

East Anglia THREE  
Offshore Windfarm

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# Protocol for minimising the risk of injury to marine mammals from piling noise

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August 2010

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## **Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise**

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### **Introduction**

This document, which has been produced by Natural England, the Countryside Council for Wales and the Joint Nature Conservation Committee, outlines a protocol for the mitigation of potential underwater noise impacts arising from pile driving during offshore wind farm construction. This protocol may also be useful to other industries in the marine environment which use pile driving. The agencies recommend that all operations that include pile driving should consider producing an Environmental Management Plan (EMP), or an equivalent document that meets the requirements of the relevant regulator.

The nature conservation agencies' policies support appropriately sited offshore renewable energy developments because they can provide environmental benefits to species of conservation concern, including marine mammals, by reducing greenhouse gas emissions and mitigating adverse climate change impacts. However, these developments can adversely affect species and features of conservation importance, including those protected by European and domestic Law. Mitigation of such impacts forms an intrinsic part of the Environmental Impact Assessment (EIA) process required as part of the consenting process for offshore windfarms.

The installation of driven piles in the marine environment without mitigation is likely to produce noise levels capable of causing injury and disturbance to marine mammals. Such effects, although incidental to consented activities, have the potential to conflict with the legislative provisions of The Conservation of Habitats and Species Regulations 2010 (the 'Habitats Regulations', HR), which applies to English and Welsh waters inside 12 nautical miles (nm), and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (the 'Offshore Marine Regulations', OMR, as amended 2009 and 2010), which apply on the United Kingdom Continental Shelf.

JNCC, NE and CCW have produced guidance on 'the protection of marine European protected species from injury and disturbance'. The piling protocol forms part of that more general guidance and the recommendations should be considered as 'best practice' for piling operations.

JNCC notes that other protected fauna, for example turtles, occur in waters where these guidelines may be used, and would suggest that, whilst the appropriate mitigation may require further investigation, the protocols recommended for marine mammals would also be appropriate for marine turtles and basking sharks<sup>1</sup>.

Scientific understanding of the issues discussed in this piling protocol is incomplete, but improving. It is therefore important to note that the piling protocol is not considered to be static policy and will be subject to regular revision following on from experience of its use, and the development of a better understanding of the efficacy of certain mitigation measures recommended in the protocol.

Pile driving in the marine environment without mitigation is likely to produce noise levels capable of inducing adverse avoidance reactions at a considerable distance from the activity, which could constitute disturbance under the Regulations (HR and OMR depending on the area). Pile driving is also likely to cause injuries (e.g. hearing impairment) and there remains the possibility of causing death in marine mammals that are in very close proximity.

**This protocol does not document measures to mitigate disturbance effects, but has been developed to reduce to negligible levels the potential risk of injury or death to marine mammals in close proximity to piling operations.**

**If the risk of disturbance cannot be avoided or reduced to negligible levels, the developers need to obtain a licence under regulations 53/49 (HR/OMR respectively) in order to avoid the application of regulations 41(1)(b) and 39(1)(b) of the HR/OMR.**

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<sup>1</sup> Basking sharks are protected from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on the Wildlife and Countryside Act (1981), Schedule 5.

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## Terminology

**Marine European Protected Species:** These are marine species in Annex IV(a) of the Habitats Directive that occur naturally in the waters of the United Kingdom. These consist of several species of cetaceans (whales, dolphins and porpoises), turtles, and the Atlantic Sturgeon.

**Marine Mammal Observer (MMO):** Individual responsible for conducting visual watches for marine mammals. It may be requested that observers are trained, dedicated and/or experienced. The MMO may also be a PAM operative.

- **Trained MMO:** Has been on a JNCC recognised course

- **Dedicated MMO:** Trained observer whose role on board is to conduct visual watches for marine mammals (although it could double up as a PAM operative)
- **Experienced MMO:** Trained observer with 3 years of field experience observing for marine mammals, and practical experience of implementing the JNCC guidelines
- **PAM Operative:** Person experienced in the use of PAM software and hardware and marine mammal acoustics

**Mitigation Zone:** The area where a Marine Mammal Observer keeps watch for marine mammals (and delays the start of activity should any marine mammals be detected).

**Passive Acoustic Monitoring (PAM):** Software system that utilises hydrophones to detect the vocalisations of marine mammals.

## Section 1 - The Standard Piling Protocol

The standard protocol should be recommended to developers as a minimum level of good practice to mitigate the potential for causing injury or death to marine mammals in close proximity to piling operations.

Many of the techniques in the standard piling protocol have their origins in the 'JNCC seismic guidelines'. As the levels of noise associated with seismic survey can, in some cases, be similar to those likely to arise from piling operations, it is appropriate to adopt comparable mitigation measures. Additionally, many of the elements of the protocol have already been incorporated as FEPA licence conditions for Round 1 and 2 offshore windfarms, following advice provided by the statutory nature conservation agencies (Section 5).

### 1.1 The planning stage

The developer should consult JNCC, NE and CCW guidance on 'the *protection of marine European Protected Species from injury and disturbance*' to assist in environmental impact assessment.

The recommendations detailed below should be considered by the developer during the planning stage and be incorporated into the project's Environmental Management Plan or the equivalent document required by the relevant regulator.

#### 1.1.1 Developer to demonstrate that Best Available Technique (BAT) is being used

BAT, which incorporates the previous concept of BATNEEC (Best Available Technique Not Entailing Excessive Cost), is an established approach in environmental management. It seeks to balance the highest level of environmental protection against commercial affordability and practicality.

The demonstration of BAT may require developers to submit commercially sensitive information to the agencies. For example, the costing of different pile construction

techniques is likely to be confidential. There may, understandably, be concerns about this process and, in such cases, the agencies will agree an approach with the developers and the regulators (currently the MMO for offshore windfarm developments covered by this protocol) to regulate this process.

Techniques such as hammer modifications, sleeving or muffling, the use of vibratory hammers and gravity based piling may all reduce noise levels. The developer may be able to demonstrate that certain installation approaches do not amount to BAT, and this can be achieved by submitting a detailed business case involving analysis of cost and impact on margins. The use of gravity base piles is particularly notable, because potential noise impacts area likely to be much reduced. In contrast, the COWRIE work has gone some way to demonstrate that the use of unenclosed bubble curtains, bubble trees<sup>2</sup> or enclosure coffer dams<sup>3</sup> is currently ineffective or uneconomical.

### 1.1.2 Consideration of the local environment

The developer must determine what marine mammal species are likely to be present in the area and assess if there are any seasonal considerations that need to be taken into account. Seasonal restrictions on piling operations may be necessary. For example this may be appropriate during periods of seal pupping, and when there is clear seasonal demarcation in animal occurrence and seasonal restrictions would have practical application<sup>4</sup>. The interaction with other potential spatial and temporal restrictions on construction times (for example in spring to mitigate impacts on commercial fish spawning or during winter to reduce impacts on certain seabirds) would also need to be considered.

## 1.2 Role of the Marine Mammal Observer (MMO)

Operators should seek to provide dedicated MMOs and Passive Acoustic Monitoring (PAM) operatives. Piling activities should be monitored by MMOs and PAM operatives whose primary role is to detect marine mammals and to potentially recommend a delay in the commencement of piling activity if any marine mammals are detected. In addition, the MMO / PAM operatives should be able to advise the crew on the implementation of the procedures set out in the agreed mitigation protocol, to ensure compliance with those procedures.

### 1.2.1 Training requirements for MMOs

MMOs should be appropriately trained and understand the mitigation procedures within the piling protocol. MMOs should be present in sufficient numbers to ensure that monitoring is not compromised by fatigue. They should ensure they receive a copy of the mitigation procedures requested by the regulating authority as they may

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<sup>2</sup> Bubble curtains and bubble trees release streams of bubbles into the water column - because of tidal flows such bubbles are likely to dissipate in the environments associated with offshore windfarms.

<sup>3</sup> Not commercially feasible currently because of the time taken to install them, particularly in the offshore environment.

<sup>4</sup> Seasonal restrictions which would restrict piling for large parts of the year and which might therefore make a project uneconomic may not be welcomed by the operator. In such cases where the impact assessments showed risk of a disturbance offence, the operator may wish to consider alternative methods, for example such as the use of gravity piles.

vary between activities. JNCC has approved a number of MMO course providers<sup>5</sup> – although the courses they run deal primarily with the seismic guidelines, the skills are easily transferable to the monitoring of piling activities.

### 1.2.2 Equipment required by the MMO

MMOs should be equipped with binoculars, a copy of the agreed monitoring protocol and the 'Marine Mammal Recording Form', which is an Excel spreadsheet containing embedded worksheets named 'Cover Page', 'Operations', 'Effort' and 'Sightings'. A Word document named 'Deck forms' is also available, and MMOs may prefer to use this when observing before transferring the details to the Excel spreadsheets. Although these forms were developed for seismic surveys, they can be used for piling operations, although many columns will not be applicable.

The ability to determine range of marine mammals is a key skill for MMOs, and a useful tool is a range finding stick. All MMO forms, including a guide to completing the forms, and instructions on how to make and use a range finding stick, are available on the JNCC website.

### 1.3 Passive Acoustic Monitoring (PAM) and PAM operatives

PAM systems consist of hydrophones that are deployed into the water column, and the detected sounds are processed using specialised software. PAM operatives are needed to set up and deploy the equipment, and to interpret the detected sounds. A PAM operative could also be a trained MMO, and this would allow them to switch roles, if required, between acoustic and visual monitoring (providing that there is another trained PAM operative available). Switching roles between acoustic and visual monitoring could help alleviate observer fatigue.

In its current state of development, PAM systems are particularly useful in detecting harbour porpoises within a 500 metre mitigation zone, although the systems have their limitations and can only be used to detect vocalising species of marine mammals.

PAM can provide a useful supplement to visual observations undertaken by MMOs and the agencies may recommend that it is used as a mitigation tool when commenting on applications for piling consents. However, in many cases it is not as accurate as visual observation for determining range, and this will mean that the mitigation zone will reflect the range accuracy of the system. For example, if the range accuracy of a system is estimated at +/-300 metres, animals detected and calculated to be within 500 metres from the source could, in reality, be  $500 + 300 = 800$  metres, but their detection would still lead to a delay in the soft-start. Although, at present it is not possible to express the range accuracy of most PAM systems in numerical terms, this example serves to illustrate that it is in the developer's best interests to use the most accurate system available, and for the PAM operative to factor in a realistic estimate of the range accuracy.

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<sup>5</sup> The JNCC website has a list of MMO course providers: <http://www.jncc.gov.uk/page-4703>



#### 1.4 Communication

At the planning stage the communication channels between those providing the mitigation service and the crew working on the piling are to be established. The MMO and PAM operatives also have to ensure there is a workable communication procedure in place so that any visual and acoustic detections can be corroborated by both. In addition, a formal chain of communication from the MMO or PAM operative to the person who can start/stop piling operations must be established. This is important, because construction contractors working to a tight timetable may not fully appreciate the roles and responsibilities of the MMO and PAM operatives. In order to establish the chain of communication and command MMOs and PAM operatives should attend any relevant pre-mobilisation meetings.

#### 1.5 Mitigation zone

It is necessary to establish a “mitigation zone” of a pre-agreed radius around the piling site prior to any piling. This is an area in which the MMO / PAM operative will monitor either visually and/or acoustically for marine mammals before piling commences. The extent of this zone should be considered during the environmental impact assessment and agreed with the regulatory authority.

The extent of this zone represents the area in which a marine mammal could be exposed to sound that could cause injury and will be determined by factors such as the pile diameter, the water depth, the nature of the activities (for example whether drilling will also take place) and the effect of the substrate on noise transmission. The radius of the mitigation zone should be no less than 500 metres, and this is measured from the pile location (figure 1). The MMO and PAM operative should be located on the most appropriate viewing platform (e.g. vessel) to ensure effective coverage of the mitigation zone. The MMO will also require a platform that provides a good all-round view of the sea.

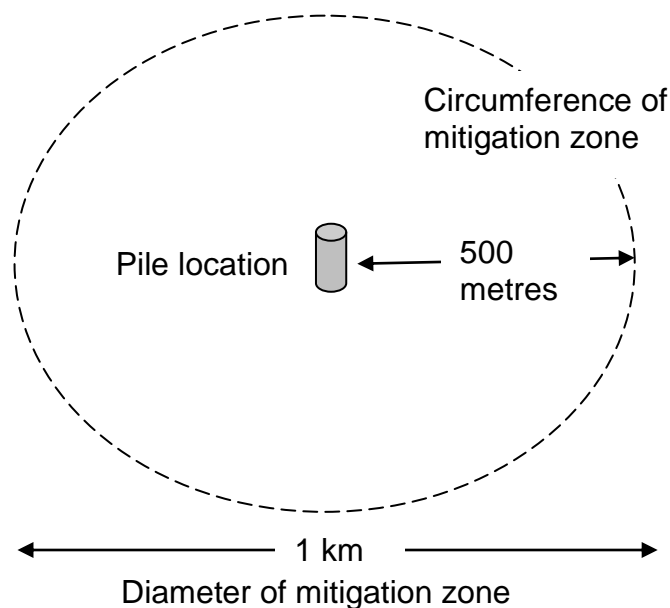


Figure 1: A representation of the mitigation zone, this is measured from the location of the pile to be installed out to a distance of 500 metres.

## Section 2 – Advice during the piling activity

The following recommendations are relevant during piling operations.

### 2.1 Piling at night or poor visibility

Piling should not be commenced during periods of darkness or poor visibility (such as fog), or during periods when the sea state is not conducive to visual mitigation (above Sea State 4<sup>6</sup>), as there is a greater risk of failing to detect the presence of marine mammals. Variations to this restriction on commercial grounds are discussed in section 4.

### 2.2 Pre-Piling Search

The mitigation zone should be monitored visually by MMOs and/or acoustically using PAM for an agreed period prior to the commencement of piling. It is recommended that the pre-piling search duration should be a minimum of 30 minutes<sup>7</sup>.

### 2.3 Delay if marine mammals detected within mitigation zone

Piling should not be commenced if marine mammals are detected within the mitigation zone or until 20 minutes<sup>8</sup> after the last visual or acoustic detection. The MMO and PAM operative should track any marine mammals detected and ensure they are satisfied the animals have left the mitigation zone before they advise the crew to commence piling activities.

### 2.4 Soft-Start of pile driver

The soft-start is the gradual ramping up of piling power, incrementally over a set time period, until full operational power is achieved. The soft-start duration should be a period of not less than 20 minutes<sup>9</sup>. It is believed that by initiating piling at a lower power this will allow for any marine mammals to move away from the noise source, and reduce the likelihood of exposing the animal to sounds which can cause injury. Soft-start noise levels will vary according to hammer and pile design and other factors, and should be assessed as part of the environmental impact assessment process. Developers might want an alternative soft-start duration depending upon the

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<sup>6</sup> Detection of marine mammals, particularly porpoises, will decrease as sea-state increases. While ideally sea-states of 2 or less, are required for optimal visual detection the risks of not detecting individuals within the MZ should be reduced by the combined use of visual monitoring and PAM.

<sup>7</sup> This 30 minute period is used in the JNCC seismic survey guidance

<sup>8</sup> A 20 minute period is adopted by the JNCC seismic survey guidance. Issues of swimming speed and noise dosage are considered in the Thame Developer report - it is considered that twenty minutes is a sufficient period of time to allow individuals to be at a distance where risk of injury or death is minor.

<sup>9</sup> The details of soft-start will vary according to substrate type, pile design and the hammer utilised. Measurements from the Lynn and Inner Dowsing test pile suggest that while "soft-start" levels are considerably lower than those occurring during full power piling they are still capable of giving rise to injury. Details of the soft-start procedure should be obtained for each project (see draft FEPA conditions Section 5).

specifics of the project and outcomes of the EIA process; any requested variation from a 20 minute soft-start should be agreed with the relevant agency and regulator.

If a marine mammal enters the mitigation zone during the soft-start then, whenever possible, the piling operation should cease, or at the least the power should not be further increased until the marine mammal exits the mitigation zone, and there is no further detection for 20 minutes. The feasibility of this approach should be agreed with the relevant agency and regulator as part of the approval process. It is recognised that the ability to cease operations may be constrained by the substrate type or pile design.

When piling at full power, there is no requirement to cease piling or reduce the power if a marine mammal is detected in the mitigation zone (it is deemed to have entered “voluntarily”<sup>10</sup>). It is also acknowledged that, for engineering reasons, it may not be possible to stop piling at full power until the pile is in final position.

## 2.5 Break in piling activity

If there is a pause in the piling operations for a period of greater than 10 minutes, then the pre-piling search and soft-start procedure should be repeated before piling recommences. If a watch has been kept during the piling operation, the MMO or PAM operative should be able to confirm the presence or absence of marine mammals, and it may be possible to commence the soft-start immediately. However, if there has been no watch, the complete pre-piling search and soft-start procedure should be undertaken.

## 2.6 Acoustic Deterrent Devices (ADDs)

The use of devices that have the potential to exclude animals from the piling area should be considered. Acoustic Deterrent Devices (ADDs) should only be used in conjunction with visual and / or acoustic monitoring.

In theory, ADDs have the potential to reduce the risk of causing injury to marine mammals, and are relatively cost effective. However, evidence relating to the efficacy of acoustic deterrents such as “scrammers” or “pingers” is currently limited and there is a need for studies to quantify the efficacy of candidate devices to determine their applicability as suitable mitigation measures.

When planning to use ADDs, the potential effectiveness of candidate devices on the key marine mammal species likely to be present in the area should be assessed as part of the EIA process for the activity. This assessment should feed into the site specific Environmental Management Plan (EMP) or equivalent. It is expected that these devices would always be used in accordance with recommended conditions that would prevent the exposure of animals to disturbance that would constitute an offence under regulations 41 and 39 of the Habitats Regulations and the Offshore Marine Regulations, respectively. It should be noted that a wildlife licence under the

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<sup>10</sup> Please note that there is no scientific evidence for this “voluntary” hypothesis, instead it is based on a common sense approach. Note, however, that other factors, such as food availability, may result in marine mammals approaching piling operations. In particular, the availability of prey species stunned by loud underwater noise may attract seals into the vicinity of piling operations.

Wildlife and Countryside Act 1981 (within 12nm) might be required to authorise a potential intentional disturbance.

The use of ADDs will be subject to a number of recommended conditions, for example:

- ADDs should be positioned in the water in close proximity to the pile to be installed; the vessel with the MMOs and PAM operatives may not necessarily be a suitable mooring location for these devices.
- ADDs should be switched on throughout the pre-piling search and turned off immediately after the piling activity has started.

### **Section 3 – After the piling activity**

#### **3.1 Reporting Requirements**

Reports detailing the piling activity and marine mammal mitigation, the ‘MMO and PAM reports’, should be sent to the relevant conservation agency after the end of the piling activity. Reports should include:

- Completed Marine Mammal Reporting Forms
- Date and location of the piling operations
- A record of all occasions when piling occurred, including details of the duration of the pre-piling search and soft-start procedures, and any occasions when piling activity was delayed or stopped due to presence of marine mammals
- Details of watches made for marine mammals, including details of any sightings, details of the PAM equipment and detections, and details of the piling activity during the watches
- Details of any Acoustic Deterrent Devices (ADDs) used, and any relevant observations on their efficacy
- Details of any problems encountered during the piling process including instances of non-compliance with the agreed piling protocol
- Any recommendations for amendment of the protocol

### **Section 4 - Variation of standard piling protocol**

The above protocol is considered to represent current best practice for a typical windfarm piling operation. Developers may, however, feel that the protocol is unduly restrictive, particularly in respect of restrictions on night-time/low visibility piling. In such cases, the burden of proof lies with the developer to demonstrate that effective mitigation can be delivered using an amended protocol.

A distinction should be made here between piling which commences during times of good visibility (and subject to the above provisions) and continues into a period of poor visibility/ night-time, and piling that commences during times of poor visibility (including night-time conditions).

Assuming that the operations are continuous the first scenario would not need additional mitigation. The second, scenario would, however, require enhanced

mitigation measures. For example, a developer wishing to commence piling at night might need to demonstrate that:

- Such piling is essential for commercial viability.
- The developer will provide enhanced detection of marine mammals (e.g. increased number of PAM systems and PAM operatives for commencement of piling during night-time).

Each request for variations from the protocol should be considered on its merits and, to ensure consistency across projects and other marine industries, in close liaison with JNCC and other statutory nature conservation agencies.

## **Section 5 - Securing of mitigation package through legally-binding consent conditions and Environmental Management Plan (EMP)**

Under current arrangements the mitigation package relating to windfarm developments is likely to be secured under FEPA conditions, rather than under the Electricity Act s.36 consent. Conditions drafting is likely to vary according to project specific issues and will evolve as our understanding of the issues improves. Conditions imposed by the MMO (formerly MFA, formerly MCEU Defra) in respect of the Thames windfarms are set out below as an example of possible consent requirements only.

*9.20 Conditions 9.20 to 9.22 shall only apply where driven or drilled pile foundations are to be installed.*

*9.21 Construction activities shall not commence until the Licence Holder has agreed with the Licensing Authority and [insert relevant nature conservation agency name] a scheme for the mitigation of potential impacts on marine mammals. The scheme must be submitted to the Licensing Authority by the date specified in the timetable required under condition 9.35. Such a scheme shall include, inter alia:*

- *A requirement on the Licence Holder to ensure that suitably qualified and experienced Marine Mammal Observers are appointed and [insert relevant nature conservation agency name(s)] notified of their identity and credentials before any construction work commences.*
- *A requirement on the Licence holder must ensure that piling activities do not commence until half an hour has elapsed during which marine mammals have not been detected in or around the site. The monitoring should be undertaken both visually (by Marine Mammal Observers) and acoustically appropriate passive acoustic monitoring equipment. Both the observers and equipment must be deployed at a reasonable time before piling is due to commence.*
- *A requirement on the Licence Holder to ensure that at times of poor visibility (night-time, foggy conditions, sea state greater than that associated with force*

*4 winds, etc.) enhanced acoustic monitoring<sup>11</sup> of the zone is carried out prior to commencement of relevant construction activity.*

- A requirement that piling may only commence using an agreed soft start procedure. The duration and nature of this procedure must be discussed and agreed prior to commencement of operations<sup>12</sup>.*
- A requirement that the Licence Holder must make provision for a reporting methodology to be in place before works commence to enable efficient communication between the MMOs and the skipper of the piling vessel.*

*9.22 Piling activities shall not take place other than in accordance with the scheme agreed at 9.21 above*

In addition to be involved in the drafting of such conditions, it is likely that statutory nature conservation agencies will want to check that a project's Environmental Management Plan contains appropriate protocols relating to the pile driving operations, such as how the MMOs will interact with the piling crew. Drafting of a potential template condition requiring approval of the EMP following consultation with the agencies is set out below:

*X: The Licence Holder must submit a copy of a project Environmental Management Plan for the approval of the Licensing Authority, in consultation with CEFAS, and the [insert relevant nature conservation agency name(s)], at least 4 months prior to the proposed commencement of construction works. To ensure that satisfactory arrangements are in place for liaison on environmental issues. Construction shall not commence until such time as the Environmental Management Plan has been approved by the Licensing Authority.*

*Y: The Licence Holder must ensure that a suitably qualified and experienced liaison officer, Marine Mammals Observer(s) and other officers are appointed (for fisheries and environmental liaison) and that the Licensing Authority is notified of their identity and credentials before any construction work commences, to establish and maintain effective communications between the Licence Holder, contractors, fishermen, conservation groups and other users of the sea during the course of the project.*

*Z: The Licence Holder must ensure that the liaison officer's environmental remit includes:*

- i) Monitoring compliance with the commitments made in the Environmental Statement and the Environmental Management Plan (as agreed under condition Y above).*

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<sup>11</sup> The details of any enhanced acoustic monitoring scheme would need to be agreed in advance with the regulator as advised by the relevant nature conservation agency however they might include the provision of additional hydrophones and/or T-Pods together with extra PAM operators

<sup>12</sup> As discussed at footnote 9 above there is potential for "soft-start" levels to be of a sufficient volume to give rise to injury or significant disturbance. Information on possible noise levels will therefore need to be provided as part of the EIA and the process will need to be agreed with the regulator as advised by the relevant nature conservation agency. An excessive level for soft-start procedures might be that capable of giving rise to TTS to an individual in close proximity (metres) to the piling operation

- ii) Providing a central point of contact for the Monitoring Programme and Ornithological Monitoring Programmes required under relevant conditions*
- iii) Liaison with fishermen, conservation groups and other users of the sea concerning any amendments to the method statement and site environmental procedures.*
- iv) Inducting site personnel on site / works environmental policy and procedures.*

## **Section 6 - References**

Collaborative Offshore Wind Research into the Environment (COWRIE):  
<http://www.offshorewindfarms.co.uk>