Monitoring Statement (Version 1.4)

June 2007

Rhyl Flats Offshore Wind Farm

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1. Statement Description

This document describes the monitoring proposed to comply with the conditions of the Food and Environmental Protection Act (FEPA) 1985: Part II (as amended), variation of licence reference 31640/06/1, issued to Rhyl Flats Wind Farm Limited for the Rhyl Flats Offshore Wind Farm and dated 21st December 2006. A copy of the licence is attached in Appendix A.

This amended version has been produced for the following reasons –

- To modify the monitoring programme to fit the proposed works program (in particular the movement of pile driving operations from 2007 to 2008)
- To take account of the comments of CCW and CEFAS to previous versions.
- Reflect change that have been made to the FEPA License, relevant to monitoring

For monitoring that commenced during August and September 2005 where the survey methodologies have been agreed with CCW and CEFAS and this document acts as a statement of these agreed methodologies.

2. Summary Tables

The items for which monitoring started in 2005 are outlined in blue text in Table 2.1 below and this monitoring statement contains the methodologies for these works. For other monitoring works, the methodologies agreed with CEFAS and CCW in due course and submitted for approval in advance of the proposed works.

It is proposed that the baseline monitoring report is provided in June 2008 and that further monitoring reports be provided subsequently each June. However, an interim report will be produced to accompany this monitoring statement, containing the following reports -

- Ornithology Surveys 2005 and 2006
- Fisheries baseline report
- Benthic surveys 2005 and 2006 (inc. PSA)
- Epi-benthos beam trawl surveys 2005 and 2006
- Seabed comparison report (for information only)

The summary table 2.1 relates to the 'initial monitoring requirements' of the FEPA licence, being 1 year pre-construction, the construction year and 3 years post construction. In this case, monitoring has commenced 2 years before construction, which will be split over 2 years. At the end of the initial monitoring period, in the Winter of 2010, a review will be held to determine what (if any) further monitoring is required.

Table 2.1 Rhyl Flats Monitoring Schedule Summary – to comply with the FEPA 'Initial Monitoring Requirements'

Survey Description & Licence Condition	Type	Number	Timing	Comments	Submit Detailed Methodologies	Submit Reports
Marine Sediments (Subtidal) *Not a licence requirement*	Grab sample, particle size analysis	Taken at all benthic survey sites – minimum 23	As for benthic – starting Sept 2005 The results will only be reported if required during the scour analysis.	All samples will be subjected to PSA as part of the benthic analysis. The classification will extend up to 125mm	Completed 2005	As part of Benthic organism report
Suspended Sediments (Annex 1 condition 1)	Sediment plume monitoring	1 survey	2008 During foundation pile driving	CMACS have provided a proposal for monitoring sediment in the water column and will produce a detailed MS.	Spring 2008	Report Dec 2008
Seabed Morphology & Scour (Annex 1 conditions 2 & 9.17, 9.18 & 9.20)	Geophysical (Side Scan Sonar & Swath Bathymetry)	Whole site 1 pre con 1 post con	Pre con June 2007 (site) Pre con April 2008 (export cable route) (Supplementary surveys carried out in 2001, Sept 2005 and March 2006)		June 2007	Baseline June 2008
Seabed Morphology & Scour (Annex 1 conditions 2 & 9.17 & 9.18)	Geophysical (Swath Bathymetry)	Sample of Turbines	Pre con June 2007 Every 6 months post construction, first survey within 3 months of installation.	100m x 100m box a selection of turbines Pre con survey = 200 x 200 of all turbine locations	June 2007	Spring 2008
General (Annex 1 condition 9.20)	Geophysical (Side Scan Sonar and Swath Bathymetry)	1 Post Con	Spring 2009	Purpose – to detect seabed obstructions – but will also monitor seabed movements.	Spring 2008	Spring 2009
Currents (Annex 1 condition 3)	ACDPs	1 survey	Post Construction Summer 2009	CEFAS suggest modelling at 2-3 points within the site.	Spring 2009	End 2009
Benthic Organisms (Annex 1 condition 4)	Subtidal Grab samples	6 years of surveys from Autumn 2005	Preconstruction Sept 2005/6 Post construction 2008 Operational 2009 / 10 / 11	Biotope map produced to aid location of sample points.	July 2005	Interim 2007, then each June following the survey year

	Intertidal transect & core samples	2 years autumn	Pre cable laying spring 2008 Post cable construction 2009	CMACS to provide methodology	Spring 2008	End of 2008 End of 2009
Not a licence requirement	Epi-benthos beam trawls	2 Baseline	Preconstruction 2005 & 2006	Baseline only – further surveys only if required by effects	July 2005	Interim 2007
Survey Description & Licence Condition	**Type**	**Number**	**Timing**	**Comments**	**Submit Detailed Methodologies**	**Submit Reports June / December**
EMF (Annex 1 condition 5)	Desktop		Spring 2008	Use COWRIE stage 1 data & cable manufacturer and load data	Spring 2008	Report June 2008
Marine Fish – Electro sensitive species (Annex 1 condition 6)	Desktop studies Third party surveys Beam trawl data Fisheries liaison		Autumn 2005 –11	Use COWRIE data and CEFAS Liverpool bay info CCW Research Sept 2005 Beam Trawls Fisheries liaison	July 2005	Baseline June 2007 Report June 2009/10/11
Marine Fish – Populations (Annex 1 condition 9.7)	Third party Surveys Beam trawl data Fisheries Liaison		2005 – 2011	Use CEFAS Liverpool bay data + fisheries liaison information	July 2005	Baseline Report June 2007 + annual reports
Underwater Noise & Vibration (Annex 1 conditions 7 and 9.7)	Sub-marine acoustic survey	1 pre-pile driving 1 con 1 operational	Spring 2008 Summer 2008 September 2009	Details to be obtained of other construction work in Liverpool Bay	Spring 2008	Baseline June 2008 + annual reports
Cetaceans	Visual		During pile driving construction period only 2008	Temporary suspension of start of piling operations if cetaceans are sighted in the area. Training of staff & procedure to be submitted	Spring 2008	Methodology
Ornithology						
Objective 1 (Bird Use)	Boat Transect Surveys	Monthly	2005 –2011		July 2005	Interim baseline 2007
Objective 1 (Bird Use)	Ariel Surveys	Annual	2002 (?) – 2007 Extension to be finalised	Part funding from Governmental agencies has ceased therefore reduced frequency is anticipated,	Spring 2008	Combined boat based survey in

				CCW has given verbal agreement on this reduction.		annual FEBA report
Objective 2 (Barrier Effect)	Boat based survey + possibly MSR	2 years x 1-2 weeks	Pre Con 2006/7 Post Con 2008/9	MSR used in spring 2006	Autumn 2006	June 2009
Objective 4 (Common Scoter population changes)	Benthic biomass index of common scoter feeding grounds	Pre con	March 2007	Further surveys only necessary if an effect is observed on the C. Scoter population.	2006	2008

3. Suspended Sediment Concentrations

Objective – To validate and confirm model predictions and to assist in the development of benthic and sedimentary monitoring requirements

Monitoring of suspended sediment at the North Hoyle wind farm was conducted using three fixed turbidity meters. The results of this monitoring found that the effects were confined to the near field and that this method was not the most effective way of obtaining data regarding the actual changes to suspended sediments created by piling operations. Therefore, an alternative methodology (Mobile SSC Monitoring) is proposed for the Rhyl Flats wind farm that will concentrate on the area of the sediment plume created by the work. A detailed methodology and proposed threshold levels will be prepared and submitted for approval in advance of the work.

Suspended sediment measurements will be taken from a boat immediately prior to and through the piling operations. These measurements will be taken throughout the water column at varying distances up and down the tide. It will also be necessary to monitor at a suitable control site and to have prior agreement with regulators on an appropriate value for the suspended sediment concentration (SSC) threshold.

The monitoring will be carried out during piling operations of the first turbine in the summer of 2008 and this document will be re-issued in the Spring of 2008 with the agreed detailed methodology.

NRL applied to the MFA in May 2007 to request that condition 9.17 be amended to permit this methodology.

Timing:

	2005	2006	2007	2008	2009
Submit Methodology				Spring	
Construction				Summer	
Report				December	

4. Sea Bed Morphology and Scour

4.1. Subtidal Sediment

Objective – To determine whether natural process, construction activities or the presence of the monopiles results in changes to the particle size of the subtidal sediment. If changes do occur, then these will be linked to the scour and benthic monitoring data.

The FEPA licence does not specifically require the monitoring of subtidal sediments. However, particle size analysis (PSA) will be undertaken as part of the analysis of all benthic samples and therefore the following monitoring will be carried out. The information will be used to interpret the scour report, but will not be reported separately.

Details of PSA analysis were included in Version 1.3.

4.2. Geophysical (Side-scan Sonar & Swath Bathymetry) – Whole Site

Objective – to monitor changes in the sea bed level and to assess sediment movement in relation to the cable burial depth.

It is proposed that the whole site and the export cable corridor will be subjected to a high resolution side scan sonar and swath bathymetry survey pre foundation construction and post construction. Whilst this is a requirement of condition 9.20 – relating to seabed obstructions, it will also be used to monitor changes in the seabed level. For the site and turbine locations, this will occur in June 2007. For the cable route, this will be undertaken before works re-commence in 2008. **The detailed methodology for the 2007 survey is attached as RF 2007- 8 Geo Phys Survey Proposal**, however the functional requirements are outlined below -

Pre-Construction Seabed Survey Requirements

The Pre-Construction Seabed Survey shall be designed to show:

a) The bathymetry of the offshore site.

b) The location (to within 1m) and size of any natural or artificial items of any material within the offshore site lying on or just below the seabed.

c) The location (to within 1m) and size of any ferrous items up to 6m below the seabed within areas defined by a 200m x 200m square centred on each WTG foundation position.

Post-Construction Seabed Survey Requirements

The Post-Construction Seabed Survey shall be designed to show:

a) The bathymetry of the offshore site.

b) The location (to within 1m) and size of any natural or artificial items of any material within the offshore site lying on or just below the seabed. These shall be cross referenced to any items found in the pre-construction survey in order to identify any objects dropped during construction.

c) Any scour within areas defined by a 200m x 200m square centred on each WTG foundation position.

d) The extent and condition of all foundation scour protection (including any scour protection laid by the foundation Contractor to protect the J-tube).

General Survey Requirements

The Pre-Construction Survey and Post-Construction Survey shall comply with the requirements contained in the International Hydrographic Office (IHO) Standards for Hydrographic Surveys, with the survey classed as Special order.
Survey line spacings and cross lines shall be selected and run to ensure complete coverage of the area specified, and in sufficient detail to comply with the aforementioned IHO standard and with the requirements detailed in the above sections.
In addition, survey lines shall be run in a grid along every line of WTG locations in both NW/SE and NE/SW directions..
Significant targets identified during the surveys shall have at least 2 parallel cross lines run each side of them, perpendicular to the main survey lines.
Bathymetry data shall be gathered using a multi-beam (swathe) bathymetry system.
The Contractor shall provide a copy of the survey specifications to the Owner for review at least 30 days prior to commencing of the survey.
At least 14 days prior to commencing the survey the Contractor shall provide a summary of the survey programme, extent and timing to the Owner Fisheries Liaison Officer, and shall issue a Notice to Mariners and inform the Hydrographic Office.
Surveys shall be conducted from a vessel capable of operating safely and effectively in the marine environment of the offshore site.
The Contractor shall make provision for 1 (one) Owner's representative and 1 (one) representative of the fishing industry to be present on the vessel during the survey if required.

Survey Reporting Requirements

The Contractor shall provide 4 (four) hard copies and 1 (one) electronic CD copy of both the Pre-Construction Seabed Survey report and the Post-Construction Seabed Survey report.
The reports shall include colour charts in A1 format showing the following:

a) Vessel track plot

b) Seabed features including sonar and magnetometer targets

c) Bathymetry contours

d) Shaded relief bathymetry

All charts shall show the turbine locations and numbers, and the met mast. Charts shall be in colour A1 format and datums shall be consistent with the requirements of the Owners Specification.
The report text shall include details of the methodology, a description of the bathymetry, a discussion on any targets/items identified, and a list of side scan and magnetometer contacts including descriptions.
The Post-Construction Seabed Survey report shall include figures showing scour around each turbine in detail and a discussion and estimation of the volume of material which has migrated due to scour.
The electronic copy shall include:

a) the report in pdf format

b) all charts in pdf and dgn format

c) a master file with all charted information in dgn format

d) side scan sonar mosaics

e) all image files in tiff format.

Surveys were carried out in 2001, 2005 and 2006 and these have been combined into a 'Seabed Comparison Report', that is included in the Interim Baseline Report 2007. **However, this is for information only and the 2007 and 2008 surveys will be taken as the baseline.**

Depending on the findings, it will be determined whether further monitoring of the cable route is required.

4.2.1 Timing of Surveys

The geophysical survey monitoring schedule would be:-

	2005	2006	2007	2008	2009	2010
Submit Methodology			June			
Pre-construction	(Autumn)	(March)	June	Spring		
Baseline Report				June		
Post construction					Autumn	
Report						Spring

4.3. Scour Locations

Objective – to confirm/validate model predictions and to provide information about the effects of scour upon wind turbine monopiles. The proposal is to install scour protection at most of the turbine locations and this is detailed in the 'Scour Protection Plan' submitted in June 2007. The filter layer of scour protection will be laid in 2007 for some turbines. The armour layer will be installed post foundation construction in 2008. An application to vary the conditions relating to scour protection was submitted to the MFA in May 2007 and the proposed wording relating to monitoring is –

9.18 The Licence Holder must undertake a bathymetric survey within three months of completion of the construction of the wind farm to assess changes in the bathymetry within the array. Ideally this would cover the whole array but a sub-sample of adjacent turbines (minimum of 4) would be acceptable. The number of turbines selected for these works should be sufficient so as to be representative of the different sediment types present at the site (e.g. cohesive, mobile etc). The survey is to be undertaken immediately after construction is complete and repeated at 6 monthly intervals for a period of 3 years.

Pre-construction surveys will be carried out in June 2007 and the methodology is attached in 'C7018 Survey Proposal'.

4.3.1. Timing of Surveys

The turbine base scour survey schedule would be:-

	2005	2006	2007	2008	2009	2010
Submit Methodology			June			
Pre-con			June			
Post-construction				Sept		
Report						
Operational					March & September	March & September

5. Current Modelling

Objective – to confirm predictions that the zone within which currents may be altered as a result of the presence of the monopiles is limited to within the turbine area

It is proposed that a post construction survey be carried out in 2009, when Acoustic Doppler Current Profilers (ADCPs) will be deployed at 3 locations within the site. A detailed methodology for the survey will be submitted in the spring of 2009.

5.1. Timing of Surveys

The current monitoring schedule would be:-

	2005	2006	2007	2008	2009
Submit Methodology					Spring
Pre-construction					
Report					
Post construction					Summer
Report					December

6. Benthic Organisms

6.1. Subtidal

Objectives – To confirm/validate the predictions made and to identify the effects of wind farm construction and operation on the subtidal benthic ecology as (potentially) mediated through impacts on sediment characteristics, scour and water quality from wind turbine installation and operation and cable installation

Under the sampling plan, pre-construction monitoring has been carried out in August/September 2005 and 2006. Similar techniques will be used for post-construction and subsequent analysis. The detailed methodology was contained in Version 1.3 and earlier.

6.1.1 Timing of Benthic Surveys (Subtidal)

As wind farm construction is scheduled over the summer months, future monitoring would take place in September to coincide with the completion of construction, reporting will be in the following June after each survey. Two years of pre-construction data have been collected and the post construction survey is planned for 2008. **It is proposed that no survey will be carried out in 2007**.The monitoring schedule would therefore be:

	2005	2006	2007	2008	2009	2010	2011
Pre-construction	Sept	Sept					
construction							
Post construction				Sept			
Operation					Sept	Sept	Sept

6.2. Epi-benthos Sampling

Objective: To provide baseline information on Epi-benthos and demersal fish species and to relate this to sediment and invertebrate data as appropriate.

The FEPA licence does not contain a specific requirement for beam trawl surveys. However, beam trawl surveys have been carried out in 2005 and 2006 to obtain baseline information and the surveys can be repeated post construction if there is a need to investigate an effect.

It is proposed that 15 beam trawls be carried out at the following locations, which will be in close proximity to the benthos grab sample locations:

- 3 on the cable route, located in close proximity to the 3 grab locations
- 2 outside the site (locations 13 1000m N of wind turbine generator (WTG) 4 and 12 1000m SE of WTG 18)
- 10 within the site, located in close proximity to the 10 grab locations

Trawl locations would be sited close to invertebrate/sediment grab sites to relate demersal fish information to sediment and invertebrate data.

Trawls will be carried out using a 2m beam trawl with a 4mm square mesh cod-end and chain matrix between the beam and foot-rope. Trawling will be directed into the prevailing current at a speed of 2 knots over ground. A rope length (fixed to the beam trawl) will be paid out to a length of 3 times the depth of water. Once this length of rope is achieved, trawling will be carried out for a period of 5 minutes. Following this period, the beam trawl will be retrieved by winch and the catch transferred to fish boxes.

6.2.1. Timing of Epi-benthos Surveys

The beam trawl survey will be carried out at the same time as the grab sample survey. The survey will only be repeated post construction if other surveys indicate an effect that requires further investigation.

	2005	2006	2007	2008	2009
Pre-construction	Sept	Sept			
Report			June		

6.3. Intertidal Sampling

Objectives: To confirm that the intertidal habitats and invertebrate populations are not adversely effected, with respect to their extent and density, by the works in the intertidal and shallow subtidal.

Intertidal invertebrate populations will be sampled by collection of sediment cores on the lower, mid and upper shore of three transects running perpendicular to the shore in the area of the cable landfall. No works are planned in the intertidal area until 2008 and so the pre-construction survey will be carried out in the Spring of that year. Five replicate samples will be collected at each station.

The proposed methodology for this survey is the same as that followed for North Hoyle monitoring as described below, however this will be confirmed and agreed with the consultees prior to the survey and will include preliminary mapping of the habitats..

Methodology used for North Hoyle monitoring:

- The methodology used followed the standard methodology described by Dalkin and Barnett (2001). At each sampling station, five replicate samples were collected to a depth of 15cm using a 0.01m^2 cylindrical corer. Samples were collected from up to a maximum of 5m either side of each transect, but not up or down the shore. One sample was collected for particle size analysis. Each replicate sample was double bagged and returned to the laboratory.
- Sediment cores were sieved over a 0.5mm mesh within 24 hours of collection and fixed in 10% solution of formalin.
- Samples were then gently washed over a white enamel tray and sediments methodically searched. All organisms found were separated according to major taxonomic groups (molluscs; worms; crustaceans; echinoderms; others) and preserved in 70% alcohol.
- Quality control was exerted by the chief taxonomist randomly checking one in every ten sorted samples. If sorting efficiency is less than 95% all ten of the samples where then resorted by the original sorter.
- All the archived sorted organisms from each sample were identified to species level where possible, but in some cases only to genus (mainly juvenile and damaged specimens) or to higher taxa. All organisms were recorded quantitatively.

In addition CCW has asked for monitoring of cobble habitats within the intertidal zone to be considered where appropriate.

The intertidal area along this stretch of coast has been habitat mapped by Countryside Council for Wales (CCW) using standard Phase I methodology with the biotopes found stated within the table below. None of these are predominantly cobble environments although it is recognised that areas of cobble may be present within these shores of mixed substrata. Such areas would likely to have high mobility and as a result contain fauna similar to other motile environments such as shingle.

Monitoring would be undertaken at these sites using the methodology previously outlined within the RF monitoring methods statement e.g. using the CCW Handbook for Marine Intertidal Phase 1 Survey and Mapping and Marine monitoring Handbook methodologies (after Wyn et al, 2000 and Davies et al, 2001). It is suggested that if areas of cobble habitat are encountered along the monitoring survey transect that, in addition to the walk over assessment, hand searches and photographic quadrats are also used as coring on such areas would be ineffective in yielding a suitable sample for analysis.

Sediment Analysis:
The sediment cores collected from the foreshore were analysed for PSA and Loss on Ignition as an indication of organic content. For PSA, sediments were sieved on Endecott BS 410 test sieves using a Retsch AS200 sieve shaker and standard set of sieve sizes (125mm - 63µm). Calculation of mean and median particle sizes and determination of sorting index by calculating standard deviation of Phi, and the classification system used for sediment type and sorting index were carried out according to the methods of Buchanan et al (1984).

6.3.1 Timing of Benthic Surveys (Intertidal)

The cable laying in the intertidal area will take place in the summer of 2008 it is proposed that the pre-construction survey be carried out in the spring of 2008.

2006	2007	2008	2009	2010

Submit Methodology			Spring		
Pre-construction			Spring		
Report			June		
Post construction				Autumn	
Report					June

7. Electromagnetic Fields

Objective: To identify the potential anticipated range of magnetic and induced electrical fields that will be produced by the operational wind farm, and to relate this to the potential for detrimental effects on electrosensitive fish species

At present, the detailed specification of the sub-sea cables is not available. Information regarding electromagnetic fields (EMF) will be provided in June 2008 – with the baseline monitoring statement. It is proposed that the following data will be submitted –

- Information on the cables and their shielding
- Details of operational load factors
- Details of burial and shielding capacities
- EMF strength predictions, based on the COWRIE model

Electromagnetic fields (EMF) from submarine power cables may potentially have impacts on marine fauna. Theoretical impacts include attraction/repulsion of electrosensitive fish species, notably elasmobranchs; interference with migrations of magnetically sensitive species such as salmonids and eels; and disruption of orientation amongst fish species using naturally induced electric fields to position themselves in relation to the tidal cycle. None of these impacts have been demonstrated in situ for standard submarine power cables but are based on extrapolation of knowledge from laboratory studies with artificially generated fields.

Most concern has been focused upon potential impact on elasmobranches (sharks, skates and rays) which are most sensitive to electromagnetic fields, using natural fields to locate both prey and conspecifics. EMF monitoring will focus on potential effects on elasmobranches

The COWRIE research will allow us to predict whether field strengths are sufficient to have effects on electro sensitive fish species. This analysis will have taken place prior to the completion of the Rhyl Flats Offshore Wind Farm construction and confirmation of fish survey methodologies.

If possible effects are determined, the final fish survey methodology would therefore include additional biological monitoring to investigate this effect. This monitoring would be subject to separate agreement by the licensing authority.

EMF monitoring work could be revised to reflect any recommendations of the anticipated COWRIE study and would be terminated early should other studies shown clearly that EMF does not represent a significant impact to marine receptor organisms.

Information from other sources would also be considered as part of this analysis. This would include, notably:

- the Westerberg and Begout-Anras (1999) investigation of the orientation of silver eels (Anguilla anguilla) in a disturbed geomagnetic field created by the presence of a submarine HVDC power cable.
- an investigation in 2002 of the effect of noise/vibration and electromagnetic fields on fisheries at the Vindeby wind farm, Denmark (Bio/consult 2002)
- SEAS, Denmark intend to repeat the above investigation at the Rodsand wind farm site. To date, they have collected baseline data on migratory/electro sensitive fish species in the general area of the cable route. Monitoring of fish migration over the cable will be carried out between 2003 - 2005 (Holm Skyt, SEAS, pers. comm.).

7.1. Timing of the EMF Report

The EMF report will be submitted as part of the baseline monitoring report in June 2008.

8. Marine Fish

8.1. Electrosensitive Species

Objectives: To determine the numbers and distribution of electrosensitive fish species and to relate this information to potential impacts from electromagnetic fields associated with the export cables

It is proposed that this licence requirement be satisfied by the following methods –

8.1.1 Desktop Studies

This will assess the current status of the COWRIE studies in to EMF and relate the findings to the Rhyl Flats site

8.1.2 Third Party Surveys

It is proposed that data from other survey programs (The Welsh Skate & Ray Group & The Chartered Angling Project Skate & Ray recording scheme) be used assessed in relation to the wind farm site.

8.1.3 Fisheries Liaison

The appointed fisheries liaison officer will identify skate & ray fishing interests in the area, obtain historical records of catches and monitor any changes, and liaise with the fishermen throughout the monitoring period. A liaison officer (Dr Stephen Lockwood) was appointed in June 2005 and this work is in progress.

8.1.4 Fish Surveys

Beam trawl data will be collected pre-construction (conducted as part of the epi-benthos survey, this will follow standard methodology as employed at the North Hoyle development) and it will be possible to repeat the survey if effects are suggested by the other monitoring methods.

8.2. Marine Fish – Populations

Objective: To establish a baseline understanding of fish populations and monitor for any effects associated with the wind farm development.

Licence condition 9.7 requires that monitoring be carried out via site specific surveys to determine the effect of the wind farm on fish populations. The proposed format for this monitoring is very similar to that proposed for monitoring electro sensitive species. The views of local fishermen will also be canvassed by the fisheries liaison officer.

8.2.1 Third Party Surveys

Data collected by The CEFAS Liverpool Bay study will provide a useful control for overall fish stocks in Liverpool Bay. One location (Site 36) is located adjacent to the wind farm site.

8.2.2 Fisheries Liaison

The appointed fisheries liaison officer (Dr Stephen Lockwood) will identify all fishery interests in the area, obtain historical records of catches and monitor any changes, and liaise with the fishermen throughout the monitoring period. This work commenced in June 2005.

8.2.3 Fish Surveys

Beam trawl data will be collected pre-construction (conducted as part of the epi-benthos survey) and it will be possible to repeat the survey if effects are suggested.

8.2.4 Timing of all Fish Surveys (including electro sensitive species)

The proposed survey schedule is as follows –

	2005	2006	2007	2008	2009	2010	2011
Pre-construction (inc. beam trawls)	Sept	Sept					
Construction			Third party data	Third party data			
Post construction					Third party data	Third party data	Third party data

A baseline fisheries report is provided in the Interim Baseline Report in 2007 and subsequent reports will update the fisheries studies.

9. Underwater Noise & Vibration

Baseline measurement of underwater noise is to be undertaken prior to construction of the Rhyl Flats Offshore Wind Farm, with construction and post-construction monitoring to follow.

The objectives of the noise monitoring are to :

- In combination with the biological aspects of the monitoring programme proposed in Annexes 1&2, inform on any interactions between noise generation and the provision of new habitat and fish aggregation effects of the support structures.
- Determining the effects of distance depth and background sources on noise propagation.

npower renewables will ensure that the results of the acoustic monitoring can be integrated as far as possible with the results of the other survey work to allow the impact of noise to be considered for the various different issues e.g. fish, marine mammals. The locations of sites for acoustic monitoring will be chosen to reflect water depth and sediment type and pile type (if relevant).

Full details of the methodology will be submitted early in 2008.

9.1. Timing of Underwater Noise & Vibration Surveys

As wind farm construction is scheduled over the summer months, future monitoring would take place in September to coincide with the completion of construction. The monitoring schedule would therefore be:

	2005	2006	2007	2008	2009
Submit Methodology				Spring	
Pre-construction				Spring	
Construction				Summer	
Operation					September

10. Ornithology (Annexe 2 Conditions)

10.1 Objective 1

Determine whether there is change in bird use, measured by numbers and behaviour, of the wind farm site and a buffer to be specified.

Survey method
The use of the wind farm site and a buffer will be determined by boat based surveys, currently conducted by Environmentally Sustainable Systems Ltd (ESS). Bird observations will be recorded following ESS refinements of the Komdeur et al (1992) methodology, together with COWRIE recommendations (NIOZ, 2004). Bird observations will be estimated to distance bands from the boat and behaviour will be recorded. See Appendix 3 for further detail.

All species will be recorded, but for the purposes of reporting to FEPA, only component species of nearby Sites of Special Scientific Interest (SSSI) Special Protection Areas (SPA) and 'proposed' Special Protection Areas will be presented. The relevant sites are Great Orme's Head SSSI, Little Orme's Head SSSI, The Dee Estuary SPA and proposed extensions, Puffin Island SPA and Liverpool Bay 'proposed' SPA, for which common scoter and red-throated diver are the anticipated qualifying species for the purpose of this monitoring programme.

Species monitored for this objective of the FEPA licence are therefore:

Red-throated diver
Fulmar
Cormorant
Shag
Common scoter
Kittiwake
Common tern
Sandwich tern
Little tern
Guillemot
Razorbill

Common scoter will be appropriately monitored by aerial survey, subject of a separate monitoring Objective (3) below and so not considered further here. For all other species, boat survey is presently considered more accurate for one or more of: (1) accuracy of numbers counted; (2) accuracy of species identification; and (3) additional information (behaviour) (Komdeur et al. 1992).

10.1.1. Sample Size and Frequency

It is proposed that surveys be carried out monthly throughout the 7 year monitoring program.

10.1.2 Timing of Surveys (in relation to states of tide and times of day)

There are likely to be different patterns of use of sea areas at different times in relation to the diel and tide cycle. Where possible, given the constraints on mobilising surveys offshore, combined with operational restrictions once the wind farm is built, surveys will be devised to provide data, for the species listed above, for a range of

states of tide and times of day for the study area. It should however be recognised that weather conditions and states of tide often enforce certain survey routes.

10.1.3 Flight Height

Flight height estimation without reference points is subjective and probably subject to large inter-observer variation. This is a problem recognised in relation to terrestrial wind farm data for collision risk assessment and aggravated at sea, where there are few reference points against which to estimate height. Given that observation with the naked eye or through binoculars gives a cone of vision with a radius that increases with distance, the accuracy of height estimates is likely to be greater for birds flying closer to the boat. Not only does the vessel provide reference points of known height, but the Rhyl Flats anemometer mast, other vessels and jack-up barges, towers and turbines, provide fixed vertical objects with features of known height, during and after construction.

Experience from North Hoyle has shown that it is possible to achieve fairly accurate height measurements. Therefore, after construction has commenced, height calibration will be undertaken in relation to parts of the anemometer and turbine structures, as well as jack-up barges. All bird flight heights will be estimated at the time of detection. The key turbine dimensions are:

- TP Platform level
- Hub height
- Bottom tip of blade
- Top Tip of Blade

10.1.4 Data Analysis

It is proposed that all data collection, analysis and reporting will follow the model as provided in Appendix 3.

10.1.5 Timing of Surveys

	2005	2006	2007	2008	2009	2010	2010
Pre-construction	Sept– Dec	Jan-Dec	Jan - Dec				
Construction				Jan-Dec			
Operation					Jan-Dec	Jan-Dec	Jan-Sept

Following the initial 3 years of post construction monitoring the level of subsequent monitoring will be determined, in agreement with CCW, by the magnitude of change in bird populations observed in the initial monitoring period.

10.2. Objective 2

Determine whether there is a barrier effect to movement of birds through the site.

Marine surveillance radar (MSR) was employed to monitor flight paths in March 2006 however the effectiveness of this relatively new technology has not been proven. Therefore proposed the results of the aerial and boat based surveys will also be analysed to assess the potential barrier effects of Rhyl Flats.

The MSR 2006 survey has not yet been analysed and a methodology for the post construction surveys will be submitted for approval in 2008.

10.2.1 Timing of Surveys

	2005	2006	2007	2008	2009
Pre-construction		March			
Methodology				Autumn 2008	
Operational				Winter 2008/9	

10.3. Objective 3

Determine the distribution of common scoter in Liverpool Bay, through continued contribution to aerial surveys (co-ordinated by WWT and funded by DTI/ defra/ JNCC/ CCW and developers)

It is proposed that the methodology be the same as that employed for North Hoyle, -

For each winter, each common scoter observation will be taken as a location and number of birds and regressed on distance from the nearest (actual or proposed) Rhyl Flats turbine location. It will be tested, for the winters pre- and post-construction, whether distance from turbines explains common scoter distribution.

The DTI aerial survey of Liverpool Bay provided data from 2002 – 2007. Proposals for further surveys will be agreed during the winter of 2007.

10.4. Objective 4

If Objective 3 shows change in common scoter population in the vicinity of Rhyl Flats, monitor the benthos to determine whether the change is a result of change in common scoter food supply

It is proposed that a baseline 'biomass index' be established for the main common scoter feeding area in close proximity to the site. The area and detailed survey methodology will be agreed with CCW. It is proposed that the survey of the feeding grounds be carried out by grab samples and that the field work methodology will be the same as for the benthic sampling in Section 6, subject to agreement with CCW. The analysis of the benthos however will also extended to include categorisation of the common scoter food supply. From this a biomass index will be established and a baseline determined.

Subject to detailed design, including statistical support, it will be determined whether there is a significant change in the distribution of common scoters in relation to Rhyl Flats Offshore Wind Farm (Objective 3).

Objective 4 is conditional on changes observed in relation to Objective 3 during the monitoring program. If there is change in the distribution of common scoter, of a magnitude to be agreed with CCW, then further sampling will be undertaken in the feeding areas to establish whether the change in population is linked to a change in food supply. As a result of this it is therefore necessary to establish the pre-construction baseline.

Methods of analysis and the magnitude of change that should trigger the benthic survey will be agreed with CCW and included in the baseline report. Data on the

change in distribution of birds will be presented to CCW within one month of provision of aerial data by the contracted organisation.

10.4.1. Timing of Surveys (Biomass Index)

A biomass index survey was carried out on the samples collected during the 2006 benthic surveys.

	2005	2006	2007	2008	2009
Pre-construction		Sept			
Post construction					Only if triggered by condition 9.3

The data from the 2006 survey is in a 'raw' state and will not be analysed and reported unless this condition is triggered by a change in Common Scoter populations.

10.5. Objective 5

If Objectives 1 or 2 reveal significant use of Rhyl Flats by populations of conservation concern, at heights that could incur a risk of collision, a programme of collision risk monitoring will be implemented

This conditional Objective requires that a programme of collision risk monitoring should be undertaken should the wind farm site become used by a significant proportion of one or more populations of conservation concern. The Objective is conditional on changes observed during the monitoring program. Any actions for this Objective will therefore take place subsequent to analysis of such data. No programme of work for this Objective is therefore proposed for 2007 or subsequent years at this time.

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Appendix A. Rhyl Flats Offshore Wind Farm FEPA Licence 31640/06/01

Condition	
1	**Particulars of the deposit**
1.1	The type of works for which the deposit of the substances or articles as specified in paragraph 1.4 of this Schedule are : **Windfarm**
1.2	Details of the works requiring the deposit of the substances or articles as specified at paragraph 1.1 of this Schedule are:- The construction of a 150MW offshore windfarm and associated infrastructure at Rhyl Flats, approximately 10km from the North wales coast, north west of Rhyl as described in Celtic Offshore Wind Ltds application dated the 25th March to the MCEU and as revised by the Supplemental Environmental Information (submitted 15th July 2000)
1.3	Such works are as detailed in the drawing(s) and sectional plan(s) detailed below which were submitted in support of your application to the Licensing Authority of 25 March 2002. As shown in the Environmental Statement (submitted 25 march 2002) the Supplimental Environmental Information (submitted 15 July 2002) and the Provisional Method statement submitted 02 August 2002.
1.4	The substances or articles authorised for deposit at sea are: Iron / steel Stone / Rock - Scour protection material (subject to further agreement in accordance with conditions 9.17 and 9.18 High Strength Grout - for all monopiles
1.5	The Licence Holder and any Agent and Contractor acting on their behalf is permitted to deposit the substances or articles specified at paragraph 1.4 of this Schedule, at the following location(s): RHYL FLATS, 53 24.21 N 03 42.11 W SH86879100 53 22.84 N 03 36.04 W SH93548831 53 23.07 N 03 42.82 W SH86038891 53 21.70 N 03 36.75 W SH92708622 RHYL FLATS : CABLE ROUTE 53 22.27 N 03 39.02 W SH90218734 53 18.37 N 03 34.69 W SH94858000 53 18.18 N 03 33.13 W SH96587960
	Rhyl Flats New Met mast 53 23.42N 03 38.97W Rhyl Flats Existing Met mast 53 22.08N 03 38.51W SH9076986958

1.6	The works shall be carried out in accordance with the works schedule and method statement as detailed in the following: The construction of an offshore wind farm located approximately 10km from the North Wales coast, off Abergele. Works to include the installation of up to 30 turbines in three rows of 7,11 and 12 turbines, an offshore substation (optional) and an additional meteorological mast. (An existing meteorological mast also forms part of the wind farm site - license ref. 31456/02/2) It is anticipated that onshore assembly will take place at a local port either Holyhead, Mostyn or Liverpool) and all componants and assembly equipment will then be transferred to the site via jack-up barges, supplemented by a transport barge and tugs as and when required in accordance with the construction programme. The pile foundations will be drilled / driven into the seabed for the wind turbine bases, the substation base and the meteorolical mast b jack-up vessel. The foundations (support Structures) will comprise tubular steel monopiles, 4 - 5.85m in diameter with a maximum penetration in the seabed of 40m. Scour protection will be installed. The extent of scour will be monitored post-construction and reviewed in accordance with the Supplementary Conditions 9.17 and 9.18.
2	**Persons Responsible for the Deposit of the Substances or Articles**
2.1	The Agents and Contractors permitted to engage in activities subject to the terms and conditions of this licence are:- Name of Agent or Contractor Function **The licence holder is not permitted to commence the deposit operation specified by this licence 31640/06/1 until the licensing authority has in writing varied the licence to include details of all the agent(s), contractor(s), (if any) to be employed in the operation.**
2.2	**The following operators and vessel(s) or vehicle(s) are permitted to engage in activities subject to the terms and conditions of this license are -**
	The license holder is not permitted to commence the deposit operation specified by this license 31640/06/1 until the licensing authority has, in writing varied the license to include details of all the agent(s), contractor(s), (if any) to be employed in the operation.
3	**Distribution of copies of this Licence 31640/06/1**
3.1	The Licence Holder is required to ensure that a copy of this licence 31640/06/1 and attached Schedule, any special conditions and any subsequent revisions or amendments thereto is given to:
3.1.1	All Agent(s) and Contractor(s) as detailed at paragraph 2.1; and
3.1.2	The Masters of all vessels and transport managers responsible for the vehicles employed in the pursuance of this Licence 31640/06/1 and detailed at paragraph 2.2.
3.2	Copies of this Licence 31640/04/1 shall also be available at the following locations :
3.2.1	at the address of the Licence Holder:
3.2.2	at any site office, located at or adjacent to the site of the works, used by the Licence Holder, agent(s) or contractors(s) responsible for the loading transportation or deposit of those substances or articles detailed at paragraph 1.2.1 of this Schedule; and,
3.2.3	on board each vessel or at the office of any transport manager with responsibility for vehicles from which licensed deposits are to be made.
4	**Inspection of the Operation**
4.1	The documents referred to in paragraph 3 shall be available at all reasonable times for inspection by an authorised Enforcement Officer at the locations stated in that paragraph.

4.2	The Licence Holder must advise the Licensing Authority and District Inspector of Fisheries 5 working days before the licensed operation, or an individual phase of the operation is expected to commence.
5	**Returns to be made to the Licensing Authority**
5.1	The Licence Holder is required to acknowledge receipt of this licence 31640/06/1 and confirm that you have understood its term by signing and returning Form FEP 14 within 28 days of the date of issue of this Licence. No operations permitted under the terms of this licence 31640/06/1 shall commence until the FEP 14 form has been signed and returned to the Licensing Authority.
5.2	All persons referred to at paragraph 2.1 and 2.2 of this Schedule shall provide an acknowledgement, using Form FEP 13, of their receipt of this licence 31640/06/1 and their understanding of all the conditions specified therein to the Licensing Authority within 28 working days of the start date of this Licence 31640/06/1 or prior to engaging in any activity to which this Licence relates, whichever is the sooner.
5.3	Only those Agent(s) or Contractor(s) whose names appear at paragraph 2.1 and the vessel(s) and operator(s) whose names appear at paragraph 2.2 may operate under the terms of this Licence 31640/06/1. Any changes must be notified to and be approved by the Licensing Authority in writing prior to operating under this Licence 31640/06/1.
6	**Contacts**
6.1	Except where otherwise indicated, the primary point of contact with the Licensing Authority and the address for returns and correspondence shall be:- **Department for Environment, Food and Rural Affairs** **Marine Consents and Environment Unit** **Area 2D** **3-8 Whitehall Place** **London SW1A 2HH** **Tel: 020 7270 8696**
6.2	For the purposes of this Licence 31640/04/1 any references to the Local District Inspector of Fisheries shall mean the relevant District Inspector in the area(s) located at:- **Defra Fisheries Office** **Suite 3, Cedar Court** **Havens Head Business Park** **Milford Haven** **Pembrokeshire** **SA73 3LS** **Tel: 01646 693412**
6.3	For the purposes of this Licence 31640/06/1 any references to the Centre for Environment, Fisheries, and Aquaculture Science (CEFAS) shall mean:- **Centre for the Environment, Fisheries, and Aquaculture Science (CEFAS),** **The Laboratory** **Remembrance Avenue** **Burnham-on-Crouch** **Essex CM0 8HA** **Tel: 01621 787284**
7	**Force Majeure**
7.1	If, by reason of "force majeure" the substances or articles specified at sub-paragraph 1.4 of this Schedule, are deposited otherwise than in the area authorised by this licence at paragraph 1.5, full details of the circumstances shall be notified to the Licensing Authority within 48 hours of the incident occurring. "force majeure" may be deemed to apply when, due to stress of weather or any other cause, the master of a vessel determines that it is necessary to deposit the substances or articles because the safety of human life and/or of the vessel is threatened.

8	**Changes to this licence**
8.1	In the event of the Licence Holder becoming aware that any of the information on which the granting of this licence 31640/04/1 was based has changed or is likely to change, he/she shall notify the Licensing Authority at the earliest opportunity of the details.
8.2	Similarly in the event that the Licence Holder wishes any of the particulars set down in the Schedule to be altered he/she shall inform the Licensing Authority at the earliest opportunity. The terms and conditions of this Licence apply until such a time as they may be varied by the Licensing Authority
9	**Supplementary Conditions:** The licence holder must submit the reports of the monitoring activities set out in the following supplementary conditions to the licencing authority at the appropriate time in order to allow the licencing authority to consider if any action may be required to mitigate or correct any adverse effects which may be identified. The licencing authority reserves the right to vary or attach additional conditions to the licence in the event that: i. the results of the monitoring studies required under the terms of the Schedule to this licence. ii. Any other observed effects considered to be directly associated with the works permitted by this licence suggest a risk of significant adverse environmental impact'.
9.1	To minimise impacts on fisheries, spawning fish and over-wintering Common Scoter, construction works must not be undertaken between 16 December and March (inclusive). The majority of construction works must take place between April to September (inclusive) the only exceptions to this being works associated with testing and commissioning, the installation of turbines and the meteorological mast in the northern row and the installation of cabling between the turbines and the meteorological mast in the northern and middle rows, which may be undertaken, if necessary, between October and 15 December (inclusive). Should it be critical that works, other than that specified above, are necessary between October and 15 December (inclusive), written approval should be sought, in advance, from the Licensing Authority (following consultation with CEFAS and CCW) which will consider the request on a case by case basis.
9.2	Pre-construction monitoring must be carried out in 2006/7 to provide a baseline for subsequent monitoring of the effects of the wind farm. NB. The Licence Holder will need agreement from the Licensing Authority that the pre-construction monitoring has generated adequate baseline data to support the construction and post construction monitoring. Assuming that the construction of the wind farm is completed as scheduled during the summer months of 2008, a post-construction monitoring programme must commence in late summer/autumn to follow the completion of the works. Monitoring must be carried out at the same time each year for comparative purposes in 2009, 2010 and 2011. Therefore, the initial monitoring schedule is as follows: - Pre- Construction - late summer/autumn 2006/07 Construction - late summer/autumn 2008 Post Construction/Operation – late summer /autumn 2009/2010/2011 Further monitoring requirements may be imposed by the Licensing Authority in the light of the results of each phase of the monitoring programme.
9.3	If the period of construction varies from that described in 9.2 above, or where unavoidable problems occur in meeting this schedule, the Licence Holder must notify the Licensing Authority and seek instruction on the monitoring schedule.
9.4	The monitoring reports must be forwarded to the Licensing Authority & the Countryside Council for Wales on an annual basis, or more frequently if the results trigger further monitoring work. Each report must be forwarded to the Licensing Authority within 3 months of the completion of the analyses. The Licence Holder should advise the Licensing Authority if circumstances suggest that there will be a delay in the submission of reports.

	The reports should include assessment, conclusions and an executive summary and the data within all reports should be presented in its processed and unprocessed forms. The various components of the monitoring programme and resultant reports, as described in conditions 9.5 to 9.9 of this Licence, should be integrated so as to compare related environmental parameters e.g. the bird monitoring should address the conclusions of the benthic studies which should similarly draw on the sedimentary studies.
9.5	Monitoring of Sedimentary and Hydrological Processes, Benthic Ecology, Electromagnetic Fields and Noise & Vibration The Licence Holder must carry out a programme of sedimentary, hydrological, benthic and other monitoring, as outlined in Annex 1 attached to this Schedule. The full specification for the monitoring programme will be subject to separate written agreement with the Licensing Authority following consultation with CEFAS and the Countryside Council for Wales at least one month prior to the proposed commencement of the monitoring work.
9.6	The Licence Holder must make provision during the construction phase of the wind farm to install facilities to enable subsea noise and vibration from the turbines to be assessed and monitored during the operational phase of the wind farm. Before completion of the construction phase the Licence Holder must supply specification to the Licensing Authority of how it proposes to measure subsea noise and vibration - at various frequencies across the sound spectrum at a selection of locations immediately adjacent to, and between turbines, within the array and outside the array at varying distances - in order to fulfil the monitoring requirement outlined in Annex 1 attached to this Licence. Such a study would need to reflect differences in foundation/tower type, water depths and sediment types within the site and would need to be supported by adequate baseline data. Collaborative studies, e.g. research funded by COWRIE in this respect, would be an acceptable means of fulfilling this condition.
9.7	Fish Monitoring: Since very little is known about the potential effect of wind farms in terms of enhancing or aggregating fish populations, the Licence Holder must produce proposals for adequate preconstruction baseline and post-construction surveys of fish populations in the area of the wind farm. The Licence Holder shall, in drawing up such proposals, canvas the views of local fishermen. The proposals must be submitted to the Licensing Authority at least one month prior to the proposed commencement of the monitoring work. (See also Annex 1 in relation to monitoring of electro-sensitive species).
9.8	The Fisheries Liaison Officer (see condition 9.13) shall pay due regard during the conduct of any fisheries survey to the need to safeguard the safety of any persons engaged in fishing operations on the site of the wind farm.
9.9	Ornithological Monitoring: Ornithological monitoring must be carried out as outlined in Annex 2 attached to this Schedule. The full specification for the monitoring programme will be subject to separate written agreement with the Licensing Authority following consultation with CEFAS and the Countryside Council for Wales prior to the proposed commencement of the monitoring work. Post-construction monitoring must be undertaken annually for three years. The level of any subsequent ornithological monitoring, during the lifetime of the wind farm's operation, will be determined, in consultation with the Countryside Council for Wales, having regard to the magnitude of any change in bird populations observed during the initial monitoring period.
9.10	Cetaceans: During construction the Licence Holder must ensure that disturbance to the cetaceans is minimised, including temporary suspension of piling operations if cetaceans are sighted in the area. The Licence Holder must also undertake monitoring of cetaceans as set out in Annex 2.

9.11	**Timing:** To minimise impacts on fisheries, spawning fish and over-wintering Common Scoter, construction works must not be undertaken between 16 December and March (inclusive). The majority of construction works must take place between April to September (inclusive) the only exceptions to this being works associated with testing and commissioning, the installation of turbines and the meteorological mast in the northern row and the installation of cabling between the turbines and the meteorological mast in the northern and middle rows, which may be undertaken, if necessary, between October and 15 December (inclusive). Should it be critical that works, other than that specified above, are necessary between October and 15 December (inclusive), written approval should be sought, in advance, from the Licensing Authority (following consultation with CEFAS and CCW) which will consider the request on a case by case basis.
9.12	Interference: The Licence Holder must ensure that a Notice to Mariners is issued at least 10 days prior to works commencing warning of the start date for the construction of the wind farm and the expected supply/construction vessel routes from the local service ports to the array. A second Notice to Mariners must be issued warning of the timing and route of laying the submarine cable. These Notices to Mariners must be updated and reissued at appropriate intervals and supplemented by VHF radio broadcasts as deemed appropriate and agreed with the Maritime and Coastguard Agency.
9.13	The Licence Holder must ensure that a suitably qualified and experienced liaison officer or officers are appointed (for fisheries and environmental liaison) and the Licensing Authority notified before any work commences, to establish and maintain effective communications between the Licence Holder, contractors, fishermen, conservation groups and other users of the sea during the project.
9.14	The Licence Holder must ensure that information is made available and circulated in a timely manner through the liaison officer(s) to minimise interference with fishing operations and other users of the sea.
9.15	The Licence Holder must ensure that the liaison officer's environmental remit includes: Monitoring compliance with the commitments made in the Environmental Statement and the Environmental Management Plan. Providing a central point of contact for the monitoring programme described in Annexes 1 and 2. Liaison with fishermen, conservation groups and other users of the sea concerning any amendments to the method statement and site environmental procedures. Inducting site personnel on site / works environmental policy and procedures.
9.16	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 Countryside Council for Wales, prior to the proposed commencement of construction work to ensure that satisfactory arrangements are in place for liaison on environmental issues (as such the plan should provide names and contact details for the environment liaison officer(s)). This must be submitted to the Licensing Authority at least 1 month prior to the proposed commencement of works
9.17	Seabed Morphology and Scour: The Licence Holder must undertake a bathymetric survey around a sample of adjacent turbines (minimum of 4) within 3 months of completion of the construction of the wind farm to assess changes in the bathymetry within the array. The number of turbines selected for these works should be sufficient so as to be representative of the different sediment types present at the site (e.g. cohesive, mobile etc). The survey is to be undertaken immediately after construction is complete and repeated at 6 monthly intervals for a period of 3 years. This shall specifically address the need for scour protection around the turbine pylons. The Licence Holder must submit the data in the form of a report to the Licensing Authority, including proposals for scour protection measures.

9.18	If the monitoring results carried out under condition 9.17 indicate that scour protection is not required, the Licence Holder must seek approval from the Licensing Authority to withhold or delay the deposit of scour protection pending further monitoring. If the monitoring results carried out under condition 9.17 indicate that scour protection is required, such material must be inert, with minimal fines, and the Licensing Authority's prior approval is required for the grade, type, nature and origin of the material proposed for use. All scour protection must be levelled with the sea bed. Should additional cable protection be required (e.g. rock armour) a separate Food and Environment Protection Act/Coast Protection Act consents application must be submitted.
9.19	General: The Licence Holder must ensure that any debris or temporary works placed below MHWS are removed on completion of the works authorised by this Licence. (NB Drill cuttings, if drilled with water-based muds, can be left on the seabed within the area leased from the Crown Estate for the construction of the offshore wind farm to which this licence refers.
9.20	The Licence Holder must undertake a pre-construction bottom and side scan sonar survey in grid lines across area of development (turbine array, cable route, and any vessel access routes from local service port(s) to the construction site) following discussions with the Licensing Authority as to those parts of the operation for which this is deemed necessary. Local fishermen must be invited at reasonable notice to send a representative to be present during the survey. All obstructions found on the seabed must be plotted. A post construction survey must be undertaken along the same grid lines (within operational and safety constraints), any new obstructions associated with the construction of the wind farm must be removed at the developer's expense.
9.21	All chemicals utilised in the drilling operation must be selected from the List of Notified Chemicals assessed for use by the offshore oil and gas industry under the Offshore Chemicals Regulations 2002 (this list can be viewed/downloaded at www.cefas.co.uk). Should any system other that a water-based mud be considered for use in the drilling operation written approval and guidance of disposal of any arisings will be required from the Licensing Authority.
9.22	The Licence Holder must ensure that any chemical agents placed within the void of the monopile, e.g. biocides, corrosion inhibitors etc, are selected from the List of Notified Chemicals (see condition 9.21). The use of any chemical not contained on this list will require prior consent from the Licensing Authority following a comparable ecotoxicological hazard/risk assessment undertaken at the Licence Holders own expense.
9.23	The Licence Holder must ensure that all protective coatings; paints etc used are suitable for use in the marine environment and, where necessary, are approved by the Health and Safety Executive.
9.24	The Licence Holder must ensure that storage, handling, transport and use of fuels, lubricants, chemicals etc during construction on vessels and equipment should prevent releases to the marine environment, i.e. bunding should be 10% total volume of all reservoirs, containers etc.
9.25	The Licence Holder must produce a Marine Pollution Contingency Plan for spills, collision incidents during construction and operation, and this must be adhered to. The Contingency Plan must have regard to plans for North Wales Coast, Liverpool Bay, Dee Estuary, Mersey Estuary & offshore installations. Practices used to refuel vessels at sea must conform to industry standards.
9.26	Directional drilling equipment should preferably be utilised for cable laying but, if this can be shown to be an inappropriate technique, the Licence Holder must ensure that all reasonable care is taken to minimise disturbance and resuspension of sea bed sediments.
9.27	The Licence Holder must ensure that all reasonable care is taken to prevent the accidental release of wet cement/grout into the marine environment.

9.28	The Licence Holder must ensure that the top layers of sediment are separated from the sub-surface sediments during works in the intertidal zone (where practicable) and replaced in the trench in the appropriate sequence to assist recolonisation of benthic organisms.
9.29	All the above conditions are also applicable to the meteorological masts (as appropriate) which must be considered as an integral part of the development.
9.30	In addition to the initial licence charge paid with the application (or application for extension) relating to this licence, the Licence Holder shall pay a further annual instalment of the licence charge in respect of the second period of twelve months of the licence (equivalent to the extension charge in force at the due date). Payment of the annual instalment shall be due and be made to the Licensing Authority 28 days prior to the anniversary of the original start date of this licence.
9.31	The licence shall be deemed to become invalid and shall be liable to be revoked in the event that the Licence Holder fails to make full payment of each annual instalment of the licence charge within a period of 28 days following the respective due date for payment.
9.32	The Licensing Authority reserves the right to seek a further variation charge in the event that the Licence Holder requests any significant change to the work or the working methods to which this licence applies, or to its terms and conditions. Should the Licence Holder seek to make changes to the terms and conditions of this licence or to the work to which it relates which in the opinion of the Licensing Authority will require it to be substantially re-assessed, the Licensing Authority may seek to revoke this licence and request a revised application.
9.33	The Licence Holder must provide access, and if necessary appropriate transportation at reasonable notice, to the disposal vesel/offshore construction site to facilitate any inspection that the licenceing authority considers maybe necessary subject to meeting mandatroy health and safety obligations
	MONITORING REQUIREMENTS
	This Annex summarises the minimum physical and biological (excluding birds) monitoring requirements that must be undertaken to comply with the conditions of license 31640/06/0. Full details of the proposed survey specifications to meet these requirements are to be set out in a seperate report to be agreed by the Licensing Authority, in consultation with CEFAS and CCW, prior to the commencement of any survey works
1	Suspended Sediment Concentrations Pre-monitoring or predictions are required into suspended sediment concentrations and movements associated with the construction of the turbine piles and cable laying. These data and predictions will provide further information on the dynamics of the site to assist in the development of the benthic and sedimentary monitoring. Such information should include the shape, size and direction of the turbidity plume and rate of sedimentation of material displaced during construction. The following monitoring must be undertaken to validate and confirm predictions. Monitoring must be based on the deployment of three suspended sediment meters over a period of at least 4 weeks during the pre-construction, construction (during drilling, piling and cabling) and post construction periods. These would need to be deployed as follows: · At a representative point identified by the modelling and within the sediment plume to measure near-field effects of sediment release. · At a representative point identified by the modelling and within the sediment plume to measure far-field effects. · At a point outside the predicted area of the sediment plume to provide a 'control' measure of natural suspended sediment levels over the respective monitoring periods.

	Alternative approaches may be acceptable but the methodologies would have to be submitted to the Licensing Authority for review and agreement at least one month prior to the proposed commencement of the monitoring work. In line with condition 9.1 should suspended sediment levels associated with the construction works be shown to be at unacceptable levels (i.e. above threshold) works may need to be suspended while a less disruptive methodology is investigated. Background levels from the monitoring programme will be used to set suitable threshold levels.
2	Seabed Morphology and Scour: (See licence conditions 9.17 and 9.18) Monitoring of seabed morphology should include the cable route (both between the turbines and to shore) to assess sediment movements in relation to the cable burial depth and the long term integrity of the cable.
3	Current Monitoring: To monitor predictions made by the numerical current modelling conducted as part of the EIA for the Rhyl Flats offshore wind farm of a wake effect downstream of each monopile further investigation is required. Post construction Acoustic Doppler Current Profiler (ADCP) monitoring should be undertaken taking transects through the wake region. The results should be compared to the model outputs and discussed in the context of possible disruption to coastal processes. If changes in current velocity are significantly greater than predicted, then the consequences for the sediment transport regime will need to be re-evaluated.
4	Benthic and Intertidal Organisms Sample locations for ongoing monitoring must be determined by factors such as precise monopile locations, location of cables etc. Sample locations must also take full account of factors such as sensitive areas, coastal process modelling outputs (for sediment transport / deposition information) and geophysical surveys (to ensure adequate coverage of sea bed habitats). In addition to the following samples should also be taken to adequately cover the extent and direction of the full tidal excursion. The number and location of the sample points needs to be submitted to the Licensing Authority along with a plan and rationale and agreed with CEFAS and CCW at least one month prior to the survey works commencing. Indicative sample locations (based on a minimum of 23 sites (maximum of 35 sites) with 3 replicate grabs at each) would be: a) 5 sites (minimum) within the wind farm area, representing different habitat types and up / down-drift conditions. b) 3 sites (minimum) within the near-field area of the monopile foundations to determine scour effects etc. c) 4 sites (minimum) to the south east of the wind farm within the area affected by sediment transport and deposition. d) 4 sites (minimum) to the north, north west, south west and south of the turbine array but within the tidal excursion. e) 3 sites (minimum) along the cable route. e) 4 sites (minimum) nearby but remote from the wind farm (controls). NB. These should be outside the tidal excursion and be spaced at reasonable distances around the development area. Colonisation of monpiles and scour protection must be determined by diver operated video observations and analyses with some accompanying sample collection for verification and identification. Intertidal invertebrate sampling must be undertaken at lower, mid and upper shore sampling stations along three transects running perpendicular to the shore in the area of the cable landfall. The precise details of the monitoring fo rthe cable route and any reinstatement works are dependant on the methodologies used. The licencing Holder must therefore provide the details of themethodology used for cable laying at least 2 months prior to works commencing so that the recommendations on the benthos monitoring specifications can be made. NB. The sedimentary and benthic data sets must be closely related and the resultant reports should include quality assurance, statistical analyses and full species lists.

5	Electromagnetic Fields: The Licence Holder must provide the Licensing Authority with information on attenuation of field strengths associated with the cables, shielding and burial described in the Method Statement and relate these to data from the Rødsand windfarm studies in Denmark and any outputs from the COWRIE tendered studies in the UK. This is to provide reassurance that the cable shielding and burial depth(s), both between the turbines and along the route to shore, given the sediment type(s) at the Rhyl Flats site are sufficient to ensure that the electromagnetic field generated is negligible. Should this study show that the field strengths associated with the cables are sufficient to have a potentially detrimental effect on electrosensitive species, further biological monitoring to that described in section 5 may be required to further investigate the effect.
6	Marine Fish: (See also licence condition 9.7 in relation to fish populations). The Environment Impact Assessment observed electrosensitive species (e.g. Thornback Ray) both within and close to the Rhyl Flats site. In the absence of any evidence that electromagnetic fields do not pose a risk to such organisms, monitoring work is required to determine the numbers and distribution of such species in the vicinity of the Rhyl Flats offshore wind farm (this should include the establishment of a baseline and the use of adequate controls). The survey should make use of non-destructive techniques e.g. live traps and visual methods. The results should be presented and discussed in combination with the EMF studies described in the preceding section (5).
7	Noise and Vibration: (See licence condition 9.6). Detailed post construction data must be collected on the frequency and magnitude of underwater noise produced by the Rhyl Flats offshore wind farm. The choice of sites for installing monitoring equipment should reflect the different conditions such as sediment type, water depth and pile type. This data is required for a variety of purposes, including: a) In combination with the biological aspects of the monitoring programme proposed in Annexes 1 and 2, the data would help to elucidate any interactions between noise generation and the provision of new habitat and fish aggregation effects of the turbine support structures. b) Determining the effects of distance depth and background sources on noise propagation.
8	Cetaceans : The number of cetacean sightings around Great Ormes Head necessitates further monitoring with regards to potential impacts by the Rhyl Flats offshore wind farm. The specification for this monitoring should be agreed with CCW and CEFAS least one month prior to the proposed commencement of the monitoring work. The monitoring must be based on the use of sightings and hydrophones to record the presence of cetaceans on or close to the site and should ensure the collection of adequate baseline data. There is scope to link this monitoring with the noise and vibration and bird studies. This data is required to assess whether a sterile area is created whilst the turbines are in operation (down-time would be used as a control).
9	Ornithological Monitoring Monitoring will commence with a year of baseline, pre-construction data gathering and monitoring during the year of construction. Post-construction monitoring will be undertaken annually for three years. The level of subsequent monitoring, during the lifetime of the wind farm's operation, will be determined, in agreement with CCW, by the magnitude of change in bird populations observed in the initial monitoring period. The ornithological monitoring programme may have to be adapted and amended as new technologies and research findings become available. Monitoring should be linked, where appropriate, with benthic monitoring. Monitoring reports will be provided to CCW annually, or more frequently where the results of the data may trigger further monitoring work. Monitoring will need to fulfil the following objectives:

	1. Determine whether there is a change in bird use, measured by numbers and behaviour, of the wind farm site and a buffer to be specified. **2.** Determine whether there is a barrier effect to movement of birds through the site. **3.** Determine the distribution of Common Scoter and divers in Liverpool Bay, covering Rhyl Flats and the vicinity. **4.** IF Objective 3 shows change in common scoter population in the vicinity of Rhyl Flats, monitor the benthos to determine whether the change is a result of change in common scoter food supply. **5.** IF Objectives 1 or 2 reveal significant use of Rhyl Flats by populations of conservation concern, at heights that could incur a risk of collision, a programme of collision risk monitoring will be implemented. Detailed study design is not presented at this stage as some uncertainties are the subject of research in progress. In addition, monitoring methods may change in response to novel research results or the development of new technologies. The Licence Holder and their consultants must develop a detailed design for this study in conjunction with the Countryside Council for Wales before monitoring can be undertaken.

1. Annexe Conditions

This is an annex to the schedule of Licence 31640/04/1

ANNEX 1

MONITORING REQUIREMENTS

This Annex summarises the minimum physical and biological (excluding birds) monitoring requirements that must be undertaken to comply with the conditions of licence 31640/02/0. Full details of the proposed survey specifications to meet these requirements are to be set out in a separate report to be agreed by the Licensing Authority, in consultation with CEFAS and CCW, prior to the commencement of any survey works.

1. Suspended Sediment Concentrations (SSC)

Pre-monitoring modelling or predictions are required into suspended sediment concentrations and movements associated with the construction of the turbine piles and cable laying. These data and predictions will provide further information on the dynamics of the site to assist in the development of the benthic and sedimentary monitoring. Such information should include the shape, size and direction of the turbidity plume and the rate of sedimentation of material displaced during construction.

The following monitoring must be undertaken to validate and confirm predictions. Monitoring must be based on the deployment of three suspended sediment meters over a period of at least 4 weeks during the pre-construction, construction (during drilling, piling and cabling) and post construction periods.

These would need to be deployed as follows:
§ At a representative point identified by the modelling and within the sediment plume to measure near-field effects of sediment release.
§ At a representative point identified by the modelling and within the sediment plume to measure far-field effects.
§ At a point outside the predicted area of the sediment plume to provide a 'control' measure of natural suspended sediment levels over the respective monitoring periods.

Alternative approaches may be acceptable but the methodologies would have to be submitted to the Licensing Authority for review and agreement at least one month prior to the proposed commencement of the monitoring work.

In line with condition 9.1 should suspended sediment levels associated with the construction works be shown to be at unacceptable levels (i.e. above threshold) works may need to be suspended while a less disruptive methodology is investigated. Background levels from the monitoring programme will be used to set suitable threshold levels.

2. Seabed Morphology and Scour

(See licence conditions 9.17 and 9.18).

Monitoring of seabed morphology should include the cable route (both between the turbines and to shore) to assess sediment movements in relation to the cable burial depth and the long term integrity of the cable.

3. Current Monitoring

To monitor predictions made by the numerical current modelling conducted as part of the EIA for the Rhyl Flats offshore wind farm of a wake effect downstream of each monopile further investigation is required. Post construction Acoustic Doppler Current Profiler (ADCP) monitoring should be undertaken taking transects through the wake region. The results should be compared to the model outputs and discussed in the context of possible disruption to coastal processes. If changes in current velocity are significantly greater than predicted, then the consequences for the sediment transport regime will need to be re-evaluated.

4. Benthic Organisms

Sample locations for ongoing monitoring must be determined by factors such as precise monopile locations, location of cables etc. Sample locations must also take full account of factors such as sensitive areas, coastal processes modelling outputs (for sediment transport / deposition information) and geophysical surveys (to ensure adequate coverage of seabed habitats). In addition to the following samples should also be taken to adequately cover the extent and direction of the full tidal excursion. The number and location of the sample points needs to be submitted to the Licensing Authority along with a plan and rationale and agreed with CEFAS and CCW at least one month prior to the survey works commencing.

Indicative sample locations (based on a minimum of 23 sites (maximum of 35 sites) with 3 replicate grabs at each) would be:
§ 5 sites (minimum) within the wind farm area, representing different habitat types and up / down drift conditions.
§ 3 sites (minimum) within the near-field area of the monopile foundations to determine scour effects etc.
§ 4 sites (minimum) to the south east of the wind farm within the area affected by sediment transport and deposition.
§ 4 sites (minimum) to the north, north west, south west and south of the turbine array but within the tidal excursion
§ 3 sites (minimum) along the cable route.
§ 4 sites (minimum) nearby but remote from the wind farm (controls). NB. These should be outside the tidal excursion and be spaced at reasonable distances around the development area.

Colonisation of monopiles and scour protection must be determined by diver-operated video observations and analyses with some accompanying sample collection for verification and identification.

Intertidal invertebrate sampling must be undertaken at lower, mid and upper shore sampling stations along three transects running perpendicular to the shore in the area of the cable landfall. The precise details of the monitoring for the cable route and any reinstatement works are dependent on the methodologies used. The Licensing Holder must therefore provide the details of the methodology used for cable laying at least 2 months prior to works commencing so that recommendations on the benthos monitoring specifications can be made.

NB. The sedimentary and benthic data sets must be closely related and the resultant reports should include quality assurance, statistical analyses and full species lists.

5. Electromagnetic Fields

The Licence Holder must provide the Licensing Authority with information on attenuation of field strengths associated with the cables, shielding and burial described in the Method Statement and relate these to data from the RÆdsand wind farm studies in Denmark and any outputs from the COWRIE tendered studies in the UK. This is to provide reassurance that the cable shielding and burial depth(s), both between the turbines and along the route to shore, given the sediment type(s) at the Rhyl Flats site are sufficient to ensure that the electromagnetic field generated is negligible. Should this study show that the field strengths associated with the cables are sufficient to have a potentially detrimental effect on electro sensitive species, further biological monitoring to that described in section 5 may be required to further investigate the effect.

6. Marine Fish

(See also licence condition 9.7 in relation to fish populations).

The Environmental Impact Assessment observed electro sensitive species (e.g. Thornback Ray) both within and close to the Rhyl Flats site. In the absence of any evidence that electromagnetic fields do not pose a risk to such organisms, monitoring work is required to determine the numbers and distribution of such species in the vicinity of the Rhyl Flats offshore wind farm (this should include the establishment of a baseline and the use of adequate controls). The survey should make use of non-destructive techniques e.g. live traps and visual methods. The results should be presented and discussed in combination with the EMF studies described in the preceding section (5).

7. Noise and Vibration

(See licence condition 9.6).

Detailed post construction data must be collected on the frequency and magnitude of underwater noise produced by the Rhyl Flats offshore wind farm. The choice of sites for installing monitoring equipment should reflect the different conditions such as sediment type, water depth and pile type. This data is required for a variety of purposes, including:
§ In combination with the biological aspects of the monitoring programme proposed in Annexes 1 and 2, the data would help to elucidate any interactions between noise generation and the provision of new habitat and fish aggregation effects of the turbine support structures.
§ Determining the effects of distance depth and background sources on noise propagation.

8. Cetaceans

The number of cetacean sightings around Great Ormes Head necessitates further monitoring with regards to potential impacts by the Rhyl Flats offshore wind farm. The specification for this monitoring should be agreed with CCW and CEFAS least one month prior to the proposed commencement of the monitoring work. The monitoring must be based on the use of sightings and hydrophones to record the presence of cetaceans on or close to the site and should ensure the collection of adequate baseline data. There is scope to link this monitoring with the noise and vibration and bird studies. This data is required to assess whether a sterile area is created whilst the turbines are in operation (down-time would be used as a control).

---------- This is the end of this Annex ----------