

**HORIZON**

NUCLEAR POWER



# Wylfa Newydd Project

## Biosecurity Risk Assessment Strategy Report

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# 1 Introduction

## 1.1 Purpose of this document

- 1.1.1 This biosecurity risk assessment strategy is a standalone document provided to support the Marine Licence application under the Marine and Coastal Access Act 2009 for the Wylfa Newydd Project. The purpose of this document is to provide a framework (strategy) for management of effects of and upon the Wylfa Newydd Development Consent Order (DCO) Project relating to marine invasive non-native species (INNS), and provide a draft assessment. A final detailed biosecurity risk assessment will be submitted to Natural Resources Wales (NRW) for approval prior to commencement of the relevant works under a Marine Licence. The completed final assessment will include details of the suitably qualified person(s) or group(s) responsible for ensuring that the required biosecurity measures are implemented.
- 1.1.2 This biosecurity risk assessment strategy provides details on the following:
- introduction to non-native species and the legal framework underpinning control of their transfer and spread (section 1);
  - invasive non-native species of concern (section 2);
  - risks and management measures including potential pathways for the transfer and spread of non-native species (section 3);
  - outline draft risk assessment for the transfer and spread of individual non-native species of concern (section 4);
  - monitoring for non-native species (section 5); and
  - corrective action for vessels (section 5).

## 1.2 Project description

- 1.2.1 Horizon Nuclear Power Wylfa Limited is currently planning to develop a new Nuclear Power Station on Anglesey as identified in the *National Policy Statement for Nuclear Power Generation (EN-6)*. The Wylfa Newydd DCO Project comprises the proposed new Nuclear Power Station, including the reactors, associated plant and ancillary structures and features, together with all of the development needed to support its delivery, such as highway improvements, worker accommodation and specialist training facilities. It also includes the licensed Disposal Site at Holyhead North (IS043). The Wylfa Newydd DCO Project will require a number of applications to be made under different legislation to different regulators. As a Nationally Significant Infrastructure Project under the Planning Act 2008, the construction and operation must be authorised by a DCO.
- 1.2.2 The Wylfa Newydd DCO Project is defined as those parts for which consent is being sought through the DCO, comprising: the Power Station; other on-site development; Marine Works; the Off-Site Power Station Facilities; and Associated Development. A description of each part is provided below, and

further detail is presented in chapters D1, E1, F1, G1 and H1 of the Environmental Statement.

- Power Station: the proposed new nuclear power station, including two UK Advanced Boiling Water Reactors (UK ABWRs), the Cooling Water System (CWS), supporting facilities, buildings, plant and structures, and radioactive waste and spent fuel storage buildings for the Grid Connection;
- Other on-site development: including landscape works and planting, drainage, surface water management systems, public access works including temporary and permanent closures and diversions of Public Rights of Way, new Power Station access road and internal site roads, car parking, construction compounds and temporary parking areas, laydown areas, working areas and temporary works and structures, temporary construction viewing area, diversion of utilities, perimeter and construction fencing;
- Marine Works: the construction and operation of the Permanent Marine Works and the Temporary Marine Works (this includes the Cooling Water intake and outfall, Marine Off-Loading Facility (MOLF) and breakwater structures);
- Off-site Power Station Facilities: comprising the Alternative Emergency Control Centre (AECC), Environmental Survey Laboratory (ESL) and a Mobile Emergency Equipment Garage (MEEG); and
- Associated Development: comprising works included in the DCO which facilitate the delivery of the Nationally Significant Infrastructure Project, and which include: the Site Campus, Park and Ride facility, Logistics Centre; and the A5025 Off-line Highway Improvements.

1.2.3 The following terms are used when describing the geographical areas related to the Wylfa Newydd DCO Project:

- Power Station Site: the indicative areas of land and sea within which the majority of the permanent Power Station buildings, plant and structures would be situated. It would include the two Nuclear Reactors, steam turbines, the Cooling Water intake and pump house, outfall structures, breakwaters and the MOLF, as well as other ancillary structures.
- Wylfa Newydd Development Area: the indicative areas of land and sea including the Power Station Site, and the surrounding areas that would be used for the construction and operation of the Power Station. This area is representative of the maximum area that would be physically affected by Power Station Main Construction activities and used to form the setting and features of the operational Power Station.
- Disposal Site: defined as the newly licensed Holyhead North (IS043). The Disposal Site covers the northern half of Holyhead Deep (IS040)

disposal site, which was closed in April 2017. It represents a rectangular area off the north-west coast of Anglesey in the Irish Sea.

### 1.3 Invasive non-native species

- 1.3.1 Invasive, non-native, alien or exotic species are species that have been released into an environment beyond their native bio-geographic range or habitat either by accident or intentionally [RD1]. On arrival in a new environment a non-native species may or may not become established depending on its tolerances of the prevailing conditions or other random events such as predation.
- 1.3.2 A species is classed as 'invasive' when it adapts too well to the new environment, out-competing native species and having a detrimental impact on native habitats. The GB Non-Native Species Secretariat (GBNNS) [RD5] defines INNS as "*any non-native animal or plant that has the ability to spread causing damage to the environment, the economy, our health and the way we live*".
- 1.3.3 In the marine environment, invasive species can be spread via a number of natural and anthropogenic pathways including ocean currents, aquatic debris, aquaculture, biofouling of marine vessels, exchange of ballast water and intentional introductions. It is estimated that c.56% of introductions of non-native, marine species arise from vessel activity on both a global and local scale [RD2].
- 1.3.4 The four stages involved in the introduction of a new species [RD3] are:
- arrival – most frequently due to human activity e.g. shipping, aquaculture;
  - settlement – having arrived in the new habitat, a species will try to integrate itself to that habitat;
  - expansion – once settled, a species will try to expand and occupy as much space as possible, and;
  - persistence – successful expansion can lead to establishment of that species in an area.
- 1.3.5 Further spread will depend on either further human activity and/or the species' natural dispersal capabilities.
- 1.3.6 In their native habitats, non-native species are often in balance with their ecological communities and may not be problem species. The introduction of non-natives often results in a 'do or die' outcome whereby the species either flourishes or fails in its new habitat. When species flourish, it is often because of a lack of competition and/or natural predators. Naturally there are exceptions whereby a species is resilient enough to become established but its spread is limited e.g. to ports.

## 1.4 Legal framework

- 1.4.1 The *EC Water Framework Directive (WFD) (2000/60/EC)* came into force in 2000 and is transposed into UK law through *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017*. The WFD aims “to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater”. It aims to ensure that all aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands meet good status or potential.
- 1.4.2 The *Marine Strategy Framework Directive (2008/56/EC)* was adopted in 2008. The goal of the Directive is to achieve ‘Good Environmental Status’ by 2020 across Europe’s marine environment. The Directive provides an overarching framework for other key directives and legislation including the WFD. Descriptor 2 requires that “*non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem*”. The directive includes targets to reduce the risk of introduction and spread of non-native species through improved management of high risk pathways and vectors and to develop action plans for key high risk marine non-indigenous species by 2020.
- 1.4.3 The *Wildlife and Countryside Act 1981* (as amended) contains measures to prevent the establishment of non-native species which may be detrimental to native wildlife. Section 14 prohibits the introduction into the wild of any animal of a kind which is not ordinarily resident in, and is not a regular visitor to, Great Britain in a wild state, or any species of animal or plant listed in Schedule 9 of the Act.
- 1.4.4 The *EU Regulation 1143/2014 on Invasive Alien Species* came into force on 1 January 2015. The aim is to protect native biodiversity and ecosystem services and to minimise and mitigate any human health and economic impact of invasive species. Under the Regulation, a list of invasive alien species of Union concern (the Union List) will be established and risk assessments produced. The Regulation restricts the transport, holding, breeding and release of these species. Member States are required to take all necessary steps to prevent the unintentional introduction or spread, including, where applicable, by gross negligence, of invasive alien species of Union concern. The Regulation requires prevention, early detection and rapid eradication, and management.
- 1.4.5 The *International Convention for the Control and Management of Ships’ Ballast Water and Sediments* (the Ballast Water Management Convention), adopted in 2004, aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships’ ballast water and sediments. Vessels must have ballast water management plans and record books. Regulations include control of where ballast water can be exchanged and volume of exchange.
- 1.4.6 The *Conservation of Habitats and Species Regulations 2010* (as amended). These Regulations implement the provisions of the *Habitats Directive*

*(92/43/EEC) and the Birds Directive (2009/147/EC). They provide for the designation and protection of European Designated Sites and species within the marine environment and the adaptation of planning and other controls for the protection of European Designated Sites. Within the Habitats Directive (92/43/EEC) it states that 'provision should be made for supplementary measures governing the reintroduction of certain native species of fauna and flora and the possible introduction of non-native species'.*

## 2 Invasive non-native species of concern

### 2.1 Species of concern in north Wales

2.1.1 The North Wales Wildlife Trust (NWWT) has identified 17 species which it considers to be non-native marine species of concern in north Wales (Table 2-1). These invasive species have either already been recorded in Wales or are expected to arrive soon.

**Table 2-1 Non-native marine species of concern in north Wales. Source [RD6]**

Scientific name	Common name	Status	Distribution in Wales
<i>Crepidula fornicata</i>	Slipper limpet	Strategic priority species	Established in parts of south Wales.
<i>Crassostrea gigas</i> (accepted as <i>Magallana gigas</i> )	Pacific oyster	Strategic priority species	Widely established in Wales.
<i>Undaria pinnatifida</i>	Japanese kelp/Wakame	High alert species	Recorded from Holyhead Marina and Pembroke Dock [RD7].
<i>Sargassum muticum</i>	Wireweed	Strategic priority species	Established in parts of Wales, particularly along the Llŷn Peninsula & Anglesey.
<i>Hemigrapsus sanguineus</i>	Asian shore crab	None given	Several sightings in the UK, with one sighting in south Wales.
<i>Didemnum vexillum</i>	Carpet sea squirt	GB rapid response alert species	Established in Holyhead Marina in north Wales.
<i>Eriocheir sinensis</i>	Chinese mitten crab	Strategic priority species	Established in the River Dee.
<i>Grateloupia turuturu</i>	Devil's tongue weed	Strategic priority species	Established in Milford Haven.
<i>Codium fragile fragile</i>	Green sea fingers	None given	Reported in areas of south Wales.
<i>Asparagopsis armata</i>	Harpoon weed	None given	Recorded on the Llŷn Peninsula and in areas of south Wales.
<i>Caprella mutica</i>	Japanese skeleton shrimp	None given	Limited reports of this species in Wales (includes Holyhead Harbour in 2014).

Scientific name	Common name	Status	Distribution in Wales
<i>Styela clava</i>	Leathery sea squirt	None given	Occurs on the west coast of Wales. Recordings in Anglesey and the Llŷn Peninsula, as well as other parts of north Wales.
<i>Tiostrea lutaria</i> (accepted as <i>Ostrea chilensis</i> )	New Zealand flat oyster	Strategic priority species	Established in the Menai Strait.
<i>Botrylloides violaceus</i>	Orange cloak sea squirt	None given	Found in Milford Haven.
<i>Corella eumyota</i>	Orange-tipped sea squirt	Low risk alert species	Known to be present in north Wales and not thought to be invasive.
<i>Rapana venosa</i>	Rapa whelk	High alert species	Not yet been recorded in Wales.
<i>Watersipora subtorquata</i>	Red ripple bryozoan	High alert species	Not yet recorded in Wales; however, it is likely to arrive and will quickly spread.

## 2.2 Holyhead Harbour INNS

- 2.2.1 In 2014 the Wales Marine Non-native Species Inshore Monitoring Network undertook a non-native species survey in Holyhead Harbour [RD8]. Table 2-2 lists the non-native species recorded. Holyhead Harbour is located nine nautical miles away from the Wylfa Newydd Development Area; there is therefore a risk that these species could be transferred on construction vessels into the area. It is also possible that these species may already be present but as yet are unrecorded in the Wylfa Newydd Development Area.
- 2.2.2 Surveys undertaken in 2014 as part of the Welsh Government Resilient Ecosystems Fund [RD7] recorded 10 non-native species in Holyhead Harbour, including three species not recorded in [RD8]: the leathery sea squirt *Styela clava*, the colonial sea squirt *Aplidium* cf. *glabrum* and Japanese kelp *Undaria pinnatifida*. *S. clava* is classified as a WFD high impact species (Table 2-3).
- 2.2.3 In October 2016 NRW commissioned a drop-down camera survey off the north and west coast of Anglesey [RD9]. One of the aims was to collect data on INNS, particularly in relation to Holyhead North Disposal Site which receives dredged disposal material mainly from Holyhead Harbour. The survey area extended from Point Lynas west to Church Bay and out to sites on the Skerries, West Anglesey Reef and Holyhead Deep. No non-native species were recorded at any of the sites.
- 2.2.4 Additional surveys were undertaken by NRW during 2018 in response to the storm event. The results of these surveys, along with any other up to date data will be incorporated into the final biosecurity risk assessment.

**Table 2-2 Non-native marine species recorded in Holyhead Harbour in 2014. Source: [RD8] with species information from [RD5]**

Scientific name	Common name	Known UK distribution	Problems caused
<i>Tricellaria inopinata</i>	A bryozoan	Marinas and harbours from the Clyde around the south coast of England and up the east coast as far as Grimsby.	Populations in harbours and marinas can become very dense affecting native species. Biofouling.
<i>Corella eumyota</i>	Orange-tipped sea squirt	Established from Oban around the south coast of England to Lowestoft. Known to be present in north Wales and not thought to be invasive [RD6].	Negative effect on the abundance and habitat occupancy of other shallow-water suspension feeding sessile invertebrates. Biofouling.
<i>Asterocarpa humilis</i>	Compass sea squirt	Several locations on the south coast of England between Newlyn and Brighton, Holyhead Marina (north Wales) and Orkney.	Negative effect on the abundance and habitat occupancy of other shallow-water suspension feeding sessile invertebrates. Biofouling.
<i>Schizoporella japonica</i>	Orange ripple bryozoan	Recorded in Holyhead Marina in north Wales, Stromness and Kirkwall Marinas in Orkney, marinas in Plymouth and Blyth. Spread to Scottish coast.	Biofouling.
<i>Caprella mutica</i>	Japanese skeleton shrimp	Southern and south-west England, the west coast of Scotland and the Western Isles. Limited reports of this species in Wales (includes Holyhead Harbour in 2014) [RD6].	Likely to have a significant impact on benthic communities. Biofouling.
<i>Austrominius modestus</i>	A barnacle	Widespread along Welsh and English coast, a few areas of Scotland.	Competes with native species for space and appears to have entirely displaced native barnacle species in some places. Biofouling.

Scientific name	Common name	Known UK distribution	Problems caused
<i>Botrylloides violaceus</i>	Orange cloak sea squirt	The south coast of England (Plymouth to Eastbourne) and Chatham, the east coast as far north as Grimsby and Milford Haven.	Capable of forming very large colonies, impact on native species. Significant Biofouling risk.
<i>Bugula neritina</i>	A colonial sea squirt	Occurs from south-west Scotland around the Welsh and English coasts to Lowestoft.	Large, dense colonies can form in harbours and marinas. Impact on native species. Biofouling.
<i>Didemnum vexillum</i>	Carpet sea squirt	Recorded in a total of nine marinas in GB, including Holyhead Marina in north Wales.	Forms large colonies. Impact on sessile hard-surface communities. Significant alteration to native species composition. Biofouling problems.

## 2.3 WFD marine INNS

- 2.3.1 The United Kingdom Technical Advisory Group (UKTAG) was established to provide advice on technical aspects of the implementation of the WFD in the UK. Although non-native species are not specifically mentioned in the WFD the UKTAG considers that non-native species are one of the significant pressures which could prevent a water body from achieving good status [RD4]. The UKTAG Alien Species Group was set up to assess the risk of non-native aquatic species. To assess the risk, non-native aquatic species have been assigned to one of four categories; high, moderate, low or unknown impact (Table 2-3). High-impact species are defined as “*alien species, known to be invasive, which have caused documented harm in habitats where they have become established*”. The degree of risk depends on a number of factors including: the present location (e.g. already in the water body, in a nearby water body); availability of suitable habitat within the water body; presence/absence of known competitors; and factors which might increase the task of a non-native species becoming established (e.g. release of ballast water [RD4]).
- 2.3.2 The impact classifications of aquatic alien species are used to determine the WFD classification; where high-impact species are present the WFD classification may be downgraded depending on evidence of any adverse impacts. Sites where a high-impact species has become established cannot be classified as ‘high’ status and will fail to reach ‘good’ status if there is more than a light adverse impact on any of the biological elements [RD4].
- 2.3.3 The GBNNSS manages the risk analysis process on behalf of the GB Programme Board for Non-native Species. The GBNNSS Risk assessments are carried out by independent experts from a range of organisations.
- 2.3.4 Risk assessments have been produced and are available from GBNNSS [RD5] for the following species:
- *Caprella mutica*;
  - *Crassostrea gigas* (accepted as *Magallana gigas*);
  - *Didemnum vexillum*;
  - *Eriocheir sinensis*;
  - *Sargassum muticum*; and
  - *Potamopyrgus antipodarum*.
- 2.3.5 Marine INNS classified as High, Moderate, Low or Unknown impact for the purposes of WFD assessment are given in Table 2-3. The lists are fixed before the start of each river basin planning cycle to enable regulations and directions to be put in place for classification. The waiting list contains species that will be added to the main lists in time for the next river basin planning cycle (following consultation in the case of High impact species) [RD4]. The distribution, habitat and impact of species relevant to the Wylfa Newydd Development Area are discussed in section 2.6.

**Table 2-3 WFD impact categories of marine INNS (taken from [RD4])**

Impact level	Scientific name	Common name
High	<i>Spartina anglica</i>	Common cord-grass, Townsend's grass or rice grass
	<i>Eriocheir sinensis</i>	Chinese mitten crab
	<i>Crepidula fornicata</i>	Slipper limpet
	<i>Styela clava</i>	Leathery sea squirt
	<i>Urosalpinx cinerea</i>	American oyster drill
	Non-native <i>Didemnum</i> spp. (includes <i>Didemnum vexillum</i> )	Colonial tunicate
	<i>Ficopomatus enigmaticus</i>	Marine tubeworm
Moderate	<i>Crassostrea gigas</i> (accepted as <i>Magallana gigas</i> )	Pacific oyster
	<i>Potamopyrgus antipodarum</i>	Jenkins' spire shell
	<i>Caprella mutica</i>	Japanese skeleton shrimp
Low	<i>Pikea californica</i>	Captain Pike's weed
	<i>Sargassum muticum</i>	Wireweed
	<i>Corophium sextonae</i>	Marine amphipod
	<i>Clymenella torquata</i>	Bamboo worm
	<i>Marenzelleria viridis</i>	Marine polychaete
	<i>Tiostrea lutaria</i> (accepted as <i>Ostrea chilensis</i> )	New Zealand flat oyster
	<i>Aulacomya atra</i>	Magellan mussel
	<i>Mercenaria mercenaria</i>	American hard-shell clam
	<i>Elminius modestus</i> (accepted as <i>Austrominius modestus</i> )	Barnacle species
Unknown	<i>Hypania invalida</i>	Polychaete
	All species except <i>Acipenser sturio</i> , which is protected on Schedule 5 of the <i>Wildlife &amp; Countryside Act 1981</i> (as amended)	Sterlet/Sturgeons
	<i>Odontella sinensis</i>	Diatoms

Impact level	Scientific name	Common name
	<i>Pleurosigma simonsensii</i> <i>Thalassiosira punctigera</i> <i>Thalassiosira tealata</i> <i>Coscinodiscus wailesii</i>	
	<i>Asparagopsis armata</i> <i>Bonnemaisonia hamifera</i> <i>Grateloupia doryphora</i> <i>Grateloupia filicina</i> var. <i>luxurians</i> <i>Agardhiella subulata</i> <i>Solieria chordalis</i> <i>Antithamnionella spirographidis</i> <i>Antithamnionella ternifolia</i> <i>Polysiphonia harveyi</i>	Red seaweeds
	<i>Undaria pinnatifida</i>	Japanese kelp
	<i>Codium fragile</i> subsp. <i>atlanticum</i> and <i>tomentosoides</i>	Green seaweeds
	<i>Petricola pholadiformis</i>	American piddock
	<i>Mya arenaria</i>	Soft -shelled clam
	<i>Ensis americanus</i>	American jack knife clam
	<i>Colpomenia peregrina</i>	Oyster thief
	<i>Balanus amphitrite</i>	Barnacle sp.
	<i>Acartia tonsa</i>	Marine copepod
	<i>Eusarsiella zostericola</i>	Marine ostracod
	<i>Rhithropanopeus harrisi</i>	Zuiderzee or dwarf crab
	<i>Gonionemus vertens</i>	Marine hydrozoan
	<i>Haliplanella lineata</i>	Orange-striped sea anemone
	<i>Goniadella gracilis</i>	Marine polychaete
	<i>Clavopsella navis</i>	Marine hydroid
	<i>Hydroides ezoensis</i> <i>Hydroides dianthus</i> <i>Janua brasiliensis</i> <i>Pileolaria berkeleyana</i>	Marine tubeworms

Impact level	Scientific name	Common name
	<i>Ammothea hilgendorfi</i>	Sea spider
	<i>Gracilaria vermiculophylla</i>	Marine alga
	<i>Mytilopsis leucophaeata</i>	Dark false mussel
	<i>Pinctada imbricata radiata</i>	Marine mollusc
	<i>Marsupenaeus japonicus</i>	Kuruma prawn
	<i>Hemigrapsus sanguineus/Hemigrapsus takanoi</i>	Asian shore crab/Brush-clawed shore crab
Waiting List – High Impact	<i>Homarus americanus</i>	American lobster

## 2.4 Priority monitoring and surveillance list for Wales

2.4.1 A list of INNS has also been produced specifically for Wales [RD10]. These include species listed under the Wildlife and Countryside Act 1981, the WFD and UKTAG [RD4] and the Marine Strategy Framework Directive (MSFD). This includes a number of species which are not known to be present in Wales, but which could arrive in the future and should therefore be prioritised for surveillance purposes. Most of the species are included in Table 2-1, Table 2-2 and Table 2-3, the additional species on the priority list are detailed in Table 2-4.

**Table 2-4 Additional species included on the priority monitoring and surveillance list for Wales [RD10]**

Impact level	Scientific name	Common name
High	<i>Ocenebra inornata</i>	Asian/Japanese oyster drill
	<i>Celtodoryx ciocalyptoides</i>	Sponge
	<i>Amphibalanus amphitrite</i>	Barnacle
	<i>Hesperibalanus fallax</i>	Crustacean
Medium	<i>Crassostrea angulata</i>	Portuguese oyster
	<i>Diadumene lineata</i>	Orange striped anemone
	<i>Ensis leei</i>	American jack knife clam
Low/unkn	<i>Aplidium cf. glabrum</i>	Sea squirt

Impact level	Scientific name	Common name
own risk (recorded in Wales)	<i>Amphibalanus improvisus</i>	Barnacle
	<i>Anotrichium furcellatum</i>	Red seaweed
	<i>Botrylloides c.f. diegensis</i>	Sea squirt
	<i>Bugula simplex</i>	Bryozoan
	<i>Bugula stolonifera</i>	Bryozoan
	<i>Feldmannophycus okamurae</i>	Red seaweed
	<i>Mytilicola intestinalis</i>	Parasitic copepod
	<i>Mytilus galloprovincialis</i>	Bivalve mussel
	<i>Perophora japonica</i>	Sea squirt
Lower risk (not yet known to be breeding in Wales)	<i>Chama sp.</i>	Jewel box clam
	<i>Polysiphonia subtilissima</i>	Red seaweed
	<i>Asterias amurensis</i>	Flatbottom sea star
	<i>Megabalanus coccopoma</i>	Titan acorn barnacle
	<i>Alexandrium catenella</i>	Dinoflagellate
	<i>Caulerpa racemose</i>	Sea grapes
	<i>Rhopilema nomadica</i>	Nomad jellyfish
	<i>Theora lubrica</i>	Asian Semele
	<i>Paralithodes camtschaticus</i>	Red king crab
	<i>Heterosigma akashiwo</i>	Dinoflagellate
	<i>Dyspanopeus sayi</i>	Say mud crab
	<i>Amphibalanus reticulatus</i>	Barnacle
	<i>Caulerpa taxifolia</i>	Green seaweed
	<i>Dendrostrea frons</i> <i>/Saccostrea frons</i>	Mangrove oyster
	<i>Hemigrapsus penicillatus</i>	Japanese shore crab
	<i>Megabalanus zebra</i>	Barnacle
	<i>Mizuhopecten yessoensis</i>	Japanese scallop
<i>Pseudochattonella verruculosa</i>	Alga	
<i>Telmatogeton japonicas</i>	Marine splash midge	

## 2.5 INNS from baseline surveys

- 2.5.1 Recording of non-native species has been carried out as part of the analysis of survey results from all marine ecology surveys from 2010 to 2016. The survey area covered a radius of 5km from the Wylfa Newydd Development Area.
- 2.5.2 All non-native species recorded during the survey programme are already known to occur around the coast of north Anglesey and are not unique to any particular area; none are classified as Moderate or High impact species under the WFD [RD4]. Species recorded to date are:
- *Coscinodiscus wailesii* (centric diatom);
  - *Odontella sinensis* (centric diatom);
  - *Asparagopsis armata* (Harpoon weed, a red seaweed);
  - *Anotrichium furcellatum* (a red seaweed);
  - *Heterosiphonia japonica* (accepted as *Dasysiphonia japonica*)(siphoned Japan weed, a red seaweed);
  - *Codium fragile* ssp. *tomentosoides* (green sea fingers, a green seaweed);
  - *Sargassum muticum* (wireweed, a brown seaweed); and
  - *Austrominius modestus* (barnacle).
- 2.5.3 Additional drop-down camera surveys and benthic grab surveys were undertaken in October 2016 within the boundaries of the proposed Disposal Site at Holyhead North; no non-native species were recorded from the sites surveyed.

## 2.6 Characteristics of key INNS of concern in north Wales

- 2.6.1 The distribution, habitat and impact of species relevant to the Wylfa Newydd Development Area are discussed below. Included are species that are classified as both of High/Moderate impact under WFD and of concern in north Wales. Additionally, species classified as of Low/Unknown impact but which were both recorded from the baseline surveys for the Wylfa Newydd DCO Project and are of concern in north Wales have also been included.

### ***High/Moderate impact species***

- 2.6.2 The carpet sea squirt, *Didemnum vexillum*, forms extensive pale orange or cream colonies comprising thin 2mm–5mm sheets and long outgrowths. *D. vexillum* is thought to be native to the north-west Pacific. In Great Britain *D. vexillum* is now established in nine marinas including one marina in Wales, Holyhead Marina, Anglesey [RD5]. The recorded habitat in Great Britain is only from marinas and adjacent shallow artificial structures. *D. vexillum* is classified as a High impact species under the WFD [RD4]. It can form very large colonies, growing over existing sessile hard structure communities,

resulting in significant alterations to the native species composition. There are potential impacts on the UK's shellfish industry; *D. vexillum* has been shown to overgrow mussels and aquaculture equipment in other countries invaded by this species [RD5].

- 2.6.3 The finding of *D. vexillum* in Holyhead Marina, Wales, in 2008 was the first official record of an established population in Great Britain. This was considered a serious threat to the ecology and socio-economic assets based on the speed at which it can colonise artificial and natural environments – particularly the Special Areas of Conservation in the Irish Sea [RD11] and the UK's most productive mussel fishery within the coastal waters of north Wales ([RD12] in [RD11]).
- 2.6.4 In October 2009 the Welsh Government agreed to fund an eradication attempt of *D. Vexillum* in Holyhead Marina [RD11]. Artificial structures were covered in reinforced polyvinyl chloride (PVC) to restrict water flow, depriving the colonies of food and oxygen, with some chemical treatment using calcium hypochlorite for the PVC bags and wrappings. Sodium hypochlorite was used for spraying boat hulls and mooring chains where wrapping was not possible. Following the eradication attempt, a rapid assessment survey was undertaken in May 2010 which indicated the eradication had been successful, however a survey in September 2010 found *D. vexillum* had re-established on 50% of the submerged surface area. Although the eradication schedule included follow-up treatment, due to lack of available funding further eradication treatment could not start until January 2012. A survey in September 2013 found small colonies on one of the breakwaters and efforts are ongoing to treat this [RD11]. As a result of the recolonisation of this species the focus is now on longer-term containment and control options including biosecurity measures and investigation of inoculation sources.
- 2.6.5 The Chinese mitten crab, *Eriocheir sinensis*, is native to eastern Asia. It is a large crab with a carapace length of up to 65mm; the distinguishing feature is the dense mat of hair on the claws (mittens). This species has established in the Rivers Thames, Medway and Ouse and has been recorded from several sites throughout England and Wales. In Wales they are established on the River Dee and one has been recorded in the River Conwy; it is not thought to have taken hold elsewhere in north Wales [RD6]. *E. sinensis* has not yet been recorded in Anglesey but it is likely to arrive soon [RD13]. This species is listed as a strategic priority species by NWWT [RD6] and is classified as a High impact species under the WFD [RD4]. The juveniles occur in lower estuarine and marine habitats, and as they develop they migrate upstream into brackish and freshwater habitats. Adults migrate into deep, open, saltwater locations to reproduce [RD5]. *E. sinensis* is likely to impact native benthic, invertebrate populations in freshwater and marine systems through predation and competition for space and through carrying diseases. It is known to impact on native white-clawed crayfish (*Austropotamobius pallipes*), salmon (*Salmo salar*) and trout (*Salmo trutta*). The economic impacts of this species include the cost of repairing damage caused by burrowing and any costs associated with impacts to salmon and trout fisheries [RD5].

- 2.6.6 The slipper limpet, *Crepidula fornicata*, originates from Point Escuminac, Canada, along the eastern coast of America, down to the Caribbean. It is now well established on the south coasts of England and Wales and spreading northwards [RD5]. Adults live on the seabed under a wide range of conditions, reaching highest densities in wave-protected muddy areas. The larvae are pelagic and are found in the water column. *C. fornicata* is listed as a strategic priority species by NWWT [RD6] and is classified as a High impact species under the WFD [RD4]. They are known to out-compete native species through spatial competition, reducing hard-surface habitat availability through high densities and deposition of faeces and sediment, and competition for food [RD5]. They frequently attach to the shells of dead and living hard-shelled invertebrates including scallops, crabs, whelks and mussels. *C. fornicata* populations have economic implications particularly to the bivalve fisheries and aquaculture industries through fouling and loss of habitat [RD5].
- 2.6.7 The leathery sea squirt, *Styela clava*, originates from the north-west Pacific. It is now well established from the Clyde (Scotland) around the south coast of England to the Humber, with the northern limits appearing relatively stable [RD5]. It has been recorded from Anglesey and the Llŷn Peninsula, as well as other parts of north Wales [RD6]. *S. clava* is classified as a High impact species under the WFD [RD4]. It attaches to solid surfaces in shallow water, especially in harbours and marinas but also on wrecks and natural rock substrate. *S. clava* can reach high densities, dominating shallow sheltered habitats resulting in a negative impact on the abundance of other native shallow-water suspension-feeding sessile invertebrates. This species may have an economic impact on bivalve fisheries, where it competes for food and smothers bivalves. It also fouls ropes, moorings, vessels etc. [RD5].
- 2.6.8 The Asian shore crab, *Hemigrapsus sanguineus*, is native to the western Pacific Ocean from Russia along the Korean and Chinese coasts to Japan. It has been found in Guernsey and Jersey since 2009 and individuals have been recorded in south Wales and Kent (England). The larval stage allows dispersal over large distances. The adults live on mid-upper shore rocky substrates. Invasions of *H. sanguineus* in Europe have resulted in significant reductions in the common shore crab and mussel densities. Other native species may be affected by predation. There is potential for economic impact on mussel and oyster industries [RD5]. *H. sanguineus* is on the WFD non-native species waiting list but will be classified as a High impact species.
- 2.6.9 The Pacific Oyster, *Crassostrea gigas* (accepted as *Magallana gigas*), is native to Japan and north-east Asia. It was introduced into the UK as a commercial species in the 1960s and is currently farmed throughout England, Scotland and Wales. Escapees have established in wild populations in south-east and south-west England and Wales. The oysters can form dense reefs which alter the natural ecosystem and pose a threat to native species. Where wild populations establish there may be economic losses to mussel and other bivalve fisheries [RD5]. *M. gigas* is classified as a Moderate impact species under the WFD.

2.6.10 The Japanese skeleton shrimp, *Caprella mutica*, is a large species of skeleton shrimp growing up to 49mm, native to sub-boreal waters of north-east Asia. It has been recorded from southern to south-west England, the west coast of Scotland and the Western Isles [RD5]. There are limited reports of this species in Wales [RD6]. *C. mutica* was reported from Anglesey in 2003 [RD14] and has been recorded from Holyhead Harbour in 2014 [RD8]. It is considered a High impact species under the WFD [RD4]. *C. mutica* is an aggressive species and even at low densities can out-compete native skeleton shrimps for food and space. *C. mutica* occurs in particularly high densities on artificial structures such as pontoons and aquaculture infrastructure which are raised from the seabed enabling the shrimp to avoid benthic predators [RD15]. High densities of this species can have economic impacts from causing blockages to water intakes at caged fish sites and from settling on mussel lines in place of juvenile mussels [RD5].

### ***Low/Unknown impact species – recorded from baseline surveys***

2.6.11 Harpoon weed, *Asparagopsis armata*, is a red seaweed native to Australia and New Zealand. The gametophyte stage occurs in the south-west of England, while the '*Falkenbergia*' stage occurs north to Shetland but is rare on the east coasts. *A. armata* has been recorded on the Llŷn Peninsula and in areas of south Wales and from the baseline surveys for the Wylfa Newydd Project. It is reported to dominate algal assemblages in some locations and may have an economic impact as a result of blooms clogging fishing nets [RD5]. *A. armata* is listed as unknown impact under the WFD [RD4].

2.6.12 Green sea fingers, *Codium fragile*, ssp. *tomentosoides* (syn. subsp. *fragile*), has been recorded in Holyhead Harbour by the Marine Non-native Species Inshore Monitoring Network (2014) and from the baseline surveys for the Wylfa Newydd Project. *C. fragile* subsp. *tomentosoides* is a spongy green seaweed with numerous Y-shaped, branching, cylindrical fronds; typically 25cm high and microscope identification is required to distinguish it from the native *Codium tomentosum*. These green sea fingers are native to the Pacific Ocean (Japan and Korea) and are now established around Great Britain occurring in pools and on rock in the mid to lower shore and in subtidal habitats up to depths of 15m. On sandy or muddy substrate it can attach to bivalve shells. It is also commonly found on artificial structures. It is listed as having unknown impact under the WFD [RD4]. In Canada, dense populations have established altering community structure and composition; in Great Britain high densities have not yet been recorded. Economic costs result from fouling, for example of vessels and harbours.

2.6.13 Wireweed, *Sargassum muticum*, is a distinctive large olive-brown seaweed with branches which can grow over 1m long. It is native to north-western Asian Pacific shores but is now widespread around the coast of continental Europe. It is widely established in the UK including parts of Wales particularly along the Llŷn Peninsula and Anglesey [RD6] and has been recorded in the marine baseline surveys in Porth-y-pistyll. *S. muticum* is most successful in areas sheltered from wave action, but occurs widely on

the coast across a range of exposures. It spreads by floating fragments which are transported by ocean currents, by boats or on shellfish [RD5] making it difficult to prevent further spread. *S. muticum* is classified as a Low impact species under the WFD [RD4]. Its rapid growth and reproduction through self-fertilisation enables it to out-compete native seaweeds and other species such as sea oak [RD5]. This species is a nuisance in harbours and shallow waters where it is a hazard to boating due to entanglement of propellers ([RD16], [RD5]). *S. muticum* fouls commercial oyster beds and fishing gear, may impact on tourism revenue where recreational activities are impeded and may result in large economic cost of removal from man-made structures [RD5].

## 3 Risks and management measures

### 3.1 Introduction

- 3.1.1 Biosecurity plans should include reducing the risk of introducing new INNS to the site and reducing the risk of any INNS already present on the site spreading elsewhere [RD17]. The marine biosecurity planning guidance for England and Wales [RD17] considers sites which have fully saline water, structures without anti-fouling coating and/or submerged for longer than six months at a time, and fixed structures which can only be cleaned *in situ* to be a significant risk. Therefore, the Wylfa Newydd Development Area would be considered as high risk under this guidance, particularly because of the introduction of permanent structures. However, with proper management in place to prevent transfer of species to the area, to monitor for the establishment of non-native species and then to control non-native species if required, the risk to and effect on native habitats and species can be managed.
- 3.1.2 When determining the risks it is important to consider both the suitability of the receiving environment for INNS as well as the particular sensitivities of the local area, such as commercial fishing and nature conservation value.

### 3.2 Potential pathways for INNS and management strategies

- 3.2.1 The following sections describe the potential project pathways through which INNS could be transferred and established from construction, operation and decommissioning activities and associated management measures. An indicative risk of INNS transfer and establishment through each pathway is also provided; however, at this stage this is estimated based only on the nature and frequency of the activities undertaken (i.e. not taking into account biology or habitat preferences of specific INNS). A summary of the potential pathways, associated management measures and risks is presented in Table 3-5, section 3.3.

#### **Construction**

#### **Sources of INNS**

##### **Source locations of materials and vessels**

- 3.2.2 Hitachi-GE Nuclear Energy Ltd. has produced a report (*Transportation and Logistics Study* CPJ-UW-A408) detailing transportation plans for equipment and materials required for construction [RD18]. The report aims to identify the transport modes and estimated number of vessels required. The details given in [RD18] are not final; further considerations are required. [RD18] should therefore be taken as the best estimate of logistical implications at the time of the report and is subject to change [RD19]. A summary of relevant information from this report is provided below.

3.2.3 The [RD18] report specifies in section 5.2 that the following would be transported by sea (on vessels or deck barges):

- components whose dimension exceeds either 2.7m in width or 4.2m in height including wheels; and
- bulk materials whose quantity is significant and not suitable for being transported by land (cement, fly ash, aggregate, steel, etc.).

3.2.4 Components which do not fall under the categories above would be transported by land.

3.2.5 Annex C1 of the Project Design Statement (PDS) [RD20] states that 60-80% of materials (by weight) for the main power station construction would be delivered by sea and 20-40% by road should be assumed. The intent is to maximise the number of deliveries by sea during construction (i.e. towards 80%) where conditions allow, to minimise the impact on the road network. The estimated number of vessels using the Marine Off-loading Facility (MOLF) during site enabling and construction works is shown in Table 3-1. These numbers are expected to occur over approximately an 80-month period.

**Table 3-1 Estimated number of vessels using the MOLF (taken from [RD20])**

MOLF	Total number of vessels
Bulk material	1,571
Abnormal Indivisible Loads barges	330
Barges	409

3.2.6 Mechanical components would be sourced from the UK/EU (75.1%), Japan (24.4%) and other countries (e.g. North America: 0.5%) [RD18]. Transport modes include overland for UK components. Other components would be transported by chartered ships, container cargo ships and barge ships. Electrical, instrumentation and control products would be sourced from the UK, EU and Japan with an estimated 79% to be brought in by sea [RD18].

#### **Shipping from UK**

- Construction materials from the UK would be transported overland where possible (size/weight-dependent). Materials requiring transport using vessels would use domestic ports.

#### **Shipping from EU**

- Equipment manufactured and shipped from the EU (e.g. France, Germany) would be via the MOLF, Channel Tunnel and domestic ferry depending on shipment size and weight.

### **Shipping from Japan**

- Material or equipment manufactured and shipped from Japan would be likely to be shipped from a large international port such as Yokohama.
- 3.2.7 Cargo transported by large ships used for international voyages would not be able to enter the MOLF. Smaller vessels would be required to transfer cargo from large ships. It would also not be possible to carry out a custom clearance in the MOLF; ships would therefore be required to bring imports to international ports with custom clearance regardless of vessel size.
- 3.2.8 Westdorpe in the Netherlands has been identified as a potential option for handling components such as Abnormal Indivisible Loads. Container ports in Liverpool and Southampton would be used; there are daily container shipments from Japan Yokohama/Kobe to Southampton, and approximately weekly shipments to Liverpool.
- 3.2.9 Six ports have been identified as proposed consolidation places:
- Holyhead Port: small-scale public port (mainly passenger) nearest to the site;
  - Liverpool Port: public international trade port located 100km from the site;
  - Southampton Port: international passenger and cargo port located 770km from the site;
  - Birkenhead: yard operated by Cammell Laird, located in Liverpool harbour;
  - Westdorpe: yard operated by Mammoet, the Netherlands;
  - Schiedam: yard operated by Mammoet, the Netherlands; and
  - Verbrugge Terminals: yard operated by an affiliate company of Sarens, the Netherlands.
- 3.2.10 The number of vessels and origins has not been finalised at this stage. The prevention measures cover all INNS. However, knowledge of likely INNS from the source areas would improve targeted measures to prevent transfer and increase awareness.

### ***INNS in the Netherlands***

- 3.2.11 In 2014 a non-native species survey was undertaken in the Port of Rotterdam, the Netherlands [RD21]. Although only one of the proposed consolidation places (Schiedam) is part of the Rotterdam network of docks, the study acts as a potentially useful comparable of Dutch/North Sea ports in respect of INNS.
- 3.2.12 The study found the number of INNS recorded from the Port of Rotterdam had previously been low compared to other Dutch ports. Surveys undertaken in 2007/2008 found three non-native fouling species: the marine tubeworm *F. enigmaticus*, the Asian shore crab *H. sanguineus* and the ascidian

*Molgula manhattensis*. The ascidian *M. manhattensis*, the brackish-water barnacle *Amphibalanus improvisus*, the slipper limpet *C. fornicata*, the amphipod *Monocorophium sextonae*, the leathery sea squirt *S. clava*, the Asian shore crab *H. takanoi* and the tanaidacean *Sinelobus stanfordi* have been recorded in the port in other studies [RD21]. The relatively low numbers of non-native species recorded was attributed to the relatively few studies undertaken and the fact that those studies focused on a few habitats [RD21].

3.2.13 In total 257 samples were taken from 118 different locations in the Port of Rotterdam in 2014; 225 species were identified to the species level of which 33 were identified as INNS (Table 3-2).

**Table 3-2 INNS recorded in the Port of Rotterdam, the Netherlands [RD21]**

Species (group)	Species (group)	Species (group)
<i>Dasysiphonia japonica</i> (Alga)	<i>Cordylophora caspia</i> (Cnidaria)	<i>Mnemiopsis leidyi</i> (Ctenophora)
<i>Ulva pertusa</i> (Alga)	<i>Nemopsis bachei</i> (Cnidaria)	<i>Corbicula fluminalis</i> (Mollusca)
<i>Ficopomatus enigmaticus</i> (Annelida)	<i>Amphibalanus improvisus</i> (Crustacea)	<i>Crassostrea gigas</i> (accepted as <i>Magallana gigas</i> ) (Mollusca)
<i>Molgula manhattensis</i> (Ascidiacea)	<i>Austrominius modestus</i> (Crustacea)	<i>Crepidula fornicata</i> (Mollusca)
<i>Styela clava</i> (Ascidiacea)	<i>Bosmina cf. longirostris</i> (Crustacea)	<i>Dreissena bugensis</i> (Mollusca)
<i>Vibrio cf. brasiliensis</i> (Bacterium)	<i>Bosmina coregoni</i> (Crustacea)	<i>Dreissena polymorpha</i> (Mollusca)
<i>Coscinodiscus wailesii</i> (Chromista)	<i>Caprella mutica</i> (Crustacea)	<i>Physa acuta</i> (Mollusca)
<i>Mediopyxis helysia</i> (Chromista)	<i>Hemigrapsus sanguineus</i> (Crustacea)	<i>Potamopyrgus antipodarum</i> (Mollusca)
<i>Odontella sinensis</i> (Chromista)	<i>Hemigrapsus takanoi</i> (Crustacea)	<i>Rangia cuneata</i> (Mollusca)
<i>Protoceratium reticulatum</i> (Chromista)	<i>Jassa marmorata</i> (Crustacea)	<i>Neogobius cf. fluviatilis</i> (Pisces)
<i>Thalassiosira nordenskiöldii</i> (Chromista)	<i>Rhithropanopeus harrisii</i> (Crustacea)	<i>Neogobius melanostomus</i> (Pisces)

3.2.14 Of the species listed in Table 3-2, the barnacle *A. modestus* and the Japanese skeleton shrimp *C. mutica* have been recorded from Holyhead Harbour. It should be noted that the non-native species survey in Holyhead Harbour did not cover plankton or human pathogens. The slipper limpet *C.*

*fornicata*, leathery sea squirt *S. clava* and marine tubeworm *F. enigmaticus* are listed as WFD High impact species (see Table 2-3). The Pacific oyster *M. gigas* and the Japanese skeleton shrimp *C. mutica* are listed as Moderate impact species. The Asian shore crab *H. sanguineus* is listed as a High impact species on the WFD waiting list. A number of species are also listed as species of concern in north Wales (Table 2-1).

- 3.2.15 There is a degree of similarity in environmental conditions between Dutch and British ports, for example in terms of temperature and salinity, which means there is a risk of any INNS which transfer between UK and Dutch ports becoming established.

### ***INNS in Liverpool and Southampton ports***

- 3.2.16 Liverpool and Southampton container ports have been identified for use in importing materials and equipment. These will then need to be transferred via smaller vessels to the MOLF. Non-native species recorded from Liverpool and Southampton ports in 2001 are shown in Table 3-3. There is potential for the transfer of these species from the container ports into the Wylfa Newydd Development Area. It should be noted that this study was undertaken 16 years ago, and there is a possibility that a number of other non-native marine species could now be present within these ports.

**Table 3-3 INNS recorded from Liverpool and Southampton Ports in 2001 [RD22]**

Species	Liverpool	Southampton
<i>Hydroides dianthus</i>		x
<i>Hydroides ezoensis</i>		x
<i>Ficopomatus enigmaticus</i>	x	x
<i>Austrominius modestus</i>	x	x
<i>Haliplanella lineata</i>	x	
<i>Styela clava</i>	x	x
<i>Sargassum muticum</i>		x
<i>Potamopyrgus antipodarum</i>		x
<i>Crepidula fornicata</i>		x
<i>Urosalpinx cinerea</i>		x
<i>Odontella sinensis</i>	x	x

- 3.2.17 The slipper limpet *C. fornicata*, leathery sea squirt *S. clava*, American oyster drill *U. cinerea* and marine tubeworm *F. enigmaticus* are all listed as WFD High impact INNS. None of these High impact species were recorded from Holyhead Harbour in 2014 (Table 2-2). *C. fornicata* is established in parts of south Wales and *S. clava* has been recorded from the Welsh coast including Anglesey ([RD6], Table 2-1).

### **Pathway: transfer of INNS through biofouling and ballast water of vessels and construction plant**

- 3.2.18 During construction there would be a number of vessels and construction plant arriving and/or working in Porth-y-pistyll which may originate from national or international destinations. Without measures being put in place the vessels and plant could act as vectors for the introduction of non-native species which could arrive on vessel hulls, in ballast water or in dredger hopper water.
- 3.2.19 All vessels should adhere to the Ballast Water Management Convention. Any vessels using ballast water must comply with the Exchange standards contained in the Ballast Water Management Convention and carry a Ballast Water Management Plan and a Certificate of Compliance. Ships must have a Ballast Water Record Book (Regulation B-2) to record when ballast water is taken on board; circulated or treated for Ballast Water Management purposes; and discharged into the sea. It should also record when Ballast Water is discharged to a reception facility and accidental or other exceptional discharges of Ballast Water. Under Regulation B-4 Ballast Water Exchange, all ships using ballast water exchange should: whenever possible, conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 200 metres in depth, taking into account guidelines developed by the International Maritime Organisation (IMO). In cases where the ship is unable to conduct ballast water exchange as above, this should be as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres in depth. When these requirements cannot be met areas may be designated where ships can conduct ballast water exchange. All ships shall remove and dispose of sediments from spaces designated to carry ballast water in accordance with the provisions of the ships' ballast water management plan (Regulation B-4).
- 3.2.20 Whilst there are strict guidelines on the exchange of ballast water, there are no regulations relating to water that may be transported on dredgers within hoppers. There is a pathway for transfer of INNS as there is likely to be some residual water within the hopper which could potentially be transported between dredging sites.
- 3.2.21 Where the risk of transfer of INNS from ballast water is identified as high (e.g. due to the origin of the vessel) then further measures would be put in place to avoid unregulated discharge as far as practicably possible.
- 3.2.22 The IMO *2011 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species* (the IMO Biofouling Guidelines) recommend that every ship should implement biofouling management practices, including the use of anti-fouling systems, inspection, cleaning and maintenance of hulls, and other operational management practices to reduce the development of biofouling and the likelihood of transferring invasive aquatic species.

- 3.2.23 The *Merchant Shipping (Anti-Fouling Systems) Regulations 2009* state that ships of 24m or more of length but less than 400 gross tonnage must carry a declaration on anti-fouling systems signed by the owner or authorised agent, accompanied by appropriate documentation for compliance with the UK regulations. Ships 400 gross tonnage and over must be surveyed to enable the endorsement of an anti-fouling system Certificate.
- 3.2.24 Vessels with an appropriate anti-fouling coating applied within the last 12 months and with all visible submerged surfaces free of biofouling are considered to be of low risk. Vessels with submerged surfaces with more than a green slime coating are considered medium risk; this is increased to high risk if vessels have noticeable clumps of algae and/or animals. Vessels are also considered high risk if they have arrived from another country or region with similar environmental conditions, have arrived from a water body known to have INNS present, have spent long periods stationary at sites or are slow-moving vehicles such as construction barges or drilling rigs [RD17].
- 3.2.25 Imported materials would be transported to major ports and transferred to holding areas prior to transport onto site. This would reduce the number of vessels entering the development area from international destinations.
- 3.2.26 Reducing movement of vessels to/from site would reduce the risk of INNS transfer. Where possible, vessels should remain on site rather than on/off site between construction stages. It is recommended in the IMO Biofouling Guidelines that vessels should implement biofouling practices to include in-water inspections and cleaning of hulls, and removal of biofouling (e.g. through dive surveys), ensuring that the biofouling material does not enter the marine environment. According to these Guidelines inspections/cleaning should be undertaken periodically as a means of routine surveillance but may be specifically appropriate before and after any planned period of vessel inactivity.
- 3.2.27 Vessels arriving from the local area are usually considered a low risk of INNS transfer. However, the presence of a number of INNS in Holyhead Harbour, including the carpet sea-squirt, *D. vexillum*, increases the risk of INNS transfer for vessels and equipment using Holyhead Harbour. Recreational boating is considered the main source of transfer of *D. vexillum* and significant movement of *D. vexillum* is not expected from commercial shipping due to anti-fouling coatings and ballast water procedures [RD23] although transfer may occur in sea chests ([RD24] in [RD23]).
- 3.2.28 Use of a number of small vessels is required to transfer workers from land onto marine plant during the two-year period of construction and during operation of the MOLF. These vessels would be limited to operating within Porth-y-pistyll and would be subject to strict controls including appropriate speed restrictions. Journeys to and from other ports would not normally be required.
- 3.2.29 Improving awareness of preventative measures and the identification of key INNS for construction staff including external contractors would be used to help prevent the potential spread of INNS and increase the likelihood of

detecting invasive species early. Early detection provides the best opportunity to prevent establishment and transfer.

- 3.2.30 Following the appointment of a marine contractor the main ports to be used for delivery of materials and plant would be identified and a final biosecurity risk assessment would be produced. Biosecurity management would be discussed with the relevant Port Authorities and particular attention would be given to managing the risk from transfer of INNS through vessel movements. If required, management strategies may be tailored to address sensitivities of the specific local port environment.
- 3.2.31 The indicative risk of INNS transfer through vessel movements on a European, national and local level is considered to be high due to the multiple movements of a high number of vessels between UK ports (e.g. Liverpool, Southampton, Holyhead Harbour), European ports (e.g. in the Netherlands) and the Wylfa Newydd Development Area; however, the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of INNS transfer through biofouling and ballast water. On an international level, the risk is considered to be low, as shipments will be consolidated at the ports mentioned above with no ships arriving to the MOLF from outside of Europe.

**Pathway: increase in artificial hard surfaces available for colonisation by INNS through introduction of man-made structures**

- 3.2.32 The construction of two breakwaters and the MOLF would introduce a large surface area of hard material which could be colonised by INNS. The majority of the INNS favour artificial surfaces. Introducing or increasing the surface area of artificial surfaces within the Wylfa Newydd Development Area would increase the risk of INNS establishing. Any structure that has been in the water for just a few weeks, particularly in the summer months when INNS typically reproduce, without an anti-fouling coating would be at risk from INNS settlement [RD17].
- 3.2.33 Anti-fouling coatings would be used where applicable and a monitoring programme for non-native species would be implemented. This would include observational surveys on structures that may provide suitable substrate for non-native species. Surveys would record presence/abundance of non-native species with reporting in agreement with NRW. Surveys would begin once construction of the breakwaters and MOLF is completed. The frequency and extent of monitoring would be reduced over time, particularly once the MOLF is no longer operational. The ongoing requirement for monitoring would be regularly reviewed and agreed with NRW.
- 3.2.34 The indicative risk of establishment of INNS on man-made structures is considered to be high due to the permanent nature of the structures; the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of INNS establishing on man-made structures.

### **Pathway: transfer of INNS on imported/removed/disposed of materials**

- 3.2.35 Materials which are being reused or sourced from the marine environment (e.g. dredged material, sheet piles) present an increased risk of transferring INNS. The rock for the breakwater would be sourced from dredging in Porth-y-pistyll; this would result in a low risk of transfer of INNS carried on the material. It may be necessary to source materials such as rock used in the temporary cofferdams from outside the Wylfa Newydd Development Area. The source would be from land and not from sea and therefore there is no risk of transfer of INNS. All artificial materials (e.g. sheet piles) used in construction will be new and will therefore be free of biofouling and INNS.
- 3.2.36 Construction of the breakwaters and MOLF would require dredging of the seabed to remove unsuitable foundation materials and to obtain the correct level for construction. Any dredged material which cannot be reused would be disposed of offshore under a marine licence. An assessment of the options for disposal location has been undertaken [RD25], recommending Disposal Site IS043, Holyhead North. This site has water depths over 50m for the majority of the site and is situated 18km away. Disposing of materials close to the source and at a greater depth than the source environment would reduce the risk of INNS transfer.
- 3.2.37 Removal of the rock material from the causeway and cofferdams would require rock to be washed and reused on land. This material would not be reused outside the Wylfa Newydd Development Area.
- 3.2.38 The indicative risk of transfer on materials is considered to be medium as no key INNS of concern are known to be present at the material sources; the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of INNS transfer on materials.

### **Pathway: disturbance and dispersal of INNS present during construction activities**

- 3.2.39 Construction of the breakwaters and MOLF would involve piling and installation of pre-bored piles, blasting and/or dredging to create a level platform for construction. This would cause disturbance to any INNS already in the area and increase the risk of subsequent dispersal during construction activities.
- 3.2.40 Baseline surveys to date have indicated that all INNS recorded in the Wylfa Newydd Development Area are known to occur already around the coast of north Anglesey. INNS monitoring surveys prior to commencement of construction would provide information on any new INNS present within the Wylfa Newydd Development Area and particularly those of concern. Specific management measures would be required should monitoring surveys indicate the presence of an INNS of concern at high risk of transfer to new areas if disturbed.
- 3.2.41 The indicative risk of disturbance and dispersal of INNS during construction activities is considered to be medium as no key INNS of concern are known

to be present within the Wylfa Newydd Development Area; the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of disturbance and dispersal of any new INNS of concern.

### **Operation**

#### **Pathway: availability of artificial hard surfaces for colonisation by INNS through presence of man-made structures**

- 3.2.42 During operation, artificial surfaces including the breakwaters and structures associated with the intake and outfall would remain present within the Wylfa Newydd Development Area. The presence of artificial surfaces increases the risk of INNS becoming established. However, the risk would be lower than during the construction period as the marine life on areas of new substrate (breakwaters, MOLF and other structures) would already be established, thus reducing the potential for colonisation by non-native species. Regular surveys of structures would be undertaken to enable early detection of previously unrecorded INNS (see also 5.1). Specific management measures would be required should surveys indicate the presence of new INNS and particularly those of concern.
- 3.2.43 The indicative risk of establishment of INNS on man-made structures is considered to be high due to the permanent nature of the structures; the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of colonisation of artificial hard surfaces by INNS.

#### **Pathway: transfer of INNS through biofouling and ballast water of vessels**

- 3.2.44 During operation, vessel movements inside the harbour would be limited to periodic maintenance dredging activities to ensure sufficient depth for the intake, and very infrequent movements (<1 per year) linked to the delivery of Abnormal Indivisible Loads during operation.
- 3.2.45 Use of a number of small vessels is required to transfer workers from land onto the MOLF during operation. These vessels would be limited to operating within Porth-y-pistyll; journeys to and from other ports would not normally be required.
- 3.2.46 The risk of introduction of INNS on vessels would therefore be lower than during the construction phase. All vessels would comply with the Ballast Water Management Convention, and would ensure they are free from biofouling material prior to arrival on site and for vessels which remain on site prior to departing.
- 3.2.47 The indicative risk of INNS transfer through vessel movements for maintenance and for delivery of Abnormal Indivisible Loads is considered to be medium as multiple movements of a number of vessels are expected per year. The risk for small vessels transferring INNS to the MOLF is low as they will be operating within Porth-y-pistyll only. The implementation of

appropriate management techniques (as outlined above) is considered to result in a low residual risk of INNS transfer through biofouling and ballast water.

### **Pathway: transfer of INNS on dredged materials**

- 3.2.48 Disposal of dredged material during maintenance dredging activities would present the risk of INNS transfer. Inspection of the area to be dredged for presence of INNS would mitigate the risk of transfer. Disposing of materials at the same Disposal Site IS043, Holyhead North, as for construction, would further reduce the risk of INNS transfer as the Disposal Site is close to the source and at a greater depth than the source environment.
- 3.2.49 The indicative risk of INNS transfer on dredged material is considered to be low as this would be undertaken only once per year; the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of transfer of INNS on dredged materials.

### **Pathway: favourable conditions for INNS resulting from discharge of Cooling Water**

- 3.2.50 During operation the discharge of Cooling Water has the potential to cause an increase in temperature of  $>3^{\circ}\text{C}$  at the surface, limited to an area 0.8km north of the Cooling Water discharge point, and may create favourable conditions for INNS. Continued surveys would be required to monitor for the presence of INNS in the area affected by the discharge as part of the monitoring programme described in 5.1.
- 3.2.51 The risk of INNS establishment as a result of favourable conditions resulting from discharge of Cooling Water (i.e. increased temperature) is considered to be medium as other factors are also important for INNS establishment, e.g. substrate suitability, wave exposure etc. The implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of INNS establishment.

## ***Decommissioning***

### **Pathway: transfer of INNS through biofouling and ballast water of vessels and equipment**

- 3.2.52 During decommissioning there would be a number of vessels and plant/equipment arriving and/or working in Porth-y-pistyll. All vessels will adhere to the Ballast Water Management Convention. Regular inspection and maintenance of hulls should be undertaken to remove any biofouling.
- 3.2.53 All biosecurity measures outlined for construction would also apply to decommissioning to avoid transfer of INNS into and out of the Wylfa Newydd Development Area.
- 3.2.54 The indicative risk of INNS transfer through vessel movements is considered to be high due to likely multiple movements of a high number of vessels; the implementation of appropriate management techniques (as outlined above)

is considered to result in a low residual risk of INNS transfer through biofouling and ballast water.

**Pathway: transfer of INNS on removed materials**

- 3.2.55 Decommissioning would involve the removal of structures including the intake and outfall, breakwaters and MOLF. Materials would either be reused on land or would be disposed of at sea at a licensed site. All materials must be cleaned and biofouling removed and disposed of on land prior to introduction to the marine environment outside the Wylfa Newydd Development Area to avoid transfer of INNS.
- 3.2.56 The risk of transfer of INNS established in Porth-y-pistyll during removal of materials is considered to be high as their status within the area might have considerably changed; however, the implementation of appropriate management techniques (as outlined above) is considered to result in a low residual risk of transfer of INNS on removed materials.

**3.3 Summary of potential pathways and management measures**

- 3.3.1 A summary of management measures taken to reduce the risk of INNS transfer by vessels is outlined in Table 3-4.
- 3.3.2 Table 1-1 summarises the pathways of INNS transfer from construction, operation and decommissioning activities and management measures. The indicative risk of each activity and residual risk after mitigation are also listed.

**Table 3-4 Reducing the risk of INNS transfer by vessels**

Management	Summary
Adherence to the Ballast Water Management Convention.	<p>Aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments.</p> <p>Vessels must have ballast water management plans and record books. Regulations include control of where ballast water can be exchanged and volume of exchange. See 3.2.19.</p>

Management	Summary
<p>Maintenance and hull cleaning.</p> <p>Follow guidance given in [RD26], IMO Biofouling Guidance, Merchant Shipping (Anti-Fouling Systems) Regulations 2009</p>	<p>Regular inspections and maintenance of hulls to remove biofouling either through dry docking or in water inspections by divers.</p> <p>Inspection of equipment, e.g. anchor cables, buoys, construction equipment.</p> <p>Cleaning of hulls prior to arrival on site.</p> <p>Disposal of biofouling material to land.</p> <p>Use and maintenance of appropriate anti-fouling coatings.</p> <p>Higher levels of biosecurity, such as disinfection berths, should be implemented in areas with known <i>D. vexillum</i> populations.</p> <p>Vessels to provide up-to-date maintenance records including cleaning schedules and anti-fouling coating records.</p>
<p>Inspection of vessels/construction plant</p>	<p>Regular inspection of submerged surfaces of construction plants and vessels for biofouling and the presence of INNS.</p> <p>Inspections on site for vessels/construction plant remaining on site.</p>
<p>Reducing the risk of transfer of <i>D. vexillum</i> and other INNS from Holyhead Harbour</p>	<p>Due to the close proximity of Holyhead Harbour and the presence of <i>D. vexillum</i> and other INNS not currently found in Porth-y-pistyll additional measures to be considered are:</p> <p>Limit time vessels/construction plant spend in Holyhead Harbour prior to arrival on site.</p> <p>If time at Holyhead cannot be avoided, inspection of mooring sites at Holyhead prior to use by vessels/construction plant to select moorings.</p> <p>Use of alternative route to site/mooring locations to avoid Holyhead Harbour.</p> <p>No uptake of ballast water within Holyhead Harbour, following IMO guidelines for distance from land for ballast water exchange.</p>
<p>Location records for vessels</p>	<p>All vessels to provide details of locations of work/travel/docking since last cleaning to determine the risk of each vessel transferring INNS (in accordance with IMO Biofouling Guidance).</p>
<p>Other guidance/legislation</p>	<p>All vessels/equipment used must conform to industry guidelines, legislation and legislative guidance from the relevant port and harbour authorities of both source and receiving ports.</p>

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**Table 3-5 Summary of the risks of INNS transfer from construction, operation and decommissioning activities, and management measures**

Activity	Pathway	Indicative risk	Management	Residual risk
<b>Construction</b>				
Use of vessels and equipment	Biofouling Ballast water	High (multiple movements of a high number of vessels)	<p>All vessels to adhere to the Ballast Water Management Convention and Merchant Shipping (Anti-Fouling Systems) Regulations 2009.</p> <p>Minimise the movement of vessels into/out of the development area. Where possible vessels to remain on site rather than on/off site between construction stages.</p> <p>Regular inspection of vessels, equipment and artificial structures for biofouling in accordance with IMO Biofouling Guidance</p> <p>Wash off the anchor and chain before stowing when leaving anchorage.</p>	Low

Activity	Pathway	Indicative risk	Management	Residual risk
Import/removal/disposal of materials	Transfer of INNS on materials	Medium (no key INNS of concern known to be present at material sources)	<p>Rock for breakwater to be sourced from dredging in Porth-y-pistyll.</p> <p>No natural material to be sourced from the marine environment outside Porth-y-pistyll.</p> <p>All artificial material to be used will be new and so free from biofouling.</p> <p>All materials sourced from the marine environment to be inspected prior to being removed and/or disposed of.</p> <p>Removed materials from the temporary causeway to be reused on land.</p> <p>Disposal of dredged material at licensed Disposal Site IS043 Holyhead North which is at greater depth than source environment of INNS.</p>	Low
Introduction of man-made structures	Increased availability of artificial hard surfaces available for colonisation by INNS	High (structures are permanent)	<p>Regular inspection for presence of INNS.</p> <p>Use of anti-fouling coatings (where applicable).</p>	Low

Activity	Pathway	Indicative risk	Management	Residual risk
Disturbance of INNS present	Dispersal of INNS released into the water during construction activities	Medium (no key INNS of concern known to be present)	Baseline surveys to establish current status of INNS within the construction area. To date all INNS recorded are known to occur already around the coast of north Anglesey. INNS monitoring surveys prior to commencement of construction would provide information on any new non-native species present within the Wylfa Newydd Development Area and particularly those of concern. Specific management measures would be required should surveys indicate the presence of an INNS at high risk of transfer to new areas if disturbed.	Low
<b>Operation</b>				
Presence of man-made structures	Availability of artificial hard surfaces for colonisation by INNS	High (structures are permanent)	Regular surveys for presence of previously unrecorded INNS to enable early detection (see also 5.1). Specific management measures would be required should surveys indicate the presence of new INNS and particularly those of concern.	Low
Use of vessels for maintenance and delivery of Abnormal Indivisible Loads	Transfer of INNS via biofouling and exchange of ballast water	Medium (more than one movement per year, more than one vessel)	All vessels to adhere to the Ballast Water Management Convention and Merchant Shipping (Anti-Fouling Systems) Regulations 2009. Regular inspections and maintenance of hulls to remove biofouling in accordance with the IMO Biofouling Guidance.	Low

Activity	Pathway	Indicative risk	Management	Residual risk
Maintenance dredging	Transfer on vessels Transfer on dredged materials	Low (once per year)	All vessels to adhere to the Ballast Water Management Convention and Merchant Shipping (Anti-Fouling Systems) Regulations 2009. Regular inspections and maintenance of hulls to remove biofouling in accordance with the IMO Biofouling Guidance. Determine if any INNS are present in area to be dredged. Disposal of dredged material at licensed Disposal Site IS043 Holyhead North which is at greater depth than source environment of INNS.	Low
Use of small vessels to transfer workers to MOLF	Transfer of INNS via biofouling	Low (operating within Porth-y-pistyll)	These vessels would be limited to operating within Porth-y-pistyll. Journeys to and from other ports would not normally be required. Where possible avoid prolonged mooring outside Porth-y-pistyll. Regular inspection of vessels for biofouling and cleaning schedule to remove biofouling in accordance with the IMO Biofouling Guidance. Use of anti-biofouling coating if applicable (Merchant Shipping (Anti-Fouling Systems) Regulations 2009).	Low
Use of small vessels (general)	Transfer of INNS via biofouling	Medium (periodic movements of a small number of vessels)	Regular cleaning and inspections of vessels in accordance with the IMO Biofouling Guidance. Use of anti-biofouling coating if applicable (Merchant Shipping (Anti-Fouling Systems) Regulations 2009).	Low

Activity	Pathway	Indicative risk	Management	Residual risk
Discharge of Cooling Water	Potential increase in temperature of >3°C at the surface, limited to an area 0.8km north of the Cooling Water discharge point may create favourable conditions for INNS	Medium (other factors also of importance for INNS)	Continued ecological monitoring within the affected area (also see 5.1).	Low
<b>Decommissioning</b>				
Use of vessels/equipment	Biofouling Ballast water	High (likely multiple movements of a high number of vessels)	All vessels to adhere to the Ballast Water Management Convention and Merchant Shipping (Anti-Fouling Systems) Regulations 2009. Regular inspections and maintenance of hulls to remove biofouling in accordance with the IMO Biofouling Guidance. Management measures for construction apply.	Low
Removal of materials	Risk of transfer of INNS established in Porth-y-pistyll	High (INNS status in Porth-y-pistyll might have changed compared to baseline surveys)	Materials either reused on land or disposed of at sea at a licensed site. If material needs to be disposed of at sea the necessary permissions would be sought and an application for a Marine Licence would be required. Any equipment/materials which would be reused e.g. piles must have bio-fouling material removed and disposed of on land and treated if required.	Low

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## 4 Draft risk assessment

### 4.1 INNS risk assessment

- 4.1.1 The risk assessment is carried out using a matrix, assessing the likelihood and severity of the introduction. The use of two five-point scales for likelihood and severity of risk is commonly accepted in risk management standards and also used in parts of the Non-native Risk Assessment scheme by GBNNSS. The judgement of risk establishes whether the risk is acceptable, whether control measures are required to mitigate the risk and whether the residual risk prevents work activity taking place. A judgement of risk is established from the matrix in Table 4-1.
- 4.1.2 The likelihood includes both the likelihood of the INNS being transferred into or out of the areas or to spread within the Wylfa Newydd Development Area as a result of the works and the likelihood of the species becoming established if successfully transferred. The likelihood of transfer is assessed based on whether a certain INNS is present and its relative abundance in the area of origin of vessels and whether there are identified pathways for transfer. The likelihood of establishment is assessed based on the availability of suitable habitat/conditions.
- 4.1.3 The severity is a measure of the impact the species would have if transfer occurred, taking into account amount of available habitat, sensitivity of the habitat and native species in the area which could be invaded and the environmental, economic and social impacts if an INNS were to successfully be transferred and establish. The judgement of scale for severity is as follows:
- Insignificant – unsuitable habitat/conditions present and no known impacts;
  - Minor – unsuitable habitat/conditions present, and/or species listed as Low or Unknown impact under the WFD or not listed but has been reported to have some impacts, and/or low sensitivity of the habitat and native species in the area;
  - Moderate – suitable habitat/conditions present and species listed as Moderate impact under the WFD;
  - Major – suitable habitat/conditions present and species listed as High impact under the WFD or as High alert/GB Rapid Response Species, with significant potential impacts to the new environment and/or local industry or amenity; and
  - Severe – suitable habitat/conditions present and species listed as High impact under the WFD with detrimental potential impacts to the new environment and/or local industry or amenity.
- 4.1.4 The assessment assumes management measures which are followed because they are a legal requirement as part of the Ballast Water Management Convention but without additional management measures. The

residual risk takes into account additional management measures to reduce the risk.

**Table 4-1 Risk matrix used in the risk assessment for the introduction of marine INNS**

		Risk				
Likelihood	Highly Likely	Low	Medium	Medium	High	Very High
	Likely	Low	Low	Medium	High	High
	Possible	Low	Low	Medium	Medium	Medium
	Unlikely	Negligible	Low	Low	Low	Medium
	Very Unlikely	Negligible	Negligible	Low	Low	Low
		Insignificant	Minor	Moderate	Major	Severe
		Severity				

- 4.1.5 High and very high risk would be unacceptable; further control measures would be required to lower the risk to an acceptable level. Medium risk would be acceptable; however, the risk should be reduced further where reasonable management measures could be put in place. No further control measures would be required where the risk is assessed as low or negligible.
- 4.1.6 The risk assessment below considers the risk of transfer and establishment of INNS into the Wylfa Newydd Development Area and surrounding environment (including the Menai Strait and Conwy Special Area of Conservation, local mussel industry and other protected sites further afield) and transfer of INNS already recorded within Porth-y-pistyll out of the area.
- 4.1.7 The initial risk is calculated assuming that vessels adhere to the Ballast Water Management Convention (if applicable) as this is a legal requirement but without additional checks for compliance. The residual risk provides the level of risk once additional management measures discussed in section 3 would have been put in place. These would include:
- regular inspections and maintenance of hulls to remove biofouling in accordance with the IMO Biofouling Guidance;
  - use of antifouling coatings; and
  - INNS monitoring surveys.
- 4.1.8 Species covered are WFD High and Moderate impact marine INNS [RD4], INNS recorded in baseline surveys, NWWT species of concern in north Wales [RD6] and non-native species recorded in Holyhead Harbour by Wales Marine Non-native Species Inshore Monitoring Network [RD8] and as part of the Welsh Government Resilient Ecosystems Fund [RD7] in 2014. All other INNS are considered to be of low or insignificant risk provided

management measures in relation to biofouling and exchange of ballast water are in place.

- 4.1.9 Where the likelihood is classified as very unlikely but there is no identified pathway for transfer to occur as a result of the works the risk has been reduced to negligible for all levels of severity; this is indicated by ‘\*’.

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**Table 4-2 Marine INNS draft risk assessment. Initial risk is calculated assuming that vessels adhere to the Ballast Water Management Convention (if applicable) as this is a legal requirement. Residual risk is calculated after the additional management measures described in section 3 have been taken.**

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Spartina anglica</i> Common cord-grass	<b>Unlikely:</b> Unlikely to transfer into the area. Main pathway is via ballast water which is controlled under the Ballast Water Management Convention. Unlikely to establish due to lack of suitable habitat: sheltered, estuarine conditions where mud flats are present.	<b>Minor:</b> <i>S. anglica</i> is classified as a High impact species [RD4] altering habitats including loss of important bird habitat and impacting on native species. However, within Porth-y-pistyll there is a lack of suitable habitat for establishment therefore the severity is minor.	Low	Low
<i>Eriocheir sinensis</i> Chinese mitten crab	<b>Unlikely:</b> Potential to transfer via fouling of vessels, equipment and via ballast water. Unlikely to transfer via ballast water due to controls under the Ballast Water Management Convention. Unlikely to establish due to lack of suitable habitat such as tidal estuaries and larger rivers.	<b>Minor:</b> <i>E. sinensis</i> is classified as a High impact species [RD4] and strategic priority species [RD6]. However, within Porth-y-pistyll there is a lack of suitable habitat for establishment therefore the severity is minor.	Low	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Crepidula fornicata</i> Slipper limpet	<b>Likely:</b> Widespread species, could be transferred via fouling of hulls/equipment. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Major:</b> Classified as a High impact species [RD4] and strategic priority species [RD6]. Potential to out-compete native species through spatial competition, reducing hard surface habitat availability though high densities and deposition of faeces and sediment, and competition for food. <i>C. fornicata</i> has economic impacts on bivalve fisheries.	High	Low
<i>Styela clava</i> Leathery sea squirt	<b>Likely:</b> Well established in the UK. Recorded from Holyhead Harbour. Could be transferred via fouling of vessels and equipment. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Major:</b> Classified as a High impact species [RD4]. May out-compete native species. Biofouling of structures and vessels.	High	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Urosalpinx cinerea</i> American oyster drill	<b>Very unlikely:</b> In the UK this species is currently found only on the Essex and Kent coasts. Its spread has been linked to the transport of oysters. Although suitable habitat is present within Porth-y-pistyll it is unlikely that transfer of this species would occur.	<b>Minor:</b> Low impact within Porth-y-pistyll. This species is classified as a High impact species [RD4] due to impact on commercial oyster industry.	Negligible	Negligible
<i>Didemnum vexillum</i> Carpet sea squirt	<b>Likely:</b> Present in Holyhead Harbour. Could be transferred via fouling of vessels and equipment. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Major:</b> Classified as a High impact species [RD4]. GB Rapid Response Species. May out-compete native species. Biofouling. Eradication could be required if colonisation occurred: significant economic costs.	High	Low
<i>Caprella mutica</i> Japanese skeleton shrimp	<b>Likely:</b> Has previously been recorded in Holyhead Harbour (2014). Potential for spread via fouling of hulls/equipment and ballast water. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Major:</b> Classified as a High impact species [RD4]. Potential significant impact on benthic communities, out-competing of native species, biofouling of vessels and structures including blocking water intakes.	High	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Ficopomatus enigmaticus</i> Marine tubeworm	<b>Likely:</b> Widespread species. Potential for spread via fouling of hulls/equipment. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Major:</b> Classified as a High impact species [RD4]. Causes alteration to habitat. Negative impact on native species. Biofouling of vessels and structures.	High	Low
<i>Tricellaria inopinata</i> , <i>Schizoporella japonica</i> , <i>Bugula neritina</i> Bryozoans	<b>Possible:</b> Have previously been recorded in Holyhead Harbour (2014). Potential for spread via fouling of hulls/equipment. Found in shallow water in protected sites, especially harbours and marinas. Increase in the amount of suitable habitat present in Porth-y-pistyll during construction and operation. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Minor:</b> These species are not listed in the WFD impact classifications [RD4]. Populations in harbours and marinas can become dense, displacing native species. Biofouling of vessels and structures.	Low	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<p><i>Botrylloides violaceus</i> Orange cloak sea squirt</p>	<p><b>Possible:</b> Potential spread from populations in harbours and marinas along the south coast of England and Wales, the east coast as far north as Grimsby, and in Milford Haven (Wales) and from populations elsewhere in Europe. Has previously been recorded in Holyhead Harbour (2014). Transfer may occur via fouling of hulls/equipment.</p> <p>Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.</p>	<p><b>Minor:</b> Not listed in the WFD impact classifications [RD4]. Competition with native species. This species is capable of forming large colonies. Biofouling of vessels and structures.</p>	<p>Low</p>	<p>Low</p>
<p><i>Corella eumyota</i> Orange-tipped sea squirt</p>	<p><b>Possible:</b> Potential to spread from established populations in GB waters, including populations in Holyhead Harbour, and elsewhere. Transfer via biofouling of vessels and equipment. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.</p>	<p><b>Minor:</b> Not listed in the WFD impact classifications [RD4]. Potential to impact on native communities and biofouling of vessels and structures.</p>	<p>Low</p>	<p>Low</p>

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Asterocarpa humilis</i> Compass sea squirt	<b>Possible:</b> Potential to spread from established populations in GB waters, including populations in Holyhead Harbour, and elsewhere. Transfer via biofouling of vessels and equipment. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Minor:</b> Not listed in the WFD impact classifications [RD4]. Potential impact on native communities although at present known only from artificial substrates in its introduced range. Biofouling of vessels and structures.	Low	Low
<i>Austrominius modestus</i> Barnacle	<b>Possible:</b> Widely distributed in GB including within Porth-y-pistyll. Potential for transfer from Porth-y-pistyll via fouling of hulls/equipment and ballast water.	<b>Minor:</b> Classified as Low impact under the WFD [RD4]. This species is already widely distributed. Colonisation of new substrate. Biofouling of vessels and structures.	Low	Low
<i>Crassostrea gigas</i> (accepted as <i>Magallana gigas</i> ) Pacific oyster	<b>Possible:</b> Widely distributed in GB including farmed populations. Potential for spread via fouling of hulls/equipment. Suitable habitat present in Porth-y-pistyll.	<b>Moderate:</b> Classified as Moderate impact under the WFD [RD4]. Strategic priority species [RD6]. May alter habitats and native species composition.	Medium	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Undaria pinnatifida</i> Japanese Kelp/Wakame	<b>Possible:</b> Potential to spread from established populations in GB waters, including populations in Holyhead Harbour, and elsewhere. Transfer via fouling of hulls/equipment. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Minor:</b> Classified as unknown impact under the WFD [RD4]. Competition with native seaweeds. Biofouling of vessels and structures.	Low	Low
<i>Sargassum muticum</i> Wireweed	<b>Possible:</b> This species is found within Porth-y-pistyll and is widely established in the UK. Potential to be transferred to other areas on vessels/equipment. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Minor:</b> Classified as a Low impact species under the WFD [RD4]. Strategic priority species [RD6]. Out-competes native seaweeds and other species. Potential to spread to new surfaces and cause problems e.g. entanglement with propellers.	Low	Low
<i>Hemigrapsus sanguineus</i> Asian shore crab	<b>Unlikely:</b> Possible transfer from populations along the Atlantic coast of France and Germany and across the UK. Nearest UK record from south Wales. Potential for spread via fouling of hulls/equipment and ballast water.	<b>Major:</b> Species classified as High impact but currently on the waiting list for inclusion under the WFD [RD4]. Could result in significant reductions in common shore crab abundance and mussel density.	Low	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Hemigrapsus takanoi</i> Brush-clawed shore crab	<b>Unlikely:</b> This species has invaded Europe but has not yet been recorded in GB. Potential transfer via vessels/equipment.	<b>Major:</b> Species classified as High impact but currently on the waiting list for inclusion under the WFD [RD4]. If established would threaten the native common shore crab and mussel densities.	Low	Low
<i>Homarus americanus</i> American lobster	<b>Very unlikely:</b> No established populations found in Europe. Transfers to date linked to release of live individuals from the catering industry.	<b>Major:</b> On the WFD waiting list and will be classified as a High impact species [RD4] due to its impact on the native lobster populations.	Negligible*	Negligible*
<i>Grateloupia turuturu</i> Devil's tongue weed	<b>Possible:</b> Potential for spread via fouling of hulls/equipment and ballast water. Possible transfer from populations in Europe and from the south-east coast of England and Pembrokeshire. Suitable habitat present in Porth-y-pistyll. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.	<b>Minor:</b> Potential to displace native seaweed species. Biofouling of vessels and structures. Strategic priority species [RD6].	Low	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Codium fragile</i> subsp. <i>tomentosoides</i> Green sea fingers	<b>Possible:</b> Widely established in the UK. Found within Porth-y-pistyll. Potential to be transferred to other areas on vessels/equipment and materials.	<b>Minor:</b> Classified as an unknown impact species under the WFD [RD4]. Potential to colonise vessels, new structure and equipment competing for space with native species.	Low	Low
<i>Tiostrea lutaria</i> (accepted as <i>Ostrea chilensis</i> ) New Zealand flat oyster	<b>Very unlikely:</b> Established in the Menai Strait [RD6]. Unlikely to spread and establish elsewhere due to low rate of spread: deliberate commercial introduction, species has spread less than 1km in 25 years [RD2].	<b>Minor:</b> Strategic priority species [RD6]. Classified as a Low impact species under the WFD [RD4].	Negligible	Negligible
<i>Rapana venosa</i> Rapa whelk	<b>Very unlikely:</b> Not currently thought to be established in GB but may be present offshore. Species is transferred by larvae in ballast water. Transfer into Porth-y-pistyll should be low due to controls under the Ballast Water Management Convention.	<b>Major:</b> This species is not listed in the WFD impact classifications [RD4]. It is a High alert species [RD6]. If established, impact of competition with the native common whelk and reduction of food availability for some other native species.	Low	Low

Species	Likelihood	Severity	Risk	Residual risk (after management)
<p><i>Watersipora subtorquata</i> Red ripple bryozoan</p>	<p><b>Possible:</b> Potential transfer from populations in GB or Europe. Transfer most likely to occur via biofouling of vessels, equipment or materials. Addition of artificial and new substrate within Porth-y-pistyll would provide colonisation sites.</p>	<p><b>Major:</b> High alert species. Not yet recorded in Wales; however, it is likely to arrive and will quickly spread [RD6]. This species is not listed in the WFD impact classifications [RD4]. Capable of forming very large colonies, and likely to have considerable effect on pre-existing sessile communities through space occupancy and overgrowth interactions [RD5]. Biofouling of vessels and structures.</p>	<p>Medium</p>	<p>Low</p>
<p><i>Coscinodiscus wailesii</i> A centric diatom</p>	<p><b>Possible:</b> This species is found in the waters off north Anglesey and is established around GB and in Europe. Potential to transfer via ballast water. However, unlikely to transfer via ballast water due to controls under the Ballast Water Management Convention.</p>	<p><b>Minor:</b> Classified as an unknown impact species under the WFD [RD4]. This species is widely distributed. At high densities it can impact on commercial fishing by clogging fishing gear.</p>	<p>Low</p>	<p>Low</p>

Species	Likelihood	Severity	Risk	Residual risk (after management)
<p><i>Odontella sinensis</i> A centric diatom</p>	<p><b>Possible:</b> This species is found in the waters off north Anglesey and in Porth-y-pistyll and is established around GB and in Europe. Potential to transfer via ballast water. However, unlikely to transfer via ballast water due to controls under the Ballast Water Management Convention.</p>	<p><b>Minor:</b> Classified as an unknown impact species under the WFD [RD4]. This species is widely distributed.</p>	<p>Low</p>	<p>Low</p>
<p><i>Asparagopsis armata</i> Harpoon weed</p>	<p><b>Possible:</b> This species is found within Porth-y-pistyll and is established in south-west England and in Europe. Potential to be transferred to other areas on vessels/equipment and materials.</p>	<p><b>Minor:</b> Classified as an unknown impact species under the WFD [RD4]. Biofouling of vessels, equipment or materials moved out of Porth-y-pistyll. Biofouling, economic costs as a result of biofouling and impacts on recreational activities and competition with native species in new areas.</p>	<p>Low</p>	<p>Low</p>

Species	Likelihood	Severity	Risk	Residual risk (after management)
<i>Anotrichium furcellatum</i> A red alga	<b>Possible:</b> This species is found within Porth-y-pistyll and is established in south-west England and in Europe. Potential to be transferred to other areas on vessels/equipment and materials.	<b>Minor:</b> This species is not listed in the WFD impact classifications [RD4]. Biofouling of vessels and structures and competition with native species if it spreads to new areas or colonises new substrate within the development area.	Low	Low
<i>Heterosiphonia japonica</i> (accepted as <i>Dasysiphonia japonica</i> ) Siphoned Japan weed	<b>Possible:</b> Found within Porth-y-pistyll and a number of other sites around the GB coast. Potential to be transferred to other areas on vessels/equipment and materials.	<b>Minor:</b> This species is not listed in the WFD impact classifications [RD4]. Biofouling of vessels and structures and competition with native species if it spreads to new areas or colonises new substrate within the development area.	Low	Low

## 5 Monitoring and corrective action

### 5.1 INNS monitoring

- 5.1.1 Monitoring for non-native species during construction and operation of the power station would be required to enable early detection should introduction of non-natives occur within the Wylfa Newydd Development Area.
- 5.1.2 Implementation of a monitoring programme for non-native species would include observational surveys on structures that may provide suitable substrate for non-native species. Surveys would record presence and abundance of non-native species with reporting in agreement with NRW. An initial pre-construction survey would be undertaken and regular surveys would begin once construction of the breakwaters and MOLF is completed. The frequency and extent of monitoring would reduce over time, particularly once the MOLF is no longer operational. The ongoing requirement for monitoring would be regularly reviewed and agreed with NRW. Early detection increases the likelihood of successful containment and the potential for full eradication [\[RD17\]](#).
- 5.1.3 As recommended in the IMO Biofouling Guidelines vessels should implement biofouling practices to include in-water inspections and cleaning of hulls, and removal of biofouling (e.g. through dive surveys), ensuring that the biofouling material does not enter the marine environment. According to these Guidelines inspections and cleaning should be undertaken periodically as a means of routine surveillance but may be specifically appropriate before and after any planned period of vessel inactivity.

### 5.2 Corrective actions for vessels

- 5.2.1 Corrective actions would be set out in the event of a biosecurity breach, for example a vessel being allowed to arrive at the MOLF but on arrival found to have significant biofouling or incorrect paperwork. Corrective actions would include:
- Inform relevant authorities where appropriate i.e. for non-compliant vessels;
  - Move vessel offshore;
  - Decide on appropriate action to clean the vessel while minimising any further risks e.g. dry docking for cleaning or returning to port of origin; and
  - Investigate the cause of the incident and put measures in place to prevent it happening again e.g. stop using a particular supplier of vessels.

## 6 Conclusion

- 6.1.1 The draft risk assessments undertaken in this strategy document have considered individual Project activities and specific marine non-native species. If during the final biosecurity risk assessment, the management measures are implemented as outlined in this report the residual risk for INNS transfer and establishment within the Wylfa Newydd Development Area and Holyhead North Disposal Site is considered to be low.
- 6.1.2 Once a marine contractor has been appointed a biosecurity risk assessment will be carried out which will identify specific risks and management strategies in relation to the key pathways. The completed final assessment will include details of the suitably qualified person(s) or group(s) responsible for ensuring that the required biosecurity measures are implemented.

## 7 References

**Table 7-1 Schedule of references**

ID	Reference
RD1	Barton, E. and Heard, J. 2004. Marine Life Topic Note. Alien, Non-Native and Invasive Marine species. <i>Marine Life Information Network</i> . Plymouth: Marine Biological Association of the United Kingdom. [Online]. [Accessed May 2017]. Available from: <a href="http://www.marlin.ac.uk/PDF/MLTN_alien_non_natives.pdf">http://www.marlin.ac.uk/PDF/MLTN_alien_non_natives.pdf</a> .
RD2	Eno, N.C., Clark, R.A. and Sanderson, W.G. 1997. <i>Non-native marine species in British waters: a review and directory</i> . Peterborough: Joint Nature Conservation Committee.
RD3	Mollison, D. 1986. Modelling biological invasion: change, explanation, prediction. <i>Philosophical Transactions of the Royal Society of London, Ser. B</i> , 314, 675–693.
RD4	UKTAG, 2015. <i>Revised classification of aquatic alien species according to their level of impact</i> . Version 7.6. UK Technical Advisory Group on the Water Framework Directive.
RD5	GB Non-Native Species Secretariat. [Online]. [Accessed: May 2017]. Available from: <a href="http://www.nonnativespecies.org/home/index.cfm">http://www.nonnativespecies.org/home/index.cfm</a> .
RD6	North Wales Wildlife Trust. <i>Marine Alien Species</i> . [Online]. [Accessed May 2017]. Available from: <a href="http://www.northwaleswildlifetrust.org.uk/what-we-do/living-seas/living-seas-projects/marine-alien-species-project/marine-alien-species/">http://www.northwaleswildlifetrust.org.uk/what-we-do/living-seas/living-seas-projects/marine-alien-species-project/marine-alien-species/</a>
RD7	Wood, C., Bishop, J. and Yunnie, A. 2015. <i>Comprehensive Reassessment of NNS in Welsh marinas</i> . Welsh Government Resilient Ecosystems Fund (REF) Grant GU9430.
RD8	Wales Marine Non-native Species Inshore Monitoring Network. (2014). School of Ocean Sciences. Bangor University.
RD9	Baldock, L. and Goudge, H. 2017. Natural Resources Wales 2016 North Anglesey INNS and <i>Sabellaria</i> video and still image analysis. Natural Resources Wales Evidence Report Series. Report No: 206, 61pp, Natural Resources Wales, Bangor.
RD10	Welsh Government. 2017. Marine invasive non-native species priority monitoring and surveillance list for Wales. [Online]. [Accessed January 2019]. Available from <a href="https://beta.gov.wales/sites/default/files/publications/2018-02/invasive-aquatic-species-priority-marine-species.pdf">https://beta.gov.wales/sites/default/files/publications/2018-02/invasive-aquatic-species-priority-marine-species.pdf</a>

ID	Reference
RD11	Sambrook, K., Holt, R.H.F., Sharp, R., Griffith, K., Roche, R.C., Newstead, R.G., Wyn, G. and Jenkins, S.R. 2014. Capacity, capability and cross-border challenges associated with marine eradication programmes in Europe: the attempted eradication of an invasive non-native ascidian, <i>Didemnum vexillum</i> in Wales, United Kingdom. <i>Marine Policy</i> . 48, 51–58.
RD12	Kleeman, S.N. 2009. <i>Didemnum vexillum</i> —feasibility of eradication and/or control. Bangor: Countryside Council of Wales; 2009; 65 (Countryside Council of Wales Contract Science Report No. 875). In Sambrook <i>et al.</i> , 2014.
RD13	Countryside Council of Wales. 2011. Natural beauty threatened by aliens! <i>Sŵyn y Môr. The magazine for the Isle of Anglesey AONB and coastal path</i> . [Online]. [Accessed January 2016]. Available from: <a href="http://www.anglesey.gov.uk/Journals/public/attachments/143/Swn_y_Mor_Winter_2011.pdf">http://www.anglesey.gov.uk/Journals/public/attachments/143/Swn_y_Mor_Winter_2011.pdf</a>
RD14	Cook, E.J., Jahnke, M., Kerckhof, F., Minchin, D., Faasse, M., Boos, K. and Ashton, G. 2007. European expansion of the introduced amphipod <i>Caprella mutica</i> Schurin 1935. <i>Aquatic Invasions</i> (2007) Volume 2, Issue 4: 411–421.
RD15	Boos, K., Ashton, G.V. and Cook, E.J. 2011. The Japanese Skeleton Shrimp <i>Caprella mutica</i> (Crustacea, Amphipoda): a global invader of coastal waters. In: Galil, B.S., Clark, P.J. and Carlton, J.T. (Eds.) <i>In The Wrong Place - Alien Marine Crustaceans: Distribution, Biology And Impacts</i> . Invading Nature – Springer Series in Invasion Ecology. Volume 6. Springer.
RD16	Mills, F. 2012. <i>Firth of Clyde BIOSECURITY PLAN 2012 – 2016</i> . Firth of Clyde Forum (with funding support from SNH, SEPA, Scottish Government and RAFTS).
RD17	Cook, E.J., Macleod, A., Payne, R.D. and Brown, S. 2014. Edited by Natural England and Natural Resources Wales (2015). <i>Marine Biosecurity Planning: guidance for producing site and operation-based plans for preventing the introduction and spread of non-native species in England and Wales</i> .
RD18	HNGE. 2016. <i>Transport and Logistics Study</i> . Document ID: A63-1505-0001-00001. Document No. CPJ-UW-A408 revision 1.
RD19	Horizon. 2016. <i>HGNE Transport and Logistics Study 2016 report caveats</i> . DCRM Ref Number: HNP-S9-SDT-REP-00093 revision 0.1.
RD20	Horizon. 2016. <i>PDS Annex C1 Site enabling and construction works</i> . DCRM Reference No WN01-S3-FD-REP-00014. Revision 3 Issue date 27/04/16.
RD21	GiMaRiS. 2014. <i>Port of Rotterdam survey and monitoring non-native species conform HELCOM/OSPAR protocol</i> . Report no. GiMaRiS 2014_31.
RD22	Welsh, S. and Lucas, I. 2002. <i>UK Compliance with Ballast Water Regulations</i> . Ref: CDEP 84/5/286. University of Wales, Bangor.

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RD23	Laing, I., Bussell, J. and Somerwill, K. 2010. <i>Project report: Assessment of the impacts of Didemnum vexillum and options for the management of the species in England</i> . Report produced by Natural England, The Food and Environment Research Agency and CEFAS.
RD24	Coutts, A.D.M. and Dodgshun, T.J. 2007. The nature and extent of organisms in vessel sea-chests: a protected mechanism for marine bioinvasion. <i>Marine Pollution Bulletin</i> . 54, 875–886. In Laing, I., Bussell, J. and Somerwill, K. 2010. <i>Project report: Assessment of the impacts of Didemnum vexillum and options for the management of the species in England</i> . Report produced by Natural England, The Food and Environment Research Agency and CEFAS.
RD25	Atkins. 2016. <i>Wylfa Newydd Disposal of Dredged Material Options Appraisal</i> . Document reference: 5150086.301.001.
RD26	Australian National Biofouling Management Guidance for non-trading vessels. 2009. <i>National Biofouling Management Guidance for Non-trading Vessels</i> . [Online]. [Accessed May 2017]. Available from: <a href="http://www.marinepests.gov.au/marine_pests/publications/Documents/Biofouling_guidance_NTV.pdf">http://www.marinepests.gov.au/marine_pests/publications/Documents/Biofouling_guidance_NTV.pdf</a>

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