV = 0.23; 95% CI = 362-414), this includes Cardigan Bay. The south Wales SAR is located within the Offshore Channel, Celtic Sea and South West England (OCSW) which has an estimated abundance of 4,856 bottlenose dolphin (CV = 0.6; 95% CI = 1,638-14,398; IAMMWG, 2015).

54 Within the north Wales SRA are low interpolated long-term sightings rates of bottlenose dolphin across the area, with less than 0.1 per 10km of effort; however there is an area of higher densities approximately within Colwyn Bay and stretching approximately 18km offshore, with a rate of more than 10 counts per 10km effort (**Plate 5**; Baines and Evans, 2012). For the south Wales SRA, the area has bottlenose dolphin sightings rates of less than 0.1 per 10km of effort across the site (**Plate 5**; Baines and Evans, 2012). Bottlenose dolphin in Welsh waters show a general trend of moving northwards from Cardigan Bay in summer to the north Wales and Anglesey coastlines in Winter (Baines and Evans, 2012).

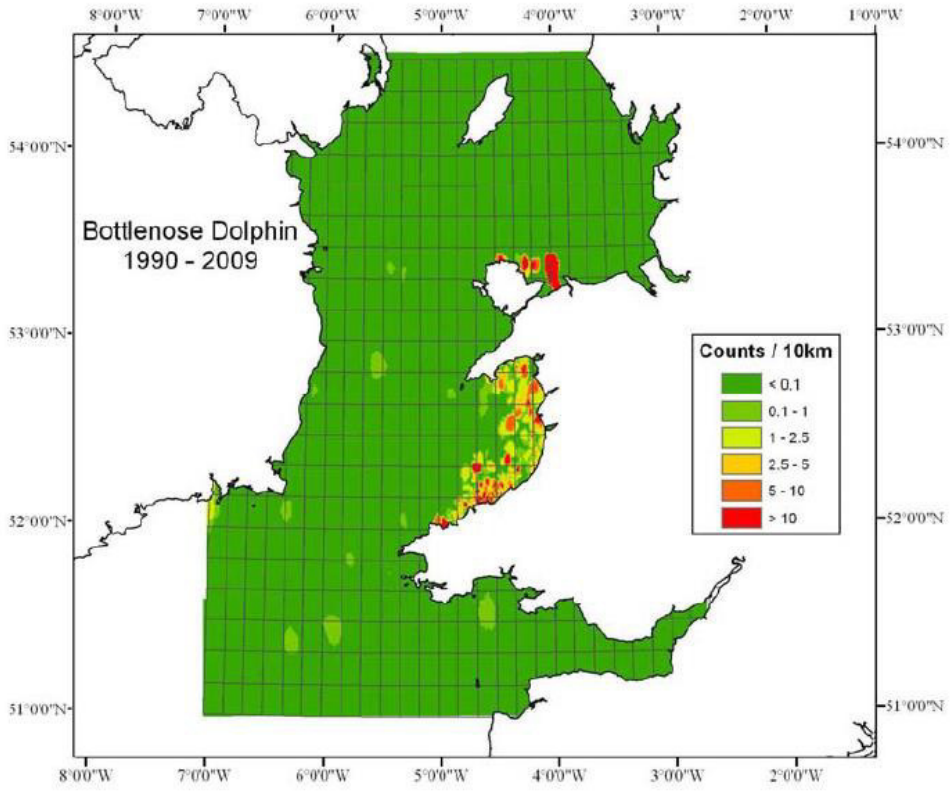


Plate 5: Interpolated long-term sighting's rates (counts per 10km of effort) of bottlenose dolphin counts per 10km of effort, taken from Baines & Evans, 2012.

55 The JCP Phase III report (Paxton *et al.*, 2016) uses a number of different effort-based cetacean surveys to estimate areas of high density within UK waters. A total of 38 different surveys covering a total of 1.05 million km of effort were used to inform the report. Density surface models were created from the dataset for each common cetacean species within UK waters, including for bottlenose dolphin (Paxton *et al.*, 2016). The JCP analysis estimates low densities within both the north and south SRA with high densities of up to 10 bottlenose dolphin per km^2 (97.5 upper CI; Paxton *et al.*, 2016).

56 The SCANS-II survey estimated the abundance of bottlenose dolphin in survey block O, which is located in the Irish Sea and includes the north Wales SRA, to be 235 individuals (CV=0.75) (Hammond et al., 2013). The south Wales SRA lies within Block P, with an abundance estimate of 7,665 (CV = 0.64) (Hammond et al., 2013). The SCANS-III survey estimated that the abundance of bottlenose dolphin in survey block F, which includes the north Wales SRA, no bottlenose dolphin were recorded (Hammond et al., 2017). The area of the south Wales SRA is not included within the SCANS III report.

2.2.2 Habitat

57 Bottlenose dolphin are found in a range of habitats, both in and offshore. However, it is primarily an inshore species occurring within 10km of land (JNCC, 2017b). In coastal water, bottlenose dolphin are often associated within river estuaries, headlands and sandbanks where there are

strong tidal currents or uneven seabed features (Lewis and Evans, 1993; Wilson *et al*., 1997; Liret *et al*., 1998; Liret, 2001; Ingram and Rogan, 2002; Reid *et al*., 2003).

58 In Cardigan Bay, bottlenose dolphins appear to use specific habitats. For example, areas within 3.2km of the shoreline, with strong currents, in proximity to rocky headlands and near small embayments and estuaries, are the habitats most frequently used (Lewis and Evans, 1993; Arnold and Mayer, 1995). Habitat analysis shows preference for areas between 5-10m in depth, although areas of 25-30m depth have seen an increase in sightings since 2005 with the majority of the sightings in this region occurring over the slope range of Cardigan Bay (Pesante *et al*., 2008b).

59 Pesante *et al*. (2008a) suggest that their preference for Cardigan Bay is a result of the shallow bathymetry and diverse benthic habitats, in addition to the fact that significant numbers of salmonids pass through the bay during migration.

2.2.3 Diet

60 Bottlenose dolphins are opportunistic feeders and take a wide variety of benthic and pelagic fish (both solitary and schooling species) as well as invertebrate species. In Irish waters, haddock, saithe and pollock are the dominant prey species, followed by whiting, blue whiting, Atlantic mackerel *Scomber scombrus* and horse mackerel *Trachurus Trachurus*; cephalopods are also important (Hernández-Milián, 2014; O'Brien and Berrow, 2006). Diet analysis suggests that bottlenose dolphin are selective opportunists and although they may have preference for a type of prey, their diet seems to be determined largely by prey availability.

2.2.4 Movements and seasonal occurrence

61 The Cardigan Bay population of bottlenose dolphin occur in a much wider area than the SAC and their range likely includes all of the west and north Wales coasts and a wide area of the Irish Sea (DECC, 2016). The seasonal distribution of bottlenose dolphins is variable, with main concentrations in the summer being around Tremadog Bay and southern Cardigan Bay (Evans e*t al*., 2015). Along the north Wales coast and Anglesey, bottlenose dolphin is more commonly seen in the winter (Pesante *et al*., 2008b). This suggests a seasonal movement between the two areas (Norrman *et al*., 2015).

62 Photo-identification studies on bottlenose dolphins in Wales revealed that of the 221 individuals recorded between 2007 and 2012 off the north coast of Anglesey, 141 (64%) had previously been recorded within the Cardigan Bay SAC and north of the Llyn Peninsula, as well as within the Llyn Peninsula and the Sarnau SAC. This indicates a movement between Cardigan Bay in the summer and the north Wales and Anglesey coast in the winter (Veneruso and Evans, 2012).

63 Feingold and Evans (2014b) further support this assessment with a photo-ID survey within along the Anglesey coastlines undertaken from 2007 to 2013. The survey revealed that of the 52 sightings from the north coast of Anglesey and the Isle of Man (two of which were within the north Wales SRA) containing a total of 211 different individuals, 84 (40%) had also previously been recorded within both the Cardigan Bay and Pen Llyn a'r Sarnau SACs and north of the Llyn

Peninsula, and a further 55 (26%) had previously been recorded within the Cardigan Bay SAC and north of the Llyn Peninsula (Feingold and Evans, 2014b).

64 Analyses of photo-identification data from multiple studies have also shown that bottlenose dolphins can make long-distance movements (Robinson *et al.*, 2012). For example, during photo-identification studies of bottlenose dolphin in Scotland, one individual was identified south of Aberdeen and then re-identified off Burghead 52 hours later, representing a distance of 218 km and a minimum swimming speed of 4.2 km/h (Wilson *et al.*, 2004).

2.2.5 Life history

65 Indications suggest that bottlenose dolphins in UK waters may have two calving peaks in the year (Evans, 1980) or an extended breeding season, meaning that calves can often be observed throughout the year. Calves stay with their mothers for at least four years (Smolker *et al.*, 1992), but have been reported to stay together until the calf is eight years old (Grellier *et al.*, 2003).

66 Cardigan Bay is an important calving area for bottlenose dolphin, alongside the Llyn Peninsula and the Isle of Anglesey (Feingold and Evans, 2014a). Peak calving time within the Cardigan Bay SAC generally occurs between July and September (where approximately 76% of all calves are born) although calving may occur at any time (Norrman *et al.*, 2015).

67 There is currently not enough information to determine what, if any, the habitat requirements are for any breeding areas or calving areas for bottlenose dolphins in UK waters (JNCC, 2017b).

2.2.6 Conservation status

68 The current conservation status, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2012), of the bottlenose dolphin is '*favourable*' (JNCC, 2013).

2.3 Grey seal (*Halichoerus grypus*)

2.3.1 Distribution and occurrence of grey seal

69 Grey seals only occur in the North Atlantic, Barents and Baltic Sea with their main concentrations on the east coast of Canada and United States of America and in north-west Europe (Special Committee on Seals (SCOS), 2016). Approximately 38% of the world's grey seals breed in the UK and 88% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. There are also breeding colonies in Shetland, on the north and east coasts of mainland Britain and in south-west England and Wales (SCOS, 2016).

70 Long-term sightings rates data as collated in the Atlas of the Marine Mammals of Wales found that the main concentrations of grey seals sightings were off the north coast of Wales, as well as the southern coast of the Isle of Man (Baines and Evans, 2012). Grey seal are present year-round within the Irish Sea and are known to regularly travel between southeast Ireland and southwest Wales (Lidgard *et al.*, 2000).

71 The grey seal distribution in UK waters has been mapped by Sea Mammal Research Unit (SMRU) by combining data for tagged seals and survey counts at haul-out sites. This data is displayed in 5km by 5km grid squares across UK waters to show mean seal usage within each grid square (Jones *et al.*, 2016).

72 These maps indicate relatively higher usage within some areas of the Celtic and Irish Sea along the coastal areas of Ireland and Wales. Important areas are the Llyn Peninsula, West Hoyle Bank, the waters surrounding Lambay Island and the south-east tip of Ireland (namely the Saltee Islands; **Figure 1**; Jones *et al.*, 2016). Grey seal usage is high in the north SRA (approximately 2.3/km^2) and very low in the south SRA (0.003/km^2; **Figure 1**; Jones *et al*, 2016).

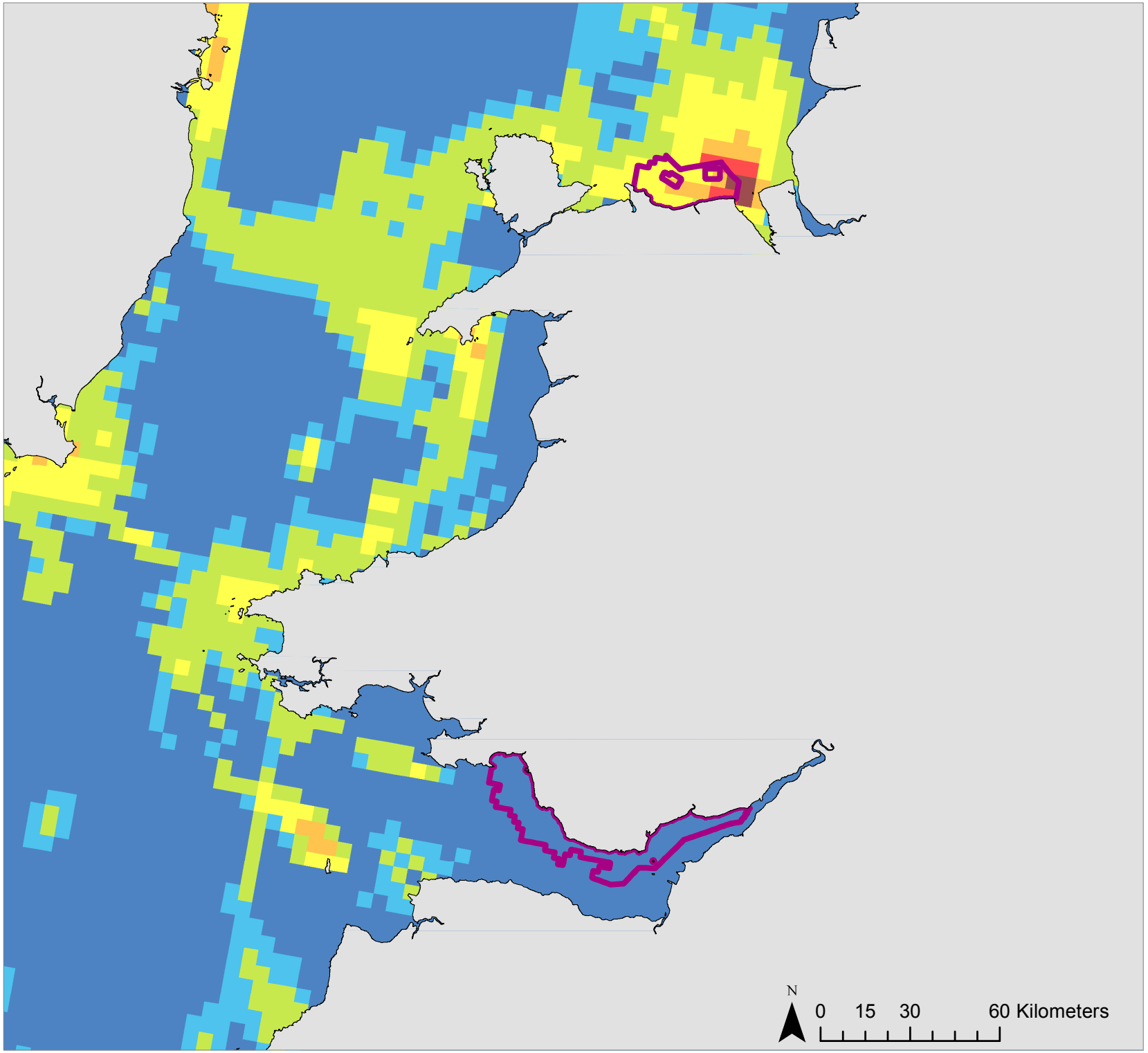
73 Spatial analysis of grey seal movements indicate that they have homogeneous usage near-shore, transit between haul-out sites in large-scale interconnected networks and spend 15% of their time far-offshore (Russell and McConnell, 2014).

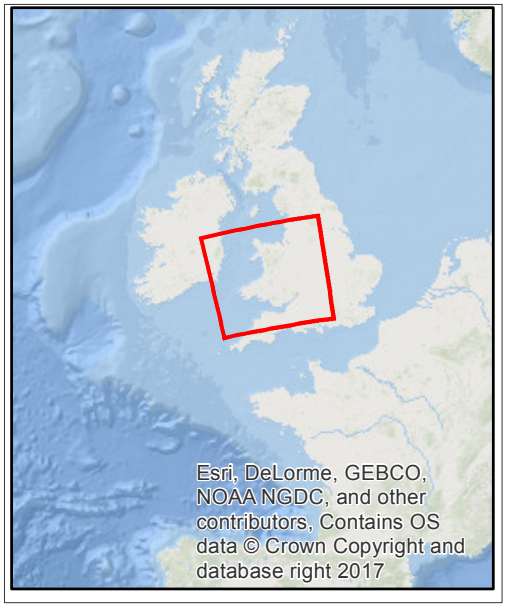
74 Grey seal population trends are assessed from the counts of pups born during the autumn breeding season, when females congregate on land to give birth (SCOS, 2016). The most recent surveys of the principal grey seal breeding sites in Scotland, Wales, Northern Ireland and south-west England, resulted in an estimate of 60,500 pups (95% CI = 53,900-66,900; SCOS, 2016). When the pup production estimates are converted to estimates of total population size, there are population model an estimated 139,800 UK grey seals (approximate 95% CI = 116,500 - 167,100; SCOS, 2016).

75 The numbers of grey seals in the UK during August harbour seal surveys were 13,880 grey seals counted in eastern England in 2008 to 2015, an estimate of 1,302 in West England and Wales, and a count of 468 in Northern Ireland during the 2011 survey, giving a most recent UK total count of grey seals in August of 37,701 (SCOS, 2016). In Ireland, the grey seal population was estimated to between 7,284 and 9,365 individuals, during the 2009-2012 monitoring program at seven main breeding sites (O'Cadhla *et al.*, 2013).

76 The MUs for seals include 11 distinct areas around the UK, with the MU of relevance being West England and Wales. Grey seal pup production for this MU was estimated at 1,900 with an estimated summer population of 6,000 based on summer survey counts from 1994 to 2003 and 2007 (IAMMWG, 2013). However, it should be noted that the West England and Welsh count is less certain due to infrequent assessment over this large area.

77 The most recent data for pup production from the major breeding sites in Wales show estimates of 96 pups in north Wales, 465 pups in north Pembrokeshire in 2005 and 379 pups born on Skomer and adjacent mainland sites in 2015. In 2014, an estimated 1,650 grey seal pups were born in Wales (SCOS, 2016). Based on August counts (2011-2015) of grey seals at haul-out sites in Wales there are an estimated 422 grey seal and an estimated 480 grey seal in south-west England (SCOS, 2016). However, there are no dedicated seal surveys in these areas and only sparse information is available, therefore, estimates are compiled from counts from various different sources (SCOS, 2016). In addition, it should be noted that grey seal summer counts are known to be more variable than harbour seal summer counts and therefore caution is advised when interpreting these numbers (SCOS, 2016).





Legend

Tidal Lagoon SRAs

Grey seal density (Upper 95% CI)

- 0-1
- 1-5
- 5-10
- 10-50
- 50-100
- 100-150
- 150+

Project

Welsh National Marine Plan: Tidal Lagoon policy marine mammal and otter HRA

Figure 1

Grey seal density per 5x5km grid square (based on data from Jones et al., 2016)

Date	*Coordinate System*	*Scale*
04/09/2017	British National Grid	1:41538462

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2.3.2 Haul-out sites

78 Grey seals haul-out for longer periods of time during their annual moults which occur between December and February (generally three and five months after the breeding season) and during the breeding season between August and September (SCOS, 2016).

79 In north Wales, grey seals are known to haul-out and use habitats such as inter-tidal rocky outcrops, beaches and sea caves that are tidally exposed (Countryside Council for Wales (CCW), 2009). Breeding colonies in Wales tend to be at the foot of steep cliffs or in caves (SCOS, 2016). Grey seal haul-out site surveys undertaken along the Anglesey coastline reveals that 48% and 75% of pups born in Anglesey and the Llyn Peninsula were born in cave habitats respectively (Stringell *et al.*, 2014). The estimated pup production in Wales for 2014 was 1,650 (96 in north Wales, 465 in north Pembrokeshire and 379 on Skomer and adjacent mainland sites) (SCOS, 2016).

80 Major haul-out sites around Wales are at the Llyn Peninsula, areas off the Pembrokeshire coast and West Hoyle Sandbank, with very few haul-out sites along the south coast (**Plate 6**; Jones *et al.*, 2015).

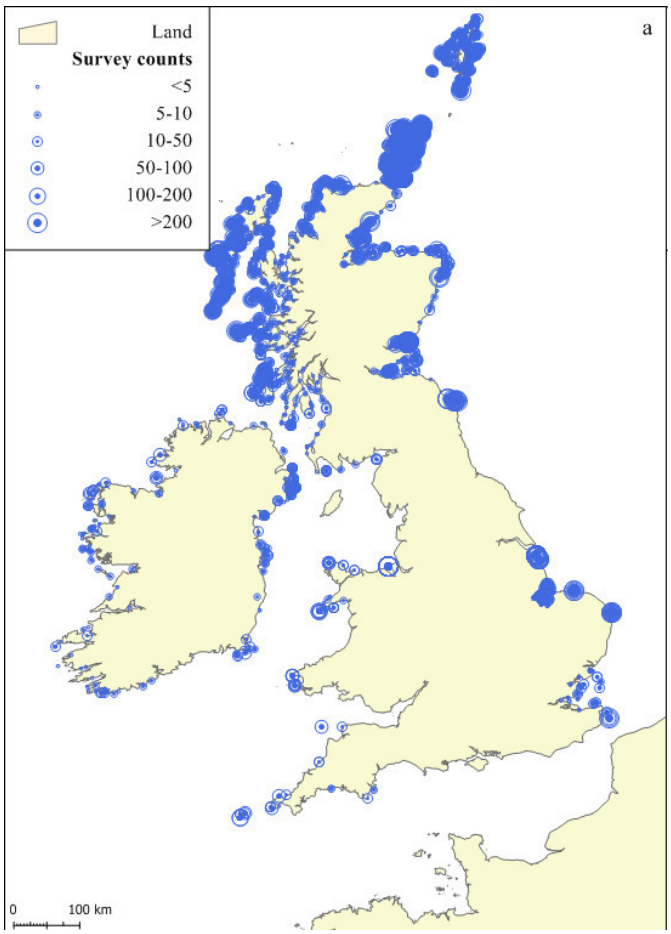


Plate 6: Grey seal haul-out site locations, map taken from Jones et al. (2015).

2.3.3 Diet

81 Grey seals are generalist feeders and forage predominantly on the sea bed at depths of up to 100m, although they are probably capable of feeding at all the depths found across the UK continental shelf (SCOS, 2016). Grey seal diet in the Irish Sea includes Gadiformes (predominantly blue whiting, rockling, cod species and pollack), Salmo species and Perciformes (namely Ammodytidae species) (Hernández-Milián, 2014).

2.3.4 Movements and foraging ranges

82 Grey seals forage in the open sea and return regularly to haul-out. Foraging trips are wide-ranging and can last up to 30 days (SCOS, 2016). Seal tagging studies have reveals that foraging probably occurs within 100km of a haul-out site with ranges generally up to 145km (Thompson *et al.*, 1996), although they can travel considerable distances with ranges of 1,088 to 6,400km recorded (Dietz *et al.*, 2003). Individual seals will often make repeated trips to the same foraging region offshore but will travel between haul-outs sites and occasionally move to a new site and begin foraging a new region (SCOS, 2016).

83 Tagging studies within the Irish Sea revealed that adults have an average foraging range of 16.4km with a maximum trip of 173km, while pups had an average trip of 19.5km and a maximum trip of 435.8km (SCOS, 2014). This data also revealed that grey seals often move between haul-out locations, in particular between the Llyn Peninsula, Cardigan Bay and the Isle of Anglesey (SCOS, 2014).

84 Data analyses of tagged seals indicate that foraging distribution is related to their breeding distribution (Russell and McConnell, 2014). Female grey seals do not make foraging trips while they are suckling their pups and so the foraging patterns of female seals differ between foraging and breeding seasons. Russell *et al.* (2013) found that between 21 and 58% of females used different regions for foraging and breeding. Tagging studies also indicate that pups have a longer range of foraging than adults (Russell and McConnell, 2014).

85 The difference in population trends between regions for UK grey seals suggests underlying regional differences in demographics. On the basis of genetic differences there appears to be a degree of reproductive isolation between grey seals that breed in the south-west (Devon, Cornwall and Wales) and those breeding around Scotland (SCOS, 2016)

86 Recent telemetry data suggest that there may be significant mixing between populations outwith the breeding season, e.g. observed movements of adult seals between summer haul-out sites in northern France and both the Scottish east coast and Inner Hebrides (SCOS, 2016).

87 Telemetry studies undertaken at five SACs across the UK (Pembrokeshire Marine, Llŷn Peninsula and the Sarnau, Monach Islands, Isle of May and Berwickshire and North Northumberland Coast) indicate that both adults and pups travel between SACs. For example, tagged seals have travelled between Pembrokeshire Marine SAC, Llŷn Peninsula and the Sarnau SAC and the Saltee Islands SAC (Ireland) (SCOS, 2014).

88 Telemetry studies of seals within the Irish Sea show that while all grey seals remained within the Irish Sea and did not travel north into Scottish waters or south to southwest England, there was

movement within the Irish Sea area (Hammond *et al*., 2005; SCOS, 2014). The study revealed areas of relatively high usage, namely along the north coast of Wales up to 40km offshore, west of the Llyn Peninsula from 30km west of Bardsey Island to 30km from the Irish east coast and southwest of the Llyn Peninsula extending 60km offshore. There were also further areas of relatively high use from the southern Cardigan Bay extending 50km offshore and area west and south of Dyfed (**Plate 7**; Hammond *et al*., 2005; SCOS, 2014). Other tagging studies undertaken in both west Scotland and north France have revealed that they grey seals tagged in these locations did not enter the Irish Sea (Hammond *et al*., 2005).

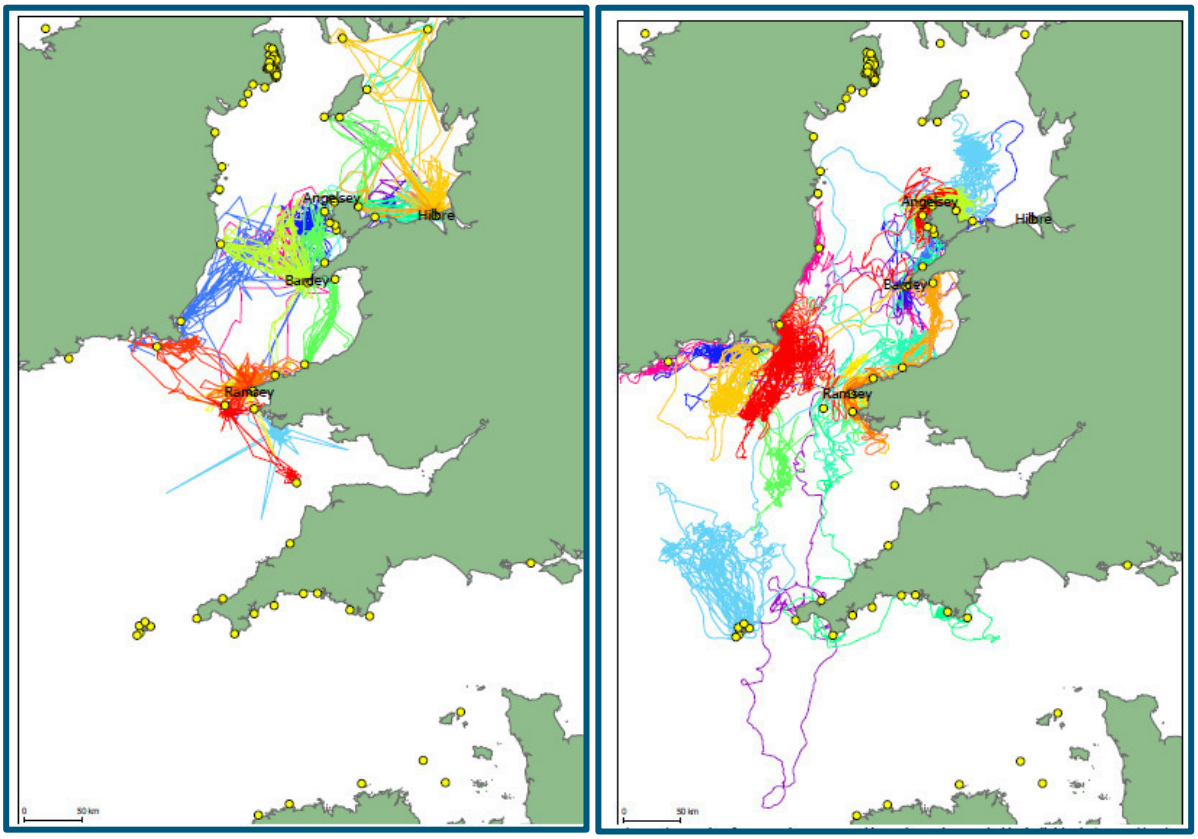


Plate 7: Movements of tagged grey seals in the Irish Sea (a) adults and (b) pups. Maps taken from SCOS (2014), based on data from Hammond et al. (2005).

2.3.5 Life history

89 The majority of pups in south-west Britain are born between August and September (SCOS, 2016). Pups are weaned at 17 to 23 days after birth and begin to moult their white natal coat, remaining within the breeding colony for two to three weeks before going to sea for the first time. Mating occurs at the end of lactation and then adult females depart to sea and provide no further parental care (SCOS, 2016).

90 In north Wales, pupping can occur between from September to November with peak births typically in mid-September (Westcott, 2002; Westcott and Stringell, 2003, 2004). Breeding sites in north Wales include Carmel Head, The Skerries, the Llyn Peninsula and Bardsey Island (the largest in north Wales).

2.3.6 Conservation status

91 The current conservation status, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2012), of the grey seal is '*favourable*' (JNCC, 2013).

2.4 Harbour seal (*Phoca vitulina*)

2.4.1 Distribution and occurrence of harbour seal

92 Around Wales, harbour seals are only found in very low numbers. The most recent harbour seal count for the West England and Wales MU was less than 50 based on surveys completed from 2007 to 2015 (SCOS, 2016). There are no dedicated harbour seal surveys within this MU due to the low number of harbour seals.

93 The harbour seal at sea usage map (**Figure 2**; Jones *et al.*, 2016) indicates low densities of harbour seal across the Irish Sea and Wales coastlines. Harbour seal usage in the north and south SRAs is very low (approximately 0.01/km^2 and 0.00000035/km^2, respectively; **Figure 2**; Jones *et al*, 2016).

94 The most recent minimum estimate for England and Wales, obtained from surveys carried out mainly in 2015, is 4,869, which is 21% higher than the 2007-2009 count (4,032) and 48% higher than the 1995-1997 count (3,289; SCOS, 2016). The 2011 count for Northern Ireland of 948, which was 25% lower than the previous complete count in 2002 (1,267). The sum of all the most recent counts carried out between 2007 and 2014 gives a UK total count of 31,216 harbour seals (SCOS, 2016).

2.4.2 Haul-Out Sites

95 Harbour seal come ashore in sheltered waters, typically on sandbanks and in estuaries, but also in rocky areas. Harbour seal regularly haul-out on land in a pattern that is often related to the tidal cycle (SCOS, 2016).

96 Harbour seal give birth to their pups in June and July, during which time females and pups spend a high proportion of their time ashore (SCOS, 2016). Harbour seals moult in August and spend a higher proportion of their time on land during the moult than at other times (SCOS, 2016).

97 There are a number of very small harbour seal haul-out sites around the Wales coastline, the largest being West Hoyle Sandbank (5-10 seals) with others along the Isle Anglesey north coast, the Llyn Peninsula and the Pembrokeshire coast (all with less than 5 seals) (Jones *et al.*, 2015).

2.4.3 Diet

98 Harbour seal take a wide variety of prey including sandeels, gadoids, herring and sprat, flatfish and cephalopods. Diet varies seasonally and regionally, prey diversity and diet quality also showed some regional and seasonal variation (SCOS, 2016).

2.4.4 Movements and foraging ranges

99 Telemetry studies indicate that the tracks of tagged harbour seals have a more coastal distribution than grey seals and do not travel as far from haul-outs (Russell and McConnell, 2014).

100 Harbour seals normally feed within 40-50 km around their haul out sites (SCOS, 2016). Tracking studies have shown that harbour seal typically travel 50-100km offshore and can travel 200km between haul-out sites (Lowry *et al.*, 2001; Sharples *et al.*, 2012).

101 SMRU telemetry data spanning 21 years (1991 – 2012) covering the UK population in all seasons revealed that there is very little harbour seal usage in the Celtic and Irish Seas (Jones *et al.*, 2013). There are small amounts of seal usage around the north-east Irish coast spanning across to the Isle of Man, but no evidence of movement to the Welsh coastline (Jones *et al.*, 2013).

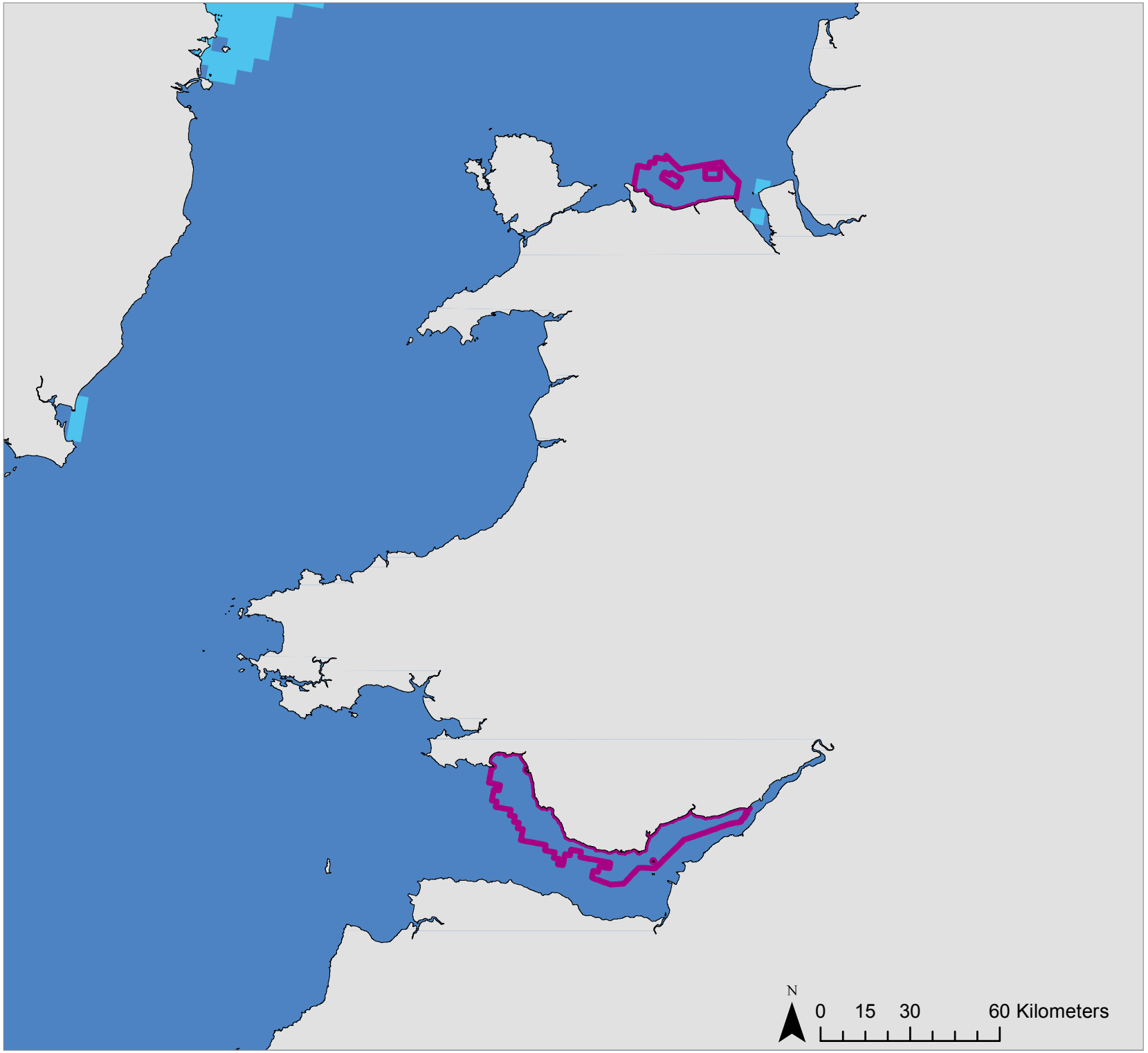
2.4.5 Life history

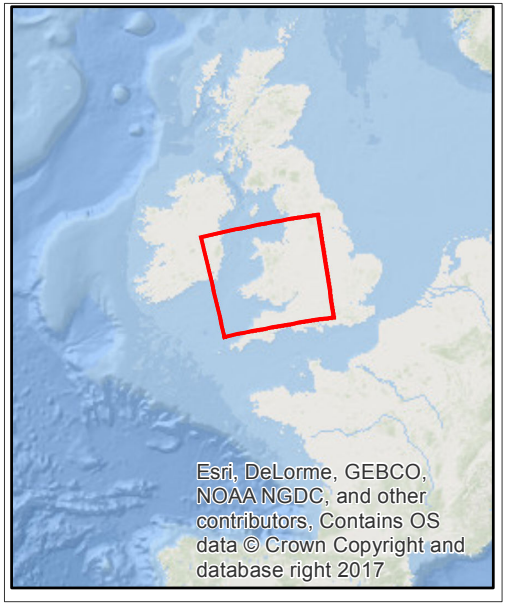
102 Harbour seal give birth to their pups in June and July and pups can swim almost immediately after birth (SCOS, 2016). The moult occurs in August and extends into September (SCOS, 2016).

2.4.6 Conservation status

103 In recent years, the populations of harbour seal have been declining with a loss of 21% between 2000 and 2010 (JNCC, 2013). The most recent research indicates that the cause of this decline is most likely down to two factors; interactions with grey seals and toxins from harmful algae (SCOS, 2016). The population of harbour seal in the UK is now increasing and is close to the level before the decline.

104 The current conservation status, as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2012), of the harbour seal is '*unfavourable / bad'* for the overall assessment (JNCC, 2013).





Legend

Tidal Lagoon SRAs

Harbour seal density (Upper 95% CI)

- 0-1
- 1-5
- 5-10
- 10-50
- 50-100
- 100-150
- 150+

Project

Welsh National Marine Plan: Tidal Lagoon policy marine mammal and otter HRA

Figure 2

Harbour seal density per 5x5km grid square (based on data from Jones et al., 2016)

Date	*Coordinate System*	*Scale*
04/09/2017	British National Grid	1:41538462

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2.5 Otter (*Lutra lutra*)

2.5.1 Distribution

105 The distribution of otters in Wales include important coastal populations along the West Wales coastline (DECC, 2016).

106 Anglesey was listed as a site of concern in the 2002 survey but the population in that area has now improved, with an increase of 49.5% use of the area in the 2009-2010 survey. The area of Glaslyn has also improved, with an increase of 43.9% otter use from 2002 to 2009 (Strachan, 2015). The use of the coast by otters has increased in recent years, with increases in the use of the Neath, Ogmore and all three identified Cardigan Bay water bodies. There were additional identified coastal sites along the north Wales coastline, including the Glaslyn, the Mawddach and the Dyfi estuaries (Strachan, 2015).

107 The Mawddach water body (as defined in the Otter Survey Wales 2009-2010) has shown improvements in the numbers of otter present. The survey also found 23 negative sites to the upper end of the catchments which could be down to lack of suitable prey species. Within this area, there has been an increased use of the coastal areas by otters (Strachan, 2015).

108 The Fifth Otter Survey of Wales (Strachan, 2015) was undertaken in 2009 and 2010 where a total of 1,108 sites known to have or recently have otter presence were surveyed. This survey found otter presence at 89.89% of sites surveyed, showing a continued increase from the first Otter Survey Wales completed in 1977-1978 (Strachan, 2015). Results of the survey areas adjacent to or within 50km of the two identified SRAs (**Table 1**) shows over 93% otter presence in the areas of importance to the two Tidal Lagoon SRAs, with the exception of the Taff and River Usk catchment area with 79% and 89% presence respectively (Strachan, 2015).

Table 1: Results of the 2009-2010 otter survey showing the number of surveyed otter sites having otter/s present and a comparison of the previous otter surveys of Wales (data taken from Strachan, 2015)

	Number (& %) of Positive Sites				
Area	1977-78	1984	1991	2002	2009-10
Clywd	1 / 27 (4%)	14 / 36 (39%)	24 / 36 (67%)	32 / 36 (89%)	34 / 36 (94%)
Conwy	1 / 32 (3%)	7 / 36 (19%)	12 / 36 (33%)	28 / 36 (78%)	34 / 36 (94%)
Dee	16 / 53 (30%)	24 / 59 (41%)	29 / 59 (49%)	46 / 59 (78%)	55 / 59 (93%)
Loughor	0 / 47 (0%)	0 / 50 (0%)	22 / 50 (44%)	39 / 50 (78%)	50 / 50 (100%)
Mid Glamorgan	1 / 53 (2%)	0 / 61 (0%)	1 / 61 (2%)	11 / 61 (18%)	43 / 61 (70.5%)
Taff	0 / 21 (0%)	2 / 42 (5%)	7 / 42 (17%)	21 / 42 (50%)	33 / 42 (79%)
Usk	6 / 56	18 / 62	34 / 62	48 / 60	55 / 62

Area	Number (& %) of Positive Sites				
	1977-78	1984	1991	2002	2009-10
	(11%)	(29%)	(55%)	(80%)	(89%)
Wye	28 / 118 (24%)	73 / 118 (62%)	100 / 122 (82%)	112 / 122 (92%)	124 / 129 (96%)

109 The estimated population of otter in Wales was 926 (as recorded in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2012; JNCC, 2013).

110 The JNCC (2013) report estimates that 25,294km of river bank is occupied by otters in Wales, giving an estimated population density of 0.037/ km of river bank (1 otter per 27.32 km of river bank) (JNCC, 2013). There were no similar estimates for coastal areas.

2.5.2 Movements

111 Within the terrestrial environment, otters will travel over large areas, using up to 20km of habitat (NE, 2007) but can be as high as 40km (Roche *et al.*, 1995). The range for coastal otters is significantly less with research undertaken by Scottish Natural Heritage (SNH) showing that coastal home ranges of otters are normally 4-5 km of coastline (SNH, 2008). Further research has revealed it can be as high as 14km (Kruuk, 2006), while The Vincent Wildlife Trust describes the smallest otter territories as being in coastal locations where they can be as little as 2km (Vincent Wildlife Trust, 2017).

2.5.3 Habitats

112 Otters are semi-aquatic mammals that can live in a range of habitats (freshwater or coastal). Within coastal areas, the otter will use shallow inshore areas for feeding but require freshwater for bathing, and terrestrial areas for resting and breeding. Suitable habitats for otters include vegetated river banks, reed beds, islands and woodlands (JNCC, 2016).

2.5.4 Diet

113 Otters will mainly prey on fish, although crustaceans, frogs, voles and birds are also eaten (NE, 2007). Estuaries provide particularly good foraging grounds for otters, with saltmarshes and mudflats providing good spawning grounds for many fish species (Strachan, 2015).

2.5.5 Life history

114 Otters breed in specific sites that they will return to year after year, using a natal den that changes every year. Breeding can occur throughout the year, with 1 to 4 cubs generally born at a time. Females will breed once every two years. Otter breeding sites are sensitive to change and protection should be given to the entire breeding site (NE, 2007).

2.5.6 Conservation Status

160. The current Favourable Conservation Status (FCS) as assessed in the 3rd UK report on implementation of the Habitats Directive (submitted to the European Commission in 2013) of the otter is '*favourable*' (JNCC, 2013).

3 Screening

The following section includes the screening stages of the HRA. The aim of this stage is to determine whether the Tidal Lagoon Policy is likely to have a significant impact on the relevant European Designated Sites for marine mammals. The approach taken is to determine the potential for connectivity between individual marine mammal species from European Designated Sites and demonstrate a clear source-pathway-receptor relationship.

3.1 Pre-screening

115 The first stage in the screening process was to assess the European Designated Sites for harbour porpoise, bottlenose dolphin, grey seal, harbour seal or otter have the potential to be impacted by the development of Tidal Lagoon projects within the two identified SRA in north and south wales. This included all SACs or cSACs for marine mammal species that overlapped with the SRAs.

116 In addition, AMEC Foster Wheeler (2017) determined a precautionary 50km marine zone of influence (ZOI) for wave and tidal stream taking place within the SRAs; this was based on tidal stream modelling for the Bristol Channel (e.g. Neill, 2013) which indicated that sediment dynamics may be influenced up to 50km from the point of energy extraction (although it was noted that far-field effect distances are likely to be above average for the Bristol Channel).

117 Evidence from other plume studies and the mobilisation of sediments from offshore activities has shown that they will be re-deposited within one tidal ellipse of the impact occurring. For example, within the Severn Estuary this was within 30km and for the Liverpool Bay area it was 21km (Amec Foster Wheeler, 2017). Modelling and monitoring from offshore discharges (such as waste) has shown that they will typically be attenuated within a few kilometres of the source at maximum. Therefore, there will be no discernible impact as a result of Tidal Lagoon developments outside of 50km (as a precautionary worst-case). Therefore any sites that intersect this ZOI were screened in for further assessment.

118 Marine mammals are wide-ranging and highly mobile, therefore, marine mammal MUs also need to be considered. The IAMMWG (2015) define MUs as "*a geographical area in which the animals of a particular species are found to which management of human activities is applied. An MU may be smaller than what is believed to be a 'population' or an 'ecological unit' to reflect spatial differences in human activities and their management. If MUs are defined at a smaller spatial scale than the population, it is important that management takes into account the rates of interchange of individuals between MUs; that is, the MUs should not be treated as if they were demographically independent*".

119 For harbour porpoise, the pre-screening stage considered connectivity was possible for any European Designated Site within the Celtic and Irish Seas MU (IAMMWG, 2015). Harbour porpoise of the Celtic and Irish Seas MU are the most likely to interact / be present within the defined SRAs, therefore any European Designated Sites outside this MU were not considered further.

120 For bottlenose dolphin, the pre-screening stage considered connectivity was possible for any European Designated Site within the Irish Sea MU (IAMMWG, 2015). As with harbour porpoise, any European Designated Sites outside this MU were not considered further.

121 For grey and harbour seal, the pre-screening stage considered connectivity was possible for any European Designated Site within the Irish Sea MU as defined within the "Recommended Management Units for Marine Mammals in Welsh Waters" report (Evans *et al.*, 2012b). As for harbour porpoise and bottlenose dolphin, any European Designated Sites outside this MU was not considered further.

122 The pre-screening of otter sites was determined by the distance to the 50km ZOI of the two identified SRAs rather than by MUs. European Designated Sites were included in the pre-screening list if they were within 5km of the 50km ZOI of either SRA. Any European Designated Sites outside this ZOI was not considered further.

123 The Welsh Government provided this initial list of European Designated Sites for harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter for consideration in the assessment. This initial pre-supplied list was based on the criteria outlined above:

- Designated sites overlapping, partly or wholly, the hydrodynamic/physical zone of influence defined as 50km from the SRA boundary (seawards from the mean high water springs line) in consideration of the high-level assessment undertaken by Cefas and by ABPMer.
- Designated sites where otters are an interest feature where any part of the site is within 5km of the zone of influence.
- Designated sites for harbour porpoise, bottlenose dolphin, grey seal and harbour seal that partly or wholly within corresponding marine mammal management units that overlap with the SRA's zone of influence.
- Designated sites where harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter is a grade A, B, C or D feature.
  - A = Outstanding examples of the feature in a European context. Feature is the primary reason for designation.
  - B = Excellent examples of the feature, significantly above the threshold for SSSI/ASSI notification but of somewhat lower value than grade A sites. Feature is the primary reason for designation.
  - C = Examples of the feature which are of at least national importance (i.e. usually above the threshold for SSSI/ASSI notification on terrestrial sites) but not significantly above this. These features are not the primary reason for SACs being selected.
  - D = Features of below SSSI quality occurring on SACs. These are non-qualifying features ("non-significant presence").

124 This initial pre-supplied list of European Designated Sites in relation to the Tidal Lagoon plan level HRA, was based on information from the European Environment Agency (https://www.eea.europa.eu/data-and-maps/data/natura-8), JNCC website (http://jncc.defra.gov.uk/page-1485) and information from NRW and NE. The pre-supplied list of SACs and cSACs for marine mammal species updates the list provided in AMEC Foster Wheeler (2017).

125 The pre-supplied initial list from the Welsh Government of 46 SACs and cSACs for marine mammal species is provided in **Appendix 1 Table A1.1**: Initial pre-supplied list of designates sites for harbour porpoise, bottlenose dolphin, grey seal and otter screened in at the pre-screened stage (list supplied by the Welsh Government, 10th August 2017)**.**

3.2 Evidence based screening

126 The pre-supplied initial list from the Welsh Government of consisted of 14 European Designated Sites for harbour porpoise, 18 European Designated Sites for bottlenose dolphin, 5 European Designated Sites for grey seal and 9 European Designated Sites for otter; no sites were screened in for harbour seal (**Table A1.1**: Initial pre-supplied list of designates sites for harbour porpoise, bottlenose dolphin, grey seal and otter screened in at the pre-screened stage (list supplied by the Welsh Government, 10th August 2017)).

127 The next stage of the screening was to review the pre-supplied list from the Welsh Government (as described in **Section 3.1**) and determine the potential for any LSE that could affect the integrity of these European Designated Sites with respect to their conservation objects as a result of the development of Tidal Lagoons within the SRAs.

128 To determine the potential for any LSE, information on the project or plan is needed to identify the potential causes of effects. However, specific Tidal Lagoon projects within the SRAs are yet to be defined, which means that the likelihood of LSE and the nature of the effects can only be determined in very general terms at the plan level for this assessment. The Tidal Lagoons that could be developed in the SRAs may involve new technologies for the devices, associated infrastructure and construction methods, which cannot currently be foreseen. Therefore the potential effects that could be associated with Tidal Lagoon developments (**Section 3.2.1**) have been based on the current information and a scientific understanding of the potential impacts that could affect marine mammals and their prey.

129 A key factor in assessing the potential for any LSE that could affect the integrity of these European Designated Sites with respect to their conservation objects was to determine a clear source-pathway-receptor relationship. This was determined by

- **(i)** The qualifying interest features identified as being present in the SRAs and potential ZOI; and
- **(ii)** The foraging ranges of the different qualifying interest features.

130 The likelihood of the of the harbour porpoise, bottlenose dolphin, grey seal, harbour seal and otter being present in the SRAs and potential ZOIs, including their foraging ranges was assessed based on the information provided in **Section 2** for each species. This information was then used to determine whether there was any likely functional linkage between the 46 European Designated Sites initially screened in and the development of Tidal Lagoons within the two identified SRAs.

131 The screening has been based on a 'source-pathway-receptor' approach. The approach identifies likely environmental impacts that could result from the proposed construction, operation and maintenance of Tidal Lagoons in the two SRAs. The parameters were defined as follows:

- Source – the origin of a potential impact (noting that one source may have several pathways and receptors).
  - Example: Re-suspension of sediments.
- Pathway – the means by which the effect of the activity could impact a receptor.
  - Example: Settlement of re-suspended sediments causing smothering of seabed.
- Receptor – the element of the receiving environment that is impacted.
  - Example: Smothering has a direct effect on a seabed organism that forms an important part of the food chain for a site interest feature.

132 Where there is no pathway or the pathway is so long that the effect from the source has dissipated to a negligible level before reaching the receptor from a European Designated Site, there is justification for the screening out of that European Designated Site.

133 The approach to screening for each receptor is outlined in **Section 3.2.2** based on the known distribution, ecology and sensitivities of each receptor (**Section 2**) and therefore the potential for being affected by Tidal Lagoons in the two SRAs.

134 Where there is insufficient information available at this stage to screen out a site, it is screened in for further consideration.

135 In addition, the screening has taken into account the advice from JNCC regarding the principles document for an HRA relating to the Welsh National Marine Plan, in particular policies relating to Tidal Lagoons (dated 25th August 2017) including:

- Taking into account the guidance by Tydesley and Associates (2015) which refers to the importance of avoiding excessive data gathering within HRAs for sites that are not likely to be impacted by either a project or plan and to keep assessments proportional to the likelihood of significant effects. Subsequently, there may not be any impact pathway to some of the sites identified, mainly due to the distance from the plan SRA regions. JNCC therefore recommend careful consideration of impact pathways during the screening process.
- The JNCC advice that a cetacean SAC should be scoped in for HRA assessment if there could be likely significant effects on the site from the plan in light of its conservation objectives. This would happen when, within the site, there could be deterioration of the habitats of the species or significant disturbance of the species. This would exclude most sites that would not spatially overlap with the SRAs unless the effect footprint of the project/plan (deterioration of habitat/disturbance of species) would overlap with the site or prevent the species from accessing the site.

3.2.1 Potential impacts of tidal lagoons

136 Tidal Lagoons can potentially generate energy from the rise and fall of tides. A large volume of water is 'captured' behind a man-made structure which is subsequently released to drive turbines and generate power. The Tidal Lagoon encloses an area of coastline with a high-tidal range behind a wall-like structure, such as a breakwater (**Plate 8**). The natural ebbs and flows of the tide are used to generate power both on incoming and outgoing tides. There is no other requirement for power and as it is entirely reliant on the power of the tides, it is wholly predictable.

Depending on the hydrostatic head required for a tidal lagoon, the amount of drainage out of the lagoon, and therefore the amount of intertidal habitat periodically exposed, may be variable.

137 The following assessment will consider impacts of Tidal Lagoons associated with the construction and operational phases. Decommissioning is not considered further (on the basis that the lifetime of Tidal Lagoon projects is expected to be 120 years which is considerably outside of the 20 year lifetime of the draft WNMP) however it is believed that decommissioning impacts will be similar to those of construction.

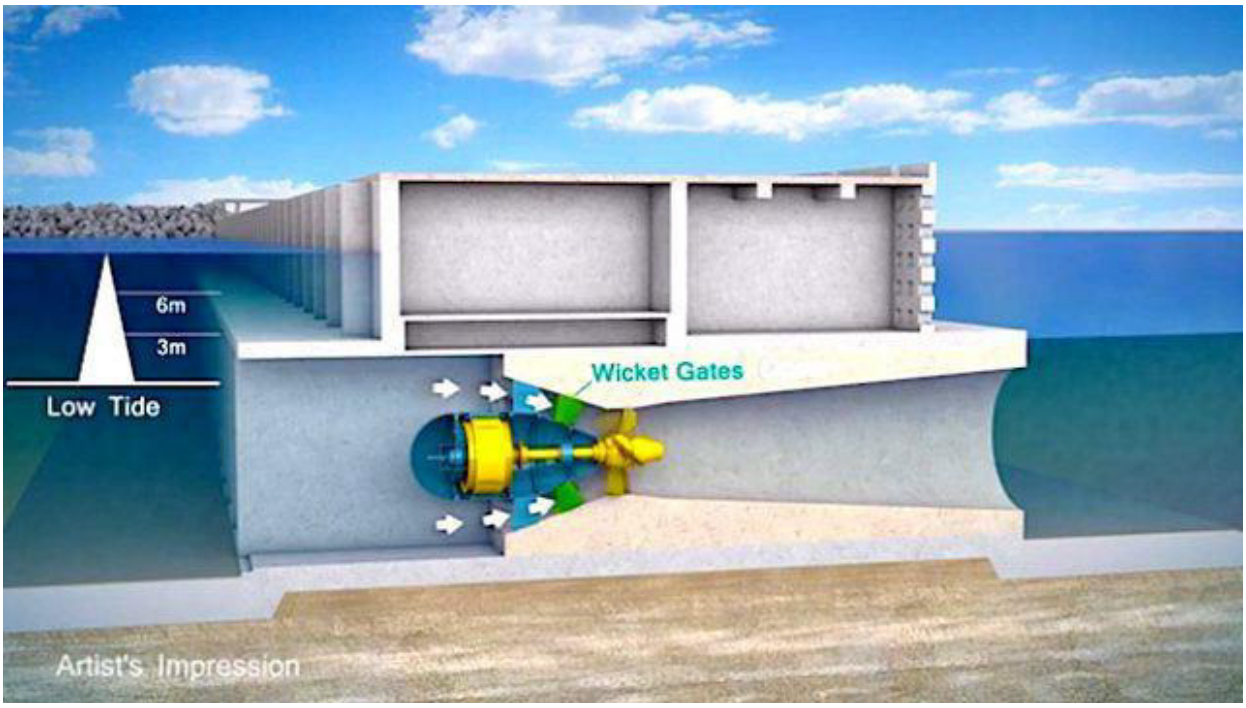

Plate 8: Diagram of Tidal Lagoon and how they generate power (taken from Tidal Lagoon Swansea Bay, 2016).

138 Tidal Lagoon development and operation is likely to occur in the following stages (based on Tidal Lagoon Swansea Bay (2014b)):

- **Phase 1**
  - Mobilisation, construction of permanent seawalls
  - Construction of temporary cofferdam(s) around the construction area for the turbine / sluice gate housing structure(s), pile driving
- **Phase 2**
  - Turbine and sluice gate housing structure construction,
  - Installation of turbines and sluice gates, pile driving
- **Phase 3**
  - Removal of temporary cofferdam around the turbine/sluice gate housing structure;
  - Permanent seawall (closure);
  - Wet commissioning of the turbines and sluice gates.

- **Phase 4**
  - Finishing's
  - Construction of public realm and buildings
- **Phase 5**
  - Operational (energy generation) and maintenance

139 Potential impacts associated with the construction and operational phases of a Tidal Lagoon project that could affect marine mammals and their prey have therefore been identified as:

- Direct habitat loss from the power generation infrastructure.
- Changes in habitat extent, type or quality as a result of alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition).
- Changes in water quality (including salinity, dissolved oxygen, suspended sediments and contaminants, regulated and accidental discharges).
- Underwater noise.
- Airborne noise.
- Visual disturbance.
- Collision risk (including vessels and infrastructure).
- Barrier effects to movement and habitat fragmentation.
- Introduction or spread of non-native species.
- Electromagnetic fields from power transmission cables.
- Changes in prey availability.

140 Some of these impacts will only apply to the construction or operational phase, while some will apply to both the construction and operational phases of Tidal Lagoons (**Table 3**).

141 **Table 2** outlines the activities that could result in these potential impacts during construction and/or operation on marine mammals and their prey species.

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Table 2: Potential impacts of Tidal Lagoons on marine mammals and their prey species

Potential Impact	Possible activities	Construction	Operation	Likely Impacts on Receptors	
				Marine Mammals including otter	Prey species
Direct habitat loss	Construction and presence of power generation infrastructure. Footprint of Tidal Lagoon.	Yes	Yes	Yes	Yes
Changes in habitat extent, type or quality as a result of alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition), including any changes to water levels.	Construction and presence of lagoon seawalls (including rock armour and works to navigation channels). Construction activities, such as dredging and disposal of material. Maintenance activities, including dredging and disposal. Presence of turbines and sluice gates impacting on hydrodynamic processes.	Yes	Yes	No	Yes
Changes in water quality (including salinity, dissolved oxygen, suspended sediments and contaminants, regulated and accidental discharges)	Construction and presence of lagoon seawalls (including rock armour and works to navigation channels). Construction activities, such as dredging and disposal of material. Accidental discharges form construction equipment, including vessels. Maintenance activities, including dredging and disposal. Changes to water quality due to impoundment of water behind lagoon wall.	Yes	Yes	Yes	Yes

Potential Impact	Possible activities	Construction	Operation	Likely Impacts on Receptors	
				Marine Mammals including otter	Prey species
Underwater noise	Construction of lagoon seawalls and other infrastructure (including percussive or vibro-pilling, cable laying and rock armour); Vessels; Dredging; and Operational turbines	Yes	Yes	Yes	Yes
Airborne noise	Construction of lagoon seawalls and other infrastructure	Yes	No	Yes	No
Visual disturbance	Visual or light disturbance from both construction and operational activities and machinery.	Yes	Yes	Yes	Yes
Collision risk	Collision with vessels. Otters - road traffic collisions with construction vehicles and for increased public use of the site during operation, including any car parks (specific for otter only). Collision with the turbines and sluice gates during the operation phase.	Yes	Yes	Yes	Yes
Barrier effects to movement and habitat fragmentation	Construction and presence of lagoon seawalls.	Yes	Yes	Yes	Yes
Introduction or spread of non-native species.	Introduction of non-native species through construction and operation phases.	Yes	Yes	No	Yes
Electromagnetic fields from power transmission cables.	Presence of cables resulting in presence of electromagnetic fields.	No	Yes	No	Yes
Changes in prey availability.	As outlined above	Yes	Yes	Yes	Yes

142 The current advice from JNCC regarding the principles document for an HRA relating to the WNMP, in particular policies relating to Tidal Lagoons (dated 25th August 2017) indicates that JNCC consider the following potential impacts as a key consideration for marine mammals in the HRA:

- *Disturbance is a key consideration for marine mammals under HRA. A standard conservation objective for Natura 2000 sites with such species as qualifying features is to avoid, in the SAC, disturbance of these species. For example, disturbance has resulted in harbour porpoise density being significantly reduced for several km away from seismic surveys and impact pile driving. Subsequently, when considering which sites to scope into the assessment, JNCC currently advise a buffer around the site of 50km for pile driving and a minimum of 15km for seismic surveys.*
- *Collision is another key consideration and should be assessed not only in relation to the conservation objectives of the site, but also in relation to the strict protection measures of Article 12. Whereas an EPS licence can be applied for to cover the risk of mortalities and injuries, this should be a last resort and only if the activity meets three tests, including that there will not be an effect on Favourable Conservation Status of the species. In addition, if a tidal turbine with the potential for collisions is situated in an area where a persistent high density of harbour porpoise occurs such, as in protected areas, then it is possible it could act a localised population 'sink', where continued immigration into the area together with injury/mortality from the turbines could result in high numbers of fatalities which could contribute to population level consequences.*
- *Potential impact pathways may also arise from activities that could affect the site in relation to conservation objective relating to the condition of supporting habitats and processes, and the availability of prey is maintained.*

3.2.2 Proximity of source to feature (i.e. SAC or cSAC), potential pathway and impact on receptors

143 For marine mammals, the approach to HRA screening primarily focuses on the potential for connectivity between individual marine mammals from European Designated Sites and the potential impacts associated with Tidal Lagoons (**Section 3.2.1**) in the SRAs (i.e. demonstration of a clear source-pathway-receptor relationship). This is based on the distance of the SRAs from the European Designated Sites, the potential range of each effect and the potential for animals from a European Designated Site to be within range of an effect.

144 Therefore the 46 European Designated Sites initially screened in (**Table A1.1**: Initial pre-supplied list of designates sites for harbour porpoise, bottlenose dolphin, grey seal and otter screened in at the pre-screened stage (list supplied by the Welsh Government, 10th August 2017)) were assessed further based on:

- The distance between the potential impact ranges (**Table 3**) and a European Designated Site with a marine mammal interest feature is within the range for which there could be an interaction e.g. the pathway is not too long for significant noise propagation.

- The distance between the resources on which the interest feature depends (i.e. an indirect effect acting though prey or access to habitat; **Table 3**) is within the range for which there could be an interaction i.e. the pathway is not too long.
- The likelihood that a foraging area or a migratory route occurs within the potential impact range (applies to mobile interest features when outside the SAC).

3.2.2.1 Potential Impact Ranges

145 **Table 3** presents the estimated maximum potential impact ranges of Tidal Lagoons on marine mammals and their prey species, based on currently available information.

Table 3: Potential impact ranges of Tidal Lagoons on marine mammals and their prey species

Potential Impact	Possible range of impact	Based on worst-case scenario
Direct habitat loss	Within SRAs	The direct loss of habitat also results in the direct loss of foraging habitat as a result of the presence of the Tidal Lagoon. Direct foot print of Tidal Lagoons
Changes in habitat extent, type or quality as a result of alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition), including any changes to water levels.	Up to 50km from SRAs	Tidal stream modelling for the Bristol Channel – see **Section 3.1** The Severn Tidal Barrage Feasibility Study modelled and predicted impacts of Tidal Lagoons on the hydrodynamic changes – see text below.
Changes in water quality (including salinity, dissolved oxygen, suspended sediments and contaminants, regulated and accidental discharges)	Up to 50km from SRAs	Plume studies and the mobilisation of sediments for Severn Estuary – see **Section 3.1** Swansea Tidal Lagoon ES - see text below
Underwater noise	Up to 50km from SRAs	JNCC advice regarding the principles document for an HRA relating to the WNMP, in particular policies relating to Tidal Lagoons (dated 25th August 2017).
Airborne noise	Within SRAs	Restricted to Tidal Lagoon development areas – see text below
Visual disturbance	Within SRAs	Restricted to Tidal Lagoon development areas – see text below
Collision risk	Within SRAs	Vessels on site during construction and operation – see text below. Tidal Lagoon infrastructure. Restricted to Tidal Lagoon development areas, although implication for MMMU.
Barrier effects to movement and habitat fragmentation	Within SRAs	The potential for barrier to movements and habitat fragmentation is from the presence of the lagoon wall. Therefore this will impact marine mammals within the SRA only. Restricted to Tidal Lagoon development areas, although implication for MMMU.
Introduction or spread of non-native species.	Within SRAs	Introduced Non-Native Species (INNS) could occur at the site due to presence on the hull

Potential Impact	Possible range of impact	Based on worst-case scenario
		of vessels and through the introduction of materials to the site (Tidal Lagoon Swansea Bay, 2014b). Therefore, INNS are only a risk to marine mammals and prey within the project area. Restricted to Tidal Lagoon development areas.
Electromagnetic fields from power transmission cables.	Within SRAs	EMF arise from the presence of power cables used for transmitting power. The strength of the EMF decreases rapidly with distance from the cable. Therefore, the impact of exposure to EMF is only a potential within the project area (Tidal Lagoon Swansea Bay, 2014b). Restricted to Tidal Lagoon development areas.
Changes in prey availability.	Up to 50km from SRAs	Possible ranges for noise, changes in habitat and /or water quality – as outlined above, although implication for MMMU.

Changes in habitat extent, type or quality

146 The Severn Tidal Barrage Feasibility Study modelled and predicted impacts of Tidal Lagoons on the hydrodynamic changes due to the construction and operation of a tidal barrage (DECC, 2010). Within the lagoon, the mean spring tidal range could be reduced by 6.3m, outside the lagoon it could decrease by 0.1-0.2m from Cardiff (13km) to Sharpness (42km upstream), and at Minehead (48km) increase by 0.1m. The lagoon could reduce peak flow speeds by 20-40% within the lagoon and 10-20% elsewhere in the estuary. There could be increases and decreases in wave heights of 20% within the impounded area, and 10-20% reductions in the wider estuary (DECC, 2010). A reduction in the sediment fluxes of the Bristol Channel was expected (35km from the tidal barrage location) with increases in the regions directly around the turbines and sluices (DECC, 2010).

Changes in water quality

147 The Swansea Tidal Lagoon Environmental Statement predicted that the sediment plume resulting from the dredging activities during construction modelled to disperse approximately 4km. at this distance from the sediment disturbance, SSC are less than 10mg/L above baseline (Tidal Lagoon Swansea Bay, 2014).

Underwater noise

148 For underwater noise impacts upon European Designated Sites themselves (or individual animals associated within them), it is considered that for piling (which is the greatest of the potential noise sources) the potential range of disturbance impact is up to 50km from the source of noise. Based on the current JNCC advice regarding the principles document for an HRA relating to the WNMP, in particular policies relating to Tidal Lagoons (dated 25th August 2017). Therefore there is no potential for any direct impact on the European Designated Sites located outwith the 50km range

of the SRA, however, taking into account the movements and foraging ranges of marine mammals (see **Section 3.2.2.2** below), animals from the European Designated Sites could be within this range and potentially disturbed.

149 For the Swansea Tidal Lagoon Project, percussive piling of the lagoon wall was found to lead to no Permanent Threshold Shift (PTS, e.g. auditory injury) impacts on marine mammals and Temporary Threshold Shift (TTS, e.g. temporary loss in hearing sensitivity) was found to impact on seals up to a couple of metres only. Strong behavioural response was found for harbour porpoise up to 445m for percussive piling and 22m for vibro-piling. For seals, strong behavioural responses were modelled at 25m and a couple of metres for percussive and vibro-piling, respectively (Tidal Lagoon Swansea Bay, 2014).

150 Studies into the nose associated with the operation of a tidal turbine found that they release a noise at 157.6dB re 1 µPa-1m. The results showed that if the most sensitive marine mammal were to spend 30 minutes within 16m of the turbine during operation it would be at risk of PTS, however, a marine mammal remaining within that distance of a noise source for that length of time is highly unlikely. If the most sensitive marine mammal remained within 934m of the turbine in operation for a period of 8 hours it would be at risk of TTS. Again, a marine mammal remaining within this distance of a noise source for that length of time is extremely unlikely (Tidal Lagoon Swansea Bay, 2014).

Airborne noise

151 The potential impact range for any airborne noise will vary depending on the type of activity and location. However, noise in air does not travel as far as noise underwater and would therefore be expected to limited to the vicinity of the construction area and therefore within the SRA.

Visual disturbance

152 Marine mammals and otters can be impacted from changes to visual components of the environment. For harbour porpoise, it is more likely that they will react to acoustic disturbance before visual. For example, they will avoid vessels due to the increase in noise before they are close enough for any visual impact (NERI, 2006).

153 Pinnipeds can be sensitive to changes in visual stimuli and disturbances (Hoover-Miller *et al*., 2013). Vessels at more than 1.5km from a seal haul-out site are unlikely to cause disturbance reactions, however between 900m and 1,500m seals will be able to detect the vessel and less than 900m can be expected to exhibit flight behaviours (Scottish Executive, 2007). This is however dependent a number of factors such as age, weather conditions and habituation to the source.

154 Otter can be disturbed up to 30m around resting places and up to 200m around breeding sites (e.g. SBC, 2017).

Vessels

155 Increased vessel activity will occur in the SRAs within the Tidal Lagoon development area and routes to local ports in the SRA. Beyond this, any vessel activity will be dispersed and become part of the background vessel traffic, using already established vessel routes. In addition, the number of vessels for each development is likely to be relatively small in relation to current vessel

movements, and would therefore not contribute to any significant increase in collision risk or disturbance.

3.2.2.2 Potential pathways

156 In addition to the potential direct and indirect impact ranges, as outlined above, it is important to take into account the likelihood that a foraging area or a migratory route occurs within the potential impact range when mobile interest features are beyond the boundaries of the SAC or cSAC.

Harbour porpoise

157 Harbour porpoise are highly mobile (see **Section 2.1.4**). However, as outlined in **Section 2.1.3**, harbour porpoise have relatively high daily energy demands and it has been estimated that they can only rely on stored energy (primarily blubber) for three to five days, depending on body condition (Kastelein *et al.*, 1997). Therefore, based on a swimming speed of approximately 1.5m/s, it is estimated that harbour porpoise could cover a distance of approximately 400km in three days.

158 It is highly unlikely that harbour porpoise from European Designated Sites located 400km or more from the potential impact ranges of the SRAs are dependent on the area. Although harbour porpoise from European Designated Sites more than 400km away could have foraging ranges that overlap the potential impact ranges, any potential indirect effects on prey as a result of the Project are highly unlikely to have a significant impact on harbour porpoise from that European Designated Site.

159 Therefore as a very precautionary approach all European Designated Sites for harbour porpoise within 400km of the SRAs, have been considered for the potential of a LSE to arise and further assessment in the HRA was required.

160 For European Designated Sites for harbour porpoise located more the 400km from the SRAs, it was determined that the potential did not exist for a LSE to arise and further assessment was not required.

161 It should be noted that as there is no discrete population of harbour porpoise associated with European Designated Sites due to their wide ranging nature within the Celtic and Irish Seas MU, it can be assumed that at any one time, harbour porpoise foraging in this area are associated with the nearest cSAC to the SRA. Therefore connectivity with animals from other designated sites foraging within the potential impact range can be screened out.

Bottlenose dolphin

162 Bottlenose dolphin form more discreet resident coastal populations and based on toxicology, diet (e.g. Borell *et al.*, 2005) and genetics (e.g. Natoli *et al.*, 2005), they exhibit a regional subpopulation structure (JNCC, 2013). This is often driven by preferences for certain habitat characteristics such as seabed topography, salinity and water temperature (Natoli *et al.*, 2005). In many inshore areas, bottlenose dolphins maintain definable, long-term multi-generational home ranges (JNCC, 2013).

163 The results of genetic analyses (Parsons *et al.*, 2002, Thompson *et al.*, 2011) show some but not complete isolation between animals found on the east and west coasts and elsewhere in Britain and Ireland (JNCC, 2013).

164 For bottlenose dolphin from the Cardigan Bay SAC, the waters around the Isle of Man appear to be the northernmost range limit of this population (Pesante *et al.*, 2008b). Photo ID catalogues from Ireland, Hebrides, Moray Firth, Cornwall or the English Channel have yielded no matches with the SWF Photo ID catalogue, showing no evidence of exchange outside of the Irish Sea (Pesante *et al.*, 2008b).

165 Taking this into account all European Designated Sites for bottlenose dolphin within the Irish Sea MU, have been considered for the potential of a LSE to arise and further assessment in the HRA was required.

166 As there is currently no evidence for bottlenose dolphin from European Designated Sites outwith the Irish MU to be present in the Irish Sea, it was determined that the potential did not exist for a LSE to arise and further assessment was not required.

Grey seal

167 Grey seals forage in the open sea and they may range widely to forage and frequently travel over 100km between haul-out sites (SCOS, 2016). Foraging trips can last anywhere between one and 30 days. Tracking of individual grey seals has shown that most foraging probably occurs within 100km of a haul-out site, although they can feed up to several hundred kilometres offshore (SCOS, 2016).

168 Telemetry data show much individual variability in the movement patterns of grey seals (McConnell, 1999; Matthiopoulos *et al.*, 2004), with some animals ranging widely and spending time in a variety of locations; while others remain in one limited area for most of the time they were tagged.

169 Grey seals from telemetry studies off western Scotland and off northern France indicate that the tagged grey seals from these areas did not enter the Irish Sea (Matthiopoulos *et al.*, 2004). Tagging data of grey seals from haul-out sites in Liverpool Bay, Wales and southeast Ireland, indicates that most movement from these sites was contained within the Irish Sea (Hammond *et al.*, 2005).

170 SCOS (2014) described telemetry studies that have been undertaken by tagging grey seals at five SACs across the UK (Pembrokeshire Marine, Llyn Peninsula and the Sarnau, Monach Islands, Isle of May, and Berwickshire and North Northumberland Coast). The results indicate that grey seal travel between Pembrokeshire Marine SAC, Llyn Peninsula and the Sarnau SAC and the Saltee SAC (Ireland).

171 Data from tagging studies in the Irish Sea were examined in order to describe the extent of 'forging trips' of grey seals in the Irish Sea (SCOS, 2014; see **Section 2.3.4**). The telemetry data included in this study were from adult grey seals tagged at Ramsey (n=7), Bardsey (n=4), and Hilbre island (n=7) in 2004 and from pups tagged at Anglesey in 2009 and 2010 (n= 3 and 5), Bardsey in 2009 (n=2) and Ramsey in 2010 (n=7). The greatest distance travelled by one pup was 435.8km and the greatest distance travelled by one adult was 172.6 km. The tag data

showed that seals often move between haul out locations, in particular between the Llyn Peninsula, Cardigan Bay and haul out locations around the Isle of Anglesey.

172 Based on the foraging ranges for grey seal and the assessment of the telemetry data in and around the Irish Sea, it was determined that there was potentially connectivity for any European Designated Site for grey seal up to 200km of the potential impact ranges.

173 Therefore, for all European Designated Sites for grey seal within 250km of the SRAs, there could be the potential for a LSE to arise and further assessment was required.

174 For any European Designated sites for grey seal located more the 250km from the defined SRAs, it was determined that the potential did not exist for a LSE to arise and further assessment was not required.

Harbour seal

175 The initial pre-screening for harbour seal did not include any European Designated Sites for harbour seal (see **Section 3.1**).

176 Harbour seal exhibit relatively short foraging trips from their haul out sites (see **Section 2.4.4**). The range of these trips varies depending on the location and surrounding marine habitat. For example, 25km on the west of Scotland (Cunningham *et al*., 2009) and 30km-45km in the Moray Firth (Thompson *et a*l., 1996). Although, data from telemetry studies in The Wash (2003- 2005) suggest that harbour seal travel further, and repeatedly forage between 75km and 120km offshore, with one seal travelling 220km (Sharples *et al*., 2008).

177 Information on harbour seal at-sea movements and habitat use in southwest Ireland suggests a limited range, generally staying within 20km of their haul-out site (Cronin *et al*., 2008). Although occasional longer trips do occur, these are often associated with young animals dispersing from sites, and are not, therefore, considered to indicate repeated connectivity between European Designated Sites and the SRAs.

178 There is limited telemetry data in and around the Irish Sea for harbour seal. Therefore, based on the average foraging ranges for harbour seal of approximately 50km, it was determined that there was no potential connectivity for any European Designated Sites for harbour seal.

Otter

179 For otter, the maximum home range on land can be up to 40km (Green *et al*., 1984; Roche *et al*., 1995). However, coastal otters have much smaller home ranges, and will only hunt as far as 100m offshore in waters less than 10m deep, although will generally stay in much shallower areas close to the shore, in less than 3m depth (CCW, 2009). Therefore, terrestrial otter sites will be screened in for assessment up to 40km from the coast of the identified SRAs, and coastal sites within the identified ZOI of 50km due to the limited movement offshore. Additionally, any sites which require otter to move more than 100m offshore to cross water-ways were screened out on the basis that otter do not travel that far in the offshore marine environment.

3.3 Results of screening

180 Taking into account the potential impacts and ranges of these impacts as well as the potential for a clear source-pathway-receptor relationship, the following European Designated Sites have been screened into the HRA:

- Harbour porpoise (10 European Designated Sites; **Figure 3**)
  - Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC
  - North Anglesey Marine / Gogledd Mon Forol cSAC
  - North Channel cSAC
  - West Wales Marine / Gorllewin Cymru Forol cSAC
  - Roaringwater Bay and Islands SAC
  - Rockabill to Dalkey Island SAC
  - Abers - Cotes des Legendes SAC
  - Baie de Morlaix SAC
  - Cote de Granit rose-Sept-Iles SAC
  - Ouessant-Molene SAC
- Bottlenose dolphin (2 European Designated Sites; **Figure 4**)
  - Cardigan Bay/ Bae Ceredigion SAC
  - Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC
- Grey seal (5 European Designated Sites; **Figure 5**)
  - Cardigan Bay/ Bae Ceredigion SAC
  - Isles of Scilly Complex SAC
  - Lundy SAC
  - Pembrokeshire Marine/ Sir Benfro Forol SAC
  - Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC
- Otter (6 European Designated Sites; **Figure 6**)
  - Afon Gwyrfai a Llyn Cwellyn SAC
  - Afon Tywi/ River Tywi SAC
  - Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC
  - River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC
  - River Usk/ Afon Wysg SAC
  - River Wye/ Afon Gwy SAC

181 **Table 4** presents the results of the screening with justification for European Designated Sites screened in or screened out from further assessment.

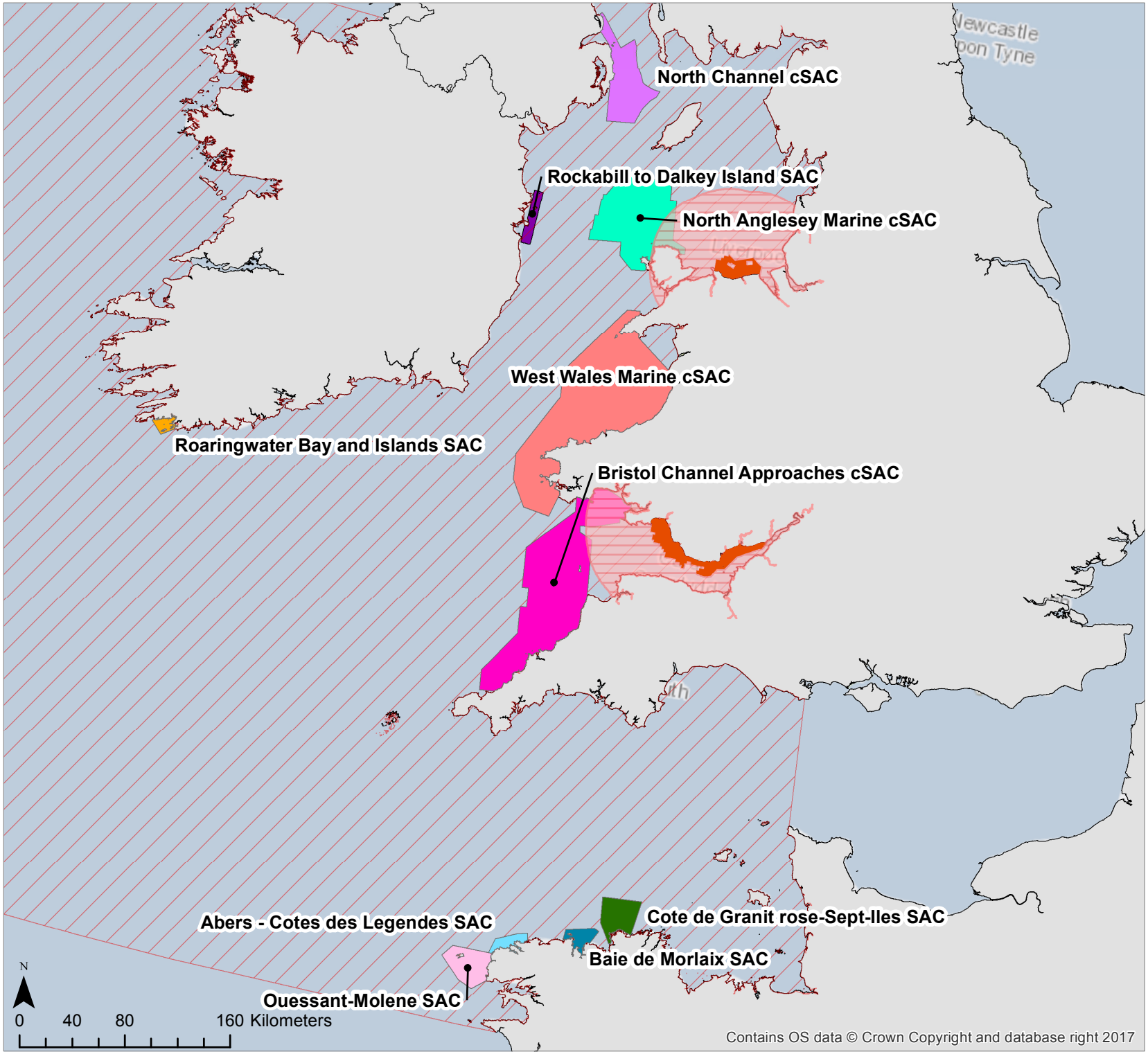
182 **Table A1.2**: Site descriptions, Conservation Objectives and Vulnerabilities for all sites provides for more information on the European Designated Sites screened in, including site descriptions, their Conservation Objectives and identified Vulnerabilities.

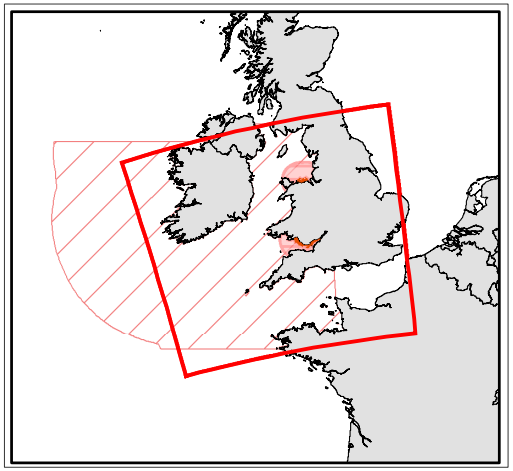
Table 4: Results of the HRA screening

Site Name	Receptor	Closest Distance to SRA	Reason Included in Pre-screening	Screened in or out for further assessment	Reasoning
Abers - Cotes des Legendes SAC (FR5300017)	Bottlenose dolphin 1349	381.65km	Within 50km of MMMU	Screened out	Outwith Irish Sea (IS) MU
	Harbour porpoise 1351		Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
Afon Gwyrfai a Llyn Cwellyn SAC (UK0030046)	Otter 1355	35.75km	Within 50km below MHWS	**Screened in**	Within 40km on land of identified SRAs
Afon Tywi/ River Tywi SAC (UK0013010)	Otter 1355	South terrestrial (29.13km)	Within 50km below MHWS	**Screened in**	Within 40km on land of identified SRAs
Anse de Vauville SAC (FR2502019)	Bottlenose dolphin 1349	486.81km	Within 50km of MMMU	Screened out	Outwith IS MU
Baie de Lancieux, Baie de l'Arguenon, Archipel de Saint Malo et Dinard SAC (FR5300012)	Bottlenose dolphin 1349	492.57km	Within 50km of MMMU	Screened out	Outwith IS MU
Baie de Morlaix SAC (FR5300015)	Harbour porpoise 1351	399.02km	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
Baie de Seine occidentale SAC (FR2502020)	Bottlenose dolphin 1349	561.66km	Within 50km of MMMU	Screened out	Outwith IS MU
Baie de Seine orientale SAC (FR2502021)	Bottlenose dolphin 1349	619.57km	Within 50km of MMMU	Screened out	Outwith IS MU
Baie du Mont Saint-Michel SAC (FR2500077)	Bottlenose dolphin 1349	533.77km	Within 50km of MMMU	Screened out	Outwith IS MU
Banc et Recifs de Surtainville (FR2502018)	Bottlenose dolphin 1349	488.53km	Within 50km of MMMU	Screened out	Outwith IS MU
Blasket Islands SAC (IE0002172)	Harbour porpoise 1351	496.02km	Within 50km of MMMU	Screened out	Outwith 400km range of SRAs
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC (UK0030396)	Harbour porpoise 1351	25.3km	Within 50km of MMMU	**Screened in**	Within 50km range of SRA
Cap d'Erquy-Cap Frehel SAC (FR5300011)	Bottlenose dolphin 1349	484.45km	Within 50km of MMMU	Screened out	Outwith IS MU
	Harbour porpoise 1351		Within 50km of MMMU	Screened out	Outwith 400km range of SRAs
Cardigan Bay/ Bae Ceredigion SAC (UK0012712)	Bottlenose dolphin 1349	149.28km	Within 50km of MMMU	**Screened in**	Within IS MU
	Grey seal 1364		Within 50km of MMMU	**Screened in**	Within 250km range of SRAs

Site Name	Receptor	Closest Distance to SRA	Reason Included in Pre-screening	Screened in or out for further assessment	Reasoning
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC (UK0020020)	Otter 1355	7.32km	Within 50 km below MHWS	**Screened in**	Within 40km on land of identified SRAs Within 50km of marine SRAs
Chausey SAC (FR2500079)	Bottlenose dolphin 1349	510.97km	Within 50km of MMMU	Screened out	Outwith IS MU
Chaussée de Sein SAC (FR5302007)	Bottlenose dolphin 1349	434.02km	Within 50km of MMMU	Screened out	Outwith IS MU
	Harbour porpoise 1351		Within 50km of MMMU	Screened out	Outwith 400km range of SRAs
Côte de Cancale á Parame (FR5300052)	Bottlenose dolphin 1349	520.85km	Within 50km of MMMU	Screened out	Outwith IS MU
Cote de Granit rose-Sept-Iles (FR5300009)	Bottlenose dolphin 1349	395.78km	Within 50km of MMMU	Screened out	Outwith IS MU
	Harbour porpoise 1351		Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
Exmoor and Quantock Oakwoods SAC (UK0030148)	Otter 1355	13.31km	5km site buffer within 50km SRA buffer	Screened out	Interaction with this site and the SRA requires travel directly across the Bristol Channel, therefore has been screened out due to otter not travelling more than 100m offshore.
Isles of Scilly Complex SAC (UK0013694)	Grey seal 1364	233.60km	Within 50km of MMMU	**Screened in**	Within 250km range of SRAs
Lundy SAC (UK0013114)	Grey seal 1364	South (60.78km) North (295.23km)	Within 50km of MMMU	**Screened in**	Within 250km range of SRAs
North Anglesey Marine / Gogledd Mon Forol cSAC (UK0030398)	Harbour porpoise 1351	North (30.54km) South (278.07km)	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
North Channel cSAC (UK0030399)	Harbour porpoise 1351	North (130.00km) South (372.32km)	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
Ouessant-Molene SAC (FR5300018)	Harbour porpoise 1351	382.33km	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
	Bottlenose dolphin 1349		Within 50km of MMMU	Screened out	Outwith IS MU
Pembrokeshire Bat Sites and	Otter 1355	68.23km	5km site buffer	Screened out	Outside of identified otter

Site Name	Receptor	Closest Distance to SRA	Reason Included in Pre-screening	Screened in or out for further assessment	Reasoning
Bosherston Lakes/Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC (UK0014793)			within 50km SRA buffer		home range from SRA. See **paragraph 108** for more information.
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	Grey seal 1364	South (58.76km) North (202.25km)	Within 50km of MMMU	**Screened in**	Within 250km range of SRAs
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC (UK0013117)	Bottlenose dolphin 1349	44.96km	Within 50km of MMMU	**Screened in**	Within IS MU
	Grey seal 1364		Within 50km of MMMU	**Screened in**	Within 250km range of SRAs
	Otter 1355		Within 50 km below MHWS	Screened out	Outside of identified otter home range from SRA.
Recifs et landes de la Hague SAC (FR2500084)	Bottlenose dolphin 1349	482.46km	Within 50km of MMMU	Screened out	Outwith IS MU
Recifs et marais arriere-littoraux du Cap Levi á la Pointe de Saire SAC (FR2500085)	Bottlenose dolphin 1349	521.42km	Within 50km of MMMU	Screened out	Outwith IS MU
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC (UK0030252)	Otter 1355	25.4km	Within 50 km below MHWS	**Screened in**	Within 40km on land of identified SRAs
River Usk/ Afon Wysg SAC (UK0013007)	Otter 1355	0km	Within 2km inland	**Screened in**	Within 40km on land of identified SRAs
River Wye/ Afon Gwy SAC (UK0012642)	Otter 1355	0km	Within 50 km below MHWS	**Screened in**	Within 40km on land of identified SRAs
Roaringwater Bay and Islands SAC (IE0000101)	Harbour porpoise 1351	384.48km	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
Rockabill to Dalkey Island SAC (IE0003000)	Harbour porpoise 1351	147.30km	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs
Tregor Goelo SAC (FR5300010)	Bottlenose dolphin 1349	415.49km	Within 50km of MMMU	Screened out	Outwith IS MU
	Harbour porpoise 1351		Within 50km of MMMU	**Screened out**	Outwith 400km range of SRAs
West Wales Marine / Gorllewin Cymru Forol cSAC (UK0030397)	Harbour porpoise 1351	69.04km	Within 50km of MMMU	**Screened in**	Within 400km range of SRAs





Legend

- Tidal Lagoon SRA
- Tidal Lagoon SRA 50km ZoI
- Harbour porpoise MU (CIS)
- Abers - Cotes des Legendes SAC
- Baie de Morlaix SAC
- Cote de Granit rose-Sept-Iles SAC
- Ouessant-Molene SAC
- Roaringwater Bay and Islands SAC
- Rockabill to Dalkey Island SAC
- Bristol Channel Approaches cSAC
- North Anglesey Marine cSAC
- North Channel cSAC
- West Wales Marine cSAC

Project

Welsh National Marine Plan: Tidal Lagoon policy marine mammal and otter HRA

Figure 3

Harbour porpoise SAC sites screened in for further assessment

Date	*Coordinate System*	*Scale*
25/09/2017	British National Grid	1:42113580

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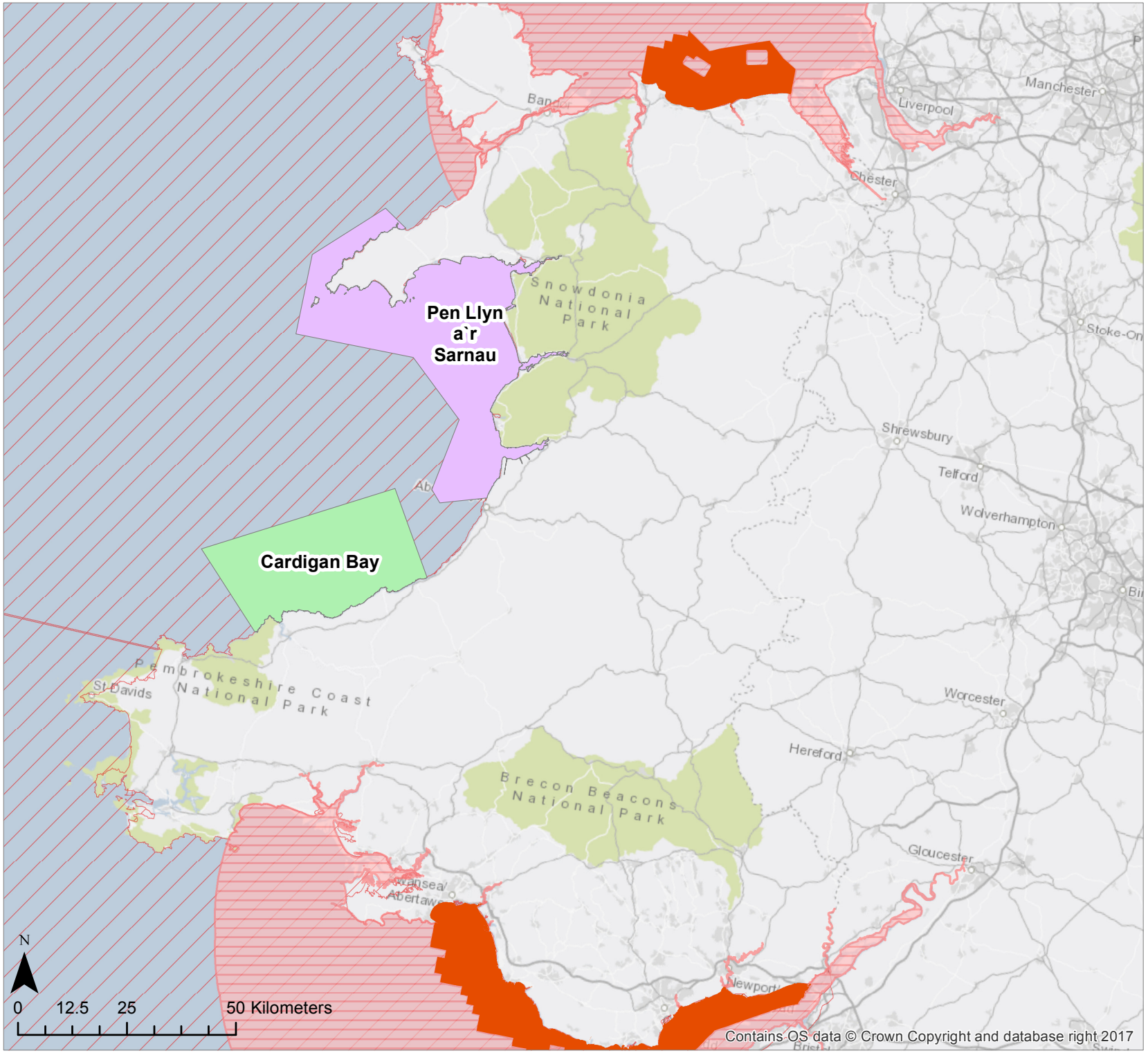

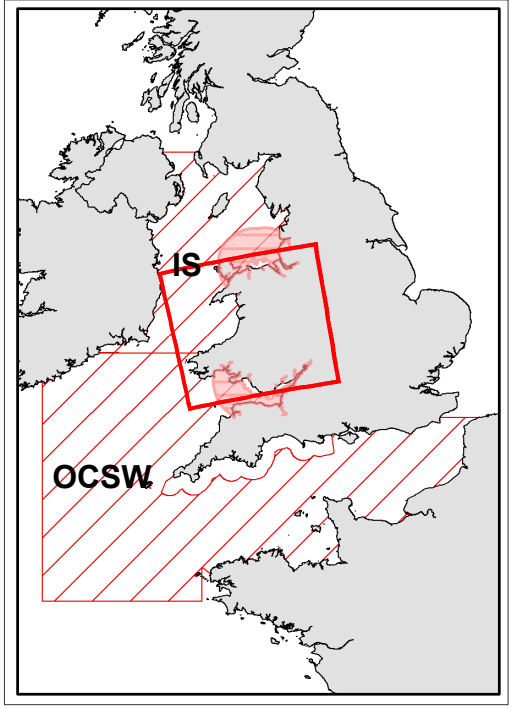

Legend

- Tidal Lagoon SRA
- Tidal Lagoon SRA 50km ZoI
- Bottlenose dolphin MU (IS & OCSW)
- Cardigan Bay
- Pen Llyn a`r Sarnau

Project

Welsh National Marine Plan: Tidal Lagoon policy marine mammal and otter HRA

Figure 4

Bottlenose dolphin SAC sites screened in for further assessment

Date	*Coordinate System*	*Scale*
07/09/2017	British National Grid	1:1200000

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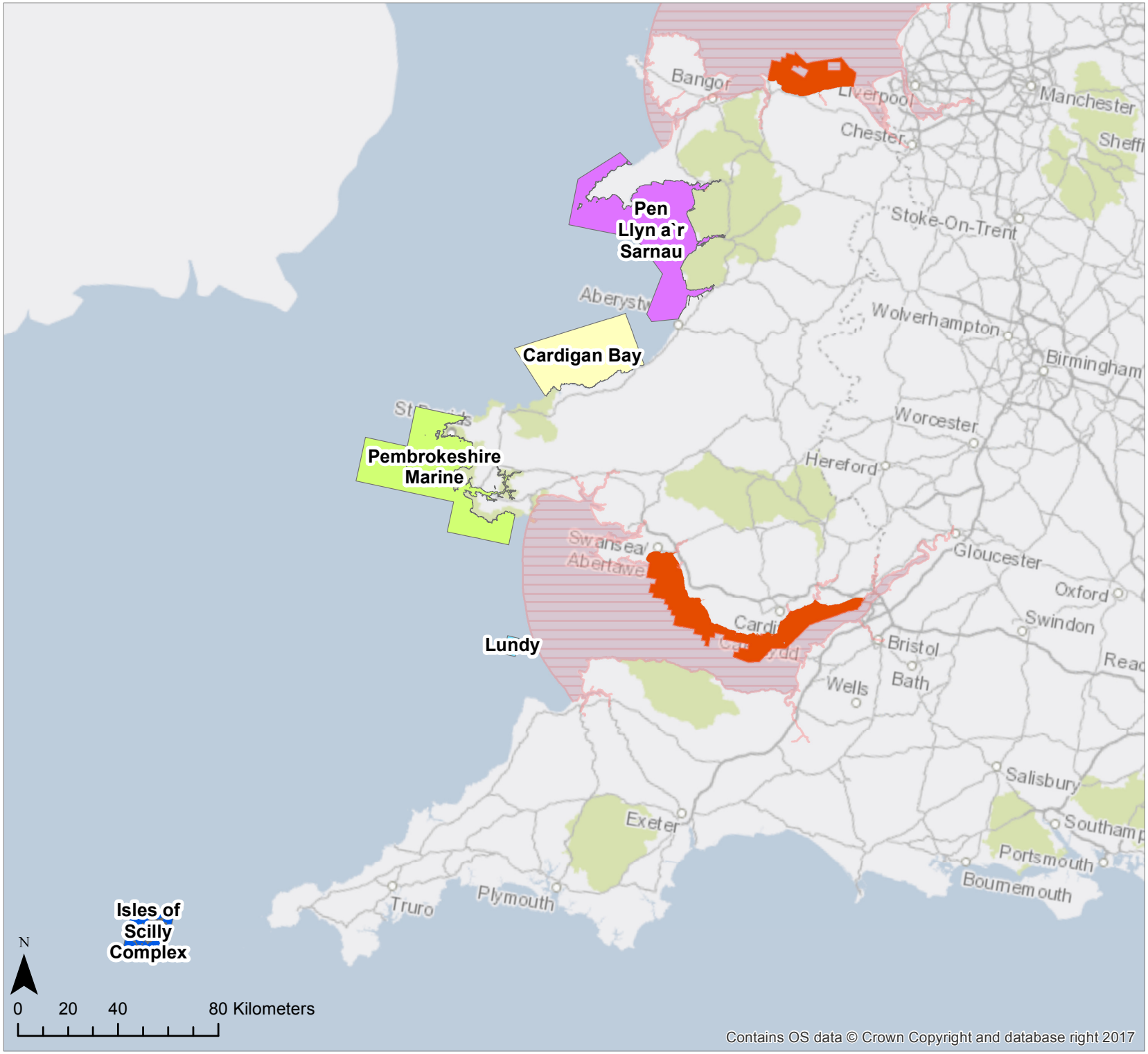

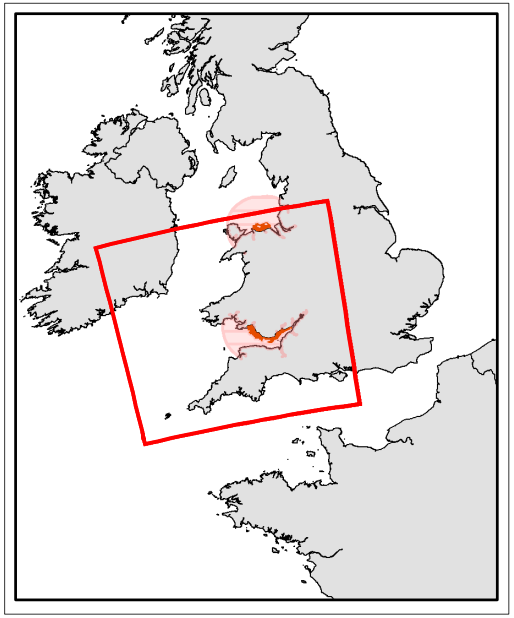

Legend

- Tidal Lagoon SRA
- Tidal Lagoon SRA 50km ZoI
- Cardigan Bay
- Isles of Scilly Complex
- Lundy
- Pembrokeshire Marine
- Pen Llyn a`r Sarnau

Project

Welsh National Marine Plan: Tidal Lagoon policy marine mammal and otter HRA

Figure 5

Grey seal SAC sites screened in for further assessment

Date	*Coordinate System*	*Scale*
07/09/2017	British National Grid	1:24718392

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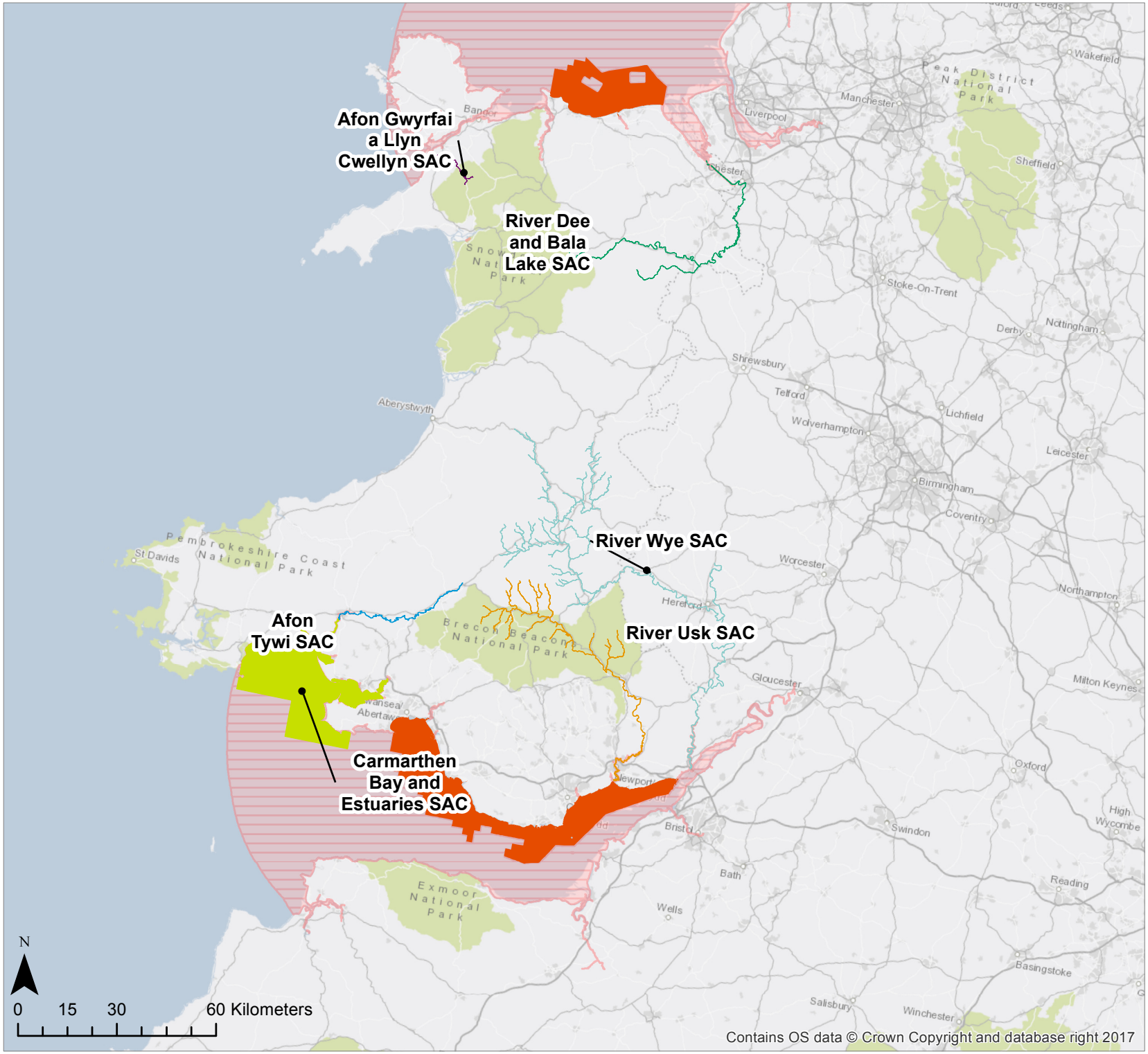

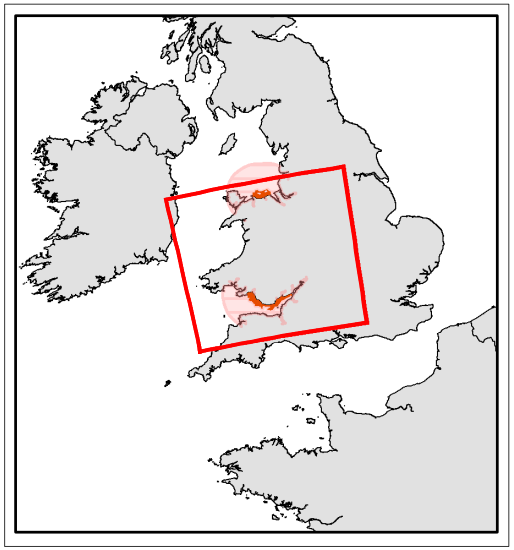

Legend

- Tidal Lagoon SRA
- Tidal Lagoon SRA 50km ZoI
- Afon Gwyrfai a Llyn Cwellyn SAC
- Afon Tywi SAC
- Carmarthen Bay and Estuaries SAC
- River Dee and Bala Lake SAC
- River Usk SAC
- River Wye SAC

Project

Welsh National Marine Plan: Tidal Lagoon policy marine mammal and otter HRA

Figure 6

Otter SAC sites screened in for further assessment

Date	*Coordinate System*	*Scale*
07/09/2017	British National Grid	1:24718392

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4 Assessment of potential for adverse effects on European Designated Sites

This section includes the plan-level assessment of the Tidal Lagoon Policy to determine any potential for LSE on the SACs and cSACs, where marine mammals are qualifying features that have been screened in, with respect to their Conservation Objectives. The assessment considers all aspects relating to the ecological requirements of marine mammals in or associated with European Designated Sites. The assessment also takes into account the potential to affect species that are qualifying interest features of SAC or cSAC, but which are present beyond the boundaries of the designation (e.g. marine mammals that rely on habitats beyond the designation for some part of their life cycle or ecological requirements, referred to a functionally-linked or supporting habitat to the designation).

183 This plan-level assessment of the Tidal Lagoon Policy determines any potential for LSE from the potential impacts identified in **Table 2** on the SACs and cSACs where marine mammals are qualifying features, which have been screened in for further assessment (**Section 3.3**), with respect to their Conservation Objectives. The assessment considers all aspects relating to the ecological requirements of marine mammals in or associated with European Designated Sites. The assessment also takes into account the potential to affect species that are qualifying interest features of SAC or cSAC, that are present beyond the boundaries of the designation (e.g. marine mammals that rely on habitats beyond the designation for some part of their life cycle or ecological requirements, referred to a functionally-linked or supporting habitat to the designation).

4.1 Direct habitat loss

184 There is the potential for a direct loss of habitat as a result of the construction, presence and removal of marine project infrastructure, such as the breakwater and cables including rock armouring, dredging activity and the disposal of material, which could have a potential effect on marine mammals and their prey species. The extent of any habitat loss will be dependent on the project size; however, any impacts would be direct and restricted to the foot print of Tidal Lagoons.

185 Therefore there could be the potential for adverse effects on the integrity of European Designated Sites that are located within or overlap with the marine area SRAs.

186 There are currently no European Designated Sites where marine mammals, including otters are a qualifying feature, that are located within or overlap with the marine area SRAs (**Table 4**; **Figure 3**, **Figure 4**, **Figure 5**, **Figure 6**).

187 There is also no potential for any significant effects on species that are qualifying interest features of an SAC or cSAC, that are present beyond the boundaries of the designation. The area of the Tidal Lagoons, for example, 11.5km^2 for the Swansea

Bay Tidal Lagoon and 70km^2 for the Cardiff Tidal Lagoon, is relatively small in relation to the potential range and available habitat for marine mammals and their prey. Also, taking into account the distance between the SACS and cSACs in relation to SRAs, it is highly unlikely that the loss of habitat could significantly affect marine mammals or the availability of their prey.

188 It is therefore concluded that any potential effects associated with any direct loss of habitat would not result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter (**Table 5**).

Table 5: Results of assessment of potential effects of any direct habitat loss on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Direct habitat loss	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	×	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	×	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	×	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC	×	×

Site Name and Receptor	Direct habitat loss	
	Project level assessment	Plan level assessment
- otter		
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives

4.2 Changes in habitat extent, type or quality

189 Changes in habitat extent, type or quality could occur as a result of alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition), including any changes to water levels. The impacts would not have a significant direct impact on designated sites for marine mammals, but could potentially result in changes to sandbanks that are used as seal haul-out sites and have an indirect impact if there are any changes to prey availability as a result of these impacts (**Table 2**).

190 Assessment of currently available information and modelling for Tidal Lagoons (**Section 3.2.2.1**) and the HRA for Fish and Supporting Environments (ABPmer, 2017), indicates that the potential impact range could be up to 50km (**Table 3**).

191 Therefore there could be the potential for adverse effects on the integrity of European Designated Sites that are located within or overlap with the marine area SRAs and 50km area surrounding the marine area of the SRAs.

192 Three of the European Designated Sites that were screened in (***Table 4***), are located within or overlap with the 50km area surrounding the marine area of the SRAs:

- Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise. Approximately 12% of this cSAC overlaps with the 50km area surrounding the marine area of the southern SRA (**Figure 3**).
- North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise. Approximately 11% of this cSAC overlaps with the 50km area surrounding the marine area of the northern SRA (**Figure 3**).
- Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter is located within the 50km area surrounding the marine area of the southern SRA (**Figure 6**).

193 The potential for any significant effects on harbour porpoise that are qualifying interest features of other SAC or cSAC, that are present beyond the boundaries of the designation are unlikely. The area of the Tidal Lagoons with potential 50km impact area would be relatively small in relation to the potential range and available habitat for harbour porpoise and their prey. For example, the northern SRA with

50km buffer (5,500km^2) is approximately 1% of the harbour porpoise CIS MU (approximate area of 519,893km^2). However, for bottlenose dolphin, the northern SRA with 50km buffer (5,500km^2) is approximately 11% of the IS MU (approximate area of 50,145km^2).

194 There could be the potential for effects on the West Hoyle or other sandbanks along the North Wales coast that seals use as haul-out sites. For example, changes in water levels or flow patterns, depending on the extent, could alter the exposure of intertidal / subtidal habitats. The presence of Tidal Lagoon structures has the potential to cause scour effects in soft sediments. The magnitude of the scour effects will depend on the size of the structures, composition of the seabed, hydrodynamic conditions and distance from the feature habitats. Hydrodynamic changes, within an estuary, coastal region or around a Tidal Lagoon development, could lead to changes in patterns erosion, extent or formation of sandbanks.

195 As outlined in **Sections 2.3.2** and **2.4.2**, sandbanks, such as the West Hoyle Sandbank in the Dee Estuary, are important seal haul-out sites. The western side of the West Hoyle Sandbank is located within the northern SRA and the eastern edge is approximately 4km from the northern SRA. Although not a European Designated Site, the West Hoyle Sandbank and other sandbanks are probably 'functionally linked' to nearby grey seal designated sites. Therefore, sandbanks are potential supporting habitats that could be important for the population, as breeding, moulting, haul-out sites, although located outside SAC boundaries.

196 Therefore there could be the potential for direct and indirect effects associated with any 'changes to habitat' on European Designated Sites where marine mammals are a qualifying feature. However, when taking into account the potential for any alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition), including any changes to water levels to have a have a significant effect on marine mammals, supporting habitats and the availability of their prey over distances of up to 50km, along with possible mitigation measures (**Table 20**), the potential for any LSE is unlikely.

197 Therefore for the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter, as a result of any alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition), including any changes to water levels, especially when taking into account the natural variation across the range of marine mammals and their prey. However, it should be noted that further assessment would be required for each Tidal Lagoon project to determine any potential impacts, including supporting habitats, such as sandbanks, and prey availability (**Table 6**).

Table 6: Results of assessment of potential effects of any changes in habitat on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential changes in habitat

	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.3 Changes in water quality

198 Changes in water quality, including salinity, dissolved oxygen, increased suspended sediments and contaminants, regulated and accidental discharges, have the potential to have direct impacts on marine mammals and indirect impacts if there are any changes to prey availability as a result of these impacts (**Table 2**).

199 Assessment of currently available information and modelling for Tidal Lagoons (**Section 3.2.2.1**) and the HRA for Fish and Supporting Environments (ABPmer, 2017), indicates that the potential impact range could be up to 50km (**Table 3**).

200 Therefore there could be the potential for adverse effects on the integrity of European Designated Sites that are located within or overlap with the marine area SRAs and 50km area surrounding the marine area of the SRAs.

201 Three of the European Designated Sites that were screened in (***Table 4***), are located within or overlap with the 50km area surrounding the marine area of the SRAs:

- Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise. Approximately 12% of this cSAC overlaps with the 50km area surrounding the marine area of the southern SRA (**Figure 3**).
- North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise. Approximately 11% of this cSAC overlaps with the 50km area surrounding the marine area of the northern SRA (**Figure 3**).
- Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter is located within the 50km area surrounding the marine area of the southern SRA (**Figure 6**).

202 As outlined above, there could be the potential for direct and indirect effects associated with any 'changes to water quality' on European Designated Sites where marine mammals are a qualifying feature, based on a 50km potential impact range. However, when taking into account the potential for any significant changes to water quality with the embedded mitigation and best practice (**Table 20**) that would be in place at each project, the potential for the release of any contaminants, regulated and accidental discharges would be very small and highly unlikely (see **Section 4.3.3** below). The potential of any significant effects from increased suspended sediments is also highly unlikely (see **Section 4.3.1** below) and any changes in salinity or dissolved oxygen would be limited to the area in the immediate vicinity of the Tidal Lagoon area (see **Section 4.3.2** below). Therefore, the potential for any changes to water quality to have a have a significant effect on marine mammals and the availability of their prey over distances of up to 50km is highly unlikely.

203 Therefore for the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter, as a result of any changes in salinity or dissolved oxygen, increased suspended sediments and contaminants, or risk from regulated and accidental discharges. It should be noted that further assessment would be required for each Tidal Lagoon project (**Table 7**).

Table 7: Results of assessment of potential effects of any changes in water quality on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential changes in water quality	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.3.1 Increase in suspended sediment concentration and contaminant re-mobilisation

204 There is the potential for an increase in suspended sediment concentration and contaminant re-mobilisation during any disturbance of the seabed as a result of construction activities, cable laying, dredging and disposal.

205 Mobilisation of sediment may release sediment-bound contaminants into the water column with potential effects on marine mammals and their prey, will be dependent on the potential contaminant levels at the Tidal Lagoon development sites.

206 The marine environment for Tidal Lagoons is characterised by strong tidal flows and the receiving marine waters have a high capacity for mixing and dilution. Therefore, upon entering the marine environment suspended solids will be rapidly dispersed. Any dredging and construction activities would be temporary.

207 Marine mammals often inhabit turbid environments and many utilise sonar to sense the environment around them and there is little evidence that turbidity affects cetaceans directly (Todd *et al*., 2014). Pinnipeds are not known to produce sonar for prey detection purposes; however, it is likely that other senses are used instead of, or in combination with, vision. Studies have shown that vision is not essential to seal survival, or ability to forage (Todd *et al*., 2014). Similarly, otters also inhabit turbid environments and there is little evidence that turbidity affects their ability to forage.

208 Todd *et al*. (2014) concluded that the limited available information indicates that increased turbidity, for example as a result of dredging, is unlikely to have a substantial direct impact on marine mammals that often inhabit naturally turbid or dark environments. This is likely because other senses are utilised, and vision is not relied upon solely.

209 Dredging and other activities that disturb the sediments can release contaminants into the water column, which has the potential to change chemical properties of the sediment, and reduce water quality for some time after dredging has ceased. Contaminants can become available to marine organisms and potentially bioaccumulate up the food chain (Todd *et al*., 2014).

210 Marine mammals are susceptible to bioaccumulation because they feed at high trophic levels, and have a large proportion of lipid-rich blubber which accumulates contaminants readily (Vos *et al*., 2003). High contaminant levels have been linked to immune system depression, disease, reproductive effects, developmental effects and endocrine disruption (Murphy *et al*., 2015; Vos *et al*., 2003).

211 However, remobilisation and bioavailability of contaminants is site-specific, complex, and affected by a multitude of factors. Literature on the release of contaminants as a result of dredging and other activities that disturb the sea bed, suggests that as long as highly contaminated sediments are managed appropriately, concentrations should not be high enough to have detrimental effects on the environment (Roberts, 2012; Todd *et al*., 2014).

212 Due to the limited dispersion area, rapid dispersion and material being quickly deposited, any potential effects on marine mammals as a result of increased suspended sediments and contaminant re-mobilisation, along with possible mitigation measures (**Table 20**), are highly unlikely.

213 Juvenile and adult fish are mobile and will be able to avoid the localised areas disturbed by increased suspended sediments and sediment re-deposition. If displaced, it is anticipated that they would be able to move to adjacent, undisturbed areas within their habitat range. However, excessive suspended sediment either in suspension or deposited can have a range of effects on fish, from mortality to gill trauma and a reduction in reproductive success.

214 Bash *et al*. (2001) determined that the relationship between suspended sediment concentration and the effect on fish health was dependent on life stage, sediment composition and the availability of refuges. In addition, the level of exposure, duration and frequency of the effect (Servizi and Martens, 1992) and the tolerance threshold to suspended sediment concentration has an effect on growth feeding and mortality rates (Redding *et al*., 1987).

215 As a function of their migratory behaviour, diadromous species of fish would encounter and tolerate a range of environmental conditions as they pass through fresh, brackish and seawater during their life cycle. Mortality is seldom recorded in migratory species as a result of increased suspended sediment concentration, although a range of sub-lethal effects can be seen, such as clogging of gills, increased deformities, fin erosion and lesions and 'coughing' behaviour (Servizi and Martens, 1992). Turbid water can also reduce feeding rates in salmonids which are visual feeders (Berg, 1982).

216 A review of critical thresholds by Berry *et al*. (2003) reported ranges of 4-330,000mg/l for various fish species, but the severity of effect was directly related to associated stressors as defined above. Exposure time is a key parameter determining the physiological effects and the resultant barrier to migration (Newcombe and McDonald, 1991).

217 The potential effects on marine mammal prey species from suspended solids would be temporary and the area affected would be small in relation to the available habitat. In addition, as the maximum predicted impact area for any increased suspended sediments is the same for marine mammals and their prey, there will be no additional impacts on marine mammals as a result of the effects of any increased suspended sediments on prey species, as marine mammals and their prey would be displaced from the same area.

Table 8: Results of assessment of potential effects of any increase in suspended sediment concentration and contaminant re-mobilisation on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential increase in suspended sediment	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.3.2 Changes in salinity or dissolved oxygen

218 The marine environment for Tidal Lagoons is characterised by strong tidal flows and the receiving marine waters have a high capacity for mixing. Therefore, any changes in salinity, temperature or dissolved oxygen would most likely to restricted to the immediate vicinity of the Tidal Lagoon area.

219 Any changes to salinity or dissolved oxygen would not have a direct impact on marine mammals, as they are adapted to live in a range of marine and estuarine habitats.

220 Langford (1990) examined data from power plant studies around the world and found that there have been no direct mortalities as a result of power station outfalls. As fish are mobile species and can avoid sub-optimal habitat conditions, the main effects to consider are any changes in local distribution and reduction in feeding opportunities in areas affected.

221 It is therefore concluded that any potential effects associated with any changes to salinity or dissolved oxygen from Tidal Lagoons would not result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

4.3.3 Any regulated or accidental discharges

222 It is assumed that if there is the potential for any regulated or accidental discharges from Tidal Lagoons that could impact the marine environment, including marine mammals and their prey, that mitigation would be required for the project. Effective mitigation (**Table 20**) at the project level would therefore reduce the risk of any significant effects from regulated or accidental discharges from Tidal Lagoons on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

4.4 Underwater noise

223 The potential sources of underwater noise associated with Tidal Lagoons (**Table 2**) include:

- Construction of lagoon seawalls and other infrastructure (including percussive or vibro-pilling, cable laying and rock armour);
- Vessels;
- Dredging; and
- Operational turbines.

224 Underwater noise can have both physiological (e.g. lethal, physical injury and auditory injury) and behavioural (e.g. disturbance and masking of communication) effects on marine mammals and their prey species.

225 High peak pressure sound levels very close to the source have the potential to cause death or physical injury, with any severe injury potentially leading to death.

226 High exposure levels from underwater sound sources can cause auditory injury or hearing impairment, taking the form of a permanent loss of hearing sensitivity (PTS) or a temporary loss in hearing sensitivity (TTS).

227 Marine mammals may exhibit varying intensities of behavioural response at lower noise levels. These include orientation or attraction to a noise source, increased alertness, modification of characteristics of their own sounds, cessation of feeding or social interaction, alteration of movement / diving behaviour, temporary or permanent habitat abandonment, and in severe cases panic or stranding, sometimes resulting in injury or death. The response can vary due to exposure level, the hearing sensitivity of the individual, context, previous exposure history or habitation, motivation and ambient noise levels (e.g. Southall *et al*., 2007).

228 The potential impacts of underwater noise are dependent on the noise source characteristics, the receptor species, distance from the sound source and noise attenuation within the environment.

229 The potential impact of underwater noise will depend on a number of factors which include, but are not limited to:

- The source levels of noise;
- Frequency relative to the hearing bandwidth of the animal;
- Duration of exposure;
- Distance of the animal to the source; and
- Ambient noise levels.

230 The spatial footprint of the impact as a feature of noise propagation conditions will depend on several factors, including, but not limited to:

- Sediment/sea floor composition;
- Water depth; and
- The sensitivity of marine mammal species present in the area.

4.4.1 Auditory injury

231 The potential impact range for PTS from piling during the construction of Tidal Lagoons would be limited, typically to tens of meters from the piling location, depending on the type of piling, location and factors outlined above. For the Swansea Tidal Lagoon Project, percussive piling of the lagoon wall was found to lead to no potential PTS impacts on marine mammals.

232 Where there is any potential risk of physical injury or auditory injury to marine mammals, Tidal Lagoon projects would be required to implement appropriate mitigation measures (**Table 20**), such as JNCC (2010) guidance for piling. Implementation of mitigation would minimise the effects of underwater noise on marine mammals and reduce any potential risks of physical injury or auditory injury.

233 Noise levels from vessels and dredging activity would not result in PTS in marine mammals, as the noise source levels are not high enough to result in auditory injury, such as PTS. A review of published sources of underwater noise during dredging activity (e.g. Thomsen *et al*., 2009, 2016; CEDA, 2011; Theobald *et al*., 2011; Todd *et al*., 2014), indicates that the sound levels that marine mammals may be exposed to during dredging activities are below auditory injury thresholds or PTS exposure criteria (as defined in Southall *et al*., 2007). Otters have similar thresholds to seals in water, however would be expected to leave the water if noise levels increased. Therefore the potential risk of any auditory injury in marine mammals as a result of dredging activity is highly unlikely.

234 It is concluded that, with appropriate mitigation, there would be no potential for any physical or auditory injury from underwater noise that could result in an adverse effect on the integrity of the on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

4.4.2 Disturbance

235 Dredging produces continuous, broadband sound. Sound Pressure Levels (SPLs) can vary widely, with, for example, dredger type, operational stage or environmental conditions (e.g. sediment type, water depth, salinity and seasonal phenomena such as thermoclines (Jones and Marten, 2016)). These factors will also affect the propagation of sound from dredging activities and along with ambient sound already present, will influence the distance at which sounds can be detected.

236 Underwater noise as a result of dredging activity has the potential to disturb marine mammals (this has been observed in other studies, e.g. Pirotta *et al*., 2013). Therefore, there is the potential for behavioural reactions and disturbance to marine mammals in the area of any dredging activity.

237 There are no clear indications that underwater noise caused by the installation of sub-sea cables poses a high risk of harming marine fauna (OSPAR, 2009). However, behavioural responses of marine mammals to dredging, an activity emitting comparatively higher underwater noise levels, are predicted to be similar to those during cable installation (e.g. OSPAR, 2009).

238 Noise from most vessels is likely to be lower frequency, associated with large, slow moving vessels and the use of dynamic positioning systems. Some of the vessels operating in and around the Tidal Lagoon sites, depending on vessel speed, size, type, age and condition etc., may generate significant noise levels, with the literature indicating maximum one-third octave bands (TOB) source level of over 200dB re 1 µPa/m (Malme *et al*., 1989) for a large tanker, over 186dB re 1 µPa/m for a cargo vessel (Arveson and Vedittis, 2000) and over 170dB re 1 µPa/m for a passenger ferry (Malme *et al*., 1989) (for the TOB where the source level is maximum).

239 Noise levels reported by Malme *et al*. (1989) and Richardson *et al*. (1995) for large surface vessels indicate that physiological damage to marine mammals is unlikely.

However, the levels could be sufficient to cause local disturbance of sensitive marine fauna in the immediate vicinity of the vessel, depending on ambient noise levels.

240 As a precautionary approach, based on the current advice from JNCC regarding the principles document for an HRA relating to the WNMP, in particular policies relating to Tidal Lagoons (dated 25th August 2017) the potential disturbance range for marine mammals as a result of piling during the construction of Tidal Lagoons would be up to 50km from the piling location.

241 Therefore there could be the potential for adverse effects on the integrity of European Designated Sites that are located within or overlap with the marine area SRAs and 50km area surrounding the marine area of the SRAs.

242 Three of the European Designated Sites that were screened in (**Table 4**), are located within or overlap with the 50km area surrounding the marine area of the SRAs:

- Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise. Approximately 12% of this cSAC overlaps with the 50km area surrounding the marine area of the southern SRA (**Figure 3**).
- North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise. Approximately 11% of this cSAC overlaps with the 50km area surrounding the marine area of the northern SRA (**Figure 3**).
- Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter is located within the 50km area surrounding the marine area of the southern SRA (**Figure 6**).

243 There are no discrete population of harbour porpoise or grey seal associated with European Designated Sites due to their wide ranging nature within the MMMUs, therefore it can be assumed that at any one time, any harbour porpoise or grey seal in the potential area of disturbance from underwater noise are associated with the nearest cSAC or SAC to the Tidal Lagoon or SRA.

244 As outlined in **Section 2.2.4**, bottlenose dolphin from the Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC and the Cardigan Bay/ Bae Ceredigion SAC are part of the same population, therefore where there is the potential for any effects on either one of these sites, both sites should be assessed together.

245 Otters are not reliant on constant access to the marine areas of their range and therefore any disturbance from underwater noise is unlikely to result in any significant effects.

246 Further assessment is required for each Tidal Lagoon project to determine the potential for any adverse effects on the integrity of the European Designated Sites. The maximum potential range of disturbance of up to 50km used in this assessment is likely to be considerably larger than actual maximum disturbance ranges from piling associated with the construction of Tidal Lagoons, for example if vibropiling is used, also taking into account variable such as pile dimeter, hammer energy, water depth,

bathymetry and seabed sediments which can all influence noise propagation and the spatial extent of the impact area.

247 There is currently not enough information for the high level project assessment to rule out any potential for any adverse effects on the integrity of the European Designated Sites (**Table 9**). However, for the high level plan assessment, taking into account (i) the temporary nature of any disturbance from underwater during construction; (ii) the mitigation measures that could be implemented to reduce the potential impact range of disturbance from underwater noise; and (iii) the relatively small area that could be temporarily affected compared to the range of marine mammals within the management units and designated sites; the potential for any long term significant effects is unlikely.

248 Therefore for the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter, as a result of any disturbance from underwater noise. However, it should be noted that further assessment would be required for each Tidal Lagoon project for any potential impacts (**Table 9**).

Table 9: Results of assessment of potential effects of any disturbance from underwater noise on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential disturbance from underwater noise	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×

Site Name and Receptor	Potential disturbance from underwater noise	
	Project level assessment	Plan level assessment
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ✓ = potential for adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.5 Airborne noise

249 Seals that are hauled-out and otters on shore could be affected by airborne noise from land-based and marine-based construction activities. Noise in air does not travel as far as noise underwater and would therefore be restricted to the construction area / SRA.

250 There could be the potential for adverse effects on the integrity of European Designated Sites for grey seal that are located within or overlap with the SRAs. However, there are currently no European Designated Sites where grey seal are a qualifying feature, that are located within or overlap with the marine area SRAs (**Table 4**; **Figure 5**).

251 There is the potential of disturbance from haul-out sites as a result of airborne noise for grey seal, as outlined in **Plate 6** there is a grey seal haul-out near the northern SRA and this is also indicated by the higher grey seal density near this site (**Figure 1**). Any potential impacts on this haul-out site could be significantly reduced by determining if airborne noise during construction could reach the haul-out site at levels that could result in disturbance to seals that are hauled-out. If there is the potential for disturbance as a result of any airborne noise, implementing mitigation measures such as, where possible, limiting airborne noise levels (using similar techniques and methods that may be required to reduce any disturbance to nearby residential areas), especially during sensitive periods, such breeding and the moult

period for grey seal (see **Section 2.3.2** and **Section 2.3.5**). Therefore for the plan-level assessment, with the proposed mitigation in place, there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for grey seal, as a result of any disturbance from airborne noise.

252 It should also be noted that seals can be habituated to disturbance, for example at Donna Nook in Lincolnshire, seals have become habituated to human disturbance with over 70,000 people visiting this colony during the breeding season with no apparent impact on the breeding seals (SCOS, 2016).

253 For otter there could be the potential for disturbance from airborne noise in the European Designated Sites overlapping the onshore impact area of the SRAs, these are the:

- River Usk/ Afon Wysg SAC; and
- River Wye/ Afon Gwy SAC.

254 However, taking into account that both these sites are designated for their river rather than coastal habitats, the potential for any LSE as a result of any disturbance from airborne noise is highly unlikely. For example,

- For the River Usk, otters are believed to be using most parts of the main river, from Newport upstream; and
- The River Wye is representative of otters occurring in lowland freshwater habitats in the borders of Wales.

255 Therefore for the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for otter, as a result of any disturbance from airborne noise associated with Tidal Lagoons in the SRAs (**Table 10**).

Table 10: Results of assessment of potential effects of any disturbance from airborne noise on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential disturbance from airborne noise	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	×	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac	×	×

Site Name and Receptor	Potential disturbance from airborne noise	
	Project level assessment	Plan level assessment
Aberoedd SAC - otter		
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	×	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives

4.6 Visual disturbance

256 The potential for any unfamiliar visual stimuli (e.g. temporary infrastructure, machinery and people) or changes in lighting levels on land to affect marine mammals in the water is unlikely and any potential effects would be temporary, restricted to a very small area and affect a very small number of individuals.

257 Seals that are hauled out on land, either resting or breeding, may be particularly sensitive to visual disturbance (Hoover-Miller *et al.*, 2013). The response of seals to disturbance at haul-out site can range from increased alertness to moving into the water (Wilson, 2014). The potential impact on breeding sites can include temporary or permanent pup separation, disruption of suckling, energetic costs and energetic deficit to pups, physiological stress and sometimes enforced move to distant or suboptimal habitat. Potential impacts on moulting groups can include energy loss and stress, while impacts on other haul-out groups can cause loss of resting and

digestion time and stress (Wilson, 2014). The level of response is dependent on a range of factors, such as the species at risk, age, weather conditions and the degree of habituation to the source of disturbance. The potential impacts will be determined by the response of the seals, the duration and proximity of the disturbance to the seals.

258 In general, shipping traffic more than 1,500m away from a haul-out site is unlikely to evoke any reaction; between 900m and 1,500m, grey seals could be expected to detect the presence of vessels; and at closer than 900m, a flight reaction could be expected (Scottish Executive, 2007).

259 For the grey seal, mothers responded by moving into the water more to boat speed than to distance, although movement into the water was generally observed to occur at distances of between 20 and 70m, with no detectable disturbance at 150m (Wilson, 2014; Strong and Morris, 2010). However, grey seals have also been reported to move into the water when vessels are at a distance of approximately 200m to 300m (Wilson, 2014).

260 There could be the potential for adverse effects on the integrity of European Designated Sites for grey seal that are located within or overlap with the SRAs. However, there are currently no European Designated Sites where grey seal are a qualifying feature, that are located within or overlap with the marine area SRAs (**Table 4**; **Figure 5**).

261 Although, there is the potential of disturbance from haul-out sites as a result of visual disturbance for grey seal, as outlined in **Plate 6** there is a grey seal haul-out near the northern SRA and this is also indicated by the higher grey seal density near this site (**Figure 1**). Any potential impacts on this haul-out site could be significantly reduced by implementing mitigation measures such as a minimum distance that vessels can pass the haul-out site, especially during sensitive periods, such breeding and the moult period for grey seal (see **Section 2.3.2** and **Section 2.3.5**). Therefore for the plan-level assessment, with the proposed mitigation in place, there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for grey seal, as a result of any visual disturbance from vessels passing the haul-out site.

262 For otter there could be the potential for visual disturbance in the European Designated Sites overlapping the onshore impact area of the SRAs, these are the:

- River Usk/ Afon Wysg SAC; and
- River Wye/ Afon Gwy SAC.

263 However, taking into account that both these sites are designated for their river rather than coastal habitats, the potential for any LSE as a result of any visual disturbance is highly unlikely. For example,

- For the River Usk, otters are believed to be using most parts of the main river, from Newport upstream; and

- The River Wye is representative of otters occurring in lowland freshwater habitats in the borders of Wales.

264 Therefore for the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for otter, as a result of any visual disturbance associated with Tidal Lagoons in the SRAs (**Table 11**).

Table 11: Results of assessment of potential effects of any visual disturbance on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential visual disturbance	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	×	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	×	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	×	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×

Site Name and Receptor	Potential visual disturbance	
	Project level assessment	Plan level assessment
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives

4.7 Collision risk with vessels

265 The additional vessel movements associated with the Tidal Lagoons could have the potential to increase the collision risk with marine mammals. Despite the potential for marine mammals to detect and avoid vessels, strikes are known to occur possibly due to distraction whilst foraging and socially interacting, or due to the mammals' inquisitive nature (Wilson *et al.*, 2007).

266 Marine mammals are relatively robust with a thick sub-dermal layer of blubber that provides some protection for their vital organs in the event of a vessel strike (Wilson *et al.*, 2007). However, non-fatal collisions can leave the animal vulnerable to secondary infection, other complications or predation (Wilson *et al.*, 2007).

267 Studies have shown that larger vessels are more likely to cause the most severe or lethal injuries, with vessels over 80m in length causing the most damage to marine mammals (Laist *et al.*, 2001). Vessels travelling at high speeds are considered to be more likely to collide with marine mammals, and those travelling at speeds below 10 knots would rarely cause any serious injury (Laist *et al.*, 2001). It is not possible to fully quantify strike rates between marine mammals and vessels because it is believed that a number go unnoticed (Evans *et al.*, 2011).

268 Harbour porpoises are small and highly mobile, and given their responses to vessel noise (e.g. Thomsen *et al.*, 2006; Evans *et al.*, 1993; Polacheck and Thorpe, 1990), are expected to largely avoid vessel collisions. However, harbour porpoises have been observed with signs of physical trauma (blunt trauma or propeller cuts) indicating vessel strike. Approximately 4% of all harbour porpoise post mortem examinations from the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS area) are thought to have evidence of interaction with vessels (Evans *et al.*, 2011). Ship strikes involving species of seal are not widely reported (with the exception of potential impacts related to ducted propellers discussed below). Typically, therefore, it is expected that the marine mammals in the area (i.e. harbour porpoise, bottlenose dolphin and grey seal) would be able to detect the presence of vessels and, given that they are highly mobile, would be able to largely avoid vessel collision.

269 In recent years there has been concern and research into the potential risks of 'corkscrew' type injuries to seals associated with ducted propellers (Thompson *et al.*, 2010, 2013; Bexton *et al.*, 2013). There is now incontrovertible evidence that such injuries can be caused by grey seal predation (Thompson *et al.*, 2015), however research by SMRU showed that similar injury patterns could be caused by ducted

propellers (Thompson *et al.*, 2010; SMRU, 2014). Therefore, the advice from the Statutory Nature Conservation Bodies (SNCBs, i.e. SNH, NE, NRW, JNCC) in February 2015, is that it is considered very unlikely that the use of vessels with ducted propellers pose any increased risk to seals over and above normal shipping activities and, therefore, mitigation measures and monitoring may not be necessary in this regard, although all possible care should be taken in the vicinity of major seal breeding and haul-out sites to avoid collisions (SNCBs, 2015).

270 Taking into account the relatively slow travelling speeds of the vessels and the relatively small increase in the numbers of vessel in comparison to the vessel density in the wider area, the increased likelihood of marine mammal strikes is considered to be low. Taking into account the limit range of otters in marine areas and close proximity to shore, they are considered to have a very low risk of a vessel strike.

271 The potential numbers of harbour porpoise, bottlenose dolphin and grey seal that could be exposed to increased collision risk from all vessel movements needs to take into account a precautionary avoidance rate (e.g. 95%) and any mitigation measures or procedures that would reduce the risk of collision with vessels.

272 For vessel interactions, condensed vessel activity will occur in the vicinity of the Tidal Lagoons and routes to local ports (beyond this, vessel activity will be dispersed and becomes part of the background vessel traffic, using already established vessel routes). Thus, all animals affected would be within or in close proximity to the SRAs.

273 Therefore for the plan-level assessment, taking into account the proposed mitigation (**Table 20**), there would be very little potential for any significant increase in the collision risk and any adverse effects on the integrity of European Designated Sites. However, further assessment would be required at the project level (**Table 12**).

Table 12: Results of assessment of potential effects of increased collision risk with vessels on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential increased collision risk with vessels	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	×	×

Site Name and Receptor	Potential increased collision risk with vessels	
	Project level assessment	Plan level assessment
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.8 Collision risk with operational turbines

274 There is currently a lot of uncertainty in the potential collision risk for marine mammals and the operational turbines for Tidal Lagoons. Any potential collision risk for marine mammals will be dependent on a number of factors, such as the design and size of the turbines, location and water depth and distance from shore.

275 However, it can be assumed that if there is the potential of collision risk for marine mammals with operational turbines that Tidal Lagoon projects would be required to implement appropriate mitigation measures (see **Section 6**). Implementation of adequate mitigation measures would reduce the potential for any adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

276 Therefore for the plan-level assessment, taking into account the implementation of effective mitigation measures (**Table 20**), there should be very little potential for any significant collision risk and any adverse effects on the integrity of European

Designated Sites. However, further assessment would be required for at the project level (**Table 13**).

Table 13: Results of assessment of potential effects of increased collision risk with operational turbines on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential increased collision risk with turbines	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.9 Barrier effects to movement and habitat fragmentation

277 Barrier effects could prevent the movement or migration of marine mammals between important feeding and / or breeding areas, or potentially increasing swimming distances if marine mammals avoid the site and go round it.

278 The SRAs are not located on any known migration routes for marine mammals.

279 As outlined in **Plate 6** there is a grey seal haul-out near the northern SRA and this is also indicated by the higher grey seal density near this site (**Figure 1**). Although the potential areas of Tidal Lagoons within the northern SRA are unlikely to result in any significant effects on the movements to and from this haul-out site. However, this would need to be assessed further for any proposed Tidal Lagoon developments within the northern SRA, taking into account the size and location of the Tidal Lagoon in the SRA.

280 Bottlenose dolphin are known to move along the coast between Cardigan Bay in the summer and the north Wales and Anglesey coast in the winter. Therefore this would need to be assessed further for any proposed Tidal Lagoon developments within the norther SRA, taking into account the size and location of the Tidal Lagoon in the SRA.

281 There is little information on the movements of harbour porpoise in the SRAs. However, given the proximity of the Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC to the southern SRA and the North Anglesey Marine / Gogledd Mon Forol cSAC to the northern SRA, this would need to be assessed further for any proposed Tidal Lagoon developments within the norther SRA, taking into account the size and location of the Tidal Lagoon in the SRA.

282 Taking into account the limit range of otters in marine areas, any potential barrier effects are considered unlikely.

283 In conclusion, there is currently not enough information for the plan-assessment to rule out any potential for any adverse effects on the integrity of the European Designated Sites. Therefore, further assessment is required for each Tidal Lagoon project to determine the potential for any adverse effects on the integrity of the European Designated Sites for marine mammals.

284 However, with a better understanding of the movements of marine mammals along coastal areas in the SRAs and the positioning of any Tidal Lagoons outwith any areas that could result in any potential barrier effects to the movements of marine mammals, would reduce and limit the potential for any adverse effects on designated sites in the plan-level assessment (

285

286 **Table *14***).

Table 14: Results of assessment of potential barrier effects on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential barrier effects	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC - otter	×	×
River Wye/ Afon Gwy SAC - otter	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.10 Changes in prey availability

287 Potential impacts on prey species can result from loss of habitat; changes to habitat extent, type or quality; changes in water quality, including increased suspended sediment concentrations and sediment re-deposition; underwater noise (leading to mortality, physical injury, auditory injury or behavioural responses); collision with operational turbines; barrier effects to movements and habitat fragmentation; the introduction or spread of non-native species; and electromagnetic fields (EMF) from power transmission cables. For further information see the HRA for Fish and Supporting Environments (ABPmer, 2017).

288 The impact areas for any direct loss of habitat or changes of habitat would be the same for marine mammals and their prey; therefore there would be no additional impacts on marine mammals as a result of any direct loss or changes or loss of habitats to prey species. As concluded in **Section 4.1** and **Section 4.2**, any potential effects associated with any direct loss of habitat or changes of habitat on marine mammals or prey availability would not result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

289 As outlined in **Section 4.3**, there could be the potential for direct and indirect effects associated with any 'changes to water quality' on European Designated Sites where marine mammals are a qualifying feature, based on a 50km potential impact range. However, when taking into account the potential for any significant changes to water quality with the embedded mitigation and best practice that would be in place at each project, the potential for the release of any contaminants, regulated and accidental discharges would be very small and highly unlikely. The potential of any significant effects from increased suspended sediments is also highly unlikely and any changes in salinity or dissolved oxygen would be limited to the area in the immediate vicinity of the Tidal Lagoon area. Therefore, the potential for any changes to water quality to have a have a significant effect on the availability of marine mammal prey over distances of up to 50km is highly unlikely. Therefore for the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter, as a result of any changes in water quality on prey availability.

290 Any potential impacts of underwater noise on fish that could result in mortality, physical injury or auditory injury, would also be mitigated with the appropriate mitigation put in place to prevent any auditory injury in marine mammals. The potential impact area of any potential disturbance of prey species as a result of underwater noise would typically be less than those for marine mammals as their hearing is less sensitive. Therefore, there would be no additional impacts on marine mammals as a result of the potential effects associated with underwater noise on prey availability.

291 It can be assumed that if there is the potential of significant collision risk for fish with operational turbines that Tidal Lagoon projects would be required to implement appropriate mitigation measures. The potential impact area for prey species will be confined to the potential zone of influence for the operational turbine, i.e. the area in which fish could be at risk. Fish are highly mobile species, with relatively large ranges and are unlikely to be restricted to the immediate area of the turbines and the loss of fish is likely to be very small in comparison to natural variation. Therefore for the plan-level assessment, taking into account the implementation of effective mitigation measures to reduce the potential for any significant effects on prey availability, there is unlikely to be aby adverse effect on the integrity of European Designated Sites in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter. However, further assessment would be required for at the project level.

292 As outlined in the HRA for Fish and Supporting Environments (ABPmer, 2017), some prey species, such as migratory fish species, could be experience a degree of habitat fragmentation and impediment to migration through the placement of a Tidal Lagoons in the SRAs. This could result in a loss of habitat, delay to migration, fragmentation of migration routes and increased energetic costs for some prey species. The significance of any obstruction on prey species would be dependent on the location and size of the Tidal Lagoons. However, although there is the potential to affect the availability of prey for marine mammals, taking into account the wide variety of prey species and relatively large foraging areas for marine mammals (see **Section 2**), any changes in prey availability as a result of any barrier effects are unlikely to have a significant impact. However, further assessment would be required for at the project level.

293 The introduction or spread of non-native species could result during construction via transport of species in ballast or bilge water, fouling of vessel hulls or the accidental import on material brought in for the construction of Tidal Lagoons. The introduction of new surfaces and habitats, such as Tidal Lagoon structures and cable protection could also provide suitable habitat for the spread of non-native species. However, the potential impact of any non-native species on marine mammal prey species is likely to be very low and restricted to the Tidal Lagoon development area. There are currently no European Designated Sites where marine mammals, including otters are a qualifying feature, that are located within or overlap with the marine SRAs (**Table 4**; **Figure 3**, **Figure 4**, **Figure 5**, **Figure 6**). Therefore it is concluded that any potential effects on prey species associated with the introduction or spread of non-native species would not result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

294 Similarly, any potential effects of electromagnetic fields from power transmission cables on prey species would be limited to the Tidal Lagoon development area. Therefore it is concluded that any potential effects on prey species associated with

EMF would not result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

295 Therefore for the plan-level assessment, taking into account the implementation of effective mitigation measures (**Table 20**), there should be very little potential for any significant changes to prey availability that could result in any adverse effects on the integrity of European Designated Sites designated for marine mammals (**Table 15**).

296 However, as concluded in the HRA for Fish and Supporting Environments (ABPmer, 2017), further assessment is required for each Tidal Lagoon project to determine the potential for any adverse effects on the prey species of marine mammals.

Table 15: Results of assessment of potential effects of any changes in prey availability on the integrity European Designated Sites screened in for marine mammals

Site Name and Receptor	Potential changes in prey availability	
	Project level assessment	Plan level assessment
Abers - Cotes des Legendes SAC - harbour porpoise	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×
Afon Tywi/ River Tywi SAC - otter	×	×
Baie de Morlaix SAC - harbour porpoise	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	?	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	?	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×
Isles of Scilly Complex SAC - grey seal	×	×
Lundy SAC - grey seal	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	?	×
North Channel cSAC - harbour porpoise	×	×
Ouessant-Molene SAC - harbour porpoise	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×
River Usk/ Afon Wysg SAC	×	×

Site Name and Receptor	Potential changes in prey availability	
	Project level assessment	Plan level assessment
- otter		
River Wye/ Afon Gwy SAC **- otter**	×	×
Roaringwater Bay and Islands SAC **- harbour porpoise**	×	×
Rockabill to Dalkey Island SAC **- harbour porpoise**	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC **- harbour porpoise**	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown or currently there is insufficient evidence to assess, therefore further assessment required

4.11 Sensitivity of Marine Mammals to Potential Impacts

297 In order to assess the potential for adverse effects on European Designated Sites where marine mammals are a qualifying feature it is important to understand the potential sensitivity each species to these impacts. These sensitivities have been assessed and presented in **Table 6** based on the definitions in ***Table 5***.

298 The sensitivity of a receptor is determined through its ability to accommodate change and reflects on its ability to recover if it is affected. The sensitivity level of marine mammals to each type of impact is justified within the impact assessment and is dependent on the following factors:

- Adaptability – The degree to which a receptor can avoid or adapt to an effect;
- Tolerance – The ability of a receptor to accommodate temporary or permanent change without a significant adverse effect;
- Recoverability – The temporal scale over and extent to which a receptor will recover following an effect; and
- Value – A measure of the receptors importance, rarity and worth (see below).

299 The sensitivity of marine mammals to potential impacts is determined based on available evidence including published data sources. **Table 16** defines the levels of sensitivity and what they mean for the receptor.

Table 16: Definitions of sensitivity levels for marine mammals

Sensitivity	Definition
High	Individual receptor has very limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Medium	Individual receptor has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Low	Individual receptor has some tolerance to avoid, adapt to,

Sensitivity	Definition
	accommodate or recover from the anticipated impact.
Negligible	Individual receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

Table 17: Sensitivity of marine mammals to potential impacts

Potential Impact	Sensitivity	Justification
Direct habitat loss	**Low to medium for harbour porpoise, bottlenose dolphin, grey seal and otter**	Any potential effects of direct habitat loss are likely to result in changes to prey availability, e.g. loss of some foraging areas, therefore the potential sensitivity to any direct loss of habitat would be the same as the potential sensitivity to changes in prey availability.
Changes in habitat extent, type or quality	**Low to medium for harbour porpoise, bottlenose dolphin, grey seal and otter**	Any potential effects of habitat change are likely to result in changes to prey availability, therefore the potential sensitivity to any habitat change would be the same as the potential sensitivity to changes in prey availability.
Changes in water quality - increased suspended sediment	**Negligible for harbour porpoise, bottlenose dolphin, grey seal and otter**	Increased turbidity is unlikely to have a substantial direct impact on marine mammals that often inhabit naturally turbid or dark environments. This is likely because other senses are utilised, and vision is not relied upon solely. Therefore, harbour porpoise have negligible sensitivity to increases in suspended sediments during construction.
Disturbance from underwater noise	**Low to medium for harbour porpoise, bottlenose dolphin, grey seal and otter**	Any potential effects of disturbance are likely to result in changes to prey availability, e.g. displacement from some foraging areas, therefore the potential sensitivity to disturbance would be the same as the potential sensitivity to changes in prey availability.
Disturbance from airborne noise	**Low for grey seal and otter**	Seals and otters in the area would be habituated to airborne noise as a result of human activity and other construction projects, etc. in and around the area.
Collision risk with vessels	**Low for harbour porpoise, bottlenose dolphin and**	Harbour porpoise, bottlenose dolphin and grey seal in the SRAs would be habituated to the presence of vessels and would be able to detect and avoid vessels. Therefore, they are considered to have a low sensitivity to

Potential Impact	Sensitivity	Justification
	grey seal	the risk of a vessel strike.
	Negligible for otter	Taking into account the limit range of otters in marine areas and close proximity to shore, they are considered to have a negligible sensitivity to the risk of a vessel strike.
Collision risk with turbines	**Low to medium for harbour porpoise, bottlenose dolphin, grey seal and otter**	The potential sensitivity of marine mammals for collision risk with operational turbines at Tidal Lagoons is unknown. However, given the ability of marine mammals to detect and avoid turbines it is currently considered to be low to medium as a precautionary approach, For example, during the operation of the SeaGen device at Strangford Lough, there were no marine mammal deaths likely to have been caused by the tidal turbine. Similarly, there is no evidence of any interaction between any marine mammal species and the turbines at the Fall of Warness since the first turbine was deployed in 2006, or from elsewhere in the UK or Europe (EMEC, 2014).
Barrier effects to movement and habitat fragmentation	**Low to medium for harbour porpoise, bottlenose dolphin and grey seal**	Any potential barrier effects are likely to result in changes to prey availability, e.g. they cannot reach some foraging areas therefore the potential sensitivity to any barrier effects would be the same as the potential sensitivity to changes in prey availability.
	Negligible for otter	Taking into account the limit range of otters in marine areas and close proximity to shore, they are considered to have a negligible sensitivity to any potential barrier effects.
Changes in prey availability	**Low to medium for harbour porpoise and bottlenose dolphin**	The diet of the harbour porpoise consists of a wide variety of prey species and varies geographically and seasonally, reflecting changes in available food resources. As outlined in **Section 2.1.3**, harbour porpoise have relatively high daily energy demands and need to capture enough prey to meet its daily energy requirements. It has been estimated that, depending on the conditions, harbour porpoise can rely on stored energy (primarily blubber) for three to five days, depending on body

Potential Impact	Sensitivity	Justification
		condition (Kastelein *et al.*, 1997). Harbour porpoise forage nearly continuously day and night, attempting to meet their metabolic demands foraging on small prey (Wisnlewska *et al.*, 2016). Harbour porpoise are therefore considered to have low to medium sensitivity to changes in prey resources. As a precautionary approach, bottlenose dolphin are also considered to have low to medium sensitivity to changes in prey resources.
Changes in prey availability	**Low for grey seal and otter**	Grey seal feed on a variety of prey species, and are considered to be opportunistic feeders, they are able to forage in other areas and have relatively large foraging ranges. Grey seal are therefore considered to have low sensitivity to changes in prey resources. Otters are not reliant on the marine areas of their range and are therefore considered to have low sensitivity to changes in prey resources.

4.12 Summary of Assessment of Potential for Adverse Effects on Designated Sites

300 **Table 18** summaries the results for the assessment of the potential for adverse effects on European Designated Sites for marine mammals.

301 **Appendix 2 Table A2.1**: Summary of high level project assessment of potential impacts (Section 3.2), taking into account potential pathways (Section 3.2.2.2), potential effects on integrity European Designated Sites for marine mammals (Section 4) and risk of potential in-combination effects (Section 5) and **Table A2.1**: Summary of high level project assessment of potential impacts (Section 3.2), taking into account potential pathways (Section 3.2.2.2), potential effects on integrity European Designated Sites for marine mammals (Section 4) and risk of potential in-combination effects (Section 5) provides an overall summary of the high level project and plan assessments for the European Designated Sites where harbour porpoise, bottlenose dolphin, grey seal or otter are qualifying features.

Table 18: Summary of plan-level assessment of potential for adverse effects on European Designated Sites for marine mammals

Potential Impact	European Designated Sites	Potential for Adverse Effects
Direct habitat loss	There are currently no European Designated Sites where marine mammals, including otters are a qualifying feature, that are located within or overlap with the marine area SRAs.	Any potential effects associated with any direct loss of habitat would not result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.
Changes in habitat extent, type or quality	• Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise • North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise • Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter	For the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter, as a result of any alterations in tidal range, tidal flows (e.g. flow speeds and flow patterns) and sediment transport (including erosion and deposition), including any changes to water levels, especially when taking into account the natural variation across the range of marine mammals and their prey.
Changes in water quality - increased suspended sediment	• Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise • North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise • Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter	For the plan-level assessment, taking into account the embedded mitigation and best practice, there should be no potential for any adverse effects on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter, as a result of any changes in salinity or dissolved oxygen, increased suspended sediments and contaminants, or risk from regulated and accidental discharges.
Disturbance from underwater noise	• Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise • North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise • Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter	There is currently not enough information for the high level project assessment to rule out the potential for any adverse effects on the integrity of the European Designated Sites. Therefore, further assessment is required. However, for the high level plan assessment, taking into account the temporary nature of any disturbance from underwater during construction, the mitigation measures that could be implemented to

Potential Impact	European Designated Sites	Potential for Adverse Effects
		reduce the potential impact range of disturbance from underwater noise, the relatively small area that could be temporarily affected compared to the range of marine mammals within the management units and designated sites, the potential for any long term significant effects is unlikely.
Airborne noise	• River Usk/ Afon Wysg SAC • River Wye/ Afon Gwy SAC Any grey seal at nearby haul-out sites that could be disturbed as a result of airborne noise would be associated with the nearest SAC to the Tidal Lagoon or SRA.	For the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for otter, as a result of any disturbance from airborne noise associated with Tidal Lagoons in the SRAs. For the plan-level assessment, there would be very little potential for any significant disturbance of seal haul-out sites as a result of airborne noise and any adverse effects on the integrity of European Designated Sites. However, further assessment would be required at the project level.
Visual disturbance	• River Usk/ Afon Wysg SAC • River Wye/ Afon Gwy SAC	For the plan-level assessment there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for otter, as a result of any visual disturbance associated with Tidal Lagoons in the SRAs.
Collision risk with vessels	Any harbour porpoise or grey seal that could be at increased risk of vessel collision would be associated with the nearest cSAC or SAC to the Tidal Lagoon or SRA. Bottlenose dolphin from the Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC and the Cardigan Bay/ Bae Ceredigion SAC are part of the same population, therefore where there is the potential for any effects on either one of these sites, both sites should be assessed together.	For the plan-level assessment, there would be very little potential for any significant increase in the collision risk and any adverse effects on the integrity of European Designated Sites. However, further assessment would be required at the project level.
Collision risk with turbines	Any harbour porpoise or grey seal or otter that could be at increased risk of collision with turbines would be associated with the nearest cSAC or SAC to the Tidal Lagoon or SRA.	For the plan-level assessment, taking into account the implementation of effective mitigation measures, there should be very little potential for any significant collision risk and any adverse effects on the integrity of European Designated Sites. However, further assessment would be required at the project level.

Potential Impact	European Designated Sites	Potential for Adverse Effects
	Bottlenose dolphin from the Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC and the Cardigan Bay/ Bae Ceredigion SAC are part of the same population, therefore where there is the potential for any effects on either one of these sites, both sites should be assessed together.	
Barrier effects to movement and habitat fragmentation	Any harbour porpoise or grey seal or otter that could be at impacted by any potential barrier effects would be associated with the nearest cSAC or SAC to the Tidal Lagoon or SRA. Bottlenose dolphin from the Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC and the Cardigan Bay/ Bae Ceredigion SAC are part of the same population, therefore where there is the potential for any effects on either one of these sites, both sites should be assessed together.	With a better understanding of the movements of marine mammals along coastal areas in the SRAs and the positioning of any Tidal Lagoons outwith any areas that could result in any potential barrier effects to the movements of marine mammals, would reduce and limit the potential for any adverse effects on designated sites in the plan-level assessment. However, it is unlikely that any potential barrier effects from Tidal Lagoons would result in any significant effects on marine mammals that could result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.
Changes in prey availability	Any harbour porpoise or grey seal or otter that could be at impacted would be associated with the nearest cSAC or SAC to the Tidal Lagoon or SRA. Bottlenose dolphin from the Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC and the Cardigan Bay/ Bae Ceredigion SAC are part of the same population, therefore where there is the potential for any effects on either one of these sites, both sites should be assessed together.	It is unlikely that Tidal Lagoons would result in any significant changes in prey availability that could result in an adverse effect on the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter. However, further assessment is required for each Tidal Lagoon project to determine the potential for any adverse effects on the integrity of the European Designated Sites for marine mammals as a result of any changes to prey availability.

5 In-combination Assessment

Section 5 outlines the in-combination assessment process which considers the potential for any likely significant effect of the Tidal Lagoon Policy in-combination with other relevant plans and projects.

302 The high level in-combination assessment considers the potential for any likely significant effect of the Tidal Lagoon Policy in-combination with other relevant projects (**Table 19**).

Table 19: High level assessment of potential in-combination effects on European Designated Sites for marine mammals

Project	Stage	Description	Potential in-combination effects on European Designated Sites for marine mammals
TIDAL LAGOON PROJECTS			
Tidal Lagoon Swansea Bay Development	Decided	Construction of a Tidal Lagoon generating station with a maximum capacity of 320MW within Swansea Bay, with seawalls enclosing an area of 11.5km^2. Construction of a substation, lighting, maintenance facilities, slipways and jetties, turbine and sluice gates housing structures with 16 variable speed hydro turbines and 10 sluice gates.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Barrier effects to movement and habitat fragmentation • Introduction or spread of non-native species • Electromagnetic fields from power transmission cables • Changes in prey availability
The West Somerset Tidal Lagoon	Pre Application	Tidal Lagoon on north Somerset coast.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Barrier effects to movement and habitat fragmentation • Introduction or spread of non-native species • Electromagnetic fields from power transmission cables • Changes in prey availability
Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	*Consent secured. Installation in 2015 – project in abeyance?*	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise

Project	Stage	Description	Potential in-combination effects on European Designated Sites for marine mammals
			• Visual disturbance • Collision risk • Barrier effects to movement and habitat fragmentation • Introduction or spread of non-native species • Electromagnetic fields from power transmission cables • Changes in prey availability
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	An EIA has not yet been completed; However construction is Planned to commence in 2017 following the decommissioning of the Ramsey Sound installation.	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Barrier effects to movement and habitat fragmentation • Introduction or spread of non-native species • Electromagnetic fields from power transmission cables • Changes in prey availability
Tidal Lagoon Newport	Pre-application with PINS (Application expected 2017-2018)	Tidal Lagoon electricity generating station with a potential generating capacity of 1800MW up to a possible 2800MW. A seawall attached to the foreshore, at its western extent approximately 1km to the mouth of the River Usk, and at its eastern extent to the foreshore in the area of Baldwin Sands. The furthest offshore extent is up to 8km from the foreshore towards the centre of the Severn Estuary.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Barrier effects to movement and habitat fragmentation • Introduction or spread of non-native species • Electromagnetic fields from power transmission cables • Changes in prey availability
Tidal Lagoon Cardiff	Pre-application with PINS (Application expected 2017)	Tidal Lagoon electricity generating station with a potential generating capacity of 1800MW up to a possible 2800 MW. A seawall attached to the foreshore, at its western extent approximately 2 km from the entrance to Cardiff Bay, and at its eastern extent approximately 2km from the mouth of the River Usk. The furthest offshore extent is	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Barrier effects to movement and habitat fragmentation

Project	Stage	Description	Potential in-combination effects on European Designated Sites for marine mammals
		approximately 8km from the foreshore to the centre of the Severn Estuary. The breakwater is expected to be 25km long with the lagoon area being approximately 70km^2	• Introduction or spread of non-native species • Electromagnetic fields from power transmission cables • Changes in prey availability
TIDAL ARRAY PROJECTS			
Minesto	Application in Prep?	Minesto Holyhead Deep Tidal Kite The 9.1km^2 AfL area could accommodate an array of up to 80 MW (160 0.5 MW DGUs). Minesto plans to start the installation of a 10MW marine energy array in 2017, subject to planning permission and a Marine Licence.	• Direct habitat loss • Changes in water quality • Underwater noise • Visual disturbance • Collision risk • Barrier effects to movement • Electromagnetic fields from power transmission cables • Changes in prey availability
Menter Môn (Morlais) West Anglesey Marine Energy Demonstration Zone	Application in Prep?	The Morlais Project capacity may be up to, but will not exceed 100W. A number of Tidal Energy Converters (TEC) are being considered. The Morlais Project will be located in the West Anglesey Demonstration Zone (WADZ) an area of 37km^2.	• Direct habitat loss • Changes in water quality • Underwater noise • Visual disturbance • Collision risk • Barrier effects to movement • Electromagnetic fields from power transmission cables • Changes in prey availability
GAS STORAGE AND GAS TRANSFER PROJECTS			
Preesall Saltfield Underground Gas Storage	Decided	Underground gas storage facility to store / extract / inject gas into caverns formed by solution halite mining; requires discharges of hypersaline brine to the Irish sea. HRA concluded 'no significant effects'; residual effects with projects supported by the WNMP possible but cannot be assessed at the strategy level and may form part of the baseline at that point if development completed.	• Changes in water quality • Changes in habitat extent, type or quality • Changes in prey availability
Amlwch LNG (Liquefied Natural Gas)		Tankers would import liquid gas to a mooring three kilometres from the Amlwch coast. The gas would then be transferred by an undersea pipeline from the mooring platform to the site near the town of Amlwch, where it would be converted back to natural gas and sent into the UK gas network.	• Changes in water quality • Underwater noise • Visual disturbance • Collision risk • Changes in prey availability
POWER STATIONS			

Project	Stage	Description	Potential in-combination effects on European Designated Sites for marine mammals
South Hook Combined Heat & Power Station	Decided	Potential effects to sites through surface and process waste water impacting on features within the Pembrokeshire Marine SAC.	• Changes in water quality • Changes in habitat extent, type or quality • Changes in prey availability
Hinkley Point C New Nuclear Power Station	Development Consent granted	A nuclear energy generating station in Somerset. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.	• Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Visual disturbance • Airborne noise • Collision risk • Changes in prey availability
Oldbury New Nuclear Power Station	Pre-application stage for Development Consent	A nuclear energy generating station in Gloucestershire. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.	• Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Changes in prey availability
Seabank 3 CCGT	Pre-application stage for Development Consent	New Combined Cycle Gas Turbine (CCGT) power station immediately adjacent to the existing Seabank Power Station; within 400m of Severn Estuary. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.	• Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Changes in prey availability
Avon Power Station	Pre-application stage for Development Consent	A 950MW gas fired energy generation proposed in Gloucestershire near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.	• Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Changes in prey availability
Wylfa Newdydd Nuclear Power Station	Pre-application with PINS (Application expected Autumn 2017)	Proposed new nuclear power station, located adjacent to existing station at Wylfa A, on the Isle of Anglesey.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Introduction or spread of non-native species

Project	Stage	Description	Potential in-combination effects on European Designated Sites for marine mammals
			• Changes in prey availability
Wylfa Decommissioning		Wylfa Decommissioning Decommissioning of the Existing Power Station (Wylfa) including care and maintenance of the existing facilities followed by decommissioning and final site clearance.	• Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Changes in prey availability
NuGens Moorside Project in West Cumbria	Pre Application	New nuclear power station in Cumbria This project is currently on-hold.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Introduction or spread of non-native species • Changes in prey availability
PORT PROJECTS			
Bristol Port Deep Sea Container Terminal (DSCT) at Avonmouth Dock	Consent secured	The Bristol Port Company is planning to build a £600m Deep Sea Container Terminal (DSCT) at Avonmouth Dock. The DSCT will handle large container vessels and next-generation ultra large container ships with a draught of up to 16 m and a capacity in excess of 150,000 DWT	• Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Changes in prey availability
SEA DEFENCE PROJECTS			
Tabb's Gout and Portland Grounds Sea Defence	Construction not started	Improvements Raising of sea defences on the Severn Estuary coastline between ST248787 and ST254790 and ST438848 and ST453857 respectively, in line with the 'Hold the Line' policies for the second Severn Estuary Shoreline Management Plan (SMP2) and the draft Severn Estuary Flood Risk Management Strategy.	• Direct habitat loss • Changes in habitat extent, type or quality • Changes in water quality • Underwater noise • Airborne noise • Visual disturbance • Collision risk • Changes in prey availability
GRID CONNECTION PROJECTS			
North Wales Connection – National Grid	Pre-application with PINS (Application expected	Proposed 400kV electricity transmission reinforcements in North Wales to connect planned new nuclear electricity generation on Anglesey and Irish Sea	• Changes in habitat extent, type or quality • Changes in water quality • Underwater noise

Project	Stage	Description	Potential in-combination effects on European Designated Sites for marine mammals
	October 2017)	offshore wind. Grid connection on Anglesey, involving Menai Straight crossing **This project is currently on hold.**	• Visual disturbance • Changes in prey availability

6 Mitigation

The following section outlines avoidance options and / or mitigation measures that could be used to reduce risk to marine mammals and minimise effects of the Tidal Lagoon Policy, alone or in-combination with other plans or projects.

303 Avoidance options and / or suitable embedded and applied mitigation measures that could be used to reduce any potential risk to marine mammals and minimise any potential effects of the Tidal Lagoon Policy, alone or in-combination with other plans or projects on the integrity of the European Designated Sites are proposed in ***Table 20***.

304 In addition the possible mitigation in **Table 20**, it is recommended that each Tidal Lagoon project prepares a detailed Marine Mammal Mitigation Plan (MMMP). In addition, projects could also consider the implementation of an Environmental Monitoring and Adaptive Management Plan (EMAMP) during the pre-installation, installation, commissioning, operational and decommissioning phases of the Tidal Lagoon Projects. It is proposed that the EMAMP could provide a flexible framework, through which further knowledge and understanding of the risks presented from Tidal Lagoon projects throughout the project lifespan.

305 The Objectives of the marine mammal EMAMP could be to:

1. Provide a framework for data collection and analysis, knowledge exchange, assessment of risk and adaptive management for the potential interaction between marine mammals and the Tidal Lagoon.
2. Enable pre- installation data gathering including:
    a. Agreement on the objectives for the pre-installation data gathering.
    b. Determining the approach to pre-installation monitoring.
    c. Agreement on survey methods.
    d. Use surveys to refine site specific densities.
    e. Knowledge exchange with other projects and wider industry to refine understanding of collision risk and effects of underwater noise.
3. Allow re-assessment of collision risk (prior to commissioning).
4. Provide sufficient data and a framework for agreement approaches to mitigation of installation and operation risks through the MMMP (if required).
5. Allow the development of on-going monitoring (operational phase). Considerations could include:
    a. Near field behaviour.
    b. Ability to detect collisions (e.g. accelerometers or strain gauges).
    c. Potential requirement for mitigation (ability to detect marine mammals and deter or shut down).
    d. Noise monitoring.

6. Allow the development of on-going adaptive management and re-assessment of risk.
7. Allow the development of mitigation or monitoring during decommissioning (if required).
8. Provide information to help answer wider questions that will be important to the future consenting of Tidal Lagoons.

Table 20: Possible avoidance options and / or suitable embedded and applied mitigation measures that could be used to reduce any potential risk to marine mammals and minimise any potential effects on the integrity of the European Designated Sites

Potential Impact	Possible Mitigation
Direct habitat loss	Avoid any potential sensitive areas / sites of importance for marine mammal prey species
Changes in habitat extent, type or quality	See recommendations in the HRA for Fish and Supporting Environments (ABPmer, 2017) which include: • Avoiding sensitive sites/ areas, including micro-siting around features. • Tidal lagoon wall should be designed to minimise footprint. • Minimise scour by utilising the locations of the lagoon structure, location and arrangement of turbines to reduce impacts as much as is possible. • Minimise the impact on water levels by designing as two-way generation (flood and ebb). • Hydraulic design to minimise sedimentation.
Changes in water quality	Where possible use construction methods that minimise sediment re-suspension. Minimise dredging where possible to reduce increases in suspended sediment. Follow best practice guidance for dredging and disposal of dredge material. Implement good practice to ensure that any spills/leaks are quickly contained and removed to reduce the risk of oils, fuel, chemicals etc. entering the marine environment.
Underwater noise	Where possible select construction methods with smallest potential noise impact ranges, e.g. vibropiling. Ensure soft-start and ramp-up procedures are implemented for all piling activity to reduce the risk of any potential risk of auditory injury from higher hammer energies. JNCC piling protocols and soft start procedures with possible MMO / PAM / ADD for any percussive piling. Consider potential noise reduction methods, such as bubble curtains.
Disturbance from airborne noise	Where possible, avoid any disturbance to otters during sensitivity periods, such as breeding season. Where possible, avoid any disturbance to nearby seal haul-out sites during sensitive periods, such as breeding and moult periods. Limiting airborne noise levels using similar techniques and methods that may be required to reduce any disturbance to nearby residential areas.

Potential Impact	Possible Mitigation
Visual disturbance	Where possible, avoid any disturbance to otters during sensitivity periods, such as breeding season. Where possible, avoid any disturbance near seal haul-out sites during sensitive periods, such as breeding and moult periods. Implementation of mitigation measures such as a minimum distance that vessels can pass haul-out site, especially during sensitive periods, such breeding and the moult period.
Collision risk with vessels	All vessels should not travel over 10 knots within the SRA / Tidal Lagoon area. All vessels, when possible, should keep a continuous watch to avoid any potential collisions with marine mammals. Where possible vessels should ensure a minimum distance of 1km from any marine mammal.
Collision risk with turbines	A monitoring programme which could the form an adaptive management plan allowing mitigation to be implemented if required. Consideration of marine mammal precautionary shutdown procedure (MMPSP) similar to SeaGen Strangford Lough tidal device, for example real time active sonar with ability to shut down when marine mammal is detected in predetermined range that could result in collision.
Barrier effects to movement and habitat fragmentation	Consideration of the siting / location of infrastructure to reduce any potential barrier effects.
Changes in prey availability	See recommendations in the HRA for Fish and Supporting Environments (ABPmer, 2017), which include: • Selecting the site to minimise the loss of high value habitat for fish (spawning and nursery grounds). • Design the lagoon wall to provide potential fish spawning grounds and habitat by avoiding use of smooth surfaces and using gravel or other substrate at the base suitable for providing spawning grounds. • Trawling translocation (where necessary) before construction of the lagoon wall. • Drainage of the storage basin controlled to minimise risk of fish stranding. • Geotextile lining to minimise sediment release. • Directional illumination on the site only. Illumination avoided outside of the lagoon. No white mercury lamps should be used. • Connection of fish spawning, nursery and foraging grounds maintained with fish passes if necessary. • 'fish-friendly' features should be incorporated into the turbine design, such as using larger sluice gates and fish deterrents (acoustic and/or visual).

7 Record of Assessment

The following section provides the Record of Assessment of potential impacts to marine mammal species and otter as a result of Tidal Lagoon developments. The section includes a table of outcome for designated sites; qualifying features, Conservation Objectives, vulnerabilities (including any pressures and trends), predicted impacts, potential in-combination effects, the likelihood of significant effects, possible avoidance or mitigation measures and conclusion.

306 This section provides a record of the assessment for European Designated Sites where harbour porpoise, bottlenose dolphin, grey seal or otter are qualifying features that have been assessed as having potential for adverse effects as a result of Tidal Lagoons in the SRAs identified in the Tidal Lagoon Policy, based on the high level project and plan assessment in **Section 4**. Where, ✖ = no potential effects on integrity European Designated Site; ✓ = potential effects on integrity European Designated Site; and ? = uncertain, therefore could be potential effects on integrity European Designated Site and further assessment at project level would be required.

307 **Appendix 2 Table A2.1**: Summary of high level project assessment of potential impacts (Section 3.2), taking into account potential pathways (Section 3.2.2.2), potential effects on integrity European Designated Sites for marine mammals (Section 4) and risk of potential in-combination effects (Section 5) and **Table A2.1**: Summary of high level project assessment of potential impacts (Section 3.2), taking into account potential pathways (Section 3.2.2.2), potential effects on integrity European Designated Sites for marine mammals (Section 4) and risk of potential in-combination effects (Section 5) provides an overall summary of the high level project and plan assessments for the European Designated Sites where harbour porpoise, bottlenose dolphin, grey seal or otter are qualifying features.

7.1 Harbour porpoise

7.1.1 Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC

Site	Qualifying Features	Distance to SRA
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC (UK0030396)	Harbour porpoise 1351	South SRA (54.06km)
Conservation Objectives (summary) – full details in Table A1.2 Appendix 1		
• Avoid the deterioration of suitable habitat • Avoid significant disturbance to harbour porpoise • The species must be a viable component of the site • Supporting processes and prey species should be maintained		
Vulnerabilities (summary) – full details in Table A1.2 Appendix 1		
• Removal of non-target fishing species and bycatch of harbour porpoise • Contaminant discharges or run-off from landfill sites and terrestrial and offshore industries • Anthropogenic underwater noise (shipping / drilling / dredging and disposal / aggregate extraction / piling / acoustic surveys / underwater explosions (UXO) / military activity / ADDs / recreational boating • Collision with vessels (commercial or recreational) • Collision with tidal energy installations		
Impact Assessment - further details in Section 4, Section 5 and Appendix 2		

Potential Impact	Potential effects on integrity European Designated Site – high level project assessment	Potential effects on integrity European Designated Site – high level plan assessment
Direct habitat loss	×	×
Changes in habitat	?	×
Changes in water quality	?	×
Increased suspended sediment	?	×
Underwater noise	?	×
Airborne noise	×	×
Visual disturbance	×	×
Collision risk with vessels	?	×
Collision risk with turbines	?	×
Barrier effects	?	×
Changes in prey availability	?	×
In-combination effects	?	×

Possible Avoidance and/or Mitigation Measures – also see Section 6

- Use of vibro-piling wherever possible
- JNCC piling protocols and soft start procedures with MMO / PAM / ADD for any percussive piling
- Noise reduction methods
- Capture and release protocol for any marine mammals that become trapped within the lagoon
- Avoidance of collision with active turbines, e.g. active acoustic monitoring and deterrents or shut down
- Good practice and embedded mitigation
- Consideration of the siting / location of infrastructure to reduce any potential barrier effects

Conclusion for Site

Further assessment is required to determine the potential for any adverse effects on the integrity of the European Designated Sites, qualifying features, prey availability or supporting habitats as there is currently not enough information for the high level project assessment to rule out any potential for any adverse effects for:

- **Changes in habitat**
- **Changes in water quality**
- **Increased suspended sediment**
- **Underwater noise**
- **Collision risk with vessels**
- **Collision risk with operational turbines**
- **Barrier effects to movements**
- **Changes to prey availability**
- **In-combination effects**

However, for the plan-level assessment there would be no potential for any adverse effects on the integrity of the cSAC in relation to their conservation objectives for harbour porpoise.

Where, × = no potential effects on integrity European Designated Site; and ? = potential effects on integrity European Designated Site and qualifying feature.

7.1.2 North Anglesey Marine / Gogledd Mon Forol cSAC

Site	Qualifying Features	Distance to SRA
North Anglesey Marine / Gogledd Mon Forol cSAC (UK0030398)	Harbour porpoise 1351	North SRA (30.54km) South SRA (278.07km)

Conservation Objectives (summary) – full details in Table A1.2 Appendix 1

- Avoid the deterioration of suitable habitat
- Avoid significant disturbance to harbour porpoise
- The species must be a viable component of the site
- Supporting processes and prey species should be maintained

Vulnerabilities (summary) – full details in Table A1.2 Appendix 1

- Removal of non-target fishing species and bycatch of harbour porpoise
- Contaminant discharges or run-off from landfill sites and terrestrial and offshore industries
- Anthropogenic underwater noise (shipping / drilling / dredging and disposal / aggregate extraction / piling / acoustic surveys / underwater explosions (UXO) / military activity / ADDs / recreational boating
- Collision with vessels (commercial or recreational)
- Collision with tidal energy installations

Impact Assessment - further details in Section 4, Section 5 and Appendix 2

Potential Impact	Potential effects on integrity European Designated Site – high level project assessment	Potential effects on integrity European Designated Site – high level plan assessment
Direct habitat loss	×	×
Changes in habitat	?	×
Changes in water quality	?	×
Increased suspended sediment	?	×
Underwater noise	?	×
Airborne noise	×	×
Visual disturbance	×	×
Collision risk with vessels	?	×
Collision risk with turbines	?	×
Barrier effects	?	×
Changes in prey availability	?	×
In-combination effects	?	×

Possible Avoidance and/or Mitigation Measures – also see Section 6

- Use of vibro-piling wherever possible
- JNCC piling protocols and soft start procedures with MMO / PAM / ADD for any percussive piling
- Noise reduction methods
- Capture and release protocol for any marine mammals that become trapped within the lagoon
- Avoidance of collision with active turbines, e.g. active acoustic monitoring and deterrents or shut down
- Good practice and embedded mitigation
- Consideration of the siting / location of infrastructure to reduce any potential barrier effects

Conclusion for Site

Further assessment is required to determine the potential for any adverse effects on the integrity of the European Designated Sites, qualifying features, prey availability or supporting habitats as there is currently not enough information for the high level project assessment to rule out any potential for any adverse effects for:

- **Changes in habitat**
- **Changes in water quality**
- **Increased suspended sediment**
- **Underwater noise**
- **Collision risk with vessels**
- **Collision risk with operational turbines**
- **Barrier effects to movements**
- **Changes to prey availability**
- **In-combination effects**

However, for the plan-level assessment there would be no potential for any adverse effects on the integrity of the cSAC in relation to their conservation objectives for harbour porpoise.

Where, × = no potential effects on integrity European Designated Site; and ? = potential effects on integrity European Designated Site and qualifying feature.

7.2 Otter

7.2.1 Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC

Site	Qualifying Features	Distance to SRA
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC (UK0020020)	Otter 1355	South SRA (16.39km – marine) South SRA (7.32km – on land)
Conservation Objectives (summary) – full details in Table A1.2 Appendix 1		
• Population is maintaining itself on a long-term basis as a viable component of its natural habitat (population size, structure and production) • Contaminant burdens from human activity are below levels that may cause physiological damage, immune or reproductive suppression • The species natural range should not be reduced and movement between areas should not be restricted or hindered, there should be sufficient prey species within the site and beyond, and supporting habitats should be accessible and their extent and quality should be stable or increasing • The presence, absence, condition and diversity of habitat and supporting species is sufficient to ensure the population of otter on the site is stable or increasing • The abundance of prey species subject to commercial fishing should be equal to or greater than that required to achieve maximum sustainable yield • Contamination of prey species should be below the level at which it would be harmful to physiological health • Disturbance by human activity should be below the level at which it would cause suppress reproductive success, physiological health to long-term behaviour • The should be sufficient sources within the SAC and beyond of high quality freshwater for drinking and bathing		
Vulnerabilities (summary) – full details in Table A1.2 Appendix 1		
• Docks, marinas and shipping – construction and dredging, discharges of fuel • Construction • Waste disposal • Commercial fishing and aquaculture • Water abstraction • Oil and gas exploration • Renewable energy generation (including tidal barrages and impoundment) • Oil spills • Recreational activities (including boating and eco-tourism) • Military activity • Educational and scientific research activities		
Impact Assessment - further details in Section 4, Section 5 and Appendix 2		
Potential Impact	**Potential effects on integrity European Designated Site – high level project assessment**	**Potential effects on integrity European Designated Site – high level plan assessment**
Direct habitat loss	×	×
Changes in habitat	?	×
Changes in water quality	?	×
Increase in suspended sediment	?	×
Underwater noise	×	×
Airborne noise	×	×
Visual disturbance	×	×
Collision risk with vessels	×	×
Collision risk with turbines	?	×
Barrier effects	×	×
Changes in prey availability	?	×
In-combination effects	?	×
Possible Avoidance and/or Mitigation Measures – also see Section 6		

• Avoidance of collision with active turbines, e.g. active acoustic monitoring and deterrents or shut down • Good practice and embedded mitigation • Avoid any disturbance to otters during sensitivity periods, such as breeding season
Conclusion for Site
Further assessment is required to determine the potential for any adverse effects on the integrity of the European Designated Sites, qualifying features, prey availability or supporting habitats as there is currently not enough information for the high level project assessment to rule out any potential for any adverse effects for: • **Changes in habitat** • **Changes in water quality** • **Increased suspended sediment** • **Collision risk with operational turbines** • **Changes to prey availability** • **In-combination effects** **However, for the plan level assessment there would be no potential for any adverse effects on the integrity of the SAC in relation to their conservation objectives for otter.**

Where, ✖ = no potential effects on integrity European Designated Site; and ? = potential effects on integrity European Designated Site and qualifying feature.

8 Consideration of applicability of the A6(4) IROPI process

Thissection considers the applicability of the A6(4) IROPI process, and the extent to which compensatory measures might reasonably be delivered as part of Tidal Lagoon developments.

308 The Habitats Directive provides a clear framework and flexible instruments within which appropriate decisions can be taken, so that the right balance can be struck between economic development and habitat/species conservation. For example, it makes provision for adverse effect on site integrity if there are Imperative Reasons of Overriding Public Interest (IROPI). The relevant Article, 6(4), states that:

"'*If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted*."

8.1 IROPI

309 'It is reasonable to consider that the "imperative reasons of overriding public interest, including those of social and economic nature" refer to situations where plans or projects envisaged prove to be indispensable:

- within the framework of actions or policies aiming to protect fundamental values for the citizens' life (health, safety, environment);
- within the framework of fundamental policies for the State and the Society;
- within the framework of carrying out activities of economic or social nature, fulfilling specific obligations of public service.'

8.2 Compensation

310 'The compensatory measures constitute measures specific to a project or plan, additional to the normal practices of implementation of the "Nature" Directives. They aim to offset the negative impact of a project and to provide compensation corresponding precisely to the negative effects on the species or habitat concerned. The compensatory measures constitute the "last resort". They are used only when the other safeguards provided for by the directive are ineffectual and the decision has been taken to consider, nevertheless, a project/plan having a negative effect on the Natura 2000 site.'

311 Compensation for disturbance of Annex II species is unprecedented, however, the following compensatory measures could be considered:

- Maintaining or improving prey species availability (see proposed compensation measures in the HRA for Fish and Supporting Environments (ABPmer, 2017)).
- Creation of highly protected areas within the nearest SAC or cSAC, where no activity is allowed.

- Reduction of other threats (e.g. bycatch).
- If, or where, there could be the potential risk of changes to sandbanks that could affect seal haul-out sites, then measures to reduce any impacts could be considered such as maintaining and replenishing sandbanks.

There is uncertainty in the specific features that could be adversely affected by a specific Tidal Lagoon project, therefore the requirements for compensation measures are difficult to determine for the plan level assessment. However, if compensation measures are required, they should be of a comparable size and type to the habitats that could be lost of affected. This could therefore be achievable by maintaining or replenishing any sandbanks that are important seal haul-out sites and supporting habitats to designated sites.

9 Conclusions

This section summarises the marine mammal and otter HRA for the Tidal Lagoon Policy of the Wales National Marine Plan, with concluding remarks on the outcomes of the assessment.

312 This plan-level HRA for the WNMP Tidal Lagoon Policy has determined the potential for any adverse effect of the Tidal Lagoon Policy (alone or in-combination) on the integrity of the screened in European Designated Sites where marine mammals are a qualifying feature, in relation of the sites conservation objectives.

313 The assessment determined that there are currently no European Designated Sites where marine mammals, including otters are a qualifying feature, that are located within or overlap with the marine area SRAs that could be impacted by any direct habitat loss. It is therefore concluded that any potential effects associated with any direct loss of habitat would not result in an adverse effect on the integrity of any European Designated Sites where marine mammals are a qualifying feature, in relation of the sites conservation objectives.

314 Three European Designated Sites (Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC for harbour porpoise; North Anglesey Marine / Gogledd Mon Forol cSAC for harbour porpoise; and Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC for otter) are located within the maximum potential impact range for any changes in habitat extent, type or quality. The plan-level assessment determined there would be no potential for any adverse effects on the integrity of these, or any other European Designated Sites, in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal, harbour seal or otter, especially when taking into account the natural variation across the range of marine mammals and their prey. However, further assessment would be required for each Tidal Lagoon project to determine any potential impacts, including supporting habitats, such as sandbanks, and prey availability.

315 The three European Designated Sites are also located within the maximum potential impact range for any changes in water quality. However, taking into account the embedded mitigation and best practice, determined there should be no potential for any adverse effects on the integrity of any SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal, harbour seal or otter, as a result of any changes in salinity or dissolved oxygen, increased suspended sediments and contaminants, or risk from regulated and accidental discharges.

316 The assessment for the potential disturbance from underwater noise concluded that there is currently not enough information for the high level project assessment to rule out any potential for any adverse effects on the integrity of the European Designated Sites. Therefore, further assessment is required. However, for the high level plan assessment, taking into account the temporary nature of any disturbance from underwater during construction, the mitigation measures that could be implemented to reduce the potential impact range of disturbance from underwater noise, the relatively small area that could be temporarily affected compared to the range of marine mammals within the management units and designated sites, the potential for any long term significant effects is unlikely.

317 Any potential disturbance of the grey seal haul-out site close to the northern SRA could be significantly reduced by implementing mitigation measures such as a minimum distance that vessels can pass the haul-out site, especially during sensitive periods, such breeding and the moult period for grey seal. Therefore for the plan-level assessment, with the proposed mitigation in place, there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for grey seal, as a result of disturbance from vessels passing the haul-out site.

318 The assessment indicates that there would be no potential for any adverse effects on the integrity of the SACs in relation to their conservation objectives for otter, as a result of any visual disturbance associated with Tidal Lagoons in the SRAs.

319 The number of marine mammals the could be potentially be at increased collision risk with vessels is likely to be relatively low, taking into account the condensed vessel activity in the vicinity of the Tidal Lagoons, the relatively slow travelling speeds of the vessels and the relatively small increase in the numbers of vessel in comparison to the vessel density in the wider area.

320 For the plan-level assessment, taking into account the implementation of effective mitigation measures, there should be very little potential for any significant collision risk with operational turbines and any adverse effects on the integrity of European Designated Sites. However, further assessment would be required at the project level.

321 With a better understanding of the movements of marine mammals along coastal areas in the SRAs and the positioning of any Tidal Lagoons outwith any areas that could result in any potential barrier effects to the movements of marine mammals, would reduce and limit the potential for any adverse effects on designated sites in the plan-level assessment.

322 The plan-level assessment determined, taking into account the implementation of effective mitigation measures, that there should be very little potential for any significant changes to prey availability that could result in any adverse effects on the integrity of European Designated Sites designated for marine mammals. However, as concluded in the HRA for Fish and Supporting Environments (ABPmer, 2017), further assessment is required for each Tidal Lagoon project to determine the potential for any adverse effects on the prey species of marine mammals.

323 There are a number of potential mitigation measures and approaches, such the implementation of an Environmental Monitoring and Adaptive Management Plan (EMAMP) and Marine Mammal Mitigation Plan (MMMP) which could be used to reduce the risks to marine mammals and the potential to adversely affect the integrity of the SACs and cSACs in relation to their conservation objectives for harbour porpoise, bottlenose dolphin, grey seal or otter.

324 The successful execution of any compensatory measures for marine mammals would be challenging, therefore if required, it is proposed that the best option would be to maintain or improve prey species availability using the proposed compensation measures in the HRA for Fish and Supporting Environments (ABPmer, 2017) and seal haul-out sites.

325 The information within this report should be sufficient for the ‘Competent Authority’ to conduct an Appropriate Assessment.

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Appendices

A1 Annexed tables of site features

Table A1.1: Initial pre-supplied list of designates sites for harbour porpoise, bottlenose dolphin, grey seal and otter screened in at the pre-screened stage (list supplied by the Welsh Government, 10th August 2017)

Site Name	Nearest SRA (distance)	Qualifying Feature	Reason for Initial Screening In Pre-Screening)	Included within the original AMEC Foster Wheeler HRA (2017)?
Abers - Cotes des Legendes SAC (FR5300017)	South (381.65km)	Bottlenose dolphin 1349	ZOI intersects Harbour porpoise MMMU	Yes
		Harbour porpoise 1351	ZOI intersects Bottlenose dolphin MMMU	Yes
Afon Gwyrfai a Llyn Cwellyn SAC (UK0030046)	North terrestrial (35.75km)	Otter 1355	Within 50 km below MHWS	Yes
Afon Tywi/ River Tywi SAC (UK0013010)	South terrestrial (29.13km)	Otter 1355	Within 50 km below MHWS	Yes
Anse de Vauville SAC (FR2502019)	South (486.81km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Baie de Lancieux, Baie de l'Arguenon, Archipel de Saint Malo et Dinard SAC (FR5300012)	South (492.57km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	No
Baie de Morlaix SAC (FR5300015)	South (399.02km)	Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Baie de Seine occidentale SAC (FR2502020)	South (561.66km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Baie de Seine orientale SAC (FR2502021)	South (619.57km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Baie du Mont Saint-Michel SAC (FR2500077)	South (533.77km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Banc et Recifs de Surtainville (FR2502018)	South (488.53km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Blasket Islands SAC (IE0002172)	South (496.02km)	Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC (UK0030396)	South (54.06km) North (257.80km)	Harbour porpoise 1351	Within 50 km below MHWS	Yes

Site Name	Nearest SRA (distance)	Qualifying Feature	Reason for Initial Screening In Pre-Screening)	Included within the original AMEC Foster Wheeler HRA (2017)?
Cap d'Erquy-Cap Frehel SAC (FR5300011)	South (484.45km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
		Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Cardigan Bay/ Bae Ceredigion SAC (UK0012712)	North (149.28km) South (165.54km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
		Grey seal 1364	ZOI intersects seal MMMU	Yes
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC (UK0020020)	South marine (16.39km) South terrestrial (7.32km)	Otter 1355	Within 50 km below MHWS	Yes
Chausey SAC (FR2500079)	South (510.97km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Chaussée de Sein SAC (FR5302007)	South (434.02km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
		Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Côte de Cancale á Parame (FR5300052)	South (520.85km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Cote de Granit rose-Sept-Iles (FR5300009)	South (395.78km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
		Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Exmoor and Quantock Oakwoods SAC (UK0030148)	South (13.31km (9.77km to coast, 3.54km from coast to site))	Otter 1355	5 km site buffer within 50 km SRA buffer	Yes
Isles of Scilly Complex SAC (UK0013694)	South (233.60km) North (425.99km)	Grey seal 1364	ZOI intersects seal MMMU	Yes
Lundy SAC (UK0013114)	South (60.78km) North (295.23km)	Grey seal 1364	Zone intersects Seal MMMU	Yes
North Anglesey Marine / Gogledd Mon Forol cSAC (UK0030398)	North (30.54km) South (278.07km)	Harbour porpoise 1351	Within 50 km below MHWS	Yes

Site Name	Nearest SRA (distance)	Qualifying Feature	Reason for Initial Screening In Pre-Screening)	Included within the original AMEC Foster Wheeler HRA (2017)?
North Channel cSAC (UK0030399)	North (130.00km) South (372.32km)	Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Ouessant-Molene SAC (FR5300018)	South (382.33km)	Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
		Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Pembrokeshire Bat Sites and Bosherston Lakes/Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC (UK0014793)	South marine (68.23km)	Otter 1355	5 km site buffer within 50 km SRA buffer	Yes
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	South (58.76km) North (202.25km)	Grey seal 1364	ZOI intersects seal MMMU	Yes
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC (UK0013117)	North terrestrial (44.96km) North marine (70.23km) South (223.63km)	Bottlenose dolphin 1349	Within 50 km below MHWS	Yes
		Grey seal 1364	Within 50 km below MHWS	Yes
		Otter 1355	Within 50 km below MHWS	Yes
Recifs et landes de la Hague SAC (FR2500084)	South (482.46km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
Recifs et marais arriere-littoraux du Cap Levi á la Pointe de Saire SAC (FR2500085)	South (521.42km)	Bottlenose dolphin 1349	ZOI intersects Bottlenose dolphin MMMU	Yes
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC (UK0030252)	North (25.4km)	Otter 1355	Within 50 km below MHWS	Yes
River Usk/ Afon Wysg SAC (UK0013007)	South (0km)	Otter 1355	Within 2km inland	Yes
River Wye/ Afon Gwy SAC (UK0012642)	South (0km)	Otter 1355	Within 50 km below MHWS	Yes
Roaringwater Bay and Islands SAC (IE0000101)	South (384.48km) North (438.55km)	Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Rockabill to Dalkey Island SAC (IE0003000)	North (147.30km) South (275.15km)	Harbour porpoise 1351	ZOI intersects Harbour porpoise MMMU	Yes
Tregor Goelo SAC (FR5300010)	South (415.49km)	Bottlenose dolphin 1349	ZOI intersects Harbour porpoise MMMU	Yes
		Harbour porpoise 1351	ZOI intersects Bottlenose dolphin MMMU	Yes
West Wales Marine / Gorllewin Cymru Forol cSAC (UK0030397)	North (69.04km)	Harbour	ZOI intersects Harbour porpoise	Yes

Site Name	Nearest SRA (distance)	Qualifying Feature	Reason for Initial Screening In Pre-Screening)	Included within the original AMEC Foster Wheeler HRA (2017)?
	South (84.27km)	porpoise 1351	MMMU	

MMMU = Marine Mammal Management Unit; ZOI = Zone of Influence; MHWS = Mean High Water Spring tide

Royal HaskoningDHV

Table A1.2: Site descriptions, Conservation Objectives and Vulnerabilities for all sites

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
Abers - Cotes des Legendes SAC (FR5300017)	This site covers an area of 2,217.4km^2 and lists both bottlenose dolphin and harbour porpoise as qualifying features. The site includes feature such as Islands, Islets and reefs along the north French coast. The area is important for marine mammals due to the thermal fronts in summer periods.	South (381.65km)	DREAL Bretagne	Bottlenose dolphin 1349	Screened out – outwith IS MU	No translation available.	No translation available.	No translation available.	Natura 2000 form
				Harbour porpoise 1351	**Screened in** – within 400km range of SRA	No translation available.	No translation available.	No translation available.	Natura 2000 form
Afon Gwyrfai a Llyn Cwellyn SAC (UK0030046)	This site covers an area of 11.43km^2 and lists otter as a qualifying feature. The site includes the Afon Gwyrfai and the Llyn Cwellyn and a small lake on the slopes on Snowdon. There are areas of semi-natural wetland riparian habitat and is recognised for its excellent example of a deep (maximum 37m) oligotrophic lake formed during the last ice age. It has nutrient-poor waters that support a number of macrophytes and one of the best populations of floating water plantain in the UK. There are a relatively high number of otter present within this site due to the natural riparian habitat and dense cover and is a key species throughout the site.	North (35.75km – on land)	NRW	**Otter 1355**	**Screened in** - Within 40km on land of identified SRAs	**Conservation Objectives** The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour. • The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. The size of breeding territories may vary depending on prey abundance. • The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site is subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance are managed. • The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers. • All factors affecting the achievement of these conditions are under control. **Performance Indicators** *A1. Population distribution.* Although Performance Indicators are given it is difficult to assess the condition of the otter population distribution feature because of the relatively small size of the SAC areas compared to the typical home range size of otters. As otters are mobile animals occupying very large home ranges, the condition of the otter feature should be considered at the landscape level. *Upper limit: None set.* *Lower limit: Otter signs are found at five of the seven (71%) sites searched within the Gwyrfai* *A2. Breeding activity* Breeding Centres are used to provide an estimate of the number of females breeding in the system. They can only be a "best guess" but are based on our present knowledge of the size of otter home ranges, the juxtaposition of potential breeding sites, and records of breeding activity for the catchment. *Upper limit: None set.* *Lower limit: Breeding Centre: There should be no deterioration in, or loss of, bank side habitats within the assumed breeding centre.* *A3. Actual & potential breeding sites.* Within the home range of a single female there may be two or more potential breeding sites. When this is the case, the female may use a different breeding site each year (Liles, 2003). Birth	Population: Unfavourable Extent: Favourable Quality of the Feature: Unfavourable	**Management Requirements** An increase from 5 to at least 8 potential breeding sites is required. These should be located in lower and upper catchments; recommended sites are GW1, GW12, GW14.	CCW, 2008a

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						takes place in a Natal Den, either above ground in a small patch of cover (i.e.1m x 1m) such as scrub or a pile of timber, or below ground, for example in a tree root system or a pile of boulders. Females often use a different natal den site each year (Liles, 2003). Although targets are set for the number of Potential Breeding sites within the SAC areas and wider subcatchments, the quality, habitat type, and location of sites is also important. Priority should be given to retaining existing sites. If the number or quality of sites does decline, alternative breeding sites can be created at nearby Habitat Improvement Sites. *Lower limit: There should be an increase in the number of mapped potential breeding sites on the Gwyrfai from five to eight.* *Upper limit: None set* *F1. Water quality* Based on Table 1a of JNCC's Common Standards Monitoring Guidance for Rivers (Current version – March 2005), for the Attributes: "Habitat functioning: water quality (General assessments)" and "Habitat functioning: water quality". *Upper limit: None set* *Lower limit: Chemical GQA Class: B, Biological GQA Class: B* *F2. Water quantity (flow)* Flow regime should be characteristic of the river. *Upper limit +10% of naturalised flow* *Lower limit: -10% of naturalised flow* *F3. Food availability & riparian habitat* The availability of food within the catchment is likely to be a major factor influencing both the distribution and breeding success of otters. *Upper limit: None set.* *Lower limit: Fish & amphibian biomass should stay within expected fluctuations.* *F4. Invasive alien species* Japanese knotweed is found growing next to the watercourses and is usually controlled via herbicides. Herbicide handled inappropriately may enter the water course and poison fish and invertebrates. Assessment of plans and projects. *F5. Coarse woody debris (CWD)* Where CWD has accumulated alongside the river bank it can create suitable sites for laying up couches and natal dens. *F6. Illegal fish poaching* Removal of salmonids. Insufficient data. *F7. Diffuse & point source pollution* *F8. Agricultural operations* *F9. Forestry operations* *F10. River engineering* *F11. Recreation* Breeding otters can be sensitive to disturbance by humans and dogs so recreational areas should be sited at a distance from suitable breeding habitat and known breeding dens. *F12. Deposition atmospheric pollution* Eutrophication and acidifcation can have an indirect impact on			

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						otter by affecting the food chain. *F13. Climate change* Change in rainfall patterns and increased flooding could affect the otter breeding cycle and success rates if natal dens are flooded and feeding patterns disrupted.			
Afon Tywi/ River Tywi SAC (UK0013010)	The site covers an area of 36.35km^2 with otter listed as a primary reason for site designation. The site lies at the base of the Cambrian Mountains covering the Afon Tywi for 10km before reaching the Llyn Brianne reservoir. Along the river banks are diverse and high quality riparian habitats with areas of wet woodland, oxbow lakes and willow scrub that provide important habitat and breeding sites for otter. Otter are a key species of the whole site.	South (29.13km – on land)	NRW	**Otter 1355**	**Screened in** - Within 40km on land of identified SRAs	**Conservation Objectives** The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour. • Refer to section 5.9 for current assessment of feature population The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. The whole area of the Tywi SAC is considered to form potentially suitable breeding habitat for otters. The size of breeding territories may vary depending on prey abundance. The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed. • Survey information shows that otters are widely distributed in the Tywi catchment. While the breeding population in the Tywi is not currently considered to be limited by the availability of suitable breeding sites, there is some uncertainty over the number of breeding territories which the SAC is capable of supporting given near-natural levels of prey abundance. The decline in eel populations may be having an adverse effect on the population of otters in the Tywi. The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers. • Otter road deaths could have a potentially significant impact on otter populations within the Tywi catchment. 56 individuals deaths were recorded from Carmarthenshire between 1983 & 2002, 12 of which were adult females. A number of mitigation schemes have been undertaken by the Trunk Roads Authority and Carmarthenshire CC Highways Dept. at sites flagged as blackspots. **Performance Indicators** *A1. Distribution* Otter signs present at 70% of Otter Survey of Wales sites (CCW, 2005) • The Otter Survey of Wales undertaken in 2002 surveyed 86 reference sites in the Tywi catchment, of which 77%	Favourable.	• The site could support a further 8 breeding pairs, ensure there is sufficient undisturbed breeding habitat • Decline in eel populations leading to loss of prey • Road mortalities • Improvement to bankside habitats should be made • Ledges, tunnels and fencing on new road schemes and retro-fitted in areas of high mortality • Pollution of rivers with toxic chemicals, such as PCBs	CCW, 2008b

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						were positive. This continued an upward trend in signs from 14% in 1977; 68% in 1984; 69% in 1991. • The next survey is planned in 2009, but CCW are currently considering a rolling programme of sub-catchment survey every 2 years using Otter Survey of Wales full survey sites. The 3 sub-catchments identified in Morgan (2005) would therefore be surveyed once in every six years. *A2. Breeding activity* 2 reports of cub/family sightings, or 2 reports of cub, lactating or pregnant female road casualties at least 1 year in 3. • Based on current information 5 centres of breeding activity have been estimated within the SAC. These sit with a reach of 67km and therefore exceed the estimate of 1 breeding female per 20km. However each of these centres includes the confluence of at least 1 major tributary, whose contribution is not take into account. *A3. Actual and potential breeding sites* No decline in number and quality of mapped breeding sites in sub-catchments. • In the Tywi catchment, 101 actual or potential breeding sites have been identified, distributed throughout the catchment on the main river and tributaries.			
Anse de Vauville SAC (FR2502019)	This site covers a marine area of 130.7km^2 with bottlenose dolphin listed as a primary reason for site designation. The site covers a shallow area with sloping from the coast offshore, with a maximum water depth of 37m. The site has large hydrodynamic influences from swells and tidal currents and these are an important part of the site's designation. There are regular sightings of bottlenose dolphins within this site, and forms part of the Gulf of Normanobreton which has a resident population of bottlenose dolphins, **estimated to have 150-200 individuals**.	South (486.81km)	Services de l'Etat sous l'autorité du Préfet maritime de la Manche et de la mer du Nord Environnement Maritime - Division Action de l'Etat en Mer	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	Being a site close to the coast, there are a number of anthropogenic activities (fishing Professional and leisure activities, water sports), which will need to be more closely identified in the management phase. Their effects on the conservation of habitats and species of community interest, whether positive, negative or neutral, remains to be assessed. The habitat "hydraulic dunes", which prevailed in the proposal of the site, is dependent on the special hydrodynamic conditions. Particular attention will be paid to projects likely to modify these hydrodynamic conditions.	Natura 2000 Form
Baie de Lancieux, Baie de l'Arguenon, Archipel de Saint Malo et Dinard SAC (FR5300012)	No translation available.	South (492.57km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
Baie de Morlaix SAC (FR5300015)	No translation available.	South (399.02km)	No translation available.	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	No translation available.	No translation available.	No translation available.	
Baie de Seine occidentale SAC (FR2502020)	No translation available.	South (561.66km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Baie de Seine orientale SAC (FR2502021)	No translation available.	South (619.57km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Baie du Mont Saint-Michel SAC (FR2500077)	No translation available.	South (533.77km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Banc et Recifs de Surtainville (FR2502018)	No translation available.	South (488.53km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Blasket Islands SAC (IE0002172)	This site covers an area of 227.12km^2 with harbour porpoise listed as a qualifying feature of the site. The Blasket Islands are located at the end of the Dingle Peninsula in County Kerry, with the site covering all the Islands are the surrounding marine areas. The site is important for harbour porpoise with relatively high abundances recorded with regular presence. There are an **estimated 267-477 harbour porpoise** present within the site.	South (496.02km)	National Parks and Wildlife Service	Harbour porpoise 1351	Screened out - Outwith 400km range of SRAs	To maintain the favourable conservation condition of Harbour Porpoise in Blasket Islands SAC, which is defined by the following list of attributes and targets: *Access to suitable habitat* Number of artificial barriers: Species range within the site should not be restricted by artificial barriers to site use. *Disturbance* Level of impact: Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site.	N/A	N/A	NPWS, 2014
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC (UK0030396)	The site covers an area of 5,850 km^2, covering the northern Cornwall and north Devon coastlines up to Carmarthen Bay along the south Wales coast and the marine area, including Lundy Island. The water depths within the site range between the **MLWT level and 70m**, with the majority of the site being 50m in depth, with steep slopes up to the shoreline towards the Cornish coast, and much shallower slopes up to Carmarthen Bay. The majority of the seabed is formed of sublittoral coarse sediments. (JNCC, 2017p). The Lundy SAC lies fully within the site, with parts of Pembrokeshire Marine SAC also covered. The site has been recognised as an area within the top 10% predicted **persistent high densities of harbour porpoise for both important summer and winter habitats** (JNCC, 2017p). This site is located within the Celtic and Irish Seas harbour porpoise MU. The **estimated harbour porpoise population is 2,147 individuals (95% CI = 810-5,693)** for at least part of the year, based on **approximately 4.7% of the UK Celtic and Irish Seas MU** (JNCC, 2017p).	South (54.06km) North (257.80km)	JNCC, NRW	**Harbour porpoise 1351**	**Screened in -** Within 50km range of SRA	To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: 1. The species is a viable component of the site. 2. There is no significant disturbance of the species. 3. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.	N/A	**Removal of non-target species:** Commercial fisheries with bycatch of harbour porpoise (predominantly static nets) and commercial fisheries (reduction in prey resources) **Contaminants:** Discharge/run-off from landfill, terrestrial and offshore industries **Anthropogenic underwater sound:** Shipping, drilling, dredging and disposal, aggregate extraction, pile driving, acoustic surveys, underwater explosion, military activity, acoustic deterrent devices and recreational boating activity **Death or injury by**	NRW *et al.*, 2016

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								collision: Shipping, recreational boating, tidal energy installations	
Cap d'Erquy-Cap Frehel SAC (FR5300011)	No translation available.	South (484.45km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
				Harbour porpoise 1351	Screened out - Outwith 400km range of SRAs	No translation available.	No translation available.	No translation available.	
Cardigan Bay/ Bae Ceredigion SAC (UK0012712)	The site covers **958.57 km²** in the southern extent of Cardigan Bay extending approximately 12 miles offshore, with 99.5% of the SAC comprising of marine areas and inlets. The site was primarily designated for the bottlenose dolphin, with grey seal listed as a qualifying feature, alongside river and sea lamprey and three Annex 1 habitats; sandbanks, reefs and sea caves (CCW, 2009a). Sediments present at the site range from highly homogenous sands to well mixed muddy gravels, pebbles and cobble. The site is relatively shallow, only reaching water depths of 50m in the outer parts of the Bay towards St Georges Channel, with the majority of the SAC being **less than 30m in depth** (CCW, 2009a). Mean **spring tides range from 4-5m** with generally **low tidal currents of less than 1.8 knots**. **Surface salinities within the Bay are generally less than 35%**, decreasing towards the coastline (CCW, 2009a). Bottlenose dolphins are seen year-round within the site, peaking in late September and October where large groups can be seen. Calving of bottlenose dolphins is known to occur in the site, with **very young calves being noted in the spring and summer months**. This site and the Llyn Peninsula and the Sarnau should be considered together due to the strong connectivity between the two. Recent population estimates for the wider Cardigan Bay vary between **254 and 330 animals (CV = 0.25 – 0.28)** for the years 2011 and 2013 inclusive (Feingold and Evans, 2014b). This site is within the Irish Sea MU for bottlenose dolphin. Grey seals within the site are not part of a discrete population but a part of the wider south-west Wales population, which is estimated to be **5,000 individuals**. **Cemaes is the most important pupping area** within the SAC, with significant numbers also born at Lochtyn, Aberporth and Cardigan. From 1992-1994, it was estimated that **66 pups were born** the site per year, **representing 1.7% of the West Wales pup population** (CCW, 2009a). The site is located within the West England and Wales MU for grey seal (IAMMWG, 2013).	North (149.28km) South (165.54km)	NRW	**Bottlenose dolphin 1349**	**Screened in** - Within IS MU	**Populations** The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include: - population size - structure, production - condition of the species within the site. As part of this objective it should be noted that for bottlenose dolphin and grey seal; • Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression • For grey seal populations should not be reduced as a consequence of human activity **Range** The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. As part of this objective it should be noted that for bottlenose dolphin and grey seal; • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered; • There are appropriate and sufficient food resources within the SAC and beyond • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing **Supporting Habitats and Species** The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include; - distribution - extent - structure - function and quality of habitat - prey availability and quality. As part of this objective it should be noted that; • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; • The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health; • Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour **Restoration and recovery** • As part of this objective it should be noted that for the bottlenose dolphin populations should be increasing.		**Docks, marinas & shipping** • Dock, harbour & marina structures: Construction & Maintenance • Dredging: capital & maintenance • Shipping: vessel traffic, moorings, vessel maintenance, ballast water discharge, refuse & sewage disposal, operational discharges, accidents (may be associated with **Civil engineering** • Construction • Land claim • Coast protection and defence • Barrages • Artificial reef • Power station • Pipelines • Power / communication cables **Waste disposal** • Effluent disposal: sewage and chemical, thermal • Sludge dumping • Wastes & debris (including refuse & litter) • Dredge spoil disposal • Urban & industrial run-off • Agricultural run-off **Exploitation of living resources** • Trawling: beam or	CCW, 2009a
				Grey seal 1364	**Screened in** - Within 250km range of SRAs				

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								otter, dredging (scallop, mussel & oyster, hydraulic dredge) • Netting: gill, tangle, trammel, beach seine, demersal seine, salmon, fyke • Potting • Commercial line fishing • Bait collection (*not grey seal*) • Aquaculture: land-based semi-enclosed **Exploitation of non-living Resources** • Water abstraction • Renewable energy generation: tidal barrage, coastal wave or tidal current **Pollution response** • Oil spill response: at sea, shore cleaning – washing, chemical, physical & ancillary **Recreation** • Recreational boating: high speed power craft (incl. PWC) • Coastal shore recreation (bathing, dog walking, coasteering, etc.), • Vehicles on foreshore • Wildfowling **Miscellaneous operations & uses** • Marine archaeology and salvage • Education & science	
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC	The site covers an area of 660.92km^2 and lists otter as a qualifying species. The site covers both the estuaries and the rivers Loughor, Taf, Tywi and Gwendraeth with extensive areas of mud and sandflats. Otters are known to breed around 1km inland on the	South marine (16.39km) South terrestrial	NRW	**Otter 1355**	**Screened in -** Within 40km on land of identified SRAs	**Populations** The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements are population size, structure, production, and condition of the species within the site. As part of this objective it should be noted that:		**Docks, marinas & shipping** • Dock, harbour & marina structures: Construction &	CCW, 2009b

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
(UK0020020)	Gwendraeth Fach and use the estuary for foraging, with evidence of further breeding near Landimore Marsh. Otters are able to forage as far as 100m offshore in waters up to 10 in depth, but most is done in waters less than 3m deep	(7.32km)				• Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression **Range** The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. As part of this objective it should be noted that • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered • There are appropriate and sufficient food resources within the SAC and beyond • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing **Supporting habitats and species** The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include; - distribution, - extent, - structure, - function and quality of habitat, - prey availability and quality. As part of this objective it should be noted that; • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term. • The management and control of activities or operations likely to adversely affect the species feature, is appropriate for maintaining it in favourable condition and is secure in the long term. • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health. • Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour • For otter there are sufficient sources within the SAC and beyond of high quality freshwater for drinking and bathing.		Maintenance • Dredging: capital & maintenance • Shipping: vessel traffic, vessel maintenance, refuse & sewage disposal, operational discharges, accidents (may be associated with • cargo / bunkers discharges or fuel oil & / or petrochemical discharges or salvage operations) **Civil engineering** • Construction • Land claim • Coast protection: hard defence (sea walls / breakwaters / railways) • Artificial reef • Hard-engineered freshwater watercourses • Power station • Pipelines • Power / communication cables **Waste disposal** • Effluent disposal: domestic, industrial, thermal sludge dumping & Inorganic wastes & debris (including refuse & litter) • Dredge spoil disposal • Urban & industrial run-off • Agricultural run-off **Exploitation of living resources** • Trawling: beam or otter • Netting: bottom-set gill, bottom-set tangle / trammel, surface-set gill, beach seine,	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								demersal seine, beach-set gill or other (e.g. fyke) • Line: long-line • Fisheries; predator control • Hand gathering: crustacean / shellfish **Cultivation of living resources** • Aquaculture: finfish -sea cages or • Impoundments, crustaceans - sea cages or Impoundments, molluscan 'farming' (molluscan culture using trestles, ropes, cages or other structures), land based semi-enclosed / Recirculation, predator control or aggregation devices **Exploitation of non-living Resources** • Water abstraction • Oil & gas exploration & production: drilling, Operations, Renewable energy generation: tidal barrage, tidal • Impoundment or tidal current • Turbine **Pollution response** • Oil spill response: at sea, shore cleaning – washing, chemical, physical & ancillary **Recreation** • Bait collection: boulder turning & digging & other sediment • shore collection techniques,	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								Recreational boating: high speed power craft (incl. PWC), low speed power craft, sail & canoeing, Coastal access for recreation • (bathing, dog walking, coasteering, etc.), • Vehicles on foreshore, Wildfowling, • Marine wildlife watching / eco-tourism **Military activities** • Military activity: ordnance ranges, marine exercises & aircraft **Miscellaneous operations & uses** • Education • Science research • Animal welfare operations & sanctuaries	
Chausey SAC (FR2500079)	No translation available.	South (510.97km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Chaussée de Sein SAC (FR5302007)	No translation available.	South (434.02km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
				Harbour porpoise 1351	Screened out - Outwith 400km range of SRAs	No translation available.	No translation available.	No translation available.	
Côte de Cancale á Parame (FR5300052)	No translation available.	South (520.85km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Cote de Granit rose-Sept-Iles (FR5300009)	No translation available.	South (395.78km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
				Harbour porpoise 1351	**Screened in -** Within 400km range of SRAs	No translation available.	No translation available.	No translation available.	
Exmoor and Quantock Oakwoods SAC (UK0030148)	This site covers an area of 189.4km^2 and includes otter as a qualifying feature. The site includes an area of old sessile oak woodlands and is to be one of the best examples in the UK. There woodlands are considered to be important for otter and supports a significant presence.	South (13.31km (9.77km to coast, 3.54km from coast to site))	NE	Otter 1355	Screened out - Interaction with this site and the SRA requires travel directly across the Bristol Channel, therefore has been scoped out due to otter not travelling more	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely	N/A	N/A	NE, 2014

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
					than 100m offshore.	• The populations of qualifying species, and • The distribution of qualifying species within the site.			
Isles of Scilly Complex SAC (UK0013694)	The site covers an area of 268.49km^2 and includes grey seal as a qualifying feature. The site includes the Scilly archipelago which is of international importance. Grey seal are present at the site year round and rely on the site for regular haul-out sites and for breeding. During the winter period the seals form breeding colonies on rocky shores, beaches and in caves	South (233.60km) North (425.99km)	NE	**Grey seal 1364**	**Screened in -** Within 250km range of SRAs	Subject to natural change, maintain the population of grey seals *Halichoerus grypus* which reside in the Isles of Scilly on an annual basis. In order to meet the above objectives, relevant authorities are advised to manage activities within their remit such that they do not result in: • Reduction in the breeding success of grey seals • Reduction in the number of seals • Disturbance to seals preventing access to haul out sites.	N/A	**Recreation:** • Medium risk from the discharge from boats • Low risk from boat maintenance, scuba diving and wildlife trips **Pollution:** • Medium risk from sewage / trade effluent • Low risk from TBT / diffuse pollution **Shipping:** • Low risk from repairs / maintenance and waste **Fisheries:** • Low risk from gill / tangle nets	NE, 2010
Lundy SAC (UK0013114)	This site covers an area of 30.71km^2 and lists grey seal as a qualifying feature. The site covers Lundy which is small rocky island with a variety of coastal formations, including granite reefs.	South (60.78km) North (295.23km)	NE	**Grey seal 1364**	**Screened in -** Within 250km range of SRAs	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species • The structure and function (including typical species) of qualifying natural habitats • The structure and function of the habitats of qualifying species • The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely • The populations of qualifying species • The distribution of qualifying species within the site.	N/A	N/A	EN, 2000
North Anglesey Marine / Gogledd Mon Forol cSAC (UK0030398)	The site covers an area of 3,249km^2, reaching north-west from Anglesey into the Irish Sea. The water depths within the site range between MLWT level and 100m. Away from coastal areas, the depths largely fall within the range of 40-50m. The site contains a mixture of hard substrate and sediments, including rock, coarse sediment, sand and mud (JNCC and NRW, 2017). The site has been recognised as an area with predicted persistent high densities of harbour porpoise. The area included within the site covers **important summer habitat for harbour porpoises**, which was identified as part of the top 10% persistent high density areas for the summer seasons within the UK (JNCC and NRW, 2017). The **estimated harbour porpoise population is 1,088 individuals (95% CI = 557-2,111)** for at least part of the year, based on approximately **2.4% of the UK Celtic and Irish Seas MU** (JNCC and NRW, 2017).	North (30.54km) South (278.07km)	JNCC, NRW	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: 1. The species is a viable component of the site. 2. There is no significant disturbance of the species. 3. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.	N/A	**Removal of non-target species:** Commercial fisheries with bycatch of harbour porpoise (predominantly static nets) and commercial fisheries (reduction in prey resources) **Contaminants:** Discharge/run-off from landfill, terrestrial and offshore industries **Anthropogenic underwater sound:** Shipping, drilling,	NRW & JNCC, 2016a

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								dredging and disposal, aggregate extraction, pile driving, acoustic surveys, underwater explosion, military activity, acoustic deterrent devices and recreational boating activity **Death or injury by collision:** Shipping, recreational boating, tidal energy installations	
North Channel cSAC (UK0030399)	The site covers an area of 1,604km^2, extending from the north-east coast of Northern Ireland towards the Isle of Man and ending as it reached Manx waters. The water depths within the site range between the **MLWT level to 150m** in the north and eastern parts of the site. The site contains a mixture of coarse sediments and sand near the Irish coastlines, and increasing amounts of moderate and high energy circalittoral rock in more offshore waters, with an area of mud in the south-west of the site (The Department of Agriculture, Environment and Rural Affairs (DAERA) and JNCC, 2017). The site has been recognised as an area within the top 10% **predicted persistent high densities of harbour porpoise during the winter season** (DAERA and JNCC, 2017). The site is located in the Celtic and Irish Seas harbour porpoise MU. The **estimated harbour porpoise population is 537 individuals (95% CI = 276-1,046)** for at least part of the year, based on **approximately 1.2% of the UK Celtic and Irish Seas MU** (DAERA and JNCC, 2017).	North (130.00km) South (372.32km)	JNCC, Department of Agriculture, Environment and Rural Affairs (DAERA)	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: 1. The species is a viable component of the site. 2. There is no significant disturbance of the species. 3. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.	N/A	**Removal of non-target species:** Commercial fisheries with bycatch of harbour porpoise (predominantly static nets) and commercial fisheries (reduction in prey resources) **Contaminants:** Discharge/run-off from landfill, terrestrial and offshore industries **Anthropogenic underwater sound:** Shipping, drilling, dredging and disposal, aggregate extraction, pile driving, acoustic surveys, underwater explosion, military activity, acoustic deterrent devices and recreational boating activity **Death or injury by collision:** Shipping, recreational boating, tidal energy installations	DOE & JNCC, 2016
Ouessant-Molene SAC (FR5300018)	No translation available.	South (382.33km)	No translation available.	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	No translation available.	No translation available.	No translation available.	
				Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Pembrokeshire Bat Sites and Bosherston Lakes/Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton SAC (UK0014793)	The site covers an area of 1.21km^2 and includes otter as a qualifying species. The site covers the Bosherston Lakes system and surrounding area. The lakes are a shallow marl system created through the systematic damming and drowning of three valleys. Otters are resident within and around the lakes and have at least one breeding holt within the site. The lakes are an important area for otter with an abundance of eels which are a key prey species. Otters are a key species at	South marine (68.23km)	NRW	Otter 1355	Screened out - Outside of identified otter home range from SRA.	The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • The Otter population will be capable of maintaining itself on a long-term basis as a viable component of its natural habitats. • The natural range of otters will neither be reduced nor will be likely to be reduced for the foreseeable future, and • There will be sufficient habitat to maintain its populations	Unfavourable: declining	N/A	CCW, 2008c

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	Stackpole only.					on a long-term basis. • The otter population will be stable or increasing. • There will be a sufficiently large area of suitable habitat to support an otter breeding population, including: • Open water with sufficient food resources (notably eels and other fish species) and a continuous network of undisturbed sheltered resting places along the lake shoreline – including swamp, broadleaved woodland and calcareous scrub. • All factors affecting the achievement of these conditions are under control. **Performance indicators for feature condition** Otter population extent Bosherston Lakes is a well-studied site, with good baseline information on otters, habitat use and preferences for sprainting, resting and breeding. Target PIs for spraint density are based on 1980/81 (Henshilwood, 1981) and 1987 (Pyke, 1988) baseline survey data from whole lake shoreline). Presence of an otter population can be deduced by regular presence of fresh or recent spraint. This attribute will be determined through examination of sprainting activity. As a minimum this will be through survey, approximately once every two months, of 12 mapped sampling locations, supporting a minimum total of 38 known/ potential sprainting sites. Otter spraint records are held in Recorder 2002 (6) and in MapInfo GIS. *Units 1a, 1b and 1c: Sprainting activity and density:* *Upper limit: None set* *Lower limit: A minimum of 10 positive sprainting sites per km and at least 20% of spraints should be recent or fresh.* A2. Otter breeding activity Target PIs for holt occupancy are based on 1980/81 (Henshilwood, 1981) and 1987 (Pyke, 1988) baseline survey data from whole lake shoreline). Reliable reports of otter presence (e.g. live sightings, otter families and behaviour indicative of breeding) are obtainable, due to on site presence of CCW and NT staff and records from visitors. Holt occupancy is to be determined through annual lake-shoreline survey. Productivity/population size is to be based on observations of otters within the lakes and confirmation of signs of breeding at known/ suspected breeding holts. Locations of otter holts and sightings are held in Recorder 2002 (6) and in MapInfo GIS. *Units 1a, 1b and 1c: Holt occupancy:* *Upper limit: None set* *Lower limit: Continued presence of at least three potential breeding holts.* *Productivity/Population size:* *Upper limit: None set* *Lower limit: Presence of at least one adult female and one cub in one year out of three successive years or evidence that a breeding holt was occupied (confirmed by bedding at the entrance) and/or adult behaviour, and that breeding was therefore attempted.* F1. Food availability Without good food availability, breeding may not occur. Previous studies indicate that eels form a high proportion of the otter diet at Bosherston Lakes and that Cyprinids may also be important in their diet. Elver runs are noted each Spring and it is possible to confirm typical local prey items in remains found at feeding sites and in spraint analyses. A suitable but			

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						simple fish population monitoring method has still to be developed. *Units 1a, 1b and 1c* *Upper limit: None set* *Lower limit: Evidence of continuing eel presence (including regularly observed elver migration into Bosherston Lakes) and presence of regular shoals of Coarse fish species within the lake system and confirmation of typical local prey items in remains found at feeding sites and in spraint analyses.* F2. Anthropogenic mortality Otter deaths, e.g. from road casualties, can have a considerable bearing on the structure and viability of the resident population. However, otters may die beyond the SAC/SSSI boundary and may not be seen and recorded. This "factor" is subject to chance events, so is not easy to measure in a regular standardised way. *Units 1a, 1b and 1c* *Upper limit: None set* *Lower limit: Not more than one in any five years, with no observable impact on the overall otter population or breeding performance.* F3. Water quality/water quantity and sediment load Significant work has been achieved with partners (such as the Environment Agency) to reduce the effects of point sources of nutrients on Bosherston Lakes. Key nutrients have been monitored regularly at standardised sampling points for approx 30 years. Quite low levels of phosphorus (P) are essential to maintain regular clear water conditions and ensure healthy stonewort growth. High phosphate concentrations cause ecological changes. Phosphate and nitrate may interact. Regular water quality sampling at established locations will be used to compare nutrient levels. A sechii disk will be used to record water transparency and depth. Phosphate: To maintain such conditions, mean annual levels of Total Phosphate (TP) should not exceed 25 micrograms per litre within the spring-fed Western and Central Arms. (This is approximately the maximum concentration that appears to be necessary to maintain bristly stonewort). Within the stream-fed Eastern Arm, it may not be possible to attain quite such low levels, but here mean annual levels of TP should not regularly go much above 50 micrograms per litre. Nitrate: High nitrogen concentrations cause ecological changes, including growth of surface algaldominated communities at the expense of macrophytes. Mean annual Total Nitrogen Concentration (TN) is used because plants can utilise N at various stages of the nitrogen cycle. Winter Nitrate is a measure of nitrate loading to the lake and is correlated with aquatic plant species richness. Suspended sediments, transporting nutrients from adjacent land outside the SAC/SSSI boundary flow into the lakes via streams. As well as exacerbating existing eutrophication problems, gradually this is progressively filling in the lake system. Although it may be difficult to achieve, methods of reducing local soil erosion within the catchment should be investigated. CCW will continue to work with others to examine existing land-use practices, to try and combat and slow down this process. Existing silt-traps outside the SAC/SSSI boundary should continue to be used and maintained to reduce silt loadings. The rate of sediment deposition should be measured to assess the results of such management. A balance should be kept between open water and swamp/fen communities. For some areas of the lake, such as the upper eastern and upper western arms, consideration should be given to open up swamp communities to maintain deeper open water conditions. A sechii disk will be			

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						used to record water clarity and depth. Repeat bathymetric surveys will be needed to record changing sediment depths. *Phosphate:* *Upper limit: In the Central Arm, Western Arm and Central Lake, mean annual levels of Total P, (measured at regular lake sampling points F,* *G, M and Z) should be 25 micrograms per litre or less. In the Eastern Arm, mean annual levels of Total P (measured at regular lake sampling points C and D) should be <50 micrograms per litre.* *Nitrate:* *Upper limit: Mean annual levels of Total N and Winter Nitrate, measured at regular lake sampling points should <1 mg/ltr at all sampling points.* *Water Transparency (clarity)* *Lower limit: Water clarity at regular lake sampling points should be >95% (measured by sechii disk).* *Upper limit: None set.* *Sediment Load* *Lower limit: Sediment load deposition in Western and Central Arms* *and Central Lake should be from natural deposition of Chara and other submerged macrophytes < 0.5 cm per year (approx). The water column in these embayments should remain clear at all times.* <u>F4. Freshwater availability (Including for rinsing sea salt from fur)</u> Otters from the freshwater Bosherston Lakes system are known to swim and hunt for food along the nearby coastline within the contiguous Pembrokeshire Marine SAC. Otter is also a feature of the Pembrokeshire Marine SAC. Evidence of use of the marine environment will be from spraint surveys, plus direct observation. *Units 1a, 1b and 1d* *Upper limit: None set* *Lower limit: No reduction in the availability of freshwater* <u>F5. Fishery management</u> Without good food availability, breeding may not occur. Previous studies indicate that eels form a high proportion of the otter diet at Bosherston Lakes and that Coarse fish species may also be important in their diet. There should be a presumption against developing an eel/elver fishery at the lakes or to removal of the closed season to favour management of habitat suitable for fish and for otters. Data from fishing permits will provide the main means of recording fishery management. *Upper limit: None set.* *Lower limit: Minimise impact to eel/elver fishery: maintain a closed fishing season (currently from mid March to mid June) to limit disturbance to natural bank-side vegetation. Regularly maintain approved fishing points along the shoreline of the Eastern Arm, Western Arm and Central Lake only, to prevent fishing debris becoming entangled in lake-side vegetation and posing a potential threat to otters etc. As now, there should be no fishing points created on the eastern side of the eastern arm, at the One Arch Pond, in the Central Arm or upper western arm (above Bosherston Causeway) where there are important otter resting places.* <u>F6. Availability of undisturbed resting places</u> Otters require a wide range of lying-up (holt) options within a large territory. These provide secure, undisturbed conditions for the male otter; the female (with or without her cubs); for the cubs (with or without their mother); and for the weaned and independent immatures. Much of the lakes extensive			

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						shoreline is relatively inaccessible and undisturbed, and so provides many potentially excellent lying up areas for otters. Evidence of their use will be from spraint density surveys of potential sites, plus direct observation of otter behaviour from shoreline paths, bridges and causeways. *Upper limit: None set.* *Lower limit: Maintain current extent of relatively undisturbed shoreline woodland and dense scrub, together with associated root holes and crevices (including fallen trees and root-plates). Maintain natural cave-like holes in the rocky shoreline and in hollow decaying tree trunks close to the shore. Maintain natural reed/swamp vegetation, especially in: One Arch swamp (NNR compt 30); top of the eastern arm (compt 31); Central lake shore (compt 32); Mere Pool (compt 33).* <u>F7. Changes in lakeside recreation pressures</u> Lakeside recreation is mainly restricted to various connecting paths around the western arm and central lake, and the western side of the eastern arm. People counters at specific points will be the main means of assessing changes in visitor pressure. It will be essential to maintain links with partner organisations, including National trust, Pembrokeshire Coast National Park Authority, plus members of the Pembrokeshire Outdoor Charter Group and Pembrokeshire Coastal Forum) to ensure that adequate steps are in place to regulate and protect potentially sensitive zones used by otters. Close contact with the local community will also be important to encourage interest in the sites features, and to explain management issues affecting otters etc. *Upper limit: Maintain the existing policy of "no human access" to the Central Arm and to the eastern side of Eastern Arm, where there are important otter resting and breeding places. Maintain a closed fishing season (currently from mid March to mid June) to limit disturbance to natural bank-side vegetation. Regularly maintain approved fishing points along the shoreline of the Eastern Arm, Western Arm and Central Lake only, to prevent fishing debris becoming entangled in lake-side vegetation and posing a potential threat to otters etc.* *Lower limit: None set.*			
Pembrokeshire Marine/ Sir Benfro Forol SAC (UK0013116)	The site covers an area of 1,380.39 km^2, including areas of the Pembrokeshire coastline and St Brides Bay and includes the islands of Ramsey, Skomer, Grassolm, Skokholm, Mean tides range from 7.8m at Milford Haven to 4.4m in Ramsey Sound with string tidal currents around the islands and islets of up to 10 knots. Grey seals within the site are not part of a discrete population but a part of the wider south-west Wales population, which is estimated to be 5,000 individuals. Annual pup production was estimated at 980, approximately 75% of the south-west Wales population (CCW, 2009b). The site is located within the West England and Wales MU for grey seal (IAMMWG, 2013).	South (58.76km) North (202.25km)	NRW	**Grey seal 1364**	**Screened in -** Within 250km range of SRAs	**Populations** The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements are population size, structure, production, and condition of the species within the site. As part of this objective it should be noted that for otter and grey seal; • Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression; • For grey seal, populations should not be reduced as a consequence of human activity **Range** The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. As part of this objective it should be noted that for otter and grey seal; • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered; • There are appropriate and sufficient food resources within the SAC and beyond; • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing **Supporting Habitats and Species** The presence, abundance, condition and diversity of habitats and species required to support this species is such that the	N/A	**Docks, marinas & shipping** • Dock, harbour & marina structures: Construction & Maintenance • Dredging: capital & maintenance • Shipping: vessel traffic, vessel maintenance, ballast water discharge, refuse & sewage disposal, operational discharges, accidents (may be associated with cargo / bunkers discharges or fuel oil & / or petrochemical discharges or salvage operations) **Civil engineering**	CCW, 2009c

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include; - distribution, - extent, - structure, - function and quality of habitat, - prey availability and quality. As part of this objective it should be noted that; • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; • The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term; • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health; • Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour; • For otter there are sufficient sources within the SAC and beyond of high quality freshwater for drinking and bathing. **Restoration and recovery** In the Milford Haven waterways complex inputs of nutrients and contaminants to the water column and sediments derived from human activity must remain at or below levels at the time the site became a candidate SAC. As part of this objective it should be noted that for the otter, populations should be increasing.		• Construction • Land claim • Coast protection / defence • Barrage • Artificial reef • Hard-engineered freshwater watercourses • Power station • Power / communication cables **Waste disposal** • Effluent disposal: sewage and chemical, thermal • sludge dumping • wastes & debris (including refuse & litter) • Dredge spoil disposal • Urban & industrial run-off • Agricultural run-off **Exploitation of living resources** • Trawling: beam or otter & dredging (scallop, mussel or oyster) • Netting: bottom-set gill, bottom-set tangle / trammel, surface-set gill, beach-set gill • Netting (gill, tangle, trammel, beach seine, demersal seine, salmon, fyke) • Potting • Commercial Line fishing • Hand gathering • Collection for aquarium / curio trade • Gathering algae and higher plants for human consumption **Cultivation of living resources**	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								• Aquaculture: finfish, crustaceans, sea or waterway based cages or impoundments, molluscan farming or • land based semi-enclosed / recirculation **Exploitation of non-living Resources** • Water abstraction • Aggregate extraction • Oil & gas exploration: seismic survey, drilling operations, operational and accidental discharges • Renewable energy generation: tidal barrage, coastal wave & tidal current, wind **Pollution response** • Oil spill response: at sea, shore cleaning – washing, chemical, physical & ancillary **Recreation** • Angling • Bait collection: digging & other sediment shore collection techniques • Recreational boating: high speed power craft (incl. PWC) and low speed power craft, other non-mechanical craft and moorings • Casual shore recreation • Vehicles on foreshore • Light aircraft • Marine wildlife	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								watching / eco-tourism **Military activities** • Military activity: ordnance ranges, marine exercises & aircraft **Miscellaneous operations & uses** • Marine archaeology & salvage • Education & science research • Animal welfare operations & sanctuaries	
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC (UK0013117)	The site covers an area of 1,460.11km^2, from the coastlines of the Llŷn Peninsula and the northern part of Cardigan Bay, and includes three tidal inlets. The water depths range from over 40m in depth off the north and south-west coast on the Llŷn Peninsula, to less than 10m around the Sarnau (CCW, 2009c). bottlenose dolphin, grey seal and otter are listed as qualifying features of the site. Bottlenose dolphin are considered to be of significant importance within the site. They do not form a resident population but should be considered as part of the wider Wales population, including those of Cardigan Bay. Photo ID studies have revealed that the dolphins travel between this site and Cardigan Bay SAC. Both these sites are within the wider Cardigan Bay area and their population should be considered together. Recent population estimates for the wider Cardigan Bay vary between 254 and 330 animals (CV = 0.25 – 0.28) for the years 2011 and 2013 inclusive (Feingold and Evans, 2014). This site is located within the Irish Sea MU for bottlenose dolphin. Grey seals present at this site are thought to be a part of the wider north Wales population (700-750 in winter and up to 1,100 in summer) and that the persistent breeding individuals form part of the larger Irish Sea population. The site has an estimated population of 365 (in 2002) and has the largest breeding colony in north Wales with a number of important pupping sites, including Bardsey Island (CCW, 2009c). The site is located within the South and West England and Wales MU for grey seal (IAMMWG, 2013). Otters are thought to use areas if the coast within and adjacent to the site. They form part of the population that reside in the freshwater habitats around Gwynedd and Ceredigon with a proportion of that population using the site. The site is important for otters as foraging grounds, access corridor and for social activity. There are also good breeding sites within the site although it is not known if they are used as such.	North terrestrial (44.96km) North marine (70.23km) South (223.63km)	NRW	**Bottlenose dolphin 1349**	**Screened in -** Within IS MU	The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements are population size, structure, production, and condition of the species within the site. As part of this objective it should be noted that: • for bottlenose dolphin, otter and grey seal; o Contaminant burdens derived from human activity are below levels that may cause physiological damage, or immune or reproductive suppression • grey seal populations should not be reduced as a consequence of human activity **Population** The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. As part of this objective it should be noted that for bottlenose dolphin, otter and grey seal; • Their range within the SAC and adjacent inter-connected areas is not constrained or hindered; • There are appropriate and sufficient food resources within the SAC and beyond; • The sites and amount of supporting habitat used by these species are accessible and their extent and quality is stable or increasing **Supporting Habitats and Species** The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include; - distribution, - extent, - structure, - function and quality of habitat, - prey availability and quality. As part of this objective it should be noted that; • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term; • The management and control of activities or operations likely to adversely affect the species	N/A	**Docks, marinas & shipping** • Dock, harbour & marina structures: Construction & Maintenance • Dredging: capital & maintenance • Shipping: vessel traffic (*bottlenose dolphin and otter only*), vessel maintenance, ballast water discharge, refuse & sewage disposal, operational discharges, accidents (may be associated with • cargo / bunkers discharges or fuel oil & / or petrochemical discharges or salvage operations) **Civil engineering** • Construction • Land claim • Coast protection (*not bottlenose dolphin*): hard defence (sea walls / breakwaters / railways), soft defence, groynes and beach replenishment • Coast protection	CCW, 2009d
				Grey seal 1364	**Screened in -** Within 250km range of SRAs		N/A		
				Otter 1355	Screened out - Outside of identified otter home range from SRA.		N/A		

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
	Otters are wide ranging within the site, close to coastline and within the estuaries. Surveys indicate regular use of the Glasyn/Dwyryd and Dyfi estuaries although it is reasonable to assume that otters may be present in any of the coastal areas.					feature, is appropriate for maintaining it in favourable condition and is secure in the long term; • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health. Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour; • For otter there are sufficient sources within the SAC and beyond of high quality freshwater for drinking and bathing. **Restoration and recovery** As part of this objective it should be noted that for the bottlenose dolphin and otter, populations should be increasing.		(storm surge / tidal barrage) • Barrage (amenity) • Foreshore deposit of rock (*not bottlenose dolphin*) • Artificial reef • Hard-engineered freshwater watercourses (*otter only*) • Power station • Pipelines • Power / communication cables **Waste disposal** • Effluent disposal: domestic, industrial, thermal, sludge dumping & Inorganic wastes & debris (including refuse & litter) • Dredge spoil disposal • Urban & industrial run-off • Agricultural run-off **Exploitation of living resources** • Trawling: beam or otter (*not otter*) • Dredging (*not otter*): toothed, mussel, mussel seed or oyster, deep hydraulic • Dredging (*otter only*): mechanical – cockle • Dredging: shallow • Netting: bottom-set gill, bottom-set tangle / trammel, surface-set gill, beach-set gill • Netting (*otter only*): beach seine, other (e.g. fyke) • Netting (*not otter*): demersal seine • Potting (*not otter*): lobster / crab, prawn or whelk • Line (*not otter*): long-line or	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								handline • Electro-fishing (*otter only*): molluscs • Aquaculture: molluscan ranching, molluscan farming or predator control • Aquaculture (*otter only*): land based semi-enclosed / recirculation • Aggregation devices (*otter only*) **Exploitation of non-living Resources** • Water abstraction (*otter only*) • Aggregate extraction • Oil & gas exploration (not *otter*): seismic survey and drilling operations • Oil & gas exploration & production: operation and accidental discharges • Renewable energy generation: tidal barrage, tidal impoundment, tidal current turbine, wave energy and wind energy **Pollution response** • Oil spill response: at sea, shore cleaning – washing, chemical, physical & ancillary **Recreation** • Angling • Bait collection (*otter only*): boulder turning & digging & other sediment shore collection techniques • Recreational boating: high speed	

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
								power craft (incl. PWC) and low speed power craft • Recreational boating (*not bottlenose dolphin*): sail & canoeing and other non-mechanical craft • Scuba diving/snorkelling (*not otter*) • Spearfishing (*grey seal only*) • Coastal access (*not bottlenose* dolphin): for recreation (bathing, dog walking, coasteering, etc.), vehicles on foreshore • Light aircraft (*grey seal only*) • Wildfowling (*otter only*) • Marine wildlife watching / eco-tourism **Military activities** • Military activity: ordnance ranges, marine exercises & aircraft **Miscellaneous operations & uses** • Marine archaeology & salvage • Education • Science research • Animal welfare operations & sanctuaries	
Recifs et landes de la Hague SAC (FR2500084)	No translation available.	South (482.46km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
Recifs et marais arriere-littoraux du Cap Levi á la Pointe de Saire SAC (FR2500085)	No translation available.	South (521.42km)	No translation available.	Bottlenose dolphin 1349	Screened out - Outwith IS MU	No translation available.	No translation available.	No translation available.	
River Dee and	This site covers an area of 12.71km^2 and lists otter as a	North	NRW	**Otter 1355**	**Screened in -**	The vision for this feature is for it to be in a favourable	Favourable: Un-	N/A	CCW,

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC (UK0030252)	qualifying species. The site includes the Llyn Tegid and Bala Lake to its outfall and the Dee Estuary. Otter are a key species within the Llyn Tegid, all along the River Dee (with the exception of the Dee Estuary itself).	(25.4km)			Within 40km on land of identified SRAs	conservation status, where all of the following conditions are satisfied: • The parameters defined in the vision for the water course as defined in 4.1 above must be met. • The SAC otter population is stable or increasing over the long term, both within the SAC and within its catchment. • There will be no loss of otter breeding or resting sites other than by natural means (such as naturally occurring river processes) within the SAC or its catchment. • There number of potential resting sites within the SAC will not be a factor limiting that limits the otter population's size or extent • There should be no reduction of fish biomass within the SAC or its tributaries except for that attributable to natural fluctuations • There should be no loss of amphibian habitat likely to provide a source of prey for members of the SAC otter population. • The potential range of otters in the within the SAC or its catchment is neither being reduced nor is likely to be reduced for the foreseeable future. • All known or potential access or dispersal routes within the catchment for otters that might be considered part of the SAC population should be maintained such that their function is not impaired including the incorporation of measures or features required to avoid disturbance. • Off-site habitats likely to function as 'stepping stones' within the catchment for members of the SAC otter population will be maintained for migration, dispersal, foraging and genetic exchange purposes. • All man-made structures within or likely to be used by otters from the SAC population must incorporate effective measures to facilitate the safe movement and dispersal of otters. • All known, controllable factors, affecting the achievement of these conditions are under control (many factors may be unknown or beyond human control). **Performance indicators for feature condition** <u>A1 Population size</u> In 2004 Morgan provided an intuitive estimate of the catchment population size of 22 breeding pairs. However, he states that this not accurate as it is based on an assessment of the habitat available. The presence of otters can be determined by carrying out standard sign surveys. The main problem with monitoring otter populations is the lack of a clear relationship between the density of signs and the density of otters. There is currently no way of reliably estimating otter density, although the use of DNA extracted from spraints may provide a solution to this in the future (Common Standards Monitoring Guidance for Mammals (2004),). In view of this, some form of survey or more accurate means of assessment is required *Upper limit: None set* *Lower limit: Insufficient information* <u>A2. Extent</u> The limits expressed here are based on the 'Sites', and their numbers, used by the Otter Survey of Wales within the River Dee SSSI's catchments. 46 of the 59 equates to 78% of sites. However, while these values may be useful for monitoring purposes, it is highly likely that otters range throughout the SAC	classified		2009d

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						and beyond. Therefore extensive survey work is required in order to adequately determine the extent, distribution and mobility of the SAC otter population. The use of artificial sprainting sites may be necessary in parts of the SAC, and beyond, where natural sprainting sites appear to be sparse. *Upper limit: None set* *Lower limit: Otter signs to be found at 46 of the 59 sites (See comments* *to the left for the definition of 'sites'). More extensive survey work* *Required* <u>A3. Breeding Success</u> Morgan (2004) identified 77 potential 'Otter Sites'. Of these he could confirm only five as being actual breeding sites but no natal holts were actually identified. A number of live sightings were reported but few of these were of cubs and their survivorship is unknown In view of this, clearly further survey or research is required *Upper limit: None set* *Lower limit: Insufficient information* <u>A4. Age structure</u> In order to properly assess the favourable conservation statues of this feature it would clearly be beneficial to have some understanding of age structure. The only information currently available for this it that of Morgan (2004), based on road deaths and live sightings. However, the numbers involved were very low. Therefore further information is required *Upper limit: None set* *Lower limit: Insufficient information* <u>A5 Dispersal and recruitment</u> Little is currently known of the extent, rate or direction of dispersal of otters from the SAC population, either within the SAC or in the wider catchmment. Similarly, little is known of the of recruitment into the population, either from births within it or from otters dispersing from other populations. Such knowledge would enable assessment of the robustness of the population and its potential ability to recover from losses. It would provide some knowledge of its likely genetic diversity. *Upper limit: None set* *Lower limit: Insufficient information* <u>A4. Good quality vegetation for breeding otters</u> Good quality vegetation for breeding otters includes dense scrub (e.g. bramble, blackthorn and gorse); reedbeds; deciduous woodland with an under-story; young conifer plantations; Rhododendron thickets; and wetlands (particularly with areas of Molinia caerulea). *Upper limit: None set* *Lower limit: No reduction in the quality of or extent of suitable otter habitat* <u>F1 Potential Breeding Sites:</u> Though clearly the presence of sites where otters can breed is a critical factor for any population, the Common Standards Monitoring Guidance for Mammals (2004), specifically excludes breeding sites as a factor or attribute for assessing conservation status of otter. It does so because "It would also be extremely difficult to decide on a reasonable target and a means of measuring the attribute." However, as the survey of Morgan (2004) collected such data, the number of potential breeding sites has been included here as a factor.			

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						Upper limit: None set *Lower limit :There should be an increase in the number of known* *potential (in addition to actual) breeding sites on the River Dee from* *72 to 76. Lakeside habitat that could provide potential breeding sites for otter should be retained at current levels.* F2 Potential resting sites Otters use a range of types of resting or laying up sites, and these may vary in type or location depending on conditions and availability. Surveys within the Dee SAC have found many potential sites but there are sections where few have been found. Where these coincide with sections of the site where little otter activity has been detected, research should be undertaken to determine whether the presence of resting sites is a limiting factor. If it is, measures should be undertaken to increase the number of potential resting sites. In addition, where potential resting sites are few, otters may travel further to find them. This may lead to a greater risk of death due to anthropogenic mortality, particularly where road crossing may occur. *Upper limit: None set* *Lower limit: Insufficient information* F2 Food availability Otters depend on food that comes from a range of aquatic environments, such as streams, marshes, ponds and backwaters. Their diet may, among other things, include fish, amphibians and crustaceans Eels are thought to be particularly favoured though at times prey, such as frogs, can assume a greater importance than that of fish. Data should be sought on fish stocks from EAW. Specific assessment limits have yet to be devised *Upper limit: None set* *Lower limit: Fish biomass stays within expected natural fluctuations. There should be no loss of amphibian habitat likely to be used by otters from the SAC population. More specific limits to be devised* F3 Dispersal and access routes Little is currently known of dispersal or access routes used by otters from the SAC population, either within the SAC or in the wider catchmment. However, such routes are essential for the dynamics of a healthy population. Therefore further information is required *Upper limit: None set* *Lower limit: No loss or impairment of any such routes. More specific limits to be devised.* F4 Anthropogenic mortality Road deaths have been noted as a primary threat to the otters conservation status across Wales, and if the numbers reported by Morgan (2004) are compared to his estimate of population size, clearly of such deaths are a significant factor affecting the population of this SAC. *Upper limit: No increase in numbers of recorded Road Deaths. Analysis* *of road death locations should be used to try and identify reasons for* *such mortality* *Lower limit: Nil* F5 Disturbance Otters are sensitive to human disturbance and especially to sudden changes in activity. They are particularly sensitive to			

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						disturbance by dogs. The female otter is particularly sensitive to disturbance when she has cubs. *Upper limit: No significant increase disturbance to otters.* *Lower limit: Nil*			

River Usk/ Afon Wysg SAC (UK0013007)	The site covers an area of 9.68km^2 and lists otter as a primary reason for site designation. The site covers the river Usk from the Black Mountain Range and to the Severn Estuary in Newport.
	
	The River Usk is an important area for otter, with presence on most of the river. The upper area of the Usk may of acted as a 'refuge' during times of decline in the 1950s and now is a 'source' population for the otters of south-east Wales. The otter is a key species throughout the site.
		South (0km)	NRW	**Otter 1355**	**Screened in -** Within 40km on land of identified SRAs	The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied:
						• The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour.
						• The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. The whole area of the Wye SAC is considered to form potentially suitable breeding habitat for otters. The size of breeding territories may vary depending on prey abundance. The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed.
						  • Survey information shows that otters are widely distributed in the Usk catchment. While the breeding population in the Usk is not currently considered to limited by the availability of suitable breeding sites, there is some uncertainty over the number of breeding territories which the SAC is capable of supporting given near-natural levels of prey abundance. The decline in eel populations may be having an adverse effect on the population of otters in the Usk.
						• The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers.
						  • Restrictions on the movement of otters around the SAC, and between adjoining sites are currently a particular concern in the reach through Newport as a result of a continued decrease in undisturbed suitable riparian habitat.
						
						Performance indicators for feature condition
						
						<u>Distribution</u>
						Otter signs present at 90% of Otter Survey of Wales sites in Subcatchments
						
						<u>Breeding activity</u>
						2 reports of cub/family sightings at least 1 year in 6
						
						6 <u>Actual and potential breeding sites</u>
						No decline in number and quality of mapped breeding sites in subcatchments.
						
						In the Usk catchment, 77 actual or potential breeding sites have
							Favourable	N/A	CCW, 2009e

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						been identified, distributed throughout the catchment on the main river and tributaries.			
River Wye/ Afon Gwy SAC (UK0012642)	This site covers are area of 21.48km^2 and lists otter as a primary reason for designation. The River Wye holds the most established and densest otter population in Wales. The river includes bankside vegetation cover, had an abundant food supply, clean water and areas of dense scrub which proved prime habitat features and breeding sites for the otter. Otters are a key species of the entire site.	South (0km)	NRW	**Otter 1355**	**Screened in -** Within 40km on land of identified SRAs	The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • The population of otters in the SAC is stable or increasing over the long term and reflects the natural carrying capacity of the habitat within the SAC, as determined by natural levels of prey abundance and associated territorial behaviour. • The natural range of otters in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches that are potentially suitable to form part of a breeding territory and/or provide routes between breeding territories. The whole area of the Wye SAC is considered to form potentially suitable breeding habitat for otters. The size of breeding territories may vary depending on prey abundance. The population size should not be limited by the availability of suitable undisturbed breeding sites. Where these are insufficient they should be created through habitat enhancement and where necessary the provision of artificial holts. No otter breeding site should be subject to a level of disturbance that could have an adverse effect on breeding success. Where necessary, potentially harmful levels of disturbance must be managed ◦ Survey information shows that otters are widely distributed in the Wye catchment. However, an assessment of otter breeding habitat has indicated that there may be a shortage of suitable habitat around the middle reaches of the river, which may affect the long-term viability of the population. This should be addressed by habitat enhancement including stock exclusion from suitable woodlands near to the river but outside the floodplain. The decline in eel populations may be having an adverse effect on the population of otters in the Wye. • The safe movement and dispersal of individuals around the SAC is facilitated by the provision, where necessary, of suitable riparian habitat, and underpasses, ledges, fencing etc at road bridges and other artificial barriers. ◦ Road and bridge improvement schemes within the catchment should take appropriate measures towards achievement of this objective. **Performance indicators for feature condition** <u>Distribution</u> Otter signs present at 82- 90% of Otter Survey of Wales sites in Subcatchments <u>Breeding activity</u> Reports of cub/family sightings (no specified <u>Actual and potential breeding sites</u> No decline in number and quality of mapped breeding sites in subcatchments. Increase from 5 to 9 sites in Middle Wye sub-catchment. In the Wye catchment within Wales, 32 actual or potential breeding sites have been identified (19 within the Wye SAC), distributed throughout the catchment on the main river and	Unfavourable	N/A	CCW, 2008f

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
						tributaries. It is recommended that this should increase to at least 40 (23 within Wye SAC). Note: breeding territories typically contain more than one breeding site.			
Roaringwater Bay and Islands SAC (IE0000101)	This site covers an area of 142.59km^2 and lists harbour porpoise as a primary reason for site designation. Roaringwater Bay is a wide shallow bay located along the south-west Ireland coast, with several offshore islands and rocky outcrops. Tidal streams area channelled through the islands with strong currents. The site is important for harbour porpoise, with relatively high abundances recorded due to the high-quality habitat for the species. Most sightings have been made in the Autumn months where more than 100 individuals have been recorded in a day, although the population is mostly resident. The population is estimated to be 117-201 individuals.	South (384.48km) North (438.55km)	National Parks and Wildlife Service	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	To maintain the favourable conservation condition of Harbour Porpoise in Roaringwater Bay and Islands SAC, which is defined by the following list of attributes and targets: Access to suitable habitat • Species range within the site should not be restricted by artificial barriers to site use. Disturbance • Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site	N/A	The main threat to Harbour Porpoise is incidental capture in fishery gear, especially set gillnets but also drift nets.	NPWS (2011)
Rockabill to Dalkey Island SAC (IE0003000)	Rockabill to Dalkey Island SAC is located on the eastern coastline of the Republic of Ireland covering an area of 273.26km^2. Harbour porpoise occur year round at this site in relatively large groups (compared to other locations) with evidence of calving occurring at this site (NPWS, 2013a). Survey effort in the 2008 summer-autumn season delivered initial overall site estimates across four surveys of 2.03 individuals per km^2, N=211±47 individuals, 95% CI = 137-327; CV = 0.23) The species is present at the site in all seasons and new born calves have also been recorded within the site, including during the calving/breeding season (NPWS, 2013a).	North (147.30km) South (275.15km)	National Parks and Wildlife Service	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	To maintain the favourable conservation condition of harbour porpoise in Rockabill to Dalkey Island SAC, which is defined by the following list of attributes and targets; Target 1: Species range within the site should not be restricted by artificial barriers to site use. • This target may be considered relevant to proposed activities or operations that will result in the permanent exclusion of harbour porpoise from part of its range within the site, or will permanently prevent access for the species to suitable habitat therein. • It does not refer to short-term or temporary restriction of access or range. • Early consultation or scoping with the Department in advance of formal application is advisable for proposals that are likely to result in permanent exclusion. Target 2: Human activities should occur at levels that do not adversely affect the harbour porpoise community at the site. • Proposed activities or operations should not introduce man-made energy (e.g. aerial or underwater noise, light or thermal energy) at levels that could result in a significant negative impact on individuals and/or the community of harbour porpoise within the site. This refers to the aquatic habitats used by the species in addition to important natural behaviours during the species annual cycle. • This target also relates to proposed activities or operations that may result in the deterioration of key resources (e.g. water quality, feeding, etc) upon which harbour porpoises depend. In the absence of complete knowledge on the species ecological requirements in this site, such considerations should be assessed where appropriate on a case-by-case basis. • Proposed activities or operations should not cause death or injury to individuals to an extent that may ultimately affect the harbour porpoise community at the site.	N/A	N/A	NPWS, 2013b
Tregor Goelo SAC (FR5300010)	No translation available.	South (415.49km)	No translation available.	Bottlenose dolphin 1349	Screened out -- Outwith IS MU	No translation available.	No translation available.	No translation available.	
				Harbour porpoise 1351	Screened out **–** Outwith 400km range of SRAs	No translation available.	No translation available.	No translation available.	
West Wales Marine / **Gorllewin Cymru**	The site covers an area of **7,376km^2**, including the majority of Cardigan Bay and the Pembrokeshire coastline to the south to the tip of the Llŷn Peninsula in the north,	North (69.04km)	JNCC, NRW	**Harbour porpoise 1351**	**Screened in -** Within 400km range of SRAs	To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an	N/A	**Removal of non-target species:** Commercial fisheries	NRW & JNCC 2016b

Site Name	Site Description	Nearest SRA (distance)	Landowner / Management Responsibility	Qualifying Feature	Screened In or Out	Conservation Objectives	Condition Assessment	Vulnerabilities	Reference
Forol cSAC (UK0030397)	Cardigan Bay SAC and part of both the Llŷn Peninsula and the Sarnau SAC and Pembrokeshire Marine SACs. The water depths within the site range between the **MLWT level and 100m**. Away from coastal areas, the depths largely fall within the range of 40-50m. The site contains a mixture of hard substrate and sediments, including rock, coarse sediment, sand and mud (NRW and JNCC, 2017). The site has been recognised as an area within the top 10% predicted persistent high densities of harbour porpoise. The area included within the site **covers important summer habitat for harbour porpoises**, while parts of the Cardigan Bay area are also identified as important in the winter periods (NRW and JNCC, 2017). The site is located within the Celtic and Irish Seas harbour porpoise MU. The **estimated harbour porpoise population is 5,222 individuals (95% CI = 1,419 – 4,484)** for at least part of the year, based on **approximately 5% of the UK part of the Celtic and Irish Seas MU** (NRW and JNCC, 2017).	South (84.27km)				appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise. To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term: 1. The species is a viable component of the site. 2. There is no significant disturbance of the species. 3. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.		with bycatch of harbour porpoise (predominantly static nets) and commercial fisheries (reduction in prey resources) **Contaminants:** Discharge/run-off from landfill, terrestrial and offshore industries **Anthropogenic underwater sound:** Shipping, drilling, dredging and disposal, aggregate extraction, pile driving, acoustic surveys, underwater explosion, military activity, acoustic deterrent devices and recreational boating activity **Death or injury by collision:** Shipping, recreational boating, tidal energy installations	

Royal HaskoningDHV

A2 Annexed table of HRA

Table A2.1: Summary of high level project assessment of potential impacts (Section 3.2), taking into account potential pathways (Section 3.2.2.2), potential effects on integrity European Designated Sites for marine mammals (Section 4) and risk of potential in-combination effects (Section 5)

Site Name and Receptor	Direct habitat loss	Potential changes in habitat	Potential changes in water quality	Potential increase in suspended sediment	Potential disturbance from underwater noise	Potential disturbance from airborne noise	Potential visual disturbance	Potential increased collision risk with vessels	Potential increased collision risk with turbines	Potential barrier effects	Potential changes in prey availability	In-Combination
Abers - Cotes des Legendes SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Afon Tywi/ River Tywi SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Baie de Morlaix SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	×	?	?	?	?	×	×	?	?	?	?	?
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	×	?	?	?	?	×	×	?	?	?	?	?
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Isles of Scilly Complex SAC - grey seal	×	×	×	×	×	×	×	×	×	×	×	×

Site Name and Receptor	Direct habitat loss	Potential changes in habitat	Potential changes in water quality	Potential increase in suspended sediment	Potential disturbance from underwater noise	Potential disturbance from airborne noise	Potential visual disturbance	Potential increased collision risk with vessels	Potential increased collision risk with turbines	Potential barrier effects	Potential changes in prey availability	In-Combination
Lundy SAC - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
North Anglesey Marine / Gogledd Mon Forol cSAC - harbour porpoise	×	?	?	?	?	×	×	?	?	?	?	?
North Channel cSAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Ouessant-Molene SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
River Usk/ Afon Wysg SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
River Wye/ Afon Gwy SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ✓ = potential for adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown therefore further assessment required.

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Table A2.2: Summary of high level plan assessment of potential impacts (Section 3.2), taking into account potential pathways (Section 3.2.2.2), potential effects on integrity European Designated Sites for marine mammals (Section 4) and risk of potential in-combination effects (Section 5)

Site Name and Receptor	Direct habitat loss	Potential changes in habitat	Potential changes in water quality	Potential increase in suspended sediment	Potential disturbance from underwater noise	Potential disturbance from airborne noise	Potential visual disturbance	Potential increased collision risk with vessels	Potential increased collision risk with turbines	Potential barrier effects	Potential changes in prey availability	In-Combination
Abers - Cotes des Legendes SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Afon Gwyrfai a Llyn Cwellyn SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Afon Tywi/ River Tywi SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Baie de Morlaix SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Bristol Channel Approaches / Dynesfeydd Mor Hafren cSAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Cardigan Bay/ Bae Ceredigion SAC - bottlenose dolphin - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Cote de Granit rose-Sept-Iles - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Isles of Scilly Complex SAC - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
Lundy SAC - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
North Anglesey Marine / Gogledd Mon Forol	×	×	×	×	×	×	×	×	×	×	×	×

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Site Name and Receptor	Direct habitat loss	Potential changes in habitat	Potential changes in water quality	Potential increase in suspended sediment	Potential disturbance from underwater noise	Potential disturbance from airborne noise	Potential visual disturbance	Potential increased collision risk with vessels	Potential increased collision risk with turbines	Potential barrier effects	Potential changes in prey availability	In-Combination
cSAC - harbour porpoise												
North Channel cSAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Ouessant-Molene SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Pembrokeshire Marine/ Sir Benfro Forol SAC - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
Pen Llyn a`r Sarnau/ Llyn Peninsula and the Sarnau SAC - bottlenose dolphin - grey seal	×	×	×	×	×	×	×	×	×	×	×	×
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
River Usk/ Afon Wysg SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
River Wye/ Afon Gwy SAC - otter	×	×	×	×	×	×	×	×	×	×	×	×
Roaringwater Bay and Islands SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
Rockabill to Dalkey Island SAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×
West Wales Marine / Gorllewin Cymru Forol cSAC - harbour porpoise	×	×	×	×	×	×	×	×	×	×	×	×

× = no potential for any adverse effect on the integrity of the site in relation to the conservation objectives; ✓ = potential for adverse effect on the integrity of the site in relation to the conservation objectives; ? = unknown therefore further assessment required.

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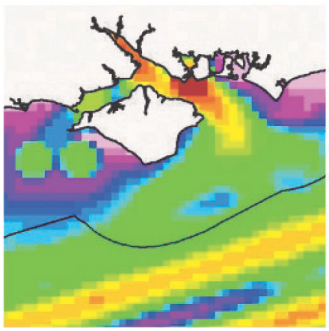
Appendix H
Appropriate Assessment – Fish and Marine Habitats

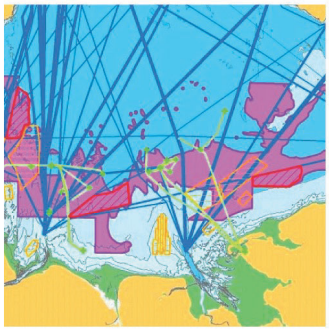
Welsh Government

Plan Level HRA of Welsh National Marine Plan Tidal Lagoon Policy

Fish and supporting environs

September 2017

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Plan Level HRA of Welsh National Marine Plan Tidal Lagoon Policy

Fish and supporting environs

September 2017



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ABPmer
Quayside Suite, Medina Chambers, Town Quay, Southampton, Hampshire SO14 2AQ
T: +44 (0) 2380 711844 W: http://www.abpmer.co.uk/

Summary

The Welsh National Marine Plan (WNMP) is currently being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA). The draft WNMP includes sector policies that support and safeguard developments including for tidal lagoons. The tidal lagoon Strategic Resource Area (SRA) covers an area of South Wales (east of Gower up to the Severn Estuary) and North Wales (north of the Great Orme to the Dee).

The Habitats Regulations Assessment (HRA) of the draft WNMP has concluded that an "absence of significant effect" cannot be ruled out for developments at the scale of tidal lagoons within the identified SRA for which WNMP draft plan supporting and safeguarding policies will apply. This project is therefore being undertaken to provide further technical evidence to inform a more detailed assessment of this policy. More specifically this project is focussed on fish and marine habitats. Further assessments (e.g. on birds and mammals) will be undertaken under separate contracts. The overall HRA of the tidal lagoon policy will be undertaken by Welsh Government.

The HRA process has followed an iterative and auditable process according to available guidance and the principles document which is being developed by Welsh Government for the over-arching plan level HRA of the tidal lagoon policy. This is in accordance with the following key steps:

- Pre-screening;
- Screening;
- Information to Inform the Appropriate Assessment
- Record of Appropriate Assessment; and
- Consideration of Article 6(4) requirements.

Initial consultation has been undertaken with Joint Nature Conservation Committee (JNCC), Natural England and Natural Resources Wales. Further consultation with these organisations is also anticipated beyond the scope of this project.

All relevant European/Ramsar sites that lie within a 50 km buffer of each component of the SRA (seawards from the mean high water springs line) were included in pre-screening, as well as terrestrial sites where any part of the site overlaps a 2 km buffer inland of the marine zone of influence. In addition, sites where migratory fish are an interest feature (including salmon, sea trout, sea lamprey, shad and eel) within the zone of influence or the wider Bristol Channel and Liverpool Bay regions, including all estuaries of Special Areas of Conservation (SACs) where migratory fish are an interest feature were also screened in to the assessment. From this pre-screening list, all European/Ramsar sites which only supported features not being considered by this HRA or terrestrial and/or freshwater habitats or species for which no impact pathways exist with respect to tidal lagoon implementation were screened out. Following the screening process, a total of 21 SACs, one site of community importance (SCI), two Ramsar sites 14 Special Protection Areas (SPAs) and one potential Special Protection Areas (pSPA) were screened in to the assessment.

To prepare the information that is needed for this Appropriate Assessment (AA), a step wise process has been followed. This has included the following key steps:

- A review of impact pathways in the context of the screened in interest features and their sensitivity to tidal lagoon development; and
- An assessment of potential effects on European/Ramsar sites.

The potential effects of the draft tidal lagoon policy was also reviewed in combination with other plans and projects. This assessment involved undertaking a review of existing activities and relevant plans and projects. In addition a review of mitigation measures that are available for tidal lagoon projects has also been undertaken as well as recommendations for plan level mitigation.

In summary, taking into consideration the potential scale of effects and the sensitivity of marine habitats and fish to the pressures associated with tidal lagoon projects and having regard to potential project level mitigation measures, it is not possible to rule out the potential for an individual tidal lagoon project located within the SRA to result in an Adverse Effect On Integrity (AEOI). In practice, however, this would be dependent on the specifics of the tidal lagoon project and the proposed location. In such circumstances, the plan can only be adopted in closely defined circumstances relating to the tests laid out in Article 6(4) of the Habitats Directive. Where projects are progressed for which AEOI cannot be concluded, this requires consideration of alternatives, imperative reasons of over-riding public interest (IROPI) and compensatory measures to protect the overall coherence of the Natura 2000 network.

The relative confidence that can be placed in the range of available compensation measures is variable dependent on the specific features that could be adversely affected by a specific project. It is not envisaged that the provision of potential compensation requirements will be considered strategically at the scale of the WNMP due to the level of uncertainty in future requirements. Furthermore the process of iterative plan review (IPR) will ensure that the WNMP is updated to reflect any lessons learnt or reductions in uncertainties based on ongoing research or projects that have subsequently been implemented.

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1 Introduction

1.1 Project background

The Welsh National Marine Plan (WNMP) is currently being prepared by the Welsh Government in accordance with the Marine and Coastal Access Act 2009 (MCAA). The aim of marine planning is to ensure a sustainable future for the UK's seas through managing and balancing the many activities, resources and assets in the marine environment. In this context, marine plans will inform and guide regulation, management, use and protection of marine plan areas.

The draft WNMP includes sector policies that support and safeguard developments. A policy offering support to renewable energy e.g. tidal stream energy and tidal lagoons in their respective Strategic Resource Areas (SRAs) is paired with a stronger policy which safeguards those areas from sterilisation from other developments (draft Policy ELC_01; Box 1). Such encouragement is not spatially or project specific beyond it being in the SRA as a whole; nor does it suggest that projects that do apply for a licence to proceed in that area will be successful. Furthermore, sector development is not excluded outside of these areas. The tidal lagoon SRA covers an area of South Wales (east of Gower up to the Severn Estuary) and North Wales (north of the Great Orme to the Dee) (Figure 1).

In developing the draft WNMP, the Welsh Government has taken account of relevant evidence on the state and current use of Welsh seas and potential future use alongside the views of stakeholders through a process of continuous engagement as set up in the Statement of Public Participation (SPP). The Welsh Government has also undertaken a range of assessments to inform the developing plan, including a Habitats Regulations Assessment (HRA). The HRA process involves an assessment of the plan's effects on European/Ramsar sites and has included consideration of the in-combination impacts that may arise between the WNMP plan and other projects and plans.

The HRA of the draft WNMP (AMEC Foster Wheeler, 2017) has concluded that an "absence of significant effect" cannot be ruled out for developments at the scale of tidal lagoons within the identified SRA for which WNMP draft plan supporting and safeguarding policies will apply. This project is therefore being undertaken to provide further technical evidence to inform a more detailed assessment of this policy (draft Policy ELC_01; Box 1). More specifically this project is focussed on fish and marine habitats. Further assessments (e.g. on birds and mammals) will be undertaken under separate contracts. The overall HRA of the tidal lagoon policy will be undertaken by Welsh Government.

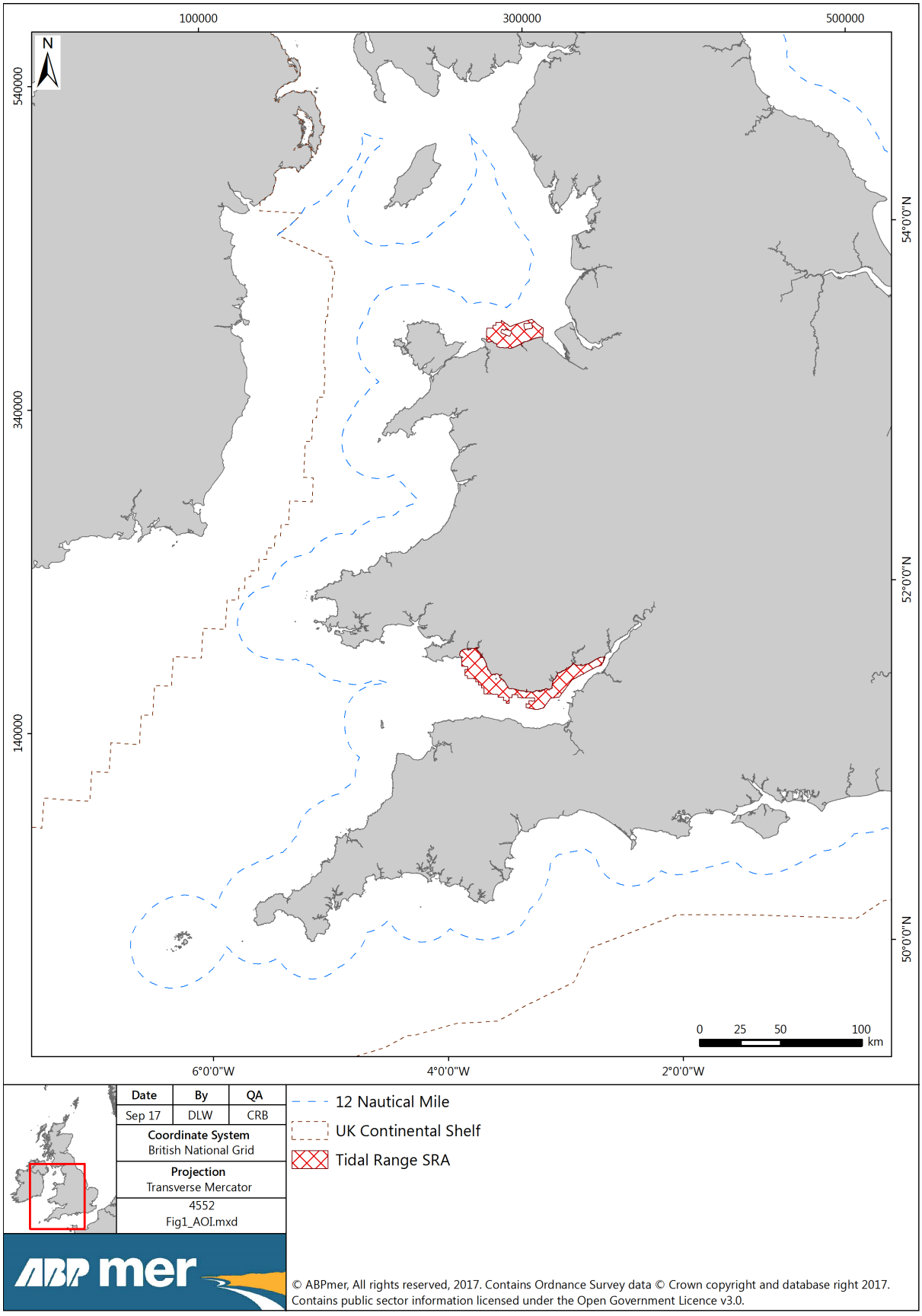


Figure 1. Spatial extent of the tidal lagoon SRA

Box 1. Draft Policy ELC_01

Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:

a) In corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and
b) In corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas.

Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to understand opportunities for the sustainable use of:

a) Renewable energy Strategic Resource Areas; and
b) Wider natural resources that provide renewable energy potential;

in order to support the sustainable growth of the renewable energy sector through marine planning.

Any support for marine renewable energy generation under this policy is conditional upon statutory process being followed and significant adverse effects on the integrity of European marine sites being effectively avoided or mitigated or, in the case of any developments that might take place under A6(4) IROPI provision, are fully compensated for.

In order to understand future opportunities for offshore wind development, strategic planning for the sector is encouraged. Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to:

a) collect evidence to support understanding of environmental and social constraints and opportunities; and
b) support understanding of the optimal siting of offshore wind developments across Wales.

Relevant public authorities should make relevant evidence widely available to support planning and decision making.

Specifically, any activity within SRAs identified in ELC_01 would also have to comply with the WNMP policies ENV_02 (Box 2) and GOV_01 (Box 3), amongst other plan policies.

Box 2. Draft Policy ENV_02

Proposals should demonstrate how they:

- Avoid adverse impacts to individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; and
- Have regard to the measures to manage MPAs.

Box 3. Draft Policy GOV_01

Proposals should demonstrate that they have assessed potential cumulative effects and, in order of preference:

- Avoid adverse effects; and/or
- Minimise effects where they cannot be avoided; and/or
- Mitigate effects where they cannot be minimised.

If significant adverse effects cannot be adequately addressed, proposals should present the case for proceeding.

Proposals that contribute to positive cumulative effects are encouraged.

1.2 Report structure

This document outlines the process and results of the HRA for the tidal lagoon element of Policy ELC_01 as contained within the draft WNMP in the context of marine habitats and fish. The report has been structured as follows:

Section 1: Provides background context to the report;
Section 2: Outlines the legislative background to HRA and the approach that has been followed;
Section 3: Describes the pre-screening phase of the HRA and the associated outputs, including the rationale for the screening criteria that has been applied;
Section 4: Provides the outputs of the screening process for both marine habitats and fish;
Section 5: Provides the Information for the Appropriate Assessment;
Section 6: Outlines potential project-level mitigation measures as well as the requirements for additional evidence gathering measures;
Section 7: Describes the process that should be followed if Article 6(4) of the Habitats Directive is required; and
Section 8: Provides an overall conclusion to the report.

The following appendices support this report:

Appendix A: Activities and pressures associated with tidal lagoon activities;
Appendix B: Baseline information on the behaviour and migratory routes of fish to inform the screening criteria;
Appendix C: Principles document describing the approach to the HRA of the WNMP draft tidal lagoon policy;
Appendix D: Plans and projects for consideration in the in-combination assessment; and
Appendix E: Further details on all of the screened in sites (i.e. those for which LSE cannot be excluded) have been captured in Appendix E. Please note that this has been provided in spreadsheet format only.

2 Background to Habitats Regulations Assessment

2.1 Legislative background

The Habitats Regulations[1] implement the EC Habitats and Birds Directives in UK waters and require that an Appropriate Assessment (AA) should be undertaken where a plan or project is not directly connected with, or necessary for, the management of designated European sites or offshore European sites and where the possibility of a likely significant effect (LSE) on these sites cannot be excluded, either alone or in-combination with other plans or projects. This assessment is made against the designated sites' Conservation Objectives by the Competent Authority in compliance with the Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EC Habitats Directive). The European sites include the following which comprise the Natura 2000 network:

- Special Areas of Conservation (SACs) designated under the Habitats Directive; and
- Special Protection Areas (SPAs) classified under the EC Directive on the Conservation of Wild Birds (the Birds Directive).

In the UK, these requirements are also extended to the consideration of effects on:

- Ramsar Sites (listed under the Ramsar Convention on Wetlands of International Importance); and
- Sites that are proposed for designation and inclusion in the Natura 2000 network and those sites that are currently in the process of being classified such as: potential SPAs (pSPAs), candidate and possible SACs (cSACs and pSACs) and Sites of Community Importance (SCIs).

These sites are collectively referred to throughout this HRA process as European/Ramsar sites.

The Competent Authority can adopt the plan only after having ascertained that it will not adversely affect the integrity of the European or Ramsar site(s) concerned. The Welsh Government is the Competent Authority for undertaking the HRA of the WNMP.

If it is concluded that the WNMP plan will have an adverse effect on integrity (AEOI) on a European/Ramsar site (either alone or in combination with other plans or projects), the plan can only be adopted if it has been ascertained that there are no alternative solutions and it is necessary for Imperative Reasons for Overriding Public Interest (IROPI), including those of a social or economic nature. In these circumstances before any component projects of the plan could proceed, compensatory measures would need to be secured to ensure that the overall coherence of the network of Natura 2000 sites is maintained.

2.2 Overall approach to HRA

Plan level HRA assessment is intended to identify and assess (at high level and at an appropriate level of detail) any adverse impacts of (supporting) plan policies upon protected species and habitats within designated European Marine Sites.

[1] The Conservation of Habitats and Species Regulations 2010 in respect of England and Wales.

Specific lagoon projects within the SRA are yet to be defined, which means that the likelihood of significant effects and the nature of the effects themselves can only be determined in very general terms at the plan-level. This inevitably means that, for many aspects of the WNMP, the final conclusions of the HRA process will be heavily influenced by the choices that are made at a project-level. As the detail of project-level work is not known at this stage the views expressed about the effects on site integrity within this HRA are based on the current scientific understanding of the impacts as well as a firm understanding of the proposed manner in which the plans are to be implemented (including the proposals for mitigation measures to avoid or reduce impacts). The manner of implementation includes a recognition that, as a matter of law, a project will be required to undergo project-level AA wherever the possibility of a LSE on a European/Ramsar site cannot be excluded at the project-level consenting stage.

The nature of the lagoons may involve new technological developments for the devices themselves, or associated infrastructure, in the future which cannot currently be foreseen. This may influence where they are located, how they are constructed and their size, all of which could have a bearing on their potential to cause LSE on European/Ramsar sites and features. It is also the case that continued improvements in scientific understanding of environmental impacts may mean some sites become more or less suitable for development in the future.

The HRA of the tidal lagoon policy (for fish and marine habitats) has been undertaken using a clearly structured methodology consistent with the established guidance developed for and endorsed by UK Statutory Nature Conservation Bodies (SNCBs), including Natural Resources Wales (NRW), Natural England, Scottish Natural Heritage (SNH) and Joint Nature Conservation Committee (JNCC) (David Tyldesley and Associates, 2009a; 2009b; 2012; 2015). This has employed the principles of the precautionary approach.

An overview of the process that has been followed is provided in Table 1. Further detail on the method and outputs of each of the iterative stages of the HRA that have been applied to this project are provided in Sections 3 to 7.

Table 1. Overall approach to the HRA

Approach to HRA	Correspondence with Key Stages in UK Guidance on HRA of Plans
Pre-screening	1. Decide whether a plan should be subject to HRA.
	2. Identify the European/Ramsar sites that should be considered in the appraisal based on a set of defined screening criteria (and the associated rationale). This has taken into account: ▪ Step 1 – Impact pathways associated with all phases of tidal lagoon projects; ▪ Step 2 – Determine list of European/Ramsar sites that occur within a defined zone of influence. ▪ Step 3 – Review of sites in the context of the specific features being considered within this HRA.
	3. Gather information about the European/Ramsar sites. Information on each of the European/Ramsar sites that meet the criteria following Stage 2 has been gathered. This has included site description, conservation objectives and links to further information.
	4. Discretionary discussions on the method and scope of the Appraisal. An over-arching principles document has been developed by Welsh Government and shared with JNCC, Natural England and NRW. Similarly the list of sites meeting the criteria defined in Stage 2 has been shared with these organisations.
	5. Consider other plans and projects that may give rise to a significant impact in-combination. Welsh Government has prepared a list of plans and projects that are required to be considered within the assessment process.
Screening	6. Screen for LSE on European/Ramsar sites. This has included a more detailed review of the sites identified in Stage 2 including a baseline review of species distributions and/or behaviours etc. to inform the screening process. This was also undertaken to ensure that there was no requirement to add in further sites.
	7. Apply plan level mitigation measures. Plan level mitigation measures were identified
	8. Rescreen the plan for LSE after mitigation measures applied. Plan level mitigation measures have been considered to determine whether this changes the potential list of sites for which LSE cannot be excluded.

Approach to HRA	Correspondence with Key Stages in UK Guidance on HRA of Plans
Information for AA	9. Undertake AA including in combination assessment. This included a more detailed review of sensitivities of marine habitats and fish (including the associated species assemblage) to each of the impact pathways identified in Stage 2. The available evidence has been documented. This has been followed by a review of the conservation objectives for these features and an assessment of the potential effects on European/Ramsar sites. A high level in combination assessment has been undertaken.
	10. Apply project-level mitigation measures and additional plan-level measures (e.g. iterative plan review (IPR)). Possible mitigation measures have been identified.
	11. Prepare draft record of the AA. The conclusions of the assessments have been documented. These will be integrated into an overall HRA of the tidal lagoon policy (by Welsh Government) and subsequently the HRA of the WNMP as a whole.
	12. Consult on draft AA record. The conclusions of this assessment will be consulted on as part of the overall consultation on the HRA of the WNMP as a whole. This will be undertaken by Welsh Government.
A6(4) IROPI	13. If any residual significant effect remains, consider applying Article 6(4) approach (e.g. David Tyldesley and Associates, 2015). The need and form of any compensatory measures (i.e. like for like compensation) or other measures which might be considered to be of equivalent value have been documented.
Record of AA	14. Record AA. The conclusions of the assessments (post consultation) will be documented (as per Stage 11).

3 Pre-screening

3.1 Determining requirement for HRA

The requirement for a HRA of the WNMP has already been determined. The HRA of the draft WNMP (AMEC Foster Wheeler, 2017) has concluded that an "absence of significant effect" cannot be ruled out for developments at the scale of tidal lagoons within the identified SRA for which WNMP draft plan supporting and safeguarding policies will apply. This project is therefore being undertaken to provide further technical evidence to inform a more detailed assessment of this policy. More specifically this project is focussed on fish and marine habitats. Further assessments (e.g. on birds and mammals) will be undertaken under separate contracts. The overall HRA of the tidal lagoon policy will be undertaken by Welsh Government.

3.2 Identify sites to be considered in the HRA

The European/Ramsar sites for which the tidal lagoon policy has the potential to have a LSE on fish and marine habitat interest features/sub-features (or where the potential for LSE cannot be excluded) has been determined. This has been based on a judgement about LSE based on a series of interlinked factors including: the impacts arising from the introduction of lagoons within the SRA; the potential exposure to pressures to which the European/Ramsar sites or features might be sensitive; and current scientific understanding (and gaps in that understanding) about the ecology, behavioural characteristics and 'sensitivities' of the interest features. The impacts of the lagoon policy, either alone or in combination, with other plans or projects has also been considered.

3.2.1 Step 1 – Impact pathways associated with tidal lagoons

The key mechanisms (i.e. the impact pathways) by which interest features can be affected by the introduction of tidal lagoons have been identified. These impact pathways encompass all stages of the development process (construction, operation and decommissioning). These pathways and the project activities which influence them are summarised in Table 2. A more detailed audit trail of how these have been derived is provided in Appendix A which is set in the context of the standardised JNCC activities-pressures matrix[2].

This has been further informed by key sources of data/information such as the Department of Energy and Climate Change (DECC) Severn Estuary Tidal Power (SETP) feasibility study, environmental assessments for the Swansea Bay Tidal Lagoon (SBTL), conservation advice packages as well as a wider understanding of impacts associated with these types of projects. A high level review of the potential sensitivity of marine habitats and fish and to such pressures has also been undertaken at this stage (with a more detailed review being undertaken at the assessment stage, see Section 5).

[2] http://jncc.defra.gov.uk/default.aspx?page=7136 (Accessed September 2017).

Table 2. Impact pathways associated with tidal lagoon projects

Impact Pathway	Project Phase		Interest Features	
	Construction	Operational	Habitats (Marine)	Fish
Direct changes in habitat extent, type and quality	✓	✓	✓	✓
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)	✓	✓	✓	✓
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)	✓	✓	✓	✓
Introduction or spread of non-native species	✓	✓	✓	
Disturbance via noise and vibration	✓	✓		✓
Visual disturbance (including lighting and shade)	✓	✓		✓
Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species	✓	✓		✓
Collision risk (including vessels and static/rotating structures)	✓	✓		✓
Introduction of electromagnetic fields from power transmission cables		✓		✓
Changes in fish prey availability (including as a result of habitat changes)	✓	✓		✓
Changes in availability of spawning/nursery grounds for fish species	✓	✓		✓

In the specific context of this HRA the environmental effects have only been considered for the construction and operation phases of tidal lagoons. Decommissioning has not been considered on the basis that:

- Tidal lagoons are intended to have a minimum life of 120 years which is outside of the life of consideration of the WNMP (20 years);
- It is anticipated that tidal lagoon life may be extended beyond 120 years;
- That decommissioned tidal lagoons may leave the wall structures intact and remove only the turbine housings; and
- That technology to undertake any de-construction may be different in 120 years to what is available today.

3.2.2 Step 2 – High level application of buffer/zone of influence

The first phase in the screening process involved an initial high level screening of European/Ramsar sites within a defined zone of influence. The potential zone of influence was defined based on an understanding of the likely extent over which pressures resulting from the implementation of tidal lagoon(s) within the SRA could be realised (i.e. where a potential impact pathway exists). On this basis the following areas of screening have been applied in respect of marine habitats and fish:

- Sites overlapping, partly or wholly, the hydrodynamic/physical zone of influence defined as 50 km from the SRA boundary, seawards from the mean high water springs line (see below for consideration of high-level assessments on water levels);
- Sites where migratory fish are an interest feature (including salmon, sea trout, sea lamprey, shad and eel) within the zone of influence or the wider Bristol Channel and Liverpool Bay regions, including all estuaries of SACs where migratory fish are an interest feature; and
- Terrestrial sites where any part of the site overlaps a 2 km buffer inland of the marine zone of influence. These were largely included as they have the potential to include rivers that support migratory fish species.

It should be noted that these "buffers", whilst appropriate at the plan level in the context of the tidal lagoon SRA, would not necessarily be applicable at the project-level. In this instance the specifics of the proposed location and project (including the potential zone of effects) should inform the screening distance to be applied.

Water level assessments

The growing body of evidence relating to the assessment of predicted effects from tidal range lagoon schemes indicates that changes to *flow speed* tend to be generally observed local to any proposed scheme (associated with draining and filling of tidal lagoon schemes through turbines and sluice gates, and with sheltering and flow acceleration effects related to individual elements of lagoon wall construction). By contrast, predicted changes to *water levels* tend to be observed over a relatively larger extent – particularly in the Bristol Channel/Severn Estuary as a result of the effects on the resonance of the incoming tidal wave. As such, any buffer on likely extent of effect from a tidal range scheme is likely to be greatest when considering effects on water levels.

With specific regard to consented and proposed tidal lagoon schemes along the Welsh coastline, predicted effects on water levels from combined schemes within the Bristol Channel/Severn Estuary are shown by a range of studies (e.g. DECC, 2010a; Tidal Lagoon Swansea Bay, 2014; Angeloudis and Falconer, 2016; Centre for Environment, Fisheries and Aquaculture Science (Cefas), 2017) to extend across the Severn Estuary and into the Bristol Channel approximately to the Gower peninsular (with slight variances depending on the number and associated operational conditions of the lagoon

schemes assessed). This is well within the proposed 50 km buffer of the associated tidal range SRA, which extends from the Pembrokeshire coast and includes Carmarthen Bay.

The results of these studies are also supported by individual and in-combination scheme testing carried out by ABPmer, on behalf of Tidal Lagoon Power (TLP). These results, which included outputs provided to the Hendry Review of tidal lagoons, also show an extent of effect on water levels that extend into the Bristol Channel, but not as far as the proposed 50 km buffer zone.

This same modelling, which is based on a numerical model of the entire UK continental shelf, has also been used to assess the potential in-combination effects of tidal range lagoon schemes within the Severn Estuary/Bristol Channel and along the north Wales coast. Noting the extents of effect predicted for schemes within each location, the in-combination assessment did not predict any cumulative effects of implementing schemes along both north and south Wales coastlines.

When considering further potential tidal lagoon schemes along the north Wales coastline, the resonant effect on the tidal wave (as observed in the Bristol Channel) is not a consideration along the relatively open coastline with the Irish Sea. As a result, the extent of effect on water levels is likely to be considerably less, as evidenced in the initial findings of the assessment of four in-combination schemes (Angeloudis and Falconer, 2016). Again, the proposed 50 km buffer on the associated tidal range SRA for north Wales is considerably larger than the anticipated extent of effect from potential schemes.

It should be further noted that individual schemes, as and when any requisite application is made, will need to assess the detail of predicted effects, both alone and in-combination with existing (and proposed) schemes.

3.2.3 Step 3 – LSE screening for interest features not considered within this assessment

European/Ramsar sites that do not support interest features being considered within this HRA were next screened out of the assessment.

Marine habitats

At this stage it was considered that all marine habitats, within the defined zone of influence, have the potential to be either directly or indirectly impacted by tidal lagoons. This included marine habitats within SPAs that fall within this zone, noting that birds are being considered in a separate HRA.

Migratory fish and freshwater pearl mussel

Within the zones of influence stated above all European/Ramsar sites that support Annex II fish species, Ramsar qualifying species and/or freshwater pearl mussel were initially screened in to the assessment. Designated Annex II species considered for pre-screening included Atlantic salmon, sea/river/brook lamprey and Allis/twaite shad as well as bullhead and freshwater pearl mussel. Similarly those species that meet the qualifying criteria of Ramsar sites include European eel, sparling (the European smelt) and sea trout.

All migratory fish species have been screened into this assessment. Receptors that range over tens of miles such as Atlantic salmon, sea lamprey, European eel and Allis/twaite shad share an increased likelihood of encountering the SRA during foraging or spawning migrations. Receptors with comparatively discrete migratory ranges (e.g. river lamprey and sea trout) may or may not encounter the SRA depending on the proximity of their natal (home) estuary to the SRA. Sites supporting river

lamprey and sea trout have, however, been screened into the assessment since it is not possible based on current information to determine whether the migratory routes for constituent river lamprey populations may intersect the SRA. To underpin the screening process a broad-scale literature review of the baseline conditions for fish has been undertaken is presented in Appendix B.

There are no European/Ramsar sites within 50 km of the SRA for which freshwater pearl mussel is an interest feature. It was therefore possible to screen out fresh water pearl mussel for further consideration in this assessment. It was also possible to effectively screen out non-migratory freshwater fish species such as bullhead and brook lamprey. Neither of these species migrate into the marine environment and as such will not encounter the SRA or be affected by any associated environmental impact.

3.3 Consultation on screening criteria

In preparation of the over-arching plan level HRA of the tidal lagoon policy, a principles document has been developed by Welsh Government and shared with JNCC, Natural England and NRW (see Appendix C). At the time of writing this document is still being finalised. However, the principles stated within the document have broadly been applied within this HRA. The justification for deviating from the screening criteria as stated in the principles document is as described in Section 3.2.2, whereby potential extent of effect (to water levels) and thus associated impacts on habitats/fish features are likely to be within the 50 km buffer from the SRA boundary (as opposed to using a 50 km buffer from Welsh waters). The list of European/Ramsar sites (including the respective conservation objectives) that meet the screening criteria have been shared with JNCC, Natural England and NRW.

3.4 In-combination

Welsh Government has prepared a list of plans and projects that are required to be considered as part of the in-combination assessment (Appendix D). The focus has been on the specific combination of effects likely to give rise to cumulative effects rather than all aspects of these plans and projects. In this context the effect of in-combination interactions would only lead to an increase in the magnitude of a potential impact, not the introduction of new exposure pathways.

The in-combination assessment has been undertaken at both the screening stage (this section) and for the appropriate assessment (Section 5.4). At this screening stage the potential for in-combination effects has been considered in the context of the potential zone of influence. Given the precautionary approach to screening, which assumed LSE where any exposure pathway exists, a greater spatial extent of in-combination effects was considered unlikely and as such no further sites were screened in on this basis.

In the specific context of individual tidal lagoon projects, these will be required to undertake their own HRA and as part of that process there will be a requirement to consider in-combination effects. In this instance the potential zone of influence (both alone and in-combination) would be reviewed on a case by case basis.

4 Screening

4.1 Introduction and scope

All relevant European/Ramsar sites that lie within a 50 km buffer of each component of the SRA (seawards from the mean high water springs line) were included in pre-screening, as well as terrestrial sites where any part of the site overlaps a 2 km buffer inland of the marine zone of influence. In addition, sites where migratory fish are an interest feature (including salmon, sea trout, sea lamprey, shad and eel) within the zone of influence or the wider Bristol Channel and Liverpool Bay regions, including all estuaries of SACs where migratory fish are an interest feature were also screened in to the assessment. The European/Ramsar sites that fall within the potential zone of influence are presented in Table 3.

From this pre-screening list, all European/Ramsar sites which only supported features not being considered by this HRA or terrestrial and/or freshwater habitats or species for which no impact pathways exist with respect to tidal lagoon implementation were screened out (see Section 3.2). These European/Ramsar sites have been greyed out in Table 3. See Figure 2 for location of European/ Ramsar sites which have been screened in.

Further details on all of the screened in sites (i.e. those for which LSE cannot be excluded) have been captured in Appendix E. This includes the following details:

- Site name;
- Site code;
- Status;
- Site location with respect to the zones of influence;
- Feature name;
- Feature code;
- Annex;
- Primary qualifying;
- Ramsar criteria;
- Site description;
- Conservation objectives; and
- Links to further information.

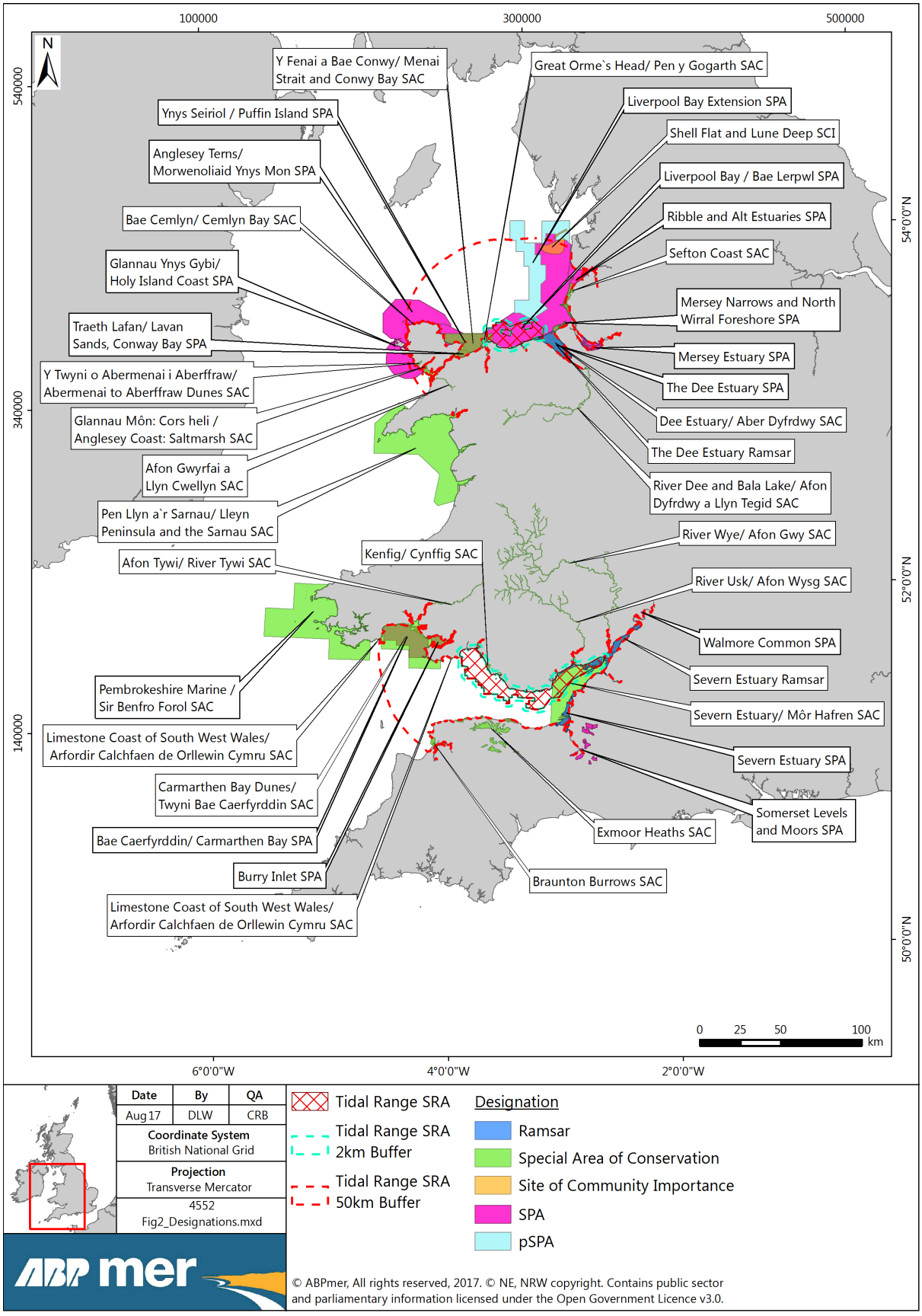


Figure 2. **Location of European/Ramsar sites for which LSE cannot be excluded in the context of marine habitats and fish**

Table 3. European/Ramsar sites within potential zone of influence of tidal lagoon projects

Type	Distance	Name	Interest Features	
			Habitats (Marine)	Fish
Ramsar	In SRA	Severn Estuary	✓	✓
		The Dee Estuary	✓	
	Within 2 km inland	Crymlyn Bog		
	Within 50 km below MHWS	Burry Inlet		
		Mersey Estuary		
		Mersey Narrows and North Wirral Foreshore		
		Ribble and Alt Estuaries		
		Somerset Levels and Moors		
	Within 2 km inland of 50 km marine buffer	Corsydd Mon a Llyn/ Anglesey and Llyn Fens		
SAC	5 km site buffer within 50 km SRA buffer	Exmoor and Quantock Oakwoods		
		Pembrokeshire Bat Sites and Bosherton Lakes/ Safleoedd Ystlum Sir Benfro a Llynnoedd Bosherton		
	In SRA	Dee Estuary/Aber Dyfrdwy	✓	✓
		Dunraven Bay		
		Great Orme`s Head/Pen y Gogarth	✓	
		Kenfig/Cynffig	✓	
		Severn Estuary/Môr Hafren	✓	✓
		Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay	✓	
	Within 2 km inland	Coedwigoedd Penrhyn Creuddyn/ Creuddyn Peninsula Woods		
		Crymlyn Bog/Cors Crymlyn		
		River Usk/Afon Wysg		✓
	Within 50 km below MHWS	Afon Gwyrfai a Llyn Cwellyn		✓
		Afon Tywi/River Tywi		✓
		Avon Gorge Woodlands		
		Bae Cemlyn/Cemlyn Bay	✓	
		Braunton Burrows	✓	
		Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd	✓	✓
		Carmarthen Bay Dunes/ Twyni Bae Caerfyrddin	✓	
		Coedydd Derw a Safleoedd Ystlumod Meirion/Meirionnydd Oakwoods and Bat Sites		
		Exmoor Heaths	✓	
		Glannau Mon: Cors heli/ Anglesey Coast: Saltmarsh	✓	
		Gower Commons/ Tiroedd Comin Gwyr		
		Limestone Coast of SW Wales/ Arfordir Calchfaen de Orllewin Cymru	✓	
		Mendip Limestone Grasslands		

Type	Distance	Name	Interest Features	
			Habitats (Marine)	Fish
		Pen Llyn a`r Sarnau/ Lleyn Peninsula and the Sarnau	✓	
		River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid		✓
		River Wye/Afon Gwy		✓
		Sefton Coast	✓	
		Wye Valley Woodlands/ Coetiroedd Dyffryn Gwy		
		Y Twyni o Abermenai i Aberffraw/ Abermenai to Aberffraw Dunes	✓	
	>50 km SRA buffer, but within Bristol Channel/Liverpool Bay	Pembrokeshire Marine/ Sir Benfro Forol	✓ (see note)	✓
	Within 2 km inland of 50 km marine buffer	Deeside and Buckley Newt Sites		
		Coedydd Aber		
		Glynllifon		
		Corsydd Mon/Anglesey Fens		
		Llyn Dinam		
		Wye Valley and Forest of Dean Bat Sites		
cSAC	Within 50 km below MHWS	Bristol Channel Approaches/ Dynesfeydd Mor Hafren		
		North Anglesey Marine/ Gogledd Mon Forol		
SCI	Within 50 km below MHWS	Shell Flat and Lune Deep	✓	
SPA	In SRA	Liverpool Bay/Bae Lerpwl	✓	
		Severn Estuary	✓	
		Dee Estuary	✓	
	Within 2 km inland of 50 km marine buffer	Walmore Common	✓	
	Within 50 km below MHWS	Anglesey Terns/Morwenoliaid Ynys Mon	✓	
		Bae Caerfyrddin/Carmarthen Bay	✓	
		Burry Inlet	✓	
		Glannau Ynys Gybi/Holy Island Coast	✓	
		Mersey Estuary	✓	
		Mersey Narrows and North Wirral Foreshore	✓	
		Ribble and Alt Estuaries	✓	
		Somerset Levels and Moors	✓	
		Traeth Lafan/Lavan Sands, Conway Bay	✓	
		Ynys Seiriol/Puffin Island	✓	
pSPA	In SRA	Liverpool Bay/Bae Lerpwl Extension	✓	

Note: The Pembrokeshire Marine/Sir Benfro Forol SAC comprises both fish and habitat interest features; however, only fish interest features have been assessed as part of this HRA due to their potential movements (migration) within the south component of the SRA, while it is considered unlikely that habitat interest features will be affected at this distant location (>50 km).

4.2 Coastal, intertidal and subtidal habitats and associated species

In summary, the screening phase concluded that there was a possibility of a LSE (or that it was not possible to conclude no LSE) for a range of Annex I qualifying habitat features which are listed below. For the purposes of this review they have been divided into five broad categories as follows:

Morphological features encompassing a range of habitats:
- Estuaries (1130 and Ramsar); and
- Large shallow inlets and bays (1160).

Subtidal habitats (soft-sediment habitat):
- Sandbanks which are slightly covered by sea water all the time (1110 and Ramsar).

Subtidal habitats (hard-substratum):
- Reefs (1170); and
- Submerged or partially submerged sea caves (8330).

Intertidal habitats:
- Mudflats and sandflats not covered by seawater at low tide (1140 and Ramsar);
- Annual vegetation of drift lines (1210 and Ramsar);
- *Salicornia* and other annuals colonizing mud and sand (1310 and Ramsar); and
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (1330 and Ramsar).

Supralittoral habitats:
- Coastal lagoons (1150);
- Fixed coastal dunes with herbaceous vegetation ('grey dunes') (2130 and Ramsar);
- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) (2150);
- Dunes with *Salix repens* ssp. *Argentea* (*Salicon arenariae*) (2170);
- Shifting dunes along the shoreline with *Ammophilia arenaria* ('white dunes') (2120 and Ramsar);
- Perennial vegetation of stony banks (1220);
- Vegetated sea cliffs of the Atlantic and Baltic Coasts (1230 and Ramsar);
- Embryonic shifting dunes (2110 and Ramsar); and
- Humid dune slacks (2190 and Ramsar).

A sub-set of the Annex I habitat types are defined as being 'priority' because they are considered to be particularly vulnerable and are mainly, or exclusively, found within the European Union (EU)[3]. Of the Annex I qualifying habitat features for European/Ramsar sites located within the potential zone of influence of tidal lagoon projects (listed above), the following are identified as priority habitats:

- Coastal lagoons (1150);
- Fixed coastal dunes with herbaceous vegetation ('grey dunes') (2130); and
- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) (2150).

In addition, the UK has a special responsibility in the EU for certain habitat types and species due to the large proportion of the European resource found within UK territory. This includes the following habitat types located within the potential zone of influence of tidal lagoon projects:

[3] http://jncc.defra.gov.uk/page-1467-theme=default (Accessed September 2017).

- Estuaries (1130 and Ramsar);
- Coastal lagoons (1150);
- Large shallow inlets and bays (1160);
- Reefs (1170);
- Perennial vegetation of stony banks (1220);
- Vegetated sea cliffs of the Atlantic and Baltic Coasts (1230 and Ramsar);
- Fixed coastal dunes with herbaceous vegetation ('grey dunes') (2130);
- Humid dune slacks (2190 and Ramsar); and
- Submerged or partially submerged sea caves (8330).

A number of habitat interest features of SACs are also designated in the respective Ramsar site (Criterion 1). In addition to these habitats, there will also be individual habitats that are identified within Ramsar citations (e.g. "sand and shingle spit") although these individual features are not listed. There are also a range of sub-features of SACs which include habitats not cited as qualifying features, such as rocky shore communities, infralittoral gravel/sand communities and mussel bed communities. However, these sub-features are considered to be covered within the broad categories described above and not assessed separately. Similarly, SPA supporting habitats are assumed to have been captured in the habitat types listed above.

To assess whether there is any AEOI of the European/Ramsar sites that were identified, the sensitivities of these habitat features (and the types of communities they support) has been reviewed in Section 5.2.2. The conservation objectives for these features have also been reviewed (in tabular format) to determine the potential effects arising from tidal lagoons in the context of the proposed plan-level mitigation measures (see Section 5.2.3).

4.3 Migratory fish and freshwater pearl mussel

In summary, the screening phase concluded that there is a possibility of a LSE (or that it was not possible to conclude no LSE) for the following fish features:

- Allis shad (1102);
- Atlantic salmon (1106);
- European eel (Ramsar);
- River lamprey (1099);
- Sea lamprey (1095);
- Sea trout (Ramsar); and
- Twaite shad (1103).

None of the above fish features are identified as priority species under the Habitats Directive. However, as described in Section 4.2, the UK has a special responsibility in the EU for certain habitat types and species due to the large proportion of the European resource found within UK territory. Of those Annex II qualifying species (fish) for European/Ramsar sites located within the potential zone of influence of tidal lagoon projects (listed above), 'Atlantic salmon' (1106) and 'River lamprey' (1099) are identified as special UK responsibility species.

With the exception of Allis and Twaite shad, all of the migratory species considered within the assessment are known to occur within both the northern and southern component of the SRA. The only known spawning stocks of Twaite shad in the UK occur in tributaries of the Severn Estuary (Carstairs, 2000) and, therefore, spawning and migratory behaviour for this species is only considered in the context of the southern component of the SRA. However, a spawning population of Allis shad may also occur in the Solway Firth (Hillman, 2003) and thus there is a possibility that fish from this population may forage within the northern component of the SRA.

European sites also support additional fish species as sub-features of individual qualifying interest features within marine SACs. For example, the marine fish assemblage forms a component of the Estuaries habitat type (1130 and Ramsar) for the Severn and the Dee Estuaries. The Severn Estuary ranks as one of the top ten estuaries in the UK for the number of marine estuarine-opportunistic species it supports (Potts and Swaby, 1993), including sprat, herring, whiting, bib, poor cod, bass and common goby (Bird, 2008). Of the marine species, a number are commercially important including sole, plaice, bass and rays (including thornback ray).

The Dee Estuary supports a number of marine species of conservation importance including Plaice (*Pleuronectes platessa*), thornback ray (*Raja clavata*), cod (*Gadus morhua*), Dover sole (*Solea solea*) and monkfish (*Lophius piscatorius*). Of these, there is a commercial fishery for thornback ray, whilst cod, Dover sole and monkfish form part of a mixed demersal fishery, along with pollack (*Pollachius pollachius*) and brill (*Scophthalmus rhombu*). Sea bass (*Dicentrarchus labrax*) and flounder (*Platichthys flesus*) are also exploited commercially[4].

The impact pathways for the marine fish supporting sub-features are considered to be the same as for qualifying interest fish features. However, their sensitivities to impacts during the construction and operational phase of a tidal lagoon development may vary, particularly given that they are resident within the estuary for at least part of their life cycle. They are therefore considered separately as a group as part of this assessment. Individual marine species are discussed specifically only where they have a particular sensitivity to an impact. The mitigation measures presented in Section 6 are considered to be equally relevant to marine fish and encompass all the levels of risk to relevant qualifying species.

To assess whether there is any AEOI of the relevant European/Ramsar sites, the sensitivities of these fish features has been reviewed in Section 5.3.1. The conservation objectives for these features have also been reviewed (in tabular format) to determine the potential effects arising from tidal lagoons in the context of the proposed plan-level mitigation measures (see Section 5.3.2).

4.4 Plan level mitigation measures

Having undertaken the screening phase, it is then necessary to apply the plan-level mitigation measures and then re-screen the European/Ramsar sites and features to determine whether this changes the scope of the HRA. In other words, to identify whether any sites or features can be removed on the basis that the mitigation measures ensure that no LSE occurs.

The intention of the draft policy ELC_01 is to offer a degree of encouragement to the renewable energy sector generally, and to signpost areas containing suitable resource (the resource area). The tidal lagoon safeguarding policy is intended to protect that resource from accidental sterilisation or interference from other sector developments. However, since not all areas of potential resource are of equal interest or availability (e.g. because they may already be of strategic importance for use by another sector such as shipping), then the tidal lagoon resource area has been further restricted to a SRA where sector development is encouraged. Such encouragement is not spatially or project specific beyond it being in the SRA as a whole; nor does it suggest that projects that do apply for a licence to proceed in that area will be successful. Furthermore, sector development is not excluded outside of these areas.

[4] ICES annual catch statistics http://www.ices.dk/marine-data/dataset-collections/Pages/Fish-catch-and-stock-assessment.aspx (Accessed September 2017).

The WNMP itself applies caveats to such developments as does the ELC_01policy. The WNMP (and tidal lagoon policy) reiterates that:

> "*Any support for marine renewable energy generation under this policy is conditional upon statutory process being followed and significant adverse effects on the integrity of European marine sites being effectively avoided or mitigated or, in the case of any developments that might take place under A6(4) IROPI provision, are fully compensated for.*"

Furthermore, any individual energy project to be licenced must also meet statutory processes involving strict environmental assessment before it may proceed. Elements of these requirements are reiterated through the suite of Environmental policies (ENV_01 to ENV_06) in the WNMP. It should be noted that the WNMP will also be updated as part of future review cycles (i.e. IPR) where policies can be updated to reflect any lessons learnt or reductions in uncertainties based on ongoing research or projects that have subsequently been implemented.

At this stage, given the uncertainties surrounding the specifics of individual lagoon projects that might be implemented within the SRA, it is not possible to screen out any additional European/Ramsar sites or features at this stage.

5 Information for Appropriate Assessment

5.1 Assessment approach

To prepare the information that is needed for this AA, a step wise process has been followed and, where relevant, tabular outputs have been produced that clearly summarise the findings. This has included the following key steps:

- Step 1 – Review impact pathways in the context of the screened in interest features and their sensitivity to tidal lagoon development; and
- Step 2 – Assess potential effects on European/Ramsar sites.

A description of the approach taken to each of these steps is provided below. The information is presented according to the relevant qualifying features and sub-features that could be affected, specifically for (marine) habitats (Section 5.2) and fish (Section 5.3), as well as potential in-combination effects (Section 5.4).

5.1.1 Step 1 – Review impact pathways and sensitivity of interest features

Following the initial audit to identify relevant qualifying interest features and sub-features during screening (see Section 4), a review of potential impact pathways associated with tidal lagoon projects has been undertaken. The external factors or environmental changes which influence the relative scale of effects associated with tidal lagoon projects that will, or might, cause these changes has also been documented. Key sources of information have included the DECC SETP feasibility study, environmental assessments for SBTL, conservation advice packages for relevant designated sites and a wider understanding of the potential impacts of tidal lagoons, encompassing the construction and operation stages of the development process.

A review of the sensitivities of these qualifying habitats and fish species has also been undertaken based on the potential impact pathways associated within tidal lagoon developments.

5.1.2 Step 2 – Assess potential effects on European/Ramsar sites

Prior to assessing the effects arising from each of the impact pathways identified, the conservation objectives were identified from online sources, such as NRW core management plans and Natural England and Countryside Council for Wales (CCW, now NRW) advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (now Regulation 35 of the Habitats and Species Regulations 2010). Based on past plan-level HRA approaches, a series of typical and generic objectives were identified which could be applied across all European/Ramsar sites. This same approach has been applied here.

Based on these generic objectives, the potential effects on the European/Ramsar sites via each of the relevant impact pathways are reviewed. An initial view is then taken and advice provided about the effect on site integrity of tidal lagoon developments both alone and in-combination with other plans or projects. Where the information indicates that there could be an effect on integrity, then proposals are presented for project-specific considerations and wider mitigation measures that should be adopted to avoid such an effect. These additional measures are reviewed in greater detail within Section 6.

5.2 Potential for adverse effects on habitat interest features

This section considers the potential for adverse effects on habitat interest features. Following the screening process, a total of 16 SACs, SCIs and cSACs and a further two Ramsar sites with qualifying marine habitat interest features were screened in to the assessment (see Table 3). In addition, 14 SPAs and one pSPA were screened in to the assessment to incorporate supporting habitats of designated bird features. The relevant qualifying habitat features within these sites includes a range of subtidal, intertidal and supralittoral interests as summarised in Section 4.2.

5.2.1 Relevant impact pathways

The following impact pathways are considered relevant in terms of potential adverse effects on habitat interest features and are discussed in detail below:

- Direct changes in habitat extent, type and quality;
- Indirect changes in habitat extent, type and quality;
- Changes in water quality; and
- Introduction or spread of non-native species.

Direct changes in habitat extent, type and quality

Subtidal, intertidal and supralittoral interest feature habitats are sensitive to a physical loss or gain of habitat at locations where new structures are introduced to, or removed from, the seabed or coastal habitats (i.e. within the development 'footprint' of these structures). Building a tidal structure across a bay or estuary, for example, will destroy the former benthic habitat in the construction footprint (Frid *et al*. 2012). Thus the key activities that are relevant are those which introduce permanent structures that lie on or protrude from the seabed and land, and cause a direct loss (whether permanent or temporary) of habitat. It is noted that tidal lagoon developments are generally intended to have a minimum lifespan of 120 years (beyond the scope of consideration for the WNMP) and decommissioned seawall structures may be left in place.

The amount of habitat that is lost will be influenced by the size and type of structure. For tidal lagoon developments, one of the main activities causing habitat loss or gain will clearly be the installation, presence and then removal of the structure on the seabed (if applicable). In addition, associated infrastructure and cables (including armouring) could result in a direct loss of an interest feature habitat. Dredging and disposal activities to support construction work, as well as any ongoing requirements for maintenance dredging within the lagoon, can also cause significant disturbance to marine habitats both directly and indirectly. This could include deterioration in habitat quality due to mechanical processes of removing sediment and/or changes in habitat type due to the disposal of dredge arisings.

Construction activities such as the use of jack-up legs, access routes and activities involved in cable installation (e.g. burial) if required can also result in direct disturbance to the seabed. Construction activities can result in impacts to adjacent intertidal areas if used for construction of caissons or as staging areas (Frid *et al*. 2012).

Such direct effects could occur in areas where there is an overlap between the SRAs and a habitat interest feature of a European/Ramsar site. The following European/Ramsar sites with habitat interest features are located within the SRA:

North component of SRA:

- Dee Estuary/Aber Dyfrdwy SAC;
- Dee Estuary Ramsar;
- Dee Estuary SPA;
- Great Orme's Head/Pen y Gogarth SAC;
- Liverpool Bay/Bae Lerpwl SPA;
- Liverpool Bay/Bae Lerpwl Extension pSPA; and
- Y Fenai a Bae Conwy/Menai Strait and Conwy Bay SAC.

South component of SRA:

- Kenfig/Cynggif SAC;
- Severn Estuary/Môr Hafren SAC;
- Severn Estuary Ramsar; and
- Severn Estuary SPA.

The significance of direct losses of habitat will vary on a site by site basis in response to differences in the extent of the habitat loss, as well as the relative value of the habitats in question. It is recognised that direct loss of habitat can potentially be mitigated, where required, by avoiding habitat interest features within a European/Ramsar site at the project planning and design phase. However, further additional measures will be needed to ensure that the relevant considerations are made at a project-level (see Section 6). For example, as part of a proposed tidal lagoon development at Swansea Bay, the lagoon seawall has been designed to promote and enhance the ecological diversity of the Bay through the use of bioblocks and rockpools which may promote the settlement of *Sabellaria* larvae and species associated with hydroid rockpools (Tidal Lagoon (Swansea Bay) PLC, 2014).

It is also recognised that the potential exists for the newly introduced structures to become surfaces for the settlement of reef forming species. The lagoon seawall itself has the capacity to function as an artificial reef by providing a new colonisation surface for species dependent on hard substrate (Bertelli and Powell, 2013). Similarly, Wilson *et al.* (2010) noted that the marine system is able to adjust to new structures in the sea and recognised the potential benefit to their receiving environment, albeit in the context of coastal and offshore wind farms. The increased production associated with the 'reefs' can create organic material for the local marine environment. Nevertheless, the relative ecological value of these different habitat types would need to be fully evaluated in the context of a specific project/location.

Indirect changes in habitat extent, type and quality

In addition to the impacts to habitat interest features outlined above (i.e. direct habitat loss and change), habitats are also sensitive to indirect physical damage from the placement of tidal lagoon developments as well as the resulting changes in physical conditions. In particular, changes in water levels are likely to have a significant impact on the surrounding marine environment (potentially larger than the direct habitat loss under the development footprint), altering the extent of intertidal/subtidal habitat and thus tidal exposure. Such changes to habitat extent, type and quality can also have profound impacts on species assemblages.

These indirect effects could occur in areas where a habitat interest feature of a European/Ramsar site directly overlaps with a lagoon as well as the full extent of potential physical changes (which will largely be determined by the scale of hydrodynamic effects). Therefore, in the context of the SRA, this includes the following European/Ramsar sites with habitat interest features:

North component of SRA:

- Anglesey Terns/Morwenoliaid Ynys Mon SPA;
- Bae Caerfyrddin/Carmarthen Bay SPA;
- Bae Cemlyn/Cemlyn Bay SAC;
- Dee Estuary/Aber Dyfrdwy SAC;
- Dee Estuary Ramsar;
- Dee Estuary SPA;
- Glannau Mon: Cors heli/Anglesey Coast: Saltmarsh SAC;
- Glannau Ynys Gybi/Holy Island Coast SPA;
- Great Orme's Head/Pen y Gogarth SAC;
- Liverpool Bay/Bae Lerpwl SPA;
- Liverpool Bay/Bae Lerpwl Extension pSPA;
- Mersey Estuary SPA;
- Mersey Narrows and North Wirral Foreshore SPA;
- Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC;
- Ribble and Alt Estuaries SPA;
- Sefton Coast SAC;
- Shell Flat and Lune Deep SCI;
- Traeth Lafan/Lavan Sands, Conway Bay SPA;
- Y Fenai a Bae Conwy/Menai Strait and Conwy Bay SAC;
- Y Twyni o Abermenai I Aberffraw/Abermenai to Aberffraw Dunes SAC; and
- Ynys Seiriol/Puffin Island SPA.

South component of SRA:

- Braunton Burrows SAC;
- Burry Inlet SPA;
- Carmarthen Bay and Estuaries/Bae Caerfyrddin as Aberoedd SAC;
- Carmarthen Bay Dunes/Twyni Bae Caerfyrddin SAC;
- Exmoor Heaths SAC;
- Kenfig/Cynggif SAC;
- Limestone Coast of South West Wales/Arfordir Calchfaen de Orllewin Cymru SAC;
- Severn Estuary/Môr Hafren SAC;
- Severn Estuary Ramsar;
- Severn Estuary SPA;
- Somerset Levels and Moors SPA; and
- Walmore Common SPA.

Damage to benthic habitats can occur during baseline surveys where these activities overlap European/Ramsar site interest features and where they involve the physical retrieval of samples or bed materials, including borehole surveying or ecological trawl sampling. Surveys to assess subsurface geological structure and suitability for installation can involve the collection of a large number of cores and the use of drilling equipment from jack-up barges, in addition to activities associated with the installation of the structure.

The increases in suspended sediments from construction activities (e.g. dredging) are typically expected to result in short-term, localised changes to the marine environment. In the event of a substantial resuspension, then the potential exists from the settlement of materials to cause a smothering of the seabed to which habitats may be sensitive. In particular, the potential for damage from smothering is highest in areas where there is dredging activity and the accompanying disposal of waste sedimentary materials on the seabed. In addition, changes in sediment stability are likely to

alter the proportions of suspension and deposit feeders, as different feeding types are facilitated or inhibited and hence lead to changes in the trophic structure of the assemblage (Rhoads and Young, 1970).

During the operational phase, the presence of newly introduced structures has the potential to cause scour effects in soft sediment systems in the marine environment, while rates of sedimentation may be altered. Changes in water velocities and sediment transport, erosion and deposition caused by the presence of new structures will alter benthic habitats, at least on a local scale (Frid *et al.* 2012). The magnitude of the scour effects will depend on the size of the structures and the associated risk will depend upon the composition of the seabed substratum, the hydrodynamic conditions and the distance of the structures from European/Ramsar site interest feature habitats. Hydrodynamic changes, including water levels, waves and flow speeds, within an estuary or coastal region, or around a new development, may lead to changes in the pattern of erosion or accretion of marine sedimentary habitats such as mudflats and sandbanks. These in turn have the potential to affect habitat quality and result in changes to diversity, abundance and biomass of habitats and species.

Frid *et al*. (2012) highlighted that the outflow of water from tidal barrages and fences (similar renewable energy concepts to tidal lagoons) will delay or alter the timing of the falling tide given the need to generate a tidal 'head'. Therefore, the presence of these structures could also influence habitats upstream and downstream of the facility, specifically altering exposure of tidal flats. The magnitude of any changes to habitat extent, type or quality will be project specific as impacts would be dependent on the scale of the development. For example, the volume of water impounded by the structure and the natural tidal range and cycle at the project site will determine the scale of any impacts on adjacent intertidal and subtidal habitats.

Changed spatial flow patterns during the operational phase will result in altered rates and locations of sediment deposition which could have impacts on benthic communities. The outflow will be constrained to a number of sites along the seawall, where the turbines are, and in these areas sediments will be scoured and coarsened while upstream of the structure the reduced flows and periods of no flow will lead to increased siltation and potentially an increasing quantity of fine material in the deposits (Frid *et al.* 2012). The prevailing sedimentary and hydrodynamic regimes and water quality are important factors structuring the biological assemblage of marine habitats. Changes in physical and chemical parameters may potentially introduce greater competition for space and food resources and change predator-prey relationships. In terms of the intertidal and subtidal ecology receptors, this may lead to changes in the benthic assemblage including the relative dominance of particular taxa. Any changes in the biomass and abundance of intertidal species have the potential to modify trophic linkages to higher consumers (Tidal Lagoon (Swansea Bay) PLC, 2014) and thus the tidal lagoon development could have a wider influence on habitat quality.

For all of the above activities, the rate at which habitats recover/adapt from damage will also be a key factor influencing the significance of any impact. Recovery rate will be strongly related to the ecology of the habitats; reef features and richer mudflat habitats for instance are likely to be more susceptible and take longer to recover than sandflats.

Changes in water quality

Interest feature habitats are sensitive to physical water quality parameters (e.g. temperature, salinity, dissolved oxygen and suspended sediment concentrations (SSCs)) as well as toxic contamination (where concentrations of contaminants exceed sensitivity thresholds) as a result of either the release of synthetic contaminants such as fuels, oils and construction material or from the releases of sediments (and any contaminants that may be present within these) during all stages of a project. These effects could occur in areas where a habitat interest feature of a European/Ramsar site directly

overlaps the SRA or within the zone of influence adjacent to the SRA. Therefore, this includes the following European/Ramsar sites with habitat interest features:

North component of SRA:

- Anglesey Terns/Morwenoliaid Ynys Mon SPA;
- Bae Caerfyrddin/Carmarthen Bay SPA;
- Bae Cemlyn/Cemlyn Bay SAC;
- Dee Estuary/Aber Dyfrdwy SAC;
- Dee Estuary Ramsar;
- Dee Estuary SPA;
- Glannau Mon: Cors heli/Anglesey Coast: Saltmarsh SAC;
- Glannau Ynys Gybi/Holy Island Coast SPA;
- Great Orme's Head/Pen y Gogarth SAC;
- Liverpool Bay/Bae Lerpwl SPA;
- Liverpool Bay/Bae Lerpwl Extension pSPA;
- Mersey Estuary SPA;
- Mersey Narrows and North Wirral Foreshore SPA;
- Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC;
- Ribble and Alt Estuaries SPA;
- Sefton Coast SAC;
- Shell Flat and Lune Deep SCI;
- Traeth Lafan/Lavan Sands, Conway Bay SPA;
- Y Fenai a Bae Conwy/Menai Strait and Conwy Bay SAC;
- Y Twyni o Abermenai I Aberffraw/Abermenai to Aberffraw Dunes SAC; and
- Ynys Seiriol/Puffin Island SPA.

South component of SRA:

- Braunton Burrows SAC;
- Burry Inlet SPA;
- Carmarthen Bay and Estuaries/Bae Caerfyrddin as Aberoedd SAC;
- Carmarthen Bay Dunes/Twyni Bae Caerfyrddin SAC;
- Exmoor Heaths SAC;
- Kenfig/Cynggif SAC;
- Limestone Coast of South West Wales/Arfordir Calchfaen de Orllewin Cymru SAC;
- Severn Estuary/Môr Hafren SAC;
- Severn Estuary Ramsar;
- Severn Estuary SPA;
- Somerset Levels and Moors SPA; and
- Walmore Common SPA.

Many intertidal species are adapted to temperature extremes, and can alter metabolic activity, burrow deeper in sediment or move to deeper water. At low tide, air temperature becomes critically important to intertidal animals, and on sandy beaches the substratum, from the surface to a depth of several centimetres, can experience large variations in temperature during a single cycle and throughout the year (Tidal Lagoon (Swansea Bay) PLC, 2014). Salinity exerts an important control on several hydro-environmental parameters including metals, nutrients and dissolved oxygen with important consequences for water quality. Due to the reduction in the magnitude of tidal currents and the volume of water entering the area within the tidal lagoon structure, a reduction in tidal flushing and seawater penetration is expected. This is likely to result in a decrease in salinity levels within the impounded water column (Sustainable Development Commission (SDC), 2007), with the

degree of change in salinity dependent on the water volume within the impounded area (Kadiri *et al*. 2012). Dissolved oxygen is an important hydro-environmental parameter which is needed to sustain aquatic flora and fauna in an estuary. Such changes in temperature, salinity and dissolved oxygen could influence the habitat type and species assemblage.

Changes in SSC can lead to changes in the intertidal and subtidal sand communities through changes in sediment availability. A reduction in the amount of sediment carried in suspension will reduce the amount of sediment available to intertidal and subtidal habitats (e.g. sandflats and sandbanks). Conversely, increases in suspended sediment will increase the amount of sediment available to intertidal and subtidal communities. These changes may alter the composition of the biological assemblage associated with these receptors (Tidal Lagoon (Swansea Bay) PLC, 2014).

Spillage of oils and fluids from construction vessels and machinery into the marine and/or coastal environment could adversely affect water and/or sediment quality potentially impacting on benthic communities and coastal habitats. In addition, in the areas being excavated or disturbed for the installation/removal of tidal lagoon structures or associated cables, there will be an increase in SSCs during the period of the activity. Where this release of suspended sediments occurs then the potential also exists for the release of sediment-bound contaminants in areas where such contaminants are present. A reduction in flushing within impounded tidal lagoon areas could also result in increased concentrations of contaminants, both through the disturbance of contaminated sediments and influences from existing sewage/wastewater discharges and surface runoff. Sediment contamination is only likely to be evident in areas close to the coastline of industrial locations or in coastal areas where water and sediments have been subject to historical contamination. For activities taking place outwith such locations, then there is unlikely to be a LSE on relevant interest features.

The resuspension of sediment as a result of areas being excavated or disturbed during construction works (and operational if maintenance dredging is required) can lead to the release and mobilisation of sediment-bound contaminants into the water column. These include both toxic contaminants, such as heavy metals, pesticides and hydrocarbons, and non-toxic contaminants, such as nutrients. The chemical contaminants associated with sediments can be removed or disturbed and may be dispersed, redistributed and deposited elsewhere in the marine environment where they may become available for uptake by marine organisms. Over the longer-term any such releases could also become stored in the surface sediments of benthic habitats for future benthic uptake (Tidal Lagoon (Swansea Bay) PLC, 2014). The likelihood of mobilising sediments and contaminated sediments and the magnitude of any effect is dependent upon the level of contamination, the proximity of the plan activity to the European/Ramsar site(s), the type of activity occurring, the manner in which that activity is pursued (including the extent and duration), the particle size of the disturbed sediments and the hydrodynamic conditions.

Introduction or spread of non-native species

Invasive species are those organisms which have been introduced by man, either accidentally or on purpose, to areas in which they are not naturally found, and have thrived to the extent that they have taken over their new environment[5]. The ecological impacts of such 'biological invasions' are considered to be the second largest threat to biodiversity worldwide, after habitat loss and destruction. In the last few decades marine and freshwater systems have suffered greatly from invasive species as a result of increased global shipping (Carlton and Geller, 1993).

The pathways which have the potential for introducing non-native species during construction are via transport of species in ballast or bilge water, fouling of vessels' hulls and the accidental imports from

[5] https://www.iucn.org/content/fight-against-invasives (Accessed September 2017).

materials brought into the ecosystem as a result of the tidal lagoon projects. Construction works traffic also has the potential to transfer non-native species that are currently present within project sites to other marine areas (Tidal Lagoon (Swansea Bay) PLC, 2014).

The introduction of new surfaces, such as tidal lagoon structures and cable armouring (or the clearing of seabed habitats to allow the introduction of these components), has the potential to facilitate the encroachment of invasive non-native species. This is because they will be initially barren with no competition from indigenous species, which could allow invasive non-native species to potentially colonise. This is based on the assumption that the current spread of such species is limited by the prevailing physical regime and lack of new colonising substrata. Therefore, any development which causes a change in physical processes or provides new colonising space (especially large expanses of such space) could create a potential sensitivity to this impact. The species composition and the rate of colonisation will depend upon the time of year and the availability of larval/juvenile stages.

The introduction or spread of non-native species could impact areas where a habitat interest feature of a European/Ramsar site directly overlaps the SRA or within the zone of influence adjacent to the SRA. Therefore, this includes the following European/Ramsar sites with habitat interest features:

North component of SRA:

- Anglesey Terns/Morwenoliaid Ynys Mon SPA;
- Bae Caerfyrddin/Carmarthen Bay SPA;
- Bae Cemlyn/Cemlyn Bay SAC;
- Dee Estuary/Aber Dyfrdwy SAC;
- Dee Estuary Ramsar;
- Dee Estuary SPA;
- Glannau Mon: Cors heli/Anglesey Coast: Saltmarsh SAC;
- Glannau Ynys Gybi/Holy Island Coast SPA;
- Great Orme's Head/Pen y Gogarth SAC;
- Liverpool Bay/Bae Lerpwl SPA;
- Liverpool Bay/Bae Lerpwl Extension pSPA;
- Mersey Estuary SPA;
- Mersey Narrows and North Wirral Foreshore SPA;
- Pen Llyn a'r Sarnau/Lleyn Peninsula and the Sarnau SAC;
- Ribble and Alt Estuaries SPA;
- Sefton Coast SAC;
- Shell Flat and Lune Deep SCI;
- Traeth Lafan/Lavan Sands, Conway Bay SPA;
- Y Fenai a Bae Conwy/Menai Strait and Conwy Bay SAC;
- Y Twyni o Abermenai I Aberffraw/Abermenai to Aberffraw Dunes SAC; and
- Ynys Seiriol/Puffin Island SPA.

South component of SRA:

- Braunton Burrows SAC;
- Burry Inlet SPA;
- Carmarthen Bay and Estuaries/Bae Caerfyrddin as Aberoedd SAC;
- Carmarthen Bay Dunes/Twyni Bae Caerfyrddin SAC;
- Exmoor Heaths SAC;
- Kenfig/Cynggif SAC;
- Limestone Coast of South West Wales/Arfordir Calchfaen de Orllewin Cymru SAC;
- Severn Estuary/Môr Hafren SAC;

- Severn Estuary Ramsar;
- Severn Estuary SPA;
- Somerset Levels and Moors SPA; and
- Walmore Common SPA.

5.2.2 Feature sensitivities

Morphological features encompassing a range of habitats

The following morphological features, encompassing a range of habitats, are considered in this section, based on the designated sites screened in (see Section 4.2):

- Estuaries; and
- Large shallow inlets and bays.

'Estuaries' (1130) are the downstream part of a river valley, subject to the tide and extending from the limit of brackish waters (there is generally a substantial freshwater influence). The mixing of freshwater and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats (European Commission (EC), 2013). The character of sediment deposition will also be a function of the tidal character of the estuary with flood dominant systems tending to act as net importers of sediment while ebb dominant systems act as sources of sediment to the coast. The patterns of flood and ebb dominance are often complex and operate in a dynamic equilibrium that is influenced by anthropogenic and natural factors. Together these factors can result in complex spatial and temporal patterns of sedimentation. In contrast to estuaries, the influence of freshwater on 'large shallow inlets and bays' (1160) is generally limited. These large indentations of the coast are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well-developed zonation of benthic communities (EC, 2013).

The sensitivity of these Annex I habitats to tidal lagoon activities that might affect them is not presented separately in this section. Instead, the overall sensitivity is considered to be reflected in the specific sensitivities of the component habitats as presented in the subsequent sections. For example, 'mudflats and sandflats not covered by sea water at low tide', 'saltmarshes', 'sandbanks which are slightly covered by sea water all the time' and 'reefs' (amongst other habitats) together form the complex mosaic of subtidal and intertidal habitats as part of these overarching morphological features, but are also identified as Annex I habitat types in their own right.

Subtidal habitats (soft sediment)

The following subtidal habitat (soft sediment) is considered in this section, based on the designated sites screened in (see Section 4.2):

- Sandbanks which are slightly covered by sea water all the time.

'Sandbanks which are slightly covered by sea water all the time' (1110) are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank. Banks where sandy sediments occur in a layer over hard substrata are classed as sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata. Reference to "slightly covered by sea water all the time" means that above a sandbank the water depth is seldom more than

20 m below chart datum. Sandbanks can, however, extend beneath 20 m below chart datum (EC, 2013).

The presence of a tidal lagoon is likely to alter sediment supply and physical processes within the system. This could be through retaining material within the impounded lagoon or changes to hydrodynamic conditions (i.e. flow rates) which naturally transport sediment. Subtidal sandbanks are dependent on the supply of material and, therefore, the extent of this habitat interest feature could be affected (in addition to any direct changes to habitat extent, type and quality).

An increase in water levels due to a tidal lagoon development can increase the extent of shallow subtidal sand areas and, therefore, has the potential to increase the extent of this habitat and associated features. Conversely, decrease in water levels has the opposite effect and have the potential to decrease the extent of this habitat type. Changes in water levels may affect some species, although many found in the intertidal sands also extend into the subtidal zone, and *vice versa*, so that changes in water levels and the tidal curve resulting in changes in inundation and emersion patterns may have fewer physiological effects on these species. Sandbanks are usually dependent on the input of colonising larvae to maintain the assemblage as few species present have benthic reproduction. This means that disruption to the water currents may alter larval supply and again lead to changes in the biological assemblage present (Elliott *et al*. 1998; cited in Tidal Lagoon (Swansea Bay) PLC, 2014).

The sensitivities of subtidal soft sediments, such as sandbanks which are slightly covered by sea water all the time, to tidal lagoon activities are shown in Table 4. The main impacts are the potential habitat loss and/or damage from the placement of the structure, cable installations and other associated infrastructure in the marine/coastal environment. In addition, the operation of tidal lagoons could significantly change the extent, type and quality of subtidal sandbanks due to changes in sediment supply and water levels.

Table 4. Potential sensitivities of subtidal habitat (soft sediment) interest features

Impact Pathway	Project Phase	
	Construction	Operation
Direct changes in habitat extent, type and quality		
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)		
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)		
Introduction or spread of non-native species		
Note: In this table, only the estimated sensitivity levels are shown. The level of risk will be dependent upon exposure (project specific). For instance, there would be an increased degree of exposure for European/Ramsar site habitat interest features where a tidal lagoon activity occurs within or near these sites. However, at the present time, there is very little information about exposure given the inherent uncertainties associated with the tidal lagoon policy within the WNMP.		
Sensitivity	Low	
	Medium	
	High	

Subtidal habitats (hard-substratum)

The following subtidal habitats (hard substratum) are considered in this section, based on the designated sites screened in (see Section 4.2):

- Reefs; and
- Submerged or partially submerged sea caves.

'Reefs' (1170) can be either biogenic concretions or of geogenic origin. They are hard compact substrata on solid and soft bottoms, which arise from the sea floor in the sublittoral and littoral zone. Reefs may support a zonation of benthic communities of algae and animal species as well as concretions of corallogenic organisms. 'Submerged or partially submerged sea caves' (8330) are caves situated under the sea or opened to it, at least at high tide, including partially submerged sea caves. Their bottom and sides harbour communities of marine invertebrates and algae (EC, 2013). Caves can vary in size, from only a few metres to more extensive systems, which may extend hundreds of metres into the rock (JNCC, 2004).

Artificial structures are often colonised by species that create their own habitat, such as kelp, mussels or honeycomb worms. As a consequence the artificial structure becomes host to secondary biogenic, reef-forming species which accelerate the development of a diverse algal and faunal community. The subtidal part of the structure can also enhance commercially important species such as lobsters and crabs. These benefits could also be extended to other commercial species such as mussels (*Mytilus edulis*) and native oysters (*Ostrea edulis*). In particular, tidal lagoon seawalls could attract settlement of *Sabellaria alveolata* offspring, which would assist in mitigating possible disturbances of existing tube-worm reefs during the construction phase, or potential negative effects of a changed hydrodynamic regime. Artificial coastal defence structures have been found to provide settlement substrate similar to natural materials and found to be colonised by large numbers of *S. alveolata* (Firth *et al*. 2013; Frost *et al*. 2004; cited in Tidal Lagoon (Swansea Bay) PLC, 2014).

Mussels such as *M. edulis* can only feed when immersed in water and, therefore, decreases in water levels due to the influence of tidal lagoon structures will affect individuals' ability to feed and their energy metabolism. Growth rates of *M. edulis* have been shown to decrease with increasing shore height and tidal exposure, due to reduced time available for feeding and reduced food availability. Decreased water levels will increase emergence and will also expose mussel populations to increased risk of desiccation and increased vulnerability to extreme temperatures, potentially reducing their upper limit on the shore, and reducing their extent in the intertidal. Conversely, increased water levels may allow the population to colonise further up the shore, but also exposes the lower limit of the population to increased predation, so that the population may effectively move up the shore (Tidal Lagoon (Swansea Bay) PLC, 2014).

Sea cave communities vary considerably depending on the structure and extent of the cave system, their degree of submergence and of exposure to sand scour and wave-surge, and their geology. Caves are typically colonised by encrusting animal species but may also support shade-tolerant seaweeds near their entrances. There are many potential threats to sea caves, but these are unquantified. In the case of sea level rise (due to climate change), more caves may be created by increased erosion, while caves that are currently intertidal may simply become subtidal (JNCC, 2008). Similar impacts to submerged or partially submerged sea caves could occur as a result of changes to emergence regimes due to tidal lagoon structures.

The sensitivities of subtidal habitats (hard substratum), such as reefs and submerged sea caves, to tidal lagoon activities are shown in Table 5. These are similar to the sensitivities of subtidal habitats comprising soft sediments; however, there is recognition that hard substratum habitats will have a higher sensitivity to sediment smothering events during construction and operation. The main impacts are the potential habitat loss and/or damage from the placement of the structure, cable installations and other associated infrastructure in the marine/coastal environment. In addition, the operation of tidal lagoons could significantly change the extent, type and quality of subtidal

sandbanks due to changes in sediment supply and water levels, while changes to water quality could influence habitat extent.

Table 5. Potential sensitivities of subtidal habitat (hard substratum) interest features

Impact Pathway	Project Phase	
	Construction	Operation
Direct changes in habitat extent, type and quality		
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)		
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)		
Introduction or spread of non-native species		
Note: In this table, only the estimated sensitivity levels are shown. The level of risk will be dependent upon exposure (project specific). For instance, there would be an increased degree of exposure for European/Ramsar site habitat interest features where a tidal lagoon activity occurs within or near these sites. However, at the present time, there is very little information about exposure given the inherent uncertainties associated with the tidal lagoon policy within the WNMP.		
Sensitivity	Low	
	Medium	
	High	

Intertidal habitats

The following intertidal habitats are considered in this section, based on the designated sites screened in (see Section 4.2):

- Mudflats and sandflats not covered by seawater at low tide;
- Annual vegetation of drift lines;
- *Salicornia* and other annuals colonizing mud and sand; and
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).

'Mudflats and sandflats not covered by seawater at low tide' (1140) are sands and muds of the coasts of the oceans, their connected seas and associated lagoons, not covered by sea water at low tide, devoid of vascular plants and usually coated by blue algae and diatoms. They are of particular importance as feeding grounds for wildfowl and waders. 'Annual vegetation of drift lines' (1210) is defined as formations of annuals or representatives of annuals and perennials, occupying accumulations of drift material and gravel rich in nitrogenous organic matter. '*Salicornia* and other annuals colonizing mud and sand' (1310) are formations composed mostly or predominantly of annuals, in particular Chenopodiaceae of the genus *Salicornia* or grasses, colonising periodically inundated muds and sands of marine or interior salt marshes (EC, 2013).

'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)' (1330) are salt meadows of Baltic, North Sea, English Channel and Atlantic shores (EC, 2013). Saltmarshes occur in stable intertidal environments typically with fine sediment above the mean high water neap level where vascular plants can survive and can further stabilise the habitat (Boorman, 2003). Once a cover of vegetation has become established the rate of sedimentation (accretion) often increases as more of the incoming sediment is intercepted and trapped by the increased surface roughness. In addition, the vegetation reduces the resuspension of deposited material and, at the same time, organic matter is added to the marsh surface.

Changes in water levels during the operation of tidal lagoon developments are likely to result in changes in habitat extent, including the proportions of intertidal and subtidal habitat interest features. A decrease in water levels is likely to increase the desiccation of intertidal sediment, especially at the top of the shore, and consequently may allow terrestrial plants such as pioneer saltmarsh species to invade. Species richness may decline and favour species more tolerant of desiccation or burrowing. An increase in water levels may move the high water mark further up shore, although this would not be possible in the presence of sea defences. If the low water mark moves inshore, the area available for intertidal species and habitats is effectively reduced, commonly referred to as 'coastal squeeze' (Tidal Lagoon (Swansea Bay) PLC, 2014).

Erosion or accretion can have an ecological effect upon the intertidal communities supported by sandflats and mudflats. Excessive sediment deposition can cause 'smothering' of benthic invertebrate fauna within sedimentary habitats. This smothering occurs where individuals are unable to migrate through any deposited sediment and their feeding and respiration apparatus becomes clogged (Elliott *et al*. 1998; cited in Tidal Lagoon (Swansea Bay) PLC, 2014). Intertidal sandflats generally experience regular changes in accretion and deposition. Even relatively stable sandflats exist in a relatively dynamic equilibrium experiencing regular movements of sediment over their surface (especially during spring tides). This means that the invertebrate assemblages that are present are often well adapted to natural levels of siltation through life history traits and can withstand burial by repositioning in sediment or simply by extending tubes or feeding and respiration structures above the sediment surface (Tidal Lagoon (Swansea Bay) PLC, 2014).

The sensitivities of intertidal habitats, such as mudflats, sandflats and saltmarsh, to tidal lagoon activities are shown in Table 6. The main impacts are the potential habitat loss and/or damage from the placement of the structure, cable installations and other associated infrastructure in the coastal environment, as well as changes to habitat extent due to water level and physical processes changes during operation of the facility. It is noted that changes in the emergence regime due to the operation of tidal lagoon structures could significantly alter the extent of intertidal habitat both within the impounded site and adjacent marine environment.

Table 6. Potential sensitivities of intertidal habitat interest features

Impact Pathway	Project Phase	
	Construction	Operation
Direct changes in habitat extent, type and quality		
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)		
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)		
Introduction or spread of non-native species		
Note: In this table, only the estimated sensitivity levels are shown. The level of risk will be dependent upon exposure (project specific). For instance, there would be an increased degree of exposure for European/Ramsar site habitat interest features where a tidal lagoon activity occurs within or near these sites. However, at the present time, there is very little information about exposure given the inherent uncertainties associated with the tidal lagoon policy within the WNMP.		
Sensitivity	Low	
	Medium	
	High	

Supralittoral habitats

The following supralittoral habitats are considered in this section, based on the designated sites screened in (see Section 4.2):

- Atlantic decalcified fixed dunes (*Calluno-Ulicetea*);
- Coastal lagoons;
- Dunes with *Salix repens* ssp. *Argentea* (*Salicon arenariae*);
- Embryonic shifting dunes;
- Fixed coastal dunes with herbaceous vegetation ('grey dunes');
- Humid dune slacks;
- Perennial vegetation of stony banks;
- Shifting dunes along the shoreline with *Ammophilia arenaria* ('white dunes'); and
- Vegetated sea cliffs of the Atlantic and Baltic Coasts.

A range of coastal habitat interest features were scoped into this assessment because they could be affected by landfall construction works, cable laying operations or other landside works, as well as changes in water level due to the operation of tidal lagoons. The 'Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)' (2160) habitat in Britain includes decalcified dunes colonised by heaths of the alliances *Calluno-Genistion* or *Ulicion minoris*. 'Coastal lagoons' (1150) are expanses of shallow coastal salt water, of varying salinity and water volume, wholly or partially separated from the sea by sand banks or shingle, or, less frequently, by rocks. Salinity may vary from brackish water to hypersalinity depending on rainfall, evaporation and through the addition of fresh seawater from storms, temporary flooding of the sea in winter or tidal exchange. 'Perennial vegetation of stony banks' (1220) include a wide range of vegetation types found on large shingle structures inland of the upper beach, while on more mature, stable, shingle coastal forms of grassland, heath and scrub vegetation may develop. Some areas of unusual vegetation dominated by lichens and bryophytes are found on more mature shingle. 'Vegetated sea cliffs of the Atlantic and Baltic Coasts' (1230) exhibit a complex pattern of variation reflecting the degree of maritime exposure, geology and geomorphology, biogeographical provenance and pattern of human management (EC, 2013).

'Dunes with *Salix repens* ssp. *Argentea* (*Salicon arenariae*)' (2170) are wet dune slacks which follow the lowering of the ground water table or accumulation of drift sand. Similarly, 'humid dune slacks' (2190) are humid depressions of dunal systems which are extremely rich and specialised habitats threatened by the lowering of water tables. 'Embryonic shifting dunes' (2110) are formations of the coast representing the first stages of dune construction, constituted by ripples or raised sand surfaces of the upper beach or by a seaward fringe at the foot of the tall dunes. 'Fixed coastal dunes with herbaceous vegetation ('grey dunes')' (2130) are fixed dunes, stabilised and colonised by more or less closed perennial grasslands and abundant carpets of lichens and mosses, while 'Shifting dunes along the shoreline with *Ammophilia arenaria* ('white dunes')' (2120) are mobile dunes forming the seaward cordon or cordons of dune systems of the coasts (EC, 2013).

The sensitivities of supralittoral habitats, such as dunes, coastal lagoons and sea cliffs, to tidal lagoon activities are shown in Table 7. The main impacts are the potential habitat loss and/or damage from the placement of the structure, cable installations and other associated infrastructure in the coastal environment. Sediment supply is an important factor in the maintenance of dune habitats. Therefore, the presence of a tidal lagoon structure and the hydrodynamic changes (i.e. flow rates) due to its operation may alter sediment transport processes and restrict/enhance the supply of material to these habitat interest features. In addition, the effects of increased water levels due to tidal lagoons could present a risk to supralittoral habitats.

Table 7. Potential sensitivities of supralittoral habitat interest features

Impact Pathway	Project Phase	
	Construction	Operation
Direct changes in habitat extent, type and quality		
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)		
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)		
Introduction or spread of non-native species		
Note: In this table, only the estimated sensitivity levels are shown. The level of risk will be dependent upon exposure (project specific). For instance, there would be an increased degree of exposure for European/Ramsar site habitat interest features where a tidal lagoon activity occurs within or near these sites. However, at the present time, there is very little information about exposure given the inherent uncertainties associated with the tidal lagoon policy within the WNMP.		
Sensitivity	Low	
	Medium	
	High	

5.2.3 Potential effects on European/Ramsar sites

On the basis of the sensitivities of the relevant interest features, this section reviews the conservation objectives for these features and assesses the potential effects on European/Ramsar sites. The conservation objectives for the qualifying habitats that are relevant to this plan-level HRA will be very similar and in many instances identical for all European sites that have been screened in. The relevant objectives seek to avoid deterioration of the qualifying habitats, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features.

The conservation objectives for interest feature habitats of designed sites screened in for this assessment are provided in Appendix E. The level of detail associated with conservation objectives varies between designated sites, ranging from generic statements (e.g. maintaining or restoring the extent/distribution of qualifying habitats) to comprehensive visions and performance indicators for each individual feature. In summary, the conservation objectives for the qualifying habitats are to ensure that the following are maintained in the long term:

- Extent of the habitat with the site;
- Distribution of the habitat within the site;
- Structure and function of the habitat;
- Processes supporting the habitat;
- Distribution of typical species of the habitat;
- Viability of typical species as components of the habitat; and
- No significant disturbance of typical species of the habitat.

Taking account of the conservation objectives and the plan-level activities to which the key habitat interest features are sensitive, Table 8 reviews the potential effects on the integrity of relevant European/Ramsar sites. Where it is not possible to eliminate the possibility of an AEOI of habitat features as a result of potential tidal lagoon developments, Section 6 provides further consideration of project-specific and wider mitigation measures that may be required.

Table 8. Assessment of the potential effects on habitats features of relevant European/Ramsar sites

Qualifying Feature Habitat Types	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
▪ Morphological features encompassing a range of habitats; ▪ Subtidal habitats (soft-sediment); ▪ Subtidal habitats (hard substratum); ▪ Intertidal habitats; and ▪ Supralittoral habitats.	Direct changes in habitat extent, type and quality	The sensitivity for all habitats screened in is considered to be high during both construction and operational phases. The amount of habitat that is lost will be influenced by the size and type of the tidal lagoon structures, as well as their location. However, it is expected that during the early stages in the design of any tidal lagoon development, a primary consideration will be to try and avoid sensitive habitats within European/Ramsar sites and minimise exposure and risk. Of the generic conservation objectives described above, all are considered to be relevant to impacts from the loss of habitat during the construction and operation phases of tidal lagoon developments. Therefore, the following conservation objectives are considered applicable: ▪ Extent of the habitat on site; ▪ Distribution of the habitat within site; ▪ Structure and function of the habitat; ▪ Processes supporting the habitat; ▪ Distribution of typical species of the habitat; ▪ Viability of typical species as components of the habitat; and ▪ No significant disturbance of typical species of the habitat.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).
▪ Morphological features encompassing a range of habitats; ▪ Subtidal habitats (soft-sediment); ▪ Subtidal habitats (hard substratum); ▪ Intertidal habitats; and ▪ Supralittoral habitats.	Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/ interaction)	Sensitivity of the habitat would be dependent on the habitat type; therefore, the worst-case sensitivity of high has been assumed here (particularly during the operational phase). The extent of the effects arising on habitats will be greatly influenced by the size and type of the tidal lagoon developments, as well as their location. Hydrodynamic changes in terms of tidal range and flow rates could be significant and thus could result in changes in habitat type and quality, with impacts also on the associated species assemblage. In particular, there is likely to be changes in intertidal exposure (extent and duration), both within the impounded tidal lagoon and the wider marine environment.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

Qualifying Feature Habitat Types	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
		Of the generic conservation objectives described above, all are considered to be relevant to impacts from changes in habitat extent, type and quality (due to changes in physical conditions) during the construction and operation phases of tidal lagoon developments. Therefore, the following conservation objectives are considered applicable: ▪ Extent of the habitat on site; ▪ Distribution of the habitat within site; ▪ Structure and function of the habitat; ▪ Processes supporting the habitat; ▪ Distribution of typical species of the habitat; ▪ Viability of typical species as components of the habitat; and ▪ No significant disturbance of typical species of the habitat.	
▪ Morphological features encompassing a range of habitats; ▪ Subtidal habitats (soft-sediment); ▪ Subtidal habitats (hard substratum); ▪ Intertidal habitats; and ▪ Supralittoral habitats.	Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)	Sensitivity of the habitat would be dependent on the habitat type; therefore, the worst-case sensitivity of medium has been assumed here. Construction works associated with the placement of tidal lagoon structures, as well as cable laying and other excavation processes, has the potential to cause redistribution of sediment and potentially affect surrounding habitats. There is also potential that disturbed sediments could be contaminated and thus could be distributed to other locations, although the characteristically high-energy environments in which the developments would be situated are likely to assist in the dispersion of any releases and minimise the effects. During construction and operational stages of a tidal lagoon development, there is the potential for accidental discharges/ spillages from machinery and vessels; however the likelihood is comparatively low due to a range of standard safety and control measures employed during works in both the marine and coastal environment. Of the generic conservation objectives described above, the following three are considered to be most relevant to impacts from changes in water quality as they relate to the composition and distribution of species present rather than the broader extent, distribution and functionality of habitats and processes affecting them:	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

Qualifying Feature Habitat Types	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
		▪ Distribution of typical species of the habitat; ▪ Viability of typical species as components of the habitat; and ▪ No significant disturbance of typical species of the habitat.	
▪ Morphological features encompassing a range of habitats; ▪ Subtidal habitats (soft-sediment); ▪ Subtidal habitats (hard substratum); ▪ Intertidal habitats; and ▪ Supralittoral habitats.	Introduction or spread of non-native species	Sensitivity of the habitat would be dependent on the habitat type; therefore, the worst-case sensitivity of medium has been assumed here. The placement of structures in the marine environment introduces new and initially barren surfaces which have the potential to facilitate the spread of non-native species where, in the absence of competition from indigenous species, they are able to colonise. The possibility also exists that non-native species could be introduced on vessels and/or equipment that is used to construct or maintain structures. However, it is difficult to quantify the risk of introduction of non-native species. Of the generic conservation objectives described above, the following three are considered to be most relevant from non-native introductions as they have the potential to affect the balance of species within the habitat: ▪ Distribution of typical species of the habitat; ▪ Viability of typical species as components of the habitat; and ▪ No significant disturbance of typical species of the habitat.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

5.3 Potential for adverse effects on fish interest features

This section considers the potential for adverse effects on fish interest features. Following the screening process, nine SACs and one Ramsar site with qualifying fish interest features were screened in to the assessment. General sensitivities of fish interest features are identified and tabulated in Section 5.3.1.

5.3.1 Relevant impact pathways and feature sensitivity

The following impact pathways are considered relevant in terms of potential adverse effects on fish interest features and are discussed in detail below:

- Direct changes in habitat extent, type and quality;
- Indirect changes in habitat extent, type and quality;
- Changes in water quality;
- Disturbance via noise and vibration;
- Visual disturbance (including lighting and shade);
- Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species;
- Collision risk (including static/rotating structures);
- Introduction of electromagnetic fields from power transmission cables;
- Changes in fish prey availability (including as a result of habitat changes); and
- Changes in availability of spawning/nursery grounds for fish species.

A description of the development activities which give rise to the impact pathways, including direct habitat loss, changes in habitat extent, type and quality and water quality are presented in Section 5.2.1 and are not described further here. The following sections highlight aspects of the impact which are relevant to fish and consider the sensitivity of fish interest features to the pressures associated with these impact pathways. Details of the ecology, life history and distribution of each of the migratory fish species considered within the assessment are presented in Appendix B. This information is used as the basis for considering the overall sensitivity of features to impact pathways and to specific sensitivities that may occur.

A sensitivity level to each impact pathway of low, medium or high has been attributed to the migratory and marine fish features (Table 9). For the purposes of this assessment fish with similar habits in terms of foraging, spawning, migration, and distribution have been grouped together. For example, Allis and Twaite shad species have been grouped together due to similarities in their migratory behaviour and occurrence only within the Severn catchment. Although sea and river lamprey demonstrate different home ranges and migratory behaviour, their sensitivity to the specific impacts considered here are similar and hence they have been grouped together. Sea trout and eel are grouped together because they are both migratory species which spend a component of their life cycle foraging within the estuarine environment. Atlantic salmon are dealt with individually since they are the only species considered within the assessment which migrates to its natal river based primarily on olfactory cues. Any differences between the likely sensitivities of species in the northern and southern components of the SRA are highlighted where known.

Table 9. Potential sensitivities of migratory fish interest features

Impact Pathway	Salmon		Shads		Lampreys		Sea Trout and Eel		Marine Species	
	Project Phase									
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Direct changes in habitat extent, type and quality					Medium for river lamprey where tidal lagoon located near mouth of natal estuary. Low for sea lamprey.		Medium for both species due to loss of benthic foraging resources.		Medium due to potential loss of spawning habitat for herring and sand eel. Low for other species.	
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)	Medium due to potential weakening and disruption of olfactory trail from natal rivers.						Medium due to loss of benthic foraging resources due to habitat change.		Medium due to potential deterioration in spawning habitat for herring and sand eel. Low for other species.	
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)										
Disturbance via noise and vibration	Medium and hearing generalist.		High as hearing specialists.		Low as little sensitivity to noise disturbance.		Medium for both species hearing generalist.		High for herring and other hearing specialists.	
Visual disturbance (including lighting and shade)	Medium for adult salmon. Low for smolts.						Medium for eel and adult sea trout.			
Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species										
Collision risk (including vessels and static/rotating structures)										
Introduction of electromagnetic fields from power transmission cables		Medium due to electro-sensitivity.					Medium for both species due to electro-sensitivity.			

Impact Pathway	Salmon		Shads		Lampreys		Sea Trout and Eel		Marine Species	
	Project Phase									
	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation	Construction	Operation
Changes in fish prey availability (including as a result of habitat changes)										
Changes in availability of spawning/nursery grounds for fish species										

Note: In this table, only the estimated sensitivity levels are shown. The level of risk will be dependent upon exposure (project specific). For instance, there would be an increased degree of exposure for European/Ramsar site fish interest features where a tidal lagoon activity occurs within or near these sites. However, at the present time, there is very little information about exposure given the inherent uncertainties associated with the tidal lagoon policy within the WNMP.

Sensitivity	
Low	
Medium	
High	

Direct changes in habitat extent, type and quality

Direct changes in habitat extent and quality have the potential to affect foraging, spawning and nursery habitat for both migratory and estuarine resident species. Habitat loss beneath structures is considered permanent, whilst temporary habitat loss may occur from dredging. Dredging undertaken during the preparation of the seabed may affect fish directly through entrainment in the draghead and indirectly through the disturbance of prey species associated with the seabed. Re-colonisation of a site following disturbance by dredging typically starts to occur immediately, although the faunal assemblage within a dredged area may remain in a perturbed state for up to four years (Boyd *et al.* 2003). For the purposes of the assessment, direct habitat loss is assumed to occur during the construction stage of the project and is highlighted as such in Table 9.

There is potential for habitat to be created during the construction phase of a tidal lagoon development. For example, construction of a lagoon seawall or other permanent infrastructure provides an opportunity for creating new reef habitat with the potential for beneficial effects on fish. Leonhard *et al.* (2011) have shown that the introduction of hard substrates to homogenous sand banks associated with renewable energy developments can result in a net gain for marine fish biodiversity.

The extent to which individual fish species are affected by direct habitat loss will depend on the location and extent of the tidal lagoon feature relative to critical habitats. Fish occupy many trophic levels of the marine food chain, feeding on phytoplankton, zooplankton, macroalgae, invertebrates or other (generally smaller) fish. In order to forage for these food items, their feeding habits are varied and comprise grazers, plankton filter feeders (e.g. shad), suckers and parasites (e.g. sea lamprey) and predators (e.g. Atlantic salmon). Many demersal fish are opportunistic predators and their prey choice reflects the species that are available in the area (Elliott *et al.* 1998). Given that fish generally feed on a range of food items, their sensitivity to the change in a particular food resource is considered to be low. Furthermore, the high mobility of fish enables them to move freely to avoid areas of adverse conditions and to use other food sources.

Migratory fish species are for the most part unlikely to be affected by a net loss of seabed habitat. Species such as Atlantic salmon, sea lamprey and Allis/Twaite shad forage over wide areas (when in the marine environment) and are not reliant on benthic food resources. Outward migrating smolts exhibit varying strategies depending on the individual's orientation behaviour, although given that they are not considered to follow the shoreline (Moriarty, 2016), they may be less likely to be affected by coastal seabed loss and disturbance associated with lagoon development. No differences in sensitivity are anticipated between the northern and southern component of the SRA. Adults returning from foraging grounds in Greenland and the Faroe Islands (Malcolm *et al.* 2010; Mork *et al.* 2012) are anticipated to approach the SRA from the north and tracking the coast. Habitat loss *per se* is considered unlikely to the affect the olfactory trails which returning adult salmon use as cues to locate natal rivers. Sensitivity of Atlantic salmon and the shad species to direct habitat loss is considered to be low.

Similarly, a net loss of seabed habitat is not like to adversely affect river lamprey, which despite having a limited foraging range, does not predate upon benthic organisms. River lamprey undertake highly localised migrations within local estuaries and surrounding waters. Siting of tidal lagoon developments to avoid blockage or interference will therefore be important. Overall, however, their sensitivity to direct habitat loss is considered to be low. The migratory behaviour of sea lamprey when they enter the marine environment is likely to result in an interaction with tidal lagoon developments in both the northern and southern components of the SRA. However, given their exoparasitic behaviour in the marine environment, the sensitivity of sea lamprey to habitat loss is considered to be

low, particularly given that their host species (large fish including basking sharks, cod and Atlantic salmon) are wide ranging in their foraging habits.

Net loss of seabed habitat is more likely to affect the Ramsar species (European eel and sea trout) that are known to reside for extended periods within estuarine and coastal waters. Both European eel and sea trout forage on benthic organisms and so may face an overall reduction in feeding area, although both species are wide ranging and their foraging habitats are well represented in both the northern and southern components of the SRA. Medium sensitivity is attributed to these species.

Direct habitat loss may occur from the Dee Estuary and Severn Estuary SAC and Ramsar sites which support marine fish assemblages. These sites lie within the northern and southern components of the SRA, respectively. Of the marine fish assemblage of the Severn Estuary, herring and sandeel are substrate spawners, laying eggs directly onto the seabed. For sandeel in particular, there is little movement of post-settled juveniles between spawning and nursery areas and, therefore, there is potential for both spawning and nursery habitat to be affected by direct habitat loss. For other marine species, spawning occurs in deeper water and therefore sensitivity to the loss of spawning habitat due to tidal developments is considered low. However, juveniles may move to shallow, intertidal habitats to forage and therefore sensitivity to loss of nursery habitat is likely to be higher. Sensitivity to the loss of foraging habitat for marine species is considered to be low given the availability of alternative foraging resources within the wider estuarine environment, and that most species, notably herring, move to foraging grounds offshore.

Indirect changes in habitat extent, type and quality

Alterations to the hydrodynamic regime will occur around the associated tidal lagoon structures and within the lagoon itself. This is likely to cause changes to the localised tidal currents and wave height within the immediate vicinity of the SRA. Similarly, there may also be a change to the degree of scouring and the sediment transport regime due to the intake and discharge of seawater through the turbines. Changes to water levels may occur over a wider area giving rise to changes in the extent and nature of subtidal and intertidal habitat, with resulting effects on the benthic communities that fish populations depend on. For example, changes in water level will result in changes in the area of subtidal sand and mud habitats, and hard substratum habitats (see Section 5.2.2). Additional hard substrate habitat in the form of artificial reefs may be incorporated into the design of the seawall in order to compensate for the loss of this habitat type.

Changes to benthic communities arising from alterations to physical conditions have the potential to affect migratory and marine species which forage in the estuarine and coastal environment. Benthic infaunal and epifaunal prey may be affected by physical smothering, or by asphyxia brought about by accretion due to changes in the hydrodynamic regime. Sandeel, sprat and herring are prey for many piscivorous fish including salmon, sea trout, turbot and rays. As discussed above, both of these prey species demonstrate fidelity to spawning grounds and are therefore sensitive to direct habitat loss or any deterioration in the quality of spawning substrate. Whilst in general the sensitivity of migratory species to physical changes in habitat is considered to be low due to the wide range of prey resources available to them, medium sensitivity is attributed to sea trout and eel due to a greater dependence on benthic invertebrate communities. However, both species are wide ranging within the estuarine environment and are unlikely to be sensitive to localised and minor changes in prey abundance.

Large scale changes to the hydrodynamic regime may influence the ability of Atlantic salmon to home on their natal (place of birth) river system by weakening or masking the olfactory trail. This may occur as a result of changes in water exchange leading to delayed release of freshwater discharge into the estuary downstream, changes to the hydraulic mixing regime of water from rivers discharging into the SRA and through excessive mixing during intake and discharge periods. The extent to which this

occurs will depend on the location and extent of a tidal lagoon development relative to freshwater inflows and the migratory pathways followed by inward migrating adults. This is discussed further under the 'Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species' impact pathway below. Other migratory species which demonstrate a lower fidelity to their natal river are considered to be of low sensitivity.

Changes in water quality

Releases of chemicals such as fuel, oil and lubricants or the re-suspension of sediment bound contaminants during construction into the marine environment has the potential to be harmful to fish. However, it is assumed for the purposes of the assessment that discharges during construction would be strictly controlled through a construction environmental management plan (CEMP) and that any releases that occur would be accidental and very infrequent. Furthermore, it is likely that any accidental spillage or release would be rapidly dispersed due to strong tidal currents and wave action. Dredging has the potential to produce very high levels of suspended sediment although background levels within the estuarine environment are also high.

Fish are known to be sensitive to increases in SSC, both directly through physiological and behavioural disruption and indirectly through habitat modification. Higher levels of suspended solids can impair foraging, increase mortality and affect growth/reproduction. Each species will have varying degrees of sensitivity depending on the stage of their lifecycle, the type and quantity of substance entering the marine environment and the dilution and dispersion properties of the receiving waters. Fish eggs and larvae tend to have a higher sensitivity whereby fine sediment settling on eggs reduces oxygen availability and may result in asphyxiation.

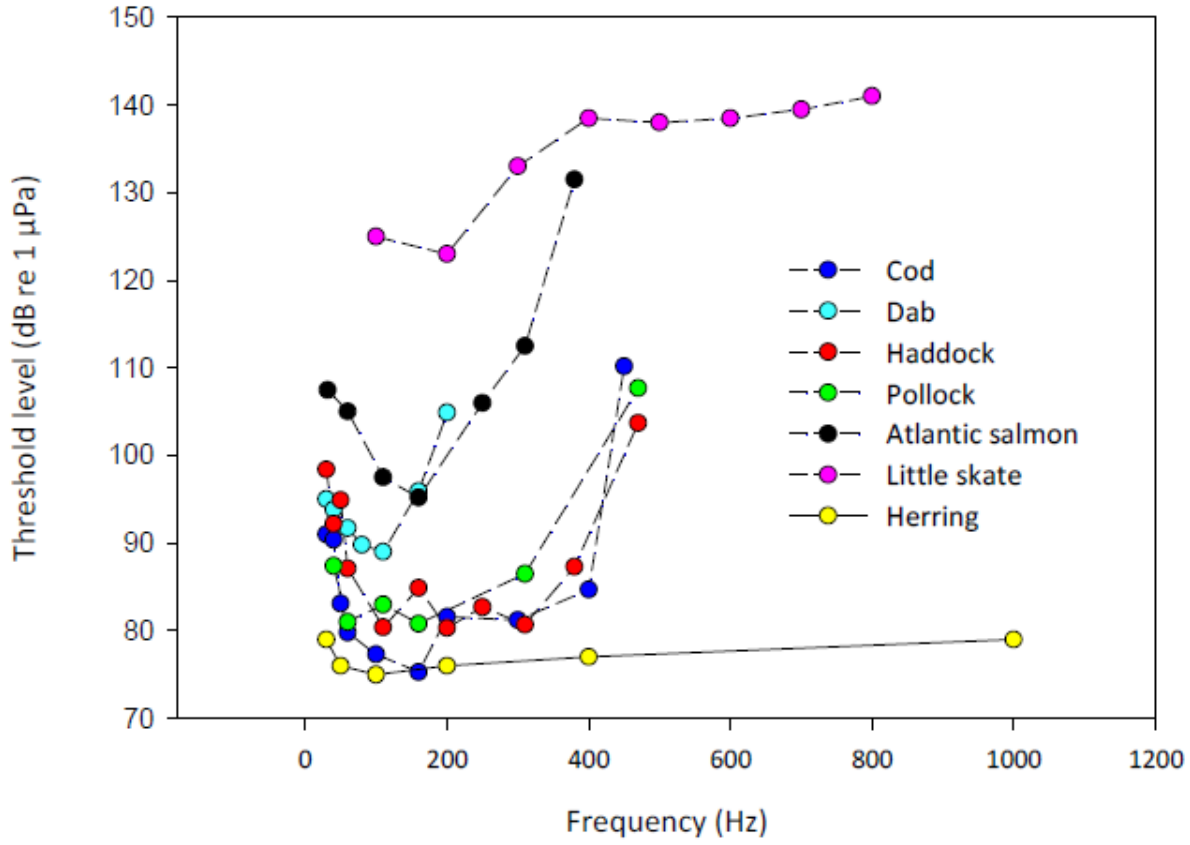
Migratory fish species including Atlantic salmon, shads, lampreys, sea trout and eel are capable of relocating or avoiding the affected area altogether. The spawning and early lifestages of shad (Allis and Twaite), lampreys (sea and river lamprey), sea trout and Atlantic salmon occur only in rivers, and hence will not be directly affected by the sediment released in the Bay. Similarly, the spawning of the catadromous European eel occurs outside of the Bristol Channel and will not be affected by predicted sediment releases. Atlantic salmon occur in the Severn Estuary in areas which can contain several thousand mg/l of suspended solids (Gibson, 1933). Juvenile (glass eel) and adult (silver) European eel are well adapted to high concentrations of suspended solids (Maitland and Campbell, 1992). Both species are often found in estuaries with very high concentrations of sediment and are known for migrating in periods of notable turbidity, whilst avoiding movements in clearer conditions (Alabaster and Lloyd, 1982). Sensitivity for migratory species is therefore considered to be low.

As for habitat loss, marine species such as herring and sandeel, which spawn on hard substrates in the Severn Estuary, are likely to be most vulnerable to smothering by sediments. Avoidance behaviour by adult herring is known to occur at relatively low suspended sediment levels, though their response seems to be dependent on the nature of the sediment (e.g. 19 ± 5 mg/l for fine sediment, 35 ± 5 mg/l for coarser sediment; Wildish and Wilson, 1977). However, surveys carried out at power station screening facilities within the Severn Estuary indicate significant numbers of herring in areas where suspended sediment levels are known to be high (Claridge *et al.* 1986), which suggests that their susceptibility to suspended sediments may vary. Given the high background levels of suspended sediments in the estuarine environment, sensitivity for marine species is considered to be low.

Disturbance via noise and vibration

Construction works including underwater blasting, percussive piling and vibro-piling, dredging, drilling and other such activities can generate underwater noise, excessive levels of which have the potential to affect the physiology, behaviour and indirectly the spawning, feeding and migrations of fish

(Hawkins, 2009). The dominant noise frequencies generated by construction work often fall within the sub-3 kilohertz (kHz) band where fish hearing sensitivity is found (Hawkins, 1981; 1986). During construction, noise from piling operations would therefore be audible to most species, though will be heard at different levels according to the emissions associated with the activity in question and the specific hearing capabilities of the fish. Audiograms presented in Figure 3 illustrate the variation in hearing ability for a selection of different fish species, using a threshold (sound pressure) level based on amplitude of a sound wave's loudness in decibels (dB) with a pressure of 1 microPascal (µPa).



Source: Offutt (1974); Hawkins and Johnstone (1978); Hawkins and Myrberg (1983); Fay (1988); Casper *et al.* (2003)

Figure 3. Audiograms of cod (*Gadus morhua*), dab (*Limanda limanda*), haddock (*Melanogrammus aeglefinus*), pollock (*Pollachius pollachius*), Atlantic salmon (*Salmo salar*) and little skate (*Raja erinacea*)

Fish detect vibrations by using sense organs of the inner ear and the lateral line. The inner ear is sensitive to sound pressure, whilst the lateral line detects particle motion and vibration. Some 'hearing specialist' species, such as herring, have connections from the inner ear to the swim bladder making them more sensitive to noise (Figure 3). Most species do not have these connections to their swim bladders (e.g. Atlantic salmon) or have no swim bladder at all (e.g. lampreys, skates, rays and flatfish species) and so are less sensitive to sound pressure. These species may be more sensitive to particle motion and vibration.

Responses by fish to underwater noise or explosions range from mild awareness to injury such as temporary or permanent hearing loss and, in extremis, mortality. Although behaviours may be impaired, any risk of injury and mortality due to exposure to piling and construction noise would reduce rapidly with distance from the source.

Where the ensonified zone spans a confined geographical area (e.g. the entrance to a bay or an estuary), there is the potential to create a temporary barrier to migration. This may inhibit the passage of hearing-specialist migratory species such as Allis and Twaite shad within the region of the proposed works, and of other more sensitive species such as herring (*Clupea harengus*). Less sensitive hearing-generalist species such as Atlantic salmon, sea trout European eel and sea/river lamprey will be less affected.

Overall, piling and other forms of construction noise will have a short-term impact, of intermittent duration, on noise sensitive species within the immediate area of the construction activities. Potential barrier effects to fish migration will be present over a short-term intermittent basis for the duration of the activity.

In accordance with good practice guidance (National Physical Laboratory (NPL), 2014), a suite of simple and complex underwater acoustic models should be used to predict the propagation of sound pressure from construction activities that generate underwater noise. A range of available published criteria can then be applied to the predicted sound pressure levels to assess the potential physiological and behavioural effects of underwater noise on fish (e.g. Popper *et al.* 2014; Hawkins *et al.* 2014).

Unpublished criteria, namely the dB hearing threshold metric for a specific species (dB_{ht}(species)) proposed by Nedwell *et al.* (2007), could also be used to provide context as this metric has been used in numerous past Environmental Impact Assessments (EIAs). It should be noted, however, that the concept of dB_{ht}(species) has not been fully validated by experimental study or accepted in any independent peer-reviewed publication. Caution should therefore be exercised in applying the dB_{ht}(species) measure. Defining response criteria applicable to all species is a far too simplistic an approach to evaluating behaviour (Popper *et al.* 2014; Hawkins *et al.* 2016). Moreover, the approach does not take into account potential for sound sensitivity to change with that of the life stage of the organism, time of year, animal motivation or other factors that might affect hearing and behavioural responses to sound.

Visual disturbance (including lighting and shade)

Changes to ambient light conditions may occur as a result of the installation of artificial lighting around the tidal lagoon during the construction phase and shading from associated infrastructure. The implications of unnatural lighting regimes for migratory fish species in coastal ecosystems are relatively unknown. However, artificial night lighting is described by Nightingale *et al.* (2006) as being capable of influencing foraging, shoaling, migration and reproduction behaviours as well as altering the predation risk to fish. In addition, light penetration through the water column could be influenced by turbidity and thus increased suspended sediment concentrations as a result of construction and operation of tidal lagoons could cause visual disturbance to fish. However, it is also recognised that some part of the SRA are naturally turbid.

Experiments manipulating light conditions have shown clear differences in fish abundance and behaviour, with an increased number of large predatory fish as well as small shoaling fish observed when artificial lights were switched on (Becker *et al.* 2013). It is likely that conditions created by artificial lighting benefit visually dependant predators by enhancing their foraging opportunities (Becker *et al.* 2013). This could potentially affect small shoaling species and juvenile fish in nurseries that occur within the illuminated area from increased predation. Sea trout disperse slowly upon entering the marine environment (Malcolm *et al.* 2010) and use shallow inshore waters to feed. This means that sea trout smolt may potentially face a higher risk of predation should they use the area surrounding the SRA for foraging purposes.

Street lighting has been shown to disrupt the onset of salmon smolt migration making it more random throughout the day as opposed to being naturally correlated to sunset when in a riverine environment (Riley *et al*. 2012). This is considered to affect the overall fitness of salmon smolt which can influence the scale of mortality and strength of the cohort (Riley *et al*. 2012). However, upon entering the marine environment salmon smolt rapidly migrate towards open marine areas and in general do not follow nearby shores (Malcolm *et al*. 2010). The influence of artificial lighting from the tidal lagoon is not likely to have a great affect.

The presence of structures will create areas of shading where underwater illumination is reduced. The extents of these shaded areas will alter daily with the movement of the sun and also seasonally with changing sunlight hours available throughout the year. Effects of shading on fish are likely to relate to vision and associated behavioural changes such as orientation, schooling/dispersal, altered predator-prey relationships and migration direction change and delay (Nightingale and Simenstad, 2001).

Most research on the shading effects of coastal structures relate to the downstream movement of juvenile salmonids and include reluctance of juveniles to pass through areas of low light, such as under piers. This has been shown to cause delays in migration until tidal and sunlight conditions are suitable.

Returning adult Atlantic salmon will likely pass through, or close to the SRA, during their inshore migration and may experience strong contrasts in underwater illumination subject to the position and brightness of the sun and dimensions of the tidal lagoon structures casting shadow(s). Impacts on returning Atlantic salmon may include minor directional change or a small delay to river entry.

Marine fish species exhibit a range of responses to artificial light, with some species being attracted to light, whilst others are repelled by it. Studies by Marchesan *et al*. (2005) on a range of commercially important marine species found that Gilthead Bream (*Sparus auratus*) and Grey mullet (*Mugil cepahlus*) exhibited an attraction to light, whereas the European sea bass (*Dicentrarchus labrax*) exhibited no reaction to artificial light.

Commercial fishermen have made use of the attractive properties of light to fish and have modified fishing techniques to use artificial lights to boost catches of a range of species, including herring, anchovy, tuna, mackerel and anchovy. The use of artificial lighting to capture herring has been banned by some countries due to unsustainably high catches of herring, which has led to the collapse of several herring fisheries (Ben-Yami, 1988).

Increases in light intensity have also been reported to increase shoaling densities in some species including the Atlantic mackerel (*Scomber Sombrus*) (Glass *et al*. 1986). The increased shoaling behaviour of prey fish species could benefit visually dependant predators (Becker *et al*. 2013); however, light has also been shown to improve the efficiency of foraging behaviour in planktivorous fish species (Ryer and Olla, 1999; Hunter, 1968). This could suggest that exposure to artificial light may have both positive and negative effects upon traditional prey species such as mackerel and herring. It should also be noted that turbidity has an impact upon the transmission of light in water and light will not travel as far in highly turbid waters as it will in low turbidity water (Ben-Yami, 1988). This should be taken into account as artificial light could potentially have a smaller effect upon fish species in highly turbid waters such as the Severn Estuary. Marine species are considered to be of low sensitivity with the exception of herring which is of medium sensitivity.

Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species

The physical presence of a tidal lagoon and associated infrastructure has the potential to interfere with the movements of migratory and marine species, resulting in delays in reaching foraging, spawning and nursery habitat, fragmentation of migration routes and increased energetic costs. The extent to which this will occur depends on the size of the tidal lagoon and its relationship with migratory pathways.

Migratory fish, including salmon and lamprey, are highly mobile species that undergo large seasonal movements and migrations to forage and breed (Hendry and Cragg-Hine, 2003; Maitland, 2003; DECC, 2009). They can, therefore, be particularly vulnerable to any structures which could act as a barrier, preventing movement to key foraging or nursery grounds. Their sensitivity will depend on their ability to move and avoid barrier structures (e.g. structures placed in a highly confined estuary will be more of an issue than those placed on the open coast).

Depending on their location relative to natal rivers, structures may interfere with olfactory and other cues influencing migration. Salmon are thought to track along the coast to provide a means of orientation (Malcolm *et al*. 2010; Davidsen *et al*. 2013). Water chemistry, olfaction, sound and vibration are all considered to be cues used by adult salmon to orientate themselves as they approach coastal waters from the open ocean (Kingsford *et al*. 2002; Huijbers *et al*. 2012). As they reach their home-river domain, navigation is believed to be through the home stream odour hypothesis in which smolts learn the unique odour signature of their home river, retain these memories and use them as adults to return to their river of origin (Hasler and Wisby, 1951; Scholz *et al*. 1976). More recent research suggests that there are a more complex set of cues including the biological, structural and environmental features of the river (Guerin *et al*. 2014). The influence of new structures on these migratory cues is difficult to predict.

Comparatively little information exists on the migratory cues of other species screened into the assessment, particularly Allis and Twaite shad. Sea trout tend to utilise shallow inshore waters combined with a slow dispersal rate. Their comparatively limited foraging range suggests that when originating from catchments close to the SRA they are likely to pass through it at some point during their marine phase. Inward migrating juvenile or glass eels may remain in coastal waters for an extended period to feed before moving into rivers to mature. Migratory behaviour at this stage in their lifecycle will be strongly influenced by tidal currents. Therefore, temporary delays in migration could occur due to structures which act as a barrier to tidal movements. Due to the uncertainty around the potential influence of new structures on migratory cues and possible barrier effects, high sensitivity is attributed to all migratory species.

Increases in energetic cost maybe incurred by migrating fish due to the need to navigate around structures associated with the tidal lagoon. Furthermore, increased current velocities along the boundaries of the tidal lagoon may also cause increased swimming effort. Migratory fish are likely to find potential refuge areas away from the flow and the energetic costs associated with swimming around the structure are likely to be low.

Movement of migratory fish between waters inside and outside the tidal lagoon will be restricted to passage via the sluice gates and through the turbines. Fish which enter the tidal lagoon may be delayed in their migration by at least one tidal cycle or more. The proportion of migrating adults and juveniles that may become trapped will depend on the configuration, orientation and proximity of the tidal lagoon to the migratory pathway. The chance of encountering the tidal lagoon increases with proximity to riverine systems that contain migratory populations.

Collision risk (including static/rotating structures)

Fish have been recorded colliding or becoming entrapped within a range of anthropogenic structures such as fishing nets and power station intakes (Johnson *et al*. 1976; Wardle, 1986). The level of light and clarity of water are important factors influencing the probability that a fish might collide with an object. In poor visibility conditions, fish have been observed only just avoiding collision with an obstacle, whereas in good visibility conditions, fish react further away from trawl otter boards and swim over/under/around trawls (Wardle, 1986). At light levels below these thresholds, fish were unaware of the netting barriers and swam straight through them.

Hydroelectric turbines have the potential to injure or kill migratory fish which become entrained within the generating flow. This can occur as a result of collision with the rotating turbine blades, or due to changes in pressure, severe turbulence or hydraulic shear stress. Risks typically increase as fish increase in length and mass, and sensitivities vary amongst species (Turnpenny, 1997).

The amount of migratory fish entering and leaving the tidal lagoon is likely to vary depending on season and the behaviour of the species. For example, increased numbers of migratory species may become entrained during peak periods of migration. Species which demonstrate a preference to swim in mid-water (Atlantic salmon, sea trout, Allis/Twaite shad) may have a higher tendency to encounter the turbine if positioned high up in the water column as opposed to a bottom dwelling species like European eel. This instance of encounter may also be increased should the tidal lagoon be located in close proximity to the entrance of estuarine/riverine environs.

Of the individuals entering or leaving the tidal lagoon, a proportion will pass through the sluice gates (open during periods near high and low water). Collision/injury rates to these individuals are likely to be greatly reduced compared to those passing through the turbine blades. All migratory fish species are considered to be of high sensitivity to collision risk.

Introduction of electromagnetic fields from power transmission cables

The electromagnetic fields (EMF) created by the current passing high voltage cables designed to bring power ashore is composed of both an induced electric field (E field) and a magnetic field (B field). Electro-sensitive migratory fish, such as Atlantic salmon, European eel, sea lamprey and sea trout can detect these fields as they use the earth's natural electromagnetic field for navigation (Metcalfe *et al*. 1993; Westerberg and Begout-Aranas, 2000; Formicki *et al*. 2004; Sadowski *et al*. 2007, Kirschvink *et al*. 2011).

The effect of EMFs on migratory fish receptors is related to the proximity of the animal to the cable. The strength of the magnetic field decreases rapidly, both horizontally along the sediment and vertically through the water column with distance from the cable. Burial of the cable or armouring with rock or steel will significantly reduce the emission field.

In a worst-case scenario where the cables are surface laid with no armour, the EMF emissions may induce behavioural responses in migratory species. However, studies on European eel show that whilst their swimming speed temporarily slowed whilst in close proximity to high voltage alternating current (HVAC) cable, they are able to traverse over them (Westerberg and Langenflet, 2008). Other migratory species, such as Atlantic salmon and sea trout, swim above the seabed whilst migrating, making any behavioural responses induced by the EMF unlikely to occur.

Species such as European eel and sea trout that forage inshore are more likely to encounter the tidal lagoon power cables on a more frequent basis. Should the cable intersect a foraging area localised exclusion may occur from the repellent area surrounding the cables. This may result in a potential reduction to the overall foraging area available to these species. However, despite similar predictions

at operational offshore wind farms in the UK, no adverse impacts on other electro-sensitive species (i.e. elasmobranchs – sharks, skates and rays) have been recorded (Cefas, 2010).

Changes in fish prey availability (including as a result of habitat changes)

Any changes to the fish prey availability are likely to be the same as those described for the 'direct changes in habitat extent, type and quality' impact pathway.

Changes in availability of spawning/nursery grounds for fish species

No direct changes are anticipated to occur to the amount of available spawning or nursery habitat resulting from the installation of a tidal lagoon within the SRA. Anadromous species (Atlantic salmon, sea trout, sea/river lamprey and Allis/Twaite shad) spawn in freshwater environments where they remain in nursery areas for the first year(+) of life. Similarly, catadromous species (e.g. European eel) which spawn in the marine environment do so some 5,000 km away in the Sargasso Sea.

Should the placement inhibit or significantly impede the entrance to a freshwater source used for migratory fish spawning/nursery then there is the potential to indirectly reduce the amount of available habitat. This can be avoided by ensuring the placement of the tidal lagoon allows free access to freshwater environs.

Of the marine species, herring and sandeel are considered to be most sensitive since they are substrate spawners and demonstrate a high fidelity to spawning sites. Effects are considered further under the 'Direct changes in habitat extent, type and quality' impact pathway described above.

5.3.2 Potential effects on European/Ramsar sites

On the basis of the sensitivities of the relevant interest features, this section reviews the conservation objectives for these features and assesses the potential effects on European/Ramsar sites. The conservation objectives for the qualifying fish interest features that are relevant to this plan-level HRA will be very similar and in many instances identical for all European sites that have been screened in.

The conservation objectives for interest feature fish of designed sites screened in for this assessment are provided in Appendix E. The level of detail associated with conservation objectives varies between designated sites, ranging from generic statements (e.g. maintaining or restoring the extent/ distribution of qualifying species) to comprehensive visions and performance indicators for each individual feature. In summary, the conservation objectives for the qualifying fish are to ensure that the following are maintained in the long term:

- Population of the species (including range of genetic types in the case of Atlantic salmon) as a viable component of the site;
- Distribution of the species within the site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species.

Taking account of the conservation objectives and the plan-level activities to which fish interest features are sensitive, Table 10 reviews the potential effects on the integrity of relevant European/ Ramsar sites. Where it is not possible to eliminate the possibility of an AEOI of fish interest features as a result of potential tidal lagoon developments, Section 6 provides further consideration of project-specific and wider mitigation measures that may be required.

Table 10. Assessment of the potential effects on fish features of relevant European/Ramsar sites

Qualifying Feature Fish	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Direct changes in habitat extent, type and quality	With the exception of river lamprey, sea trout and eel, the sensitivity of all migratory fish screened in is considered to be low during both construction and operational phases. Those species (sea trout, European eel and sea lamprey) with limited migratory ranges or that spend extended periods of residency in coastal and estuarine environments may be more adversely affected within the immediate locality of the tidal lagoon but are likely to be able to find suitable alternative foraging areas. Medium sensitivity is attributed to these species, though for river lamprey this would only be the case for tidal lagoons located on or near natal estuary mouths. Of the marine species, substrate spawners such as herring and sandeel are most sensitive although only where siting of development impinges directly on spawning habitat. Sensitivity is considered to be medium in respect of sandeel and herring. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from the loss of habitat during the construction and operation phases of tidal lagoon developments: ▪ Distribution of the species within the site; ▪ Distribution and extent of habitats supporting the species; and ▪ Structure, function and supporting processes of habitats supporting the species.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

Qualifying Feature Fish	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/ interaction)	The sensitivity for all fish screened in is considered to be low during both construction and operational phases, with the exception of salmon, sea trout and eel. Effects of physical habitat loss/gain are likely to be similar to those outlined above for 'direct loss of habitat' with primary species of concern being sea trout and European eel, which both have limited foraging ranges. Sensitivity is considered to be medium for these species. Hydrodynamic changes in terms of tidal range and flow rates could result in disruption of olfactory trails for Atlantic salmon which home to natal rivers. Marine species are considered to be of low sensitivity with the exception of herring and sandeel which are of medium sensitivity due to fidelity to spawning and nursery habitat. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from change in habitat extent, type and quality during the construction and operation phases of tidal lagoon developments: ▪ Distribution of the species within the site; ▪ Distribution and extent of habitats supporting the species; and ▪ Structure, function and supporting processes of habitats supporting the species.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)	The sensitivity for all fish screened in (including marine species) is considered to be low during both construction and operational phases. Each species will have varying degrees of sensitivity depending on the stage of their lifecycle, the type and quantity of substance entering the marine environment and the dilution and dispersion properties of the receiving waters. Dispersal rates likely to be fast in the marine environment with species such as Atlantic salmon being able to actively avoid contaminated areas. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from changes in water quality during the construction and operation phases of tidal lagoon developments:	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

Qualifying Feature Fish	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
		▪ Distribution of the species within the site; ▪ Distribution and extent of habitats supporting the species; and ▪ Structure, function and supporting processes of habitats supporting the species.	
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Disturbance via noise and vibration	Sensitivity of fish interest features would be dependent on hearing specialism of the species. High sensitivity assumed for hearing specialists such as shad. Medium sensitivity assumed for hearing generalists such as salmon, sea trout and eel. Low sensitivity assumed for lampreys which show little or no response to sound. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from noise and vibration during the construction and operation phases of tidal lagoon developments: ▪ Population of the species (including range of genetic types in the case of Atlantic salmon) as a viable component of the site; ▪ Distribution of the species within the site; and ▪ No significant disturbance of the species.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Visual disturbance (including lighting and shade)	Sensitivity is considered to be medium for salmon and sea trout and low for other migratory species during both construction and operational phases. Changes to the lighting regime resulting from the installation of a tidal lagoon may influence foraging, shoaling, migration and reproduction behaviours of fish. Migratory species may incur increased predation risk whilst transiting past the tidal lagoon or incur minor alterations to the timings of their run due the extent of the artificial change in light period. Marine species are considered to be of low sensitivity with the exception of herring which is of medium sensitivity. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from visual disturbance during the construction and operation phases of tidal lagoon developments:	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

Qualifying Feature Fish	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
		▪ Population of the species (including range of genetic types in the case of Atlantic salmon) as a viable component of the site; ▪ Distribution of the species within the site; and ▪ No significant disturbance of the species.	
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species	Sensitivity of fish interest features would be dependent on the species and location; the worst-case sensitivity of high has been assumed here (particularly during the operational phase). Migratory fish species are likely to experience a degree of habitat fragmentation and impediment to migration through the placement of a tidal lagoon within the SRA. This could result in a loss of foraging habitat, delay to migration, fragmentation of migration routes and increased energetic costs. There could also be a dilution or masking of olfactory output from riverine environment. The significance of any obstruction is also dependent on the spatial confines and size of the devices and array; for example, whether the tidal lagoon spans across the entire mouth of an estuary and the functional use of the area by fish. Due to the uncertainty around the potential influence of new structures on migratory cues and possible barrier effects high sensitivity is attributed to all migratory species. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from barriers to movement during the construction and operation phases of tidal lagoon developments: ▪ Population of the species (including range of genetic types in the case of Atlantic salmon) as a viable component of the site; ▪ Distribution of the species within the site; and ▪ No significant disturbance of the species.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and	Collision risk (including vessels and static/rotating structures)	Sensitivity of fish interest features would be dependent on the species, location and turbine type. Hydroelectric turbines have the potential to injure or kill migratory fish which become entrained within the generating flow. This can occur as a result of collision with the rotating turbine blades, or due to changes in pressure, severe turbulence or hydraulic shear stress. Risks typically increase as fish increase in length and mass, and	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP.

Qualifying Feature Fish	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
▪ Marine species.		sensitivities vary amongst species (Turnpenny, 1997). The worst-case sensitivity of high has been assumed here (particularly during the operational phase) for all migratory species. Collision risk can be seen as a function of the extent of exposure, avoidance response (both long range avoidance and close range evasion) and the potential physiological damage caused by a wet renewable device. The extent of any risk will also be dependent on device characteristics and modified by various environmental features. In general, it is considered likely that tidal energy devices would not provide sufficient cues for long range avoidance in most fish species. It is possible that fish may be able to undertake close range evasion of tidal stream devices. However, the speed of rotating blades in horizontal axis and venturi turbines combined with very fast flow rates in the surrounding tidal rapids means that strikes could be possible for fish with these devices. Of the generic conservation objectives described above, the following are considered to be relevant to impacts on fish from barriers to movement during the construction and operation phases of tidal lagoon developments: ▪ Population of the species (including range of genetic types in the case of Atlantic salmon) as a viable component of the site; ▪ Distribution of the species within the site; and ▪ No significant disturbance of the species.	Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Introduction of electromagnetic fields from power transmission cables	Sensitivity of fish interest features would be dependent on the species and location; the worst-case sensitivity of medium has been assumed here (particularly during the operational phase). The generated magnetic fields that can be produced by tidal developments are expected to be perceived by electro-sensitive migratory fish species such as Atlantic salmon, sea trout and European eel as a new localised addition to the heterogeneous pattern of geomagnetic anomalies already occurring naturally and anthropogenically in the sea. Of the generic conservation objectives described above, the	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

Qualifying Feature Fish	Impact Pathway	Sensitivity and Relevant Conservation Objectives	Is There an AEOI with Plan-Level Mitigation Measures?
		following are considered to be relevant to impacts on fish from the introduction of EMF during the construction and operation phases of tidal lagoon developments: ▪ Population of the species (including range of genetic types in the case of Atlantic salmon) as a viable component of the site; ▪ Distribution of the species within the site; and ▪ No significant disturbance of the species.	
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Changes in fish prey availability (including as a result of habitat changes)	Refer to 'direct changes in habitat extent, type and quality' and 'changes in habitat extent, type and quality due to changes in physical conditions' impact pathways above.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).
▪ Atlantic salmon; ▪ Sea lamprey; ▪ River lamprey; ▪ Allis shad; ▪ Twaite shad; ▪ European eel; ▪ Sea trout; and ▪ Marine species.	Changes in availability of spawning/nursery grounds for fish species	No direct changes are anticipated to occur to the amount of available spawning or nursery habitat. Sensitivity is considered to be low for migratory species. Of the marine species, herring and sandeel are considered to be of medium sensitivity since they are substrate spawners and demonstrate a high fidelity to spawning sites.	There is a possibility of an AEOI. Further work would be required to confirm no AEOI. This is because of: ▪ The level of uncertainty associated with this effect at plan-level; and ▪ The absence of any formal mitigation measures within the tidal lagoon policy within the WNMP. Therefore, there is a need for project-specific considerations and wider mitigation measures (see Section 6).

5.4 Potential in-combination effects

The Habitats Regulations require that, in determining whether a plan or project is likely to have a significant effect on a European/Ramsar site, its effects should be considered both alone and in-combination with other plans or projects. For this plan-level assessment of tidal lagoon policy which lacks any detail on the potential location and scale of tidal lagoon developments or the extent that mitigation or avoidance measures are practically (as opposed to theoretically) available or are likely to be successfully implemented, the in-combination assessment has been of a necessarily high level and sign-posting in nature. The focus has been on the specific combination of effects likely to cumulate rather than all aspects of these plans and projects. In this context, the effect of in-combination interactions would only lead to an increase in the magnitude of a potential impact, not the introduction of new exposure pathways.

Welsh Government has prepared a list of plans and projects that are required to be considered as part of the in-combination assessment (Appendix D). The list of plans and projects is relatively comprehensive and encompasses a wide range of known activities, issues and potential impacts. However, it is understood that, for this high level assessment, these lists are often generic in nature and that it is not feasible to generate complete lists of all relevant and extant plans and projects which may have an in-combination effect with all elements of the plan. For instance, plans and projects that might be important at a local small-scale or on land may not have been captured. They will also exclude plans and projects that occur outside of the UK. In addition, there would be activities such as recreational activities, commercial fishing and military activities which do not require assessment in their own right but will influence the baseline conditions of the environment and may need to be considered (especially at a local level) as a result.

The plans and projects identified by Welsh Government fall into the broad categories of activities that are defined within the JNCC activities/pressures matrix[6]. These activity categories are summarised in Table 11 along with the respective human activities. Furthermore, the activity categories that could potentially result in the same impact pathways as those considered for tidal lagoons are summarised in Table 12. This illustrates the key project types that could result in the specific combination of effects likely to cumulate rather than all aspects of these plans and projects. However, at the project-level, there would be a requirement to consider all potential in-combination impacts as part of the HRA.

Tidal lagoon projects will be required to undertake their own HRA and, as part of that, will need to consider in-combination effects. They will be able to do so at a more local-level and include local plans relating more specifically to areas of potential interest than would be possible at overall (WNMP) plan-level. In addition, the WNMP includes mitigating provisions within it that will minimise the risk of in-combination effects, notably:

- The need for activities to consider the overall coherence of the MPA network;
- The requirement for proposals to assess potential cumulative effects;
- The requirements for project-level HRA; and
- The three yearly review process, which will allow for potential in-combination effects to be identified and mitigated with the benefit of new data.

The WNMP therefore includes appropriate plan-level mitigating provisions within it that will minimise the risk of in-combination effects. It is recognised, however, that in-combination effects will need to be revisited and addressed in a more comprehensive manner at the project-level when more detailed information is available.

[6] http://jncc.defra.gov.uk/default.aspx?page=7136 (Accessed September 2017).

Table 11. Activity categories and associated human activities

Activity Category	Human Activity
Coastal management activities	Coastal defence and land claim protection (including beach replenishment)
	Coastal docks, ports and marinas
Waste management activities	Waste gas emissions
	Industrial and agricultural liquid discharges
	Sewage disposal
	Waste disposal – munitions (chemical and conventional)
	Power stations – thermal effluent and nuclear discharge
Extraction of living resources	Fishing
	Harvesting – seaweed and other sea-based food (bird eggs, shellfish, etc.)
	Extraction of genetic resources (e.g. bioprospecting and maerl – blue technology)
Production of living resources	Aquaculture – finfish
	Aquaculture – shellfish
	Aquaculture – macroalgae
Extraction (and disposal) of non-living resources	Extraction – sand and gravel (aggregates)
	Extraction – rock/mineral (coastal quarrying)
	Extraction – navigational dredging (capital and maintenance)
	Dredge and spoil disposal
	Extraction – water (abstraction)
Energy generation	Renewable energy – wind (not including cables)
	Renewable energy – wave (not including cables)
	Renewable energy – tidal (not including cables)
	Marine hydrocarbon extraction (not including pipelines)
Transport	Shipping – port operations (mooring, beaching, launching, etc.)
	Shipping – general (at sea)
Recreation and leisure	Coastal tourist sites (public beaches and resorts)
	Recreational activities (e.g. boating, yachting, diving, etc.)
Marine research	Marine research activities (incl. physical sampling and remote sensing)
Defence/security	Military activities
Other man-made structures	Submarine cable and pipeline operations
	Gas storage operations (carbon capture and natural gas storage)
	Artificial reefs and other environmental structures
	Cultural and heritage sites/structures (e.g. wrecks, sculptures, foundations, etc.)

There are a number of key guidance and research papers which provide relatively early and sound guidance on undertaking cumulative impact assessments (CIA) at the project-level (e.g. Council on Environmental Quality (CEQ), 1997; Hyder, 1999). More recently, a number of initiatives have been taken forward in the UK, mainly driven by the requirements to adequately assess the cumulative impacts of offshore wind and wet renewables development. These include a review of common approaches to key CIA issues in Pentland Firth and Orkney Waters (PFOW; The Crown Estate, 2013), identifying potentially significant cumulative and in-combination effects resulting from wave and tidal development in PFOW (The Crown Estate, 2011), work to develop methodologies for CIA for seabirds (King *et al.* 2009), a general review of CIA for offshore wind farm development (Marine Management Organisation (MMO), 2013) and work to develop guiding principles for offshore wind CIA (RenewableUK (RUK) and Natural Environment Research Council (NERC), 2013).

A generic framework for undertaking CIA has also been developed by ABPmer (2014) to provide the basis for Natural England case officers advising on CIA of human activities affecting MPA features. These, together with any further advances, should be considered by developers to ensure that robust CIAs are being undertaken at the project-level as part of EIAs and/or HRAs.

Table 12. Impact pathways associated with high level activity categories

Impact Pathway	Plan/Project Type										
Description	Coastal management activities	Waste management activities	Extraction of living resources	Production of living resources	Extraction (and disposal) of non-living resources	Energy generation	Transport	Recreation and leisure	Marine research	Defence and national security	Other man-made structures
Direct changes in habitat extent, type and quality	✓			✓	✓	✓		✓		✓	✓
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction)	✓		✓	✓	✓	✓		✓	✓	✓	✓
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Introduction or spread of non-native species	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Disturbance via noise and vibration	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Visual disturbance (including lighting and shade)	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species	✓			✓		✓				✓	✓
Collision risk (including vessels and static/ rotating structures)			✓	✓	✓	✓	✓	✓	✓	✓	✓
Introduction of electromagnetic fields from power transmission cables						✓				✓	✓
Changes in fish prey availability (including as a result of habitat changes)	✓		✓	✓	✓	✓				✓	✓
Changes in availability of spawning/nursery grounds for fish species	✓		✓	✓	✓	✓				✓	✓

6 Assessment Conclusions and Mitigation Requirements

In advance of considering further 'additional' mitigation measures, it cannot be concluded that there will be no AEOI of any European/Ramsar sites. This is because of the inherent uncertainties that exist about future developments that will result from WNMP tidal lagoon policy and also the lack of an absolute guarantee that there will be no evidence/analysis gaps in the future. These uncertainties relate to several key aspects, such as:

- The location of tidal lagoon activities (both within and outside the SRA);
- The scale of tidal lagoon development;
- The proposed technologies to be used and future advances in these technologies;
- The scale of the effects arising via some of the defined impact pathways;
- The detailed baseline ecology of the development locations;
- The sensitivities of species to impacts; and
- The efficacy of some project-level mitigation options.

In addition, uncertainty exists with respect to the in-combination effects that might arise with other plans or projects. There is a need to be assured that the uncertainties outlined above are addressed in order to ensure that WNMP tidal lagoon policy will have no AEOI of European/Ramsar sites. Two formal additional mitigation measures are considered to be needed, as follows:

- The pursuance by developers of project-level HRA requirements with associated project-level mitigation measures where required (see Section 6.1); and
- The application/continuation of evidence gathering measures (see Section 6.2) with links to ongoing and future high-level strategic plan (IPR or similar) processes by the UK's statutory marine planning bodies.

Further details about these measures are presented in the following sections.

6.1 Project-level HRA requirements and mitigation measures

It is viewed as an important mitigating measure that all future projects will need to have project-level HRA work undertaken (i.e. application of initial screening and undertaking an AA if required) in the context of the latest scientific knowledge and evidence base that is available at the time. It will also need to be completed to the satisfaction of the consenting body (as competent authority at the project stage), taking account of advice from relevant SNCBs and consultees where appropriate.

The pursuance of project-level HRAs is a legal requirement in all cases where LSE cannot be excluded. Furthermore, the application of project-level mitigation is required where these are relevant to the project and necessary to avoid adverse effects at a project-level. This will provide assurance of no adverse effect from individual projects, but will also improve understanding of the impacts from key pathways. The information that is likely to be needed within project-level HRAs includes:

- Details of the location, scale and densities of the proposed activities associated with the tidal lagoon(s);
- The location and status of any relevant new European/Ramsar designations;
- Latest information on the Conservation Objectives and the Favourable Condition Status of relevant European/Ramsar site features;

- Latest information on interest feature sensitivities (in the context of the latest scientific understanding);
- Assessment of effects during all phases of the project (including the in-combination effects with other plans or projects); and
- Proposed mitigation measures where identified to be relevant and necessary.

There are many project-level mitigation measures available to help avoid and reduce ecological effects where necessary. To assist with judgments about the possible need for such measures in the future, an overall list of generic measures to address all potential effects to European/Ramsar site interest features has been assembled. This has been presented separately for marine habitats (Section 6.1.1) and fish (Section 6.1.2).

The review incorporates those measures that have been identified within past strategies/guidance and applied to past projects of similar nature. For a better understanding of where these measures apply, they have been listed against the associated impact for which they mitigate. Both embedded and applied measures are considered in the context of a 'standard' design scenario which has the potential to adversely affect habitat and/or fish features cited under European/Ramsar designations. Embedded mitigation provides environmental protection of features built into the development at the design stage through site and equipment selection, while applied mitigation are achieved by operational management of the scheme.

6.1.1 Marine habitats

The following section identifies the available mitigation measures that are available for tidal lagoon projects with respect to marine habitats. Table 13 sets out potential embedded and applied mitigation that should be considered at the project-level.

Table 13. Mitigation typical of tidal energy schemes for habitat interest features

Potential Impact Pathway	Recommended Mitigation
Direct changes in habitat extent, type and quality	Seek to avoid sensitive sites/areas where necessary and possible, including micro-siting around features. Tidal lagoon seawall designed to minimise footprint (e.g. use of caissons or concrete armour protection), including size of lagoon.
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/ interaction)	Seek to minimise scour by reviewing the lagoon structure, location/ arrangement of turbines and need for cable protection. Minimise impacts on water levels. Management of tidal exposure and exchanges on a daily/seasonal basis. Design might be two-way generation (i.e. tidal energy generated during both flood and ebb tides) to minimise water level impacts. Hydraulic design to minimise sedimentation. Manage operational maintenance dredging regime to minimise habitat impacts. Also see 'direct changes in habitat extent, type and quality' impact pathway above.
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)	Aim to site structures in areas with low suspended sediment loads. Use construction (installation) methods that minimise sediment resuspension. Suspended sediment dispersion and coastal processes modelling may be required.

Potential Impact Pathway	Recommended Mitigation
	Design structure to achieve high degree of flushing on each tide. Locate structure to avoid interfering with dilution and dispersion of existing outfalls. Relocate outfalls. Enhanced treatment of outfalls discharging into/near tidal lagoon. Minimise dredging where possible to avoid/reduce physical impact on the seabed and indirect effects due to sediment resuspension (construction and operation). Implement appropriate construction techniques to prevent polluted surface water runoff entering main watercourse (e.g. use of oil interceptors and silt traps in construction area). Seek to avoid placement of structure in areas of known sediment contamination. Design structure (e.g. turbines) to minimise leakage of pollutants. Follow up-to-date best practice guidance on the use of anti-foulants. Agree anti-foulant type and usage with regulator. Manage operational regime to minimise water quality impacts. Minimise use of sacrificial anodes and contact of grout with water. Where necessary, installation of a bund (storage facilities) to prevent release of fuels, oils and chemicals. Such secondary containment should be used with a capacity of not less than 110% of the container's storage capacity. All equipment, temporary structures, waste and/or debris associated with the works are removed within a designated period (to be agreed with the regulator).
Introduction or spread of non-native species	Consider potential for development to support introduction or spread of non-native species. Use local vessels where possible. Appropriate cleaning techniques for equipment and subsequent waste disposal. Management and eradication of invasive non-native species and, where feasible, seeding of native species. Review distribution of non-native species in locality of development. Identify potential pathways for the introduction or spread of non-native species due to the construction or operation (maintenance) of the tidal lagoon. Provision of biosecurity plan if necessary.

6.1.2 Fish

The following section identifies the available mitigation measures that are available for tidal lagoon projects with respect to fish. Table 14 sets out potential embedded and applied mitigation that should be considered at the project-level. Mitigation measures associated with habitats in general, which could also support fish, are described in Section 6.1.1 (Table 13).

Table 14. Mitigation typical of tidal energy schemes for fish interest features

Potential Impact Pathway	Recommended Mitigation
Direct changes in habitat extent, type and quality	Select site to minimise loss of habitat of high ecological value to fish (e.g. spawning and nursery grounds, sandeel habitat). Developments should avoid enclosing river mouths for natal rivers of migratory species. Design of seawall should be adapted to increase heterogeneity and potential for fish and shellfish spawning and habitat: ▪ Avoid smooth rock material/increase roughness; ▪ Introduce gravel/appropriate media at the base of the seawall for fish which use substrate to spawn (e.g. herring). Removal and relocation of shellfish from the development footprint by trawling translocation.
Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/ interaction)	Scheme sizing, turbine flow capacity and turbine positioning will be the primary factors in minimising changes to tidal regime. Rate of drainage of storage basin should be controlled during ebb generation to minimise the risk of fish stranding in intertidal zone. Areas of scour should be mitigated through the appropriate use of scour protection techniques such as concrete mattresses and rock armour.
Changes in water quality (including temperature, dissolved oxygen, suspended sediment concentrations and contaminants)	Use of appropriate geotextile lining to minimise the release of fine sediment into the water column. Minimise the creation of sediment plumes during dredging activity. Marine habitat or seafloor disturbance clearing for the construction of the project. Project to adhere to Best Practice Guidance identified in Marine Minerals Guidance 1: Extraction by dredging from the English seabed (Office of the Deputy Prime Minister (ODPM), 2002), or other industry standards with respect to dredging and disposal of dredged material. Disposal of dredge arisings at licensed disposal grounds (if not used within development infrastructure, e.g. infill). Prevent on-board screening or minimising material passing through spillways when outside the dredging area.

Potential Impact Pathway	Recommended Mitigation
Disturbance via noise and vibration	Design to minimise noisy piling activity. Low-noise piling techniques (e.g. vibropiling) would be the preferred method of construction to reduce underwater noise / vibration impact on sound sensitive fish species such as herring and cod. 'Soft start' piling procedures will be adopted for impact piling to minimise impacts when this technique is used. Seasonal piling restrictions to be enforced during peak periods of sensitivity (i.e. salmon migration runs and herring spawning activity). Turbines will generate underwater noise, though modern turbines operated close to design point are relatively quiet. Some emission of noise and vibration in the range 10-3,000 hertz (Hz) frequency range audible to fish may help hearing-sensitive fish species to detect and avoid turbines.
Visual disturbance (including lighting and shade)	Illumination of the site should be directional. The illumination/shading of the water surface, especially outside the tidal lagoon, should be avoided where possible. The use of white mercury vapour lamps should be avoided. All none essential lights should be turned off to minimise the illuminated area created by the development.
Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species	The key factor in planning a tidal lagoon is to avoid blocking access to streams or rivers frequented by migratory fish species where possible by ensuring they are not enclosed within the lagoon. Design turbine positioning within seawall to minimise risk of fish entrainment into the lagoon. Design lagoon to minimise impacts on odour (olfactory) trails used in the homing mechanism of some migratory species. Positioning and tidal operation pattern of sluices can be designed to optimise the porosity of the lagoon seawalls to migratory fish. Individual-based modelling (IBM) of fish behaviour within hydrodynamic models of the operating lagoon can be used at the planning stage to investigate alternative arrangements. Connectivity to fish spawning, foraging and nursery grounds must be maintained with suitable fish-pass and return infrastructure. Access between freshwater and marine environments should be maintained to allow migratory species to traverse with minimal impediment.

Potential Impact Pathway	Recommended Mitigation
Collision risk (including vessels and static/rotating structures)	Collision of fish forced to pass through turbines and sluice gates may cause injury. Near misses may also result in injury caused by associated hydraulic anomalies such as shear stress and pressure flux. Turbine selection is the key factor. Larger turbines have larger water passages relative to blockage by runner blades, guide and stay vanes, reducing collision risk with any of these elements. Other 'fish-friendly' features should be incorporated in the selected turbine design (see text below). Passage through large sluices has a low probability of injury due to hydraulic shear stress unless the gap is small (relative fish body size): this can be managed through applied operational control. Use of acoustic, lighting and bubble curtain fish deterrents can be installed to discourage the ingress of fish to the tidal lagoon. The operation of these should be such that during periods of sluicing, free passage of fish is not deterred between the habitat outside and inside the Lagoon.
Introduction of electromagnetic fields from power transmission cables	Route cables below lagoon seawall as far as possible. Beyond this, bury cables to sufficient depth or armour them to reduce the emission field. This will prevent potential effects on fish movement, especially when passing beneath migration corridors such as river channels.
Changes in fish prey availability (including as a result of habitat changes)	Provision of suitable replacement habitat, as per 'direct changes in habitat extent, type and quality' impact pathway described above.
Changes in availability of spawning/nursery grounds for fish species	Provision of suitable replacement habitat, as per 'direct changes in habitat extent, type and quality' impact pathway described above.

The large volumes of water passing through turbines on each tide into and out of a tidal power lagoon put fish at risk of fish injury during turbine passage (Turnpenny, 1998). This can occur as a result of collision with fixed components such as guide vanes and stay vanes but the rotating runner blades present the most risk. In addition, hydrodynamic anomalies such as hydraulic shear stress, cavitation and rapid pressure changes as water passes at high speed around these structures can be a significant cause of injury, especially in fragile fish species such as members of the Clupeid family (shads and herrings). The risk due to any of these factors varies across a tidal cycle as the dynamics of the processes change with operating head and water flow.

The risks to fish associated with fixed structures are relatively low and are primarily addressed through turbine sizing (larger turbines having lower relative risk due to the large water passage dimensions relative to dimensions of fixed structures. Good efficient hydraulic design is also important in avoiding hydrodynamic anomalies but this is already achieved for engineering and power generation efficiency.

Earlier tidal range generation proposals (e.g. Severn Barrage) employed traditional run-of-river axial-flow bulb turbine designs, as exemplified by the reference design described by Turnpenny *et al.* (1992). This envisaged a 9 m diameter runner section with three blades operating at a fixed rotational speed of 50 revolutions per minute (rpm), but with adjustable runner and guide vane angles according to flow and head. The fixed speed was designed to synchronise with the 50 Hz alternating current frequency of the National Grid and could not be varied. The turbine was also designed for

unidirectional flow but could be operated in reverse flow for ebb and flood generation but at lower efficiency. Lower efficiency operation implies shedding of surplus energy as turbulence, creating shear stress and rapid hydrodynamic pressure changes, all potential fish injury factors. This turbine design was viable for energy production but not optimal for safe fish passage. Also, it exhibited peak energy capture efficiency around one operating point and became less efficient across widely ranging tidal heads.

A key parameter affecting fish collision injury risk is the 'water-length' of the turbine (defined as the distance water passes axially through a point in the turbine after one blade pass and before the next. A fish aligned with the turbine axis is 100% likely to collide with the blade if its length is greater than the water length. Water-length varies according to flow through the turbine, number of blades and rotational rate (Turnpenny, 1998).

Owing to new interest in tidal range energy and technical innovations, turbine manufacturers and scheme developers have been able to work together to offer more fish friendly turbine designs specifically intended for tidal power applications. These still follow the horizontal axial-flow bulb turbine pattern, the key fish-friendly innovations being as follows:

- Bi-directional design, with runner blades rotatable through 180 degrees to present leading edge to flow; and
- Runner rotational speed varying according to flow, allowing optimum efficiency to be maintained across a wide range of flow and conditions.

Fish friendliness is enhanced for two main reasons:

- The variable speed allows the water-length to be maximised, reducing fish collision risk; and
- Computational fluid dynamics (CFD) modelling shows that the improved hydrodynamic efficiency of operating close to the turbine's optimum design point appears to reduce shear stress levels to values well below the 1,600 newtons per square meter (N/m^2) injury threshold reported by in turbine passage studies (Čada *et al.* 2007).

6.2 Additional evidence gathering measures

In addition to the project-level HRA and mitigation measures that are described in the preceding section, it is proposed that a process of evidence and assessment gathering continues to be undertaken. This provides additional assurance that implementation of the tidal lagoon policy can be done in a manner that complies with the requirements of the Habitats Directive. Evidence gathering measures should continue to be undertaken to ensure that scientific information is collated. This will provide an on-going evidence base for project-level consenting decisions. They can also be linked to, and support, the IPR processes being undertaken for other relevant UK higher-level marine plans both now and in the future.

There are a number of initiatives currently in place to facilitate the gathering of cross-sector evidence and ensure lessons learned are documented. For example, the Offshore Renewables Joint Industry Programme (ORJIP) aims to support and bring together stakeholders from industry, regulatory, nature conservation and academic sectors regarding the current environmental research and development (R&D) and innovation needs for developing tidal lagoons. A significant body of science, knowledge and experience from the offshore sector (energy, coastal defence, ports and harbours, etc.) can be mobilised and translated to support the development of tidal lagoons. However, the specific evidence gaps and corresponding R&D priorities for tidal lagoon developments have not yet been consolidated into a clear action plan, agreed across industry, regulators and other key stakeholders.

Through the continued involvement of SNCBs, marine planners/regulators and wider stakeholders in such initiatives, the lessons learned from tidal lagoon (and other) projects, their associated mitigation and monitoring work and any further strategic information will be fed into the marine planning and regulatory processes. Ultimately, this will ensure individual project site developers are aware of new/emerging information and best-practice and can incorporate this, where relevant, into their work at the project-level. This will also help to inform on-going decisions about the implementation of future projects and reduce environmental impact and consenting risks at the project-level. Furthermore, as monitoring data is collected and made available (when projects are consented), these can be used to validate the conclusions of future project-level HRAs and, where required, AAs (including in-combination assessments).

7 Habitats Directive Article 6(4)

The potential for an individual tidal lagoon project located within the SRA to result in an AEOI cannot be ruled out at this stage. This takes in to consideration the potential scale of effects and the sensitivity of marine habitats and fish to the pressures associated with tidal lagoon projects as well as possible project level mitigation measures. The key impact pathways for which it might not be possible to avoid adverse effects include:

- Direct changes in habitat extent, type and quality;
- Indirect changes in habitat extent, type and quality (including sediment transport, tidal regime and species assemblage/interaction);
- Barrier to movement through presence of infrastructure and habitat fragmentation for aquatic species; and
- Collision risk (including vessels and static/ rotating structures).

In practice, however, this would be dependent on the specifics of the tidal lagoon project and the proposed location. It may also be possible for a project to be progressed at a location and scale, where through the use of mitigation measures, AEOI could be avoided. Ultimately this would be established through a project-level HRA designed to ensure no AEOI.

Mechanisms to avoid/limit the potential for AEOI include the specific location of a particular scheme. This includes avoiding direct overlap with a European/Ramsar site as well as limiting the geographical and temporal scale of indirect effects. Through careful siting of a scheme it may be possible, for example, to reduce the extent of water level changes (and hence habitats/species changes). SBTL provides an example of this where the placement of the lagoon limits the extent of interaction with the Bristol Channel due to the local hydrodynamic processes operating in this area. Avoiding the potential for AEOI also requires an understanding of the specific features within a particular location. This needs to be considered along with an understanding of their sensitivity to physical, chemical and biological changes at the magnitude that would result from any such scheme.

Article 6(4) of the EC Habitats Directive (92/43/EC) establish strict procedures for the approval of plans or projects that have the potential to affect designated features associated European/Ramsar sites. When evaluating the effects of a proposed development on these designated sites as part of the HRA process, if the competent authority cannot conclude that the plan or project will not have an AEOI of a European/Ramsar site (either alone or in combination with other plans or projects), the plan or project can only be adopted if it has been ascertained that there are no alternative solutions and it is necessary for IROPI, including those of a social or economic nature.

Where the site concerned hosts a priority natural habitat type (identified in Annex I of the Habitats Directive) or a priority species (identified in Annex II of the Habitats Directive), the grounds for IROPI are more restricted, being limited only to reasons relating to human health, public safety or beneficial consequences of primary importance to the environment or any other reasons which the competent authority, having due regard to the opinion of the EC, consider to be imperative reasons of overriding public interest. In circumstances where the strict tests relating to alternatives and IROPI are met, such plans or projects are required to take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected.

This section contains the following:

- Signposting of guidance for the provision of compensation; and
- An outline of possible compensation measures and factors influencing the success of implementation.

7.1 Overview of guidance

The key guidance documents addressing the requirements for compensation include:

- UK guidance:
  - ODPM (2005) provides useful guidance on the relative timing of compensatory measures against the commencement of the impacts;
  - Natural Environment White Paper (referenced in HM Government, 2012) sets out how an ecosystems approach will result in better informed and integrated decisions;
  - Defra (2012) provides guidance on IROPI; and
  - National Planning Policy Framework (Department for Communities and Local Government, 2012).
- EU guidance:
  - Managing Natura 2000 Sites (EC, 2000) provides guidance on the scope of compensation in the context of the Natura 2000 Network;
  - EC (2001) provides guidance on the assessment of plans and projects significantly affecting Natura 2000 sites;
  - The guidance document on Article 6(4) of the Habitats Directive (EC, 2007) confirms and expands on the requirements outlined in (EC, 2000) clarifying the concepts of alternatives, IROPI and compensatory measures; and
  - Guidelines on the implementation of the Birds and Habitats Directive in Estuaries and Coastal Zones (EC, 2011).

The key requirements of relevance to the provision of project level compensation for tidal lagoon projects are summarised below.

Compensatory measures are required to maintain the coherence of the Natura 2000 network and should be of a comparable size and type to the habitats being lost or affected. The guidance recommends that 'best efforts' should be made to assure compensation is in place beforehand. Where this is not achievable, the competent authorities should consider extra compensation for the interim losses that would occur in the meantime.

A range of ratios have been applied to determine the habitat creation objectives of a particular scheme or strategy, however, a minimum ratio of at least 2:1 has typically been applied where the required habitat gains are associated with the compensatory requirements for an identified development. To date, compensatory habitat has typically been provided broadly on a like-for-like basis (i.e. delivering through compensation the same habitats that have been or will be lost through development). However, increasing consideration is now being given to moving towards a greater emphasis on ecosystem functioning. The concept behind ecosystem functioning involves considering the full range of benefits that the natural environment provides.

The 'Managing Natura 2000 Sites' document (EC, 2000) states that the compensatory measures proposed for a project should 'concern the same biogeographical region in the same Member State'. EC (2001) further indicates that the compensatory provision should 'be in as close proximity as possible to the habitat that has been adversely affected by the project or plan'. The EC (2007) guidance repeats the requirements for compensation measures to be within the same biogeographic region (for Habitat Directive sites) or within the same range, migration route or wintering area for bird species (site designated under the Birds Directive) in the Member State concerned. In addition, there is general agreement that the local conditions necessary to reinstate the ecological assets at stake are found 'as close as possible to the area affected by the plan or project'. Therefore, locating compensation near to the Natura 2000 site concerned in a location showing suitable conditions for

the measures to be successful seems the most preferred option. However, this is not always possible and it is necessary to set a range of priorities to be applied when searching locations that meet the requirements of the Habitats Directive.

These principles were tested relatively recently in the review of compensatory measures associated with the SETP feasibility studies commissioned by DECC. The discussions related to this project reinforced the published guidance with respect to the requirement to create compensatory habitat as close as possible to the location(s) where the loss or damage is predicted to occur. It was further re-iterated that the creation of compensatory habitat outside of the UK was unlikely to be acceptable. The only possible exceptions related to particular species where their ecological requirements could be better met in other Member States.

The principles of Measures of Equivalent value were also discussed with the EC. In this context the difficulties of re-creating the specific habitats of the Severn Estuary (which are strongly influenced by the extreme tidal range) were discussed along with the possibility of instead creating mudflat/saltmarsh habitats of a high functional value. Similarly the principle of providing compensatory measures for a different migratory fish species (as opposed to that affected by the proposals) was also explored. No firm agreements were reached, however, it is recommended that these principles are further explored with the EC.

In the light of the above issues, it is therefore important to develop a sufficiently robust scientific understanding about the specific ecological requirements of the affected features and consider the flexibilities of extent, timing and location to ensure that compensatory measures are adequate. In this respect, it should be noted that there are precedents for considering not just like-for-like delivery but wider ecosystem functioning and how the offsetting measures compare against the losses in the context of the long-term projected natural evolution of a coastal ecosystem.

7.2 Project level compensation options

Compensation measures typically involve the creation of new or the enhancement of existing habitats to replace the functions that are affected by a particular development. In the context of tidal lagoon projects the following types of compensatory measures are most likely to be of relevance:

- Assessment of managed realignment opportunities - New habitat creation through managed realignment of low lying areas behind existing flood defences with the presumption that such areas are subsequently designated as SACs, Ramsar sites and/or SPAs.
- Scoping the potential for new SAC site designations (or Ramsar sites) – European guidance indicates that it may be possible to compensate for impacts to designated features through the inclusion of additional sites within the overall SAC list, although it should be noted that there is currently no formal process by which this might be progressed. These would comprise areas that are currently not designated as SAC but support one or more of the following features and which merit inclusion in the SAC list:
  - Estuarine habitats (estuary, intertidal mudflats and sandflats, subtidal sandbanks, Atlantic saltmeadow, reefs);
  - Migratory and estuarine fish species (Allis shad, Twaite shad, river lamprey, sea lamprey, Atlantic salmon; Ramsar site series only: eel, sea trout, estuarine fish).
- Assessment of enhancement opportunities - Enhancement measures within designated areas (SACs or SPAs) that are additional to any measures required to support achievement of conservation objectives:
- Improvements to estuarine habitats (estuary, intertidal mudflats and sandflats, subtidal sandbanks, Atlantic saltmeadow, reefs);
- Fish stock enhancement, fish spawning habitat enhancement, predator control; and
- Fish stock translocation (transferring fish from potentially affected sites to other sites).

The methodologies applied for these elements of the study are briefly described below.

7.2.1 Habitat creation

The following four techniques can be used to create intertidal habitats:

- Managed realignment;
- Regulated tidal exchange (RTE);
- Sediment recharge; and
- Manipulation of natural processes.

The term 'managed realignment' is most commonly understood to involve a deliberate breaching, or removal, of existing seawalls, embankments or dikes in order to allow the waters of adjacent coasts, estuaries or rivers to inundate the land behind (e.g. Leggett *et al.* 2004). In most instances, the newly flooded land is low-lying coastal flood plain and therefore a new seawall is needed to clearly define the inundated area and protect the hinterland behind.

RTE involves the controlled exchange of estuarine or coastal waters onto a previously terrestrial site using a variety of exchange structures. This intertidal habitat creation option frequently removes the need for new embankment construction, although existing seawalls remain *in situ*, and thus tend to require at least continued maintenance if not upgrading. A RTE allows water levels within a site to be artificially managed, therefore influencing the types of habitat that can be created over time.

Sediment recharge in intertidal areas is a process by which dredged sediments are placed over or around intertidal mudflats and saltmarshes to either create habitat (most often saltmarshes), or restore or protect intertidal habitats from ongoing erosion (Nottage and Robertson, 2005; Defra and Environment Agency, 2007). This approach is particularly valuable for protecting habitats that are sediment starved or subject to erosion and where the introduction of dredge arisings will allow the habitat to cope with, or respond to, sea level rise.

The manipulation of natural processes encompasses projects which alter the existing sedimentary regime along a shoreline in order to protect habitat and possibly create mudflat. This includes a wide range of possible techniques such as introducing obstructions or altering shorelines. There are techniques which can potentially be used to expand mudflat seawards, onto existing subtidal areas, though there are no known (intentional) examples of this in the UK. Such structures are installed in areas which are exposed to relatively high tidal or wave energy forces which would normally prevent the settling of sediments, or re-suspend any that had settled during slack periods. This is provided that the SSC in the system is high enough for accretion to take place. Thus, the artificial import of sediment is not necessary, but instead, structures are put in place to reduce energy and encourage sediments to settle and accrete. In the past, the main methods used for increasing sedimentation in intertidal areas have included brushwood fencing, polders/sedimentation fields, wave breaks or groynes.

The selection of the most suitable technique is dependent on a series of site specific factors including the features that the habitats need to support. These techniques are typically better suited for the creation of mudflat and saltmarsh and as such the creation of some habitats that could be lost and/or damaged through a lagoon project would be more challenging. In such circumstances, it may be possible to agree the implementation of measures of equivalent value.

Specific considerations and challenges in the context of creating and sustaining compensatory mudflat have been documented in Natural England (2015). It is also of note that a review of coastal compensation sites in England has been undertaken on behalf of Defra and Natural England which

aims to provide an overall assessment of whether these sites are meeting their conservation objectives (Natural England, 2016). The report provides some over-arching lessons learnt as well as provide recommendations for the process under which compensation is secured in the UK.

As part of the SETP feasibility studies the scope for managed realignment of low lying areas behind existing flood defences was evaluated for England and Wales based on the Environment Agency's 1:100 year tidal flood plain and using a search area of up to 5 km inland from the existing coastline. Urban areas and internationally designated sites (SPA, SAC and Ramsar) were excluded from the search area. The area of search was limited to England and Wales because there is readily available and consistent information available for this area, although in theory it may be possible to provide compensatory habitat anywhere within the Atlantic biogeographical region.

The resulting potential realignment areas were then validated against a number of existing regional scale studies which have used additional criteria to more accurately define potential realignment sites. Based on this validation exercise a scaling factor was derived that could be applied for England and Wales as a whole. Separate consideration was given to possible habitat creation opportunities for sites >500 hectares identified through the screening process. This screening exercise resulted in an area of 111,600 hectares that was considered to have a realistic prospect of being suitable for managed realignment (DECC, 2008).

7.2.2 Identification of additional sites for inclusion in SAC list

Theoretically, it could be possible to designate additional locations as SACs in order to compensate for losses to existing sites. Potential locations for additional designations would need to be evaluated against the site selection criteria laid down in the Habitats Directive and in relation to the potential contribution they might make in compensating for impacts of a tidal lagoon development. Areas of search for new SAC site designations would need to focus on areas supporting potentially qualifying features. This could include features within areas currently classified as SPAs but which were not already protected by the SPA designation. Habitat enhancement may be required in order to ensure that areas are of a sufficient quality to be designated.

An initial scoping exercise was undertaken as part of the SETP feasibility studies to identify a list of estuaries and coastal waters supporting significant intertidal habitats and which are not currently designated as SACs, based on the comprehensive list of transitional waterbodies in England and Wales (prepared under the auspices of the Water Framework Directive) and with reference to JNCC's Designated Sites database. A total of 82 locations were identified of which 63 were transitional (estuarine) and 19 were coastal. The list was further filtered by selecting sites with intertidal areas greater than 200 hectares (DECC, 2008).

A similar scoping exercise was undertaken to identify non-SAC estuaries and non-SAC rivers supporting migratory fish (allis shad, twaite shad, river and sea lamprey and Atlantic salmon), based on records held in the National Biodiversity Network (NBN) database. This indicated that there are a number of rivers where key migratory fish species have been observed but are not designated (DECC, 2008). It should be noted that this was based on a series of high level assumptions. Furthermore, while the records indicate that the relevant species were present, they do not indicate whether the records relate to an established population or to stray individuals. It should be emphasised that the presence of populations of particular migratory species does not imply that the sites may be suitable for SAC designation and all potential sites would require detailed assessment against the SAC site selection criteria to ascertain their suitability.

While these broad areas of search provide a starting point for consideration of the merits of inclusion of additional sites, detailed evaluation would need to be undertaken in accordance with the criteria set out in the Habitats Directive (Article 4 and Annex III).

7.2.3 Assessment of enhancement opportunities

A further type of compensatory mechanism involves the enhancement of existing habitats and populations in areas that are not affected by any power project (including other designated and potentially 'designatable' sites). The scale and nature of any enhancements for fish populations would be based on an understanding of the potential loss of fish production arising from the TL scheme. This is commonly undertaken by back calculating the number of eggs and other fish life stages that would be lost for key migratory species based on predicted entrainment rates for adult fish. Opportunities for enhancement measures will be site specific and could include:

- Enhancement of habitats;
- Enhancement of migratory fish spawning and nursery habitats in rivers;
- Migratory fish stock enhancement (e.g. artificial hatcheries; predator control); and
- Fish stock translocation.

Enhancement of habitats

Within individual designated SACs there are likely to be opportunities to enhance the extent and/or quality of habitats. Such enhancement initiatives could potentially contribute to a package of compensatory measures where those actions were not already required to support achievement of the conservation objectives. Examples might include the removal of redundant structures that are affecting the quality of designated features.

In the context of fish this could include structures such as weirs that are affecting the quality of designated features by, for example, preventing upstream migration. Such opportunities would need to be reviewed on a local basis and ideally would be supported by studies to determine the relative importance of structures as barriers to upstream migration. For example, acoustic tracking of salmon smolts on tributaries of the River Dee has been used to determine the effect of sluice height on fish passage and downstream migration.

Migratory fish spawning and nursery habitats

Improvements to the spawning and nursery habitats of migratory fish affected by tidal lagoons could contribute to an overall package of compensation. The measures could include installation of fish passes, removal of weirs, gravel cleaning, gravel replacement and/or measures to reduce sediment inputs to rivers (e.g. buffer strips, improved land management). Any such measures would necessarily have to be additional to measures already required to support achievement of site conservation objectives.

Migratory fish stock enhancement

Various measures to improve stocks of migratory fish might be included within an overall package of compensatory measures. These could include the establishment of artificial hatcheries to boost production of fry, predator control or reductions in commercial fishing activity (paying commercial fishermen not to fish) within the affected rivers or translocation of fish to other river systems.

For example, hatcheries have been successfully used internationally to enhance stocks of salmon. However, the establishment of artificial hatcheries can be a contentious option because of the distorting effects on the natural gene pool. Predation of smolts at man-made barriers where fish

accumulate before making upstream migrations may represent important source of loss from salmon and sea trout populations. Improved predator management at barriers, including deterrents may be deployed as part of an offsetting strategy.

Fish translocation

Translocation of migratory fish has been undertaken on a widespread basis. For instance shad have been successfully translocated within North America. In addition, Atlantic salmon and eel have successfully been moved between catchments within Europe.

7.3 Over-arching considerations

If a plan-making body is unable to ascertain that a policy or proposal will not adversely affect the integrity of a European site, it may progress to adoption of the plan only in the closely defined exceptional circumstances set out in regulations 85C and 85E or 49 and 53 of the Habitats Regulations. An illustration of this process from a Scottish perspective can be found in David Tyldesley and Associates (2015). The same principles would apply to the adoption of the WNMP.

As already highlighted the potential for an individual tidal lagoon project located within the SRA to result in an AEOI cannot be ruled out at this stage. This is despite taking into consideration possible plan and project level mitigation measures. Ultimately this would be established through a project level HRA, following which compensation measures would be identified if necessary. The relative confidence that can be placed in the range of available compensation measures is variable dependent on the specific features that could be adversely affected by a specific project. It is not envisaged that the provision of potential compensation requirements will be considered strategically at the scale of the WNMP due to the level of uncertainty in future requirements. Furthermore the process of IPR will ensure that the WNMP is updated to reflect any lessons learnt or reductions in uncertainties based on ongoing research or projects that have subsequently been implemented.

8 Conclusion

This plan-level HRA of WNMP tidal lagoon policy has considered whether there is the potential for an AEOI of European/Ramsar sites that were identified and 'screened into' the assessment. A large number of such European/Ramsar sites were screened in following the application of a necessarily robust and precautionary screening process.

Section 5 reviews the effects of the tidal lagoon policy alone on (marine) habitats and fish interest features screened into the HRA, as well as in-combination effects with other plans and projects. The in-combination assessment suggests that without additional (project-level) mitigation measures it cannot be guaranteed that there will no AEOI on European/Ramsar sites from the WNMP tidal lagoon policy alone and/or in-combination other plans and projects with the requisite level of certainty that is needed under the Habitats Regulations.

One of the reasons for reaching this conclusion is the high degree of uncertainty in the scale and location of any tidal lagoon projects that could be implemented within the SRA. This has further implications for the uncertainties about the likely effects of the plan. In this context the intention of the draft policy within the WNMP is to offer a degree of encouragement to the renewable energy sector generally, and to sign-post areas containing suitable resource. Such encouragement is not spatially or project specific beyond it being in the SRA as a whole; nor does it suggest that projects that do apply for a licence to proceed in that area will be successful. Furthermore, sector development is not excluded outside of these areas.

There is also a high-level of uncertainty in respect of the effects that may arise in-combination with other plans or projects. This is in large part due to uncertainties associated with the design, timing and therefore effects of these other plans or projects. This means that it cannot be definitively concluded that no evidence/analysis gaps will arise between the different assessment processes and methods leading to an in-combination effect. Therefore, it has been concluded that two further 'additional' mitigation measures are required, as follows:

- **Mitigation 1 (Project-Level HRA):** the legal requirement for an HRA process to be pursued by developers at a project-level; and
- **Mitigation 2 (Additional Measures):** the application of a process of continued/additional evidence and assessment gathering measures as projects are implemented under the plan (or more widely) and developing linkages through established forums.

Even with the adoption of these two additional mitigation measures, and project specific mitigation measures, it cannot be concluded that the tidal lagoon policy will not give rise to AEOI of European/Ramsar sites alone or in-combination with other plans and projects. In practice, however, this would be dependent on the specifics of tidal lagoon projects and the proposed location. It may be possible for a project to be progressed at a location and scale where, through the use of mitigation measures, AEOI could be avoided. Ultimately, this would be established at the level of individual projects through a project level HRA, following which compensation measures would be identified if necessary. The relative confidence that can be placed in the range of available compensation measures is variable dependent on the specific features that could be adversely affected by a specific project.

It is not envisaged that the provision of potential compensation requirements will be considered strategically at the scale of the WNMP due to the level of uncertainty in future requirements. Furthermore the process of IPR will ensure that the WNMP is updated to reflect any lessons learnt or reductions in uncertainties based on ongoing research or projects that have subsequently been implemented.

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10 Abbreviations

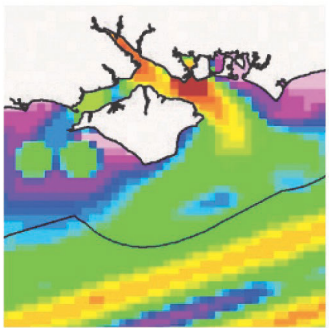
AA	Appropriate Assessment
AEOI	Adverse Effect On Integrity
CCW	Countryside Council for Wales
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CEQ	Council on Environmental Quality
CFD	Computational Fluid Dynamics
CIA	Cumulative Impact Assessment
cSAC	Candidate Special Area of Conservation
CSTP	Celtic Sea Trout Project
dB	Decibel
DECC	Department of Energy and Climate Change
EC	European Commission
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EU	European Union
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
Hz	Hertz
IBM	Individual-Based Modelling
ICES	International Council for the Exploration of the Sea
IECS	Institute of Estuarine and Coastal Studies
IPR	Iterative Plan Review
IROPI	Imperative Reasons for Overriding Public Interest
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
LSE	Likely Significant Effect
MCAA	Marine and Coastal Access Act 2009
MMO	Marine Management Organisation
MPA	Marine Protected Area
NBN	National Biodiversity Network
NERC	Natural Environment Research Council
NPL	National Physical Laboratory
NRW	Natural Resources Wales
ODPM	Office of the Deputy Prime Minister
ORJIP	Offshore Renewables Joint Industry Programme
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic, commonly referred to as the OSPAR (Oslo-Paris) Convention
PFOW	Pentland Firth and Orkney Waters
pSAC	Possible Special Area of Conservation
pSPA	Potential Special Protection Area
R&D	Research and Development
Ramsar	Wetlands of international importance, designated under The Convention on Wetlands (Ramsar, Iran, 1971)
rpm	Revolutions Per Minute
RTE	Regulated Tidal Exchange
RUK	RenewableUK

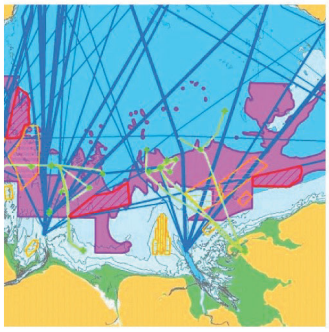
SAC	Special Area of Conservation
SBTL	Swansea Bay Tidal Lagoon
SCI	Site of Community Importance
SDC	Sustainable Development Commission
SETP	Severn Estuary Tidal Power
SNCB	Statutory Nature Conservation Body
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SPP	Statement of Public Participation
SRA	Strategic Resource Area
SSC	Suspended Sediment Concentration
TLP	Tidal Lagoon Power
WNMP	Welsh National Marine Plan
µPa	MicroPascal

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Appendices




Innovative Thinking - Sustainable Solutions

ABP mer

A Activities and Pressures Associated with Tidal Lagoons

Table A1. Marine activities and pressures evidence

Pressure Theme	Pressure	Description	Lagoons	Sub-Activity Resulting in Pressure	Project Phase	Pathway(s)	Generic Impacts	Fish (Sensitivity)	Marine habitats (Sensitivity)
Hydrological changes (inshore/local)	Temperature changes - local	Events or activities increasing or decreasing local water temperature. This is most likely from thermal discharges, e.g. the release of cooling waters from power stations. This could also relate to temperature changes in the vicinity of operational sub sea power cables. This pressure only applies within the thermal plume generated by the pressure source. It excludes temperature changes from global warming which will be at a regional scale (and as such are addressed under the climate change pressures).	✓	Presence of structure	C O	Change in water quality (temperature) as a result of the presence of the lagoon	Changes in water quality	✓	✓
Hydrological changes (inshore/local)	Salinity changes - local	Events or activities increasing or decreasing local salinity. This relates to anthropogenic sources/causes that have the potential to be controlled, e.g. freshwater discharges from pipelines that reduce salinity, or brine discharges from salt caverns washings that may increase salinity. This could also include hydromorphological modification, e.g. capital navigation dredging if this alters the halocline, or erection of barrages or weirs that alter freshwater/seawater flow/exchange rates. The pressure may be temporally and spatially delineated derived from the causal event/activity and local environment.	✓	Presence of structure	C O	Change in water quality (salinity) as a result of the presence of the lagoon	Changes in water quality	✓	✓
Hydrological changes (inshore/local)	Water flow (tidal current) changes - local	Changes in water movement associated with tidal streams (the rise and fall of the tide, riverine flows), prevailing winds and ocean currents. The pressure is therefore associated with activities that have the potential to modify hydrological energy flows, e.g. Tidal energy generation devices remove (convert) energy and such pressures could be manifested leeward of the device, capital dredging may deepen and widen a channel and therefore decrease the water flow, canalisation and/or structures may alter flow speed and direction; managed realignment (e.g. Wallasea, England). The pressure will be spatially delineated. The pressure extremes are a shift from a high to a low energy environment (or *vice versa*). The biota associated with these extremes will be markedly different as will the substrate, sediment supply/transport and associated seabed elevation changes. The potential exists for profound changes (e.g. coastal erosion/deposition) to occur at long distances from the construction itself if an important sediment transport pathway was disrupted. As such these pressures could have multiple and complex impacts associated with them.	✓	Presence of structure	C O	Change in hydrodynamic regime as a result of operating the lagoon	Changes in water quality; Changes in tidal regime; Changes in habitat extent/type; Changes in habitat quality; Changes in species assemblage and interaction	✓	✓
Hydrological changes (inshore/local)	Emergence regime changes - local	Changes in water levels reducing the intertidal zone (and the associated/dependant habitats). The pressure relates to changes in both the spatial area and duration that intertidal species are immersed and exposed during tidal cycles (the percentage of immersion is dependent on the position or height on the shore relative to the tide). The spatial and temporal extent of the pressure will be dependent on the causal activities but can be delineated. This relates to anthropogenic causes that may directly influence the temporal and spatial extent of tidal immersion, e.g. upstream and downstream of a tidal barrage the emergence would be respectively reduced and increased, beach re-profiling could change gradients and therefore exposure times, capital dredging may change the natural tidal range, managed realignment, saltmarsh creation. Such alteration may be of importance in estuaries because of their influence on tidal flushing and potential wave propagation. Changes in tidal flushing can change the sediment dynamics and may lead to changing patterns of deposition and erosion. Changes in tidal levels will only affect the emergence regime in areas that are inundated for only part of the time. The effects that tidal level changes may have on sediment transport are not restricted to these areas, so a very large construction could significantly affect the tidal level at a deep site without changing the emergence regime. Such a change could still have a serious impact. This excludes pressure from sea level rise which is considered under the climate change pressures.	✓	Presence of structure	C O	Change in emergence regime as a result of operating the lagoon	Changes in habitat extent/type; Changes in habitat quality; Changes in species assemblage and interaction	✓	✓

Pressure Theme	Pressure	Description	Lagoons	Sub-Activity Resulting in Pressure	Project Phase	Pathway(s)	Generic Impacts	Fish (Sensitivity)	Marine habitats (Sensitivity)
Hydrological changes (inshore/local)	Wave exposure changes - local	Local changes in wave length, height and frequency. Exposure on an open shore is dependent upon the distance of open seawater over which wind may blow to generate waves (the fetch) and the strength and incidence of winds. Anthropogenic sources of this pressure include artificial reefs, breakwaters, barrages, wrecks that can directly influence wave action or activities that may locally affect the incidence of winds, e.g. a dense network of wind turbines may have the potential to influence wave exposure, depending upon their location relative to the coastline.	✓	Presence of structure	C O	Change in wave conditions due to the presence of the lagoon wall	Changes in habitat extent/type; Changes in habitat quality; Changes species assemblage and interaction	✓	✓
Pollution and other chemical changes	Non-synthetic compound contamination - overall	See non-synthetic compound contamination pressures below (combined).	✓	Accidental spillage; Dredging (non-living resources); Disposal	C O	Change in water quality during all project phases	Changes in water quality	✓	✓
Pollution and other chemical changes	Non-synthetic compound contamination - Transition elements and organo-metals	The increase in transition elements levels compared with background concentrations, due to their input from land/riverine sources, by air or directly at sea. For marine sediments the main elements of concern are Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead and Zinc Organo-metallic compounds such as the butyl tins (Tributyl tin and its derivatives) can be highly persistent and chronic exposure to low levels has adverse biological effects, e.g. Imposex in molluscs.	✓	Accidental spillage; Dredging (non-living resources); Disposal	C O	Change in water quality during all project phases	Changes in water quality	✓	✓
Pollution and other chemical changes	Non-synthetic compound contamination - Hydrocarbon and PAH Contamination	Increases in the levels of these compounds compared with background concentrations. Naturally occurring compounds, complex mixtures of two basic molecular structures: - straight chained aliphatic hydrocarbons (relatively low toxicity and susceptible to degradation) - multiple ringed aromatic hydrocarbons (higher toxicity and more resistant to degradation). These fall into three categories based on source (includes both aliphatics and polyaromatic hydrocarbons): - petroleum hydrocarbons (from natural seeps, oil spills and surface water run-off) - pyrogenic hydrocarbons (from combustion of coal, woods and petroleum) - biogenic hydrocarbons (from plants and animals). Ecological consequences include tainting, some are acutely toxic, carcinomas, growth defects.	✓	Accidental spillage; Dredging (non-living resources); Disposal	C O	Change in water quality during all project phases	Changes in water quality	✓	✓
Pollution and other chemical changes	Synthetic compound contamination	Increases in the levels of these compounds compared with background concentrations. Synthesised from a variety of industrial processes and commercial applications. Chlorinated compounds include polychlorinated biphenols (PCBs), dichlor-diphenyl-trichloroethane (DDT) and 2,3,7,8-tetrachlorodibenzo(p)dioxin (2,3,7,8-TCDD) are persistent and often very toxic. Pesticides vary greatly in structure, composition, environmental persistence and toxicity to non-target organisms. Includes: insecticides, herbicides, rodenticides and fungicides. Pharmaceuticals and Personal Care Products originate from veterinary and human applications compiling a variety of products including, Over the counter medications, fungicides, chemotherapy drugs and animal therapeutics, such as growth hormones. Due to their biologically active nature, high levels of consumption, known combined effects, and their detection in most aquatic environments they have become an emerging concern. Ecological consequences include physiological changes (e.g. growth defects, carcinomas).	x	N/A	N/A	N/A	N/A	N/A	N/A
Pollution and other chemical changes	Radionuclide contamination	Introduction of radionuclide material, raising levels above background concentrations. Such materials can come from nuclear installation discharges, and from land or sea-based operations (e.g. oil platforms, medical sources). The disposal of radioactive material at sea is prohibited unless it fulfils exemption criteria developed by the International Atomic Energy Agency (IAEA), namely that both the following radiological criteria are satisfied: (i) the effective dose expected to be incurred by any member of the public or ships crew is 10 µSv or less in a year; (ii) the collective effective dose to the public or ships crew is not more than 1 man Sv per annum, then the material is deemed to contain *de minimis* levels of radioactivity and may be disposed at sea pursuant to it fulfilling all the other provisions under the Convention. The individual dose criteria are placed in perspective (i.e. very low), given that the average background dose to the UK population is ~2700 µSv/a. Ports and coastal sediments can be affected by the authorised discharge of both current and historical low-level radioactive wastes from coastal nuclear establishments.	x	N/A	N/A	N/A	N/A	N/A	N/A

Pressure Theme	Pressure	Description	Lagoons	Sub-Activity Resulting in Pressure	Project Phase	Pathway(s)	Generic Impacts	Fish (Sensitivity)	Marine habitats (Sensitivity)
Pollution and other chemical changes	Introduction of other substances (solid, liquid or gas)	The 'systematic or intentional release of liquids, gases …' (from MSFD Annex III Table 2) is being considered e.g. in relation to produced water from the oil industry. It should therefore be considered in parallel with P1, P2 and P3.	x	N/A	N/A	N/A	N/A	N/A	N/A
Pollution and other chemical changes	De-oxygenation	Any deoxygenation that is not directly associated with nutrient or organic enrichment. The lowering, temporarily or more permanently, of oxygen levels in the water or substrate due to anthropogenic causes (some areas may naturally be deoxygenated due to stagnation of water masses, e.g. inner basins of fjords). This is typically associated with nutrient and organic enrichment, but it can also derive from the release of ballast water or other stagnant waters (where organic or nutrient enrichment may be absent). Ballast waters may be deliberately deoxygenated via treatment with inert gases to kill non-indigenous species.	✓	Accidental spillage; Dredging (non-living resources); Disposal	C O	Change in water quality (de-oxygenation) as a result of the lagoon	Changes in water quality	✓	✓
Pollution and other chemical changes	Nutrient enrichment	Increased levels of the elements nitrogen, phosphorus, silicon (and iron) in the marine environment compared to background concentrations. Nutrients can enter marine waters by natural processes (e.g. decomposition of detritus, riverine, direct and atmospheric inputs) or anthropogenic sources (e.g. waste water runoff, terrestrial/agricultural runoff, sewage discharges, aquaculture, atmospheric deposition). Nutrients can also enter marine regions from 'upstream' locations, e.g. via tidal currents to induce enrichment in the receiving area. Nutrient enrichment may lead to eutrophication (see also organic enrichment). Adverse environmental effects include deoxygenation, algal blooms, changes in community structure of benthos and macrophytes.	x	N/A	N/A	N/A	N/A	N/A	N/A
Pollution and other chemical changes	Organic enrichment	Resulting from the degraded remains of dead biota and microbiota (land and sea); faecal matter from marine animals; flocculated colloidal organic matter and the degraded remains of: sewage material, domestic wastes, industrial wastes etc. Organic matter can enter marine waters from sewage discharges, aquaculture or terrestrial/agricultural runoff. Black carbon comes from the products of incomplete combustion (PIC) of fossil fuels and vegetation. Organic enrichment may lead to eutrophication (see also nutrient enrichment). Adverse environmental effects include deoxygenation, algal blooms, changes in community structure of benthos and macrophytes.	x	N/A	N/A	N/A	N/A	N/A	N/A
Physical loss	Physical loss (to land or freshwater habitat)	The permanent loss of marine habitats. Associated activities are land claim, new coastal defences that encroach on and move the Mean High Water Springs mark seawards, the footprint of a wind turbine on the seabed, dredging if it alters the position of the halocline. This excludes changes from one marine habitat type to another marine habitat type.	✓	Presence of structure	C O	Permanent loss of marine habitat	Permanent habitat loss; Changes in habitat extent/type; Changes in habitat quality; Changes in species assemblage and interaction	✓	✓
Physical loss	Physical change (to another seabed type)	The permanent change of one marine habitat type to another marine habitat type, through the change in substratum, including to artificial (e.g. concrete). This therefore involves the permanent loss of one marine habitat type but has an equal creation of a different marine habitat type. Associated activities include the installation of infrastructure (e.g. surface of platforms or wind farm foundations, marinas, coastal defences, pipelines and cables), the placement of scour protection where soft sediment habitats are replaced by hard/coarse substrate habitats, removal of coarse substrate (marine mineral extraction) in those instances where surficial finer sediments are lost, capital dredging where the residual sedimentary habitat differs structurally from the pre-dredge state, creation of artificial reefs, mariculture i.e. mussel beds. Protection of pipes and cables using rock dumping and mattressing techniques. Placement of cuttings piles from oil and gas activities could fit this pressure type, however, there may be an additional pressures, e.g. "pollution and other chemical changes" theme. This pressure excludes navigation dredging where the depth of sediment is changes locally but the sediment typology is not changed.	✓	Presence of structure; Dredging (non-living resources); Disposal	C O	Change in habitat type	Changes in habitat extent/type; Change in habitat quality; Changes in species assemblage and interaction	✓	✓
Physical damage	Habitat structure changes - removal of substratum (extraction)	Unlike the "physical change" pressure type where there is a permanent change in sea bed type (e.g. sand to gravel, sediment to a hard artificial substrate) the "habitat structure change" pressure type relates to temporary and/or reversible change, e.g. from marine mineral extraction where a proportion of seabed sands or gravels are removed but a residual layer of seabed is similar to the pre-dredge structure and as such biological communities could re-colonise; navigation dredging to maintain channels where the silts or sands removed are replaced by non-anthropogenic mechanisms so the sediment typology is not changed.	✓	Dredging (non-living resources); Disposal	C O	Change in habitat type	Changes in habitat extent/type; Change in habitat quality; Changes in species assemblage and interaction	✓	✓

Pressure Theme	Pressure	Description	Lagoons	Sub-Activity Resulting in Pressure	Project Phase	Pathway(s)	Generic Impacts	Fish (Sensitivity)	Marine habitats (Sensitivity)
Physical damage	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	The disturbance of sediments where there is limited or no loss of substrate from the system. This pressure is associated with activities such as anchoring, taking of sediment/geological cores, cone penetration tests, cable burial (ploughing or jetting), propeller wash from vessels, certain fishing activities, e.g. scallop dredging, beam trawling. Agitation dredging, where sediments are deliberately disturbed by and by gravity and hydraulic dredging where sediments are deliberately disturbed and moved by currents could also be associated with this pressure type. Compression of sediments, e.g. from the legs of a jack-up barge could also fit into this pressure type. Abrasion relates to the damage of the sea bed surface layers (typically up to 50 cm depth). Activities associated with abrasion can cover relatively large spatial areas and include: fishing with towed demersal trawls (fish and shellfish); bio-prospecting such as harvesting of biogenic features such as maerl beds where, after extraction, conditions for recolonisation remain suitable or relatively localised activities including: seaweed harvesting, recreation, potting, aquaculture. Change from gravel to silt substrate would adversely affect herring spawning grounds.	✓	Sampling; Mooring/anchoring,	C O	Change in water quality; Disturbance of seabed habitat	Changes in water quality; Changes in habitat extent/type; Change in habitat quality	✓	✓
Physical damage	Penetration and/or disturbance of the substrate below the surface of the seabed - Surface	See penetration and/or disturbance of the substrate pressures above (surface only).	✓	Sampling; Mooring/anchoring,	C O	Change in water quality; Disturbance of seabed habitat	Changes in water quality; Changes in habitat extent/type; Change in habitat quality	✓	✓
Physical damage	Penetration and/or disturbance of the substrate below the surface of the seabed - Subsurface	See penetration and/or disturbance of the substrate pressures above (sub-surface only).	✓	Sampling; Mooring/anchoring,	C O	Change in water quality; Disturbance of seabed habitat	Changes in water quality; Changes in habitat extent/type; Change in habitat quality	✓	✓
Physical damage	Changes in suspended solids (water clarity)	Changes in water clarity from sediment and organic particulate matter concentrations. It is related to activities disturbing sediment and/or organic particulate matter and mobilising it into the water column. Could be 'natural' land run-off and riverine discharges or from anthropogenic activities such as all forms of dredging, disposal at sea, cable and pipeline burial, secondary effects of construction works, e.g. breakwaters. Particle size, hydrological energy (current speed and direction) and tidal excursion are all influencing factors on the spatial extent and temporal duration. This pressure also relates to changes in turbidity from suspended solids of organic origin (as such it excludes sediments - see the "changes in suspended sediment" pressure type). Salinity, turbulence, pH and temperature may result in flocculation of suspended organic matter. Anthropogenic sources mostly short lived and over relatively small spatial extents.	✓	Dredging (non-living resources); Disposal; Piling; Sampling	C O	Change in water quality (SSC); Disturbance of seabed habitat (smothering)	Changes in water quality; Changes in habitat extent/type; Change in habitat quality	✓	✓
Physical damage	Siltation rate changes including smothering (depth of vertical sediment overburden)	When the natural rates of siltation are altered (increased or decreased). Siltation (or sedimentation) is the settling out of silt/sediments suspended in the water column. Activities associated with this pressure type include mariculture, land claim, navigation dredging, disposal at sea, marine mineral extraction, cable and pipeline laying and various construction activities. It can result in short lived sediment concentration gradients and the accumulation of sediments on the sea floor. This accumulation of sediments is synonymous with "light" smothering, which relates to the depth of vertical overburden. “Light” smothering relates to the deposition of layers of sediment on the seabed. It is associated with activities such as sea disposal of dredged materials where sediments are deliberately deposited on the sea bed. For “light” smothering most benthic biota may be able to adapt, i.e. vertically migrate through the deposited sediment. “Heavy” smothering also relates to the deposition of layers of sediment on the seabed but is associated with activities such as sea disposal of dredged materials where sediments are deliberately deposited on the sea bed. This accumulation of sediments relates to the depth of vertical overburden where the sediment type of the existing and deposited sediment has similar physical characteristics because, although most species of marine biota are unable to adapt, e.g. sessile organisms unable to make their way to the surface, a similar biota could, with time, re-establish. If the sediments were physically different this would fall under L2. Eleftheriou and McIntyre, 2005 describe that the majority of animals will inhabit the top 5-10 cm in open waters and the top 15 cm in intertidal areas. The depth of sediment overburden that benthic biota	✓	Presence of structure; Dredging (non-living resources); Disposal	C O D	Change in water quality (SSC); Disturbance of seabed habitat (smothering)	Changes in water quality; Changes in habitat extent/type; Change in habitat quality	✓	✓

Pressure Theme	Pressure	Description	Lagoons	Sub-Activity Resulting in Pressure	Project Phase	Pathway(s)	Generic Impacts	Fish (Sensitivity)	Marine habitats (Sensitivity)
		can tolerate is both trophic group and particle size/sediment type dependant (Bolam, 2010). Recovery from burial can occur from: - planktonic recruitment of larvae - lateral migration of juveniles/adults - vertical migration (see Chandrasekara and Frid, 1998; Bolam *et al.* 2003, Bolam and Whomersley, 2005). Spatial scale, timing, rate and depth of placement all contribute the relative importance of these three recovery mechanisms (Bolam *et al.* 2006). As such the terms "light" and "heavy" smothering are relative and therefore difficult to define in general terms. Bolam, 2010 cites various examples: - H. ulvae maximum overburden 5 cm (Chandrasekara and Frid, 1998) - H. ulvae maximum overburden 20 cm mud or 9 cm sand (Bijerk, 1988) - S. shrubsolii maximum overburden 6 cm (Saila *et al.* 1972, cited by Hall 1994) - N. succinea maximum overburden 90 cm (Maurer *et al.* 1982) - gastropod molluscs maximum overburden 15 cm (Roberts *et al.* 1998). Bolam, 2010 also reported when organic content was low: - H. ulvae maximum overburden 16 cm - T, benedii maximum overburden 6 cm - S. shrubsolii maximum overburden <6 cm - Tharyx sp.A. maximum overburden <6 cm							
Other physical pressures	Litter	Marine litter is any manufactured or processed solid material from anthropogenic activities discarded, disposed or abandoned (excluding legitimate disposal) once it enters the marine and coastal environment including: plastics, metals, timber, rope, fishing gear etc. and their degraded components, e.g. microplastic particles. Ecological effects can be physical (smothering), biological (ingestion, including uptake of microplastics; entangling; physical damage; accumulation of chemicals) and/or chemical (leaching, contamination).	x	N/A	N/A	N/A	N/A	N/A	N/A
Other physical pressures	Electromagnetic changes	Localised electric and magnetic fields associated with operational power cables and telecommunication cables (if equipped with power relays). Such cables may generate electric and magnetic fields that could alter behaviour and migration patterns of sensitive species (e.g. sharks and rays).	✓	Active cable on seafloor	O	Electromagnetic field	Electromagnetic field	✓	x
Other physical pressures	Underwater noise changes	Increases over and above background noise levels (consisting of environmental noise (ambient) and incidental man-made/anthropogenic noise (apparent)) at a particular location. Species known to be affected are marine mammals and fish. The theoretical zones of noise influence (Richardson *et al.* 1995) are temporary or permanent hearing loss, discomfort and injury; response; masking and detection. In extreme cases noise pressures may lead to death. The physical or behavioural effects are dependent on a number of variables, including the sound pressure, loudness, sound exposure level and frequency. High amplitude low and mid-frequency impulsive sounds and low frequency continuous sound are of greatest concern for effects on marine mammals and fish. Some species may be responsive to the associated particle motion rather than the usual concept of noise. Noise propagation can be over large distances (tens of kilometres) but transmission losses can be attributable to factors such as water depth and sea bed topography. Noise levels associated with construction activities, such as pile-driving, are typically significantly greater than operational phases (i.e. shipping, operation of a wind farm).	✓	Acoustic devices; Rotating structures; Piling; Dredging (non-living resources); Disposal; Vessel movements	C O	Disturbance (behavioural response); Physical injury or death	Disturbance via noise and vibration	✓	x
Other physical pressures	Introduction of light	Direct inputs of light from anthropogenic activities, i.e. lighting on structures during construction or operation to allow 24 hour working; new tourist facilities, e.g. promenade or pier lighting, lighting on oil and gas facilities etc. Ecological effects may be the diversion of bird species from migration routes if they are disorientated by or attracted to the lights. It is also possible that continuous lighting may lead to increased algal growth.	✓	Presence of structure; Vessel movements	O	Disturbance (behavioural response)	Visual disturbance (icl. Light)	✓	✓
Other physical pressures	Barrier to species movement	The physical obstruction of species movements and including local movements (within and between roosting, breeding, feeding areas) and regional/global migrations (e.g. birds, eels, salmon, whales). Both include up river movements (where tidal barrages and devices or dams could obstruct movements) or movements across open waters (offshore wind farm, wave or tidal device arrays, mariculture infrastructure or fixed fishing gears). Species affected are mostly birds, fish, mammals.	✓	Presence of structure	O	Physical barrier to species movements	Barrier to movement; Changes in availability of spawning/nursery grounds; Changes in fish prey availability	✓	x
Other physical pressures	Death or injury by collision	Injury or mortality from collisions of biota with both static and/or moving structures. Examples include: Collision with rigs (e.g. birds) or screens in intake pipes (e.g. fish at power stations) (static) or collisions with wind turbine blades, fish and mammal collisions with tidal devices and shipping (moving). Activities increasing number of vessels transiting areas, e.g. new port development or construction works will influence the scale and intensity of this pressure.	✓	Presence of structure; Rotating structure; Vessel movements	C O	Death or injury through collision	Collision risk	✓	x

Pressure Theme	Pressure	Description	Lagoons	Sub-Activity Resulting in Pressure	Project Phase	Pathway(s)	Generic Impacts	Fish (Sensitivity)	Marine habitats (Sensitivity)
Biological pressures	Visual disturbance	The disturbance of biota by anthropogenic activities, e.g. increased vessel movements, such as during construction phases for new infrastructure (bridges, cranes, port buildings etc.), increased personnel movements, increased tourism, increased vehicular movements on shore etc. disturbing bird roosting areas, seal haul out areas etc.	✓	Presence of structure; Vessel movements	C O	Disturbance (behavioural response)	Visual disturbance (icl. Light)	✓	x
Biological pressures	Genetic modification and translocation of indigenous species	Genetic modification can be either deliberate (e.g. introduction of farmed individuals to the wild, GM food production) or a by-product of other activities (e.g. mutations associated with radionuclide contamination). Former related to escapees or deliberate releases e.g. cultivated species such as farmed salmon, oysters, scallops if GM practices employed. Scale of pressure compounded if GM species "captured" and translocated in ballast water. Mutated organisms from the latter could be transferred on ships hulls, in ballast water, with imports for aquaculture, aquaria, live bait, species traded as live seafood or 'natural' migration.	x	N/A	N/A	N/A	N/A	N/A	N/A
Biological pressures	Introduction or spread of non-indigenous species	The direct or indirect introduction of non-indigenous species, e.g. Chinese mitten crabs, slipper limpets, Pacific oyster and their subsequent spreading and out-competing of native species. Ballast water, hull fouling, stepping stone effects (e.g. offshore wind farms) may facilitate the spread of such species. This pressure could be associated with aquaculture, mussel or shellfishery activities due to imported seed stock imported or from accidental releases.	✓	Presence of structure	C O	Introduction or spread of non-natives	Change in species assemblage; Introduction or spread of non-natives	✓	✓
Biological pressures	Introduction of microbial pathogens	Untreated or insufficiently treated effluent discharges and run-off from terrestrial sources and vessels. It may also be a consequence of ballast water releases. In mussel or shellfisheries where seed stock are imported, 'infected' seed could be introduced, or it could be from accidental releases of effluvia. Escapees, e.g. farmed salmon could be infected and spread pathogens in the indigenous populations. Aquaculture could release contaminated faecal matter, from which pathogens could enter the food chain.	x	N/A	N/A	N/A	N/A	N/A	N/A
Biological pressures	Removal of target species	The commercial exploitation of fish and shellfish stocks, including smaller scale harvesting, angling and scientific sampling. The physical effects of fishing gear on sea bed communities are addressed by the "abrasion" pressure type D2, so B5 addresses the direct removal / harvesting of biota. Ecological consequences include the sustainability of stocks, impacting energy flows through food webs and the size and age composition within fish stocks.	x	N/A	N/A	N/A	N/A	N/A	N/A
Biological pressures	Removal of non-target species	By-catch associated with all fishing activities. The physical effects of fishing gear on sea bed communities are addressed by the "abrasion" pressure type (D2) so B6 addresses the direct removal of individuals associated with fishing/ harvesting. Ecological consequences include food web dependencies, population dynamics of fish, marine mammals, turtles and sea birds (including survival threats in extreme cases, e.g. Harbour Porpoise in Central and Eastern Baltic).	x	N/A	N/A	N/A	N/A	N/A	N/A
For references, see http://jncc.defra.gov.uk/default.aspx?page=7136 (Accessed September 2017). Project phase: C – Construction; O – Operation.									

B Migratory Fish – Baseline Review

B.1 Atlantic Salmon

B.1.1 Ecology

Atlantic salmon typically spend the first two to four years of life in freshwater. After this time, juvenile salmon undergo a behavioural, morphological and physiological transformation to allow them to survive at sea. At this stage, the young salmon become known as smolts and usually enter the marine environment between April and June (Hendry and Cragg-Hine, 2003).

Upon entering the marine environment salmon smolts undergo an active migration towards open marine areas (Davidsen *et al*. 2008; Malcom *et al*. 2010). The direction of travel is thought to be variable depending on river of origin and the individuals' orientation behaviour but it is not thought to follow the shoreline (Moriarty *et al*. 2016). Smolts generally move toward northern feeding grounds located in the Norwegian Sea (Mork *et al*. 2012). Swimming during migration occurs within the uppermost surface (<10 m) waters although this may be interspersed with foraging dives to depths of between 25-50 m (Malcom *et al*. 2010; Reddin *et al*. 2006).

Adults may return to their natal (place of birth) river throughout the year although there will be periods of peak activity Greenhalgh (2005). Those returning in spring will comprise mainly of multi-sea winter (MSW) individuals (salmon that have spent >1 year at sea) with the run beginning in winter and peaking in spring. Those returning is summer consist of a mixed cohort of grilse (salmon that have spent one year at sea) and MSW salmon. Autumn represents the third run which is comprised mainly of grilse.

Adults returning from feeding grounds around west Greenland and the Faroe Islands (Malcolm *et al*. 2010; Mork *et al*. 2012) are likely to approach the strategic resource area (SRA) from the north. When migrating, adult salmon will occupy surface waters (Godfrey *et al*. 2014) but will undertake periodic dives in relation to behavioural traits such as thermoregulation and predator avoidance as well as exploiting feeding opportunities and searching for olfactory (scent) cues from natal rivers (Godfrey *et al*. 2014). As such the entire water column will be periodically used by adults during the inbound migration.

The route taken by returning adults is likely to be coastal based on the principal that Atlantic salmon rely on olfactory (smell) senses to locate natal spawning rivers. Davidsen *et al*. (2013) found that the ebb tide facilitated salmons homing ability in response to outflowing fresh water influences. As such salmon are thought to track along the coast to provide a means of orientation (Malcolm *et al*. 2010; Davidsen *et al*. 2013).

Salmon will usually transition into freshwater environments during periods of increased flow following periods of heavy rainfall (Hendry and Cragg-Hine, 2003). Solomon *et al*. (1999) described within Hendry and Cragg-Hine (2003) states that for salmon to pass the tidal limit, flow thresholds need to be exceeded for 95% of the time. Therefore, should flow conditions not be suitable upon arrival, salmon will hold-up in nearshore environments until environmental conditions become conducive for river entry.

B.1.2 Distribution and occurrence

Atlantic salmon is described by the Joint Nature Conservation Committee (JNCC) as being widely distributed in the EU, ranging from Portugal in the south to Sweden and Finland in the north. In the UK salmon are widely distributed and can be found in several hundred rivers (JNCC, 2017a). However, there has been a national decline in abundance of salmon by over 85% from the 1970's to the present day (Cefas and Environment Agency, 2015). Abundance of returning fish has fallen and is particularly pronounced for the MSW population. Catches of MSW salmon in the last five years are reported to have increased on a national level (Cefas and Environment Agency, 2015).

There are a number of genetically distinct populations of salmon that migrate through the Severn Estuary, including populations originating from the Severn, Wye, Usk and Taff/Ely at the eastern end of the estuary. Further west, populations exist on the eastern and western Cleddau which discharge at Millford Haven, and the Torridge and the Tamar on the English coast. Salmon catches have reduced considerably in recent decades; in the three major Severn Estuary tributaries (Severn, Wye and Usk) in common with many other parts of the eastern North Atlantic (DECC, 2010b).

B.2 Sea Trout

B.2.1 Ecology

Sea trout are the migratory variant of the widely distributed freshwater brown trout. In this respect sea trout share much of their life-cycle with Atlantic salmon. After spawning, juvenile trout remain in freshwater close to their nursery/foraging grounds for between one and six years. After this time sea trout will undergo a behavioural and physiological change (smoltification) in preparation of their downstream migration to the estuary/open sea. This usually takes place between March and May in European rivers (Celtic Sea Trout Project (CSTP), 2016).

Sea trout originate from a large number of freshwater catchments distributed around the Irish Sea. Smolt disperse slowly and generally do not migrate over large distances upon entering the marine environment (Johnstone *et al*. 1995; Finstad *et al*. 2005; Middlemas *et al*. 2009). Foraging is regarded to be confined to inshore coastal waters (CSTP, 2016). However, new evidence complied by the CSTP shows that sea trout adopt a variable migratory strategy whereby some individuals will range over much greater distances. Where these wide spread dispersals occur, the strength of the prevailing current was considered the primary influencing factor. Other environmental influences, such as the surrounding topography of the coastline, is also considered to influence dispersal but the exact mechanisms are unknown (CSTP, 2016).

There is little information available on the swimming behaviour of sea trout in the marine environment but they are thought to typically swim in the top 10 m with dives to 20 m being recorded. Dives may be associated with feeding and physiological regulation of body temperature. Sea trout feed predominantly in estuarine and coastal areas on fish, amphipods and benthic invertebrates (CSTP, 2016).

After a period of feeding some sea trout will re-enter freshwater environments in autumn of the same year but only a few will actively participate in spawning. Most remain in the marine environment for between one year and three years before migrating back into riverine environments to spawn between August and September. Unlike Atlantic salmon entry into the river is not dependent on high flow conditions triggered by natural flood events (CSTP, 2016). Instead sea trout can move upstream under extreme drought conditions.

After spawning, a proportion of the adults will succumb to the energetic costs involved; however, some will survive and may go on to spawn again. These will return to the sea to regain strength and take part in the subsequent year(s) spawning migration (De Laak, 2012).

B.2.2 Distribution and occurrence

Sea trout populations are widely distributed throughout much of Europe, the UK and along the coast of Iceland. Marine bound smolts will be present between March and May with the returning adults generally being present between February and October and again between December and January, when they make their return journey to the sea after spawning.

The tendency to utilise shallow inshore waters combined with a slow dispersal rate and a comparatively limited foraging range suggests that sea trout originating from catchments close to the SRA are likely to encounter the SRA at some point during their marine phase. It is not possible to fully describe the migratory routes taken by sea trout due to a lack of scientific data.

B.3 European Eel

B.3.1 Ecology

The European eel has a complex life history and may live for more than 50 years (OSPAR, 2010). Unlike anadromous species, such as Atlantic salmon and sea trout described above, the European eel is catadromous, which means they reproduce in the marine environment and mature in freshwater (Cefas, 2011).

The lifecycle of the European eel begins in the Sargasso Sea spawning grounds. After hatching into larvae, they undertake a passive drift migration using the Gulf Stream and North Atlantic Current to reach the coast of continental Europe. Upon reaching continental waters, the larvae metamorphose into a transparent stage known as 'glass' eel. Glass eels then move further inshore where they begin to develop pigment on the body and become known as 'elvers'. As young elvers, the European eel inhabits coastal and estuarine areas living under rocks, in crevices, or in the mud of estuaries, coastal lagoons, rivers, lakes and ponds (Wang and Tzeng, 2000; OSPAR, 2010; Natural England, 2013). Entry into estuarine environments generally takes place between October and November in western Ireland and the south-west peninsular of Britain spreading around the coast of the British Isles over the following few months.

Some elvers may take up residency in estuarine or coastal waters (Solomon and Beach, 2004), but the majority will pass into riverine environments from April through the summer to feed and grow into the adult stage known as 'yellow' eels (Laffaille *et al.* 2005). European eel that enter freshwater may spend 25 years or more in this environment but on average males stay for six years and females nine years before reaching maturity (Tesch, 2003). Once ready for reproduction European eel become known as 'silver' eels due to the physiological adaptations for life in the marine environment. Silver eel start to migrate downstream in autumn and may continue to do so until early spring with peak activity occurring between August and October (Malcolm *et al.* 2010). Once in the marine environment, the European eel undertakes a long spawning migration across the Atlantic Ocean, where they are believed to travel more than 5,000 km to reach their spawning grounds in Sargasso Sea (Munk *et al.* 2010). Once the adults are spent they succumb to the energetic cost of spawning (OSPAR, 2010).

B.3.2 Distribution and occurrence

European eel are widely distributed across the coastal countries of Europe and North Africa and is present within the Mediterranean and Blas Sea (OSPAR, 2010). The abundance of eel has dramatically declined across Europe in the last 22 years. Since 2006, European eel recruitment has reduced by around 90% when compared to pre-1980 levels (Bark *et al*. 2007). This is supported by a recent assessment made by the International Council for the Exploration of the Sea (ICES). The ICES study reports that glass eel recruitment in the North Sea and the rest of continental Europe is currently <10% of that recorded between 1960-1979 (ICES, 2015).

Migration routes of tagged silver eel released from the west coast of Ireland show a south-west migration into the North Atlantic toward the Azores (Righton *et al*. 2016) the. Silver eel emigrating from the west coast of England are likely to follow a similar route south into the North Atlantic. During this time silver eel are reported to display diel vertical migrations moving from cooler deep water environments by day to warmer shallow water environments by night (Malcolm *et al*. 2010; Righton *et al*. 2016). However, Malcolm *et al*. (2010) also states that European eel exhibit a pronounced negative phototaxis in all stages with individuals rarely found within a few meters of the surface during daylight, or even bright moonlight, if deeper water is available.

There are no direct accounts of larval migration routes for the west coast of England although they are likely to enter the SRA from the south given the northerly direction of the prevailing current. An unknown proportion of the population will remain in coastal waters for an extended period to feed and mature. These coastal populations are considered resident increasing the likelihood of eel encountering the SRA during their lifetime. When in the marine environment, the available evidence suggests that European eels utilise a wide range of depths (Malcolm *et al*. 2010) and may reside within coastal environments for up to 25 years.

B.4 Sea Lamprey

B.4.1 Ecology

Sea lamprey is present along most of the Atlantic coast of western and northern Europe (Maitland, 2003). Spawning in British rivers usually occurs in late May or June, when the water temperature reaches 15°C.

After hatching, larvae (ammocetes) drift downstream to reach sheltered areas of fine silt within which they bury themselves. Here they may spend several years feeding, until they metamorphosize into the adult stage. Metamorphosis usually takes place around mid-to late summer with functional eyes appearing and the mouth becoming sucker like (known as the oral disc) with teeth (Gardiner, 2003; Maitland, 2003).

Following metamorphosis sea lamprey enter the marine environment where they feed and mature. Little is known about their behaviour or distribution at sea although sea lamprey has been found in both shallow coastal regions and deep offshore waters (Maitland, 2003). Adults exhibit exoparasitic feeding behaviour in the marine environment predating on of a variety of large fish including basking shark, cod and Atlantic salmon (Maitland, 2003; Wilkie *et al*. 2004).

B.4.2 Distribution and occurrence

Sea lamprey are widely distributed in UK rivers but have declined in recent years with local extinctions being recorded in parts of the UK (JNCC, 2017b). Scotland is considered to represent the northern limit of the species range.

Little is known about the distribution and abundance of sea lamprey when in the marine environment. However, due to prey preference their foraging range is significantly larger than that of the river lamprey. This increases the chance that sea lamprey will at some stage encounter the SRA's either during foraging or spawning migration.

B.5 River Lamprey

B.5.1 Ecology

River lamprey has a similar life history to that of the larger sea lamprey, described above. Numbers have declined in Britain but they remain widely distributed throughout most of England and Wales. Upstream migration of adults into freshwater spawning grounds generally occurs between October and December (Maitland, 2003). Migration may continue throughout winter and early spring when conditions are suitable. After hatching the larvae (ammocetes) spend between three and five years buried within riverine silts, until metamorphosis, after which they migrate downstream and into the marine environment. Entry into the estuary tends to take place between July and September (Maitland, 2003).

Once in the marine environment river lampreys undergo highly localised migrations staying within their local estuary and surrounding coastal areas. Here they feed on a variety of fish, particularly herring, sprat and flounder (Maitland, 2003). After a period of one or two years the adults stop feeding and return to the river to breed.

B.5.2 Distribution and occurrence

River lamprey are widely distributed throughout western Europe from southern Norway to the western Mediterranean. The species is described as being widespread in the UK from south of the Great Glen in Scotland (JNCC, 2017c).

Little is known about the marine distribution and movement of these species. However, it likely that due to their parasitic nature as adults they will sometimes be distributed in accordance to prey availability. As river lamprey parasitise on estuarine fish their distribution is considered more restricted than that of sea lamprey as they will remain in estuarine waters (Maitland, 2003).

B.6 Allis and Twaite Shad

B.6.1 Ecology

Allis and Twaite shad are the only members of the herring family (Clupeidae) that can be found in UK fresh waters (Maitland and Hatton-Ellis, 2003). Shad inhabit coastal areas and spawn in fresh water systems from April to June (Maitland and Hatton-Ellis, 2003; Reeve, 2005; Barnes, 2008; JNCC, 2017d; 2017e).

Adult Allis shad stop feeding and move into estuarine environments before entering riverine habitats during late spring. Adults aggregate in shoals within suitable pools, where nocturnal spawning occurs. Most Allis shad die after spawning, with any surviving individuals returning downstream to the sea (Maitland and Hatton-Ellis, 2003).

Twaite shad displays similar migratory and spawning behaviour as that of Allis shad, detailed above, but with a slightly later entry time into the estuary of early summer. Upstream movement to spawning areas occurs from mid-May to mid-July for Twaite shad. Another difference is that unlike Allis shad, Twaite shad may spawn multiple times (Maitland and Hatton-Ellis, 2003).

Juvenile shad remain in the lower parts of the rivers that are slow flowing before moving to estuarine and coastal waters from July before returning to sea by the end of summer. Downstream migration takes around a year, (Maitland and Hatton-Ellis, 2003).

B.6.2 Distribution and occurrence

Allis shad are considered to be rare and in decline throughout much of its range which incorporates the western coast of Europe from southern Norway to Spain and east towards Italy (JNCC, 2017d; 2017e). Allis shad were not thought to spawn in the British Isles (Maitland and Lyle, 2001) until a study by Hillman (2003) confirmed a spawning site within the Tamar Estuary. Hillman (2003) also outlines the existence of a potential Allis shad spawning population within the Solway Firth area. This raises the possibility that Allis shad may on occasion migrate through the SRA on route to the Solway Firth.

Twaite shad is distributed along the western coast of Europe from southern Norway to Morocco and along the eastern Mediterranean, but has declined throughout Europe. The only known spawning stocks of Twaite shad in the UK occur in Welsh rivers and on the England/Wales border in tributaries of the Severn Estuary (Carstairs, 2000). Three distinct British population groups of Twaite shad have been defined; Tywi, Usk and the Severn group which encompasses the Wye, Teme and Severn rivers (Alexandrino *et al*. 2006). No spawning stocks are known north of Severn Estuary, although the species is present in south-west Scotland, in rivers flowing into the Solway Firth, where hybrids with Allis shad have been reported (Maitland and Lyle, 2001).

C Principles Document

DRAFT: Principles document describing the approach to the Habitats Regulations Assessment of the WNMP draft Tidal Lagoon (TL) policy – 2017 (provided by Welsh Government).

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Principles document describing the approach to the Habitats Regulations Assessment of the WNMP draft Tidal Lagoon (TL) policy.

The following abbreviations are used:

TL – Tidal lagoon
ES – European Site
SAC – Special Area of Conservation
SPA- Special Protection Area (birds)
Natura 2000 - the network of ESs
HRA – Habitats Regulations Assessment
AA – Appropriate Assessment
TLSE – Test of Likely Significant effect
No AESI - No adverse effect on site integrity
IROPI – A6(4) provision – Imperative Reasons of Overriding Public Interest
CO – Conservation Objective
WNMP – Welsh National Marine Plan
WNMP SRA – Strategic Resource Area

1. Requirement for Habitats Regulations Assessment (HRA)

Appropriate Assessment (AA) forms part of a legal process known as a Habitats Regulations Assessment (HRA)and is a requirement of the EU Habitats Directive 92/43/EEC (SACs) and Birds Directive 79/409/EEC (SPAs) as implemented by the Conservation of Habitats and Species Regulations 2010. Under these regulations all 'competent authorities' must undertake a formal assessment of the implications of any new "plans or projects" which are capable of affecting the designated interest features of European Sites before deciding whether to undertake, permit or authorise such a plan or project. HRA involves screening to determine whether there could be a Likely Significant Effect (LSE) of the plan on any European site followed (if required) by the AA itself.
It is Government policy to include Ramsar sites, Natura 2000 sites which are proposed for designation, including candidate SACs (cSACs) and proposed SPAs (pSPAs), as well as Sites of Community Importance (SCI's), collectively referred to here as 'European sites'. In addition, any sites not currently within a designation process, but which clearly meet the criteria for classification and that have been consulted upon will also be considered.[1]

As part of the HRA process, the plan-making authority may need to amend the plan, e.g. by amending the policy or ensuring appropriate mitigation is available at the project level to eliminate or reduce potentially damaging effects on European sites.

Annex 1 describes the HRA process in more detail.

[1] http://gov.wales/topics/environmentcountryside/consmanagement/conservationbiodiversity/habitatdirective/?lang=en

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2. WNMP and the Habitats Directive

The draft WNMP is a plan in the context of "plans & projects" (Habitats Directive: Council Directive 92/43/EEC[2]) and the Welsh Ministers are a competent authority to which the Conservation of Habitats and Species Regulations 2010 apply.[3]

The draft WNMP is being prepared for formal consultation. The purpose of the Plan is to set out planning policy to guide future use and the management of marine activities in a sustainable way, taking into account economic, social and environmental priorities.[4]

Following the general principles in Annex 1, the WNMP has been subject (at plan level) to a Sustainability Appraisal and HRA (AMEC, 2017) during which it has not been possible to rule out with certainty (based upon advice from NRW) an absence of likely significant effect for the specific part of policy ELC-01 that supports Tidal lagoons (TL).

Accordingly a Habitats Regulations Assessment (HRA) of this policy will be undertaken and this document establishes the scope of that work.

3. WNMP Tidal Lagoon supporting policy

The draft WNMP includes sector policies that support and safeguard developments. A policy offering support to renewable energy eg tidal stream energy and tidal lagoons in their respective Strategic Resource Areas (SRAs) is paired with a stronger policy which safeguards those areas from sterilisation from other developments.

This scoping document sets out our approach to undertaking the AA of the highlighted components of the tidal lagoon element of the following policy:

Draft Policy ELC-01 says:

Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:
a) in corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and
b) in corresponding wave, tidal stream and **tidal lagoon Strategic Resource Areas**.

Relevant public authorities should, in liaison with the sector and other interested

[2] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

[3] http://www.legislation.gov.uk/uksi/2010/490/contents/made

[4] http://gov.wales/topics/environmentcountryside/marineandfisheries/marine-planning/?lang=en

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parties, collaborate to understand opportunities for the sustainable use of:
a) renewable energy Strategic Resource Areas; and
b) wider natural resources that provide renewable energy potential;

in order to support the sustainable growth of the renewable energy sector through marine planning.

Any support for marine renewable energy generation under this policy is conditional upon statutory process being followed and significant adverse effects on the integrity of European marine sites being effectively avoided or mitigated or, in the case of any developments that might take place under A6(4) IROPI provision, are fully compensated for.

In order to understand future opportunities for **offshore wind** development, strategic planning for the sector is encouraged. Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to:

- collect evidence to support understanding of environmental and social constraints and opportunities
- support understanding of the optimal siting of offshore wind developments across Wales.

Relevant public authorities should make relevant evidence widely available to support planning and decision making.

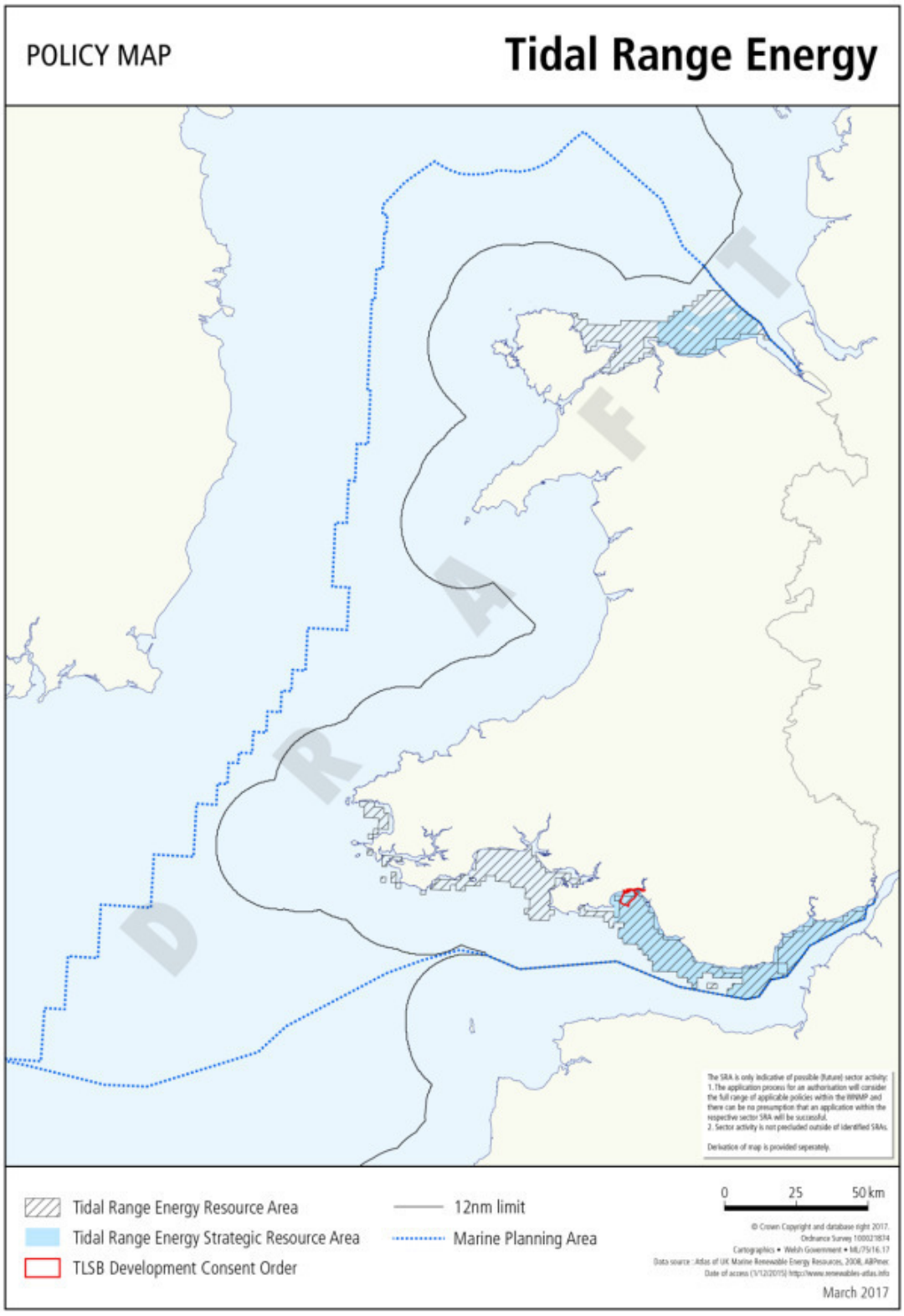
Specifically, any activity within SRAs identified in ELC_01 would also have to comply with the WNMP policies ENV_02 and GOV_01 (amongst other plan policies):

ENV_02: *Proposals should demonstrate how they:*
- *avoid adverse impacts to individual Marine Protected Areas (MPAs) and the coherence of the network as a whole; and*
- *have regard to the measures to manage MPAs.*

GOV_01: *Proposals should demonstrate that they have assessed potential cumulative effects and, in order of preference:*
- *avoid adverse effects; and/or*
- *minimise effects where they cannot be avoided; and/or*
- *mitigate effects where they cannot be minimised.*

If significant adverse effects cannot be adequately addressed, proposals should present the case for proceeding.
Proposals that contribute to positive cumulative effects are encouraged.

Figure 1: Shows the extent of the Tidal Lagoon strategic resource area (SRA) to which this TL supporting policy applies and which lies within a broader Resource Area (RA) which is not subject to any specific TL policy.
{To re-title map Tidal Lagoon, now that ELC-01 refers specifically to TL ?}



4. The basis of policy ELC-01 offering support to Tidal Lagoons

The intention of the policy is to offer a degree of encouragement to the renewable energy sector generally, and to sign-post areas containing suitable resource (the resource area, RA).
The TL Safeguarding policy (not to be further HRA assessed) is intended to protect that resource from accidental sterilisation or interference from other sector developments.
However, since not all areas of potential resource are of equal interest or availability (eg because they may already be of strategic importance for use by another sector such as shipping), then the TL RA has been further restricted to a Strategic (S)RA where sector development is encouraged.

Such encouragement is not spatially or project specific beyond it being in the SRA as a whole; nor does it suggest that projects that do apply for a licence to proceed in that area will be successful. Furthermore, sector development is not excluded outside of these areas.

The WNMP itself applies caveats to such developments as does the ELC-01 policy. *Eg* the WNMP (and TL policy itself) reiterates that: "Any support for marine renewable energy generation under this policy is conditional upon statutory process being followed and significant adverse effects on the integrity of European marine sites being effectively avoided or mitigated or, in the case of any developments that might take place under A6(4) IROPI provision, are fully compensated for."

Furthermore, any individual energy project to be licenced must also meet statutory processes involving strict environmental assessment before it may proceed - elements of these requirements are reiterated through the suite of Environmental policies (ENV_01 to ENV_06) in the WNMP. Accordingly, supporting policy ELC-01, although indicating encouragement, offers weak support.

Welsh Government considers that the proposed SRA for Tidal Lagoons are large areas that do not prescribe the scale or specific locations for individual projects. The policy approach therefore provides reasonable scope for a scenario involving a lagoon or lagoons to be located in a position and / or being of a size where significant adverse effects upon designated ES features can be effectively managed. Areas of the Bristol Channel west of Cardiff and in North Wales north of Llandudno may present such opportunities for example.
Therefore, it is reasonable to retain the policy and its spatial context (the associated SRA) but to conclude that, despite the high level nature of the plan, potential significant adverse effects cannot be ruled out and a plan level AA should therefore be undertaken.

Unlike tidal barrages, which by definition block or present a barrier across estuaries, inlets or rivers; tidal lagoons have the capacity to scale and locate away from some of the more sensitive environmental features and to not

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therefore necessarily act as a significant ecological barrier eg to species movements in the way that a barrage might be conceived to.

Such considerations underpin WG high-level planning policy support for sustainable tidal lagoon developments through the proposed policy (where appropriately located and considered).

NRW has expressed a view to Welsh Government that given the nature and scale of TLs, that all TL projects at any position or scale within the identified TL SRA are likely to have adverse effects, the size of which is likely to preclude their development unless invoking an A6(4) IROPI provision.

Welsh Government recognises the extent of the issues involved and believes that the HRA process, potentially reverting to A6(4) as is necessary, can help identify at an early strategic stage, and increase our understanding of the opportunities and constraints associated with TL development within Wales. Such considerations would not pre-judge whether any particular application at project level may be likely to succeed.

Notwithstanding the above, plan level AA also has the potential to conclude that the WNMP policy requires amending so as to reduce the element of support or to reduce the impacts of any such development on designated ES, or if significant impacts cannot be ruled out, to consider supporting any lagoon development through A6(4) provisions ie IROPI along with the consideration of the need to provide adequate compensation.

5. Proposed HRA approach on Tidal Lagoon supporting policy

5.1 Table of process (following Annex 1)

NB. Developers and their consultants have some scope to vary their approach in following Annex 1, but the main principles apply.

Table 1: Overview of the approach to WNMP HRA, its correspondence with UK guidance and the method by which findings will be documented.

Approach to HRA	Correspondence with key stages in UK guidance on HRA of plans
Pre-screening	1. Decide whether a plan should be subject to HRA
	2. Identify the European sites (ES) that should be considered in the appraisal
	3. Gather information about the European sites
	4. Discretionary discussions on the method and scope of the Appraisal.
	5. Consider other plans and projects that may give rise to a significant impact in-combination – *See text below*
Screening	6. Screen for Likely Significant Effects (LSE) on European sites
	7. Apply mitigation measures
	8. Rescreen the plan for LSE after mitigation measures applied

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Information for Appropriate Assessment	9. Undertake Appropriate Assessment (AA) where the absence of significant effect on a ES cannot be ruled out.
	10. Apply avoidance, mitigation measures and consider in combination assessment ie where an impact might be considered non significant on its own but may become significant if considered with the effects of another plan or project to identify if any residual significant effects remain.
	11. Prepare draft record of the AA
	12. Consult on draft AA record (as part of the overall consultation on the HRA of the WNMP as a whole)
	13. Rescreen any amendments for adverse effect on integrity; carry out AA.
Record of Appropriate Assessment	14. Modify and record AA, including any meaningful project level guidance to future TL developers which may influence the general nature, timing, duration, scale or location of future proposals.
A6(4) IROPI	15. If any residual significant effect remains, consider applying Article 6(4) approach. Such an approach will require assessment of alternatives and justification of the need to progress the project in spite of the environmental consequences, making the case to proceed on the basis of IROPI, and consideration of the provision for adequate compensation to ensure the integrity of the network despite the likely residual adverse impacts identified. As part of 6(4), consideration will be needed as to whether "priority" species or habitats are involved and will involve discussion with WG, UK Government and the Commission (where appropriate). For the purposes of this Plan level assessment, the HRA will set out the steps to be taken and the broad considerations that will need to be considered at PROJECT LEVEL if an individual project was to proceed that related to the policy being assessed.

5.2 **The potential effects of WNMP supporting policy on the environment - Scoping in of features**

It is necessary to understand the relationship (and pathways) between potentially sensitive receptors to the potential development of Tidal Lagoon(s).

This HRA principles document considers the environmental effects generated by the **construction and operation** of Tidal Lagoons, but not de-commissioning, in view that:

- TL are intended to have a minimum life of 120 years which is outside of the life of consideration of the WNMP (20 years).
- It is anticipated that TL life may be extended beyond 120 years,
- that decommissioned TL may leave the wall structures intact and remove only the turbine housings
- that technology to undertake any de-construction may be totally different in 120 years to what is available today.

Notwithstanding the above, the environmental effects of decommissioning are likely to be similar to, and no worse than, those considered in the construction phase and which are to be considered as part of the AA.

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Table 2 considers our approach to identifying the potential activities of constructing and operating a TL (Annex 2) and the environmental effects (Annex 3) in relation to potential receptors for which ES have been designated and which will be considered as part of the HRA / AA.
The potentially sensitive receptors have been combined into groups where impacts are similar, however differences will occur between species and habitats and their response to pressures depending on their individual natural characteristics. Furthermore impacts may have cumulative (and therefore additional) effect and which must also be taken into consideration within the AA.

Impacts on receptors may be direct or indirect; for example: increased suspended solids may directly effect fish or they may induce habitat change on which fish feed etc.

D = Direct; I = Indirect; B= Both; ? = uncertain relationship; – No relationship.

The table is intended to be indicative of the types of impacts and not to be definitive, and this will be developed by consultants to WG.

Table 2: Impact pathways and potential impacts to features of European sites that could be affected by supporting TL policy in the WNMP

Activity	**Effects**	**Likely Impacts on types of receptors**				
		Benthic (subtidal) habitats *Annex I habitats that are SAC features*	**Coastal / inter-tidal Habitats** *Annex I habitats that are SAC features or support SPA bird populations*	**Fish, shellfish** *Species that are SAC features*	**Marine mammals / Turtles and Otters** *Annex II species that are SAC features*	**Birds** *Populations of birds that are SPA features*
Effects of constructing a TL						
Construction & Dredging	Changes in sediment deposition and erosion /increase in suspended sediment composition (coastal processes as a result of changer in wave or tidal regime)	D	D	B	B	B
	Changes in sediment deposition (habitat modification)	D	D	B	B	I

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	disturbance and re-deposition of contaminated sediments,	D	D	D	D	D
	species disturbance or displacement (or that of their prey)	?	?	B	B	B
Disposal of dredging (if at sea)	increase in suspended sediment composition	D	-	D	D	-
	disturbance and re-deposition of contaminated sediments	D	-	D	D	?
	species disturbance or displacement	-	-	D	D	-
Lagoon seawalls (including rock armour and works to navigation channels)	Changes in sediment deposition and erosion (coastal processes as a result of changer in wave or tidal regime)	D	D	B	B	B
	disturbance and re-deposition of contaminated sediments	D	D	D	D	D
	species disturbance or displacement	-	-	B	B	B
Vehicle, machinery and plant operations	Noise & vibration (eg from percussive or vibro pilling) visual or light; causing disturbance	-	-	B	B	B
	Airborne pollutants, dust	D	D	?	?	?
Collision risk with construction vessels		-	-	?	D	?
Discharges and accidental spillages		D	D	B	B	B
Introduction of non-native species		D	D	B	B	B
Effects of the presence of and operating a TL						
Presence of lagoon	Direct changes to hydrodynamic processes (waves or tidal regime) eg	D	D	B	B	B

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	changes in littoral drift altering the feed of sediments to beaches; changes in erosion and local deposition patterns					
	Change / loss / fragmentation of habitat, change to foraging / increased competition / isolation due to lagoon spatial footprint	?	?	D	D	D
	Change in behaviour or barrier to movement or migratory route	?	?	D	D	-
Maintenance dredging and disposal	increase in suspended sediment composition	D	?	D	D	-
	disturbance and re-deposition of contaminated sediments	D	-	D	D	-
	disturbance to species	-	-	B	B	B
Turbines and Sluice gates	Direct changes to hydrodynamic processes associated with the effects of the operation of the turbines and sluice gates	I	I	B	B	B
	Potential species injury / mortality due to collision with turbines	-	-	D	D	D
Impoundment of water	Saline intrusion locally	-	D	-	-	-
	Changes to impounded water quality eg plankton, physio-chemical characteristics	I	I	B	D	D
Vehicle, machinery and plant operations and of people presence	Noise, vibration visual or light; causing disturbance	-	-	D	D	D
Increased predation	Due to induced behaviour eg at	-	-	D	-	-

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	bubble screens / mitigation measures					
	Increased recreational take	-	-	D	-	-
Electromagnetic fields		-	-	?	?	-
Introduction of non-native species		D	D	B	B	B

5.3 Scoping in of features (field of influence)

Different receptors operate over, and are affected by, different activities/pressures over various geographic scales. The following areas of screening have been applied:

- Sites overlapping, partly or wholly, the hydrodynamic/physical zone of influence defined as 50 km from the SRA boundary (seawards from the mean high water springs line) in consideration of the high-level assessment undertaken by Cefas and by ABPMer.

- Terrestrial sites where any part of the site overlaps a two-kilometre buffer inland of the marine zone of influence.

- Sites where otters are an interest feature where any part of the site is within 5 km of the zone of influence.

- Sites where migratory fish are an interest feature (including salmon, sea trout, sea lamprey, shad and eel) within the zone of influence or the wider Bristol Channel and Liverpool Bay regions, including all estuaries of SACs where migratory fish are an interest feature.

- All seabird sites in the UK; all sites in the UK and Ireland supporting wintering birds that could migrate across the zone of influence; all terrestrial bird sites within 20 km inland of the zone of influence (see WNMP HRA, AMEC Foster Wheeler (2017)).

- Marine mammals – harbour seal, grey seal, harbour porpoise and bottle-nosed dolphin – in sites partly or wholly within marine mammal management units that overlap with the SRA's zone of influence. *(NB AMEC used in the overall WNMP HRA the MMMUs plus a 50 km buffer).*

5.4 High level nature of HRA assessment of the WNMP

The draft WNMP is generally a high level framework which sets out ways-of-doing, but has little spatial specificity. Individual projects still require a specific permission or licence in order to proceed, and which will be issued in accordance with the provisions of the new WNMP along with other statutory considerations, not least of which is the Habitats Directive /Regulations.

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The WNMP is therefore not a signpost that developments will proceed, but at the same time it must realistically reflect the likelihood or projects that it supports having a chance of receiving a licence and of being developed. It is in that context that this plan level HRA of TL policy takes place.

This plan level HRA process must meaningfully reflect the potential environmental impacts of lagoon construction and operation on designated features of ES within its sphere of influence, and in consideration of other plans or projects which may act in combination.

In doing so, the WNMP and policies must consider both its role and the nature of any project applicant's role for any future lagoon development that might arise. This will include individual project level processes including the Habitats Directive A6 (HRA / AA) process through to A6(4) provisions (if necessary) where it can be decided whether any TL project may proceed or not.

Commission (Advocate General) guidance is that "adverse effects on areas of conservation must be assessed at every relevant stage of the procedure to the extent possible on the basis of the precision of the plan. This assessment is to be updated with increasing specificity in subsequent stages of the procedure".

There are expected to be occasions when the developer will, at project level, be able to identify more precisely the nature, timing, duration, scale or location of development and thus its potential effects.

It is not possible that policy at plan level can ever consider the knowledge and understanding of an area and of options that might be applied within an area, as might potential developments at project level. Similarly as to the extent a potential environmental impact may be mitigated or avoided by changes in approach or design that might be applied at local level. Considerations of eg modelled impacts at fine scale or opportunities for compensation can better be undertaken at project level and consider their location, scale and chance of success. Of necessity therefore, these are aspects that will need to be carefully considered by individual projects at the stage of their application. The WNMP HRA will on these occasions defer to the project level in the manner described below.

The WNMP, through its HRA process, will consider these aspects at high level and offer meaningful guidance to future TL developers through influencing the general nature, timing, duration, scale or location of future proposals. This will be recorded in the HR Assessment Report.

Accordingly, this plan level HRA assessment adopts the following high level approaches:

a) In-combination approach to the consideration of other plans and projects

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Known plans and projects will be taken into account for in-combination effects and processed as part of the HRA in accordance with the principles in Annex 1. A list of known plans and projects is provided at Annex 4 and will be reviewed for relevance and brought up to date. The focus will be the specific combination of effects likely to cumulate rather than all aspects of these plans and projects.

In-combination assessment will be undertaken at both screening stage and that of appropriate assessment, and considered on the basis that where effects alone do not have a likely significant effect or adverse effect upon integrity (respectively) that a residual non-significant effect remains that might become significant when considered alongside other developments.

However, in-combination interactions may increase the zone of influence requiring additional sites to be screened in.

In practice, however, because of the precautionary approach to screening, which assumes LSE where there is any exposure pathway, additional in-combination effects during screening are less likely to arise. The effect of in-combination interactions can only lead to an increase in the magnitude of a potential impact, not the introduction of new exposure pathways.

For this plan level assessment of tidal lagoon policy which lacks any detail on the potential location and scale of TL developments or the extent that mitigation or avoidance measures are practically (as opposed to theoretically) available or are likely to be successfully implemented, then any in-combination assessment can only be of a high level and sign-posting in nature.
TL projects will be required to undertake their own HRA and as part of that will need to consider in-combination effects. They will be able to do so at a more local level and include local plans relating more specifically to areas of potential interest than would be possible at overall (WNMP) plan level (see below).

b) Policy on deferring down to project level of avoidance and mitigation measures.

Avoidance and mitigation measures are activities that a project level may be put in place to minimise or avoid a project having an adverse effect. These may include considerations at project planning, design and implementation. For example in the siting of a TL itself or in the location and design of operating components or in condition's of their use (eg times of day or night).

The WNMNP (and TL policy) has a reasonable expectation of avoidance measures being implemented at project level so as to minimise or avoid all together any adverse environmental impact. Such considerations will be addressed as part of the assessment process under which a licence(s) are granted and may be imposed as a condition of grant.

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The plan-making body may rely on avoidance or mitigation measures being introduced at a later stage where:

- The earlier stage cannot reasonably predict any effect of an ES in a meaningful way, and
- The later stage will identify more precisely the nature, timing, duration, scale or location of development and thus its potential effects and will have the flexibility to enable adverse effects on site integrity (AESI) to be avoided, and
- The HRA of the plan or project at the later stage is required as a matter of law or Government policy.

The project level assessment will contain details which are not available at higher level, and will be able to apply particular avoidance or mitigation measures.

As this is part of a statutory process associated with the granting of a licence(s) for a TL then the plan making body has high confidence that these later assessments will ensure that no adverse effect on site integrity (AESI) will arise.

The WNMP TL HRA will consider whether it can outline at principled level some aspects of avoidance or mitigation measures which must be provided at later project level in order to conclude no AESI and will record these as meaningful project level guidance in its Record of AA.

Licence issuing authorities should ensure that any future TL development takes into account the findings of this plan level HRA in more detailed project-level HRA(s). Should project-level findings determine that there are effects which cannot be mitigated by the avoidance and mitigation measures identified by this assessment (or by those that emerge as a result of project level investigations), then changes to the development design may be required to ensure adverse effects on the integrity of the European Sites are adequately addressed. However, the effectiveness of the measures proposed can only be ascertained with certainty through HRA at a project level, where the specific details of developments and primary data sources will be available.

c) Plan level consideration of mitigation and of compensation measures

Under the EU Habitats Directive **mitigation** measures are those which aim to minimise, or even cancel, the negative impacts on a site that are likely to arise as a result of the implementation of a plan or project during or after its completion. These measures are an integral part of the specifications of a plan or project.

Conversely, **compensatory** measures are independent of the project (including any associated mitigation measures). They are intended to offset the negative effects of the plan or project outside of the site affected so that the overall ecological coherence of the Natura 2000 Network is maintained.

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At high, WNMP plan level , compensation measure are considered where, following AA, an AEIS cannot be ruled out and it has been decided to implement A6(4) process. The process is a specific one and contains a number of sequential steps and tests (as outlined in Annex 1) involving consideration of alternatives and giving justification for implementing an IROPI approach, decisions on which are taken at government level. A key element is that a project may proceed despite concluding that an AEIS exists only if adequate compensation is provided for. The Habitats Directive / Regulations require that any necessary compensatory measures are taken which ensure that the overall coherence of the Natura 2000 network is protected.

Given the strategic nature of the WNMP TL HRA process, the inherent uncertainties of the AA conclusions, and the potential changes that may occur as the plan is implemented, it is not possible at Plan level stage to specify the precise nature or location of any compensation measures that might be required.

The role of the WNMP plan is, therefore, to provide a robust framework through the direction it provides to any licencing authority and Government that sets out the broad parameters for compensation measures, should they be required following the more detailed site level assessments undertaken for plan implementation.

All project level HRAs must take account of the potential adverse effects and the proposed avoidance and mitigation measures identified through the strategic level assessment(s) and which are:

- Appropriate for the area and the loss caused by the project;
- Capable of protecting the overall coherence of the Natura 2000 network;
- Capable of implementation;
- Ensure that, the Natura 2000 site is not irreversibly affected by the project before the compensation is in place;
- Directed in measurable proportions to the habitats and species negatively affected;
- Related to the same biogeographical region (within the UK) and should be as close as possible to the habitat that has been negatively affected;
- Serving functions that are comparable to those that motivated the original area's submission for designation; and
- Clearly defined, with implementation goals and managed so that the compensatory measures can achieve the goal of maintaining the overall coherence of Natura 2000.

The findings of the strategic level WNMP TL HRA, and possible strategic level compensation measures for the European Sites identified as potentially affected will be identified in the Record of AA. These measures are indicative of the types of compensation that may be necessary at the coastal, estuary

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and river sites identified as potentially affected by the proposed TL policy and any subsequent proposals for development.

Actual compensation measures can only be effectively determined at a project level stage through the findings of detailed, site specific Appropriate Assessments focused on the requirements of the Habitats Directive to ensure the ecological functionality of individual European Sites.

6. Statutory Nature Conservation Agency contact points:

The following contact points have been established to offer information and advice on the environmental implications of the TL policy on designated ES:

- **Wales –** NRW: Specialist advisers through: **Kirsty Lindenbaum,** Kirsty.Lindenbaum@cyfoethnaturiolcymru.gov.uk 0300 0654925 and **Roger Matthews** Senior Environmental Assessment Adviser, Roger.Matthews@cyfoethnaturiolcymru.gov.uk Tel: 0300 065 4687

- **England** – NE: Specialist adviser through: **Chris McMullon,** Principal Adviser, Government Advice; Phone: 07971-974439 Email: Chris.McMullon@naturalengland.org.uk **Awaiting other contacts?**

- **Offshore** (> 12nm)- JNCC: **Dr Sarah Canning,** Offshore Industries Advisor, Inverdee House, Baxter Street, Aberdeen, AB11 9QA Direct Tel: 01224 266589 Email: Sarah Canning Sarah.Canning@jncc.gov.uk

Annex 1

Approach to plan-level HRA

The requirements of Article 6 of the Habitats Directive / Regulation 61 of the Habitats Regulations are usually addressed through a staged process with sequential tests and this has been used for the purpose of assessing any policies within the draft WNMP. The current EC guidance[5] suggests a four-stage process for HRA; these stages, and the assessment process, are summarised in Figure 2 below:

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[5] *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).

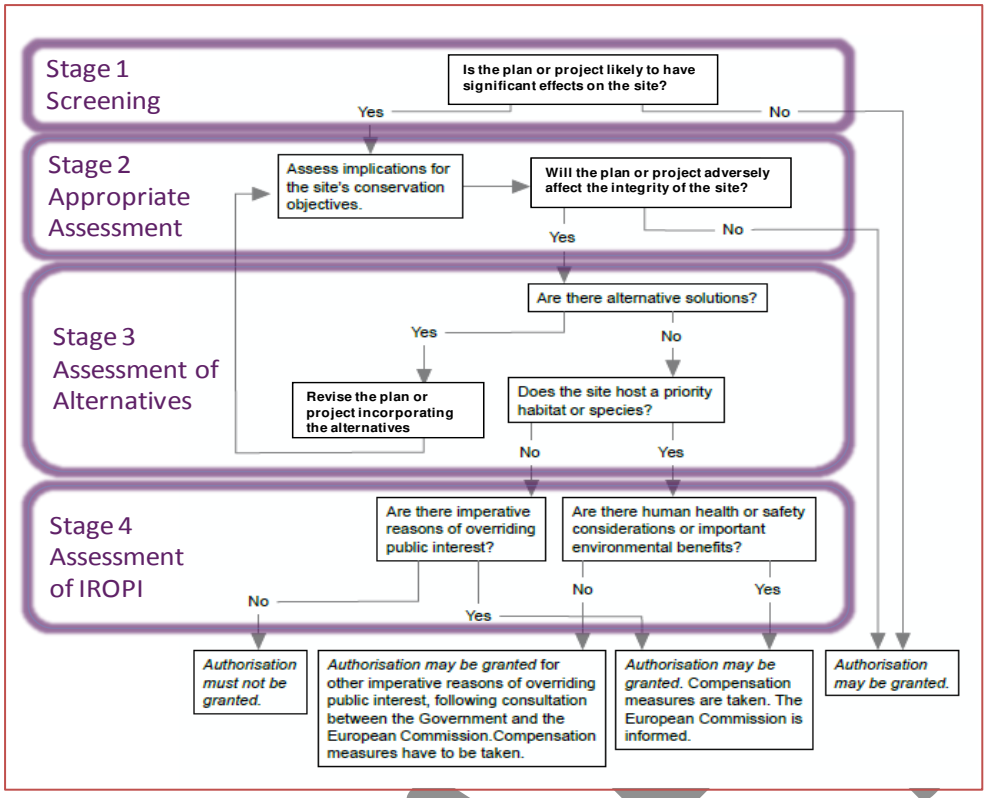

Figure 2: Summary of HRA process and stages

Stage 1- Screening

Pre-screening – during which it is confirmed whether the proposals comprise a plan that is subject to assessment as required by the Habitats Regulations and if, so, which European sites should be considered.

In addition, it is also an opportunity to agree the principles that will be applied to HRA to ensure that the proposed approach is clearly defined, understood and agreed with consultees, including statutory marine planning bodies and statutory nature conservation bodies (SNCBs).

Screening – involving the production of a Screening/Scoping Report that systematically identifies which European sites are potentially affected either alone or in-combination with other plans and projects.
Agreement with SNCBs about which sites and their features are exposed to LSE and will form the subject of Appropriate Assessment (AA).

Screening is a precautionary action and will assume adverse scenarios**. In the absence of being able to rule out a likely significant effect on the features of designated European Site it is necessary to proceed to AA.**

In the context of the plan-level HRA, a Likely Significant Effect (LSE) (English Nature, 1999) is considered to be: "*Any effect that may reasonably be predicted as a consequence of* [a plan or] *the project that may significantly affect the conservation or management objectives of the features for which a*

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site was designated, but excluding trivial or inconsequential effects [*de minimis*]."

A likely effect is not just one that is probable but also should be taken to mean an effect which may/could happen if, using the best available evidence, its occurrence cannot be ruled out.

Where there is no effect pathway between an activity and a receptor that is also a feature of a European site, either directly or indirectly, then there can be no LSE and that receptor can be screened out of further assessment.

Screening will take into account that some receptors are fixed features of sites (e.g. habitats within in the boundary of an SAC), whilst others may be mobile and potentially over a wider geographical area (e.g. foraging seabirds from an SPA breeding colony).

In practice this involves looking for spatial overlap between the zone of influence of a supported development (in any SRA) under the WNMP and either the boundary of a European site or the foraging range or areas of importance for breeding of a mobile species. The specific criteria and evidence used to determine these pathways and their geographical extent zone of influence) are set out in para 5c.

The potential for LSE should also be considered 'in-combination' with other plans and projects:
"The total effects/impacts of all reasonably foreseeable and relevant plans and projects with designated and/or classified feature(s) of a Natura 2000 [European] site within the context of natural variability or trends."(English Nature, 1999)

Where appropriate, the screening process will also consider cross-boundary European sites and classified populations from other member states. The process and rationale used will be the same as for screening UK sites.

Where the plan or project is screened-in to the extent that an adverse effect cannot be ruled out, it is therefore necessary to further assess in more detail whether the plan is likely to have significant effect on the various features of a European site for which it has been designated in line with their stated Conservation Objectives. This is called an Appropriate Assessment (AA).

Plans or projects are not able to proceed if they are likely to have an adverse effect on the integrity of the site, either alone or in combination with any other plans or projects. In which case, either the plan does not proceed or avoidance or mitigation measures are put in place to reduce adverse influences to an acceptable level. If, following the above processes, there is still a significant residual effect, then a specific procedure under A6(4) may be considered(see Stages 3 & 4 below).

Stage 2 Appropriate Assessment

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Information for Assessment– in this stage a systematic assessment is undertaken of the effects of the plan on each of the sites and their features that are screened into AA. The aim of this assessment is to identify whether an adverse effect on the integrity of any of those sites is predicted either alone or in-combination with other plans and projects and, if so, what measures can be implemented or amendments made to the plan to mitigate those effects.

The results are compiled into a Report to Inform Appropriate Assessment (RIAA).

Record of Appropriate Assessment – the competent authority considers the RIAA, and any other evidence, including the advice provided by SNCBs, and completes its AA prior to the implementation of the plan.

Stages 3 & 4 (if necessary)

Plans or projects that likely have an adverse effect on the integrity of a European site (even after prior consideration of all reasonable avoidance or mitigation measures) can only go ahead by following the stage 3 and / or 4 process shown in Fig 1 ie in the consideration of whether there are any alternative solutions, and if not, if there exists Imperative Overriding Public Interests (IROPI) that the project should go ahead, and only then after securing adequate compensatory measures.

EU Directives, guidance and the UK regulations should be consulted for the definitive advice and the above is only a summary.

Annex 2

Stages of developing a Tidal Lagoon

Lagoon development and operation is likely to progress in the following phases. Adapted from [6].

Phase 1:

- Mobilisation, construction of permanent seawalls
- construction of temporary cofferdam(s) around the construction area for the turbine / sluice gate housing structure(s), pile driving

Phase 2:

- Turbine and sluice gate housing structure construction,
- Installation of turbines and sluice gates, pile driving

Phase 3:

[6] SBTL HRA https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010049/EN010049-000617-5.5a%20Habitats%20Regulations%20Assessment%20Report.pdf

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- Removal of temporary cofferdam around the turbine/sluice gate housing structure;
- Permanent seawall (closure);
- Wet commissioning of the turbines and sluice gates.

Phase 4:
- Finishings
- Construction of public realm and buildings

Phase 5:
- Operational (energy generation) and maintenance

Decommissioning has been screened out of the HRA because this will be out-with the 20-year influence of the WNMP

Annex 3

Potential environmental effects associated with Tidal Lagoon Development

A range of potential hazards have been identified which can be associated with a specific phase in the lifecycle of Lagoon development.[7] The hazards can be grouped according to whether they result from construction works, or as a result of operational effects as follows:

Construction effects

- Permanent habitat loss from the placement of power generation infrastructure
- Temporary habitat loss/fragmentation/disturbance/introduction or spread of non-native species during construction activities
- Noise, vibration and light pollution during construction
- Sediment generation during construction
- Pollution incident during construction
- Direct mortality

Operational effects

- Changes to the tidal regime due to the operation of power generation infrastructure

[7] STFS HRA (April 2010) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/51261/13._Habitat_Regulations_Assessment_-_AA_-_NTS.pdf

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- Direct mortality of aquatic species (sluices and turbines)
- Barrier to movement and habitat fragmentation for aquatic species
- Barrier to movement and habitat fragmentation and for terrestrial species (infrastructure on land)
- Noise, vibration and light pollution during operation (gates, sluices, turbines and permanent lighting installations)
- Electromagnetic field from power transmission cables
- Habitat loss/change as a result of alterations in tidal range upstream of a lagoon, including potential expansion of non-native species
- Habitat loss/change as a result of alterations in tidal range downstream of a lagoon, including potential expansion of non-native species
- Habitat loss/change as a result of alterations to tidal flows (*e.g.*, flow speeds and flow patterns) and wave action
- Habitat loss/change as a result of alterations to sediment transport (including erosion and deposition)
- Habitat loss/change as a result of alterations to physicochemical parameters such as salinity, dissolved oxygen and the dispersion of regulated discharges
- Habitat loss/change as a result of alterations in land drainage capacity
- Reduction in prey/resource availability, *e.g.*, reduced invertebrate populations, reduced fish populations, and displacement effects causing increased competition
- Increased predation (of the feature)
- Reduced fitness and/or reproductive success resulting from stress of non-fatal injuries sustained

NB. Some of the operational effects will apply during the construction phase (e.g. changes to tidal regime, barrier to movement of aquatic species) as the extent of infrastructure increases.

Annex 4

Source: Cardiff TL proposal (March 2015) as amended by NSIPs (July 17)

Project	Stage at March 2015	Description
At March 2015 – need to check a) N Wales b) for later developments c) stage		

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of progress.		
Tidal Lagoon Swansea Bay Development	Consent decision stage	A proposed tidal lagoon in the vicinity of the Bristol Channel, which may share receptors linked to far field effects.
The West Somerset Tidal Lagoon	Pre-application stage for Development Consent	A proposed tidal lagoon in relatively close proximity in the Severn Estuary. Environmental receptors may be shared in the dynamic environment of the estuary.
Hinkley Point C New Nuclear Power Station	Development Consent granted	A nuclear energy generating station. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Oldbury New Nuclear Power Station	Pre-application stage for Development Consent	A nuclear energy generating station. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Hinkley Point C Connection	Development Consent examination stage	A grid connection. The scheme will be a linear scheme with an impact on the landscape near the estuary.
M4 corridor around Newport	Pre-application consultation	The proposed relief road would be constructed inland of the impounded foreshore. The scheme will be a linear scheme with an impact on the landscape.
Seabank 3 CCGT	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Avon Power Station	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
BBC Headquarters Cardiff	Planning applications have been submitted to the Local Authority and commencement of construction is due for 2018.	Relocation of BBC Wales Headquarters to be a major project in Cardiff City Centre. Construction impacts may be shared in terms of impacts on the local highway network as Tidal Lagoon Cardiff and this scheme would be constructed concurrently.

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Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	*Consent secured. Installation in 2015 – project in abeyance?*	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	Update An EIA has not yet Been completed; However construction is Planned to commence in 2017 following the decommissioning of the Ramsey Sound installation.	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Bristol Port Deep Sea Container Terminal (DSCT) at Avonmouth Dock	Consent secured	The Bristol Port Company is planning to build a £600m Deep Sea Container Terminal (DSCT) at Avonmouth Dock. The DSCT will handle large container vessels and next-generation ultra large container ships with a draught of up to 16 m and a capacity in excess of 150,000 DWT
Tabb's Gout and Portland Grounds Sea Defence	Construction anticipated Summer 2015???	Improvements Raising of sea defences on the Severn Estuary coastline between ST248787 and ST254790 and ST438848 and ST453857 respectively, in line with the 'Hold the Line' policies for the second Severn Estuary Shoreline Management Plan (SMP2) and the draft Severn Estuary Flood Risk Management Strategy.
Wylfa Newdydd Nuclear Power Station	Pre-application with PINS (Application expected Autumn 2017)	Proposed new nuclear power station, located adjacent to existing station at Wylfa A, on the Isle of Anglesey.
Tidal Lagoon Newport	Pre-application with PINS (Application expected 2017-2018)	Tidal lagoon electricity generating station with a potential generating capacity of 1800MW up to a possible 2800 MW. A seawall attached to the foreshore, at its western extent approximately 1km to the mouth of the River Usk, and at its eastern extent to the foreshore in the area of Baldwin Sands. The furthest offshore extent is up to 8km from the foreshore towards the centre of the Severn Estuary.
Tidal Lagoon Cardiff	Pre-application with PINS (Application expected 2017)	Tidal lagoon electricity generating station with a potential generating capacity of 1800MW up to a possible 2800 MW. A seawall attached to the foreshore, at its western extent approximately 2 km from the entrance to Cardiff Bay, and at its eastern extent approximately 2km from the mouth of the River Usk. The furthest offshore

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		extent is approximately 8km from the foreshore to the centre of the Severn Estuary.
North Wales Connection – National Grid	Pre-application with PINS (Application expected October 2017)	Proposed 400kV electricity transmission reinforcements in North Wales to connect planned new nuclear electricity generation on Anglesey and Irish Sea offshore wind

Plans and projects, Source: WNMP HRA – January 2017)

Environment Agency (2008) Better Sea Trout and Salmon Fisheries: Our Strategy for 2008-2021
Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
Defra (2007) Fisheries 2027: A long-term vision for sustainable fisheries
Defra (2009) Our Seas – a Shared Resource: High Level Marine Objectives
Defra (2012) National Policy Statement for Waste Water
Defra (2013) The National Adaptation Programme: Making the Country Resilient to a Changing Climate
DECC (2010) Marine Energy Action Plan
DECC (2011) Carbon Plan: Delivering our Low Carbon Future
DECC (2011) National Policy Statements for Energy Infrastructure
DECC (2016) Offshore Energy Licensing Rounds
Department for Transport (2011) National Policy Statement for Ports
HMG, NI Executive, Scottish Government, Welsh Government (2011) UK Marine Policy Statement
Infrastructure and Projects Authority (2016) National Infrastructure Delivery Plan 2016–2021
Joint Nature Conservation Committee and Defra (2012) UK Post-2010 Biodiversity Framework
Joint Nature Conservation Committee (1994) UK Biodiversity Action Plan
Strategic Plan for Biodiversity 2011-2020 (2010)
National (Wales) Plans and Programmes
Welsh Assembly Government (2007) Welsh Coastal Tourism Strategy
Wales Biodiversity Partnership (2010) Wales Biodiversity Framework
Welsh Government (1997) Technical Advice Note 13: Tourism
Welsh Government (1998) Technical Advice Note 14: Coastal Planning
Welsh Government (2005) Technical Advice Note 8: Planning for Renewable Energy
Welsh Government (2007) Coastal Access Improvement Programme
Welsh Government (2007) Technical Advice Note 18: Transport
Welsh Government (2008) Wales Transport Strategy

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Welsh Government (2008) Wales Fisheries Strategy
Welsh Government (2008) People, Places, Future – The Wales Spatial Plan
Welsh Government (2009) Technical Advice Note 5: Nature Conservation and Planning
Welsh Government (2010) Valuing the Welsh Historic Environment
Welsh Government (2010) Climate Change Strategy for Wales
Welsh Government (2010) Low Carbon Revolution – the Welsh Government Energy Policy Statement
Welsh Government (2011) Marine Renewable Energy Strategic Framework
Welsh Government (2011) Understanding the risks, empowering communities, building resilience: The national flood and coastal erosion risk management strategy for Wales
Welsh Government (2013) The Historic Environment Strategy for Wales
Welsh Government (2012) Preparing Wales for Climate Change. Energy Wales A Low Carbon Transition
Welsh Government (2012) Wales Infrastructure Investment Plan
Welsh Government (2012) A living language: a language for living – Welsh language strategy 2012 to 2017
Welsh Government (2013) Partnership for Growth: The Welsh Government Strategy for Tourism 2013 – 2020
Welsh Government (2013) National Flood and Coastal Erosion Strategy for Wales
Welsh Government (2013) Wales Marine and Fisheries Strategic Action Plan
Welsh Government (2013) Technical Advice Note 20: Planning and the Welsh Language
Welsh Government (2014) Technical Advice Note 23: Economic Development
Welsh Government (2014) Technical Advice Note 15: Development and Flood Risk
Welsh Government (2015) Water Strategy for Wales
Welsh Government (2016) Planning Policy Wales – Edition 9
Welsh Government (emerging) Natural Resources Policy
Regional/Local Plans and Programmes
AONB Management Plans (various)
Biodiversity Action Plans
Local Development Plans (various)
National Park Management Plans (various)
Shoreline Management Plans (various)

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D Projects and Plans for In-combination Assessment

The following tables provide a list of plans and projects for consideration in high level in-combination assessment as supplied by Welsh Government in August 2017.

Table D1. Projects for consideration in high level in-combination assessment

Project	Stage at March 2015	Description
Tidal Lagoon Swansea Bay Development	Consent decision stage	A proposed tidal lagoon in the vicinity of the Bristol Channel, which may share receptors linked to far field effects.
The West Somerset Tidal Lagoon	Pre-application stage for Development Consent	A proposed tidal lagoon in relatively close proximity in the Severn Estuary. Environmental receptors may be shared in the dynamic environment of the estuary.
Hinkley Point C New Nuclear Power Station	Development Consent granted	A nuclear energy generating station. The proposal has interactions with the Severn Estuary and may share receptors linked to far field effects.
Oldbury New Nuclear Power Station	Pre-application stage for Development Consent	A nuclear energy generating station. The proposal has interactions with the Severn Estuary and may share receptors linked to far field effects.
Hinkley Point C Connection	Development Consent examination stage	A grid connection. The scheme will be a linear scheme with an impact on the landscape near the estuary.
M4 corridor around Newport	Pre-application consultation	The proposed relief road would be constructed inland of the impounded foreshore. The scheme will be a linear scheme with an impact on the landscape.
Seabank 3 CCGT	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn Estuary and may share receptors linked to far field effects.
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BBC Headquarters Cardiff	Planning applications have been submitted to the Local Authority and commencement of construction is due for 2018.	Relocation of BBC Wales Headquarters to be a major project in Cardiff City Centre. Construction impacts may be shared in terms of impacts on the local highway network as Tidal Lagoon Cardiff and this scheme would be constructed concurrently.
Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	*Consent secured. Installation in 2015 – project in abeyance?*	An array of tidal stream devices. The proposal has interactions with the Severn Estuary and may share receptors linked to far field effects.

Project	Stage at March 2015	Description
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	An EIA has not yet been completed; However construction is planned to commence in 2017 following the decommissioning of the Ramsey Sound installation.	An array of tidal stream devices. The proposal has interactions with the Severn Estuary and may share receptors linked to far field effects.
Bristol Port Deep Sea Container Terminal (DSCT) at Avonmouth Dock	Consent secured	The Bristol Port Company is planning to build a £600m Deep Sea Container Terminal (DSCT) at Avonmouth Dock. The DSCT will handle large container vessels and next-generation ultra large container ships with a draught of up to 16 m and a capacity in excess of 150,000 DWT.
Tabb's Gout and Portland Grounds Sea Defence	Construction is not yet started.	Improvements Raising of sea defences on the Severn Estuary coastline between ST248787 and ST254790 and ST438848 and ST453857 respectively, in line with the 'Hold the Line' policies for the second Severn Estuary Shoreline Management Plan (SMP2) and the draft Severn Estuary Flood Risk Management Strategy.
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North Wales Connection – National Grid	Pre-application with PINS (Application expected October 2017)	Proposed 400 kV electricity transmission reinforcements in North Wales to connect planned new nuclear electricity generation on Anglesey and Irish Sea offshore wind

Table D2. Projects for consideration in high level in-combination assessment

Projects
Environment Agency (2008) Better Sea Trout and Salmon Fisheries: Our Strategy for 2008-2021
Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland
Defra (2007) Fisheries 2027: A long-term vision for sustainable fisheries
Defra (2009) Our Seas – a Shared Resource: High Level Marine Objectives
Defra (2012) National Policy Statement for Waste Water
Defra (2013) The National Adaptation Programme: Making the Country Resilient to a Changing Climate
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DECC (2011) National Policy Statements for Energy Infrastructure
DECC (2016) Offshore Energy Licensing Rounds
Department for Transport (2011) National Policy Statement for Ports
HMG, NI Executive, Scottish Government, Welsh Government (2011) UK Marine Policy Statement
Infrastructure and Projects Authority (2016) National Infrastructure Delivery Plan 2016–2021
Joint Nature Conservation Committee and Defra (2012) UK Post-2010 Biodiversity Framework
Joint Nature Conservation Committee (1994) UK Biodiversity Action Plan
Strategic Plan for Biodiversity 2011-2020 (2010)
National (Wales) Plans and Programmes
Welsh Assembly Government (2007) Welsh Coastal Tourism Strategy
Wales Biodiversity Partnership (2010) Wales Biodiversity Framework
Welsh Government (1997) Technical Advice Note 13: Tourism
Welsh Government (1998) Technical Advice Note 14: Coastal Planning
Welsh Government (2005) Technical Advice Note 8: Planning for Renewable Energy
Welsh Government (2007) Coastal Access Improvement Programme
Welsh Government (2007) Technical Advice Note 18: Transport
Welsh Government (2008) Wales Transport Strategy
Welsh Government (2008) Wales Fisheries Strategy
Welsh Government (2008) People, Places, Future – The Wales Spatial Plan
Welsh Government (2009) Technical Advice Note 5: Nature Conservation and Planning
Welsh Government (2010) Valuing the Welsh Historic Environment
Welsh Government (2010) Climate Change Strategy for Wales
Welsh Government (2010) Low Carbon Revolution – the Welsh Government Energy Policy Statement
Welsh Government (2011) Marine Renewable Energy Strategic Framework
Welsh Government (2011) Understanding the risks, empowering communities, building resilience: The national flood and coastal erosion risk management strategy for Wales
Welsh Government (2013) The Historic Environment Strategy for Wales
Welsh Government (2012) Preparing Wales for Climate Change. Energy Wales A Low Carbon Transition
Welsh Government (2012) Wales Infrastructure Investment Plan
Welsh Government (2012) A living language: a language for living – Welsh language strategy 2012 to 2017
Welsh Government (2013) Partnership for Growth: The Welsh Government Strategy for Tourism 2013 – 2020
Welsh Government (2013) National Flood and Coastal Erosion Strategy for Wales
Welsh Government (2013) Wales Marine and Fisheries Strategic Action Plan

Projects
Welsh Government (2013) Technical Advice Note 20: Planning and the Welsh Language
Welsh Government (2014) Technical Advice Note 23: Economic Development
Welsh Government (2014) Technical Advice Note 15: Development and Flood Risk
Welsh Government (2015) Water Strategy for Wales
Welsh Government (2016) Planning Policy Wales – Edition 9
Welsh Government (emerging) Natural Resources Policy
Regional/Local Plans and Programmes
AONB Management Plans (various)
Biodiversity Action Plans
Local Development Plans (various)
National Park Management Plans (various)
Shoreline Management Plans (various)

E European/Ramsar Sites

Details of all screened in European and Ramsar sites (i.e. those for which LSE cannot be excluded) including:

- Site name;
- Site code;
- Status;
- Site location with respect to the zones of influence;
- Feature name;
- Feature code;
- Annex;
- Primary qualifying;
- Ramsar criteria;
- Site description;
- Conservation objectives; and
- Links to further information.

Please note that this appendix has been provided in spreadsheet format (under separate cover) only (Excel File: UKSACSPARamsar_Fish_Marine_Habitats_14Sept2017.xlsx).

Contact Us

ABPmer

Quayside Suite,
Medina Chambers
Town Quay, Southampton
SO14 2AQ

T +44 (0) 23 8071 1840
F +44 (0) 23 8071 1841
E enquiries@abpmer.co.uk

www.abpmer.co.uk

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Appendix I
Appropriate Assessment – Birds

the INSTITUTE of ESTUARINE and COASTAL STUDIES



UNIVERSITY OF Hull
Institute of Estuarine and Coastal Studies

HRA of the Welsh National Marine Plan Tidal Lagoon Policy:

Bird Features

Final Report

Report to the Welsh Government

Institute of Estuarine and Coastal Studies
University of Hull

30th September 2017

Author(s): N. Cutts, K. Hemingway & S. Nemana

Report: YBB362-F1-2017

Institute of Estuarine & Coastal Studies (IECS)
The University of Hull
Cottingham Road
Hull
HU6 7RX
UK

Tel: +44 (0)1482 4646771

E-mail: iecs@hull.ac.uk

Web site: http://www.hull.ac.uk/iecs

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EXECUTIVE SUMMARY

The Welsh Government is developing the first National Marine Plan for Wales (WNMP) in accordance with the Marine & Coastal Access Act (2009 (MCAA). As part of this process, it must make various assessments of the potential effects of the plan including the Habitats Regulations Assessment (HRA) process. A Draft WNMP has been undertaken, including a Sustainability Assessment (SA) and a HRA of the developing plan policies. The HRA has broadly concluded that the Draft WNMP is unlikely to result in potential significant adverse effects upon European sites. However, the assessment of the tidal lagoon policy (TLP) which supports the technology in a series of defined coastal areas has been unable to conclude no *Likely Significant Effect* (LSE) arising from the policy on some designated features and as such, a more detailed Appropriate Assessment of this policy is required.

This document provides a more detailed plan-level HRA to address this issue and includes:

- Review of a list of European Marine Sites (SPA, pSPA, Ramsar Sites) screened in for which the tidal lagoon policy may have an adverse impact.
- Plan-level assessment of the tidal lagoon policy (relating to construction & operation) of the likely significant effects on these SPA, pSPA & Ramsar sites.
- High level characterisation and assessment of the key issues and impacts, their significance, strategic options for mitigation and case for IROPI.
- Conclusions on whether the WNMP is likely to have a significant effect after mitigation measures and whether residual impacts will need consideration via the A6(4) IROPI process, including the extent and efficacy of any compensatory measures.

The initial analysis process required the compilation of a list of potential sites to be screened in where the TLP had a potential LSE, or at least where LSE could not be excluded, based on spatial and functional attributes, including the foraging ranges of Interest Feature species.

Based on the Natural England review of marine pressures and responses used to define their Advice on Operations for Marine Sites (NECR213), a list of pressure pathways relating to the construction and operation of tidal lagoon energy (TLE) developments was then identified. This approach characterises bird receptors under a series of functional groups, and establishes sensitivity values to these in relation to relevant pressure pathways. The pressure pathways include aspects such as barrier to movement, changes in tidal inundation, loss of habitat, changes to hydrodynamic processes, changes to sediment, collision risk and disturbance.

The Interest Features screened into the assessment where then designated under relevant functional groups and associated sensitivities to aspects of TLE projects, with the methods of pressures acting on these species as well as likely responses described.

A high level Appropriate Assessment process was then undertaken with each of the identified TLE pathways of effect analysed for their impacts on the Interest Features at a functional group level, and the implications of these on the high level Conservation Objectives pertaining to these. This process identified a series of potential impact areas both from construction and operation phases of TLE generation, and attempted to

characterise these in terms of their severity and the main groups and species affected by them.

At a high analysis level, a clear series of issues relating to direct or indirect habitat loss or alteration were then identified, these impacting on most of the functional groupings, and thus Interest Feature species. These impacts were through the loss or reduction in foraging and roosting/resting potential via direct habitat loss and/or changes to habitat composition, and via increases in energy budget deficits, through loss of foraging quality and time and increased competition, as well as increased energy expenditure from revisions to routes and increased disturbance. Some potential benefits were also identified, but these were far out-weighed by the disbenefits associated with foraging function reduction.

A high level review of potential in-combination effects was then undertaken using project data supplied by the Welsh Government. The list was restricted Welsh developments and as such cannot be considered as comprehensive as there is a potential for impacts to European Sites at a wider scale. Furthermore, at this level of assessment, there was little development specific detail available, although general pathways of effect could be identified at a sector level e.g. other TLE projects, other forms of power generation, pipeline & cable routes.

Potential mitigation measures were then identified and the efficacy of their application for TLE explored, and residual impacts identified. A clear remaining deficit in terms of direct and indirect intertidal habitat loss was identified, with associated carrying capacity issues and effects on the Interest Features and site Conservation Objectives.

It was concluded that there would be a likelihood of an Adverse Effect on Integrity (AEOI) conclusion for most TLE sites, and compensation requirement. For the most part, compensation would be required for direct and indirect habitat loss issues and methods to deliver compensation have been identified and assessed.

It is considered that at a project specific level such compensation requirements could (and have) been provided, delivering sufficient capacity to offset predicted losses and maintain site integrity and wider site coherence. However, at a regional level e.g. for the south Wales and north Wales TLP areas, the potential for the delivery of sufficient compensation function is less clear. Studies undertaken for the Severn Tidal Power (STP) scheme concluded that there would be insufficient compensation habitat available to offset likely losses, and it is difficult to disagree with this conclusion with respect to the two TLP regional areas, at least with any degree of surety at this scale of analysis.

Methods of mitigation and compensation for TLE in the context of the TLP have been assessed. These primarily relate to offsetting residual impacts arising from large scale direct and indirect habitat loss, and their associated impacts on function delivery for Interest Features such as migratory and wintering waders and ducks.

The main method of compensation currently employed is via managed realignment. This technique can delivery compensatory function, although there is usually a requirement for a greater ratio of provision than a simple 1:1 area basis, as the new habitat tends to have a lower carrying capacity than existing habitat. Furthermore, managed realignment sites often tend to deliver saltmarsh rather than intertidal mud in the longer term, although these other habitats have valuable ecosystem functions in their own rights. These constraints to habitat delivery require both large areas of terrestrial land to become intertidal, and with a

series of specific physical attributes to ensure they deliver sustainable functioning intertidal habitat for waterbirds. As such, the availability of such land is constrained, and unlikely to be readily available in the area required to address all habitat loss were it to be taken up within the TLP development areas.

In conclusion, at an individual scheme level, such new habitat delivery is possible, but within most systems the provision of suitable habitat is finite. As such, at a regional/national level, full compensation for direct and indirect habitat loss is unlikely with associated issues for individual European Site and the wider N2K network condition.

However, there is a potential for the utilisation of additional resources at a trans-national level, or through revisions to the interpretation of the Habitats Directive to allow for non like for like provision and establishment of new qualifying habitats.

Such wider ranging issues and provisions cannot be addressed at a development specific level and it is therefore recommended that the process is investigated at a strategic level in advance of multiple development applications in a similar way to the regional offshore wind groupings.

This would possibly be best suited to a spatial rather than governmental framework, e.g. perhaps two groups covering South Wales and the Severn, and North Wales and Liverpool Bay given likely Interest Feature synergisms.

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1. INTRODUCTION

1.1 Project Context

The Welsh Government is developing the first National Marine Plan for Wales (WNMP) in accordance with the Marine & Coastal Access Act (2009 (MCAA), with the aim of managing the resources, assets and activities of the coast and seas to ensure a sustainable future.

As part of this process, it must make various assessments of the potential effects of the plan including an assessment of the plan in the context of the requirements of EU Habitats & Species and Birds Directives and the UK regulations (Conservation of Habitats & Species Regulations, 2010), including the Habitats Regulations Assessment (HRA) process.

The Habitats Regulation Assessment (HRA) is required to ensure that potential adverse effects of policies in the plan on the integrity of any European Marine Site are identified and avoided where possible and that the overall coherence of the network is safeguarded.

A Draft WNMP has been undertaken on behalf of the Welsh Government and includes a Sustainability Assessment (SA) and a HRA of the developing plan policies. The HRA has broadly concluded that the Draft WNMP alongside project level controls is unlikely to result in potential significant adverse effects upon European sites.

However, the assessment of the tidal lagoon policy which supports the technology in a series of defined coastal areas has been unable to conclude no *Likely Significant Effect* (LSE) arising from the policy on some designated features and as such, a more detailed Appropriate Assessment of this policy is required.

A series of specialist advice review contracts have been let by the Welsh Government to address plan level HRA aspects and this report covers the provision of a high level review of bird interest features for the plan level HRA process (e.g. seabirds and waterbirds including ducks and waders)

1.2 Project Brief and Approach

In summary, the project has required:

- Review of a pre-supplied list of European Marine Sites (SPA, pSPA, Ramsar Sites) screened in for which the tidal lagoon policy may have an adverse impact and to suggest further inclusions.
- Undertake a plan-level assessment of the tidal lagoon policy (relating to construction & operation) of the likely significant effects on the SPA, pSPA & Ramsar sites that have been scoped in with respect to their Conservation Objectives.
- Results to be presented in a format consistent with the requirements for AA.
- The report should provide an assessment that is, as far as practicable, concise and high-level, focussing on the key issues and impacts, their significance, strategic options for mitigation and case for IROPI.
- The report should conclude whether the WNMP is likely to have a significant effect (having considered project level avoidance and mitigation measures) and in the case

of any residual impacts whether they might be considered through any A6(4) IROPI process, and the extent that compensatory measures might reasonably be delivered.

Associated with the report will be a series of Annexed tables describing:

- The key details of screened in sites and features, Conservation Objectives (CO), vulnerabilities etc.
- Potential impact pathways and effect on EMS, LSE, in-combination effects, mitigation and requirement for AA.

2. HABITATS REGULATIONS ASSESSMENT REQUIREMENTS

2.1 Legislative Background

Under the Conservation of Habitats and Species Regulations 2010 (the Habitats Regulations), which transpose the European Habitats and Wild Birds Directives in English and Welsh Law, there is a requirement for the formal assessment of the implications of any new plans or projects which are capable of affecting designated interest features of European Sites. This process is referred to as a Habitats Regulations Assessment (HRA) and comprises a series of defined stages to determine impacts and measures to address these etc.

For the current project, this process refers to the effect on bird interest features of European Sites (e.g. Special Protection Areas (SPAs) designated under the EC Directive on the Conservation of Wild Birds (Birds Directive).

However, in the UK, the HRA process is extended to other designated sites, and for this project these will include sites that are proposed for designation, e.g. for birds this will be proposed Special Protection Areas (pSPAs). However, it is understood that offshore SPAs and pSPAs are not to be covered within this process. In addition to European Sites, sites designated as Wetlands of International Importance under the Ramsar Convention (Ramsar Sites) are also included within the HRA process.

The HRA process includes an Appropriate Assessment stage where a plan or project alone or in combination with others has the potential for Likely Significant Effect (LSE) on a designated site, or where an LSE cannot be ruled out. This is frequently the initial case and as such, the HRA process is often referred to as an Appropriate Assessment.

The Appropriate Assessment is made by the Competent Authority, but often with a range of supporting documents provided by the developer or other interested parties, and with consultation on the outcome undertaken with statutory consultees and others.

In addition to European sites around the Welsh Coast, the potential for impact to other sites requires consideration, and as such, sites in England, Scotland, Ireland and France have been included in the HRA process.

A brief description of the HRA phases in relation to the current project is provided below.

2.2 Plan-level HRA Process

2.2.1 GENERAL

A plan level HRA is designed to address and assess the adverse impacts of a plan/policy on the designated interest features of European Sites that may be influenced by the said plan/policy alone or in combination with other plans or projects.

By necessity, the assessment process needs to be at a high level, given the complexities and uncertainties of impacts and interactions with features, but in general, should address and assess the potential for impact of the plan or policy on the Conservation Objectives of the European Sites.

As such, the plan level HRA provides a sign-posting of Likely Significant Effect, in-combination issues, mitigation measures and the potential for IROPI issues and compensation. However, it will not replace the requirement for project specific HRAs to be undertaken as part of the standard regulatory/planning process.

2.2.2 FOR THE TIDAL LAGOON COMPONENT OF THE WNMP

The WNMP includes the provision of tidal lagoon power projects around the Welsh coast and some support for the development of the technology. Although not all areas of the coast are suitable for the technology, the majority of the coast and inshore waters in the south and north have been identified as having a *potential* tidal range resource. Of these areas, the WNMP has identified in consultation, areas of coast that can be encouraged for the development of tidal lagoon energy (TLE) generation. This is referred to as the Strategic Resource Area (SRA) with two areas of coast and inshore waters identified:

- South Wales: east of the Gower to the Severn Estuary
- North Wales: Great Orme to the Dee Estuary

These areas are shown in Figure 1.

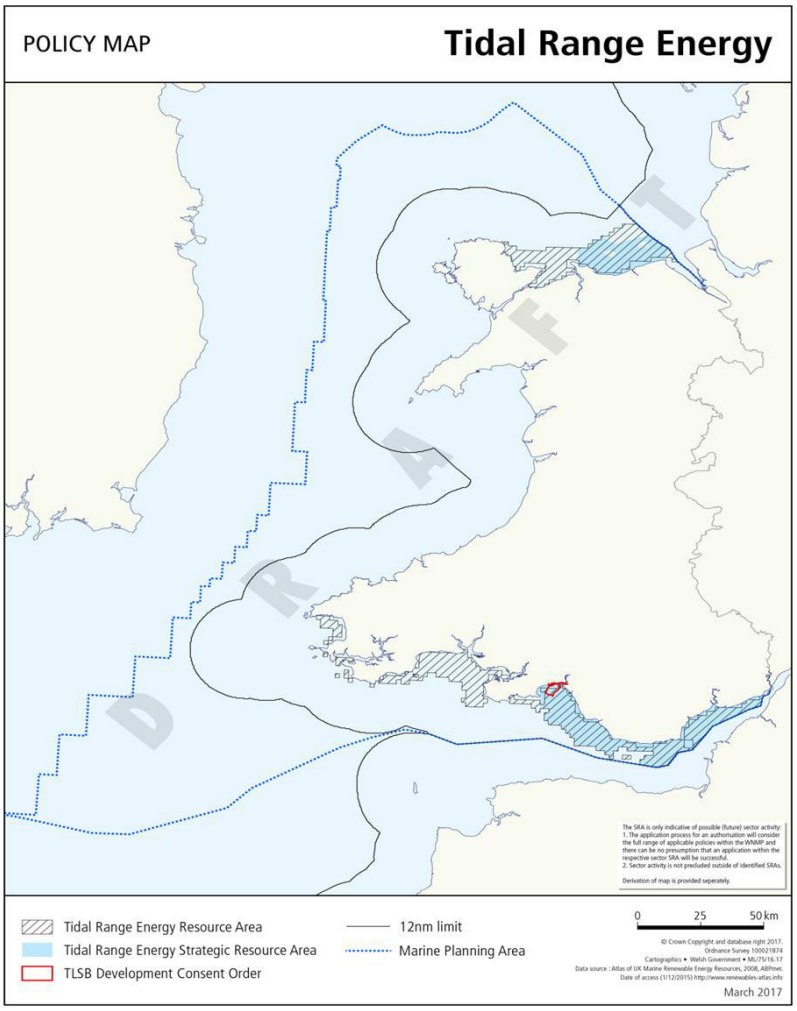


Figure 1: Welsh Coast including areas identified for tidal range energy (Source: Welsh Govt.)

As yet, specific tidal lagoon energy (TLE) projects have not been identified within the WNMP, but with the Tidal Lagoon Swansea Bay (TLSB) awaiting a final development decision. As such, the environmental effects of the technology and in particular, the Likely Significant Effects under HRA cannot currently be identified except at a general plan level, although there has been a considerable amount of work undertaken on aspects of these in relation to a range of potential projects, primarily for the south of the region in relation to tidal power project proposals for the Severn Estuary.

It should also be acknowledged that the technology is an evolving one in the region, and may develop over time within the timeframe of the WNMP. The environmental issues may therefore similarly alter as the technology and processes evolve. As such, the necessary high level nature of the assessment process in relation to key pathways of effect and receptor group responses is an appropriate level of consideration for the current policy process.

The high level HRA process will therefore require the utilisation of best available scientific advice on pathways of effect relating to tidal lagoon power, and the responses of receptor group interest features to these in order to determine LSE. Similarly, the application of mitigation measures and determination of potential IROPI scenarios will be approached at this level.

Underlying this high level approach is the requirement that for each individual tidal lagoon project taken forward for potential development, there will be a requirement for a full HRA to be undertaken (in addition to other required planning processes), and that these will need to take into account location specific environmental data and interest feature details as part of the LSE assessment process. Furthermore, depending on development time, additional scientific information on pathways and severity of impact will be available from other similar projects, and these data will need to be incorporated into the individual project appraisal process.

The current high level review is thereby designed to assist in the process of identifying whether the Welsh Government's policy of tidal lagoon power development will have an LSE at an individual or in-combination level on interest features of European Sites, and if so, what mitigation measures and potential for IROPI and compensation needs are available.

2.3 Approach

The approach for the high level WNMP HRA analysis therefore broadly follows the standard HRA process. This includes:

Pre-screening where the relevant European Sites and likely effects are initially identified for the development scenario(s) and including the identification of potential in-combination plans or projects.

Screening whereby sites and associated species are addressed to identify effects, together with potential plan level mitigation measures and where possible feature specific issues.

Appropriate Assessment with high level review of feature sensitivities to pathways of effect, application of mitigation measures and in-combination effects.

A6(4) IROPI approach consideration and compensatory measures provisions.

Conclusions with record of the AA.

3. PRE-SCREENING

The requirement for a high level HRA of the WNMP has been identified, with the draft HRA (AMEC Foster Wheeler, 2017) identifying that an absence of significant effect cannot be ruled out for a policy promoting tidal lagoon development at the current scale, e.g. within the Strategic Resource Area (SRA) for marine features associated with European and Ramsar designated sites.

Of specific relevance to this document, the absence of a Likely Significant Effect on birds associated with the designations could not be concluded, and hence a plan level HRA is required.

As such, a process has been undertaken to develop a series of criteria for the high level HRA process and Appropriate Assessment.

3.1 Pathways of Effect (Tidal Power Generated Environmental Pressures on Birds)

The mechanisms whereby tidal lagoon energy projects (construction and operation) can modify the marine environment have been addressed through a range of documents for projects proposed for the Severn Estuary and South Wales coast, together with consenting issues to development proposals e.g. Severn Estuary Tidal Power (SETP) e.g. DECC, 2010a[1]; DECC 2010b[2], and the Swansea Bay Tidal Lagoon (TLSB) e.g. TLSB, 2014[3] & SoS, 2015[4].

These various activity specific pathways of effect have been translated into a series of pressures acting on the marine environment and have been collated, e.g. the JNCC activities-pressure matrix.

A sub-set of these pressures has been standardised as part of Natural England's operations advice for tidal lagoon energy construction and operation (Natural England, 2017[5]) and these have been used for this assessment.

Those pathways identified as being a 'high risk' within the Natural England advice matrices are summarised in Table 1 and are based on generic pressures that have the ability to modify structure and/or function in the marine environment, in this instance for components

1 Department of Energy & Climate Change. 2010a. Severn Tidal Power: Feasibility Study Conclusions. Ref 10D/808.

2 Department of Energy & Climate Change. 2010b. Severn Tidal Power Feasibility Study: Report to Inform a Stage 2 (Appropriate Assessment) Habitats Regulations Assessment.

3 Tidal Lagoon Swansea Bay. 2014. Volume 5: Folder 3. Report to Inform the Habitats Regulation Assessment Document 5.5.

4 Secretary of State. 2015. Development Consent Order. Swansea Bay Tidal Lagoon.

5 Natural England. 2017. On Line Access September 2017. https://designatedsites.naturalengland.org.uk/Marine/FAPMatrix.

that have a direct or indirect effect on the marine ecology of habitats and species within a designated area, and thus included as part of Natural England's advice on operations.

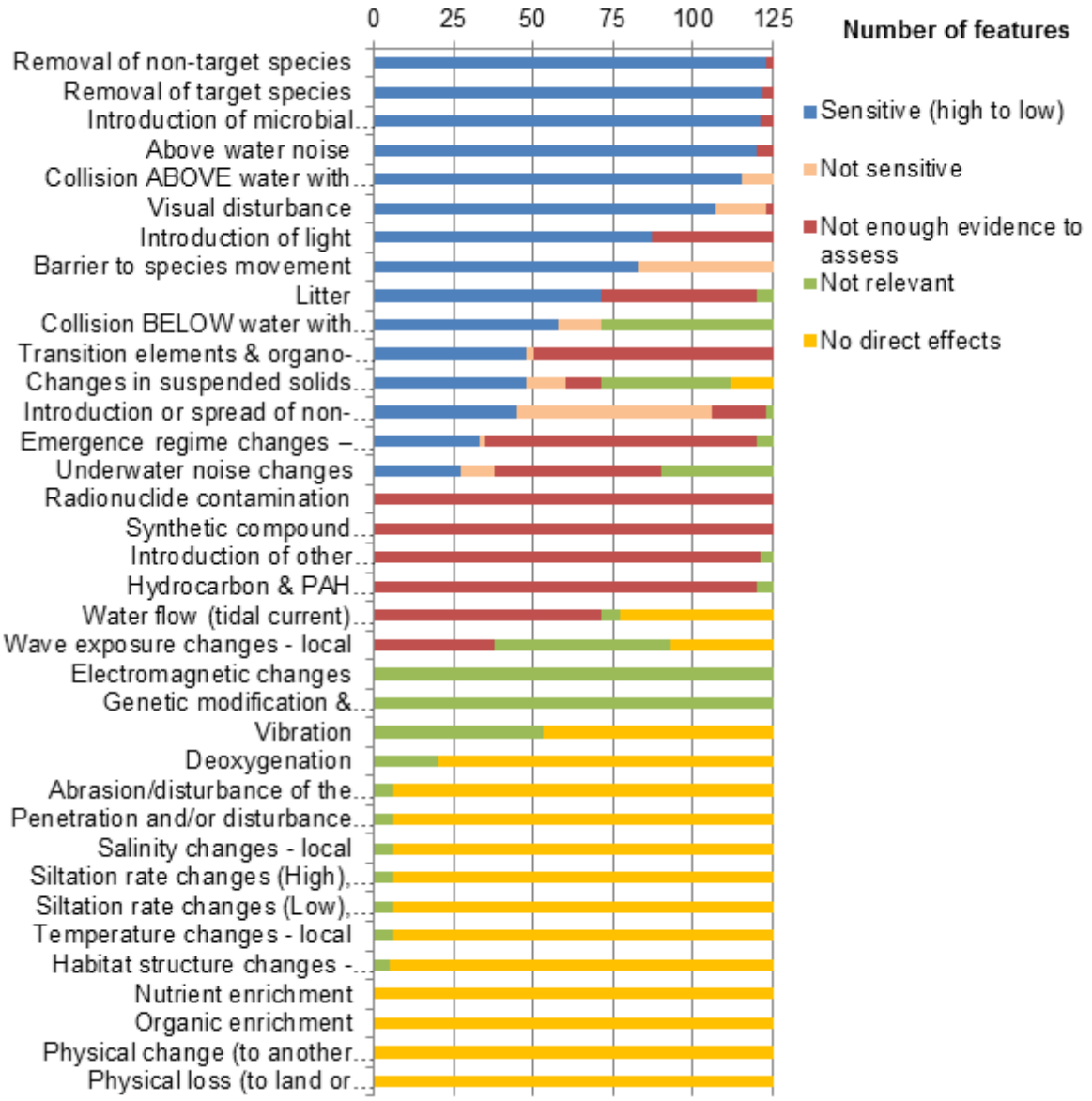
Table 1: High Risk Pressure (Impact) Pathways for Tidal Lagoon Energy (Based on Natural England Advice on Operations)

Direct Impact Pathways of Effect Arising from Tidal Lagoon Power Generation
Barrier to species movement
Changes in suspended solids (water clarity)
Emergence regime changes, including tidal level change considerations
Collision BELOW water with static or moving objects not naturally found in the marine environment
Habitat structure changes - removal of substratum (extraction)
Physical loss (to land or freshwater habitat)
Smothering and siltation rate changes (Heavy)
Smothering and siltation rate changes (Light)
Underwater noise changes
Water flow (tidal current) changes, including sediment transport considerations
Visual disturbance
Wave exposure changes
Indirect Impact Pathways of Effect Arising from Tidal Lagoon Power Generation
Abrasion/disturbance of the substrate on the surface of the seabed
Deoxygenation
Nutrient enrichment
Salinity decrease
Salinity increase
Temperature decrease
Temperature increase
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion
Physical change (to another seabed type)
Physical change (to another sediment type)

In addition to these high risk pressures, a number of low risk pressures are also identified, including above water noise, collision above water, light, invasive species, litter and visual disturbance. Whilst Natural England have considered these pressures to be of a lower or indeterminate risk in relation to birds and tidal lagoon power, there are potential interaction pathways and these are included where considered of relevance, later in this report.

For the application of these generic pressures for specific feature-related advice, a scoring category was then applied to the pressures for birds, within the NECR213 process to derive specific operational advice. This process is summarised in Table 2.

Table 2: Sensitivity Score per Pressure for Birds (sum of affected Features) (Source NECR213)



Based on the above criteria, a series of specific impact pathways were then derived for the Tidal Lagoon HRA and Appropriate Assessment. However, for some pressure attributes, an indication of 'no effect' from the above analysis is considered uncertain, and where applicable, despite the outcomes described in the above Table, the pressure is discussed in relation to bird feature implications later in text.

3.2 Appropriate Area of Consideration

A series of European/Ramsar sites and their associated bird Interest Features were required to be identified, these sites initially identified as having either a potential Likely Significant Effect on them, or at least where Likely Significant Effect could not be excluded.

This list was based on spatial and functional attributes of the sites, and their component Interest Features, together with a high level indication of likely pressures acting on these features directly or indirectly from a Tidal Lagoon development policy. Effectively, this initial list was therefore based on a high level judgement on whether tidal lagoon policy within the SRA has the potential to effect (or at least an effect cannot be discounted) on the functional attributes of SPA and Ramsar features. Given the high mobility of many bird species associated with these sites, both undertaking long-distance migration, as well as diurnal movements for foraging, roosting etc., then the area of potential 'effect' is large, particularly when viewed in conjunction with in-combination factors, with a necessity to include sites in other member states.

As such, in addition to the SRA and buffer (a potential Zone of Influence), a wider and variable assessment area was identified taking into account potential functional range interactions (see below).

Advice on sites and associated features for inclusion in the initial assessment phase was accommodated by the Welsh Government at the early stages of the process, based on the HRA draft (AMEC Foster Wheeler, 2017) and in consultation with statutory agencies, and with additional modification by the authors, e.g. inclusion of Balearic Shearwater (*Puffinus mauretanicus*).

In order to constrain the search criteria, the Zone Of Influence (ZOI) was identified based on the feature components and likely pathways of effect, drawing on a range of data sources including a considerable body of work carried out for tidal power proposals in the Severn Estuary and along the south Wales coast, e.g. by the Department of Energy and Climate Change (DECC, 2010a & 2010b) for the Severn Estuary Tidal Power (SETP) and the Swansea Bay Tidal Lagoon (SBTL); NERC, 2013 (Kirby *et al.*, 2013[6]).

Based on this, the potential ZOI was set as being the SRA, and a 50km buffer, but with an additional search and assessment area based on individual species requirements, e.g. breeding location and foraging range.

NRW advised that mean maximum foraging ranges should also be used for key species to extend the potential interaction radii on a species level basis, these distances based on data described in Thaxter (2012[7]) (Table 3), with sites screened in wherever they overlap with the zone of influence (the SRA and 50 km buffer around it).

6 Natural Environment Research Council. 2013. Wave & Tidal Consenting Position Paper Series: Ornithological Impacts. Authors Kirby, A., Hawkins, K., Freeman, S., McCall, R., Furness, R. & Edhouse, E.

7 Thaxter, C., Lascelles, B., Sugar, K., Cook, A., Roos, S., Bolton, M., Langston, R., & Burton, N. 2012. Seabird Foraging Ranges as a Preliminary Tool for Identifying Candidate Marine Protected Areas. Biological Conservation. 156.

Table 3: Breeding Season Seabird Foraging Ranges (km) (Thaxter *et al.*, 2012).

	Direct			Indirect			Survey				Speculative			All data		
Species	Max	Mean Max	Mean	Max	Mean Max	Mean	Max	Mean Max	Mean	Most within	Max	Mean Max	Mean	Max	Mean Max	Mean
Common eider						2.4 (1)					80	80 (1)		80	80 (1)	2.4 (1)
Red-throated diver	9	9 (1)	4.5 (1)								12	8±4 (3)	11.5±12 (2)	12	8.3±3.3 (4)	9.2±9.4 (3)
Northern fulmar	580	400±245.8 (3)	47.5±17.7 (2)	839	601 (1)	275.4±43.0 (2)	300	300 (1)	75.5±105.4 (2)		460	290±240.4 (2)	35 (1)	839	383.0±204.6 (7)	118.8±117.8 (7)
Manx shearwater[1]	32[a] & >330[b]	18.3±12.5(3)[a] & >330(1)[b]	2.3±0.8(3)[a]	360	360 (1)	355 (1)	260	135±176.8 (2)	50 (1)		850	616.7±225.5 (3)		850	352.5±281.5 (8)	202.5±215.7 (2)
European storm-petrel							>65							>65		
Leach's storm-petrel				<120	<120 (1)		65	65 (1)			90	90 (1)		<120	91.7±27.5 (3)	
Northern gannet	590	229.4±124.3 (7)	92.5±59.9 (8)	480	269.7±182.2 (3)	106.4±50.2 (5)	320	205±162.6 (2)	55.4±49.8 (4)	133.3±161.7 (3)	643.7	627.9±24.2 (3)	321.8 (1)	643.7	313.9±200.4 (15)	100.9±76.9 (18)
Great cormorant	35	25±10 (3)	5.2±1.5 (3)				50	50 (1)			35	35 (1)		50	32±13 (5)	5.2±1.5 (3)
European shag	17	14.5±3.5 (2)	5.9±4.7 (3)	19	18.5 (1)		20	20 (1)	1 (1)	3.5±1.3 (4)			10±2.8 (2)	20	16.9±3.5 (4)	6.5±4.6 (6)
Arctic skua[2]							75	62.5±17.7 (2)	6.4±5.9 (5)	15 (1)	65	65 (1)	3 (1)	75	63.3±12.6 (3)	5.8±5.4 (6)
Great skua[3]	13[a] & 219[b]	10.9±3.0 (2)[a] & 86.4 (1)[b]		>100[b]	58±43 (3)[b]		200	110±127.3 (2)						219[b]	115.5±79.6 (6)[b]	86.4 (1)[b]
Black-headed gull							40	25.5±20.5 (2)	11.4±6.7 (4)	18.2±9.4 (5)	70	40±26.5 (3)	12.5 (1)	70	34.2±22.8 (5)	11.7±5.8 (5)
Common gull							50	50 (1)		25 (1)				50	50 (1)	
Mediterranean gull							20	20 (1)	11.5 (1)	14 (1)				20	20 (1)	11.5 (1)
Herring gull	92	61.1±44 (2)	10.5 (1)				100	44.0±23.9 (14)	24.0±17.2 (4)	25 (2)	100	45.8±29.7 (6)	20 (1)	100	46.0±26.1 (22)	21.1±14.4 (6)
Lesser black-backed gull	181	141.0±50.8 (3)	71.9±10.2 (2)			44 (1)	144	144 (1)	50.8±27.3 (3)	63.0±29.5 (3)	130	130 (1)	30 (1)	180.5	139.4±36.3 (5)	52.9±22.1 (7)
Black-legged tittiwake	120	60.0±23.3 (6)	24.8±12.1 (8)	73	63.0±11.3 (2)		110	67.7±32.3 (8)	34.1±18.2 (3)	27.4±21.3 (7)	50	40±14.1 (2)		120	61.6±26.1 (18)	27.4±13.7 (11)
Sandwich tern	54	49.0±7.1 (2)	11.5±4.7 (3)	25	24.5 (1)	4 (1)	60	39.0±13.9 (5)	12.8±7.4 (4)	15±11.1 (3)	70	50.7±30.9 (3)	27.5 (1)	70	42.7±18.4 (11)	13.0±15.5 (4)
Roseate tern	24	23.9 (1)	6.9 (1)				30	16.6±11.6 (6)	12.2±12.1 (6)	3.4±3.3 (5)	20	20 (1)		30	17.9±10.1 (8)	11.4±11.2 (7)
Common tern	30	15.2±11.2(6)	4.5±3.2(5)	22	22 (1)	30 (1)	37	21.5±9 (6)	7.9±3.5 (9)	12.1±7.3 (5)	30	18.3±10.4 (3)		37	20.3±9.0 (14)	8.7±7.0 (14)
Arctic tern	30	24.2±6.3(4)	7.1± 2.2(3)	20	17.5±3.5 (2)		25	12.9±9.4 (4)	15 (1)	15±8.7 (3)	50	28±31.1 (2)		50	20.2±13.3 (11)	10.5±3.9 (3)
Little tern	5	5 (1)	3.5 (1)				11	6.3±2.4 (6)	2.1 (3)	2.8±1.6 (3)	7	4.4±2.8 (3)	1.8±2.4 (2)	11	5.6±2.4 (10)	2.2±1.3 (6)
Common guillemot	135	84.2±50.1 (5)	37.8±32.3 (5)	200	83.8±74.1 (5)	47.2±26.8 (3)	200	51.7±43.8 (23)	35.7±29.1 (11)	57.2±48.1 (9)	200	90.0±96.4 (3)	20 (1)	200	63.9±54.0 (36)	37.1±27.8 (20)
Razorbill	52	32.0±28.0 (2)	23.7±7.5 (2)	95	65±42 (2)		51	36.3±12.3 (4)	13.9±11.8 (4)	14.2±16.1 (5)	15	15 (2)	16.5±4.9 (2)	95	36.9±25.0 (10)	17.0±9.5 (8)
Atlantic puffin	10	10 (1)		200	105.4±46.0 (8)	4 (1)	70	44.5±17.3 (5)	15.9±24.2 (5)	15.1±6.8 (3)	25	25 (1)	7.0±1.4 (2)	200	73.4±49.8 (15)	12.2±19.0 (8)

Other data on foraging ranges is available, e.g. Gove *et al.* (2016[8]), which can be incorporated into the assessment phase where required.

Sites or features where the distance flying over sea would exceed the mean maximum foraging ranges (e.g. west coast of Ireland and north east coast of France) have been screened out. Any other bird sites and features within the zone of influence (including 2km inland buffer) were also initially screened in.

3.3 Species Sensitivity and Resilience

The Natural England advice on operations for tidal lagoon power includes an indication of species sensitivity to the pressures, based on the identification of a series of functional groups and the allocation of species into these groups. Impact sensitivity has been included at this stage of the process including aspects of species ecology and their resilience, e.g. lifespan, mortality rate, fecundity etc. to develop a recovery potential value (low to high).

These criteria have been used to apply a high level assessment of potential effect and mitigation requirement. Species and associated functional groups are provided in Table 4.

However, additional species specific data have been used where appropriate, based on a range of data sources.

[8] Gove, B., Williams, L., Beresford, A., Roddis, P., Campbell, C., Teuten, E., Langston, R. and Bradbury, R. 2016. Reconciling Biodiversity Conservation and Widespread Deployment of Renewable Energy Technologies in the UK. PLoS ONE

4. SITE SCREENING, DEFINATION OF EFFECT PATHWAYS AND RECEPTOR SENSITIVITY

Based on the identification of high level pathways of effect and the high level list of potential interest features that a potential Likely Significant Effect could not be ruled out on, a matrix of features and pathways of impact has been identified.

As described earlier, for this project the impact component has been based on those pressure pathways identified by Natural England in NECR213 (Natural England, 2016[9]) and used in their revised Advice on Operations for Marine Sites - *Tidal Lagoon/impoundment: During Construction* and *Tidal Lagoon/impoundment: Operation and Maintenance* operations and sensitivity advice (Natural England, 2017). This takes the form of a standardised set of pressures rated as medium to high risk and low risk, with the low risk pressures screened out for this project.

4.1 Pressure Pathways & Severity to Bird Receptors

This component has been based on those pressure pathways identified by Natural England in NECR213 and used in their revised Advice on Operations for Marine Sites. In addition to the direct pressure effects, there will be indirect pressure pathways potentially acting on the receptors. For the most part, aspects of these are covered at a high level review through some of the direct pressure effects, and/or are of low risk. As such, they have been screened out of the current review process.

The list of pressure pathways, and their likely impact level on bird receptors for both Construction and Operation phases of tidal lagoon power generation are summarised in Table 4.

The information includes an indication of severity of effect based on the criteria described briefly in Section 3. The application of this typology (as developed under NECR213 and applied to the Natural England Advice on Operations for Tidal Power therefore ensures a degree of correlation in approach for HRA conclusions and records of Appropriate Assessment for both Welsh and English sites.

9 Natural England, 2016. Designing and Applying a Method to Assess the Sensitivities of Highly Mobile Marine Species to Anthropogenic Pressures. NECR213. APEM Ltd.

Table 4: Pressure (Impact) Pathways and their Severity for Tidal Lagoon Energy for Construction and Operation (Based on Natural England Advice on Operations and NECR213).

Direct Impact Pathways	Construction	Operation
Barrier to species movement		
Changes in suspended solids (water clarity)		
Emergence regime changes, including tidal level change considerations		
Collision BELOW water with static or moving objects not naturally found in the marine environment		
Habitat structure changes - removal of substratum (extraction)		
Physical loss (to land or freshwater habitat)		
Smothering and siltation rate changes (Heavy)		
Smothering and siltation rate changes (Light)		
Underwater noise changes		
Water flow (tidal current) changes, including sediment transport considerations		
Visual disturbance		
Wave exposure changes		

Key to Impact Weighting based on NECR213 Sensitivity Scores:

High		Almost all groups are sensitive to the pressure
Medium		Some groups sensitive, some with insufficient evidence
Low		Insufficient evidence/not sensitive

Indirect Impact Pathways (Screened Out)

Abrasion/disturbance of the substrate on the surface of the seabed	Construction and Operation
Deoxygenation	Operations
Nutrient enrichment	Operations
Salinity decrease	Operations
Salinity increase	Operations
Temperature decrease	Operations
Temperature increase	Operations
Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Construction and Operation
Physical change (to another seabed type)	Construction
Physical change (to another sediment type)	Construction

As described earlier, although a generally comprehensive analysis of pressure pathway issues relating to birds, the NECR213 analysis does exclude some potential effects and where considered applicable, these are addressed later in text e.g. removal of substratum during operation.

4.2 Site Derivation

Using the criteria outlined in Section 3, European Sites of potential interaction (based on the ZoI, foraging ranges etc.) have been identified.

A list of the screened in European/Ramsar sites and their reason for inclusion and designation status is provided in Table 5.

A summary map showing the SPA/pSPA/Ramsar sites included in the initial review process for the HRA are shown in Figure 2, which also references the Tidal Lagoon Strategic Resource Area (SRA) identified under the AMEC Foster Wheeler review, and the associated 50km buffer zone associated with this.

It should however be noted that following consultation with WG/NRW/JNCC, offshore designated sites have been excluded from the analysis, as well some species associated with Irish SPAs, as they do not have specific Conservation Objectives to assess against. However, these species are included within the wider HRA review process and as such, are covered at a high level in any case.

Table 5: European/Ramsar Sites included in the HRA Process (including species with an ecology that meets the spatial screening in criteria). Note: Where a cell is blank, this means ditto to the above entry.

STATUS	SITE LOCATION	SITE NAME
pSPA	Within 50 km below MHWS	Liverpool Bay / Bae Lerpwl Extension
	Within foraging range	Irish Sea Front (but excluded due to being an offshore designation)
Ramsar	Beyond 50 km	Duddon Estuary
		Morecambe Bay
	In SRA	Severn Estuary
		The Dee Estuary
	Within 50 km below MHWS	Burry Inlet
		Mersey Estuary
		Mersey Narrows and North Wirral Foreshore
		Ribble and Alt Estuaries
		Somerset Levels and Moors
	Within foraging range	Duddon Estuary
		Morecambe Bay
		Outer Ards
SPA	Beyond 50 km	Morecambe Bay and Duddon Estuary
	In SRA	Liverpool Bay / Bae Lerpwl
		Severn Estuary
		The Dee Estuary
	Within 2 km inland of 50 km marine buffer	Walmore Common
	Within 50 km below MHWS	Anglesey Terns / Morwenoliaid Ynys Mon
		Bae Caerfyrddin/ Carmarthen Bay
		Burry Inlet
		Glannau Ynys Gybi/ Holy Island Coast
		Mersey Estuary
		Mersey Narrows and North Wirral Foreshore
		Ribble and Alt Estuaries
		Somerset Levels and Moors
		Traeth Lafan/ Lavan Sands, Conway Bay
		Ynys Seiriol / Puffin Island
	Within foraging range	Ailsa Craig
		Beara Peninsula SPA
		Bowland Fells
		Camaret
		Cap Sizun
		Copeland Islands
		Cote de Granit Rose-Sept Iles
		Galley Head to Duneen Point SPA
		Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island
		Grassholm
		Helvick Head to Ballyquin SPA
		Horn Head to Fanad Head SPA
		Howth Head Coast SPA
		Inishtrahull SPA
		Ireland's Eye SPA
		Lambay Island SPA
		Mingulay and Berneray
		Morecambe Bay and Duddon Estuary
		Old Head of Kinsale SPA
		Ouessant-Molene
		Poulaphouca Reservoir SPA
		Saltee Islands SPA
		Sheep's Head to Toe Head SPA
		Skerries Islands SPA
		Skomer, Skokholm and the Seas Off Pembrokeshire
		Tacumshin Lake SPA
		The Bull and The Cow Rocks SPA
		Tory Island SPA
		Wicklow Head SPA

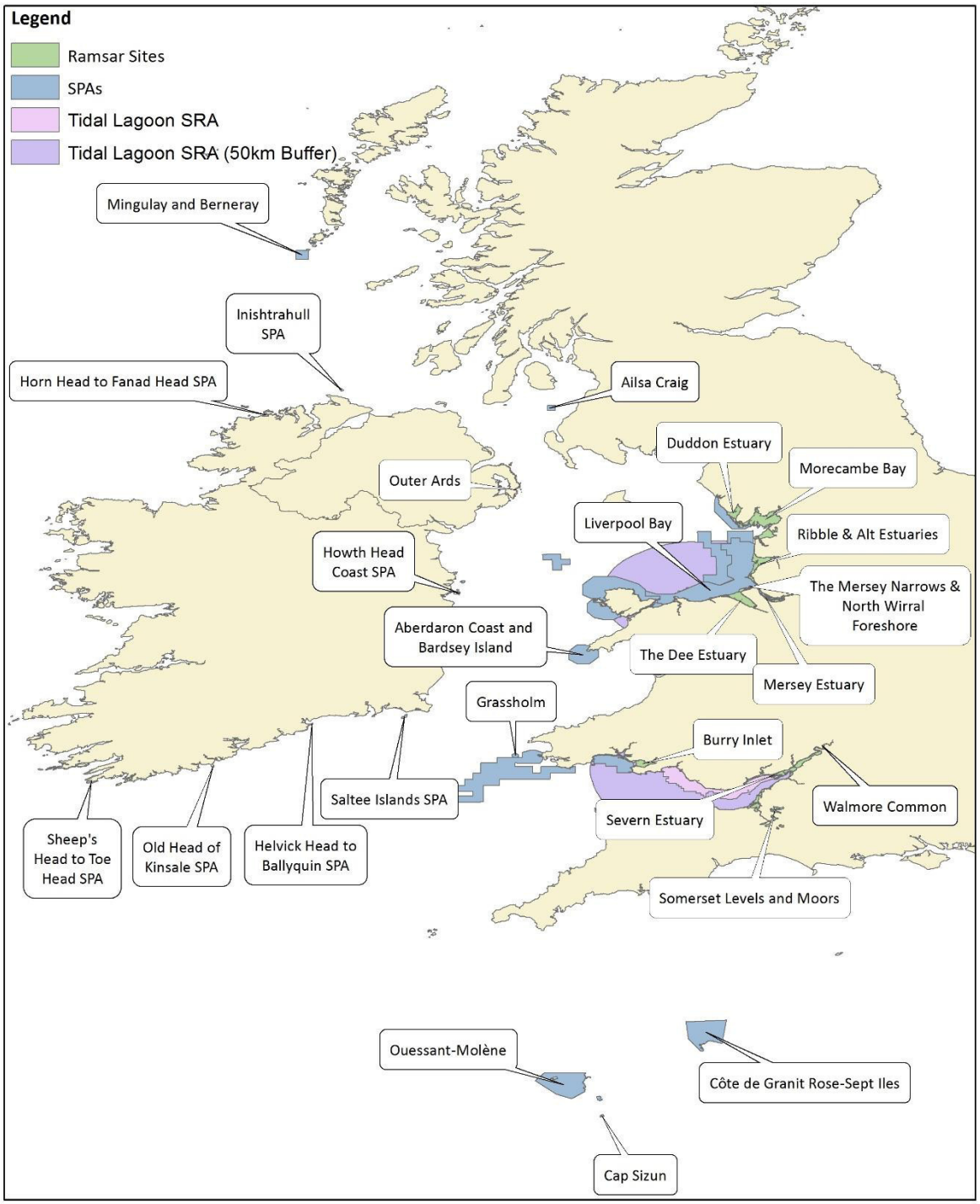


Figure 2: Map showing the European/Ramsar Sites included in the HRA review as well as the Tidal Lagoon SRA and 50km buffer. Note: Not all sites are shown on map, but are given in Table 5.

4.3 Feature Sensitivity

The pressures outlined above have been linked to the Interest Features of each potential European Site and for associated bird species, these are then identified as being *Sensitive*, *Insufficient Evidence* or *screened out* (e.g. not sensitive to the specific pressure pathway). The individual species sensitivity levels are based on a functional assessment described in

NECR213, which allocates all species into one of a series of functional groups with a matrix of pressure sensitivity values assigned on this basis.

This process in assigning pathways and associated sensitivity levels provides a standardised approach based on an existing assessment protocol applied to the HRA process, and has the value of being an accepted standard for adjacent trans-boundary sites as well as for other locations outside the SRA/ZoI.

Using the NERC213 approach, all bird species (excluding Chough) included in the screened in sites have been allocated a functional code. The functional code descriptors are provided in Table 6.

Table 6: Functional Codes and their Descriptors (Following NERC213).

Criteria	Grouping	Short-form	Descriptor
Ecology	Coastal Breeding Waterbird	**CBWB**	Species that breed on or near the coast
Ecology	Coastal Non-breeding Waterbird	**CnBWB**	Species that spend the non-breeding period on or near the coast
Ecology	Seabirds at Sea	**SBS**	Species which occur in the marine environment during any time of year (distinct from their coastal occurrence)
Feeding Mode	Wading Birds and Intertidal Feeders	**WB&IF**	Species that feed by wading in shallow water or on exposed (intertidal) substrates. Includes shallow feeding ducks: shelduck, teal and pintail
Feeding Mode	Surface Feeders	**SF**	Species feeding on resources available on the water surface or slightly below, that can be picked from the surface or gathered by shallow plunge dives
Feeding Mode	Water-column Feeders	**WCF**	Species using the water column for extended dives in search for food resources
Feeding Mode	Benthic Demersal Feeders	**BDF**	Species diving through the water column to the seabed where they search for food. Spearate to waders undertaking surficial feeding
Feeding Mode	Herbivorous & Grazing Birds	**HGB**	Species feeding mainly on coastal meadows/grassland or nearby agricultural land by grazing. May feed on shallow waters/lagoons too

In addition to this relatively high level assessment approach, individual species with specific sensitivities and/or spatial issues are also addressed in the Appropriate Assessment.

For the NERC213 analysis, the OSPAR common indicator and bird functional groups approach was followed as recommended for the implementation of bird indicators for the MSFD by ICES. The groups were therefore identified using both indicators based around the species' ecology/habitat and reproductive preferences, and by their foraging method.

Relevant Interest Feature species and their functional group classifications are provided in Table 7 (species listed in alphabetical rather than taxonomic order), and shown for both their habitat/breeding and forging descriptors. These are species included within the designated sites (from Table 5) that have been considered within the ZoI.

These species have subsequently been collated into a series of functional groups following the protocols developed in NECR213, which have the potential to be affected by tidal lagoon power generation impact pathways described in Table 4, and thus the WNMP policy which provides encouragement to the sector.

As such, these functional groups and the species included within them have the possibility of LSE, and have been screened into the Appropriate Assessment Process.

Table 7: Interest Feature Species and their Functional Groups following NECR213.

Common Name	Bird Species	CBWB	CnBWB	SBS	WB&IF	SF	WCF	BDF	HGB
		Functional Group 1 (Ecology/Taxonomy)			Functional Group 2 (Feeding)				
Arctic Tern	Sterna paradisaea	y		y		y			
Bar-tailed Godwit	Limosa lapponica		y		y				
Bewick's Swan	Cygnus columbianus bewickii		y						y
Black-headed Gull	Chroicocephalus ridibundus	y	y				y		
Black-tailed Godwit	Limosa limosa islandica		y		y				
Chough	Pyrrhocorax pyrrhocorax								
Common Scoter	Melanitta nigra		y					y	
Common Tern	Sterna hirundo	y		y		y			
Cormorant	Phalacrocorax carbo	y	y					y	
Curlew	Numenius arquata	y	y		y				
Dark-Bellied Brent Goose	Branta bernicla bernicla		y						y
Dunlin	Calidris alpina alpina		y		y				
Eider	Somataria mollissima	y	y					y	
Fulmar	Fulmarus glacialis		y	y		y			
Gadwall	Anas strepera	y	y			y			
Gannet	Morus bassanus	y		y			y		
Golden Plover	Pluvialis apricaria		y						
Goldeneye	Bucephala clangula		y		y			y	
Great Black-backed Gull	Larus marinus	y		y		y			
Great Crested Grebe	Podiceps cristatus		y				y		
Greenshank	Tringa nebularia	y	y		y				
Grey Plover	Pluvialis squatarola		y		y				
Herring Gull	Larus argentatus	y	y			y			
Knot	Calidris canutus		y		y				
Lapwing	Vanellus vanellus		y		y				
Lesser Black-backed Gull	Larus fuscus	y		y		y			
Little Egret	Egretta garzetta	y	y						y
Little Gull	Hydrocoloeus minutus		y	y		y			
Little Tern	Sternula albifrons	y		y		y			
Manx Shearwater	Puffinus puffinus	y		y			y		
Mediterranean Gull	Ichthyaetus melanocephalus	y	y			y			
Mute Swan	Cygnus olor	y	y						y
Red Knot	Calidris canutus islandica		y		y				
Northern Shoveler	Anas clypeata	y	y			y			
Oystercatcher	Haematopus ostralegus	y	y		y				
Pink-footed Goose	Anser brachyrhynchus		y						y
Pintail	Anas acuta		y		y				
Puffin	Fratercula arctica	y		y			y		
Red-breasted Merganser	Mergus serrator		y				y		
Redshank	Tringa totanus	y	y		y				
Red-throated Diver	Gavia stellata	y	y				y		
Ringed Plover	Charadrius hiaticula	y	y		y				
Roseate tern	Sterna dougallii	y		y		y			
Ruff	Philomachus pugnax	y	y		y				
Sanderling	Calidris alba		y		y				
Sandwich Tern	Sterna sandvicensis	y	y	y		y			
Scaup	Aythya marila		y					y	
Shelduck	Tadorna tadorna	y	y		y				
Spotted Redshank	Tringa erythropus	y	y		y				
Storm Petrel	Hydrobates pelagicus		y	y		y			
Teal	Anas crecca	y	y		y				
Turnstone	Arenaria interpres		y		y				
Whimbrel	Numenius phaeopus	y	y		y				
White-Fronted Goose	Anser albifrons albifrons		y						y
Whooper Swan	Cygnus cygnus		y						y
Wigeon	Anas penelope		y						y

In order to identify whether any of the groups and associated features (species) which have been identified as having an LSE component will translate into an Adverse Effect on Integrity (AEOI), an Appropriate Assessment (AA) is required.

The process for undertaking this AA at a plan level, and the outcomes of the process are addressed in Section 5.

5. APPROPRIATE ASSESSMENT

5.1 Introduction

The initial step-wise approach to undertaking the AA and in determining an Adverse Effect on Integrity (AEOI) has been described in Section 4.

As described above, this process has involved the identification of European Sites (SPA and pSPA), as well as Ramsar sites and then the birds (Interest Features) associated with these sites that have the potential to be affected by the Tidal Lagoon Policy (TLP) and these species assigned to relevant functional groups. Pressure pathways have then been identified for both construction and operational phases of tidal lagoon power generation and potential severity of effect on groups established.

In order to undertake the high level AA for the tidal lagoon policy of the Welsh Government, including an indication of Adverse Effect on Integrity, the initial component of the analysis involves a high level assessment of likely impact alone and then in combination with other plans or polices.

This approach addresses the individual pathways of effect against the requirements of each functional group to determine a generic impact potential for key groups.

As part of the assessment process, the impact of the tidal lagoon energy aspect of the plan (through its pathways of effect and feature sensitivities) requires assessment against the Conservation Objectives for the sites. Given the high level nature of this review, the individual details of the Conservation Objectives for each site have not been considered, but rather, they have a generic component to them which focuses on the structure and function of the feature and its supporting habitats and these have been used as a basis for the assessment of effect from the plan-level activities e.g.:

- Stable or increasing population size of each feature (species). This can be for both breeding and non-breeding species;
- Extent of supporting habitats within the site to be stable or increasing (subject to natural change) and in sufficient quality to support key functions for the feature including provision of food sources;
- Range and distribution of each species within the designated site to not be constrained or hindered;
- Control of activities likely to impinge of the sustainability on the population of the feature to be controlled.

5.2 Pathways of Effect

As described earlier in text, a series of pathways of effect (pressures) have been identified as a result of tidal power generation activities and these have been assessed in relation to their severity of potential impact. These are summarised in Table 4.

Of these pathways, the following are considered to have the greatest impact potential for the main phases of tidal lagoon activity (construction and operation) (Table 8). The mode of effect of these pressures is then discussed in relation to the functional groups.

Table 8: Main Impact Pathways for Birds from Tidal Lagoon Generation (including Pressure Descriptions from NECR213). Note: These pressures as described in NECR213 relate to (based on pressure descriptors under the MarESA approach (Tillin & Tyler-Walters, 2014[10]):

Pressure	Construction	Operation
Barrier to species movement	High	High
Collision below water with non-natural objects	Medium	High
Habitat structure changes (removal of substratum)	High	N/A
Physical loss of habitat	High	NA
Visual disturbance	Medium	High
Wave exposure changes	High	High

Pressure Name	Pressure Description
Barrier to Species Movement	This pressure relates to the physical obstruction of species movements and including local movements (within and between roosting, breeding, feeding areas) and regional/global migrations (e.g. birds, eels, salmon, and whales). Both include up-river movements (where tidal barrages and devices or dams could obstruct movements) or movements across open waters (offshore wind farm, wave or tidal array devices, mariculture infrastructure or fixed fishing gears). The species affected are mostly birds, fish, and mammals. This pressure includes temporary physical discontinuities to migratory (or commuting) corridors such as DO sags (low dissolved oxygen concentration event).
Collision above or below water with static or moving objects not naturally found in the marine environment For TLE this is for below water only	This pressure relates to the injury or mortality of biota from collisions with both static and/or moving structures. Examples include collisions with: rigs (e.g. birds) screens in intake pipes (e.g. fish at power stations) wind turbine blades (e.g. birds) tidal devices (e.g. fish and mammals) and shipping (e.g. fish and mammals). Activities increasing number of vessels transiting areas, e.g. new port development or construction works will influence the scale and intensity of this pressure. In the assessments the above and below collision risks were assessed separately as two independent pressure types.

[10] Tillin, H. & Tyler-Walters, H. 2014. Assessing the sensitivity of subtidal sedimentary habitats to pressures associated with marine activities. Phase 2 Report – Literature review and sensitivity assessments for ecological groups for circalittoral and offshore Level 5 biotopes. JNCC Report No. 512B.

Table 8 Cont.

Pressure Name	Pressure Description
Habitat structure changes - removal of substratum (extraction)	This pressure is likely to only act indirectly on mobile species. Unlike the 'physical change' pressure where there is a permanent change in sea bed type (e.g. sand to gravel, sediment to a hard artificial substrate) the 'habitat structure change' pressure relates to a temporary and/or reversible change. For example, a reversible change occurs with marine mineral extraction where a proportion of seabed sands or gravels are removed but a residual layer of seabed is left which is similar to the pre-dredge structure and as such biological communities could re-colonise. Navigation dredging to maintain channels is another example where the silts or sands removed are replaced by non-anthropogenic mechanisms so the sediment typology is not changed. Other examples of this type of pressure include removal of structures required for spawning, shelter or roosting.
Physical loss (to land or freshwater habitat)	This pressure relates to the permanent loss of marine habitats. Associated activities are: land claim; new coastal defences that encroach on and move the Mean High Water Springs level seawards; the footprint of a wind turbine on the seabed and the sea surface it covers; and dredging if it alters the position of the halocline. This pressure excludes changes from one marine habitat type to another marine habitat type.
Visual disturbance	This pressure relates to the disturbance of biota by anthropogenic activities, e.g. increased vessel movements, such as during construction phases for new infrastructure (bridges, cranes, port buildings, offshore platforms, offshore wind farms etc.), increased personnel movements, increased tourism, moving wind turbine blades, increased vehicular movements onshore and offshore disturbing bird roosting areas, rafting areas, feeding areas, seal haul out areas etc.
Wave exposure changes - local	This pressure refers to local changes in wave length, height and frequency. Exposure on an open shore is dependent upon the distance of open seawater over which wind may blow to generate waves (the fetch) and the strength and incidence of winds. Anthropogenic sources of this pressure include artificial reefs, breakwaters, barrages, and wrecks that can directly influence wave action or activities that may locally affect the incidence of winds, e.g. a dense network of wind turbines may have the potential to influence wave exposure, depending upon their location relative to the coastline.

The following reference boxes summarise the potential implications of the pressure pathways identified above to the functional bird groups.

For those interest feature/pathway combinations where a clear potential sensitivity has been identified, then these are detailed for the specific functional groups. Where the sensitivity value is less clear, but potential (e.g. where insufficient data are available), then these are addressed textually. Similarly, where a low risk was identified via NECR213, but it is considered that the risk cannot be discounted, then these are addressed textually following (Section 5.2.7)..

For each pathway of effect, the likelihood of an Adverse Effect on Integrity (AEOI) is then provided as a summary box linked to each pathway.

5.2.1 BARRIER TO MOVEMENT

This pathway of effect would potentially include the effect of physical structures and associated operations on and within them, with avoidance potential around the sites. Given the scale of the potential technology these could have an alone effect, although perhaps more readily when in a localised or regional series. Methods of effect on the features (functional groupings) are summarised in Box 1a, based on NECR213.

However, although not apparently addressed within the NECR213 report, there might also be the potential for impact on site integrity through the attraction of a feature to one or more of these sites were the TL process to provide a new and exploitable resource. This could have associated effects on feature movement e.g. modifying existing area utilisation, through say the attraction to the exploitation of a newly provided resource, and potentially with associated impacts via other pathways e.g. collision.

Box 1a: Barrier to Movement Summary of Feature Effects

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CBWB	Coastal Breeders	Increasing potential for disruption to flyways and diurnal flights between nest and feeding areas effecting energy budget, condition and fledging rate. Consider disturbance as a non-physical barrier	Potential for disruption to flyways and diurnal flights between nest and feeding areas effecting energy budget, condition and fledging rate.
CnBWB	Non-breeding Coastal Species	Potential modification to flyway routes with associated issues for energy budget; use of sub-optimal areas and/or increased competition in preferred areas. Scale of effect perhaps greater for multiple TL developments in an area with less opportunity to undertake a localised avoidance route. In early stages disturbance may be a greater barrier than physical structures.	Modification to flyway routes with associated issues for energy budget; use of sub-optimal areas and/or increased competition in preferred areas. Scale of effect perhaps greater for multiple TL developments in an area with less opportunity to undertake a localised avoidance route.
SBS	Present in Marine Environment	Modifications to localised movements between foraging and loafing areas. Loss of functional habitat and potential for displacement. Location of TL sites might mean impacts are constrained outwith the occurrence of more pelagic species or only an issue for key seasons or life stages.	Modifications to localised movements between foraging and loafing areas. Loss of functional habitat and potential for displacement. Location of TL sites might mean impacts are constrained outwith the occurrence of more pelagic species or only an issue for key seasons or life stages.

Box 1a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
WB&IF	Intertidal/Shallow Water Forager	Developing potential for an interruption to annual and/or diurnal movements affecting energy budgets and breeding condition. Potential disruption between foraging and roost sites also leading to displacement to sub-optimal areas and or increased competition. When TL sites in multiple then potential abandonment of an area. Disturbance might be considered a non-physical barrier.	Interruption to annual and/or diurnal movements affecting energy budgets and breeding condition. Potential disruption between foraging and roost sites also leading to displacement to sub-optimal areas and or increased competition. When TL sites in multiple then potential abandonment of an area.
SF	Shallow Water Column Forager	Developing potential to disrupt movements between feeding sites (loss of connectivity) as well as between feeding and roosting areas with impacts to energy budgets from increased flight distance and/or reduced foraging time. Consider also underwater noise and general disturbance as barriers.	Potential to disrupt movements between feeding sites (loss of connectivity) as well as between feeding and roosting areas with impacts to energy budgets from increased flight distance and/or reduced foraging time. Underwater noise may be a barrier.
WCF	Deep Water Column Forager	Developing potential to disrupt movements between feeding sites (loss of connectivity) as well as between feeding and roosting areas with impacts to energy budgets from increased flight distance and/or reduced foraging time. Consider also underwater noise and general disturbance as barriers.	Potential to disrupt movements between feeding sites (loss of connectivity) as well as between feeding and roosting areas with impacts to energy budgets from increased flight distance and/or reduced foraging time. Underwater noise may be a barrier.
BDF	Seabed Foragers	Developing potential to disrupt movements between feeding sites (loss of connectivity) as well as between feeding and roosting areas with impacts to energy budgets from increased flight distance and/or reduced foraging time. Depending on water depth potential for impact to be constrained with species using offshore areas. Consider also underwater noise and general disturbance as barriers.	Potential to disrupt movements between feeding sites (loss of connectivity) as well as between feeding and roosting areas with impacts to energy budgets from increased flight distance and/or reduced foraging time. Depending on water depth potential for impact to be constrained with species using offshore areas. Underwater noise may be a barrier.

Box 1a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
HGB	Adjacent Habitat Foragers	Potential modification to diurnal movements between foraging sites and even the exclusion of some resources depending on location and habitat needs. Disturbance is also a barrier.	Modification to diurnal movements between foraging sites and even the exclusion of some resources depending on location and habitat needs. Disturbance may also be a barrier.

Whilst tidal lagoon energy provision has the potential to create a barrier to movement for a number of marine and coastal bird species, the direct effect potential once operational will vary between species and designs. For instance, the elevation of the majority of the structure will be relatively low (e.g. in comparison to offshore wind structures) and therefore, some long-distance migratory movements, e.g. some species of wildfowl and waders, would be considerably higher than the structure and thus have a low potential for direct effect.

However, the lateral extent of the individual sites means that for low altitude movements, such a structure could provide a substantial barrier. This might be more likely to affect local diurnal movements, e.g. between foraging and breeding or roosting sites, such an affect would occur on a daily basis and thus have a considerable localised impact. Furthermore, some migratory movements can also be undertaken at low altitude, e.g. by preference or in response to adverse weather conditions, and as such, impacts resulting from barrier effects cannot be discounted for a relatively large number of species across a number of taxonomic groups. Such impacts would therefore be applicable at a range of scales from local population impacts within a designated site, e.g. disruption to breeding colonies through to longer distance migration.

Box 1b: Relevant Conservation Objectives (COs) and Potential for AEOI from the Barrier to Movement Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential at a plan-level, given the long-distance movements of many Interest Features through modification to routes increasing energy use and associated reduction in prey take
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Direct and indirect AEOI potential through modification to routes increasing energy use and associated reduction in prey take of features
Range and distribution of each species to be unhindered and maintained	Long-distance movements through modification to routes increasing energy use and associated reduction in prey take. Potential site specific constraint and AEOI
Control of activities likely to impinge on the sustainability of the population of the feature	Possible AEOI requires at least site specific assessment and in-combination consideration. Mitigation extent and scale needs consideration

Multiple developments would potentially increase the impact potential, although it is noted that for some of the functional attributes used in this analysis, there is also a potential for a few species to exploit niches created by increased water depth and period of retention.

Box 1b briefly summarises potential fields of impact for an Adverse Effect On Integrity (AEOI). There is clearly a potential for disruption to movements of some species at a daily or seasonal (migratory) scale, although this will be dependent on design, location and positioning of other coastal and offshore developments. For instance there are potential implications for low flying species including some ducks, shags and cormorants and auks to be affected both on a diurnal basis e.g. between breeding colonies and preferred foraging sites, and during migratory movements.

In theory this has the potential to affect fledge and survival rates on coastal and inland colonies through reduced foraging time/efficiency, as well as general energy budgets in adult birds, and in the extreme, might affect utilisation of a colony. Similarly, some migratory movements may be affected such that access to key foraging sites is lost (this being a different pressure route to that of direct habitat loss), with implications for energy budgets, breeding and wintering condition. Again, this might have a direct impact on site utilisation and thus AEOI.

No current plan-level mitigation has been identified but at least project specific consideration will be required as well as detailed in-combination assessment with appropriate mitigation, e.g. design, location, staging provision and alternative habitat delivery.

It is unlikely that there is a great deal of design potential as a mitigation measure, as TLG requires sufficient bund elevation to ensure tidal capture and safe amenity and maintenance access along the crest. Provision of a more linear design, or joining across headlands of an embayment might promote better longitudinal movement along and around the structure, but might not necessarily address all issues, particularly where direct disruption to breeding colony foraging routes occur. However it is also noted that many species of waterbird will routinely fly above the elevation of a TLG bund, and will have the potential to accommodate any visual barrier within their movements.

As such, whilst some mitigation measures may be possible, significant impacts to some species and sites may occur. Mitigation measures should not be discounted and may not be limited to development location and design, but also potentially the provision of alternative habitat (and replacement functional delivery) as AEOI might not be possible with any surety.

5.2.2 COLLISION BELOW WATER

This pathway of effect has been assumed to relate predominately to the operational phase. Effects would be potentially in relation to static and moving infrastructure, although it would be expected that there would be little potential for collision with the solid and most probably moving structures associated with a lagoon boundary and associated equipment once operational.

Box 2a: Collision Below Water Summary of Feature Effects

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CBWB	Coastal Breeders	Potential collision risk when foraging e.g. terns, but construction activity likely to restrict proximity of this activity.	For some species of diving bird there is a risk of sub-surface collision e.g. tern spp., gannet and auks as part of their foraging behaviour. For larger, longer lived species impacts may be greater and recovery longer.
CnBWB	Non-breeding Coastal Species	This functional group could include species such as wintering divers, grebes, cormorants and some ducks. Potential for collision would be low given the likely disturbance effects arising from construction work together with natural avoidance behaviour.	This will include wintering divers & grebes as well as ducks. Depending on the design detail e.g. water retention period and depth as well as subtidal habitat development, for some species TL may be an attractive foraging resource and thus depending on the potential mortality rate, could have a large impact on a population.
SBS	Present in Marine Environment	This functional group could include species that approach the coast for parts of their lifecycle or in perhaps of bad weather (e.g. excluding pelagic species that breed on the coast). Potential for collision would be low given the likely disturbance effects arising from construction work together with natural avoidance behaviour.	This will has the potential to cover a wide range of species including wintering divers and ducks as well as seabirds outwith their breeding season, although, for the most part, it would be expected that the sector would utilise predominantly inshore waters rather and with a reduction in more pelagic distribution impacts.
WB&IF	Intertidal/Shallow Water Forager	This functional group includes a range of species. However no potential for underwater collision given foraging strategy and disturbance potential.	Given the foraging strategy, there is a very low probability of any significant impact to this group.

Box 2a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
SF	Shallow Water Column Forager	An elevated risk to the group above, but with likely avoidance and the effects of disturbance, then a low potential exposure to risk given the shallow nature of the dive e.g. terns and other shallow water plunge divers.	An elevated risk to the group above, but with likely avoidance from some potential collision risks and a low potential exposure to risk given the shallow nature of the dive e.g. terns and other shallow water plunge divers.
WCF	Deep Water Column Forager	Species in this group would have a higher potential risk of impact, as it includes deep plunge divers and pursuit divers e.g. auks, gannets, some species of duck, grebes, divers, cormorants and shearwaters. However, construction activity and associated disturbance effect is likely to restrict the proximity of approach to the structure and natural avoidance behaviour should minimise potential further.	Species in this group would have a high risk of impact, and would include deep plunge divers and pursuit divers e.g. auks, gannets, some species of duck, grebes, divers, cormorants and shearwaters. It should be noted that maximum pursuit depths for some species is well in excess of the likely water column depth for coastal based TLE.
BDF	Seabed Foragers	Species in this group would have a higher potential risk of impact, as it includes deep plunge divers and pursuit divers e.g. auks, gannets, some species of duck, grebes, divers, cormorants and shearwaters. However, construction activity and associated disturbance effect is likely to restrict the proximity of approach to the structure and natural avoidance behaviour should minimise potential further.	As above, these species would have a relatively high risk given the depth penetration e.g. for Common Scoter >10m to the bed.
HGB	Adjacent Habitat Foragers	Given the foraging strategy, there is a very low probability of any significant impact to this group.	Given the foraging strategy, there is a low probability of any significant impact to this group.

Sub-surface collision with structures is a possibility for some of the groups as their foraging strategies require some form of diving (plunge or pursuit). Foraging by some species would be surficial and unlikely therefore to have a significant interaction potential, however for some plunge and pursuit divers, vertical and horizontal movements can be substantial, leading to a potential collision risk, albeit fairly minor. For instance, many species will retain visual acuity whilst diving, and thus may be able to exercise avoidance behaviour. However, faster moving equipment may be less readily observed and, in areas where there is a high flow velocity, avoidance even with visual awareness may not be possible with potential collision e.g. the turbine assembly. It is however acknowledged that for the majority of any TLG development area, the potential for underwater collision is low.

The potential for lagoons to attract foraging plunge and pursuit divers will depend on design parameters, but may increase the potential collision risk e.g. retention of tidally inundated areas to a greater depth than externally with an exploitable fish resource e.g. by Auk spp. (Furness, 2012[11]. Similarly, the potential development of seabed communities e.g. mussel beds, may also have an influence of site utilisation by ducks, e.g. Scoter spp. There exists, therefore a potential for in some instances species to be attracted to a TLG site to exploit a foraging resource e.g. extended foraging duration, concentration of prey items. This may have a positive effect on functional delivery and an associated feature population.

However, there remains also the potential for collision related mortality from such exploitation, e.g. around the turbine draw areas, which could have a repeatable detrimental impact on the same population, with ongoing mortality of a species or group exploiting a resource . This will require development specific consideration and will be largely influenced by location. The likelihood of an in-series and in-combination effect is however relatively low.

Potential collision risk interactions between marine renewable energy devices and birds are described in Wilson *et al*. (2007).

Box 2b: Relevant Conservation Objectives (COs) and Potential for AEOI for the Collison Below Water Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential AEOI impact for some species at a plan level for operation cannot be ruled out via collision mortality affecting a single species or functional group. Project specific consideration needed for some groups (e.g. diving birds) with AEOI a possibility in extreme cases
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Potential associated AEOI impact via alteration to some fish (prey) availability through direct collision/avoidance. Increased provision of habitat (water retention) may prolong/focus foraging activity by some species with potential benefits, but also with potential impacts (repeated species or group specific collision mortality)
Range and distribution of each species to be unhindered and maintained	Localised constraint on diving activity through project specific development and loss of habitat (collision avoidance)
Control of activities likely to impinge on the sustainability of the population of the feature	AEOI possibility at least at a development specific scale, through repeated collision mortality risk from bird:turbine interactions. Mitigation measures should be effective if considered necessary

[11] Furness, R., Wade, H., Robbins, A., and Masden, E. 2012. Assessing the Sensitivity of Seabird Populations to Adverse Effects from Tidal Stream Turbines and Wave Energy Devices. ICES Journal of Marine Science, 69.

Plan-level issues are therefore probably minor e.g. restricted at worst to individual feature/group mortality at an individual site, but could have an effect on integrity e.g. for colonial diving species. Mitigation measures however could be applied either at an industry or project site scale. Measures could include site design to minimise flow rates adjacent to the turbines and the use of deterrents e.g. noise, lights, bubble screens, and would only be required were there some specific site/species/function combinations.

5.2.3 HABITAT STRUCTURE CHANGE

From the NE guidance this pressure attribute relates to the extraction of substratum and/or removal of relevant structures. Although from NE guidance, this pressure appears to largely relate to specific aggregate removal, this may also relate to indirect changes to habitat type through modification to inundation and flow regimes (e.g. scour or deposition), and may therefore influence foraging potential and thus survival and condition in receptors.

There is however, also the potential for operational maintenance to require cyclical removal of depositional material within the lagoon via some form of dredging, which would have an impact on benthic community structure and function, in turn affecting feature use (primarily foraging). The requirement for such activity is uncertain and would depend on site location and design, e.g. more likely to occur in areas of high suspended material such as the Severn. In addition to the potential for dredging within the lagoon, disruption to sediment transport may require maintenance dredging outwith the site, particularly were there to be issues associated with navigation.

It is however considered to be less of a potential impact pathway than a more direct physical loss of habitat.

Box 3a: Habitat Structure Change Summary of Feature Effects

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CBWB	Coastal Breeders	A localised reduction in foraging potential for some species of shorebird and terns from changes to intertidal and subtidal habitats (excluding direct loss). This will potentially effect breeding success and or site utilisation	A modification to function from the lagoon structures and inundation regime change. Change in substratum likely with erosion and deposition areas Reduction in foraging potential for some species of shorebird and terns from intertidal and subtidal habitat change. This will potentially affect site take up and success (reduced food availability, increased foraging range). However it should be noted that for some species, these changes may increase foraging potential.
CnBWB	Non-breeding Coastal Species	A localised reduction in foraging potential for some species of shorebird and terns from changes to intertidal and subtidal habitats (excluding direct loss). This has the potential to affect a range of waders including migratory staging provision, as well as wintering ducks and divers etc.	Considerable potential to affect habitat provision for waders as a result of inundation regime changes. Changes may however be beneficial depending on baseline habitat and physical modification and thus will need detailed consideration on an individual development basis. Wader forgoing will be affected, as well as provisions for wintering diving ducks and divers etc.

Box 3a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
SBS	Present in Marine Environment	Potentially a low impact given the scale of change during construction and the location of the sector in inshore waters. Some effects to seabird foraging (both breeding and wintering), although pelagic nature means less likely to be affected apart from at times when using the coastal margins (covered elsewhere).	Potentially only a small impact given the location of the sector in inshore waters. Some effects to seabird foraging (both breeding and wintering), although pelagic nature means less likely to be affected apart from at times when using the coastal margins (covered elsewhere).
WB&IF	Intertidal/Shallow Water Forager	A localised reduction in foraging potential for some species of shorebird and terns from changes to intertidal and subtidal habitats (excluding direct loss) and disturbance. Migratory and over-wintering species susceptible.	Depending on site parameters (location and design), then this may be a sizeable impact e.g. through alteration to intertidal habitat communities (as a foraging or roosting resource in terms of prey items, size, density etc.). Likely to affect migratory and over-wintering waders and wildfowl.
SF	Shallow Water Column Forager	Limited impact during construction but small scale habitat function loss.	Change to habitat availability, may deliver opportunities but this will depend on habitat development within each site. Loss or modification of natural processes may have an indirect effect through restriction to prey.
WCF	Deep Water Column Forager	Limited impact during construction but small scale habitat function loss.	Change to habitat availability, may deliver opportunities but this will depend on habitat development within each site. Loss or modification of natural processes may have an indirect impact through restriction to prey availability, but may increase potential foraging time.

Box 3a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
BDF	Seabed Foragers	Limited impact during construction but small scale habitat function loss.	Change to habitat availability, may deliver opportunities but this will depend on habitat development within each site. Loss or modification of natural processes may have a direct effect on prey e.g. loss of suitable substratum and smothering of mussel beds. However, provision of an increase in permanently inundated seabed may also deliver additional habitat and foraging potential.
HGB	Adjacent Habitat Foragers	Limited impact during construction but small scale habitat function loss and disturbance to preferred adjacent inland sites.	Some small scale potential loss of habitat (intertidal/shallow water). However such habitat is not the primary component of this group.

Tidal lagoon energy production has the potential for quite considerable direct changes to habitat type and structure, e.g. a shift from cobble/gravel substratum to sand and mud, and an associated modification to the biological communities associated with them. It is uncertain to what extent this specific pathway of effect will influence these, although lagoon operation will modify natural processes and this will potentially affect the provision of key habitats and associated function for bird interest features. It might be expected that there would be a general increase in fine material (deposition) across the majority of the lagoon reflecting a lower energy environment, but with some areas of increased flow velocity e.g. adjacent to the turbine(s), leading to scout and removal of fine material.

Relating directly to this specific pressure pathway, habitat structure change via the removal of material e.g. through dredging, has the potential to occur during construction, depending on the construction process, and during operation both within and outwith the lagoon area. The requirements for such operations will be site specific, depending on a range of factors, although it might be expected that depositional and associated management requirements would be more likely in areas of high suspended solids, e.g. the Severn.

However, the type and scale of impact will be dependent on a series of site specific factors and it has been argued that whilst there will be loss of some function, other habitats and function will increase, in delivery. For this plan-level review, the assumption has been made that loss of function and an associated impact on dependent features and their conservation objectives is by default undesirable. However, there is the potential for some changes to be beneficial, either in the form of a direct shift in habitat (potentially a feature to feature direct change), or even for feature enhancement e.g. the replacement of barren shingle with a more productive mudflat, albeit this may also have implications between feature groups.

Box 3b: Relevant Conservation Objectives (COs) and Potential for AEOI for the Habitat Structure Change Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential for site level impacts to habitat function and thus foraging potential for some species. May be sufficient for AEOI
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Potential changes to structure may remove/alter habitats e.g. loss of biogenic reef provision, with associated function delivery issues for some features and thus potential AEOI
Range and distribution of each species to be unhindered and maintained	Change in habitat structure and extent may influence feature distribution at a site specific level
Control of activities likely to impinge on the sustainability of the population of the feature	Habitat modification process needs to be assessed and any AEOI concluded with mitigation provided if considered relevant at a development/site level

There is some potential for AEOI through habitat function modification, although this may be expected to be development/site specific depending on design, assemblage and distribution rather than an intrinsic and comprehensive issue at a plan-level. Depending on site specific likely responses, mitigation measures may be needed, but in general, effects are considered to present less of an AEOI potential than those associated with direct habitat loss and modification.

5.2.4 PHYSICAL LOSS OF HABITAT

This pressure relates to the permanent loss of marine habitat but excludes changes to habitat type (e.g. intertidal to subtidal). For the most part, this pressure arises from the construction of man-made structures, land-claim etc., and for tidal lagoon power generation will predominantly relate to the loss of habitat under the footprint of the bund structures. Associated with the direct loss of habitat, loss of function, e.g. prey resources would be an expected issue for bird features.

Box 4a: Physical Loss of Habitat Summary of Feature Effects

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CBWB	Coastal Breeders	Gradual loss of resource area under the structural footprint and ancillary operations e.g. shingle and marsh nesters. Wider impact zone due to disturbance (see below). Potential to influence breeding site take up and foraging area and thus breeding success.	Loss of resource area under the structural footprint e.g. shingle and marsh nesters. Potential to influence breeding site take up and foraging area and thus breeding success. However (although not directly covered under this pathway), potential for additional foraging resource availability for some breeding species.
CnBWB	Non-breeding Coastal Species	Gradual loss of resource area under the structural footprint and ancillary operations. Wider impact zone due to disturbance (see below). Loss of intertidal area function affecting foraging potential and roost site availability, with associated impacts to energy budgets, condition, resilience and mortality rates.	Loss of resource area under the structural footprint and ancillary operations. Wider impact zone due to disturbance (see below). Loss of intertidal area function affecting foraging potential and roost site availability, with associated impacts to energy budgets, condition, resilience and mortality rates. Potential additional roost site provision depending on disturbance.
SBS	Present in Marine Environment	Gradual loss of resource area under the structural footprint and ancillary operations. Wider impact zone due to disturbance (see below). Coastal nature means impacts to this group are reduced, but may be important at times of year/life stages e.g. winter coastal use, moult periods.	Loss of resource area under the structural footprint and ancillary operations. Wider impact zone due to disturbance (see below). Coastal nature means impacts to this group are reduced, but may be important at times of year/life stages e.g. winter coastal use, moult periods. Although not directly covered under this pathway, a potential positive in provision of sheltered areas adjacent to the bund structures and new roost sites.

Box 4a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
WB&IF	Intertidal/Shallow Water Forager	Small increasing loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year e.g. winter, passage. Disturbance from works would increase the zone of impact.	Design will influence area of loss of resource, but increased area of impact through associated buffer effects. Substantial impacts may occur at important at key times of year through loss of intertidal area function affecting foraging potential and roost site availability, with associated impacts to energy budgets, condition, resilience and mortality rates. However, potential additional roost site provision depending on disturbance. Additional effects through change to habitat not covered under this pathway.
SF	Shallow Water Column Forager	Small increasing loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year. Disturbance from works would increase the zone of impact.	Loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year. Disturbance from works would increase the zone of impact. Changes in habitat type and availability (intertidal to subtidal, inundation times) not covered under this pathway.
WCF	Deep Water Column Forager	Small increasing loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year. Disturbance from works would increase the zone of impact.	Loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year. Disturbance from works would increase the zone of impact. +/- changes in habitat type and availability (intertidal to subtidal, inundation times) not covered under this pathway.
BDF	Seabed Foragers	Small increasing loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year. Disturbance from works would increase the zone of impact.	Loss of resource potential under the footprint. Restriction to foraging activity may be important at certain times of year. Disturbance from works would increase the zone of impact. +/- changes in habitat type and availability (intertidal to subtidal, inundation times) not covered under this pathway.

Box 4a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
HGB	Adjacent Habitat Foragers	Feature includes potential shallow water usage so small sale increasing impacts as above, and potential disturbance effects (see below).	Feature includes potential shallow water usage so small sale impacts as above, and potential disturbance effects (see below).

This pathway covers direct habitat loss and associated function from the footprint of the lagoon, e.g. the bunds and associated structures. Whilst, depending on design, this will entail a large direct loss of intertidal and subtidal area, the alteration to habitat type from the operation of the lagoon might be considered of equal or greater importance.

However the loss, in particular of intertidal habitat and potentially productive subtidal areas, e.g. biogenic reefs, will have the potential to detrimentally affect a range of bird receptors primarily through a direct loss of productivity, but also indirectly through the likelihood of a buffer effect, e.g. most birds will not forage immediately adjacent to a structure. This will potentially affect some breeding species, with localised impacts on breeding site sustainability a possibility, e.g. if the loss is located on a key foraging resource for species with specific breeding habitat needs. However, a more generic impact might be expected for a range of species that forage on the intertidal and nearshore coastal areas out with the breeding season, e.g. passage and over wintering waders and wildfowl. Roost and rest function may also be lost, particularly for wader species, although potentially for some seabirds, the provision of more sheltered wave conditions may increase this functional provision.

Depending on design, a large area of habitat could be directly excluded from delivering a characteristic foraging function, leading to utilisation of sub-optimal resources and/or increased completion on other sites during both construction and operation, with a further loss from buffer effects and disturbance stimuli e.g. recreation during operational phases.

A reduction in this site function availability could affect mortality rates in over-wintering species and breeding condition for passage birds. Roost site provision may also be an issue depending on design, but it is noted that similar structures can provide additional roost site potential for some species.

Box 4b: Relevant Conservation Objectives (COs) and Potential for AEOI for the Physical Loss of Habitat Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential for plan-level AEOI if same resource is lost or modified, through replicated reduction in function provision for features (prey availability). Potential to affect a number of groups e.g. wintering and migratory birds, some breeding species with AEOI a possibility via carrying capacity modification.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Potential for large scale modification to key habitats and their function (direct spatial loss, modification to assemblage, reduced availability (temporal)). Effects not uniform across all functional groups but clear potential for AEOI.
Range and distribution of each species to be unhindered and maintained	Change in habitat availability (spatial and temporal) may occur at a development/site specific level with AEOI potential.
Control of activities likely to impinge on the sustainability of the population of the feature	May require detailed plan-level consideration of resource and function loss – mode of action is change in habitat and function availability with associated possible AEOI and may necessitate consideration of mitigation measures within and outwith sites.

Potential plan-level issues exist, e.g. loss of key function feature replicated across multiple sites leading to mortality or reduced condition in species (interest features). Whilst development specific measures will be required depending on location, e.g. managed realignment offset, mitigation development may require a plan-level component e.g. strategic provision or mitigation measures and/or compensation.

5.2.5 VISUAL DISTURBANCE

This pressure pathway relates to a range of anthropogenic activities both during construction and once operational. However, for this approach, other forms of disturbance, e.g. noise and vibration have been addressed elsewhere within the NECR213 approach and are not identified as delivering a high impact level on birds, although they will be addressed separately later in this document.

Visual disturbance will include a range of activities during construction (primarily via plant and personnel), and subsequently once operational, will largely be driven by third party (recreational) activity, e.g. walking, along the structure, boating on the lagoon.

The general pathway of effect will be similar for both construction and operational phases. However, the type and severity of the disturbance stimuli will be largely dependent on individual site design and location, e.g. receptor proximity during construction and potential for recreational activity once operational, as well as the receptor assemblage, function and other external factors.

Disturbance has the potential to impact on both foraging and roosting activities and can have an equal or even greater impact potential than direct habitat loss depending on the scale of works and stimuli.

Box 5a: Visual Disturbance Summary of Effects

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CBWB	Coastal Breeders	Has the potential to exclude or restrict foraging usage from the area of construction e.g. within a radius of up to +300m of activity. Depending on species and proximity there may be a direct disturbance to nest sites leading to reduced take-up or desertion e.g. shingle and marsh nesters on the immediate adjacent shore, potentially some cliff nesters.	Has the potential to exclude or restrict foraging usage from the area of construction e.g. within a radius of up to +300m of activity. Depending on species and proximity there may be a direct disturbance to nest sites leading to reduced take-up or desertion e.g. shingle and marsh nesters on the immediate adjacent shore, potentially some cliff nesters. Habituation may reduce impacts once operational.

Box 5a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CnBWB	Non-breeding Coastal Species	Has the potential to exclude or restrict foraging and roost usage from the area of construction e.g. within a radius of up to +300m of activity. Some species more tolerant than others and may habituate, but pressure has the potential to considerably increase the extent of functional habitat loss, with displacement to sub-optimal foraging areas, and increased completion impacting on energy budgets, condition, resilience, and mortality rates. Repeated intermittent disturbance can have a high level of impact by reducing foraging/resting time and increasing time in the air.	Has the potential to exclude or restrict foraging and roost usage from the area of construction e.g. within a radius of up to +300m of activity. Some species more tolerant than others but pressure has the potential to considerably increase the extent of functional habitat loss, with displacement to sub-optimal foraging areas, and increased completion impacting on energy budgets, condition, resilience, and mortality rates. Repeated intermittent disturbance can have a high level of impact by reducing foraging/resting time and increasing time in the air. Potential for manage activity to restrict impact and promote habituation.
SBS	Present in Marine Environment	Has the potential to exclude or restrict foraging and loafing usage from the area of construction. Some species more tolerant than others and may habituate, but pressure has the potential to considerably increase the extent of functional habitat loss, impacting on energy budgets, condition, resilience, and mortality rates. However the coastal positioning of TLE may mitigate the impact on pelagic species other than those that specifically use inshore areas at certain times of the year or life stage e.g. wintering, moults.	Has the potential to exclude or restrict foraging and loafing usage from the area of construction. Some species more tolerant than others and may habituate, but pressure has the potential to considerably increase the extent of functional habitat loss, impacting on energy budgets, condition, resilience, and mortality rates. However the coastal positioning of TLE may mitigate the impact on pelagic species other than those that specifically use inshore areas at certain times of the year or life stage e.g. wintering, moults.
WB&IF	Intertidal/Shallow Water Forager	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss.	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss.

Box 5a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
SF	Shallow Water Column Forager	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss. The zone of impact may be reduced from that of intertidal feeders for some species.	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss. The zone of impact may be reduced from that of intertidal feeders for some species.
WCF	Deep Water Column Forager	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss. The zone of impact may be reduced from that of intertidal feeders for some species.	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss. The zone of impact may be reduced from that of intertidal feeders for some species.
BDF	Seabed Foragers	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss. The zone of impact may be reduced from that of intertidal feeders for some species.	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss. The zone of impact may be reduced from that of intertidal feeders for some species.
HGB	Adjacent Habitat Foragers	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss.	The pathway of effect will be similar to that identified above, with disturbance stimuli increasing the effective zone of functional loss.

This impact pressure pathway has a similar impact level to that of direct habitat loss as it can lead to the exclusion of species from foraging, roosting/resting and breeding areas. Inter-species and inter-stimuli response levels are variable, and can be further influenced by background activity, time of year, function, weather etc. A rule of thumb of an impact radius greater than 300m has been used based on the likely effect level to more disturbance-sensitive species, although this requires site specific application as there will be a range of assemblage, activity and habituation modifiers.

Noise, which is not covered under this pathway, can also have a similar effect range, and it might be expected that above and below water noise would occur during construction and below water at the least, during operation. Precautionary sound pressure levels (dB(A)max) for terrestrial noise have been identified for receptors, although they require local (development specific) context to reflect the local noise climate and receptor sensitivities. IECS research e.g. Cutts et al 2013[12], has identified 70dB(A)max at a receptor to be a suitable threshold of effect, although with caveats that this will vary on a site and season

[12] Cutts, N.D., Hemingway, K.L., & Spencer, J. 2013. Waterbird Disturbance Mitigation Toolkit: Informing Estuarine Planning & Construction Projects. TIDE Project, EU.

specific basis and as such should be used for guidance purposes only. Cutts et al, 2013 also note that for most activities, including many relating to construction and recreation, a visual disturbance cue will have a disturbance effect before a noise effect. Only very loud or sudden noise events from static or hidden sources such as impact pilling and wildfowling have the potential to generate noise levels at source to deliver a sufficient 'dose' at a bird receptor that would elicit a response before a visual cue would kick in. For most activities, visually generated cues will have an effect before an approach distance is sufficient for an associated noise effect to be of sufficient level to create a response.

Habituation to regular disturbance stimuli, both visual and noise related, is documented but the degree of the effect will vary between species, function and stimuli.

The impact effect of disturbance can be similar to that of direct habitat loss, e.g. use of sub-optimal habitat, increased resource completion and corresponding reduction in condition and resilience. However, repeated intermittent disturbance can have a considerable potential impact through repeated flight responses combined with reduced foraging or resting times affecting energy budgets particularly in individuals undertaking migration, and thus requiring ready access to energy sources, but for which habituation will not have time to develop.

Some groups, e.g. some seabirds are more tolerant of disturbance than others, e.g. some waders, and thus the radius of impact will vary depending on the location of the site and the groups interacting with it. For example, auks can be disturbed by boats at a range of several hundred metres but can also tolerate an approach to 10's of metres in some conditions. Divers are especially sensitive to approaching vessels with flight responses often noted more than 1km away and seaducks are also very vulnerable to boat activity (Schwemmer *et al*., 2011).

Box 5b: Relevant Conservation Objectives (COs) and Potential for AEOI for the Visual Disturbance Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Disturbance will have an effect on resource availability as well as energy budgets. Although probably not at a plan level, individual development issue potential may be high with AEOI depending on design and site detail and may affect a range of receptor groups depending on development detail.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Effect pathway will operate partially in the same way as direct habitat loss, with the potential for some areas/habitats to be excluded at least in part from the features and associated AEOI.
Range and distribution of each species to be unhindered and maintained	As above, an effective restriction in habitat availability will restrict feature distribution with AEOI potential on a site specific basis.
Control of activities likely to impinge on the sustainability of the population of the feature	A range of potential activities will impinge on the features via 'disturbance' both during construction and operation. These will be largely additive to the existing activity pressures identified within the COs for the site but with

mitigation potential available.

A suite of potential mitigation measures are available for the reduction in disturbance (visual and noise) impacts to bird species. These will depend on a range of variables including type of stimuli and receptors, and as such will be development specific.

5.2.6 WAVE EXPOSURE CHANGE

This pressure pathway was identified as having a potential impact on birds for the tidal power generation activity, and will arise from modification to wind power and fetch. The effect of the pressure for tidal generation would be expected to be a reduction in wave height within the lagoon and this will have an effect on bed and beach sediment particle size and profile. In turn, this would alter the substratum and the associated community structure and/or cliff communities. Further external modifications to the wave climate might be expected in adjacent coastal areas, depending on lagoon design, and would have a similar effect on bed conditions. There is the possibility that multiple in-series TLE developments would have a wider spatial influence, although given their probable coastal distribution, this effect would more likely generate a duplication of effect along a coastal area rather than a multiplication of effect within a system.

Box 6a: Wave Exposure Change Summary of Effects

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
CBWB	Coastal Breeders	Small-scale spatial alterations to wave climate (shelter) might create beneficial conditions for foraging. Impact level small however.	Alterations to wave climate (shelter) might create beneficial conditions for foraging. Impact level small spatial scale however.
CnBWB	Non-breeding Coastal Species	Small-scale spatial change to intertidal and nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability.	Change to intertidal and nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability.
SBS	Present in Marine Environment	Very small potential for measurable alteration given coastal location of the development and largely pelagic nature of species in the group.	Small potential for measurable alteration given coastal location of the development and largely pelagic nature of species in the group. Potential additional shelter within the lagoon may provide useful habitat during storm events.
WB&IF	Intertidal/Shallow Water Forager	Small-scale change to intertidal and nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability.	Change to intertidal and nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability.
SF	Shallow Water Column Forager	Very small potential for measurable alteration in foraging potential.	Alteration to nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability is possible.
WCF	Deep Water Column Forager	Negligible potential for measurable alteration in foraging potential.	Negligible potential for measurable alteration in foraging potential.

Box 6a Cont.

Short-form	Descriptor	Construction Effect on Feature	Operational Effect on Feature
BDF	Seabed Foragers	Water (dive) depth will reduce any potential impact effect to negligible, except for species using the infralittoral zone.	Water (dive) depth will reduce any potential impact effect to negligible, except for species using the infralittoral zone.
HGB	Adjacent Habitat Foragers	Small-scale change to intertidal and nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability.	Small-scale change to intertidal and nearshore bed habitat arising from changes in wave climate will vary. Associated alteration to prey type and availability.

Changes in wave climate would be expected to largely take the form of a reduction in height and energy, given the likely reduction in fetch. This might have an influence on the shore and nearshore substratum and beach profile, which in turn may influence the benthic community and thus prey availability. This change in substratum may entail remedial measures such as dredging e.g. to maintain a navigation channel in adjacent local areas.

As such, some effects would be covered under other pathways, and directly would be relatively low level in the context of other potential impacts.

There would also be a corresponding localised increase in wave action (energy) on the walls of the structure. This would largely be for the outer wall where a greater fetch would be expected, but could also occur against the inner wall depending on wave climate on occasion. Such increased wave attack would have a localised impact e.g. potentially resulting in bed scour, but it is assumed that the majority of wave energy would be absorbed within the hard substratum of the bund structure itself, depending on design, and thus any impacts would be localised. Corresponding bed and invertebrate conditions are difficult to predict at this scale, and the corresponding effects on bird provisions therefore difficult assess. It is considered that any bird related issues would be very localised.

There would however remain some potential for functional alteration, e.g. loss of nearshore reef communities or reduced scour of wave-cut platforms. Similarly, such changes in wave energy could deliver habitats that provide additional function for birds and as such, the impact action and severity of this pressure pathway on bird interest features will have a strong site/development specific component.

Box 6b: Relevant Conservation Objectives (COs) and Potential for AEOI for the wave Exposure Change Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	A potential AEOI although probably development specific and low with certain species more susceptible.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	A potential AEOI although probably development specific and low with certain species more susceptible.
Range and distribution of each species to be unhindered and maintained	A potential AEOI although probably development specific and low with certain species more susceptible.
Control of activities likely to impinge on the sustainability of the population of the feature	Low AEOI via this pathway

Impact levels and pathway of action may mean mitigation is unnecessary/ineffective. Potential for design to influence this if necessary.

5.2.7 OTHER IMPORTANT PATHWAYS OF EFFECT

In addition to the main effects pathways described above (scoring as high in terms of species sensitivity for most functional groups), a series of additional medium impact pathways were identified (including some species of high sensitivity and some with insufficient evidence) that relate to both the construction and operation phases of TLE generation.

Some of these pressure pathways are potentially very important in the consideration of impact to Interest Features (birds), although given the nascent technology, some areas of impact may not be fully characterised (hence the category insufficient evidence). However, surrogate response information and/or knowledge of other associated ecosystem responses can be used to describe the potential effects to Interest Feature receptors, at least at a high level.

Changes in Suspended Solids

Modification to the current and wave regime within and around tidal power lagoon installations will have an impact on suspended solid (sediment) loadings, primarily with a reduction in hydrological energy leading to settlement out (clarification), but also with areas of high energy potentially increasing suspension (obscuration). Effects would occur both during construction and operation. Further potential for increased suspended solid (organic) loads may occur, e.g. from changes to a range of water quality parameters and potentially aspects of blooms.

The main direct effect pathway would be through changes in water clarity, and this would primarily impact diving birds, e.g. plunge divers which would visually identify prey from the surface or air, pursuit divers which will use visual cues whilst hunting in the subtidal and some demersal feeders. However, some surficial feeders will also use visual cues for foraging.

As such, a number of the functional groupings identified in Table 4 would have the potential to be affected with the effect pathway primarily relating to a reduction in foraging efficiency. This could have effects on breeding success, condition, resilience and mortality rates for different species and life stages.

Box 7: Relevant Conservation Objectives (Cos) and Potential for AEOI for the Changes in Suspended Solids Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential reduction to foraging efficacy in diving birds may influence function delivery and delivers a potential AEOI at least at a development specific level.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Not directly affected although associated sediment settlement issues may introduce AEOI (below)
Range and distribution of each species to be unhindered and maintained	Potential impact to foraging potential may exclude areas from function delivery and thus species distribution.

Control of activities likely to impinge on the sustainability of the population of the feature	As above with potential to have an effect on function and thus species.

Mitigation measures may be possible, although components of change to the hydraulics will constrain applicability, e.g. use of bubble screens.

Emergence Regime Changes, Including Tidal Level

This pressure primarily relates to water level changes reducing the availability of intertidal habitat either through tidal impoundment and retardation or changes to shore elevation, effectively reducing the spatial and temporal exposure of intertidal habitat. The impact pathway for birds would therefore mostly relate to operational phases of tidal lagoon power generation, although construction activity may physically effect the emergence regime as well.

Functional groups most impacted would be those using the intertidal zone for foraging and roosting, and in particular migratory and overwintering wildfowl and waders (CnBWB). The reduction in habitat resource (both spatial and temporal) will have the potential to affect species in terms of meeting their calorific intake requirements creating sub-optimal foraging areas with attendant reduction in carrying capacity and displacement issues.

Furthermore, a modification to emergence regime may also directly modify the suitability of the benthic invertebrate community for exploitation by several functional groups of bird Interest Features.

In addition, changes in emergence regime and associated dependent habitats may impact on fish utilisation of a resource and as such, affect a number of plunge and pursuit diving species.

Box 8: Relevant Conservation Objectives (COs) and Potential for AEOI for the Emergence Regime Changes Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Effective loss of spatial and/or temporal foraging and roosting resource will require development specific AEOI consideration, and as the effect is likely to be replicated across most sites, would have a plan-level potential influence with functional loss an effective reduction in carrying capacity which would be delivered to a range of interest feature species.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	The pathway of the effect has the ability to directly influence supporting habitat in terms of function delivery and is applicable at development and plan levels in terms of AEOI potential.
Range and distribution of each species to be unhindered and maintained	Potential to directly and indirectly constrain the distribution of interest features within individual sites through modification to inundation patterns and effects on associated habitats. Given the mobile nature of some species e.g. migratory

	flyways, then a wider plan level AEOI potential.
Control of activities likely to impinge on the sustainability of the population of the feature	Modification to functional delivery will potentially affect population sustainability at several scales.

There is also a potential for increased subtidal habitat to deliver some functional benefits, but in general, the dis benefits of intertidal habitat loss would be considered to be far greater than any habitat gain offset. However, these issues as well as wider components relating to tidal flushing in estuaries and embayments require focus and modelling (hydrological and ecological effects) within any site specific HRA process.

Clearly, this is a potentially important pathway of effect for bird Interest Features at both a site specific level and potentially plan-scale. Changes to inundation patterns will be required at a project specific level and then impacts and mitigation measures applied. At a plan level, an assumption of reduced foraging (and roost/rest) potential is expected and this will have likely detrimental impacts to migratory and over wintering species in terms carrying capacity and energy budgets with a potential AEOI for a range of sites along such routes.

Whilst some mitigation measures may be possible, e.g. management zonation to maximise habitat delivery through exclusion of anthropogenic disturbance, more significant impacts and mitigation measures should not be discounted to address AEOI including provision of alternative habitat (and delivery of function replacement).

Smothering and Siltation Rate

These aspects are associated primarily with modifications to the hydrological regime and wave climate and simplistically for tidal lagoons might be expected to vary across the site with areas of low hydrological and wave energy subject to siltation and higher flow a degree of scour. Anthropogenic activities such as dredging can also lead to modifications to the siltation rate with high overburden levels occurring over a short period of time.

There may also be further modification to these components outwith any lagoon development, with disruption to hydrological processes and changes to wave climate affecting patterns of accretion and erosion.

However, sedimentation rates can naturally vary substantially in the marine and estuarine environment, and benthic and pelagic communities have developed to accommodate this where such conditions occur. As such, many communities can tolerate small short-term increases in sedimentation, where the communities are dominated by errant species. More sedentary species, as well as colonising ones are less able to tolerate such rates and can be smothered, for instance biogenic reefs.

Changes in sediment deposition will have the potential to affect both the intertidal and subtidal habitats, and as such, most functional groups of birds through changes to benthic communities and any associated fish communities. This could therefore lead to a reduction or change in foraging potential for coastal birds on passage or overwintering, as well as for some diving species either directly, e.g. subtidal benthic feeders such as Scoter spp. or indirectly to plunge and pursuit divers in relation to fish availability.

A reduction in foraging potential (carrying capacity) will have a range of impacts including reduction in numbers of interest features, loss of physical condition, increased competition interactions and displacement and over utilisation in over adjacent sites.

Box 9: Relevant Conservation Objectives (COs) and Potential for AEOI for the Smothering and Siltation Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential to affect habitat and thus associated assemblage and function delivery to Interest Features. Potential then to lead to a reduction in population size and an AEOI on a site specific level. Potential depending on actions for this to be applicable to plan level.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Potential to change habitat type and thus an effective habitat loss for some receptor features. AEOI at a development level could occur and depending on habitat distribution and severity of the mode of action this could be at a plan level.
Range and distribution of each species to be unhindered and maintained	Change in habitat parameters can effect species distribution at a development level, and if replicated up-scale, might have a plan level AEOI which would need consideration.
Control of activities likely to impinge on the sustainability of the population of the feature	Change in sediment conditions a documented potential effector of habitat and function change

Development specific and potentially plan level AEOI mitigation measures can be applied relating to the maintenance of hydrological processes, although focus, detail and efficacy would need to be determined at the least at an individual project level.

Underwater Noise

Underwater (and terrestrial) noise as an impact pressure to bird receptors is a developing area of study, with insufficient evidence of effect currently available. There is the potential direct physical damage, as well as indirect impacts through disturbance/avoidance reducing foraging activity. In addition, underwater noise has the potential to affect use by prey items including fish.

Impacts could occur during construction, e.g. piling, but also during operation from turbine function including cavitation. Effected receptor groups would be those that forage underwater, e.g. plunge and pursuit divers as well as subtidal benthic feeders.

Mitigation measures are possible but are not well understood (nor the process and level of effect). Depending on development detail AEOI would be development specific, although with a degree of industry level issues that could be applied at plan level.

Box 10: Relevant Conservation Objectives (COs) and Potential for AEOI for the Underwater Noise Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Potential for action on some functional groups (diving birds) with some reduction possible in habitat area. Effects not well understood, but a potential AEOI which would be at a plan level.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Possible effect on prey may reduce carrying capacity. Potential small scale localised AEOI.
Range and distribution of each species to be unhindered and maintained	Disturbance may constrain foraging activity in some species, with associated AEOI potential at a site level at least.
Control of activities likely to impinge on the sustainability of the population of the feature	Disturbance an identified issue which would increase. Effects are not well defined, so uncertainties present.

Terrestrial Noise

Although not identified explicitly within the NECR213 effect pathway pressure criteria, it is considered that terrestrial noise as a form of disturbance stimuli to birds is an issue requiring consideration within the plan-level HRA for TLE generation.

As described earlier in text (see Visual Disturbance), airborne (terrestrial) noise has the potential to affect bird usage and can entail an effective loss of habitat through disturbance response exclusion, with associated impacts for energy budgets through reduced foraging and roosting area availability, as well as an increase in energy usage through flight responses.

Precautionary sound pressure levels (dB(A)max) for terrestrial noise have been identified for receptors e.g. Cutts et al 2013 identified 70dB(A)max at a receptor to be a suitable threshold of effect. However, the response levels will vary per site based on assemblage and activity as well as external values including background noise and season. Furthermore, the typology of noise will affect responses e.g. sudden noise event at around the threshold of response will elicit a greater potential impact response than ongoing noise at the same level reflecting habituation.

Cutts et al, 2013 also noted that for most activities, including many relating to construction and recreation, a visual disturbance cue will have a disturbance effect before a noise effect. Only loud events from static or hidden activities will usually have the potential to deliver a sufficient 'dose' at a bird receptor that would elicit a response before a visual cue would kick in. For most activities, visually generated cues will have an effect before an approach distance is sufficient for an associated noise effect to be of sufficient level to create a response e.g. at the precautionary visual disturbance radius of 300m, a noise value of c. 120dB(A) at around 1m from source would be needed to deliver a 70dB(A) dose at the receptor. The majority of mobile plant operate with noise outputs of below these levels.

As such, terrestrial noise disturbance is considered to be a potentially important pathway of effect on birds in relation to TLE, predominantly resulting from construction operations. However these effects would be site specific and localised and unlikely to generate AEOI.

Water Flow (Tidal Current) Changes, Including Sediment Transport

The pathway of this pressure effect is largely related to modification to the hydrological regime, and is thus linked (often a driver) to other pressures described above. There is the potential for there to be both increased and reduced flow effects within the lagoon development both during construction (as a barrier to natural tidal streams and water movement), and during operation (as an enclosed water body with reduced rates, and with modified flows through the generation sections leading to increased and decreased flow velocities).

Changes in these rates will modify the *in situ* biota through changes to the substratum (e.g. reduced energy environments). This will influence foraging potential for some species including potentially waterbirds using the intertidal zone and subtidal benthic feeders.

There is also the potential for a tidal lagoon development to have a substantial effect on adjacent water flows, modifying currents and sediment transport for considerable distance around the development. Primarily, this might be seen in the form of disruption and modification to sediment transport pathways including areas of deposition and potentially starvation. These could be large scale changes affecting both the subtidal and intertidal substratum of large areas, and influence associated biological communities.

Such large scale effects cannot be identified at this high-level, but have the potential to effect site integrity and will require detailed consideration at a site level HRA.

Box 11: Relevant Conservation Objectives (COs) and Potential for AEOI for the Water Flow Changes Pressure

Potentially Effected COs	AEOI
Stable or increasing population size of each feature	Similar pathway of effect to some others with a potential to deliver AEOI through habitat change within site. However also the potential to affect habitat outwith a development and increase the scale and severity of effect. Plan-level AEOI is therefore a possibility effecting sites along migratory routes.
Extent of supporting habitats within the site to be stable or increasing (function delivery)	Pathway directly acts on this CO, and has the potential to affect within site delivery as well as at a wider level, with a potential AEOI at both development and plan level.
Range and distribution of each species to be unhindered and maintained	Changes to dynamics will have the potential to influence habitat distribution and thus functional delivery, with associated constraints on feature distribution. Clear potential AEOI which has a plan level potential.
Control of activities likely to impinge on the sustainability of the population of the feature	Modifications to hydrological patterns identified as an activity of influence via habitat change.

Development specific and potentially plan level AEOI mitigation measures can be applied relating to the maintenance of hydrological processes, although focus, detail and efficacy would need to be determined at the least at an individual project level. Potential depending on outcomes for replacement function (habitat) provision to be required.

5.3 Interest Feature and Site Specific Effects

A summary of the likely sensitivity of individual Interest Feature species for each screened in site is provided in tabular form in Appendix 1.

This assessment is by necessity high-level using general impact criteria described above, as well as where applicable, the application of expert opinion to address individual sites or species that have immediately identifiable issue(s).

5.4 In-combination Effects

A list of plans or projects that have the potential to require consideration of in-combination effects with the WNMP TLP have been provided by the Welsh Government. These projects are listed in Table 9 below.

Table 9: Plans or Projects Provided for In-combination Consideration (Source Welsh Government).

Project	Stage at March 2015 with NSIP update 07/17	Description
Tidal Lagoon Swansea Bay Development	Consent decision stage	A proposed tidal lagoon in the vicinity of the Bristol Channel, which may share receptors linked to far field effects.
The West Somerset Tidal Lagoon	Pre-application stage for Development Consent	A proposed tidal lagoon in relatively close proximity in the Severn Estuary. Environmental receptors may be shared in the dynamic environment of the estuary.
Hinkley Point C New Nuclear Power Station	Development Consent granted	A nuclear energy generating station. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Oldbury New Nuclear Power Station	Pre-application stage for Development Consent	A nuclear energy generating station. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Hinkley Point Connection	Development Consent examination stage	A grid connection. The scheme will be a linear scheme with an impact on the landscape near the estuary.
M4 corridor around Newport	Pre-application consultation	The proposed relief road would be constructed inland of the impounded foreshore. The scheme will be a linear scheme with an impact on the landscape.
Seabank 3 CCGT	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.

Table 9 Cont.

Project	Stage at March 2015 with NSIP update 07/17	Description
Avon Power Station	Pre-application stage for Development Consent	A gas fired energy generation proposed near the mouth of the River Avon. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
BBC Headquarters Cardiff	Planning applications have been submitted to the Local Authority and commencement of construction is due for 2018.	Relocation of BBC Wales Headquarters to be a major project in Cardiff City Centre. Construction impacts may be shared in terms of impacts on the local highway network as Tidal Lagoon Cardiff and this scheme would be constructed concurrently.
Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	Consent secured. Installation in 2015 - project in abeyance?	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	An EIA has not yet been completed; However construction is planned to commence in 2017 following the decommissioning of the Ramsey Sound installation.	An array of tidal stream devices. The proposal has interactions with the Severn estuary and may share receptors linked to far field effects.
Bristol Port Deep Sea Container Terminal (DSCT) at Avonmouth Dock	Consent secured	The Bristol Port Company is planning to build a £600m Deep Sea Container Terminal (DSCT) at Avonmouth Dock. The DSCT will handle large container vessels and next-generation ultra large container ships with a draught of up to 16 m and a capacity in excess of 150,000 DWT
Tabb's Gout and Portland Grounds Sea Defence	Construction anticipated but unknown	Improvements Raising of sea defences on the Severn Estuary coastline between ST248787 and ST254790 and ST438848 and ST453857 respectively, in line with the 'Hold the Line' policies for the second Severn Estuary Shoreline Management Plan (SMP2) and the draft Severn Estuary Flood Risk Management Strategy.
Wylfa Newdydd Nuclear Power Station	Pre-application with PINS (Application expected Autumn 2017)	Proposed new nuclear power station, located adjacent to existing station at Wylfa A, on the Isle of Anglesey.

Table 9 Cont.

Project	Stage at March 2015 with NSIP update 07/17	Description
Tidal Lagoon Newport	Pre-application with PINS (Application expected 2017-2018)	Tidal lagoon electricity generating station with a potential generating capacity of 1800MW up to a possible 2800 MW. A seawall attached to the foreshore, at its western extent approximately 1km to the mouth of the River Usk, and at its eastern extent to the foreshore in the area of Baldwin Sands. The furthest offshore extent is up to 8km from the foreshore towards the centre of the Severn Estuary.
Tidal Lagoon Cardiff	Pre-application with PINS (Application expected 2017)	Tidal lagoon electricity generating station with a potential generating capacity of 1800MW up to a possible 2800 MW. A seawall attached to the foreshore, at its western extent approximately 2 km from the entrance to Cardiff Bay, and at its eastern extent approximately 2km from the mouth of the River Usk. The furthest offshore extent is approximately 8km from the foreshore to the centre of the Severn Estuary.
North Wales Connection – National Grid	Pre-application with PINS (Application expected October 2017)	Proposed 400kV electricity transmission reinforcements in North Wales to connect planned new nuclear electricity generation on Anglesey and Irish Sea offshore wind

Given the current absence of design detail requirements for the above, a detailed assessment of potential in-combination effects cannot be undertaken at this stage, and indeed, given the high level nature of this review, is not appropriate. In particular, whilst the project and plan list is relevant for developments located in Wales, there are no corresponding data available for adjacent countries, e.g. England, Northern Ireland, Eire and France, which for completeness would require consideration given the potential ZoI for some aspects of the Interest Features (e.g. foraging seabirds, migratory wildfowl and waders).

However, some basic pathways of effect can be suggested arising from these works (construction and operation) based around the main Conservation Objectives for the Interest Features under review (Table 10). It is emphasised that these potential in-combination effects are high level and thus should be treated as indicative only, based on an incomplete evidence base and project/plan detail and timings.

Table 10: Potential Areas of In-combination Impacts. Note: Bold **X**s indicate a near certain and potentially important in-combination impact potential. Lower case xs indicate a likely but less important in-combination effect, whilst ?s indicate a potential in-combination interaction but the likelihood and severity cannot be ascertained at this level of analysis with any certainty.

Project	Population Size	Supporting Habitat	Species Distribution	Activity Control	Comment
Tidal Lagoon Swansea Bay Development	**X**	**X**	**X**	**X**	Development impact typology effectively the same as for this plan-level review, and as such there will be considerable in-combination impacts
The West Somerset Tidal Lagoon	**X**	**X**	**X**	**X**	Development impact typology effectively the same as for this plan-level review, and as such there will be considerable in-combination impacts
Hinkley Point C New Nuclear Power Station	**X**	**X**	**X**	x	Components of the build and operation will be similar to those of tidal lagoon power although potentially at a smaller scale. Depending on design, potential for direct and indirect habitat loss and associated impacts to carrying capacity and Interest Feature status, potential for reduction in prey availability also affecting this. Localised changes to flow regimes and water quality (e.g. temperature loadings). Unlikely to present a barrier to movement. Disturbance potential primarily during construction
Oldbury New Nuclear Power Station	**X**	**X**	**X**	x	Components of the build and operation will be similar to those of tidal lagoon power although potentially at a smaller scale. Depending on design, potential for direct and indirect habitat loss and associated impacts to carrying capacity and Interest Feature status, potential for reduction in prey availability also affecting this. Localised changes to flow regimes and water quality (e.g. temperature loadings). Unlikely to present a barrier to movement. Disturbance potential primarily during construction
Hinkley Point Connection	?	?	?	?	Range of potential issues including habitat loss/change, disturbance, water quality and hydrological change, but generally small in scale
M4 corridor around Newport	?	?	?	?	Range of potential issues including habitat loss/change, disturbance, water quality and hydrological change, but generally small in scale
Seabank 3 CCGT	x	x	x	x	Components of the build and operation will be similar but smaller scale to those for nuclear coastal stations. Issues potentially focussed around disturbance and changes to water parameters in the Severn
Avon Power Station	x	x	x	x	Components of the build and operation will be similar but smaller scale to those for nuclear coastal stations. Issues potentially focussed around disturbance and changes to water parameters in the Severn

Table 10 Cont.

Project	Population Size	Supporting Habitat	Species Distribution	Activity Control	Comment
BBC Headquarters Cardiff	?	?	?	?	In-combination effects expected to be of low potential
Tidal Energy Ltd Deltastream Installation, Ramsey Sound, Pembrokeshire.	**X**	**X**	**X**	x	Some components similar to TLE e.g. general construction related impacts and operational alteration to hydrological regime and associated parameters including changes to habitat and prey availability. Potential collision risk
Tidal Energy Ltd, Deltastream Demonstration Array, St David's Head, Pembrokeshire.	**X**	**X**	**X**	x	Some components similar to TLE e.g. general construction related impacts and operational alteration to hydrological regime and associated parameters including changes to habitat and prey availability. Potential collision risk
Bristol Port Deep Sea Container Terminal (DSCT) at Avonmouth Dock	x	x	x	x	Potentially similar construction related impacts as well as operational habitat loss,
Tabb's Gout and Portland Grounds Sea Defence	x	x	x	x	Potential localised construction issues e.g. habitat loss and disturbance. Operational potential small direct/indirect habitat loss with associated issues in capacity.
Wylfa Newdydd Nuclear Power Station	X	X	X	x	Components of the build and operation will be similar to those of tidal lagoon power although potentially at a smaller scale. Depending on design, potential for direct and indirect habitat loss and associated impacts to carrying capacity and Interest Feature status, potential for reduction in prey availability also affecting this. Localised changes to flow regimes and water quality (e.g. temperature loadings). Unlikely to present a barrier to movement. Disturbance potential primarily during construction
Tidal Lagoon Newport	**X**	**X**	**X**	x	Development impact typology effectively the same as for this plan-level review, and as such there will be considerable in-combination impacts
Tidal Lagoon Cardiff	**X**	**X**	**X**	x	Development impact typology effectively the same as for this plan-level review, and as such there will be considerable in-combination impacts
North Wales Connection – National Grid	?	?	?	?	Range of potential issues relating to the Menai crossing options including habitat loss/change, disturbance, water quality and hydrological change.

It is emphasised that the information in Table 10 is only indicative, however there are some

clear areas of in-combination effect potential in relation to bird interest features. These are obviously present for other tidal energy schemes, but also arise from other large coastal infrastructure schemers, e.g. power station construction and operation, as they will generate activities which fit within the main pressure pathways discussed earlier in text, and thus affect the same Interest Features in a similar method of action.

These pressure impacts will include habitat loss or modification resulting in reduced carrying capacity, changes in hydrodynamics and water quality parameters, affecting habitat and thus carrying capacity, disturbance effecting energy budgets. There are potential additional additive effects from other, differing developing types, but at this scale of review, these are considered relatively small in scale and effect.

It is emphasised, that no data on developments in neighbouring countries have been included in this high level appraisal.

6. APPLICATION OF MITIGATION MEASURES AND AEOI DETERMINATION

6.1 Generic Mitigation Measures

The following Table 11, provides a high level overview of some potential mitigation measures. However, these will need to be addressed on a development specific basis.

In particular, mitigation measures will need to address individual species (Interest Feature) needs, for instance differing species will require different prey item provision, and site specific impacts may identify one or more feature requiring specific foraging mitigation. As such, whilst this may be delivered through the provision of new or modified habitat, the detail of how parameters relating to this habitat are delivered will depend on the desired prey assemblage, e.g. bivalves, polychaetes, seagrass, fish, intertidal or terrestrial invertebrates etc.

Table 11: Potential Mitigation Measures and Efficacy

Impact Pathway	Potential Mitigation Measures
Barrier to Movement	Severity of impacts and required mitigation will depend on aspects of design and location. May require new habitat for staging provision offset and/or alternative habitat delivery.
Collison Below Water	Could occur at an industry & project site scale depending on location and assemblage/function. Potential measures to reduce this would include deterrents, but this will depend on site/species potential (e.g. presence/absence of sensitive receptors) and will also have an impact (direct mortality reduction but habitat function loss).
Habitat Structure Change	This may be development/site specific depending on design, assemblage and distribution. Mitigation might be provided through timing and restriction of operations and/or alternative management of available habitat.
Physical Loss of Habitat	Potentially this will require strategic provision either as mitigation or compensation. Some functional offset may be possible by exclusion of existing constraints on delivery but these will be only partially able to offset impacts.
Visual Disturbance	A suite of potential mitigation measures are available for the reduction in disturbance (visual and noise) impacts to bird species. These will depend on a range of variables including type of stimuli and receptors, and as such will be development specific but for construction may relate to works timings and standard screening etc., and for operation, to restriction or

	zoning of activities e.g. types of recreation.
Wave Exposure Change	Impact levels and pathway of action may mean mitigation is unnecessary/ineffective, although there is the potential for project design to minimise this.
Changes in Suspended Solids	Level of effect is uncertain and will be site/receptor specific. Measures to influence hydrological change may be limited given the requirements for power generation, However the extent of change might be constrained, e.g. through the use of partial barriers such as bubble screens.
Emergence Regime Changes, Including Tidal Level	Whilst some mitigation measures may be possible e.g. management zonation to maximise habitat delivery through exclusion of anthropogenic disturbance, the need for more significant mitigation measures should not be discounted to address AEOI including provision of alternative habitat (and delivery of function replacement).
Smothering and Siltation Rate	Mitigation measures can be applied relating to the maintenance of hydrological processes during the design stages, although focus, detail and efficacy would need to be determined at an individual project level.
Underwater Noise	Mitigation measures are possible but are not well understood (nor the process and level of effect). This may require a degree of industry level research focus that could be applied at both plan and site level.
Water Flow (Tidal Current) Changes, Including Sediment Transport	Mitigation measures can be applied relating to the maintenance of hydrological processes during the design phases, although focus, detail and efficacy would need to be determined at the least at an individual project level. Individual site level influence could be considerable outwith the direct footprint of the development site, and as such relatively large scale offset function (habitat) provision may be required. This may be difficult to meet without the provision of new habitat and associated function and will required detailed planning both at plan and site level.

6.2 Determination of Likely Significant Effect from the Severn Tidal Power SEA and Potential for Compensatory Measures

As part of the feasibility and planning considerations for the Severn Tidal Power (STP) scheme, various environmental impact aspects were investigated in detail at a strategic (SEA) scale, including the effects of the scheme on waterbirds (e.g. DECC, 2010c[13]).

This study undertook detailed analysis, including modelling, of a number of the pressure pathways described earlier in text and whilst the results are not described in detail here, concluded for relevant pathways:

Hydrodynamics, Sediment and Nutrients

A likely reduction in suspended sediment through reduced energy and an increase in mud within the sediment. Associated increases in biodiversity but a an increased risk of eutrophication. Potential scour reduction with associated increases for shingle and rocky shore habitats and seaweed. Potential loss of *Sabellaria* reef.

Benthic Habitat and Communities

Whilst there is a potential for increases in sand and shingle habitat, these outweighed by intertidal habitat loss. With significant negative effects on marine ecology and waterbird receptors. Additional issues resulting from maintenance dredging. Some evidence to suggest more muddy conditions may improve productivity, although with an altered assemblage.

Waterbirds

Loss of area and quality of intertidal habitat would have a negative effect on the waterbird species of the Severn SPA with redistribution of usage and additional impacts through increased competition elsewhere. Modelling of population effects indicated that for some species densities may actually increase due to increased productivity in the mudflat generating greater prey potential. However these positive changes were considerably offset by effective reductions in functional availability resulting from direct habitat loss and loss through changes to the intertidal exposure period. The results of the modelling identified substantial reductions in the populations of a range of waterbird species, with the Habitat Association model indicating large percentage reductions in most duck and wader species and with slightly lower reductions for the Individual Based models.

In-combination effects

A general lack of knowledge and uncertainty in terms of multiple project operational effects on biodiversity attributes. For waterbirds, the main uncertainties focused around the potential for increased mud content in the substratum and associated community changes in response to this, including alterations to productivity and thus utilisation by waterbird species.

13 DECC, 2010c. Severn Tidal Power – SEA Environmental Report. Parsons Brinckerhoff Ltd.

Measures to Prevent or Reduce LSE

A series of recommendation to reduce environmental impacts were identified including for waterbirds:

- Sluicing after the generation period combined with early commencement of turbine generation in ebb mode only.
- Topographic modification (creation of intertidal area)
- Seawater level management – pumping at high water
- Use of construction materials to enhance colonisation
- Minor alignments adjustment to avoid specific features e.g. reduction in disturbance to breeding seabirds and reduce sedimentation.
- Construction timing

None of the above measures are considered to have the potential to substantially offset the potential functional losses for waterbirds, and this is backed up by figures in the SEA report indicate that their application would reduce the physical loss of habitat by less than 10%.

The report goes on to consider offsetting measures in relation to compensation requirements outwith those of the EC Habitats Directive. Of these that are of main relevance to birds are the potential for habitat creation and ecological enhancement, as well as changes to dredging and aggregate extraction licences.

Within the Severn area a range of options for habitat creation have been examined and have been calculated as delivering up to 7000ha when like-for like habitat considerations are excluded. However, given known constraints on function delivery from such schemes and a usual requirement to provide increased area for compensation to that lost, this provision would not appear to be sufficient.

Habitat compensation requirements are covered in further detail in DECC, 2010d[14]. This report identifies the likely unprecedented effects that the STP scheme would have on the Severn estuary, including intertidal habitats and associated bird communities and draws together a series of measures, both established and novel, to address these impacts.

Within the toolbox of measures, the report identifies a number of untried or uncertain tools, and high levels of knowledge gaps in their behaviour. Most substantially, the loss of hyper-tidal conditions could not be directly addressed with associated issues for site condition and coherence. Managed realignment could be used for largescale habitat offset, although not necessarily delivering like for like habitats with associated issues for waterbird community condition. One of the main challenges for the Severn, and other estuaries with similarly high suspended sediment loads would be for managed realignment sites to deliver sustainable mudflat rather than mudflat developing into saltmarsh, although methods such as Regulated Tidal Exchange may assist in this process.

Ultimately, the options reviewed for the STP included delivery of compensatory habitat outwith the boundaries of the Severn. However, such a strategy requires considerable strategic planning and trans-national agreement, and even if the necessary compensatory

14 DECC, 2010. Severn Tidal Power Report on Possible Compensatory Measures under Article 6(4) Habitats Directive.

area and function potential can be delivered, there remain issues regarding utilisation by flyway populations that are very difficult to conclude in advance of implementation. Following a precautionary approach would suggest that an ongoing significant effect on site(s) integrity cannot be discounted.

The STP report on habitat compensation requirements concluded that whilst compensation for habitat loss was not impossible to achieve for the scheme, to undertake such a process would require 'unprecedented measures including some measures which rely on an interpretation of the requirements of the directive that varies from the Commission's interpretation in its guidance'.

6.3 Conclusions of Compensation Efficacy

For the TLP, it is possible to identify a series of potential scales of impact and compensatory response:

- Site Specific
- Regional
- Flyway

On a site specific scale it is possible that compensation requirements would be met, in that any one scheme is unlikely to generate direct or indirect losses of function for the Interest Features that cannot be compensated for given sufficient funding and planning will.

For the WNMP it might be argued that there are two regional TLE clusters, one covering the south wales coast, and another on the north Wales coast. The bird assemblage impact issues associated with these two locations are slightly dissimilar at a site specific and individual species level e.g. differing assemblage composition, and include some differing habitat types and associated physical drivers. However, when considered at a plan-level, they effectively face the same impact pathways and assemblage responses.

At a regional scale, however, there are some considerable issues either as part of a site specific in-combination consideration, or at an SEA scale. This was borne out by the STP study, where the ability to adequately address compensation requirements was considered only possible with both the use of novel measures with uncertainty of delivery, and a shift in EC Directive interpretation. The latter may be possible over coming years as the UK resets its national legislation.

Based on the above, although at a site specific level compensation issues might be addressed, it is considered that there are substantial impediments to drawing any other conclusion that a TLP will have considerable potential impacts on waterbird communities both around the Welsh coast and in European sites in adjacent countries, and that these impacts cannot be adequately compensated for with any degree of surety or without modification to the existing interpretation of the Directive.

These effects would be occurring both on a site specific in-combination basis and at a regional level via the same route. However, they would also have a trans-national flyway effect. Whilst compensation provision might be best applied at this level, the complexities and uncertainties in delivering such a process make this unlikely to occur.

6.4 Determination of Adverse Effect on Integrity

Based on the above, it is considered likely that there is the potential for Adverse Effect on Integrity to occur for one or more Interest Features and one or more European/Ramsar Sites from tidal lagoon energy projects either individually or in-combination resulting from the TLP.

Certainly there is, at this plan-level review scale, insufficient certainty to discount the possibility of AEOI at an individual project level, and it would seem appropriate to concur that for bird Interest Features, the consideration of a policy promoting this technology has the potential to generate a number of potential impacts to Interest Features which, even following the application of mitigation measures, would be have an AEOI, or at least retain sufficient uncertainty to conclude that AEOI cannot be discounted.

7. RESIDUAL IMPACTS AND IROPI (ARTICLE 6(4))

7.1 Identification of Potential Compensation Requirements

At this scale of review, it is very difficult to accurately determine the type, scale and certainty of any residual impacts, other than to draw some high level conclusions.

Based on the assessment in Table 11 and earlier in text, there are clearly a series of potential impacts that arise at a development scale for many Interest Features and via a series of pressure pathways. These impacts will require the determination of mitigation measures and residual impacts via the individual HRAs for each development.

Such an approach is not novel and it might be expected that for all or most potential schemes, a package of mitigation could be developed and deployed to a level of surety sufficient to meet planning requirements.

However, there are several impact pathways that are considered to have a mitigation requirement that in some development scenarios may not adequately address, either individually or in-combination, the identified impact(s) on site integrity, with a potential AEOIs even following the application of basic mitigation.

In these cases, Article 6(4) of the EC Habitats Directive has procedures identified for the approval of plans or projects where an AEOI cannot be discounted, or is expected. In these instances, a plan or project can only be adopted where it can be demonstrated that there are no alternative solutions (e.g. locations or designs), and that the plan or project is necessary under IROPI (e.g. over-riding public interest).

In situations where an IROPI case can be made, it remains necessary for the developer & competent authority to ensure all measures are in place to maintain the overall coherence of the Natura network. This usually requires the provision of one or more compensatory measures to be put in place.

In many instances, such compensatory measures take the form of the delivery of new habitat which provides an offset in entirety for the functionally requirements that cannot be addressed through other mitigation measures.

Details on the provisions for such habitat offset (type, ratio, timing etc. are not provided here, and will require detailed characterisation as part of the consenting process for the plan or project. However, it is important to emphasise that the process for permitting such measures requires a rigorous scientific understanding of the requirements and outcomes, and in most instances, given inherent uncertainties in aspects of estuarine ecological function, a ratio of compensatory area is usually required (e.g. in excess of 1:1 to the loss).

7.2 Project Level Compensation

A project level application of mitigation and compensation measures would usually be the most appropriate level to address AEOI issues, and there are a number of options available to deliver this.

From the assessment process undertaken above, there is a clear requirement to provide compensatory habitat function from several impact pathways. For the most part, this relates

to the provision of habitat function for foraging and/or resting and roosting activity and can be achieved (in part) in a number of ways.

For waders and many duck species the main impacts from TLE will be in the reduction of supporting habitat (intertidal mudflat), and such losses can be offset by direct and indirect habitat provision:

- **Intertidal Habitat Creation**. This approach has been applied for a range of development activities, in differing locations and for a number of habitats. Importantly, the new habitat is often less able to deliver necessary function on a 1:1 basis to that lost, and requires additional compensatory area. In addition, the development of such habitat can take a number of years and ideally therefore needs to be initiated in advance of any losses elsewhere. At a site specific level, there is also a need for the provision to have a degree of locality, although not necessarily within the same site if N2K coherence can be maintained. A number of techniques to deliver habitat creation are available, including managed realignment which is most commonly used in estuaries, regulated tidal exchange, where a greater control of inundation patterns and habitat development is required and sediment recharge, to create an elevated intertidal zone, more commonly used in embayment's and along the open coast.

- **Habitat (Function) Enhancement**. This approach uses a range of techniques to provide additional carrying capacity, function or diversity to an existing area. This can be achieved through the provision of features such as structures to provide safe roosting and/or nesting, or the alteration to process to provide better environmental quality such as the re-instatement of creek systems, and restriction of drainage.

- **Site Management**. This approach can include the restriction of damaging activities to improve habitat function and capacity, for instance via management of recreational activity including zonation and restriction. This can take the form of a reduction in extractive activities such as fishing, or in disturbance stimuli, e.g. public access regulation. Education on feature sensitives and codes of practice can also be employed, together with a more active intervention in habitat development trajectory in order to maintain or improve condition.

The application of these measures has been routinely applied for a range of development scenarios, and would be applicable for TLE generation projects. Indeed, these approaches are identified in the compensation requirement document for the STP scheme as well as being applied singularly, or in combination, for existing TLE generation developments.

At an individual scheme level, these approaches remain the most relevant for addressing the main impact issue of direct/indirect loss of habitat and associated foraging and roosting function for birds.

The degree to which such measures adequately address the impact pathways and Interest Feature effects will require site specific determination, but in terms of operational offset tools, these are the most effective at addressing relatively large scale loss or modification to features and supporting habitats.

For other species of duck, divers and some seabirds, the site specific impact effect may be more through changes to the subtidal supporting habitat, although with other potential effects through collision mortality etc.

- **Habitat (Function) Enhancement**. Techniques to provide additional carrying capacity, function or diversity to an existing area. This can be achieved through the provision of features such as structures to provide safe roosting and/or nesting, or the alteration to process to provide better environmental quality such as increased flows. Key functions such as foraging delivery can be improved by the provision of improved habitat for prey, e.g. fish, biogenic reefs through the use of artificial structures, fish passes etc.

- **Impact Prevention**. The use of devices to restrict access by birds close to potentially damaging equipment e.g. turbines, through use of underwater lights, noise, screens. Provision of no access areas to the public to avoid disturbance effects and provide sanctuary areas. These could be coupled to areas of function enhancement e.g. to provide optimal foraging conditions.

- **Site Management**. This approach can include the restriction of damaging activities to improve habitat function and capacity, for instance via management of recreational activity including zonation and restriction. This can take the form of a reduction in extractive activities such as fishing, or in disturbance stimuli, e.g. public access regulation. The provision of sanctuary periods based around known sensitivity times, but with potential interactive implementation e.g. during hard weather periods and voluntary restrictions on wildfowling. Education on feature sensitives and codes of practice can also be employed, together with a more active intervention in habitat development trajectory in order to maintain or improve condition.

7.3 Plan-level Compensation Needs

As noted in Section 6, there is the potential for a plan level AEOI for some features, in that the promotion of TLE at a series of sites around the Welsh coast has the potential to impact on Interest Features and with the ability of mitigation measures unlikely (or with considerable uncertainty) to address these.

As described above, for the most part, it is considered appropriate that such issues will be addressed either alone or in combination at a site specific HRA level. However, for this plan-level HRA, there remain some potentially difficult considerations relating to the provision of compensatory habitat function, given the scale of individual projects can be large, and that there is a likelihood of a number being operational around the coast at the same time. These would then form at a regional scale of review

Such a review was performed for the STP scheme, and concluded that there are a number of IROPI issues that will occur, and that there will be difficulties to compensate adequately or at least with surety and in the context of current interpretation of the Directive. In particular, for birds, there were some significant issues regarding the delivery of sufficient compensatory habitat and function.

This finding remain valid for this review, both for the south Wales and north Wales TLE clusters and it is not suggested that a strategic appraisal of the provision of this

compensation component is addressed within the WNMP directly, given the current level of uncertainty surrounding the technology and site take-up.

However, based on the conclusions relating to the STP scheme review and from this analysis, it may be necessary to provide a framework for a more detailed strategic environmental review as some of these development uncertainties need to addressed, in much the same way that similar regional strategic reviews were undertaken for the offshore wind industry.

Such a process might be better addressed at a spatial regional basis than a national basis taking into account transnational requirements, e.g. the North Wales and Liverpool Bay region and the South Wales and the Severn Estuary region. However, there are further flyway level issues that require even greater co-ordination of approach at a trans-national level.

8. CONCLUSIONS AND RECOMMENDATIONS

The plan level HRA for bird Interest Features in relation to the Tidal lagoon Policy for the Welsh National Marine Plan has identified a number of potential AEOI scenarios for European/Ramsar Sites both around the Welsh coast and further afield.

This conclusion has been based on an extensive screening process, with a large number of sites screened in using a wide ranging Zone of Influence taking into account the ecology of individual Interest features including foraging ranges and potential migratory routes.

A robust and step-wise assessment process using established pathways of effect and receptor sensitivities has then been applied to these Interest Features, and conclusions drawn on the possibility and severity of the level of impact(s).

By necessity at this scale of assessment, there are considerable uncertainties in details of impact potential from the development of the plan and the associated encouragement to tidal power generation.

Such uncertainties are amplified when in-combination effects are investigated, and it is emphasised that the process pursued in this document should be treated with caution given the high level of the data reviewed here.

Clearly however, there is an AEOI potential for a number of tidal generation projected on their own, much of this, but not exclusively, linked to loss or alteration to habitat function and the delivery of foraging and roosting potential, and when these are assessed across a regional development scale, there are clearly substantial compensation requirements.

Within site mitigation measures may to some extent address these issues, but there remains a potential residual AEOI following their application, and a probable requirement for the provision of compensatory habitat in addition to other mitigation measures, at least at a regional scale.

When these issues are assessed at an in-combination level, then the requirements become more certain, particularly given other similar project developments as well as other developments which at least partially, deliver impacts to the same Interest Features through the same pressure pathways.

The following Table summarises potential areas of impact, mitigation and residual impacts for the TLE sector relating to the main impactor on integrity – habitat loss.

Table 12: Impact Pathways, Mitigation and Residual Effects

Habitat Loss Impact Pathway	Mitigation Measure	Potential for Residual Impacts	Likelihood of Delivery Success		
			Site	Regional	Flyway
Direct Habitat Loss (operational phase)	Managed Realignment	Assuming sufficient land available then with a compensation ratio of 1:2 or greater then a likelihood of offset delivery for an individual site. However, suitable habitat availability will reduce with subsequent schemes requiring greater compensation ration and/or management interventions. Targeted at waders and some ducks and geese primarily for migration and over-wintering use. In addition to foraging, some use for roosting. Associated habitats can deliver other ecosystem services e.g. fish nurseries.	Full or Partial	No	No
	Artificial Roosts	Potential artificial roost sites (in addition to those provided by the bunds which may be used by some species of wader e.g. dunlin, turnstone).	Full or Partial	Possible	No
	Artificial Reefs	For diving birds associated pursuit and plunge foraging for fish e.g. auks, divers, some ducks, cormorants.	Possible	Possible	Uncertain/ N/A
	Artificial Breeding Sites	Success in the use of pontoons for terns, and in gravel and wet grassland treatments for some waders. Benefits may be relatively low when viewed at a population level e.g. against potential loss of breeding condition in migratory birds.	Gain, Full or Partial	Possible	No

Table 12 Cont.

Habitat Loss Impact Pathway	Mitigation Measure	Potential for Residual Impacts	Likelihood of Delivery Success		
			Site	Regional	Flyway
Indirect Habitat Loss (construction phase)	Timing	Avoids sensitive periods. Can be an efficient tool, but scale of developments and multiple receptor needs may preclude full utilisation, although zoned activity matched to timing sensitivities may be of value and could operate at an in-combination level. Effective for wintering and passage waders and ducks as well as breeding species.	Partial	Yes	Possible
	Visual and noise (disturbance) constraint	Screening and muffling measures, restriction of light spill, avoidance of linear access can all have a positive effect in terms of impact migration and would be viable for both waders and ducks as well as breeding birds	Partial	Possible	No
Indirect Habitat Loss (operation phase)	Visual and noise (disturbance) constraint	Zoning of activities away from sensitive areas, restrictions in activities during sensitive periods, education, screening, identification of honey-pot areas all can assist in reducing the extent of indirect habitat loss. However, the spatial and functional extent of offset provision is often limited.	Partial	Possible	No

Table 12 Cont.

Habitat Loss Impact Pathway	Mitigation Measure	Potential for Residual Impacts	Likelihood of Delivery Success		
			Site	Regional	Flyway
Alteration to processes leading to a change in habitat (operational phase)	Design to minimise change to sediment transport around the development	Difficult to ensure success even at a site level with greater potential at regional level affecting sediment transport, wave action and tide	Possible	No	No
	Designs to minimise change to physical processes within the development – turbine operations	Large scale impacts in terms of inundation time and thus habitat loss (see above). Options to modify turbine operation times with some reductions	Possible	No	No
	Accretion of fine sediment within the site	Potential for large scale increases in mud component within the lagoons and a shift in habitat type. Some potential biodiversity increases, but also an intrinsic loss in key habitat and associated function. Turbine operation may reduce this effect but issues will have a site and design specific component.	Possible	No	No
	Erosion of sediment within the site	Potential for some areas of fine sediment removal will lead to habitat change and increases in biodiversity, although nett change not desirable within the designation context as a supporting habitat.	Possible	No	No

Table 12 Cont.

Other Impact Pathways	Mitigation Measure	Potential for Residual Impacts	Likelihood of Delivery Success		
			Site	Regional	Flyway
Collison Risk (moving objects)	Deterrents including lights, noise, screens	Difficult to ensure success even at a site level with greater potential at regional level. Primarily for plunge and pursuit divers e.g. auks, cormorants, some ducks, gannets.	Partial	Partial	partial
Collision Risk & Barrier to Movement	Difficult to effectively action other than design to allow early detection and route modification	At a site specific level, there may be some success, although this would depend on specific habitat needs e.g. avoidance of foraging routes between key breeding and feeding sites. Less effective at a multiple site level	Partial	Partial	No

The application of potential success/fail metrics at a regional scale (e.g. Table 12), are by necessity indicative, as most would require detailed analysis and/or individual development details (location, design etc.).

However, there are some measures that will have at least a partial implementation success. Managed Realignment has been seen to be an affective compensatory tool in addressing the most important aspect of TLE impacts to bird Interest Features at a site specific level e.g. direct habitat loss through a variety of pathways. However, difficulties arise when multiple realignment sites are required, as there is a finite provision of suitable compensatory habitat within a system. This was identified as an issue for the STP scheme, and would similarly be for the WNMP at a regional level. There is the potential for wider ranging application of the tool together with the introduction of novel measures, but these will have uncertainties in delivery and require a strategic view.

The over-riding issue for the provisioning of TLP development within the WNMP remains that of direct and indirect habitat loss and for birds, the associated loss of function for foraging and other activities. Mitigation measures can offset some of these losses, but there will be a requirement for the triggering of compensation measures.

There are a series of measures that can be put in place to address some of these functional losses, but with managed realignment and other habitat creation schemes being the main pathways of delivery. However, experience has shown that in most instances, the functional capacity of such schemes for birds at least, tends to be lower than that lost, and thus a positive ratio of provisioning is necessary e.g. at least on a 2:1 basis for direct loss. At an individual scheme level, such new habitat delivery is possible, but within most systems the provision of suitable habitat is finite. This would appear to be the case for the Welsh TLP, with a deficit in potential offset habitat availability at a regional/national level. There remains however, the potential for the utilisation of additional resources at a trans-national level, or through revisions to the interpretation of the Habitats Directive to allow for non like for like provision and establishment of new qualifying habitats.

As such, whilst these regional/national in-combination issues will in part require to be addressed through the standard HRA process, the level of potential impact is such that a more strategic approach is required to ascertain viability of any compensation package.

It is therefore recommended that the process is investigated at a strategic level in advance of multiple development applications in a similar way to the regional offshore wind groupings.

This would possibly be best suited to a spatial rather than governmental framework, e.g. perhaps two groups covering South Wales and the Severn, and North Wales and Liverpool Bay given likely Interest Feature synergisms. However, there is also the potential to use such strategic groups to exchange information on best available technologies and mitigation method efficacy in order to more rapidly develop a suitable suite of mitigation and compensation measures.

APPENDICES

APPENDIX 1: CONSTRUCTION RELATED IMPACT PRESSURES FOR ALL SCREENED IN SITES AND ASSOCIATED INTEREST FEATURES

See Supplied Spreadsheet

Status	Site Name	Site Location	Bird Species (Scientific Name)	Abrasion/disturbance of the substrate on the surface of the seabed	Barrier to species movement	Changes in suspended solids (water clarity)	Emergence regime changes, including tidal level change considerations	Habitat structure changes - removal of substratum (extraction)	Penetration and/or disturbance of the substratum below the surface of the seabed, including abrasion	Physical change (to another seabed type)	Physical change (to another sediment type)	Physical loss (to land or freshwater habitat)	Smothering and siltation rate changes (Heavy)	Smothering and siltation rate changes (Light)	Underwater noise changes	Water flow (tidal current) changes, including sediment transport considerations	Wave exposure changes
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Gavia stellata*		S	IE	S	S				S			IE	S	S
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Hydrocoloeus minutus*		S	IE	S	S				S	IE			IE	IE
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Melanitta nigra*		S		IE	S				S			IE	IE	IE
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Sternula albifrons*		S	IE	S	S				S	IE			IE	IE
pSPA	Irish Sea Front	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
Ramsar	Duddon Estuary	Beyond 50 km	*Calidris alba*		S		S	S				S				IE	S
Ramsar	Duddon Estuary	Beyond 50 km	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Duddon Estuary	Beyond 50 km	*Haematopus ostralegus*		S		S	S				S				S	S
Ramsar	Duddon Estuary	Beyond 50 km	*Mergus serrator*		S	IE	IE	S				S			IE	S	IE
Ramsar	Duddon Estuary	Beyond 50 km	*Numenius arquata*		S		S	S				S				S	S
Ramsar	Duddon Estuary	Beyond 50 km	*Sternula albifrons*		S	IE	S	S				S	IE			IE	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Anas acuta*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Anas penelope*		S		S	S				S	IE			IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Anser brachyrhynchus*		S		S	S				S	IE			IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Arenaria interpres*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Bucephala clangula*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris alba*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris canutus*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Charadrius hiaticula*		S		S	S				S				S	S
Ramsar	Morecambe Bay	Beyond 50 km	*Haematopus ostralegus*		S		S	S				S				S	S
Ramsar	Morecambe Bay	Beyond 50 km	*Limosa lapponica*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Mergus serrator*		S	IE	IE	S				S			IE	S	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Numenius arquata*		S		S	S				S				S	S
Ramsar	Morecambe Bay	Beyond 50 km	*Pluvialis apricaria*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Pluvialis squatarola*		S		S	S				S				IE	S
Ramsar	Morecambe Bay	Beyond 50 km	*Podiceps cristatus*		S	IE	IE	S				S			IE	S	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Tadorna tadorna*		S		S	S				S				S	S
Ramsar	Morecambe Bay	Beyond 50 km	*Tringa totanus*		S		S	S				S				S	S
Ramsar	Morecambe Bay	Beyond 50 km	*Vanellus vanellus*		S		S	S				S				IE	S
Ramsar	Severn Estuary	In SRA	*Anas acuta*		S		S	S				S				IE	S
Ramsar	Severn Estuary	In SRA	*Anas crecca*		S	IE	S	S				S			IE	S	S
Ramsar	Severn Estuary	In SRA	*Anas strepera*		S	IE	S	S				S				S	S
Ramsar	Severn Estuary	In SRA	*Anser albifrons albifrons*		S		S	S				S	IE			IE	S
Ramsar	Severn Estuary	In SRA	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Severn Estuary	In SRA	*Charadrius hiaticula*		S		S	S				S				S	S
Ramsar	Severn Estuary	In SRA	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
Ramsar	Severn Estuary	In SRA	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
Ramsar	Severn Estuary	In SRA	*Tadorna tadorna*		S		S	S				S				S	S
Ramsar	Severn Estuary	In SRA	*Tringa totanus*		S		S	S				S				S	S
Ramsar	The Dee Estuary	In SRA	*Anas acuta*		S		S	S				S				IE	S
Ramsar	The Dee Estuary	In SRA	*Anas crecca*		S	IE	S	S				S			IE	S	S
Ramsar	The Dee Estuary	In SRA	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	The Dee Estuary	In SRA	*Calidris canutus islandica*		S		S	S				S				IE	S
Ramsar	The Dee Estuary	In SRA	*Haematopus ostralegus*		S		S	S				S				S	S
Ramsar	The Dee Estuary	In SRA	*Limosa lapponica*		S		S	S				S				IE	S
Ramsar	The Dee Estuary	In SRA	*Limosa limosa islandica*		S		S	S				S				IE	S
Ramsar	The Dee Estuary	In SRA	*Numenius arquata*		S		S	S				S				S	S
Ramsar	The Dee Estuary	In SRA	*Pluvialis squatarola*		S		S	S				S				IE	S
Ramsar	The Dee Estuary	In SRA	*Tadorna tadorna*		S		S	S				S				S	S
Ramsar	The Dee Estuary	In SRA	*Tringa totanus*		S		S	S				S				S	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Branta bernicla*		S		S	S				S	IE			IE	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Egretta garzetta*		S		S	S				S				S	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Numenius arquata*		S		S	S				S				S	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Numenius phaeopus*		S		S	S				S				S	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S				S				S	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Tringa erythropus*		S		S	S				S				S	S
Ramsar	Burry Inlet	Within 50 km below MHWS	*Tringa nebularia*		S		S	S				S				S	S

Ramsar	Mersey Estuary	Within 50 km below MHWS	*Anas acuta*		S		S	S				S				IE	S
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S				S				IE	S
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S				S				S	S
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alba*		S		S	S				S				IE	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris canutus islandica*		S		S	S				S				IE	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S				S				S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Hydrocoloeus minutus*		S	IE	S	S				S	IE			IE	IE
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Limosa lapponica*		S		S	S				S				IE	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S				S			IE	S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas acuta*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas penelope*		S		S	S				S	IE			IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anser brachyrhynchus*		S		S	S				S	IE			IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alba*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris canutus islandica*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Charadrius hiaticula*		S		S	S				S				S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus cygnus*		S		S	S				S	IE			IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S				S				S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa lapponica*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S				S				S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas acuta*		S		S	S				S				IE	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas clypeata*		S	IE	S	S				S				S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas penelope*		S		S	S				S	IE			IE	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Cygnus olor*		S		S	S				S	IE			S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S				S				IE	S
Ramsar	Duddon Estuary	Within foraging range	*Sterna sandvicensis*		S	IE	IE	S				S	IE			S	IE
Ramsar	Morecambe Bay	Within foraging range	*Larus argentatus*		S	IE	S	S				S				S	S
Ramsar	Morecambe Bay	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
Ramsar	Morecambe Bay	Within foraging range	*Phalacrocorax carbo*		S		S	S				S			IE	S	S
Ramsar	Morecambe Bay	Within foraging range	*Somataria mollissima*		S		S	S				S			IE	S	S
Ramsar	Morecambe Bay	Within foraging range	*Sterna sandvicensis*		S	IE	IE	S				S	IE			S	IE
Ramsar	Outer Ards	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Anas acuta*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Anser brachyrhynchus*		S		S	S				S	IE			IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Arenaria interpres*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Calidris alba*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Calidris alpina alpina*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Calidris canutus*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Charadrius hiaticula*		S		S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Cygnus cygnus*		S		S	S				S	IE			IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Egretta garzetta*		S		S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Haematopus ostralegus*		S		S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Limosa lapponica*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Limosa limosa islandica*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Numenius arquata*		S		S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Philomachus pugnax*		S	IE	S	S				S			IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Pluvialis apricaria*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Pluvialis squatarola*		S		S	S				S				IE	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Sterna sandvicensis*		S	IE	IE	S				S	IE			S	IE
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Sternula albifrons*		S	IE	S	S				S	IE			IE	IE
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Tadorna tadorna*		S		S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Tringa totanus*		S		S	S				S				S	S
SPA	Liverpool Bay / Bae Lerpwl	In SRA	*Gavia stellata*		S	IE	S	S				S			IE	S	S
SPA	Liverpool Bay / Bae Lerpwl	In SRA	*Melanitta nigra*		S		IE	S				S			IE	IE	IE

SPA	Severn Estuary	In SRA	*Anas strepera*		S	IE	S	S				S				S	S
SPA	Severn Estuary	In SRA	*Anser albifrons albifrons*		S		S	S				S	IE			IE	S
SPA	Severn Estuary	In SRA	*Calidris alpina alpina*		S		S	S				S				IE	S
SPA	Severn Estuary	In SRA	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
SPA	Severn Estuary	In SRA	*Tadorna tadorna*		S		S	S				S				S	S
SPA	Severn Estuary	In SRA	*Tringa totanus*		S		S	S				S				S	S
SPA	The Dee Estuary	In SRA	*Anas acuta*		S		S	S				S				IE	S
SPA	The Dee Estuary	In SRA	*Anas crecca*		S	IE	S	S				S			IE	S	S
SPA	The Dee Estuary	In SRA	*Calidris alpina alpina*		S		S	S				S				IE	S
SPA	The Dee Estuary	In SRA	*Calidris canutus*		S		S	S				S				IE	S
SPA	The Dee Estuary	In SRA	*Haematopus ostralegus*		S		S	S				S				S	S
SPA	The Dee Estuary	In SRA	*Limosa lapponica*		S		S	S				S				IE	S
SPA	The Dee Estuary	In SRA	*Limosa limosa islandica*		S		S	S				S				IE	S
SPA	The Dee Estuary	In SRA	*Numenius arquata*		S		S	S				S				S	S
SPA	The Dee Estuary	In SRA	*Pluvialis squatarola*		S		S	S				S				IE	S
SPA	The Dee Estuary	In SRA	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
SPA	The Dee Estuary	In SRA	*Sterna sandvicensis*		S	IE	IE	S				S	IE			S	IE
SPA	The Dee Estuary	In SRA	*Sternula albifrons*		S	IE	S	S				S	IE			IE	IE
SPA	The Dee Estuary	In SRA	*Tadorna tadorna*		S		S	S				S				S	S
SPA	The Dee Estuary	In SRA	*Tringa totanus*		S		S	S				S				S	S
SPA	Walmore Common	Within 2 km inland of 50 km m	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna dougallii*		S	IE	S	S				S	IE			IE	IE
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna paradisaea*		S	IE	S	S				S	IE			IE	IE
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna sandvicensis*		S	IE	IE	S				S	IE			S	IE
SPA	Bae Caerfyrddin/ Carmarthen Bay	Within 50 km below MHWS	*Melanitta nigra*		S		IE	S				S			IE	IE	IE
SPA	Burry Inlet	Within 50 km below MHWS	*Anas acuta*		S		S	S				S				IE	S
SPA	Burry Inlet	Within 50 km below MHWS	*Anas clypeata*		S	IE	S	S				S				S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Anas penelope*		S		S	S				S	IE			IE	S
SPA	Burry Inlet	Within 50 km below MHWS	*Arenaria interpres*		S		S	S				S				IE	S
SPA	Burry Inlet	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
SPA	Burry Inlet	Within 50 km below MHWS	*Calidris canutus*		S		S	S				S				IE	S
SPA	Burry Inlet	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S				S				S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Numenius arquata*		S		S	S				S				S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
SPA	Burry Inlet	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S				S				S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
SPA	Glannau Ynys Gybi/ Holy Island Coast	Within 50 km below MHWS	*Pyrrhocorax pyrrhocorax*														
SPA	Mersey Estuary	Within 50 km below MHWS	*Anas acuta*		S		S	S				S				IE	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Anas penelope*		S		S	S				S	IE			IE	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Charadrius hiaticula*		S		S	S				S				S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S				S				IE	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Numenius arquata*		S		S	S				S				S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Pluvialis apricaria*		S		S	S				S				IE	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Podiceps cristatus*		S	IE	IE	S				S			IE	S	IE
SPA	Mersey Estuary	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S				S				S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S				S				IE	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alba*		S		S	S				S				IE	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris canutus islandica*		S		S	S				S				IE	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S				S				S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Larus minutus*		S	IE	S	S				S	IE			IE	IE
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Limosa lapponica*		S		S	S				S				IE	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S				S			IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas acuta*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas penelope*		S		S	S				S	IE			IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anser brachyrhynchus*		S		S	S				S	IE			IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Aythya marila*		S		IE	S				S			IE	IE	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alba*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S				S				IE	S

SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris canutus*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Charadrius hiaticula*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus cygnus*		S		S	S				S	IE			IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Larus ridibundus*		S	IE	S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa lapponica*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Melanitta nigra*		S		IE	S				S			IE	IE	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Numenius arquata*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Numenius phaeopus*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S				S			IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Philomachus pugnax*		S	IE	S	S				S			IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Pluvialis apricaria*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S				S				IE	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S				S				IE	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S				S			IE	S	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	S				S	IE			IE	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Pluvialis apricaria*		S		S	S				S				IE	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S				S				IE	S
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S				S				S	S
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Mergus serrator*		S	IE	IE	S				S			IE	S	IE
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Numenius arquata*		S		S	S				S				S	S
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Podiceps cristatus*		S	IE	IE	S				S			IE	S	IE
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Tringa totanus*		S		S	S				S				S	S
SPA	Ynys Seiriol / Puffin Island	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S				S			IE	S	S
SPA	Ailsa Craig	Within foraging range	*Morus bassanus*		S	IE	S	S				S			IE	S	IE
SPA	Beara Peninsula SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Bowland Fells	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Camaret	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Cap Sizun	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Copeland Islands	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Cote de Granit Rose-Sept Iles	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Cote de Granit Rose-Sept Iles	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Galley Head to Duneen Point SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Grassholm	Within foraging range	*Morus bassanus*		S	IE	S	S				S			IE	S	IE
SPA	Helvick Head to Ballyquin SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Horn Head to Fanad Head SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Howth Head Coast SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Inishtrahull SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Ireland's Eye SPA	Within foraging range	*Fratercula arctica*		S	IE	IE	S				S			IE	S	IE
SPA	Ireland's Eye SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Lambay Island SPA	Within foraging range	*Fratercula arctica*		S	IE	IE	S				S			IE	S	IE
SPA	Lambay Island SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Lambay Island SPA	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Lambay Island SPA	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Mingulay and Berneray	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Larus argentatus*		S	IE	S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Larus melanocephalus*		S	IE	S	S				S				S	S
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Sterna hirundo*		S	IE	S	S				S	IE			IE	IE
SPA	Old Head of Kinsale SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Ouessant-Molene	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Ouessant-Molene	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Poulaphouca Reservoir SPA	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Saltee Islands SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Saltee Islands SPA	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Saltee Islands SPA	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE
SPA	Sheep's Head to Toe Head SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Skerries Islands SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Fratercula arctica*		S	IE	IE	S				S			IE	S	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Hydrobates pelagicus*		S	IE	S	S				S	IE			IE	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Puffinus puffinus*		S	IE	S	S				S			IE	S	IE

SPA	Tacumshin Lake SPA	Within foraging range	*Larus fuscus*		S	IE	S	S				S	IE			IE	IE
SPA	The Bull and The Cow Rocks SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Tory Island SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE
SPA	Wicklow Head SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S				S				S	IE

APPENDIX 2: OPERATION RELATED IMPACT PRESSURES FOR ALL SCREENED IN SITES AND ASSOCIATED INTEREST FEATURES

See Supplied Spreadsheet

Status	Site Name	Site Location	Bird Species (Scientific Name)	Abrasion/disturbance of the substrate on the surface of the seabed	Barrier to species movement	Changes in suspended solids (water clarity)	Energetic reprieve changes, including tidal level change consultations	Collision BELOW water with static or moving objects not naturally found in the marine environment	Decompensation	Nutrient enrichment	Salinity decrease	Salinity increase	Smothering and siltation rate changes (Heavy)	Smothering and siltation rate changes (Light)	Temperature decrease	Temperature increase	Underwater noise changes	Water flow (tidal current) changes, including sediment transport considerations	Visual disturbance	Wave exposure changes
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Gavia stellata*	5	IE	5	5	5									IE	5	5	5
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Hydrocoloeus minutus*	5	IE	5	5						IE					IE	5	IE
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Melanitta nigra*	5		IE	IE										IE	IE	5	IE
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Sterna hirundo*	5	IE	5	5						IE					IE	5	IE
pSPA	Liverpool Bay / Bae Lerpwl Extension	Within 50 km below MHWS	*Sternula albifrons*	5	IE	5	5						IE					IE	5	IE
pSPA	Irish Sea Front	Within foraging range	*Puffinus puffinus*	5	IE	5	5										IE	5	5	IE
Ramsar	Duddon Estuary	Beyond 50 km	*Calidris alba*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Duddon Estuary	Beyond 50 km	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Duddon Estuary	Beyond 50 km	*Haematopus ostralegus*	5		5	5											IE	5	5
Ramsar	Duddon Estuary	Beyond 50 km	*Mergus serrator*	5	IE	IE	5										IE	5	5	IE
Ramsar	Duddon Estuary	Beyond 50 km	*Numenius arquata*	5		5	5											5	5	5
Ramsar	Duddon Estuary	Beyond 50 km	*Sternula albifrons*	5	IE	5	5						IE					IE	5	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Anas acuta*	$\underline{5}$		$\underline{IE}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Anas penelope*	5		5	IE						IE					IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Anser brachyrhynchus*	5		5	IE						IE					IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Arenaria interpres*	5		5	5											IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Bucephala clangula*	5		5	5											IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris alba*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris canutus*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Charadrius hiaticula*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Haematopus ostralegus*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Limosa lapponica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Mergus serrator*	5	IE	IE	5										IE	5	5	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Numenius arquata*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Pluvialis apricaria*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Pluvialis squatarola*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Podiceps cristatus*	5	IE	IE	5										IE	5	5	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Tadorna tadorna*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Vanellus vanellus*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	In SRA	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	Within 50 km below MHWS	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	Within 50 km below MHWS	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	Severn Estuary	Within 50 km below MHWS	*Anas strepera*	5	IE	5	5											5	5	5
Ramsar	Severn Estuary	Within 50 km below MHWS	*Anser albifrons albifrons*	5		5	IE						IE					IE	5	IE
Ramsar	Severn Estuary	Within 50 km below MHWS	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	Within 50 km below MHWS	*Charadrius hiaticula*	5		5	5											5	5	5
Ramsar	Severn Estuary	Within 50 km below MHWS	*Cygnus columbianus bewickii*	5		5	IE						IE					IE	5	5
Ramsar	Severn Estuary	Within 50 km below MHWS	*Larus fuscus*	5	IE	5	5						IE					IE	5	IE
Ramsar	Severn Estuary	Within 50 km below MHWS	*Tadorna tadorna*	5		5	5						IE					IE	5	IE
Ramsar	Severn Estuary	Within 50 km below MHWS	*Tringa totanus*	5		5	5											5	5	5
Ramsar	The Dee Estuary	In SRA	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	The Dee Estuary	In SRA	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Calidris canutus islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Haematopus ostralegus*	5		5	5											IE	5	5
Ramsar	The Dee Estuary	In SRA	*Limosa lapponica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Limosa limosa islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Numenius arquata*	5		5	5											5	5	5
Ramsar	The Dee Estuary	In SRA	*Pluvialis squatarola*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Tadorna tadorna*	5		5	5											5	5	5
Ramsar	The Dee Estuary	In SRA	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Severn Estuary	In SRA	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	In SRA	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	Severn Estuary	In SRA	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	In SRA	*Calidris canutus islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	In SRA	*Charadrius hiaticula*	5		5	5											5	5	5
Ramsar	Severn Estuary	In SRA	*Larus fuscus*	5	IE	5	5						IE					IE	5	IE
Ramsar	Severn Estuary	In SRA	*Tadorna tadorna*	5		5	5						IE					IE	5	IE
Ramsar	Severn Estuary	In SRA	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alba*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris canutus islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Limosa limosa islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Tadorna tadorna*	5		5	5											5	5	5
Ramsar	Mersey Estuary	Within 50 km below MHWS	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Tringa erythropus*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Tringa nebularia*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Calidris canutus islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Charadrius hiaticula*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Haematopus ostralegus*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Limosa lapponica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Mergus serrator*	5	IE	IE	5										IE	5	5	IE
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Numenius arquata*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Pluvialis apricaria*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Pluvialis squatarola*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Podiceps cristatus*	5	IE	IE	5										IE	5	5	IE
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Tadorna tadorna*	5		5	5											5	5	5
Ramsar	Ribble Inlet	Within 50 km below MHWS	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Vanellus vanellus*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Tadorna tadorna*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Podiceps cristatus*	5	IE	IE	5										IE	5	5	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Pluvialis squatarola*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Pluvialis apricaria*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Numenius arquata*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Mergus serrator*	5	IE	IE	5										IE	5	5	IE
Ramsar	Morecambe Bay	Beyond 50 km	*Limosa lapponica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Haematopus ostralegus*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Charadrius hiaticula*	5		5	5											5	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris canutus*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Calidris alba*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Bucephala clangula*	5		5	5											IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Arenaria interpres*	5		5	5											IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Anser brachyrhynchus*	5		5	IE						IE					IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Anas penelope*	5		5	IE						IE					IE	5	5
Ramsar	Morecambe Bay	Beyond 50 km	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Duddon Estuary	Beyond 50 km	*Sternula albifrons*	5	IE	5	5						IE					IE	5	IE
Ramsar	Duddon Estuary	Beyond 50 km	*Numenius arquata*	5		5	5											5	5	5
Ramsar	Duddon Estuary	Beyond 50 km	*Mergus serrator*	5	IE	IE	5										IE	5	5	IE
Ramsar	Duddon Estuary	Beyond 50 km	*Haematopus ostralegus*	5		5	5											IE	5	5
Ramsar	Duddon Estuary	Beyond 50 km	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Duddon Estuary	Beyond 50 km	*Calidris alba*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Tringa totanus*	5		5	5											5	5	5
Ramsar	The Dee Estuary	In SRA	*Pluvialis squatarola*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Tadorna tadorna*	5		5	5											5	5	5
Ramsar	The Dee Estuary	In SRA	*Numenius arquata*	5		5	5											5	5	5
Ramsar	The Dee Estuary	In SRA	*Limosa limosa islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Limosa lapponica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Haematopus ostralegus*	5		5	5											IE	5	5
Ramsar	The Dee Estuary	In SRA	*Calidris canutus islandica*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	The Dee Estuary	In SRA	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	The Dee Estuary	In SRA	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	In SRA	*Tringa totanus*	5		5	5											5	5	5
Ramsar	Severn Estuary	In SRA	*Tadorna tadorna*	5		5	5						IE					IE	5	IE
Ramsar	Severn Estuary	In SRA	*Larus fuscus*	5	IE	5	5						IE					IE	5	IE
Ramsar	Severn Estuary	In SRA	*Cygnus columbianus bewickii*	5		5	IE						IE					IE	5	5
Ramsar	Severn Estuary	In SRA	*Charadrius hiaticula*	5		5	5											5	5	5
Ramsar	Severn Estuary	In SRA	*Calidris alpina alpina*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	In SRA	*Anser albifrons albifrons*	5		5	IE						IE					IE	5	IE
Ramsar	Severn Estuary	In SRA	*Anas strepera*	5	IE	5	5											5	5	5
Ramsar	Severn Estuary	In SRA	*Anas crecca*	5	IE	5	5										IE	5	5	IE
Ramsar	Severn Estuary	In SRA	*Anas acuta*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Severn Estuary	In SRA	*Vanellus vanellus*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$
Ramsar	Morecambe Bay	Beyond 50 km	*Vanellus vanellus*	$\underline{5}$		$\underline{5}$	$\underline{5}$											$\underline{IE}$	$\underline{5}$	$\underline{5}$

Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S										S	S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Hydrocoloeus minutus*		S	IE	S	S					IE					IE	S	IE
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Limosa lapponica*		S		S	S										IE	S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S									IE	S	S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S										IE	S	S
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S					IE					IE	S	IE
Ramsar	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas acuta*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S									IE	S	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas penelope*		S		S	IE					IE					IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anser brachyrhynchus*		S		S	IE					IE					IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alba*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris canutus islandica*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Charadrius hiaticula*		S		S	S										S	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	IE					IE					IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus cygnus*		S		S	IE					IE					IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S										S	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa lapponica*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S										IE	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S										S	S	S
Ramsar	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas acuta*		S		S	S										IE	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas clypeata*		S	IE	S	S										S	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S									IE	S	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Anas penelope*		S		S	IE					IE					IE	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	IE					IE					IE	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Cygnus olor*		S		S	S					IE					S	S	S
Ramsar	Somerset Levels and Moors	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S										IE	S	S
Ramsar	Duddon Estuary	Within foraging range	*Sterna sandvicensis*		S	IE	IE	S					IE					S	S	IE
Ramsar	Morecambe Bay	Within foraging range	*Larus argentatus*		S	IE	S	S										S	S	S
Ramsar	Morecambe Bay	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
Ramsar	Morecambe Bay	Within foraging range	*Phalacrocorax carbo*		S		S	S									IE	S	S	S
Ramsar	Morecambe Bay	Within foraging range	*Somataria mollissima*		S		S	S									IE	S	S	S
Ramsar	Morecambe Bay	Within foraging range	*Sterna sandvicensis*		S	IE	IE	S					IE					S	S	IE
Ramsar	Outer Ards	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Anas acuta*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Anser brachyrhynchus*		S		S	IE					IE					IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Arenaria interpres*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Calidris alba*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Calidris canutus*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Charadrius hiaticula*		S		S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Cygnus cygnus*		S		S	IE					IE					IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Egretta garzetta*		S		S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Haematopus ostralegus*		S		S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Limosa lapponica*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Limosa limosa islandica*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Numenius arquata*		S		S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Philomachus pugnax*		S	IE	S	S									IE	S	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Pluvialis apricaria*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Pluvialis squatarola*		S		S	S										IE	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Sterna sandvicensis*		S	IE	IE	S					IE					S	S	IE
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Sternula albifrons*		S	IE	S	S					IE					IE	S	IE
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Tadorna tadorna*		S		S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Beyond 50 km	*Tringa totanus*		S		S	S										S	S	S
SPA	Liverpool Bay / Bae Lerpwl	In SRA	*Gavia stellata*		S	IE	S	S									IE	S	S	S
SPA	Liverpool Bay / Bae Lerpwl	In SRA	*Melanitta nigra*		S		IE	IE									IE	IE	S	IE
SPA	Severn Estuary	In SRA	*Anas strepera*		S	IE	S	S										S	S	S
SPA	Severn Estuary	In SRA	*Anser albifrons albifrons*		S		S	IE					IE					IE	S	S
SPA	Severn Estuary	In SRA	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	Severn Estuary	In SRA	*Cygnus columbianus bewickii*		S		S	IE					IE					IE	S	S
SPA	Severn Estuary	In SRA	*Tadorna tadorna*		S		S	S										S	S	S
SPA	Severn Estuary	In SRA	*Tringa totanus*		S		S	S										S	S	S
SPA	The Dee Estuary	In SRA	*Anas acuta*		S		S	S										IE	S	S
SPA	The Dee Estuary	In SRA	*Anas crecca*		S	IE	S	S									IE	S	S	S
SPA	The Dee Estuary	In SRA	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	The Dee Estuary	In SRA	*Calidris canutus*		S		S	S										IE	S	S
SPA	The Dee Estuary	In SRA	*Haematopus ostralegus*		S		S	S										S	S	S
SPA	The Dee Estuary	In SRA	*Limosa lapponica*		S		S	S										IE	S	S
SPA	The Dee Estuary	In SRA	*Limosa limosa islandica*		S		S	S										IE	S	S
SPA	The Dee Estuary	In SRA	*Numenius arquata*		S		S	S										S	S	S
SPA	The Dee Estuary	In SRA	*Pluvialis squatarola*		S		S	S										IE	S	S
SPA	The Dee Estuary	In SRA	*Sterna hirundo*		S	IE	S	S					IE					IE	S	IE
SPA	The Dee Estuary	In SRA	*Sterna sandvicensis*		S	IE	IE	S					IE					S	S	IE
SPA	The Dee Estuary	In SRA	*Sternula albifrons*		S	IE	S	S					IE					IE	S	IE

SPA	The Dee Estuary	In SRA	*Tadorna tadorna*		S		S	S										S	S	S
SPA	The Dee Estuary	In SRA	*Tringa totanus*		S		S	S										S	S	S
SPA	Walmore Common	Within 2 km inland of 50 km marine buffer	*Cygnus columbianus bewickii*		S		S	IE					IE					IE	S	S
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna dougallii*		S	IE	S	S					IE					IE	S	IE
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S					IE					IE	S	IE
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna paradisaea*		S	IE	S	S					IE					IE	S	IE
SPA	Anglesey Terns / Morwenoliaid Ynys Mon	Within 50 km below MHWS	*Sterna sandvicensis*		S	IE	IE	S					IE					S	S	IE
SPA	Bae Caerfyrddin/ Carmarthen Bay	Within 50 km below MHWS	*Melanitta nigra*		S		IE	IE									IE	IE	S	IE
SPA	Burry Inlet	Within 50 km below MHWS	*Anas acuta*		S		S	S										IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Anas clypeata*		S	IE	S	S										S	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S									IE	S	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Anas penelope*		S		S	IE					IE					IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Arenaria interpres*		S		S	S										IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Calidris canutus*		S		S	S										IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S										S	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Numenius arquata*		S		S	S										S	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S										IE	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S										S	S	S
SPA	Burry Inlet	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
SPA	Glannau Ynys Gybi/ Holy Island Coast	Within 50 km below MHWS	*Pyrrhocorax pyrrhocorax*																	
SPA	Mersey Estuary	Within 50 km below MHWS	*Anas acuta*		S		S	S										IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S									IE	S	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Anas penelope*		S		S	IE					IE					IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Charadrius hiaticula*		S		S	S										S	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S										IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Numenius arquata*		S		S	S										S	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Pluvialis apricaria*		S		S	S										IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S										IE	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Podiceps cristatus*		S	IE	IE	S									IE	S	S	IE
SPA	Mersey Estuary	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S										S	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
SPA	Mersey Estuary	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S										IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alba*		S		S	S										IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Calidris canutus islandica*		S		S	S										IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S										S	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Larus minutus*		S	IE	S	S					IE					IE	S	IE
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Limosa lapponica*		S		S	S										IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S									IE	S	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S										IE	S	S
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S					IE					IE	S	IE
SPA	Mersey Narrows and North Wirral Foreshore	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas acuta*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S									IE	S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anas penelope*		S		S	IE					IE					IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Anser brachyrhynchus*		S		S	IE					IE					IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Aythya marila*		S		IE	IE									IE	IE	S	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alba*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris alpina alpina*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Calidris canutus*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Charadrius hiaticula*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	IE					IE					IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Cygnus cygnus*		S		S	IE					IE					IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Larus ridibundus*		S	IE	S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa lapponica*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Limosa limosa islandica*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Melanitta nigra*		S		IE	IE									IE	IE	S	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Numenius arquata*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Numenius phaeopus*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S									IE	S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Philomachus pugnax*		S	IE	S	S									IE	S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Pluvialis apricaria*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Pluvialis squatarola*		S		S	S										IE	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Sterna hirundo*		S	IE	S	S					IE					IE	S	IE
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tadorna tadorna*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
SPA	Ribble and Alt Estuaries	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S										IE	S	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Anas crecca*		S	IE	S	S									IE	S	S	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Cygnus columbianus bewickii*		S		S	IE					IE					IE	S	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Pluvialis apricaria*		S		S	S										IE	S	S
SPA	Somerset Levels and Moors	Within 50 km below MHWS	*Vanellus vanellus*		S		S	S										IE	S	S
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Haematopus ostralegus*		S		S	S										S	S	S
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Mergus serrator*		S	IE	IE	S									IE	S	S	IE
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Numenius arquata*		S		S	S										S	S	S

SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Podiceps cristatus*		S	IE	IE	S									IE	S	S	IE
SPA	Traeth Lafan/ Lavan Sands, Conway Bay	Within 50 km below MHWS	*Tringa totanus*		S		S	S										S	S	S
SPA	Ynys Seiriol / Puffin Island	Within 50 km below MHWS	*Phalacrocorax carbo*		S		S	S									IE	S	S	S
SPA	Ailsa Craig	Within foraging range	*Morus bassanus*		S	IE	S	S									IE	S	S	IE
SPA	Beara Peninsula SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Bowland Fells	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Camaret	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Cap Sizun	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Copeland Islands	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Cote de Granit Rose-Sept Iles	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Cote de Granit Rose-Sept Iles	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Galley Head to Duneen Point SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Grassholm	Within foraging range	*Morus bassanus*		S	IE	S	S									IE	S	S	IE
SPA	Helvick Head to Ballyquin SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Horn Head to Fanad Head SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Howth Head Coast SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Inishtrahull SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Ireland's Eye SPA	Within foraging range	*Fratercula arctica*		S	IE	IE	S									IE	S	S	IE
SPA	Ireland's Eye SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Lambay Island SPA	Within foraging range	*Fratercula arctica*		S	IE	IE	S									IE	S	S	IE
SPA	Lambay Island SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Lambay Island SPA	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Lambay Island SPA	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Mingulay and Berneray	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Larus argentatus*		S	IE	S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Larus melanocephalus*		S	IE	S	S										S	S	S
SPA	Morecambe Bay and Duddon Estuary	Within foraging range	*Sterna hirundo*		S	IE	S	S					IE					IE	S	IE
SPA	Old Head of Kinsale SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Ouessant-Molene	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Ouessant-Molene	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Poulaphouca Reservoir SPA	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Saltee Islands SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Saltee Islands SPA	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Saltee Islands SPA	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Sheep's Head to Toe Head SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Skerries Islands SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Fratercula arctica*		S	IE	IE	S									IE	S	S	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Hydrobates pelagicus*		S	IE	S	S					IE					IE	S	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	Skomer, Skokholm and the Seas Off Pembrokeshire	Within foraging range	*Puffinus puffinus*		S	IE	S	S									IE	S	S	IE
SPA	Tacumshin Lake SPA	Within foraging range	*Larus fuscus*		S	IE	S	S					IE					IE	S	IE
SPA	The Bull and The Cow Rocks SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Tory Island SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE
SPA	Wicklow Head SPA	Within foraging range	*Fulmarus glacialis*		S	IE	IE	S										S	S	IE

APPENDIX 3: INTEREST FEATURE STATUS, ECOLOGY AND TLE THREATS

See Supplied Spreadsheet

Common Name	Scientific Name	UK Conservation Status	European Conservation Status: E = Endangered; V = Vulnerable NT = Near Threatened LC - Least Concern, NA = Not Assessed	% Occurrence in Zone of Influence	Ecology - Diet	Ecology - Foraging Range (Thaxter et al)	Threats (Pressures for Tidal Lagoons)
Arctic Tern	*Sterna paradisaea*	Amber	LC	2%	Its diet consists predominantly of fishas well as crustaceans (especially planktonic species), molluscs, insects (e.g. caterpillars, Chironomidae) and earthworms (del Hoyo et al. 1996). It will also take berries in the early spring on arrival on its breeding grounds but does not readily switch to other prey items when preferred prey supplies fail (del Hoyo et al. 1996).	30km	Loss of breeding habitat and foraging potential, disturbance. Mortality from collision, changes to hydrodynamic conditions altering sediment and thus prey.
Bar-tailed Godwit	*Limosa lapponica*	Amber	LC	9%	When breeding the species feeds on insects, annelid worms, molluscs and occasionally seeds and berries (del Hoyo et al. 1996). In intertidal areas the species's diet consists of annelids (e.g. Nereis spp. and Arenicola spp.), bivalves and crustaceans, although it will also take cranefly larvae and earthworms on grasslands and occasionally larval amphibians (tadpoles) and small fish (del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Bewick's Swan	*Cygnus columbianus bewickii*	Amber	E (Winter pop)	7%	The species is predominantly herbivorous (del Hoyo et al. 1992), its diet consisting of the seeds, fruits, leaves, roots, rhizomes and stems of aquatic plants (e.g. Potamogeton, Zostera and Glyceria spp.), grasses (del Hoyo et al. 1992), sedges, reeds (Phragmites and Typha spp. [Kear 2005a]) and herbaceous tundra vegetation (Kear 2005a). During the winter the species complements its diet with agricultural grain and vegetables (del Hoyo et al. 1992) (e.g. potatoes [del Hoyo et al. 1992] and sugar beet [Kear 2005a]), and may also take estuarine invertebrates such as molluscs, amphipods (e.g. Corophium spp.) and polycheate worms on tidal mudflats prior to migration (Kear 2005a).		Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Black-headed Gull	*Chroicocephalus ridibundus*	Amber	LC	2%	Its diet consists predominantly of aquatic and terrestrial insects, earthworms and marine invertebrates (e.g. molluscs, crustaceans and marine worms) (del Hoyo et al. 1996) although it may also take fish (del Hoyo et al. 1996) (usually dead or sick) (Flint et al. 1984), rodents (e.g. voles) (Flint et al. 1984) and agricultural grain (del Hoyo et al. 1996). During the non-breeding season the species may rely heavily on artificial food sources provided by man, especially in Western Europe (del Hoyo et al. 1996), and often scavenges from refuse tips during this period (Richards 1990).	40km	Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Black-tailed Godwit	*Limosa limosa islandica*	Red	V	7%	Its diet consists of adult and larval insects (especially beetles), annelid and polychaete worms, molluscs, ragworms, crustaceans, spiders, fish eggs, and the spawn and tadpoles of frogs (Johnsgard 1981, del Hoyo et al. 1996). On the breeding grounds grasshoppers and other orthopterans are often prevalent in the diet (Johnsgard 1981). Particularly during the winter and on migration it will also take plant material including berries, seeds and rice grains (Cramp et al. 1983, Lourenço et al. 2010). On its wintering grounds in Portugal, the bivalve Scrobicularia plana has been found to represent its primary food source (Moreira 1994), while in the salinas of Spain, it mainly feeds on chironomid larvae (Estrella and Masero 2010).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Chough	*Pyrrhocorax pyrrhocorax*	Green	LC	2%	It is chiefly insectivorous, particulary in spring and summer, but also feeds on a wide variety of other invertebrates and rarely on small vertebrates such as lizards (Lacertidae) and small mammals. In autumn and winter, when invertebrate food more difficult to find, it takes grain, seeds and small berries, including those of rowan (Sorbus), pear (Pyrus), juniper (Juniperus), sea-buckthorn (Hippophae) and olive (Olea).	Coastal (terrestrial) breeder	Coastal resident - small potential for disturbance to nest sites,
Common Scoter	*Melanitta nigra*	Red	LC	5%	Its diet consists predominantly of molluscs, especially during the winter (del Hoyo et al. 1992), although it occasionally takes other aquatic invertebrates such as crustaceans (del Hoyo et al. 1992) (e.g. barnacles and shrimps) (Johnsgard 1978), worms (del Hoyo et al. 1992), echinoderms, isopods, amphidods(Kear 2005) and insects (del Hoyo et al. 1992) (e.g. midges and caddisflies) as well as small fish (del Hoyo et al. 1992) and fish eggs (Snow and Perrins 1998). On the breeding grounds the species may also consume plant matter (del Hoyo et al. 1992) such as seeds, roots and tubers (del Hoyo et al. 1992) and the vegetative parts of aquatic plants (Flint et al. 1984).		Wintering flocks focussed around biogenic reefs but also other subtidal communities where prey is accessible. Direct and indirect loss of habitat for foraging and potential disturbance with impacts to energy budget.
Common Tern	*Sterna hirundo*	Amber	LC	9%	The species is opportunistic, its diet consisting predominantly of small fish and occasionally planktonic crustaceans and insects (del Hoyo et al. 1996).	30km	Loss of breeding habitat and foraging potential, disturbance. Mortality from collision, changes to hydrodynamic conditions altering sediment and thus prey.
Cormorant	*Phalacrocorax carbo*	Green	LC	7%	The species' diet consists predominantly of fish, including sculpins, Capelin, gadids (Gremillet et al 2004) and flatfish (Leopold et al 1998) as well as crustaceans, amphibians (del Hoyo et al. 1992), molluscs and nestling birds (Brown et al. 1982). At sea the species preys mostly on bottom-dwelling fish, occasionally also taking shoaling fish in deeper waters (del Hoyo et al. 1992). It is a generalist, having been shown to feed on at least 22 different fish species (Gremillet 1997).	35km	Loss or alteration to prey availability affecting wintering and breeding usage. Potential disturbance to breeding sites.
Curlew	*Numenius arquata*	Red	V	14%	Its diet consists chiefly of annelid worms and terrestrial insects (del Hoyo et al. 1996) (e.g. Coleoptera and Orthoptera) (Johnsgard 1981) especially during the summer (del Hoyo et al. 1996), although it will also take crustaceans, molluscs, polychaete worms (del Hoyo et al. 1996), spiders (Johnsgard 1981), berries and seeds, as well as occasionally small fish, amphibians, lizards, young birds and small rodents (del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Dark-Bellied Brent Goose	*Branta bernicla bernicla*	Amber	LC	2%	The species is mainly herbivorous (del Hoyo et al. 1992) although it may take animal matter (e.g. fish eggs, worms, snails and amphipods) (Johnsgard 1978). Breeding In its breeding habitat the diet of the species consists of mosses, lichens, aquatic plants (del Hoyo et al. 1992), sedges, tundra grass Dupontia spp., arrowgrass Triglochin spp. and saltmarsh grass Puccinellia spp. (Alaska) (Kear 2005a), although the young may also take insects and aquatic invertebrates (Johnsgard 1978). Non-breedingOutside of the breeding season the species predominantly takes marine microscopic and macroscopic algae (del Hoyo et al. 1992) (e.g. seaweeds, Ulva spp. (Kear 2005a)) and other aquatic plants linked with saline or brackish waters (del Hoyo et al. 1992) in the intertidal zone (e.g. especially eelgrass Zostera spp. (Madge and Burn 1988, Kear 2005a), as well as Ruppia maritima, Spartina alterniflora, Salicornia spp., and arrowgrass Triglochin spp.) (Kear 2005a).		Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna. Distribution means effects less likely.

Dunlin	*Calidris alpina alpina*	Amber	LC	16%	Breeding This species is omnivorous during the breeding season, consuming mostly adult and larval insects (dipteran flies, beetles, caddisflies, wasps, sawflies and mayflies), and also spiders, mites, earthworms, snails, slugs and plant matter (usually seeds) (Cramp and Simmons 1977, del Hoyo et al. 1996). Non-breeding It is also omnivorous during the non-breeding season, consuming mostly polychaete worms and small gastropods, as well as insects (dipteran flies and beetles), crustaceans, bivalves, plant matter and occasionally small fish (Cramp and Simmons 1977, del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Eider	*Somataria mollissima*	Amber	V	2%	Its diet consists predominantly of benthic molluscs especially Mytilus edulis, although a wide range of crustaceans (e.g. amphipods and isopods), echinoderms, other marine invertebrates and fish may also be taken (Waltho and Coulson 2015, del Hoyo et al. 1992, Johnsgard 1978). During the breeding season incubating females in the Arctic are reported to feed on algae, berries and the seeds and leaves of surrounding tundra plants (del Hoyo et al. 1992), while in temperate regions they do not eat leading to temporary breakdown of their digestive system (Waltho and Coulson 2015, Laursen and Møller 2016).	80km	Wintering flocks focussed around biogenic reefs but also other subtidal communities where prey is accessible. Direct and indirect loss of habitat for foraging and potential disturbance with impacts to energy budget.
Fulmar	*Fulmarus glacialis*	Amber	E	34%	Its diet comprises of variable quantities of fish, squid and zooplankton (especially amphipods), and it will also feed on fish offal and carrion (e.g. whale blubber).	580km	Potential habitat/foraging loss during breeding season and less so, disturbance. More pelagic during winter but some use of coastal areas.
Gadwall	*Anas strepera*	Amber	LC	2%	The species is predominantly herbivorous (del Hoyo et al. 1992), its diet consisting of the seeds, leaves, roots and stems of aquatic plants (del Hoyo et al. 1992) (submerged and emergent) as well as grasses and stoneworts Chara spp. (Kear 2005b), occasionally also taking cereal grains on land (Brown et al. 1982, Snow and Perrins 1998). In addition, the species may take a small amount of animal matter during the winter (Africa), such as insects, molluscs, annelids, amphibians, amphibian spawn and small fish (Brown et al. 1982).		Small potential for marine issues, but coastal wetlands used most of the year with some habitat function and disturbance potential.
Gannet	*Morus bassanus*	Amber	LC	3%	This strictly marine species wanders mostly over continental selves, feeding on shoaling pelagic fish which are mostly caught by plunge-diving from large heights. It also attends trawlers and will form large congregations where food is plentiful.	590km	Wide ranging foraging during breeding season may lead to interaction/habitat function loss, with further potential during migration/winter. Potential barrier/modifier to movement pathway.
Golden Plover	*Pluvialis apricaria*	Green	LC	7%	Its diet consists predominantly of insects (especially the adults, pupae and larvae of beetles (del Hoyo et al. 1996), larval Lepidoptera, locusts and grasshoppers (Urban et al. 1986)), as well as earthworms, spiders, millipedes, snails, polycheate worms (del Hoyo et al. 1996), crustaceans (Johnsgard 1981) and some plant material (e.g. berries, seeds and grass) (del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Goldeneye	*Bucephala clangula*	Amber	LC	2%	The diet of the species consists predominantly of aquatic invertebrates such as molluscs, worms, crustaceans, aquatic insects and insect larvae (del Hoyo et al. 1992) (e.g. dragonflies, damsel flies and may flies) (Johnsgard 1978), as well as amphibians, small fish (del Hoyo et al. 1992) and some plant material (mainly in the autumn) such as seeds, roots and the vegetative parts of aquatic plants (del Hoyo et al. 1992).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Great Black-backed Gull	*Larus marinus*	Amber	LC	2%	The species is omnivorous and opportunistic, its diet consisting of fish, adult and young birds, birds eggs, mammals (e.g. rabbits, lemmings, rats and mice), insects, marine invertebrates (e.g. molluscs), carrion and refuse (del Hoyo et al. 1996).		Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Great Crested Grebe	*Podiceps cristatus*	Green	LC	3%	Its diet consists predominantly of large fish as well as insects, crustaceans (e.g. crayfish, shrimps) and molluscs, occasionally also adult and larval amphibians (del Hoyo et al. 1992). The species's invertebrate consumption is highest during the breeding season (del Hoyo et al. 1992).		Potential loss of foraging resource outwith summer, either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna. Potential changes to wave climate may effect suitability of a coastal areas.
Greenshank	*Tringa nebularia*	Amber	LC	2%	This species is chiefly carnivorous, its diet consisting of insects and their larvae (especially beetles), crustaceans, annelids, molluscs, amphibians (del Hoyo et al. 1996), small fish (mullet Liza spp., clinids Clinus spp. and tilapia Oreochromis spp.) (Hockey et al. 2005) and occasionally rodents (del Hoyo et al. 1996).		Potential loss/change to foraging availability during passage & winter. Disturbance and implications for energy budget.
Grey Plover	*Pluvialis squatarola*	Amber	LC	10%	Breeding During the breeding season the diet of this species consists largely of adult and larval insects such as beetles and Diptera (del Hoyo et al. 1996) as well as some plant matter (e.g. grass seeds and stems) (del Hoyo et al. 1996). Non-breeding When on the coast in its wintering range the species takes marine polychaete worms, molluscs and crustaceans (del Hoyo et al. 1996) (e.g. crabs, sand shrimps) (Johnsgard 1981), occasionally also taking insects (e.g. grasshoppers and beetles) or earthworms when in inland habitats on passage (del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Herring Gull	*Larus argentatus*	Red	NT	3%	The species has a highly opportunistic diet and will exploit almost any superabundant source of food (del Hoyo et al.1996). It takes fish, earthworms, crabs and other marine invertebrates (e.g. molluscs, starfish or marine worms), adult birds, bird eggs and young, rodents, insects (e.g. ants), berries and tubers (e.g. turnips) (del Hoyo et al. 1996). It also scavenges at refuse dumps, fishing wharves and sewage outfall zones and frequently follows fishing boats (del Hoyo et al. 1996, Huppop and Wurm 2000).	95km	Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Knot	*Calidris canutus*	Amber	LC	9%	During the breeding season it feeds predominantly on insects (mainly adult and larval Diptera, Lepidoptera, Trichoptera, Coleoptera and bees) as well as spiders, small crustaceans, snails and worms (del Hoyo et al. 1996). When it first arrives on the breeding grounds, however, the species is dependent upon vegetation (including the seeds of sedges, horsetails Equisetum spp. and grass shoots) owing to the initial lack of insect prey (Johnsgard 1981). Outside of the breeding season the species takes intertidal invertebrates such as bivalve and gastropod molluscs, crustaceans (del Hoyo et al.1996) (e.g. horseshoe crab Limulus spp. eggs) (Karpanty et al. 2006), annelid worms and insects, rarely also taking fish and seeds (del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.

Lapwing	*Vanellus vanellus*	Red	V	5%	Its diet consists of adult and larval insects (e.g. beetles, ants, Diptera, crickets, grasshoppers, dragonflies, mayflies, cicadas and Lepidoptera), spiders, snails, earthworms, frogs, small fish (Africa) and seeds or other plant material (Africa) (Urban et al. 1986, del Hoyo et al. 1996).		Direct and indirect loss of foraging habitat and roost potential. Barrier or modification to longer distance movement and diurnal routes between foraging and roosting areas - energy budget issues.
Lesser Black-backed Gull	*Larus fuscus*	Amber	LC	17%	The species is an omnivorous, opportunistic feeder (BirdLife International 2000) that forages extensively at sea. Its diet consists of small fish (especially Baltic herring Clupea harengus) (del Hoyo et al. 1996), aquatic and terrestrial invertebrates (e.g. beetles, flies and larvae, ants, moths (Urban et al. 1986), grasshoppers (Olsen and Larsson 2003), crustaceans, molluscs, segmented worms and starfish (Urban et al. 1986)), bird eggs and nestlings, carrion, offal (del Hoyo et al. 1996), rodents, berries (del Hoyo et al. 1996) and grain (Urban et al. 1986). It often follows fishing fleets, feeding on discarded bycatch (BirdLife International 2000).	181km	Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Little Egret	*Egretta garzetta*	Green	LC	3%	It is a highly opportunistic feeder (Kushlan and Hancock 2005), taking mainly small fish under 20 g in weight and less than 10 cm long (del Hoyo et al. 1992) (averaging 4 cm) (Kushlan and Hancock 2005), aquatic and terrestrial insects (e.g. beetles, dragonfly larvae, mole crickets and crickets) (Kushlan and Hancock 2005) and crustaceans (del Hoyo et al. 1992) (e.g. Palaemonetes spp., amphipods, phylopods, crabs and exotic species of crayfish) (Kushlan and Hancock 2005) as well as amphibians, molluscs (del Hoyo et al. 1992) (snails and bivalves) (Kushlan and Hancock 2005), spiders, worms, reptiles and small birds (del Hoyo et al. 1992).		Loss/change of habitat function may affect suitability of an area.
Little Gull	*Hydrocoloeus minutus*	Green	NT	2%	Breeding - The species is mainly insectivorous when breeding, taking e.g. dragonflies, beetles, midges (del Hoyo et al. 1996), mayflies and stoneflies (Richards 1990). Non-breeding - On migration its diet is the same as during the breeding season (consisting mainly of insects) (del Hoyo et al. 1996), although during the winter the species switches to a diet of small fish and marine invertebrates (del Hoyo et al. 1996), (Urban et al. 1986).		Present in particular outwith the breeding season, could be affected by loss of foraging and/or roosting resources, and barriers to movement associated with these functions.
Little Tern	*Sternula albifrons*	Amber	LC	3%	Its diet consists predominantly of small fish (e.g. Ammodytes spp., roach Rutilus rutilus, rudd Scardinius erythrophthalmus, carp Cyprinus carpio and perch Perca fluviatilis) and crustaceans 3-6 cm long as well as insects, annelid worms and molluscs (del Hoyo et al. 1996). In Scotland, Little Terns feed mainly on small fish and invertebrates, including herring, sandeel, and shrimps (Crangon vulgaris) (BirdLife International 2000). In Portugal, birds were found to feed mainly on sand-smelts (Atherina spp.) and gobies (Pomatoschistus spp.), which were the most abundant fish species in the study areas (Catry et al 2006). On Rigby Island, Australia, chicks were fed entirely on juvenile fish of the families Clupeidae, Engraulidae, Pomatomidae and Carangidae, including pilchard, southern anchovy and blue sprat (Taylor and Roe 2004).	11km	Potential impacts to breeding site usage given short foraging range if habitat and function is lost/modified. Disturbance.
Manx Shearwater	*Puffinus puffinus*	Amber	LC	14%	This marine species is mainly found on waters over the continental shelf, feeding mainly on small shoaling fish but also on some squid, crustaceans and offal. Prey is caught mainly by pursuit-plunging and pursuit-diving, either alone or in small flocks.	>330km	Greatest potential impact in closer proximity to breeding sites, but wide ranging foraging means potential interactions in terms of barriers to movement and foraging cannot be discounted at a wide scale. Potential further issues with migratory functions albeit at a lower level of function loss/flight response.
Mediterranean Gull	*Ichthyaetus melanocephalus*	Amber	LC	2%	Breeding - During the breeding season its diet consists of terrestrial and aquatic insects, gastropods, small numbers of fish and rodents (del Hoyo et al. 1996). Non-breeding - When not breeding the species takes marine fish, molluscs (Urban et al. 1986, del Hoyo et al. 1996), insects (Urban et al. 1986) (e.g. beetles and grasshoppers) (Milchev et al. 2004), earthworms, berries (Urban et al. 1986), seeds (e.g. of barley, wheat, sunflowers and ragwort) (Milchev et al. 2004), offal (del Hoyo et al. 1996) and occasionally sewage and refuse (del Hoyo et al. 1996).	20km	Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Mute Swan	*Cygnus olor*	Amber	LC	2%	Its diet consists predominantly of leaves and the vegetative parts of aquatic plants (Johnsgard 1978, del Hoyo et al. 1992) and grasses (del Hoyo et al. 1992) as well as algae (Johnsgard 1978) and grain (del Hoyo et al. 1992), occasionally also taking small amphibians (Johnsgard 1978, del Hoyo et al. 1992) (frogs, toads and tadpoles) (Snow and Perrins 1998) and aquatic invertebrates (e.g. molluscs, insects and worms) (Johnsgard 1978, del Hoyo et al. 1992).		Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Northern Shoveler	*Anas clypeata*	Amber	NA	3%	Its diet consists of small aquatic invertebrates such as adult and larval insects (del Hoyo et al. 1992) (e.g. caddisfly larvae, damselfly and dragonfly nymphs, adult beetles, bugs and flies [Johnsgard 1978, Brown et al. 1982]), molluscs (del Hoyo et al. 1992), planktonic crustaceans (Snow and Perrins 1998), the seeds of emergent and aquatic plants (del Hoyo et al. 1992, Kear 2005b) (e.g. bulrushes and waterweeds) (Johnsgard 1978), annelids, amphibian spawn, tadpoles, spiders, fish and the vegetative parts of aquatic plants (e.g. duckweeds) (Johnsgard 1978, Brown et al. 1982). Breeding site The nest is a scrape or depression (del Hoyo et al. 1992, Kear 2005b) on the ground in tall grass, among hummocks, in the open (Flint et al. 1984) or (rarely) in bulrush marshes (Kear 2005b). Usually the species nests close to water but if grass cover is unavailable in the wetland site it may also nest far away from water under bushes, in hayfields or in meadows (Flint et al. 1984, Kear 2005b). Although it is not a colonial species, several pairs may nest in close proximity (Madge and Burn 1988).		Small potential for coastal wetlands and estuary impacts during winter months through loss of foraging function.
Oystercatcher	*Haematopus ostralegus*	Amber	V	10%	When foraging on soft intertidal substrates bivalves and gastropods are the most important food items for this species (del Hoyo et al. 1996). Polychaetes and crustaceans are more important in estuaries however, and molluscs (e.g. mussels, limpets and whelks) are most important on rocky shores (del Hoyo et al. 1996). When inland, prey such as earthworms and insect larvae (e.g. caterpillars and cranefly larvae) are also taken (del Hoyo et al. 1996).		Direct and indirect loss of foraging potential and roost sites, Disturbance and modification to movement.
Pink-footed Goose	*Anser brachyrhynchus*	Amber	LC	5%	The species is hebivorous (del Hoyo *et al*. 1992) and an opportunistic forager (Kear 2005a). *Breeding* During the breeding season its diet consists of the leaves, stems, roots, berries and seed-heads of sedges, mosses, lichens (del Hoyo *et al*. 1992), *Empetrum* spp. and grasses (Kear 2005a). *Non-breeding* In its wintering areas the species is more reliant on grass, grain, vegetables (e.g. carrots, sugar beet (Kear 2005a)) and potatoes grown on agricultural land (del Hoyo *et al*. 1992).		Mostly impacts through loss of roosting/resting areas which have a link to preferred foraging sites. Some potential for disturbance and general energy budget issues. However their distribution limits the severity of any issues to minimal.
Pintail	*Anas acuta*	Amber	LC	14%	This species is omnivorous (del Hoyo et al. 1992) and opportunistic (Johnsgard 1978), its diet consisting of algae (Brown et al. 1982), seeds (Hockey et al. 2005) (e.g. cereals (del Hoyo et al. 1992) and rice (Brown et al. 1982)), tubers (e.g. potatoes) (Brown et al. 1982, del Hoyo et al. 1992, Hockey et al. 2005), and the vegetative parts of aquatic plants, sedges (del Hoyo et al. 1992, Hockey et al. 2005) and grasses (Brown et al. 1982, Hockey et al. 2005), as well as aquatic invertebrates (e.g. insects, molluscs and crustaceans), amphibians (Brown et al. 1982, del Hoyo et al. 1992, Hockey et al. 2005) and small fish (del Hoyo et al. 1992), feeds on mud bottom at depths of 10-30cm.		Peak coastal/estuarine use during winter months. Roosting and foraging on mud/sandflats might be affected (habitat loss/modification. Disturbance effects and potential issues from flock concentrations e.g. on the Dee.
Puffin	*Fratercula arctica*	Red	E	5%	The species is a pursuit-diver catching most of its prey within 30 m of the water surface but capable of diving to 60 m (Piatt and Nettleship 1985, Burger and Simpson 1986). They prey on 'forage' species, including juvenile pelagic fishes, such as herring Clupea harengus, juvenile and adult capelin Mallotus villosus, and sandeel Ammodytes spp. (Barrett et al. 1987). At times, they also prey on juvenile demersal fishes, such as gadids (Harris and Hislop 1978, Martin 1989, Rodway and Montevecchi 1996). Sandeels usually form the majority of the prey fed to chicks (Corkhill 1973, Hislop and Harris 1985, Harris and Wanless 1986, Martin 1989, Harris and Riddiford 1989), and many chicks starve during periods of low sandeel abundance (Martin 1989), although there are exceptions, such as at Skomer Island in 1969 when sprat made up the majority of the diet fed to chicks (Corkhill 1973).	200km	Greatest potential impact in closer proximity to breeding sites, but wide ranging foraging means potential interactions in terms of barriers to movement and foraging cannot be discounted at a wide scale. Changes to hydrodynamics and physical conditions may influence prey availability even outwith TLP sites. Potential further issues with migratory functions albeit at a lower level of function loss/flight response.

Red-breasted Merganser	*Mergus serrator*	Green	NT	2%	Its diet consists predominantly of small, shoaling marine or freshwater fish (del Hoyo et al. 1992), as well as small amounts of plant material (del Hoyo et al. 1992) and aquatic invertebrates (del Hoyo et al. 1992) such as crustaceans (e.g. shrimps and crayfish) (Johnsgard 1978), worms and insects (Kear 2005b).		Loss or changes to habitats and prey availability has the potential to influence breeding usage as well as wintering potential (e.g. changes to hydrodynamics directly or indirectly affecting wintering conditions.
Redshank	*Tringa totanus*	Amber	LC	12%	Breeding When breeding its diet consists of insects, spiders and annelid worms (del Hoyo et al. 1996). Non-breeding During the non-breeding season the species takes insects, spiders and annelid worms (del Hoyo et al. 1996), as well as molluscs, crustaceans (especially amphipods e.g. Corophium spp.) (del Hoyo et al. 1996) and occasionally small fish and tadpoles (del Hoyo et al. 1996).		Potential loss/change to foraging availability during passage & winter. Disturbance and implications for energy budget.
Red-throated Diver	*Gavia stellata*	Green	LC	2%	Its diet consists predominantly of fish as well as crustaceans, molluscs, frogs, fish spawn (del Hoyo et al. 1992), aquatic insects, annelid worms (Snow and Perrins 1998) and plant matter (del Hoyo et al. 1992).	9km	Potential loss of foraging resource outwith summer, either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna. Potential changes to wave climate may effect suitability of a coastal areas.
Ringed Plover	*Charadrius hiaticula*	Red	LC	9%	Its diet consists of small crustaceans, molluscs, polycheate worms, isopods, amphipods, insects (e.g. ants, beetles, flies and fly larvae) and millipedes (del Hoyo et al. 1996).		Potential implications for breeding habitat availability. Potential loss/change to foraging availability during passage & winter. Disturbance and implications for energy budget.
Roseate tern	*Sterna dougallii*	Red	LC	2%	This species is a specialist forager, and takes a small prey spectrum compared to Common Tern at the same sites (Birdlife International 2000). Its diet consists predominantly of small pelagic fish (Urban et al. 1986, del Hoyo et al. 1996), particularly sandeel (Birdlife International 2000, Newton and Crowe 2000) and sprat (Birdlife International 2000) and sometimes clupeids (Birdlife International 2000, Newton and Crowe 2000) and gadoids (Newton and Crowe 2000), although it will also take insects and marine invertebrates (del Hoyo et al. 1996) such as crustaceans (Urban et al. 1986). Sandeel are particularly important during chick rearing (Newton and Crowe 2000). In Puerto Rico, adult Roseate Terns fed primarily on dwarf herrings (Jenkinsia lamprotaenia) and anchovies (Anchoa spp.), and chicks were mostly fed dwarf herrings and sardines (Harengulaand Opisthonema spp.); few anchovies were fed to chicks (Shealer 1998).	30km	Breeding site potential issues, although effect limited by foraging range. Potential for loss of habitat and disturbance. Colonial nature and status means risk is severe if within proximity of TLP.
Ruff	*Philomachus pugnax*	Red	LC	3%	The species rarely utilises intertidal habitats (Hayman et al. 1986) but may frequent tidal mudflats and lagoons in India (del Hoyo et al. 1996). During the breeding season the species's diet consists almost entirely of adult and larval terrestrial and aquatic insects such as Coleoptera and Diptera (del Hoyo et al. 1996). On passage and during the winter the species takes insects (e.g. caddisflies, water-bugs, mayflies and grasshoppers), small crustaceans, spiders, small molluscs, annelid worms, frogs, small fish and the seeds of rice and other cereals, sedges, grasses and aquatic plants (del Hoyo et al. 1996).		Some potential for wintering and passage effects through direct habitat loss of estuary/coast.
Sanderling	*Calidris alba*	Amber	LC	9%	Breeding When breeding the species takes insects (especially adult and larval Diptera, Coleoptera and Lepidoptera) as well as spiders and crustaceans (del Hoyo et al. 1996). On arrival on the breeding grounds the species may also complement its diet with plant matter (e.g. seeds, saxifrage buds, moss and algae) (del Hoyo et al. 1996) before invertebrate prey becomes available (Johnsgard 1981). Non-breeding During the winter its diet consists of small molluscs, crustaceans, polychaete worms and adult, larval and pupal insects (e.g. Diptera, Coleoptera, Lepidoptera, Hemiptera and Hymenoptera), as well as occasionally fish and carrion (del Hoyo et al. 1996).		Passage and wintering foraging function loss potential with barrier effects (loss of function) during migration
Sandwich Tern	*Sterna sandvicensis*	Amber	LC	9%	Its diet consists predominantly of surface-dwelling marine fish (Snow and Perrins 1998) 9-15 cm long (del Hoyo et al.1996) as well as small shrimps, marine worms and shorebird nestlings (del Hoyo et al. 1996).	54km	Loss of breeding habitat and foraging potential, disturbance. Mortality from collision, changes to hydrodynamic conditions altering sediment and thus prey.
Scaup	*Aythya marila*	Red	V (Winter pop)	2%	The species is omnivorous (Kear 2005b), its diet consisting predominantly of molluscs (e.g. mussels [Kear 2005b] Mytilus spp. [del Hoyo et al. 1992], cockles Cardium spp. and clams Macoma spp. in coastal habitats, and Hydrobia spp. in brackish habitats [Kear 2005b]) especially during the winter (Johnsgard 1978), as well as insects (del Hoyo et al. 1992), aquatic insect larvae (Johnsgard 1978), crustaceans (del Hoyo et al. 1992) (e.g. amphipods [Johnsgard 1978]), worms, small fish (del Hoyo et al. 1992), and the roots, seeds and vegetative parts of aquatic plants such as sedges (del Hoyo et al. 1992) (Kear 2005b) and water weeds (Kear 2005b).		Loss or modification to foraging habitat on coast/estuaries e.g. the Dee during winter. Potential modifications to movement and disturbance.
Shelduck	*Tadorna tadorna*	Amber	LC	10%	Its diet consists predominantly of salt-water molluscs (e.g. Hydrobia spp.) as well as other aquatic invertebrates (e.g. insects, crustaceans and worms), small fish, fish spawn and plant material (del Hoyo et al. 1992) (e.g. algae, seeds and agricultural grain) (Kear 2005a).		Loss or modification to foraging habitat on coast/estuaries. Potential modifications to movement and disturbance with moult period vulnerabilities. Some limited breeding site function issues either directly via habitat loss or indirectly e.g. disturbance.
Spotted Redshank	*Tringa erythropus*	Amber	LC	2%	The species is carnivorous, its diet consisting chiefly of aquatic insects and their larvae (especially swimming beetles and hemipterans), terrestrial flying insects (such as craneflies), small crustaceans, molluscs, polycheate worms, and small fish and amphibians up to 6-7 cm long (Johnsgard 1981, del Hoyo et al. 1996).		Passage and wintering foraging function loss potential with additional barrier effects (loss of function) during migration e.g. Dee estuary, Burry Inlet.
Storm Petrel	*Hydrobates pelagicus*	Amber	LC	2%	This is a marine species feeding mainly on small fish, squid and crustaceans, but it will also feed on medusae and offal. It feeds mainly on the wing by pattering and fishing, and will occaisionally follow ships and attend trawlers.	>65km	Greatest potential impact in closer proximity to breeding colonies but wide ranging foraging means potential interactions in terms of barriers to movement and foraging cannot be discounted at a wide scale. Changes to hydrodynamics and physical conditions may influence prey availability even outwith TLP sites. Potential further issues with migratory functions albeit at a lower level of function loss/flight response.
Teal	*Anas crecca*	Amber	LC	10%	Breeding In spring and summer the diet of the species consists predominantly of animal matter such as molluscs, worms, insects and crustaceans (del Hoyo et al. 1992). Non-breeding During winter the species mainly takes the seeds of aquatic plants (del Hoyo et al. 1992) (e.g. emergent and submerged macrophytes) (Kear 2005b), grasses, sedges and agricultural grain (del Hoyo et al. 1992) (cereals and rice) (Kear 2005b).		Coastal distribution predominantly during winter, with large concentrations on estuaries e.g. Mersey. Potential for foraging and loafing function loss directly or through disturbance. Possible modification to movement.

Turnstone	*Arenaria interpres*	Amber	LC	5%	*Breeding* On its Arctic breeding grounds the species takes Diptera(especially adult and larval midges) as well as larval Lepidoptera, Hymenoptera, Coleoptera and spiders, occasionally also taking vegetable matter early in the season (del Hoyo *et al.* 1996). *Non-breeding* Outside of the breeding season its diet consists of insects, crustaceans, molluscs (del Hoyo *et al.* 1996) (especially mussels or cockles) (Johnsgard 1981), annelids, echinoderms, small fish, carrion and birds eggs (del Hoyo *et al.* 1996).		Direct and indirect loss of foraging potential and roost sites, Disturbance and modification to movement.
Whimbrel	*Numenius phaeopus*	Red	LC	2%	When inland on migration and during the breeding season its diet consists of adult and larval insects (Johnsgard 1981, del Hoyo et al. 1996) (e.g. Coleoptera, Orthoptera and cranefly larvae), spiders, millipedes, earthworms, snails, slugs, seeds, leaves and berries (del Hoyo et al. 1996) (e.g. of ericaceous plants) (Johnsgard 1981). On the coast during the winter the species takes crustaceans (e.g. crabs), molluscs, large polychaete worms and occasionally fish, reptiles or young birds (del Hoyo et al. 1996).		Direct and indirect loss of foraging potential and roost sites, Disturbance and modification to movement.
White-Fronted Goose	*Anser albifrons albifrons*	Red	LC	2%	The species is herbivorous, its diet consisting of the roots, leaves, stems, seeds and fruits of terrestrial plants such as herbs, grasses and sedges (del Hoyo *et al*. 1992), as well as agricultural grain (e.g. corn, oats (del Hoyo *et al*. 1992), wheat, rice and barley (Johnsgard 1978)), potatoes and sprouting cereals (especially in the winter) (del Hoyo *et al*. 1992).		Mostly impacts through loss of roosting/resting areas which have a link to preferred foraging sites. Some potential for disturbance and general energy budget issues e.g. Severn.
Whooper Swan	*Cygnus cygnus*	Amber	LC	3%	The species is predominantly herbivorous (del Hoyo et al. 1992), its diet consisting of the leaves, stems and roots (Johnsgard 1978) of aquatic plants (e.g. algae and Zostera, Ruppia and Potamogeton spp.), grasses (del Hoyo et al. 1992), sedges and horsetails (Equisetum spp.) (Kear 2005a). During the winter the species also takes agricultural grain, vegetables (e.g. potatoes and turnips (Johnsgard 1978)) and acorns (del Hoyo et al. 1992), and on the breeding grounds young birds often take adult and larval insects (Johnsgard 1978) (e.g. emerging chironomids) (Kear 2005a). Adults may also supplement their diet with marine and freshwater mussels (Kear 2005a).		Potential loss of foraging resource either directly or through change to hydrodynamic/sediment conditions and thus flora & fauna.
Wigeon	*Anas penelope*	Amber	LC	9%	It is vegetarian and consumes the leaves, seeds, stems and root bulbs of pond weeds, fine grasses (Myrfyn and Thomas 1979) (especially from agricultural land surrounding lakes) (Jacobsen 1993), horsetails (Kretchmar 1994) and eelgrass, as well as algae (Johnsgard 1978). Animal material is taken rarely and usually incidentally along with vegetation or seeds (Myrfyn and Thomas 1979, Kear 2005b).		Coastal distribution predominantly during winter, with large concentrations on estuaries e. Potential for foraging and loafing function loss directly or through disturbance. Possible modification to movement.

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Appendix J
Annexes to Section 13

14.1 Annexe 1

The case for increased production of renewable energy

There is an imperative, urgent need to decarbonise the economy in order to reduce greenhouse gas emissions. At the same time, it is critical that the UK continues to have secure and reliable sources of electricity as we make the transition to a low carbon economy.

An introduction to the national and global context for low carbon energy in relation to the energy trilemma (Security, Equity and Sustainability), and the policy landscape in Europe, the UK and Wales is given in the **NAW Research Briefing: Low Carbon Energy in Wales (May 2017)**[71]

International Policy context

The international policy context for reducing greenhouse gas emissions and taking steps to tackle climate change includes:

- **Intergovernmental Panel on Climate Change** (IPCC) Fifth Assessment Report (AR5) (2013) and more recent updates, which states "It is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together."
- **Kyoto protocol** (United Nations Framework Convention on Climate Change; December 1997) which commits its signatories to binding targets to reduce greenhouse gas emissions
- **Doha (December 2010) Amendment** to the Protocol furthers these commitments in the future.
- Under the **Renewable Energy Directive** (2009/28/EC) (2009), EU members made a legally-binding commitment to collectively cut their carbon dioxide emissions by at least 20 per cent of 1990 levels; improve energy efficiency to achieve a 20 per cent reduction in primary energy use compared to projected levels; and increase the proportion of EU energy consumption from renewable sources to 20 per cent, all by 2020.

UK policy context

The UK policy context includes:

The UK Climate Change Act 2008[72]

The Act makes it the duty of the Secretary of State to ensure that the net UK carbon account for all six Kyoto greenhouse gases for the year 2050 is at least 80% lower than the 1990 baseline, toward avoiding dangerous climate change. The Act aims to enable the UK to become a low-carbon economy and gives ministers powers to introduce the measures necessary to achieve a range of greenhouse gas reduction targets.

[71] http://www.assembly.wales/research%20documents/17-010%20low%20carbon%20energy%20in%20wales/17-010-web-english.pdf

[72] https://www.legislation.gov.uk/ukpga/2008/27/contents

To ensure that regular progress is made towards the 2050 target, the Act also established a system of five-yearly carbon budgets, to serve as stepping stones on the way. The first four carbon budgets, leading to 2027, have been set in law. The UK is currently in the second carbon budget period (2013-17). Meeting the fourth carbon budget (2023-27) will require that emissions be reduced by 50% on 1990 levels in 2025. The Government is committed, under the Fifth Carbon Budget covering the period 2028-32, to reduce carbon emissions by 57% from 1990 levels. The UK Government has made significant progress in decarbonising the electricity sector to meet our 2050 obligations, although progress in other sectors has been slower than anticipated.

The main direction of UK policy on energy and climate change was set out in two White papers, published in 2007 and 2009. The 2007 White paper "Meeting the Energy Challenge: a White Paper on Energy" was published with the aim of defining a long-term strategic vision for energy policy. In the 2009 paper, UK Low Carbon Transition Plan, renewable energy is identified as a key part of the plan and the strategy recognises that accelerating the uptake of renewable energy will help in decarbonising energy production in the UK, while ensuring secure and safe energy supplies.

UK Renewable Energy Strategy (2009)[73]

This identifies the need to radically increase our use of renewable electricity, heat and transport and sets out how and why. It sets out the path to meet legally-binding target to ensure 15% of energy comes from renewable sources by 2020.

It will help tackle climate change, reducing the UK's emissions of carbon dioxide by over 750 million tonnes between now and 2030. It will also promote the security of our energy supply, reducing overall fossil fuel demand by around 10% and gas imports by 20–30% against what they would have been in 2020.

In parallel with energy saving, nuclear and carbon capture and storage, this is a key element of the overall transition plan for setting the UK on the path to achieve a low-carbon, sustainable future that helps address dangerous climate change.

Lead scenarios suggest that:

- More than 30% of our electricity generated from renewables, up from about 5.5% today. Much of this will be from wind power, on or offshore, but hydro and wave and tidal will also play an important role.
- 12% of our heat generated from renewables, up from very low levels today. We expect this to come from a range of sources including biomass, biogas, solar and heat pump sources in homes, businesses and communities across the UK.
- 10% of transport energy from renewables, up from the current level of 2.6% of road transport consumption. The Government will also act to support electric vehicles and pursue the case for further electrification of the rail network.

To deliver this various mechanisms will be put in place to deliver financial support, drive delivery and clear away barriers, increase in vestment in emerging technologies and pursue new sources of supply and create new opportunities for individuals, communities and business to harness renewable energy.

Stern made clear in his 2007 Review of the Economics of Climate Change the costs of inaction are much greater. And there will be significant benefits. Our goal is to maximise the environmental, economic and employment opportunities for the UK from renewables. We want the UK to be the location of choice for inward investment and a world class centre of energy expertise. This Strategy – and our wider UK Low Carbon Transition Plan published in parallel with it – will enable us to build the UK low-carbon economy, promote energy security and take action against climate change.

[73] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228866/7686.pdf

UK Government's National Renewable Energy Action Plan (2010)[74]

This the National Renewable Energy Action Plan (NREAP) for the United Kingdom. The plan was commissioned by the Directive 2009/28/EC which required Member States of the European Union to notify the European Commission with a road map. The report describes how the United Kingdom planned to achieve its legally binding target of a 15% share of energy from renewable sources in gross final consumption of energy by 2020.

UK Renewable Energy Roadmap (2011)[75]

The Renewable energy roadmap sets out how the UK will reach the goal introduced in the 2009 EU Renewable Energy Directive of generating 15% of UK energy use from renewables by 2020. It presented a framework and set of actions for the delivery of renewable energy deployment. The first update of the Roadmap reported on progress the UK is making toward the 15% target up to the end of 2012 and the second update provides analysis on further achievements and changes that have taken place in 2013.

The UK Committee on Climate Change[76]

This has stated in order to achieve UK decarbonisation targets there is a need for the supply of electricity to be almost entirely decarbonised by 2025. This is a very significant undertaking and it is therefore essential that no form of low carbon generation is ruled out.

UK Marine Policy Statement (March 2011)[77]

The above policy priorities for increased contributions from Renewable energy are supported by the UK Marine Policy Statement (MPS) which states that:

"*A secure, sustainable and affordable supply of energy is of central importance to the economic and social well being of the UK. The marine environment will make an increasingly major contribution to the provision of the UK's energy supply and distribution. This contribution includes the oil and gas sectors which supply the major part of our current energy needs, and a growing contribution from renewable energy and from other forms of low carbon energy supply in response to the challenges of tackling climate change and energy security. Contributing to securing the UK's energy objectives, while protecting the environment, will be a priority for marine planning.*"

Also that "*The UK faces a significant challenge in achieving a secure, affordable low carbon energy supply. The Climate Change Act 2008 and Climate Change (Scotland) Act 2009 established a long-term framework to cut greenhouse gas emissions by at least 80% below 1990 levels by 2050, and the Climate Change Committee recommended that the electricity sector needed to be largely decarbonised by 2030. As part of our move to a low carbon energy economy, the UK must meet a legally binding EU target for 15% of energy consumption to come from renewable sources by 2020*" and that "*A significant part of the renewable energy required to meet these targets and objectives will come from marine sources*".

The MPS goes on to state that "*When developing Marine Plans, marine plan authorities should identify how these will contribute to delivery of national targets and priorities, including legally binding commitments entered into under the Renewable Energy Directive (Directive 2009/28/EC) and our domestic binding target to reduce greenhouse gas emissions by 80% by 2050. This will include taking account of preferred areas for development of different energy sources, generation and distribution infrastructure and, if appropriate, setting out potential new opportunities, taking into account the most sensitive areas for biodiversity and considering carefully areas with competing and incompatible uses.*"

74 https://www.gov.uk/government/publications/national-renewable-energy-action-plan
75 https://www.gov.uk/government/collections/uk-renewable-energy-roadmap
76 https://www.theccc.org.uk/
77 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69322/pb3654-marine-policy-statement-110316.pdf

At para 3.3.4 the MPS states, amongst other considerations, that when decision makers are examining and determining applications for energy infrastructure and marine plan authorities are developing Marine Plans they should take into account:

- The national level of need for energy infrastructure, as set out in the Overarching National Policy Statement for Energy (EN-1) which applies in England and Wales;
- The positive wider environmental, societal and economic benefits of low carbon electricity generation and carbon capture and storage as key technologies for reducing carbon dioxide emissions;
- That the physical resources and features that form oil and gas fields or suitable sites for gas or carbon dioxide storage occur in relatively few locations and need first of all to be explored for and can then only be exploited where they are found. Similarly, renewable energy resources can only be developed where the resource exists and where economically feasible;
- The potential impact of inward investment in offshore wind, wave, tidal stream and tidal range energy related manufacturing and deployment activity; as well as the impact of associated employment opportunities on the regeneration of local and national economies. All of these activities support the objective of developing the UK's low carbon manufacturing capability.

UK Overarching National Policy Statement for energy EN-1[78] (July 2011)

The UK Overarching National Policy Statement for energy EN-1[79] (July 2011) sets out the strategic need for renewable energy:

"*2.2.1 We are committed to meeting our legally binding target to cut greenhouse gas emissions by at least 80% by 2050, compared to 1990 levels. Analysis done on possible 2050 pathways shows that moving to a secure, low carbon energy system is challenging, but achievable. It requires major investment in new technologies to renovate our buildings, the electrification of much of our heating, industry and transport, prioritisation of sustainable bioenergy and cleaner power generation. And it requires major changes in the way energy is used by individuals, by industry, and by the public sector.*

2.2.2 Delivering this change is a major challenge not least for energy providers, and the Government is working to ensure their efforts produce the major, rapid change the UK needs. Within a market-based system and with severe constraints on public expenditure in the near-term, the focus of Government activity in this transformation is clear. It should be on developing a clear, long-term policy framework which facilitates investment in the necessary new infrastructure (by the private sector) and in energy efficiency.

2.2.5 The UK economy is reliant on fossil fuels, and they are likely to play a significant role for some time to come. Most of our power stations are fuelled by coal and gas. The majority of homes have gas central heating, and on our roads, in the air and on the sea, our transport is almost wholly dependent on oil.

2.2.6 However, the UK needs to wean itself off such a high carbon energy mix: to reduce greenhouse gas emissions, and to improve the security, availability and affordability of energy through diversification. Under some of the illustrative 2050 pathways, electricity generation would need to be virtually emission-free, given that we would expect some emissions from industrial and agricultural processes, transport and waste to persist. By 2050, we can expect that fossil fuels will be scarcer, but will still be in demand, and that prices will therefore be far higher. Further, the UK's own oil and gas resources will be depleting and, worldwide, the costs and risks of extracting oil in particular will increase.

2.2.7 Continuation of global emissions, including greenhouse gases like carbon dioxide, at current levels could lead average global temperatures to rise by up to 6°C by the end of this century. This would make extreme weather events like floods and droughts more frequent and increase global instability, conflict, public health-related deaths and migration of people to levels beyond any recent experience. Heat waves, droughts, and floods would affect the UK.

[78] https://www.gov.uk/government/publications/national-policy-statements-for-energy-infrastructure
[79] https://www.gov.uk/government/publications/national-policy-statements-for-energy-infrastructure

2.2.8 To avoid the most dangerous impacts of climate change, the increase in average global temperatures must be kept to no more than 2°C, and that means global emissions must start falling as a matter of urgency. To drive the transition needed the Government has put in place the world's first ever legally binding framework to cut emissions by at least 80% by 2050, that will deliver emission reductions through a system of five year carbon budgets that will set a trajectory to 2050.

2.2.20 It is critical that the UK continues to have secure and reliable supplies of electricity as we make the transition to a low carbon economy. To manage the risks to achieving security of supply we need:

- *sufficient electricity capacity (including a greater proportion of low carbon generation) to meet demand at all times. Electricity cannot be stored so demand for it must be simultaneously and continuously met by its supply.*

This requires a safety margin of spare capacity to accommodate unforeseen fluctuations in supply or demand;

- *reliable associated supply chains (for example fuel for power stations) to meet demand as it arises;*
- *a diverse mix of technologies and fuels, so that we do not rely on any one technology or fuel. Diversity can be achieved through the use of different technologies and multiple supply routes (for example, primary fuels imported from a wide range of countries); and*
- *there should be effective price signals, so that market participants have sufficient incentives to react in a timely way to minimise imbalances between supply and demand.*

2.2.22 Looking further ahead, the 2050 pathways show that the need to electrify large parts of the industrial and domestic heat and transport sectors could double demand for electricity over the next forty years. It makes sense to switch to electricity where practical, as electricity can be used for a wide range of activities (often with better efficiency than other fuels) and can, to a large extent, be scaled up to meet demand. To meet emissions targets, the electricity being consumed will need to be almost exclusively from low carbon sources. Contrast this with the first quarter of 2011, when around 75% of our electricity was supplied by burning gas and coal."

3.4.1 of EN-1 states: "*The UK has committed to sourcing 15% of its total energy (across the sectors of transport, electricity and heat) from renewable sources by 2020 and new projects need to continue to come forward urgently to ensure that we meet this target. Projections suggest that by 2020 about 30% or more of our electricity generation – both centralised and small-scale – could come from renewable sources, compared to 6.7% in 2009. The Committee on Climate Change in Phase 1 of its advice to Government in September 2010 agreed that the UK 2020 target was appropriate, and should not be increased. Phase 2 was published in May 2011 and provided recommendations on the post 2020 ambition for renewables in the UK, and possible pathways to maximise their contribution to the 2050 carbon reduction targets*."

3.4.5 states: "*Paragraph 3.4.1 above sets out the UK commitments to sourcing 15% of energy from renewable sources by 2020. To hit this target, and to largely decarbonise the power sector by 2030, it is necessary to bring forward new renewable electricity generating projects as soon as possible. The need for new renewable electricity generation projects is therefore urgent.*"

Government's 2050 Pathways Analysis[80]

The **Government's 2050 Pathways Analysis** considers different scenarios by which the UK can move to a secure low carbon economy by 2050. Whilst there are different pathways by which the UK can reach its 2050 objectives, common themes from the different pathways have emerged which show that:

- ambitious per capita demand reduction is needed and the greater the constraints on low carbon energy supply the greater the reduction in demand will need to be;
- a substantial level of electrification of heating, transport and industry will be required;

[80] The 2050 Pathways Analysis was published as part of a call for evidence in July 2010 http://econsultation.decc.gov.uk/decc-executive/2050_pathways/consult_view.

- electricity demand could double by 2050 from present levels; and
- the electricity supply will need to be decarbonised.

Welsh National policy context

The Welsh Government views climate change as one of the greatest challenges facing the world and believes that it is imperative to act urgently to reduce emissions. There is therefore an imperative need to decarbonise the economy in order to reduce greenhouse gas emissions. At the same time, it is critical that the UK continues to have secure and reliable sources of electricity as we make the transition to a low carbon economy.

The **NAW Research Briefing: Low Carbon Energy in Wales (May 2017)**[81] at pages 9 – 13 sets out the broad Welsh Policies and context for low carbon energy in Wales. Further additional marine renewables and environmental context is given below:

- The Welsh Government Energy Wales: **Route Map to a Clean, Low Carbon and More Competitive Energy Future for Wales (2005**) (archived) identifies that Wales is seeking to achieve a renewable electricity production target of 7TWh (7,000MWh) per annum by 2020. A further target figure of 22,500MW (22.5TW) of installed capacity of renewables by 2025 has also been set in the Welsh Government's **Energy Policy Statement, Low Carbon Revolution**[82] **(2010**).
- A Welsh Ministerial **Policy Statement on Marine Energy in Wales**[83] **(July 2009)** proposes how marine energy can be maximised from the Welsh coasts with minimum local environmental impact. The statement includes suggestions of actions for key stakeholders to put Wales on track for when low carbon electricity might be practically produced from the Welsh seas, something thought to be achievable by 2025. The statement notes that capturing the tidal-range energy in the Severn Estuary alone could contribute up to 9GW of electricity (more than 5% of the UK's current electricity needs). The statement explains how tidal range projects, and marine energy projects in general, will be supported by actions such as:
  - encouraging research and development capabilities;
  - laying foundations in Wales for a strong marine-energy industrial sector including relevant port developments;
  - ensuring that the new marine planning process takes full account of the climate change mitigation potential of large and small scale marine energy developments off the coasts of Wales; and
  - working with the UK Governments and Crown dependencies to accelerate the delivery of this whole agenda.
- Under the **Environment (Wales) Act 2016**[84], The Welsh Ministers must ensure that the net Welsh emissions account for the year 2050 is at least 80% lower than the baseline. This very significant and legally binding target means that Welsh Minsters need to promote policies that support the deployment of a range of renewable technologies as part of the energy mix as well as promoting increased efficiency and conservation of energy. It is clear that efficiencies alone will not address the need to replace ageing capacity as well as meet future increases in demand and new renewable energy sources will need to be deployed at scale. The UK and Wales are therefore committed to increasing the proportion of energy generation from renewable sources.

[81] http://www.assembly.wales/research%20documents/17-010%20low%20carbon%20energy%20in%20wales/17-010-web-english.pdf

[82] http://www.marineenergywales.co.uk/wp-content/uploads/2016/01/WAG-low-carbon-revolution2.pdf

[83] http://gov.wales/topics/environmentcountryside/energy/renewable/marine/marineenergy/?lang=en

[84] http://www.legislation.gov.uk/anaw/2016/3/contents/enacted

- A Welsh Ministerial **Policy Statement for clean energy generation in Wales [85] (28th September 2017)** by the Cabinet Secretary for Environment announced new ambitious targets.

Electricity generation from renewables in Wales has trebled since 2010, and last year provided 32% of the electricity we use. The Cabinet Secretary said she believes Wales can be at the forefront of global efforts to de-carbonise and today announced challenging new targets for renewable energy production. She told Assembly Members she wanted Wales to generate 70 per cent of its electricity consumption from renewable energy by 2030.

The Cabinet Secretary said: "*Wales must be able to compete in global low carbon markets, particularly now we face a future outside the EU. The ability to meet our needs from clean energy is the foundation for a prosperous low carbon economy. This is why I am today announcing targets to focus action across the country and to capture the benefits for Wales.*

"Firstly, I am setting a target of Wales generating 70 per cent of its electricity consumption from renewable energy by 2030.

"Secondly, I am setting a target for one Gigawatt of renewable electricity capacity in Wales to be locally owned by 2030.

"Finally, by 2020 I expect new renewable energy projects to have at least an element of local ownership.

"I believe these are stretching but realistic targets which will help us to de-carbonise our energy system, reduce long-term costs and deliver greater benefits to Wales."

[85] http://gov.wales/newsroom/environmentandcountryside/2017/170928-lesley-griffiths-high-on-ambition-for-clean-energy/?lang=en

14.2 Annexe 2

The case for supporting tidal lagoons as a component of marine renewable energy generation, particularly in Wales

Welsh Government policy in the form of '**Planning Policy Wales**[86]', '**Energy Wales: A Low Carbon Transition**[87]' and the **Programme for Government 'Taking Wales Forwards 2016-2012**[88]**'** provide a wider basis of policy support for tidal lagoons as part of the marine renewable energy mix in Wales (as noted by the SoS in determining the Swansea Bay Tidal Lagoon Development Consent Order (DCO): '*The SoS considered that there is policy support for the proposed development in terms of its contribution to the generation of renewable energy*'). '

There is no tidal range technology specific National Policy Statement. However, in determining the Development Consent Order for Swansea Bay Tidal Lagoon, the Secretary of State (SoS) considered that that '… in the absence of any adverse effects which are unacceptable in planning terms …" making the order would be consistent with NPS EN-1 (Overarching NPS for Energy), EN-3 (Renewable Energy Infrastructure) and EN-5 (Electrical Networks Infrastructure) which collectively set out a generic national need for development of new nationally significant electricity generating and network infrastructure.

Specifically, 'Taking Wales Forward' states that Welsh Government will 'support the development of more renewable energy projects, including tidal lagoons and community energy schemes.

An independent review of tidal lagoons was undertaken by **Charles Hendry**[89]**: "The role of tidal Lagoons "(December 2016).** The review aimed to assess the strategic case for tidal lagoons and whether they could represent value for money for the consumer. The review included:

- an assessment of whether, and in what circumstances, tidal lagoons could play a cost effective role as part of the UK energy mix;
- the potential scale of opportunity in the UK and internationally, including supply chain opportunities;
- consideration of a range of possible structures for financing tidal lagoons;
- consideration of different sizes of projects as the first of a kind; and
- whether a competitive framework could be put in place for the delivery of tidal lagoon projects.

The review took place in consultation with the relevant Government departments, in particular the Department for Business, Energy and Industrial Strategy and HM Treasury, but also with devolved offices. UK Government are considering their response to the Review (at October 2017).

The Review concluded: Having considered broad ranging evidence taken during the review into the potential role of tidal lagoons in the UK that: "*I am persuaded that power from tidal lagoons could make a strong contribution to UK energy security, as an indigenous and completely predictable form of supply."*

And

"*My conclusion is that tidal lagoons would help deliver security of supply; they would assist in delivering our decarbonisation commitments; and they would bring real and substantial opportunities for the UK supply chain. I have also concluded that they could play a competitive role as part of the UK's energy mix alongside low carbon energy from nuclear and offshore wind.*"

[86] http://gov.wales/topics/planning/policy/ppw/?lang=en

[87] http://gov.wales/topics/environmentcountryside/energy/energywales/?lang=en

[88] http://gov.wales/about/programme-for-government/?lang=en

[89] https://hendryreview.wordpress.com/

Tidal lagoons may have a very long generation lifetime (e.g. 120 years or more), providing a potentially important long-term benefit to society. The Hendry Review sates that: *'Evidence TLP submitted as part of the Review, taken from the development consent process for Tidal Lagoon Swansea Bay, indicates that the lifetime carbon costs of the project would be 14gCO2e/kWh'* and that: *' even with rock and aggregate construction, our technical advisers indicate that larger tidal lagoons could achieve lifetime carbon costs in the region of 14gCO2e/kWh due to a higher ratio of output to seawall length. This broadly aligns with a 2014 report by the Intergovernmental Panel on Climate change, and would compare well against estimated median emissions from other generation technologies."*

The below table shows that nuclear, wind and 'ocean' technologies are in a league of their own in terms of their lifetime carbon emissions. Even if the carbon emissions of tidal lagoons were to be driven up by changes in construction techniques, or in the provenance of component parts, they would still represent low-carbon generation.

Technology	Median lifetime emissions (incl. albedo effect), gCO2eq/kWh
Currently commercially available technologies	
Coal – PC	820
Gas – combined cycle	490
Biomass – cofiring	740
Biomass – dedicated	230
Geothermal	38
Hydropower	24
Nuclear	12
Concentrated Solar Power	27
Solar PV (rooftop)	41
Solar PV (utility)	48
Wind onshore	11
Wind offshore	12
Currently commercially available technologies	
CCS – Coal – Oxyfuel	160
CCS – Coal – PC	220
CCS – Coal – IGCC	200
CCS – Gas – Combined Cycle	170
Ocean (including wave and tidal)	17

Table: Emissions of selected electricity supply technologies. Source: IPCC

If tidal lagoons can be constructed and operated with such low levels of lifetime emissions, then it is clear that they would contribute positively to progress towards the UK's decarbonisation goals**.** Specifically, as part of the renewable energy mix, tidal lagoons technologies may be expected to provide a wide range of benefits through their contribution to a low carbon economy and security and diversity of energy supplies.

Swansea Bay Tidal Lagoon sets out its own case for tidal lagoons in Wales in its Environmental Statement (SBTLES)[90] as:

- Wales has significant wave and tidal energy potential and is considered to be exceptionally well placed to participate strongly in the creation of a new marine energy sector;
- generate reliable, renewable, predictable and carbon-free electricity;
- wave and tidal energy has the potential to meet up to 20 per cent of the UK's current electricity demand;
- reduce reliance upon fossil fuels and to secure energy from a mix of energy types for which tidal lagoons add to and diversify the 'energy mix' … producing significantly more power than current tidal stream or wave energy devices, and not creating dangerous or radioactive waste;
- are suitable for *{i.e. may be located at}* multiple sites around the UK coast with high tidal ranges (the Severn Estuary has the second highest tidal range in the world) and overseas;
- will generate energy for 120 years per project, a far greater lifespan than any other generating technology, whether renewable or fossil-fuelled;
- are well-supported by policy, and by the public (the statutory public consultation on TLSB indicated 86% support for the scheme) and that;
- while tidal lagoon energy at any one site is intermittent, a network of tidal lagoons around the UK coast would, in combination, overcome the intermittency issue and generate reliable, base load power around the clock. This is in contrast to the intermittency of offshore wind or wave technology.

Continuity and reliability of supply are important considerations in the context of energy security. Electricity from tidal range energy would be generated reliably; the SBTLES notes that "for around 14 hours of the day, and provide periods of energy production that can be used as base load electricity for the National Grid".

In terms of contributing to carbon reduction targets, the net carbon reduction effect of a technology is a consideration. Paragraph 5.4.0.3 of the SBTLES illustrates "that the Project will be carbon neutral in around 4 years" which equates to around 3% of its anticipated operational lifetime. Tidal lagoon technologies should therefore make a significant contribution to reducing greenhouse gas emissions over their lifetime.

Conclusion

Tidal range energy in Wales could potentially be exploited through either a Tidal barrage structure (i.e. impoundment of a water by developing a fixed structure between 2 fixed points e.g. a river or estuary mouth) or Tidal lagoons (i.e. an impoundment as per the barrage option, but one that can either stand alone (e.g. mid channel) or which intercepts the land and incorporates the land within its boundary walls. Stand alone lagoons are less likely to be financially viable in view of the amount of construction material involved, especially as waters significantly increase in depth offshore around Wales.

A substantial amount of work has been undertaken in relation to barrage and lagoon tidal range options for the Severn estuary, including the large cross-Severn tidal barrage (STFS, 2010).[91]

Arising from these considerations and others as outlined in this report, and in the development of technologies and understanding since 2010; whilst not ruling out tidal barrage options, Welsh Government believes that tidal lagoon technologies have the greatest immediate potential to make a significant contribute to our renewable energy mix.

[90] SBTL Environmental Statement https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010049/EN010049-000327-6.2.5%20ES%20Planning%20and%20Policy%20Context.pdf

[91] https://www.gov.uk/government/collections/severn-tidal-power-feasibility-study-conclusions

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