

## 12. Mitigation

### 12.1 Introduction

Mitigation has been built into the Wave Dragon device and project design and especially throughout the EIA process, wherever possible. The following text consolidates the detail contained in the preceding chapters and presents the mitigation and monitoring proposals for the Wave Dragon project during the construction and operational phases of the development.

### 12.2 Physical Environment

#### 12.2.1 Offshore Physical Environment

Impacts identified generally relate to the reduced wave energy in the lee of the Wave Dragon device structure. There is no tangible mitigation for this apart from making the Wave Dragon device less efficient as an energy device, reducing its size, none of which are viable options for Wave Dragon Wales Limited. The impact of this process on the coast could be mitigated by moving the device further offshore, however the device location was selected after careful examination of the seabed substrate and is in the only suitable position in that area. The cables may need protecting or regular reburial across the beach / nearshore and they may need to be removed up to the directional drill reception pit upon decommissioning at the end of the Pre-commercial demonstrator phase. Upon completion of the project coastal processes will return to existing conditions and any changes to subsea and coastal sediments will also return to their pre-project state.

#### **Monitoring**

Monitoring relating to coastal processes will be proposed as part of a monitoring evaluation plan to address any FEPA licence conditions.

#### 12.2.2 Onshore Physical Environment

Measures to monitor and control the effects of construction and operation of the onshore works on the physical environment will be agreed with the local authority in advance of the commencement of construction, and implemented through a suite of environmental management procedures (as discussed in Chapter 6) and design control measures in the permanent works. The following measures have been identified to mitigate against potential effects as well as being considered good practice construction management:

- Road sweeping to reduce mud on the road to minimise the incidence of silty water entering road drainage and streams;
- Wheel wash facility to be self contained with dirty water discharged via a settlement tank onto vegetated ground;
- Temporary works areas to be minimised as far as practicable. On site vehicles to use to use designated on-site haul route(s) to avoid unnecessary compaction of agricultural soils;

- Topsoil and excavated material to be stored in designated stockpile areas;
- Oil/fuel pollution control through designated refuelling areas and practices and compliance with the Control of Pollution (Oil Storage) Regulations 2001;
- Concrete washout from concrete delivery vehicles to be undertaken in designated areas only;
- Provision of recycling facilities to remove the residual bentonite discharge;
- Compliance with Environment Agency Pollution Prevention Guidance;
- Use of bunded areas with at least 110% capacity for containment for areas/equipment containing fuels and oils in compliance with the Control of Pollution (Oil Storage) Regulations 2001;
- Implementation of adequate training and procedures for pollution prevention and incident control.

### **Monitoring**

Monitoring will largely relate to on site surveillance and control mechanisms linked to compliance with the Project Environmental Management Plan and any salient planning conditions.

## **12.3 Biological Environment**

### **12.3.1 Sub-Tidal Benthic Ecology**

A drop down camera and diver survey is planned for 2007 during which it will be confirmed whether or not there are ecological sensitivities on bedrock areas (including, but not limited to, the cable routes). If any activities on areas of bedrock are proposed these would only proceed if mitigation of the potentially significant adverse impacts identified above proved possible following survey. Mitigation would involve micro-siting of the cable and any mooring block or jack up legs a safe distance away from identified sensitivities and within areas confirmed as low sensitivity.

If possible, this would reduce the impact of installation from one of potentially major significance to one of negligible or low magnitude and hence minor or moderate significance.

Use of dynamic positioning (DP) vessels rather than vessels requiring physical anchoring would reduce the magnitude of impact by minimising potential areas of bedrock reef affected during both installation and decommissioning. In terms of cable alignment and rock bolting, in the absence of site-specific information on the nature and importance of reef communities on bedrock areas within the cable route corridor options it must be assumed that cable pinning alone could have a significant adverse impact on receptors of high importance.

### **Monitoring**

A full site survey involving drop down camera and divers is planned for 2007 and following this it will be possible to prepare a detailed monitoring plan, in consultation with the Department of Trade and Industry (DTI) and other Government departments / agencies. It is presently expected that monitoring is likely to focus on:

- 1) nearby extensive bedrock areas that might be affected during emplacement of the structures; in particular, if any significant colonies of pink sea fan *Eunicella verrucosa*, or other species of importance in their own right, were discovered in potentially vulnerable situations, for example on the edges of bedrock where dragging blocks could potentially cause damage, or where jack up legs are likely to be placed, then these would be the subject of specific monitoring plans.
- 2) the mooring blocks themselves, in order to monitor the development of epifauna. The monitoring should be carried out by divers and should cover both horizontal and vertical faces of the blocks. Vertical faces should include examples facing in different directions to see if there are significant differences caused by variations in exposure to waves and currents. The conjunction between the block and the sediment should be monitored as part of this exercise.
- 3) areas of sedimentary habitat upon which the mooring blocks are placed, including any significant areas of bedrock or more stable boulders within this area. Unless the site specific survey reveals any unexpected communities or species, monitoring of this habitat should take a relatively low priority since it is expected to be a scour tolerant community on mobile sediments with a large component of cobble.

Following the site survey the relative merits of diver surveys and drop-down video / Remotely Operated Vehicle (ROV) will be considered before finalising survey methods in discussion with DTI and other Government departments/agencies.

### 12.3.2 Fish

No mitigation specifically for fish is proposed, apart from the enclosure of the turbines to prevent larger fish being damaged as they pass through the draft tube. However, it is expected that suitable environmental management plans would be in place to prevent the spillage or leak of any pollutant from either vessels or the device itself to be in place. Any noise mitigation proposed for marine mammals would be suitable for fish as they are less sensitive to underwater noise than the mammals and would therefore be sufficiently protected from any mitigation proposed for marine mammals.

#### **Monitoring**

A post-construction survey is recommended to monitor the effects of the Wave Dragon device on the fish species of the area. It is suggested that this programme considers the effect of the Wave Dragon structure as a Fish Aggregating Device (FAD), and of the mooring blocks as artificial reefs. Such surveys may be undertaken by diver survey or ROV as part of any benthic monitoring programme suggested and should be developed using statutory guidance and after consultation with the relevant statutory authorities e.g. the Countryside Council for Wales (CCW) and Centre for Environment, Fisheries and Aquaculture Science (CEFAS).

The results of ongoing work through COWRIE (Collaborative Offshore Wind Research Into The Environment) to investigate potential EMF effects on elasmobranchs should be monitored and any appropriate best practice incorporated into the project design if practical.

### 12.3.3 Marine Mammals

No specific mitigation marine mammals or sea turtles is considered necessary as the general level of subsea noise during installation and construction are relatively low. However the turbine cage will prevent any potential harm coming to marine mammals and turtles from the moving parts of the device.

#### **Monitoring**

Wave Dragon Wales Ltd has expressed willingness to support ongoing marine mammal monitoring, notably common dolphin surveys, currently being undertaken in local Pembrokeshire waters by the Sea Trust. Sea Trust have also indicated that their surveys could be tailored to take in a routine pass by the Wave Dragon deployment site, before, during and after construction, which would provide useful additional information on marine mammals usage of the immediate and surrounding area. These surveys would be based on visual observation from a boat, in line with previous work in the area reported in Earl *et al.* 2004 and 2005.

It would also be beneficial if any visiting vessels could log marine mammal sightings on standard pro forma, for example those used by Sea Watch Foundation, or via reporting arrangements with the local Sea Trust.

### 12.3.4 Inter-Tidal Ecology

To minimise the area of the intertidal zone affected, and hence also to facilitate recovery of affected areas, it is suggested that the area of beach used for installation, including the movement of any plant up the beach onto site from the sea, should be minimised as far as practical within a clearly delineated area. This would also serve to maximise confidence that adjacent habitats, including rocky areas, would not be affected by works. Guidance should be built into the Environmental Management Plan and disseminated to contractors. This mitigation should apply during both construction and decommissioning phases (if appropriate).

#### **Monitoring**

Monitoring of the impacts to, and recovery of, the inter-tidal areas affected as a result of export cable installation should be included as part of a benthic monitoring plan detailed within the preceding sections. These surveys should be developed following statutory guidance and after consultation with the relevant statutory authorities, notably CCW and CEFAS.

### 12.3.5 Terrestrial Ecology

In order to reduce the magnitude of impact to nocturnally foraging bats from lighting (should this be required for 24 hour working in exceptional circumstances) it is recommended that all lighting be directional and unnecessary glare away from the required zone of illumination is avoided. The residual short term impact would be of low severity, negligible magnitude and overall **minor** significance.

A simple pre-works inspection by an ecologist hand searching in front of excavation works to ensure that any reptiles, which are mobile during spring through to autumn months, have an

opportunity to move away should be carried if works are undertaken outside of October to March. Such mitigation would reduce the likelihood of an impact to low and impact magnitude to negligible. The residual impact would therefore be of **minor** significance.

It is important that scaly cricket *Pseudmogoplistes squamiger* (also known as *P. vicentae*) habitat present within 50m of the possible reception pit position A at Marloes (Option 2) is not damaged and that a check is made that scaly cricket do not occur at the actual position of the reception pit works. If this option is to be pursued a thorough hand search should be made in summer (no earlier than June) by an experienced ecologist at the potential reception pit position and around the area to the east from where scaly cricket has been recorded previously. If scaly cricket are found at reception pit position A then an alternative reception pit (B) on inter-tidal sands over bedrock should be pursued.

Should scaly cricket be clearly demonstrated as absent from the position of reception pit A then as a precaution against accidental disturbance to adjacent habitat any sensitive area (based on results of hand searching described above) should be temporarily marked using stakes and tape during the duration of works and contractors excluded from the area.

Equivalent hand searching and, if appropriate, marking of any sensitive areas, should be undertaken if the Westdale Bay option is pursued. From the results of the site visit in January 2007 it is considered unlikely that scaly cricket would be present at the position of the reception pit at Westdale and probable that it would be practical to safely protect their habitat if indeed they do occur to the south of the pit area. This would result in no more than negligible magnitude residual impact of **minor** significance.

### **Monitoring**

No ongoing monitoring is considered necessary.

#### **12.3.6 Birds**

Due to the negligible effects on birds of the Wave Dragon device both during deployment and operation no mitigation is required. However the effects associated with Wave Dragon device deployment are significantly minimised due to off site (Pembroke Dock) construction. The only effects within the location area are associated with a short term increase in vessel numbers and activity during the device deployment phase and also increased traffic during the establishment of mooring buoy anchors, the activities of all staff associated with these deployment activities will be strictly monitored to avoid any undue disturbance from vessel activity or lighting.

### **Monitoring**

No monitoring is considered necessary.

## 12.4 Human Environment

### 12.4.1 Landscape and Seascape

A range of measures have been factored into the proposed development to reduce any adverse effects on the seascape / landscape resource and visual amenity. These can be summarised as follows:

- The temporary and reversible nature of the development;
- Interpretation boards, if permitted by National Parks Authority, would be introduced at key locations along the coastline to identify the development, describe the structure and outline the objectives of the project (subject to agreement in advance with the Pembrokeshire Coast National Park Authority and CCW);
- The drilling of the cable route from the cliff tops to the beach will eliminate disturbance to surface features and vegetation; and
- The cable route (from the cliff top) will be buried and routed along the local road network for much of its length.

### 12.4.2 Commercial Fisheries

Wave Dragon Wales Ltd has been, and is, committed to best practice with their involvement with the fishing industry who currently operate in and around the proposed Wave Dragon Pre-Commercial Demonstrator site. They will ensure, through their independent liaison, that all parties related to the fishing industry will receive advanced notice of all works to be undertaken, complete with charts of the area that include up to date information about the safety zones required, navigation through the area and any corridors agreed with the industry for installation traffic. Advance discussion will also take place, to ensure that such corridors impact as little as possible on the fishing vessels that may be in the area.

Best practice includes :

- informing all fishermen of possible developments as far in advance as possible
- a commitment to use fishing vessels wherever possible for ancillary work
- discussing with fishermen practical means of assisting in mitigating any possible effects of the development, as well as ensuring that they do not suffer as a result of the development

From consultation with industry and enforcement officers, all parties agree that the level of impact on the local fishing industry can be mitigated. The main form of mitigation will take the form of disruption payments during the installation of the cable and the installation of the Wave Dragon device structure and anchors. The use of local guard / safety vessels from the local fishing industry is another form of mitigation that was discussed and that was acceptable to industry leaders and well received by Marine Fisheries Agency (MFA) and Sea Fisheries Committee. Local Fisheries liaison officers should be employed for offshore works to help a smooth transition with local fishermen and governed under the Food and Environmental Project Act (FEPA) Licence.

The possibility of attaching mussel strings from the stern of the structure has been discussed and has positive aspects within the industry. Safe working practices would need to be assessed before this could be put in place in relation to accessibility. A good reputation has been built up between the local fishing industry and the Wave Dragon team. This has been enforced by good relations during offshore surveys carried out in the spring of 2006. Disruption arrangements were made and the use of local knowledge taken on board. This has been a positive step in building a good relationship for the future.

### **Monitoring**

A Fisheries Liaison Officer will be appointed for the installation and operational phase of the project.

#### **12.4.3 Commercial Navigation**

Based on the navigation risk assessment, the key mitigation measures are for the device to be appropriately lit and marked to aid its identification by vessels in the area and for promulgation of information about the project to local stakeholders.

WDW has consulted with Trinity House about the marking of the device and its moorings (including cardinal buoys N, S, E and W) and plan to meet all their requirements. The device will also be marked on Admiralty Charts and details will be included in Notices to Mariners and navigational broadcasts.

WDW have also been actively engaging with the local marine community including Milford Haven Port Authority (MHPA), the Royal National Lifeboat Institute (RNLI), Coastguard, fishermen and fishing organisations, recreational clubs and societies, etc. This will continue throughout the life of the device deployment.

In the event of an accident, which is considered most likely to involve a small craft, there will be ladders to provide safe access onboard for distressed mariners. Emergency response exercises are planned once the device is commissioned to ensure the local RNLI stations and other relevant organisations are familiar with the device and its moorings.

Safety zones are planned for the construction / decommissioning phases to ensure the personnel carrying out these activities and those navigating in the area are not exposed to unnecessary risk. They are also being considered for the operational phase in order to deter vessels from approaching very close and ultimately mooring to and/or boarding the device and this issue will be subject to further discussion between the DTI, Marine Coastguard Agency (MCA) and other stakeholders.

In terms of station-keeping, the mooring system has been designed with high levels of redundancy. There will be remote monitoring of the position of the device from shore and contingency plans will be in place should it move outside of its defined operating envelope. An alarm will be triggered by the device in such a scenario and discussions are being held with MHPA about active radar and Automatic Identification System (AIS) monitoring. The device itself will be fitted with AIS and a locator beacon.

## **Monitoring**

There will be video surveillance onboard the device with remote viewing capability to monitor activities as well as to detect potential trespassers.

### **12.4.4 Archaeology and Cultural Heritage**

The following measures are proposed to mitigate the impact of the Wave Dragon demonstrator deployment upon known sites and to establish the presence of unknown sites around the proposed deployment position.

It is highly recommended that all aspects of any further archaeological work proposed here be detailed in a Written Scheme of Investigation (WSI).

#### **Marine Mitigation**

Given the discrepancy between the National Monuments Record (NMR) and the United Kingdom Hydrographic Office (UKHO) positions (800m NNE) for the *Faraday*, damage to anomaly **6006** should be mitigated against until further investigation is undertaken. If the UKHO position for the *Faraday* is correct, the NMR position may still mark the remains of another wreck site, possibly represented by the mound **6006**.

In view of the uncertainty as to the nature of **6006** and its location less than 20m from the edge of the Marloes Sands cable route corridor, a 50m avoidance zone is recommended around this site. The exclusion zone covers a small area of the proposed Marloes Sands cable route corridor and it is thought likely that the cable can be routed to avoid it.

Should this avoidance zone impinge on installation, then further archaeological investigation, possibly in the form of further geophysical survey, diver or ROV inspection can be undertaken to characterise the anomaly further and determine the best course of action. A magnetometer survey would help establish whether the mound is a wreck or a geological feature.

Two further anomalies (**6004, 6005**) lie within the wider proposed mooring areas for the Wave Dragon installation. These both lie over 1400m from the proposed fore buoy position. The mooring configuration proposed is anticipated as having a spread of approximately 300m around the fore buoy and an axial extent of 455m to the rear mooring block. Provided the position for the fore buoy mooring system is not changed, **6004** and **6005** should be well outside and unaffected by the proposed mooring footprint. No further mitigation is proposed in regard to these two anomalies. However, should the fore buoy position be altered this may require re-assessment.

#### **Terrestrial Mitigation**

It is recognised that the sediments on the foreshore for the cable landfall options are highly mobile, and as a result archaeological material may be limited to heavily abraded larger wreck material or heavily abraded derived material.

However, a walkover survey of the proposed cable landfall areas is recommended to accurately position fix, identify and classify any visible sites within the intertidal zone as the survival of



wreck material can occur in such an environment. If any significant features of interest are noted, these could be marked as exclusion zones on the scheme master plans. Should an exclusion zone impinge on construction and an archaeological origin is suspected, then further archaeological investigation, possibly in the form of geophysical survey, or evaluation trenching can be undertaken to resolve the situation.

It is recommended that a suitable archaeological contractor be engaged to carry out a watching brief on the remainder of the cable landfall route and in any areas where structures or facilities that may be constructed for the purposes of connecting the Wave Dragon demonstrator to the grid and at the cable landfall jointing bays. Priority should be given to areas that fall directly within the footprint of any proposed construction and associated works.

Should any remains be identified in the course of a watching brief and a negative impact upon them cannot be avoided, it is suggested that the location of the landfall point could be moved to a less sensitive area. This would require further evaluation to appraise its suitability and would require further agreement with the local curator and relevant planning bodies. Alternatively a full archaeological excavation could be undertaken by a suitable archaeological contractor according to a written scheme of investigation considered appropriate by the local curator and relevant planning bodies.

If any existing structures require substantial additional construction or ground stripping it is recommended that an archaeological contractor be contracted to carry out a watching brief on these works. The discovery of any archaeological remains of note would require an immediate stop on these works until an appropriate rerouting or excavation strategy can be devised. This should aim to either avoid further impact on the remains, or ensure an appropriate archaeological record of them.

### ***Mitigation of Impacts on Historic Landscape Character***

The installation of a buried cable jointing bay at the cliff top and drill pits at the landfall point on the coastal strip should not detract from or alter the prevailing historic landscape of the Dale and St Brides coastal strip. Given the relatively small footprint of this development onshore and the ability to re-instate the ground post construction, it is unlikely to have a serious impact on historic landscape character and it is likely the landscape can absorb this development without any significant change to its overall character.

The installation of the cable along the existing road network further inland requires no further mitigation as it is highly unlikely that it will alter the historic landscape character of the wider area and archaeological material is likely to have been disturbed already by the construction of the road.

At the potential grid connection point near Mullock Bridge, the existing bridges are the dominant structures in the historic landscape. Any new construction at this point should be designed and built so as not detract from this dominance. Care should be taken when situating the electrical control building structure at the point of grid connection, to eliminate any negative impact it may have on the existing dominance of the bridge structures.

#### **12.4.5 Socio-economics**

There is no mitigation proposed for this issue.

#### **12.4.6 Subsea Noise**

No direct mitigation has been nominated for subsea noise levels. However, the choice of ultimate installation technique, vessel type, materials for construction etc. will consider the need to be sympathetic in terms of minimising subsea noise.

#### **12.4.7 Marine Recreation and Amenity**

Impacts on marine recreation and amenity will be mitigated by the following measures :

- all structures will be lit, marked and operated in accordance with the relevant standards (e.g. Trinity House Lighthouse Service)
- the wave device construction area and completed layout will be displayed on Admiralty Charts

To minimise the risk of collision in this worst-case scenario, mitigation measures will be put in place. For example, it will be ensured, consistent with the requirements of THLS, that the device is marked in such a way as to enhance the prospect of visual observation by passing recreational craft even in adverse conditions. THLS will consider the needs of small leisure craft by taking into account the likely traffic type and density when determining the correct level of marking for the site.

The Operator will also ensure notification of the development to the recreational craft community is widespread and effective throughout all phases. Information will be promulgated to yacht clubs, marinas, harbour masters, etc.

These measures mean that whilst the collision risk cannot be completely eliminated it will be reduced to a level as low as reasonably practicable.

#### **12.4.8 Offshore Oil and Gas**

There is no mitigation proposed for this issue.

#### **12.4.9 Marine Aggregate Extraction**

There is no mitigation proposed for this issue.

#### **12.4.10 Subsea Cables and Pipelines**

There are no cables or pipelines to be crossed by the export cable.

#### **12.4.11 Marine Waste Disposal and Dumping**

There is no mitigation proposed for this issue.

#### **12.4.12 Defence and Civil Aviation**

Mitigation for defence areas has been enacted through choice of deployment location thus avoiding the Ministry of Defence Castlemartin Training Area.

#### **12.4.13 Abandoned Munitions**

Areas of high magnetic return will be identified from further geophysical and magnetometer surveys, and Wave Dragon Wales Ltd will place “no-build” areas for seabed works and cables around these.

The management of potential abandoned munitions will be a key factor in the construction process of the project. It is proposed to undertake a non-intrusive survey on selected areas of the mooring footprint, and liaise with the relevant authorities concerning any clearance operations which maybe required prior to any construction taking place.