

7.1 INTRODUCTION

This section of the ES presents information on the existing environment pertinent to the offshore wind farm proposal and cable landfall. The primary study area is that affected by the area which will be occupied by the turbines and subsea cables. Certain other information (eg information relating to seabirds, marine mammals, coastal nature conservation sites) is presented for a wider area, where this is considered relevant.

7.2 PHYSICAL ENVIRONMENT

7.2.1 *Climate and Meteorology*

Winds

Wind direction and velocity in the Liverpool Bay area are variable throughout the year, however the prevailing wind is south-westerly and westerly (13% of the time). There is also a south-easterly wind for approximately 10% of the time (Met Office 2000 and Hamilton Oil 2000).

Along the coast of the region, the mean wind speed is approximately 3.5 m s^{-1} (7 knots) for 25% of the time and exceeds 18 m s^{-1} (36 knots or Force 8) for only 0.1% of the time (BGS, 1996). The highest hourly mean wind speeds at Speke (approximately 40km north-east of the proposed wind farm) are 25 m s^{-1} (49 knots) gusting up to 41 m s^{-1} (82 knots) (BHP 2000).

The Clwyd coast is protected from the area's dominant westerly winds but is open to winds from the north-western sector (British Geological Survey 1996).

Probable maximum and minimum air temperatures in Liverpool Bay are 24°C and -4°C respectively (NERC 1998).

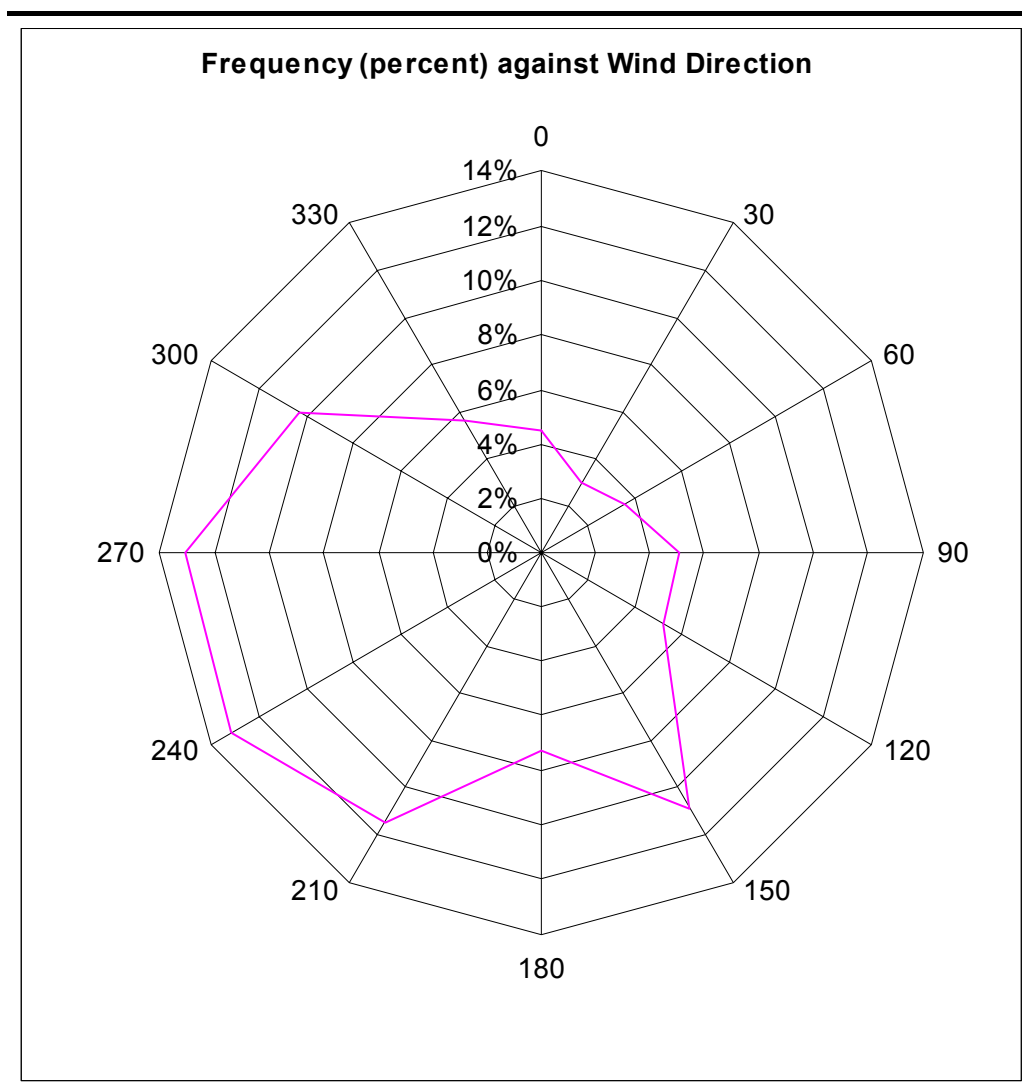
7.2.2 *Oceanography*

Tidal Range

Tidal inflow into the Irish Sea occurs through St. Georges Channel to the south and through the North Channel to the north. Maximum inflow through both channels is approximately simultaneous. To the east of the Isle of Man, tidal flows are deflected eastwards resulting in strong flows throughout the eastern part of the Irish Sea (HR Wallingford 2001). The tidal range also increases from the west to east and the mean spring tidal range in the study area ranges between 7m at Great Ormes Head and 8m at the mouth of the Mersey (British

Geological Society, 1996). The average spring tide at the proposed site is approximately 7.2m (HR Wallingford 2001).

Figure 7.1 *Aggregate Wind Rose for North-Eastern Irish Sea (Source: Met Office 2000 and Hamilton Oil 2000)*



Surges in excess of 2m have been recorded within the study area. The surge interacts with the normal 'tidal cycle' leading to a peak surge normally occurring at high water (HR Wallingford 2001).

Tidal Currents

Tidal currents within the study area are generally rectilinear and the maximum flows on both the flood and ebb tides are on an east to west axis (UK Admiralty 1998). Currents within the study area are generally westwards (ebb) and east-south-east (flood), but with a small tendency for a clockwise rotation through the tide (*Figure 7.2*) (HR Wallingford 2001).

Tidal currents in the region are generally weak in relation to currents elsewhere around the UK coast (not greater than 2m s⁻¹ on mean spring tides)

(British Geological Society, 1996). Mean neap tidal currents are approximately 50% of the spring tidal current (NERC 1998). Nearshore tidal streams flow parallel to the coast with a maximum current speed of between 0.75 and 1m s⁻¹ (HR Wallingford 2001).

Figure 7.2 Peak Flood and Ebb Current Speeds

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Waves

The Irish Sea effectively constitutes a land locked basin and the maximum wave fetch is less than 160km which makes swell in the vicinity of the proposed lease area negligible (HR Wallingford 2001). Wave direction is predominantly west to north-west (HR Wallingford, 2001).

Wave heights are generally less than 1.5m (NERC 1998), however data have been obtained from an offshore Waverider buoy located at Rhyl Flats and inshore pressure sensors have recorded wave heights of over 5m off the coast of Towyn (Conwy Bay) during storm conditions (HR Wallingford 2001).

Table 7.1 shows the long-term offshore average wave climate, wave height versus wave period (HR Wallingford, 2001) expressed as a percentage of the total.

Table 7.1 *Wave Height and Period (expressed as a percentage of the total)*

Wave period (seconds)	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
Wave height (m)									
Up to 1 m	2.0	26.3	23.7	8.7	3.6	-	-	-	-
1 to 2 m	-	-	1.4	5.1	10.4	9.9	1.1	-	-
2 to 3 m	-	-	-	-	0.1	1.4	4.2	0.7	-
3 to 4 m	-	-	-	-	-	-	0.5	0.8	0.1
4 to 5 m	-	-	-	-	-	-	-	-	0.1

The majority of the offshore waves in Colwyn Bay are up to 1 m high and have a period of between 2 and 4 seconds (50%). Approximately 20.3% of waves are between 1 and 2m in height and have a wavelength of between 5 and 7 seconds. Waves greater than 2m occur 7.9% of the time and have wavelengths of between 5 and 10 seconds.

Salinity

The salinity of the eastern Irish Sea decreases eastwards, due to the freshwater inputs from the Mersey, Dee, Clwyd, Ribble and Conwy estuaries. The salinity of coastal waters may fluctuate considerably through the year with variations in river flow (British Geological Survey 1996). Surface salinity is typically 31g l⁻¹ during the winter months and 32g l⁻¹ during the summer months in offshore waters (NERC 1998). Bottom waters show little seasonal variation and are more saline, typically 34g l⁻¹ (BHP Billiton, 2001).

7.2.3

The Seabed

Bathymetry and Seabed Topography

Liverpool Bay is a comparatively shallow basin in the eastern part of the Irish Sea. Depth increases uniformly with distance from the coast and reach approximately 25m near the north-west light buoy (25km from the north-west coast). The sea floor is generally smooth and featureless and is bisected by

two major channels, which are indicative of tidal flow in and out of the Dee and Mersey estuaries.

The proposed lease area is located on the north-eastern edge of Constable Bank which runs in a east-west direction approximately 8 km offshore. The minimum depth of approximately 3 m occurs at the south-western end, with the depth gradually increasing to approximately 21 m at Lowest Astronomical Tide (LAT) at the north-eastern end of the proposed lease area (Fugro UDI 2001). *Figure 7.3* shows the bathymetry of the marine survey area.

The top of the bank is covered with a series of ridges and troughs. The features which strike north-north-west to south-south-east have peak to trough amplitudes of 3 to 5 m and a periodicity of several hundred metres. They are asymmetric with their steep slopes occurring on the easterly side of the ridge, probably indicating they are bedforms. In this region, sand is being transported into Liverpool Bay (Fugro UDI 2001).

Most of the ridges and troughs disappear on the northern flank of Constable bank. This was the only flank to be surveyed. In general, depths increase steadily on the flank, with gradients less than 1 degree (Fugro UDI 2001).

The area of seabed surveyed by Fugro (*Figure 7.3*) can be divided up into three distinct areas as follows:

- An area extending from the western limits of the survey area in a broad band running in an east to west direction to finish in the eastern section of the site is characterised by the presence of defined megaripples, characteristic of medium to coarse sand.
- A relatively small area confined to the northern part of the survey area is characterised by sediment with high reflectivity bearing the characteristics of thin sedimentary beds. A number of boulders are also associated with this area, suggesting the glacial till in the area may have undergone considerable reworking and the boulders are part of this reworked material.
- The eastern and central south parts of the survey area have relatively low reflectivity, cut by a band of higher reflectivity in a north-west to south-east direction. Isolated patches of higher reflectivity occur. A series of steep east facing slopes is present, correlating well with the bathymetry of this area. This area also appears to be composed of a series of long wavelength sandwaves moving over a material of higher reflectivity, probably clay.

Figure 7.3 *Bathymetry of the Proposed Lease Area (from Fugro UDI 2001)*

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A well preserved wreck was noted on the seabed in the south-west corner of the proposed wind farm area (Figure 7.38).

Two corridors (preliminary cable route option) were surveyed between the proposed lease area and the shore (Rhyl and Abergele), as indicated in Figure 7.3. Once on the inshore side of Constable Bank, the depth at first increases to between 7 and 8m, then shoals very gently with undulations of up to one metre to the shore. Close to shore the gradient steepens slightly on the approach to Rhyl and Abergele. The seabed is predominantly composed of sand, patches of more highly reflective material have also been noted (interpreted as gravel). Close inshore sand remains a major component of the seabed although patches of both high and low reflectivity have been noted (interpreted as gravel and mud respectively) (Fugro UDI 2001).

Seabed Geology

Seabed surveys undertaken of the proposed lease area in 2001 identified that in the north-west corner, in water depths less than 15m, bedrock is recognisable in the form of boulders on the seabed. Within much of the remaining survey area, bedrock remains beneath the seabed (varying between approximately 15 to 36m depth) and is generally irregular in nature and thickness (Fugro UDI 2001).

The borehole surveys undertaken within the proposed lease area indicate that the sediment typical profile comprises the following (Fugro UDI 2002):

- sand and gravel (surficial sediments);
- sandy gravely clay (up to about 20m depth); and
- till (a combination of mudstone and siltstone) (down to 30 m depth).

Sediment Distribution

The seabed of Liverpool Bay comprises fine to medium sands (0.2 to 0.4mm) overlying a partly eroded surface of boulder clay (HR Wallingford 1990). This deposit is thought to be the primary source of sediments in the inner part of Liverpool Bay. Localised patches of gravel and sandy gravel occur, particularly off the North Wales coast as well as further offshore (HR Wallingford 2001). Liverpool Bay is characterised by numerous inshore sandbanks located within the 10m depth contour. The nearshore sediments along much of the coast within the wider project area are sandy, apart from the Dee estuary, which is characterised by intertidal mudflats and saltings (HR Wallingford 2001).

Sediment Transport and Seabed Stability

The sediment composition within Liverpool Bay can vary widely within a relatively short distance, however the sediment in Liverpool Bay is predominantly sand with varying amounts of clay within it.

Large volumes of sediment are transported landwards from offshore in suspension. Studies on bedform orientation indicate that bedload transport of sand-sized material occurs in an easterly direction (HR Wallingford 1990). There is a net influx of sand into the Mersey estuary in the order of 2.5 million tonnes per year from the outer part of Liverpool Bay. The overall trend of littoral drift is from east to west along the north Wales and Wirral coasts. To the north the net drift is in a northerly direction (HR Wallingford 2001).

The superficial sediments in the vicinity of the proposed lease area are thought to be mobile. The high tidal current velocities and occasionally significant wave energies (*ie* during storm events) will be sufficient to prevent the accumulation of the finer sediment fractions in many areas. This is supported by the predominance of sand and gravel deposits, as well as the presence of seabed megaripples ⁽¹⁾ and sandwaves ⁽²⁾ over most of the seabed in the area (HR Wallingford 2001).

Particle size analysis undertaken in 2001 (Titan 2002) (*Figure 7.4*) indicates that most of the study area comprises of fine or medium sand, with small percentages of gravel or mud material. Sediments present in the majority of survey area were moderately well to very well sorted, but site 1 (north-west central part of the study area) was distinct, as a very poorly sorted sandy pebble gravel. Sites 11 (centre of proposed lease area), 41, 44 and 47 (preliminary cable route options), exhibited a greater percentage of gravel, and site 44 (nearshore site) was also noted for being the only site composed primarily of coarse and very coarse sand. Only site 50 (nearshore site) had a significant percentage of mud (silts and clays). With the exception of site 1, sands from the eastern part of the proposed lease area were found to be finer than those in the west, where medium sand was more prevalent. Samples from the preliminary cable routes had more heterogeneous sediments.

HR Wallingford (HR 2002) has considered seabed mobility at 6 locations within the proposed lease area using a representative sediment grain size (0.25mm, calculated from the particle size analysis results, Titan 2002) and the results of the tidal model simulation. The HR calculations predict that at all sites, peak tidal ebb and flood flows are capable of mobilising sediment. A range of wave conditions were also analysed by HR. It has been identified that a range of wave conditions (analysed during the HR study) are also capable of mobilising 0.25mm.

(1) Wavelength between 0.3 to 1 m, height 0.05 to 0.2 m (Whitehouse et al 2001)

(2) Wavelength between 30 and 100 m, height 1-2m to 10-15 m (Whitehouse et al 2001)

Figure 7.4 Sediment Particle Size within the Proposed Lease Area

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7.2.4

Subsea Noise

Characteristics of Underwater Noise

For a sound signal to be detected, it must contain sufficient energy to exceed any ambient noise present at frequencies near the signal frequency. The signal to noise ratio (at the receiver) is determined by the source level, the transmission through air or water, the ambient noise level and the sensitivity of the receiver.

Offshore drilling and piling produces underwater noise and the construction activity will require a number of subsidiary activities such as vessel support which will also result in noise.

There is relatively little information concerning noise levels detected for drilling from jack-up rigs. It is likely, however, that noise levels are similar to those measured for drill ships. Hall et al (Richardson et al 1995) reported broadband source levels (10 Hz to 10,000 Hz) during drilling from the *Kulluk* drillship of 191dB re 1 μ Pa-m, based on measurements in 20m water depth. Moore et al (Richardson et al 1995) reported noise generated by driven piling in the region of 105 to 115 dB (50 to 200Hz), one km from the source.

Very few data are available regarding the operational noise of offshore wind farms. Westburg made a series of measurements from the worlds first offshore wind turbine, Svante, off the west coast of Sweden (Vella et al 2001). The main characteristics were the presence of low frequency tones in the narrowband frequency spectra, corresponding to harmonics of the blade passing frequency (approx 2Hz) from the tower. The strongest peak, the 8th harmonic (approx. 16Hz) was at a sound level approximately 20dB above background noise (at a distance approx 100m from the turbine). Assuming attenuation loss of 3dB per doubling of distance from the turbine, the level at 1m from the turbine would be 35-40dB above the ambient noise levels. Assuming ambient noise levels are approximately 80dB re 1 μ Pa (fairly calm sea state), the estimated source level of the turbine is 115-120dB re 1 μ P-1m, which is significantly lower than the anthropogenic noise level in the ocean (Vella et al 2001).

7.2.5

Electromagnetic Fields

Water currents flowing through, as well as fish swimming through, the Earth's magnetic field generate inductive electric fields. These geomagnetic field strengths are between 30 and 50 μ T (Danish Institute for Fisheries Research, 2000).

Cartilaginous fishes (sharks and rays) are known to exploit the electric outputs of organisms in saltwater, to detect their prey. There is evidence to suggest that a number of live mammal strandings may have been correlated with local geomagnetic anomalies or with disruptions in normal patterns of daily

geomagnetic fluctuations, suggesting that cetaceans are capable of sensing geomagnetism (Danish Institute for Fisheries Research 2000).

The installation of offshore wind turbines requires the transport of electricity between turbines and from the turbines to the mainland via submarine cabling which in the process produces electromagnetic fields around the cables. Magnetic fields from cables and turbines and offshore substation may be expected to reach geomagnetic field-strength levels only in the immediate vicinity of the structures, at no more than 1m.

In wind turbines with steel housings, magnetic fields are practically undetectable outside the monopile (Danish Institute for Fisheries Research 2000).

There exists, therefore, the potential for electrosensitive species to detect and respond to the electromagnetic fields produced by offshore power installations.

7.2.6

Coastal Geomorphology

Overview

A description of the coastal geomorphology between Colwyn Bay and Point of Ayr is presented in *Table 7.2*.

Table 7.2 Coastal Geomorphology between Rhos Point and Point of Ayr (from HR Wallingford 2001)

Frontage	Key Features	Coastal Protection Measures
Rhos Point to Penmaen Head (Colwyn Bay)	Wide and flat sandy foreshore. Net drift west to east locally reversed to the south at Rhos Point. Beach levels in western Colwyn Bay are depleted. Further offshore bed levels fluctuate considerably, however total volume of sediment in Colwyn Bay is considered stable.	Beach backed by concrete sea wall and rock berm. Breakwater at Rhos Point restricts sediment supply to Colwyn Bay.
Penmaen Head to River Dulas	Shallow shingle embayment backed by limestone cliffs. Net drift west to east. At Llanddulas, shingle has accumulated into bars and ridges. Beach levels volatile particularly at western end of frontage.	Cliff protected by embankment and rock armour. Between Llanddulas and the River Dulas, groynes and timber/rock armour breastwork protect the beach. Mouth of the river Dulas trained with rock breakwater which directs the main channel seawards.
River Dulas to Pensarn	Characterised by shingle beach and flat sandy foreshore, net drift west to east. At Abergele, a large shingle ridge has accreted but the foreshore has undergone erosion.	Timber groynes and a modest beach nourishment scheme are in place at Abergele.
Pensarn to River Clwyd	Between Pensarn and Towyn, the beach is shingle, becoming progressively sandier towards the River Clwyd. Immediately to east of the River Dulas, beach levels are receding despite the presence of timber groynes. Between Pensarn and Towyn, there are no signs of erosion, however, to the west of Towyn, the beach volumes have dropped.	The majority of the beach is backed by a concrete sea wall. There are a number of Timber groynes to the east of the River Dulas.
River Clwyd to Point of Ayr	The River Clwyd has been deflected onto a north-eastward course due to the sand build up on the west side of the river mouth. Much of the frontage is characterised by a wide sandy foreshore with ridges indicating a pronounced east-west drift. Beach levels at Rhyl generally healthy, however beach levels at Prestatyn are low and foreshore gullied. Extensive sand dune systems at Point of Ayr.	Rhyl frontage protected by concrete sea wall and foreshore at Rhyl and Prestatyn is groyned. Some beach nourishment at Prestatyn.

7.2.7

Flood Defence

In 1990, severe and extensive flooding occurred to parts of Kimmel Bay, Towyn and Pensarn as a result of a breach in the flood defences along this stretch of sea frontage. The 1990 floods affected some 2,681 properties and forced the evacuation of some 3,500 people (Binnie, Black and Veatch 2002).

As a result of this incident, defences along the entire length of coastline have been improved to provide a greater level of flood protection (1 in 200 year still water level (SWL)) over the past 10 years. The defences are currently described as being in good condition. Such improvements cannot, however, remove the inherent risk of flooding affecting developments sited below the level of high tide.

Flood risk studies carried out by Binnie, Black and Veatch (2002) indicate that Abergele, Pensarn, Towyn and Kimmel Bay are all classified as high flood risk areas (having a low probability of flooding but combined with high impact if a flood should occur). This demonstrates the need for the assessment of any action which may influence the probability of flooding.

7.3

ENVIRONMENTAL QUALITY

7.3.1

Water Quality

Many large volume trade effluents discharge into Liverpool Bay concentrated mainly around large industrialised areas of Deeside and Merseyside. There are also a number of sewage effluents discharged into the region including two at Merseyside and four on the Clywd coast adjacent to the proposed lease area. In addition, there are discharges from ships and offshore installations in Liverpool Bay itself.

Water quality sampling carried out within the BHP Billiton Liverpool Bay asset area during 1993/94 indicates that, in general, levels of metals such as copper, nickel, zinc and cadmium were elevated near the sea surface. This is thought to be due to atmospheric inputs from industries on the Liverpool Bay coast (BHP Billiton 2001). In the rest of the water column, concentrations of cadmium, zinc and lead are typical of those found in other coastal regions (BHP Billiton 2001).

Oxygen measurements were taken at a depth of 5 m during the Titan 2001 survey (Titan 2002). The minimum recorded level of oxygen was 91.6%. The majority of the readings indicated oxygen saturation as would be expected in this high energy well mixed environment.

Turbidity measurements were taken at 5m depth (Titan 2002). Turbidity generally ranges between 3 and 27 turbidity units. In general terms, turbidity is greatest at the shallowest sites as expected due to greater wave energy on the seabed at these sites.

Overall bathing water quality in the region is good with 32 out of 37 beaches classified as having good water quality in Liverpool Bay in 2000. The beaches at Prestatyn, Rhyl, Kinnel Bay, Colwyn bay, Llandudno North Shore and Llandudno West shore were consistently rated 'good' between 1997 and 2000. The water quality in Kinnel Bay was classified as excellent in 2000 (BHP Billiton 2001).

7.3.2 *Sediment Quality*

The generally coarse nature of the seabed sediments is reflected in relatively low concentrations of sediment-associated contaminants. This is because coarser sediments have a smaller surface area and therefore a reduced capacity to adsorb contaminants.

During the Titan 2001 marine survey, metal analysis was undertaken at five representative sites across the proposed lease area. The results of the analysis are presented in *Table 7.3*. In general terms, the metal/aluminium ratios for copper, zinc, cadmium, mercury, lead, vanadium, chromium and nickel are well within the guide ranges defined for these substances in sediments by OSPARCOM.

The mercury/aluminium ratio is slightly higher (8.06E-06) than the upper guide limit (6.60E-06) at the most eastern inshore sites. This may be as a result of the fact that these sites are nearer the Clwyd estuary mouth which could be a potential source of contamination.

The iron/aluminium ratio is very high at all sites (2.38E – 4.36E) and is well above the guide levels (1.26E-03). As the rest of the metal/aluminium ratios are more or less within range, it is unlikely that the elevated levels of iron are likely to be due to either geological factors or anthropogenic activities.

Table 7.3 *Metal/Aluminium Ratios for 5 sites within the Rhyl Flats Proposed Lease Area (mg kg⁻¹)(See Figure 7.4 for sampling site locations).*

	Cu	Zn	Cd	Hg	Pb	Va	Cr	Fe	Ni
1	1.38E-03	1.97E-02	1.21E-05	6.43E-06	6.16E-03	8.57E-03	5.38E-03	4.36E+00	2.52E-03
5	8.91E-04	1.25E-02	1.82E-05	6.57E-06	3.27E-03	6.19E-03	4.16E-03	3.69E+00	2.53E-03
13	6.68E-04	1.19E-02	6.73E-06	1.92E-06	2.68E-03	6.20E-03	3.63E-03	3.25E+00	1.98E-03
43	1.03E-03	1.68E-02	1.88E-05	8.06E-06	4.12E-03	6.94E-03	4.09E-03	3.60E+00	1.97E-03
50	1.37E-03	1.15E-02	1.93E-05	1.37E-05	3.55E-03	3.61E-03	3.46E-03	2.38E+00	1.75E-03
*min	2.20E-03	8.80E-03	7.00E-06	3.40E-06	1.80E-03	1.20E-02	9.00E-03	1.20E-04	4.40E-03
*maximum	5.70E-03	1.80E-02	3.00E-05	6.60E-06	4.00E-03	2.20E-02	2.00E-02	1.26E-03	9.10E-03

* Oslo and Paris Convention for the Prevention of Marine Pollution.

7.4 BENTHOS

7.4.1 Sublittoral Benthos

Overview of Benthic Communities in the Eastern Irish Sea

Benthic communities are influenced by a number of different environmental parameters including energy (waves, sediment stability), water depth, sediment type, organic inputs and anthropogenic activities.

The general distributions of such communities in the eastern Irish Sea, , are depicted in *Figure 7.5*.

The deeper waters of Liverpool Bay are dominated by the Deep *Venus* community which occurs in coarse sand/gravel/shell sediments at moderate depths (40 to 100m depth). This community typically includes the urchin *Spatangus purpueus* and bivalves *Glycimeris*, *Astarte sulcata* and *Venus spp* (Mackie et al 1993).

The two dominant benthic community types in shallower water within the vicinity of the proposed lease area are the 'Shallow *Venus*' and 'Abra' communities as follows:

Figure 7.5 *Benthic Habitats in the Eastern Irish Sea (from Mackie et al 1993)*

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- The Shallow *Venus* community occurs in shallow (4 to 40m) nearshore sands and typically comprises the bivalve *Tellina fibula* and the polychaete *Magelona mirabilis* or the bivalve *Spisula elliptica* and polychaete *Nephtys cirrosa*. This community is widely distributed throughout the Irish Sea.
- The *Abra* community occurs as small pockets in shallow (5 to 30m depth) nearshore muddy sands/muds with rich organic contents and typically includes the bivalve mollusc *Abra alba* and polychaete worm *Pectinaria koreni*. This community occurs in small localised patches in embayments throughout the Irish Sea.

Other benthic communities present in the wider area include the following:

- The *Amphiura* community occurs in offshore sandy muds (15 to 100m depth) and typically includes species such as brittle-star *Amphiura filiformes*, urchin *Echinocardium cordatum* and tower shell *Turritella communis*.
- The *Brissopsis* community occurs in offshore muds (15 to 100m depth) and typically includes species such as the urchin *Brissopsis lyrifera* and brittle-star *Amphiura chiajei*.
- The muddy-gravel community is not well quantified in the Irish Sea. Generally the highest diversity and biomass measurements have been recorded from mixed mud-sand-gravel sediments, some of which additionally supported large *Modiolus* (horse-mussel) clumps.
- The *Modiolus* community occurs on coarse sand/gravel/shell/stone sediments at moderate depth (15 to 100m depth) typically including species such as the horse-mussel *Modiolus* and the brittle star *Ophiothrix fragilis*.

The *Amphiura* and *Brissopsis* community types are generally located to the north of the proposed lease area. The muddy-gravel and *Modiolus* communities are observed in the central Irish Sea and to the south-east of the Isle of Man respectively and are not known within the proposed lease area.

There are also areas of hard substrate (*ie* rock, boulders and stones) which may have particular epifauna and may include elements from some soft-bottom communities (Mackie et al 1993).

Existing Survey Data for the North Wales/Liverpool Bay Area

The Marine Nature Conservation Review (MNCR) reports for Sector 10 (Cardigan Bay and North Wales) and Sector 11 (Liverpool Bay and Solway Firth) provide a broad overview of the littoral and sublittoral (nearshore) ecology within and adjacent to the proposed wind farm area. (Brazier et al 1999, Covey 1998).

The seabed of Conwy Bay (approximately 20km to the south-west of the proposed lease area) is characterised by well-sorted sand with varying degrees of mud. Infaunal communities of the cleaner sand found to the north west of Great Ormes Head (resulting from strong tidal streams prevalent at this location) are characterised by polychaetes *Nephtys cirrosa* and *Scolecopsis bonnieri*, amphipods *Bathyporeia guilliamsonia* and robust bivalves *Dosinia lupinus*, *Chamelea gallina* and *Donax vittatus*. In contrast, the sediment to the south side of Great Ormes Head is consistently mudier than the rest of Conwy Bay. Dominant species include polychaete *Lagis koreni* and *Nephtys hombergii* and bivalves *Abra alba* and *Spisula subtruncata*. In the muddier central and western parts of Conwy Bay, the dominant species include polychaetes *S. armingeri*, *Magelona mirabilis* and *Chaetozone setosa*, bivalves *Fabulina fibula* and *Ensis* sp. and brittlestars *Ophiura* sp. (Brazier et al 1999). These communities are broadly consistent with shallow *Venus* and *Abra* communities anticipated at this location (Mackie et al 1993).

The vertical limestone walls of the sea caves located on the steep cliffs of the Ormes are colonised with rock-boring polychaete *Polydora* sp and the piddock *Hiatella arctica*. Amongst these rock boring animals are abundant anemones *Sagartia elegans*, dense patches of *Mytilus edulis* and the ascidian *Polycarpa scuba*. A variety of sponges are also attached to the walls such as *Halichondria panicea*, *Dysidea fragilis* and *Hymeniacidon perleve*. Offshore sediments comprise mobile sands. Constable Bank comprises fine mobile sands and is characterised by *Nephtys cirrosa*, mysids *Gastrosaccus sanctus* and amphipods *Bathyporeia* spp. *L. Conchilega* tubes have also been noted (Brazier et al 1999).

Data for nearshore sites in Colwyn Bay is limited, however available data indicates that communities are dominated by the bivalve *Abra Alba* or the polychaete *Lagis koreni* (Mills 1991). These communities are associated with inshore muddy sediments and do not appear to be reflected further offshore at Constable Bank. No rare benthic species have been recorded in the vicinity of the proposed Rhyl Flats lease area (Rees, Nicholaidou and Laskaridou 1977). The benthos of the Clwyd estuary (at Rhyl) was studied by Parsons and Pugh-Thomas (1979) and is dominated by species tolerant of lower salinities such as the ragworm *Hediste diversicolor*, the bivalves *Macoma baltica* and *Scrobicularia plana* as well as the amphipods *Corophium volutator* and *Gammarus duebeni*.

A benthic survey was undertaken as part of the Lennox Drilling Well EIA (located approximately 50 km to the north-west of the proposed lease area, some 7km offshore)(BHP Petroleum 2000). The survey, undertaken in 1993/94 indicated a fine sand community dominated by bivalves with *Abra alba*, *Donax vitatusi*, *Spisula subtruncata* and *Fabulina fibula*. The crustaceans *Bathyporeia guilliamsoniana* and polychaete *Nephtys cirrosa* were also abundant. In general terms this site has a low species richness and diversity compared with sites further offshore (BHP Petroleum 2000).

Studies undertaken by MAFF in 1992 of dredge disposal sites in the vicinity of the Lennox development (generally further offshore) found that the benthic

community adapted to the increased sedimentation rates with *Pectinaria koreni* (polychaete) and *Abra alba* (mollusc) becoming more abundant.

Further offshore, benthic surveys associated with the Douglas, Hamilton and Hamilton North drilling platforms indicate the presence of offshore coarse sand (shell gravely), offshore fine-coarse sand and offshore fine-medium sand. All the offshore sites had a high species diversity and evenness, with sites at Hamilton and Douglas having high species richness (BHP 2000). Species such as the tube worms *Pomatoceros triqueter*, *Hydroides norvegica*, the ascidian *Dendrodoa grossularia* and brittle star *Amphiura filiformes* have been noted as being abundant.

Benthic Communities at Rhyl Flats

A site-specific benthic survey was undertaken of the proposed lease area and two cable route options by Titan in 2001 (Titan 2002) (Figure 7.6). Although faunal samples were sieved on-site to provide separate 1mm and 0.5mm samples, final analysis was undertaken to the 0.5mm fraction as a high proportion of fauna were retained in the 0.5mm samples. The faunal communities observed were loosely defined and only moderately rich. Much of the infauna was typical of mobile sands and very few epifauna species were identified (Titan 2002).

A gradation of species richness and abundance was observed between the three main faunal groups as follows:

- Group A – *Donax vittatus/Lagis koreni* community. This group comprised six stations from the south-east of the survey area, the closest inshore. Large numbers of bivalve molluscs were found in the samples, especially *Donax vittatus*, *Mysella bidentata*, *Fabulina fibula* and *Spisula subtruncata*, in order of abundance. Polychaete worms were also common including, in order of abundance, *Lagis koreni*, *Pholoe minuta* and *Nephtys cirrosa*. Stations had, on average, approximately 25 taxa and 460 individuals. The sediment was dominated by fine sand. One site also had moderately large proportions of finer material.
- Group B – *Bathyporeia/Nephtys cirrosa* community. The majority of stations (33) comprised fauna dominated by amphipod crustaceans *Bathyporeia elegans* and *Bathyporeia guilliamsonia*. This type also included moderate numbers of polychaete worms *Nephtys cirrosa*, *Cirriformia tentaculata* and *Hesionura elongata* and the bivalve *Donax vittatus*. This group comprised fewer taxa and fewer individuals than Group A. Fine sand dominated the sediment of Group B samples. Medium sand was also important at some sites in the group.
- Group C – *Urothoe elegans* community. The fauna of Group C (six sample sites) was rich with an average of 55 taxa and 454 individuals. The dominant macro-invertebrate species were the amphipod crustaceans *Corophium sextone* and *Urothoe elegans* and the bivalves *Abra alba* and *Mysella bidentata*. The

amphipods *Corrophium sextone* and *C. bonellii*, however were only observed in large numbers at one site.

- X - Unassigned samples. One sample (Station 44, in the south-east) was dominated with nematode worms and the small polychaete *Microphthalamus*. The sediment at this station was significantly different from that of other sites, with higher proportions of coarse material.

For the purpose of JNCC biotope classification, all communities identified are known as IGS.FaS of the shallow sand faunal communities complex. The majority of the survey area was fairly typical of the biotope IGS.NcirBat or *Nephtys cirrosa* and *Bathyporeia spp.* in infralittoral sand (Group B). The communities identified are broadly consistent with the communities identified through the MNCR surveys described for Constable bank in the previous section. These communities, however are distinctly different to the bivalve *Abra Alba* and polychaete *Lagis koreni* dominated communities associated with muddier sediments nearer shore in Colwyn Bay (Mills 1991).

The communities described appear broadly similar to the communities identified at the Lennox drilling site (approximately the same distance offshore some 50km to the north east).

7.4.2 *Intertidal Benthos*

Colwyn Bay

The shores of Colwyn Bay (to the south of the proposed lease area) are typically uniform, with predominantly sandy beaches interrupted only occasionally by small areas of boulders. The boulders are extensively scoured by the surrounding sediments and typically support sparse communities of barnacles (*Balanus* and *Semibalanus*) and limpets (*Patella spp*) in the most scoured areas (Covey 1998).

Communities of the mussel *Mytilus edulis* and green alga *Enteromorpha sp.* occur where there is increased stability such as rock outcrops or shelter from scouring (Covey 1998).

The sandy beaches of the area generally consist of mobile, fine sands with sparse communities of burrowing amphipods and polychaetes including lugworm (*Arenicola marina*) and *Scololepis squamata* in the most exposed areas (Covey 1998). In sediment adjacent to the boulder areas there are dense populations of sand mason worm *Lanice conchilega* (Covey 1998, Mills1991, pers com Gabrielle Wyn CCW 2001). These communities are generally typical of moderately exposed to sheltered conditions rocky and sandy shores and are represented at other locations in Liverpool Bay including the Dee and Mersey Estuaries and in Morecambe Bay (Covey 1998, pers com Gabrielle Wyn CCW 2001).

Figure 7.6 Benthic Survey Sampling Sites

INSERT A4 FIGURE

Cable Landfall

An area approximately 250m either side of the proposed cable landfall (SH 965 800) were surveyed during winter 2001/02 (see *Annex E*). Due to the overall timing of the studies, surveys were not conducted at low water springs. However, due to the noted uniformity of the area this is not considered significant.

At the western cable landfall, the breakwater community appeared to be less diverse and possibly younger. The dominant species were *Enteromorpha* sp. with a low density of *Fucus* sp. Barnacles, *Porphyra*, rough periwinkle *Littorina saxatilis*, small periwinkle *Littorina neritoides* were also present.

A small area (approximately 30m x 20m) of shingle/pebble/sand sparse dune grassland community occurred immediately to the west of the western cable landfall route (SH 965 796). Species included scentless mayweed *Tripleurospermum maritimum*, yellow horned-poppy *Glaucium flavum*, buck's-horn plantain *Plantago coronopus*, curled dock *Rumex crispus*, sea beet *Beta vulgaris* with sparse clumps of marram grass *Ammophila arenaria*.

An intertidal survey was undertaken approximately 2000m to the east of the eastern cable landfall by the Countryside Council for Wales in 1990. Upper, mid and lower shore communities are presented in *Table 7.4*. The survey results are in accordance with other CCW survey observations for the area (Mills 1991). No species of international value were recorded.

Table 7.4 *CCW Survey*

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7.5 FISH

7.5.1 Overview

In addition to the offshore areas of the Irish Sea, Liverpool Bay has a great variety of coastal and estuarine habitats, including large tidal bays, resulting in a particularly rich and well studied fish fauna. There are 130 exploited and unexploited fish species which have been recorded in the area comprising; 2 jawless fish (Agnatha), 22 sharks and rays (Elasmobranchs) and 106 bony fish (Teleosts) (Potts & Swabey 1996).

The common skate (*Raja batis*) is recently said to be extinct in Welsh waters due to overfishing (Gill and Taylor 2001) being confined to coastal waters off Scotland and Ireland. It is a UK Biodiversity Action Plan species and the IUCN status is Endangered on a global scale (but Critically Endangered for inshore Populations).

The thornback ray (*Raja clavata*) is common in inshore sandy and gravel habitats in British waters, most of the year, however is seriously declining in Welsh waters due to overfishing, especially in the case of juveniles (Gill and Taylor 2001).

The cuckoo ray (*Raja naevus*) can be found on all types of substrata in British waters, however prefers the North Sea to the Irish Sea. The spotted ray (*Raja montagui*) is more common to waters off the south coast but is occasionally found in Welsh waters. The sting ray (*Dasyatis pastinaca*) is common off the south coast in summer favouring mud or sandy bottom habitats including sheltered estuaries.

Table 7.5 list some common species encountered in Liverpool Bay.

7.5.2 Spawning and Nursery Areas

Liverpool Bay is utilised by a number of sea fish species throughout the year as a spawning and nursery area. Figure 7.7 illustrates the main spawning areas and species within the bay. It can be seen that a number of species spawn directly within, or very close to, the proposed lease area ie Sprat (*Sprattus sprattus*), sole (*Solea Solea*), plaice (*Pleuronectes platessa*) and whiting (*Merlangius merlangus*). Other species which spawn further away from the proposed lease area, but still within Liverpool Bay, include herring (*Clupea harengus*), cod (*Gadus morhua*), lemon sole (*Microstomas kitt*) and shrimp *Nephrops* (Coull *et al*, 1998).

The most widespread spawning species within the bay is sprat (*Sprattus sprattus*) and its main egg and larval area of distribution covers the whole region. Juvenile sprat are often found mixed with young herring in inshore areas, when they are known as whitebait.

Table 7.5 *Some Common Fish Species Recorded from Liverpool Bay*

Common Name	Scientific Name
Lesser spotted dogfish	<i>Scyliorhinus canicula</i>
Tope	<i>Galeorhinus galeus</i>
Monkfish, angel shark	<i>Squatina squatina</i>
Skate	<i>Raja batis</i>
Thornback ray	<i>Raja clavata</i>
Spotted ray	<i>Raja montagui</i>
Cuckoo ray	<i>Raja naevus</i>
Sting ray	<i>Dasyatis pastinaca</i>
Eel	<i>Anguilla anguilla</i>
Conger eel	<i>Conger conger</i>
Herring	<i>Clupea harengus</i>
Sprat	<i>Sprattus sprattus</i>
Argentine	<i>Argentina sphyraena</i>
Angler	<i>Lophius piscatorius</i>
Five-bearded rockling	<i>Ciliata mustela</i>
Three-bearded rockling	<i>Gaidropsarus vulgaris</i>
Cod	<i>Gadus morhua</i>
Haddock	<i>Malanogrammus aeglefinus</i>
Ling	<i>Molva molva</i>
Whiting	<i>Merlangius merlangus</i>
Bib	<i>Trisopterus luscus</i>
Poor Cod	<i>Trisopterus minutus</i>
Gar fish	<i>Belone belone</i>
John Dory	<i>Zeus faber</i>
Greater pipefish	<i>Syngnathus acus</i>
Nilsson's pipefish	<i>Syngnathus rostellatus</i>
Red gurnard	<i>Aspitrigla cuculus</i>
Grey gurnard	<i>Eutrigla gurnardus</i>
Sea scorpion	<i>Taurulus bubalis</i>
Lumpsucker	<i>Cyclopterus lumpus</i>
Sea snail	<i>Liparis liparis</i>
Bass	<i>Dicentrarchus labrax</i>
Thin-lipped grey mullet	<i>Liza ramada</i>
Goldsinny	<i>Ctenolabrus rupestris</i>
Lesser weever	<i>Echiichthys vipera</i>
Dragonet	<i>Callionymus lyra</i>
Sand goby	<i>Pomatoschistus minutus</i>
Mackerel	<i>Scomber scombrus</i>
Turbot	<i>Scophthalmus maximus</i>
Brill	<i>Scophthalmus rhombus</i>
Common topknot	<i>Zeugopterus punctatus</i>
Witch	<i>Glyptocephalus synoglossus</i>
Dab	<i>Limanda limanda</i>
Flounder	<i>Pleuronectes flesus</i>
Plaice	<i>Pleuronectes platessa</i>
Solenette	<i>Buglossidium luteum</i>
Thickback sole	<i>Microchirus variegatus</i>
Dover sole	<i>Solea solea</i>

(Nomenclature according to Wheeler 1992)

Figure 7.7 Fish Spawning and Nursery Areas in Liverpool Bay

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7.5.3

Overwintering Grounds and Migration Routes

Flounders (*Platichthys flesus*) migrate from inshore, estuarine and even riverine nursery areas all along the coast of Liverpool bay to spawn up to 50 km offshore in late winter. With the exception of this migration there appears to be little coastal movement of Flounders other than in the egg or larval phase.

Bass (*Dicentrarchus labrax*) and grey mullet (*Liza, Cranimugil spp*) are seasonally abundant inshore and in estuaries in the region (including the Dee). Both species migrate south-west along the coastline in the autumn to over-wintering areas, before moving offshore to spawn then returning north to feeding grounds in the spring (Pawson and Robson 1996).

Atlantic salmon (*Salmo salar*), sea trout (*S. trutta*) and eels (*Anguilla anguilla*) are diadromous fish which migrate between freshwater and the sea. Salmon, sea trout and eels are present in the majority of rivers and coastal areas of Liverpool Bay (including the River Clwyd) and are also present in the smaller streams and rivers of the Isle of Man. The distribution of these species is regulated by natural factors such as river levels, by man-made barriers such as dams, which would limit the extent to which they can migrate upstream and by pollution levels.

7.6

MARINE MAMMALS

7.6.1

Cetaceans

The coastal waters of Liverpool Bay are relatively unimportant for cetaceans in the context of other UK coastal shelf (UKCS) waters. Only three species of cetacean occur regularly within Liverpool Bay throughout the year as follows:

- harbour porpoise *Phocoena phocoena*;
- bottlenose dolphin *Tursiops truncatus*; and
- common dolphin *Delphinus delphis*.

The harbour porpoise and bottlenose dolphin are the most frequent visitors nearshore (particularly during the summer months). Both species have been sighted off Great Ormes Head to the south-west of the proposed lease area although neither are considered common in this area (CCW and Seawatch 2001). Both these species are listed on Annex II of the Council Directive 92/43 EEC of May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, as species whose conservation requires the designation of Special Areas of Conservation (SACs) (Section 4.3.6). The most common species offshore is the common dolphin (Evans 1996) which has recently been sighted in Colwyn Bay during 2001 (CCW and Seawatch 2001).

In the central and western parts of the Irish Sea, Risso's dolphin (*Grampus griseus*) occurs during the summer months (Evans 1996). Other species that have been recorded in the Irish Sea are listed below, however these are

unlikely to be encountered in the vicinity of the proposed lease area (CCW and Seawatch 2001, Evans 1996):

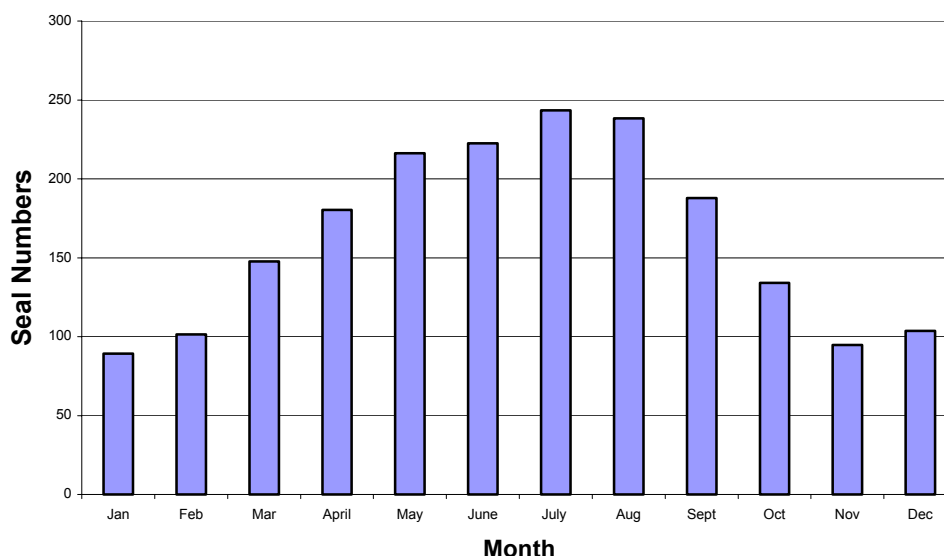
- minke whale *Balaenoptera acutorostrata*;
- fin whale *Balaenoptera physalus*;
- sei whale *Balaenoptera borealis*;
- sperm whale *Physeter macrocephalus*;
- northern bottlenose whale *Hyperoodon ampullatus*;
- white beaked dolphin *Lagenorhynchus albirostris*;
- striped dolphin *Stenella coeruleoalba*;
- killer whale *Orcinus orca*;
- white-sided dolphin *Lagenorhynchus acutus*; and
- long-finned pilot whale *Globicephala melas*.

7.6.2 Seals

Liverpool Bay is relatively unimportant for common seals (*Phoca vitulina*) or grey seals (*Halichoerus grypus*) in the context of the UKCS. Both common seals and grey seals are listed in Annex II of the EC Habitats Directive (92/43 EEC).

There are a number of important localities within Liverpool Bay which act as pup hauls including Puffin Island (off Anglesey) and West Hoyle Bank located at the mouth of the River Dee (approximately 20 km to the east of the proposed lease area) (Duck 1996).

Figure 7.8 Average monthly Peak Numbers of Grey Seals at West Hoyle Bank (1984-1995)



Data compiled from the Hilbre Bird Observatory reports (1984 - 1995) (Figure 7.8) for grey seals (*Halichoerus grypus*) indicate that numbers vary between about 100 sightings during each of the winter months and peak sightings of up to 250 individuals during July and August at West Hoyle Bank. As

significant numbers of grey seals are frequently observed at this location, West Hoyle Bank is considered of local importance.

Currently no data are available for common seals. There are no seal pupping sites in the immediate vicinity of the proposed Rhyl Flats lease area.

7.7 **ORNITHOLOGY**

There are a large number of coastal conservation sites in the Liverpool Bay area. The main sites of international and national interest in the vicinity of the proposed lease area and cable route options are shown in *Error! Reference source not found.* and *Error! Reference source not found.*

7.7.1 **Baseline Situation**

General Context and Species of Note

The Northern Irish Sea ⁽¹⁾ is important for a number of seabird and waterfowl species that occur in internationally and nationally important numbers ⁽²⁾ (Barne *et al*, 1996). Many designated sites are associated with important bird species (see *Table 7.6*). Several species are listed on *Annex I* of the *Birds Directive, Schedule 1* of the *Wildlife and Countryside Act, 1981* and amendments and/or are Red List species (see *Annex G*).

Consultations identified the need to consider the effects of the proposals on bird species including those within designated sites of nature conservation value. Particular emphasis was placed upon those species that may form part of the qualifying interest for a future designation of a marine SPA in Liverpool Bay including:

- divers (especially red-throated diver);
- cormorant;
- common scoter; and
- tern species.

(1) As defined in Barne *et al* (1996).

(2) $\geq 1\%$ of the national or European populations of a species.

Figure 7.9

Designated sites (A3 - KXS)

Table 7.6

Insert Table 7.6 Page 1

Insert Table 7.6 Page 2

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With the exception of common scoter, which feeds on benthos, the remainder are fish eaters and reference has been made to the baseline sections on fish species and populations (see *Section 7.5*). The benthic food resource of common scoter is more static and reference is made to the findings of benthic surveys (see *Section 7.4*). The distribution of common scoter is known to be influenced by a number of factors and given that this is likely to be the key qualifying interest species of a future marine SPA, the distribution of this species is considered in some detail.

This assessment also focuses on the likely effects on species such as great-crested grebe (nationally important numbers of moulting birds), shag, red-breasted merganser, kittiwake, guillemot and razorbill which are known in considerable numbers from the area and hence these are considered in some detail also in the baseline.

The following section sets out the existing use of the study area and is based on information gathered from surveys, from existing information and from consultations (see *Section 6.6*). It is split into two parts as follows:

- passage and wintering birds;
- breeding birds.

Passage and Wintering Birds

A range of seabird species is known to occur in the waters off the North Wales coast including the study area, during the passage and winter periods and a list of relevant records from existing survey data is contained in *Annex G*.

Several bird species are known to occur in internationally, or nationally, important numbers including in particular red-throated diver, cormorant and common scoter. Concentrations of great crested grebe and red-breasted merganser are known from areas to the west the study area (see *Table 7.7*). The distribution of each of these species is considered in the following sections.

- Red-throated diver occurs offshore as a passage migrant and winter visitor to the area with a peak in numbers in March (*pers com* John Clarke, 2002) and there are regular sightings every year including off Gronant, Rhos Point, Rhyl and Llanddulas (see local bird reports ⁽¹⁾). Divers were recorded also during the aerial bird surveys for CCW in 2000/2001 (Oliver *et al*, 2001). Data from Stone *et al* (1995) ⁽²⁾ show wintering divers in the area of the wind farm, although on average the density was less than 1 bird per km².

The November 2001 aerial surveys recorded numbers of divers ⁽³⁾ in the study area in nationally important levels (see *Table 7.6*). In general the data from the 2001/2002 aerial surveys shows that divers are present in extremely low

(1) Clwyd Bird Reports 1989 - 1999, Clwyd Bird Recording Group.

(2) Transects used in collecting this data are contained in *Annex G*.

(3) The majority were probably red-throated divers.

densities and scattered throughout the study area ⁽¹⁾. Birds were recorded generally well offshore, but not in the deepest waters especially deeper than 25 metres, and several were recorded on the wind farm site (see *Figures 7.10 – 7.12* and Fox & Petersen, 2002b). Statistical analyses of these data indicate that wintering divers do not show any preference for the wind farm site compared with the rest of the study area (see *Table G4.1 in Annex G* and *Section 6.5.3*).

Table 7.7 *Numbers of Birds Recorded During November 2001 - January 2002 in the North Wales Aerial Surveys of Offshore Birds in the Study Area*(Source: Fox & Petersen, 2002b)

Species ⁽²⁾	November 2001	December 2001	January 2002
Diver spp	46	13	33
Red-throated Diver	14	5	3
Grebe spp	1	-	1
Fulmar	6	39	20
Gannet	52	-	-
Cormorant/Shag	10	3	8
Shag	-	-	16
Cormorant	338	182	69
Eider	-	2	-
Common Scoter	2758	6127	6058
Velvet Scoter	-	-	10
Goosander	3	11	4
Bar-tailed Godwit	-	-	30
Dunlin	-	-	725
Small wader	-	-	500
Arctic Skua	1	-	-
Common Gull	15	1	-
Herring Gull	56	53	28
Lesser Black-backed Gull	15	2	4
Great Black-backed Gull	51	30	9
Black-headed Gull	9	17	8
Kittiwake	148	53	31
Gull spp	176	719	838
Auk spp	131	268	262

(1) Threshold for nationally importance is low (50 birds) (see Musgrove *et al*, 2001).

(2) It was not always possible to differentiate between species during the survey due to the distance, angle of the sun etc. In such cases, birds have been recorded as spp, or small wader.

Figure 7.10 *Distribution of Divers from Aerial Surveys (November 2001 to January 2002)*
(Source: Fox & Petersen, 2002b)

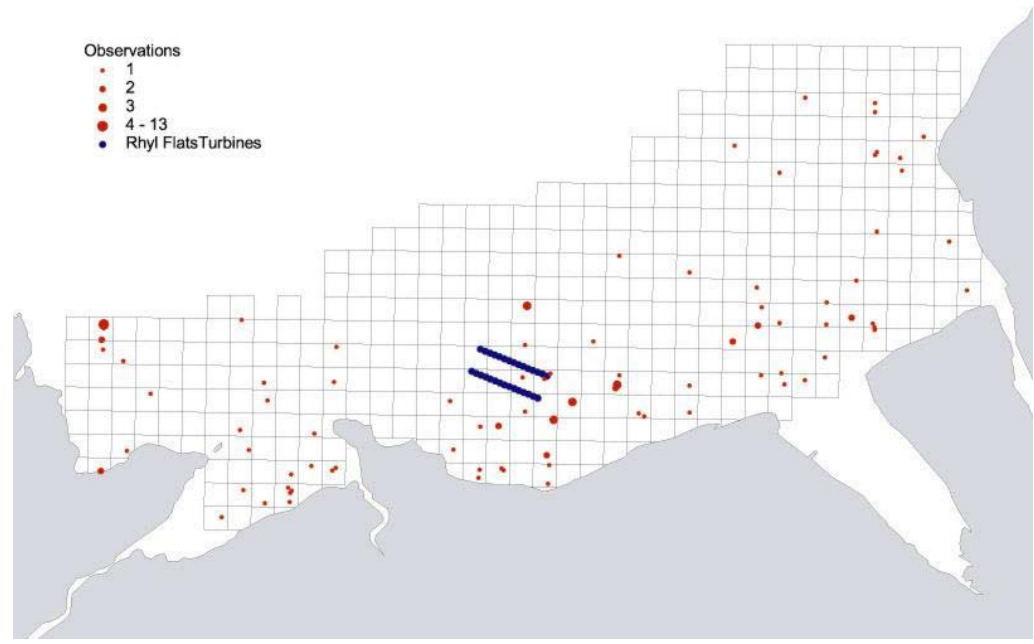


Figure 7.11 *Relative Density of Divers from Aerial Surveys (November 2001 to January 2002)*
(Source: Fox & Petersen, 2002b)

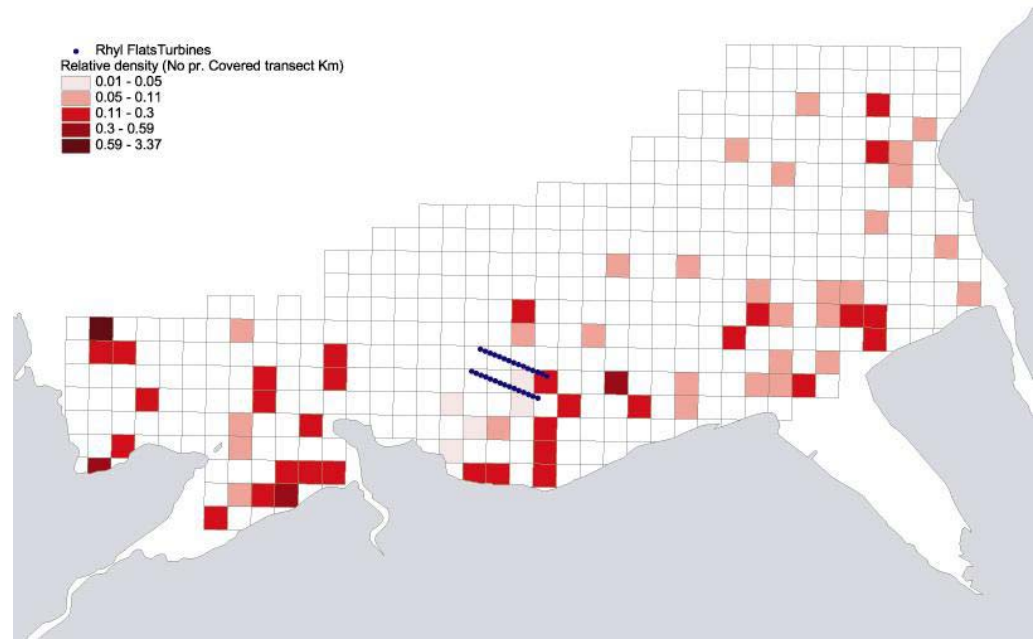
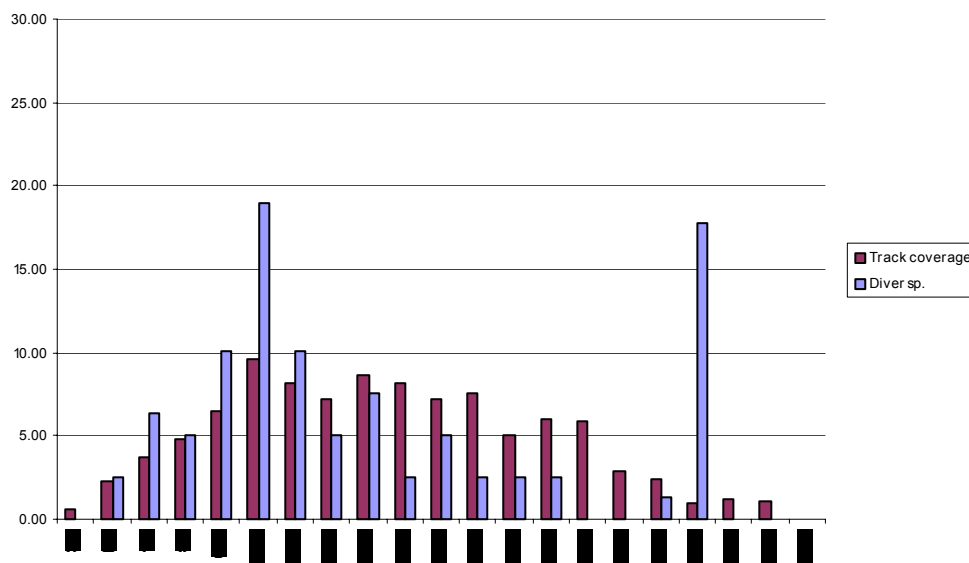


Figure 7.12 *Percentage Frequency of Diver Distribution with Varying Water Depth (in 2 metre intervals) from Aerial Surveys (November 2001 to January 2002)*
(Source: Fox & Petersen, 2002b)



Red-throated divers were recorded also during the boat surveys. Single, or small groups, of divers were recorded in the wind farm area, with up to six birds on the water during one point count on 3 March 2002 (see findings of boat surveys in *Annex G*). However, the majority of birds were recorded in flight especially across inshore waters in Colwyn Bay.

- Cormorant is known to occur in high densities in Liverpool Bay over the winter months (see *Figure G2.5, Annex G*) and Stone *et al*, 1995), although the WeBS counts show peak numbers in autumn (possibly reflecting increases in the population through recruitment of young birds). They are relatively evenly distributed along the coast, although the greatest concentrations are found in the Dee Estuary (see *Figure G2.4, Annex G*) and there are nationally important numbers also on the Clwyd Estuary (five-year mean peak count of 132). Data from WeBS counts⁽¹⁾ shows that peak numbers of cormorants within the study area have increased significantly over time, from about 200–300 in the 1980s up to a current peak of 500–600 (see *Figure G2.2, Annex G*). This increase reflects the changes that have occurred nationally (Musgrove *et al*, 2001).

Cormorant ⁽²⁾ was recorded in nationally important numbers in the study area by the 2001/2002 winter aerial surveys (see *Table 7.7* above). An estimate of the likely numbers in the areas surveyed was made for the survey visits where the encounter rate was sufficient to allow reliable estimates to be made (see *Table 7.8* and *Section 6.6*).

(1) WeBS counts do not provide comprehensive coverage of marine waterfowl species which are often present at distances which are not visible from land. They do, however, indicate minimum numbers present in inshore waters and provide information on distribution along the coast and seasonal variations.

(2) Cormorant and shag species were considered together in the analysis due to the difficulties which can occur in distinguishing the two species during surveys.

Table 7.8 *Estimated Number of Offshore Birds Present During Five Aerial Surveys During The Period November 2001 - January 2002 (Source: Fox & Petersen, 2002b) (Birds in brackets are additional birds recorded in flight and are not included in the distance sampling analysis)*

Species	3 Nov 2001	7 Dec 2001	17 Dec 2001	15 Jan 2002	16 Jan 2002
Cormorant	N/A	216 (119)	N/A	N/A	N/A
Common	7858	3812	7953	5570	7858
Scoter	(615)	(302)	(785)	(16)	(3345)
Kittiwake	N/A	N/A	134	170	45
Auk spp	604	227	1225	578 (160)	528 (36)

The 2001/2002 aerial survey data show that cormorant/shag were associated with the coast (within 6km), with concentrations particularly off Merseyside and the Wirral and few records in the wind farm area (see Figures 7.13 - 7.15). Statistical analyses of the available data indicate that wintering cormorant/shag show a significant avoidance of the wind farm site compared with other parts of the study area (see Table G4.1 in Annex G and Section 6.6), perhaps illustrating their preference for shallower waters.

Figure 7.13 *Distribution of Cormorant/Shag from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*

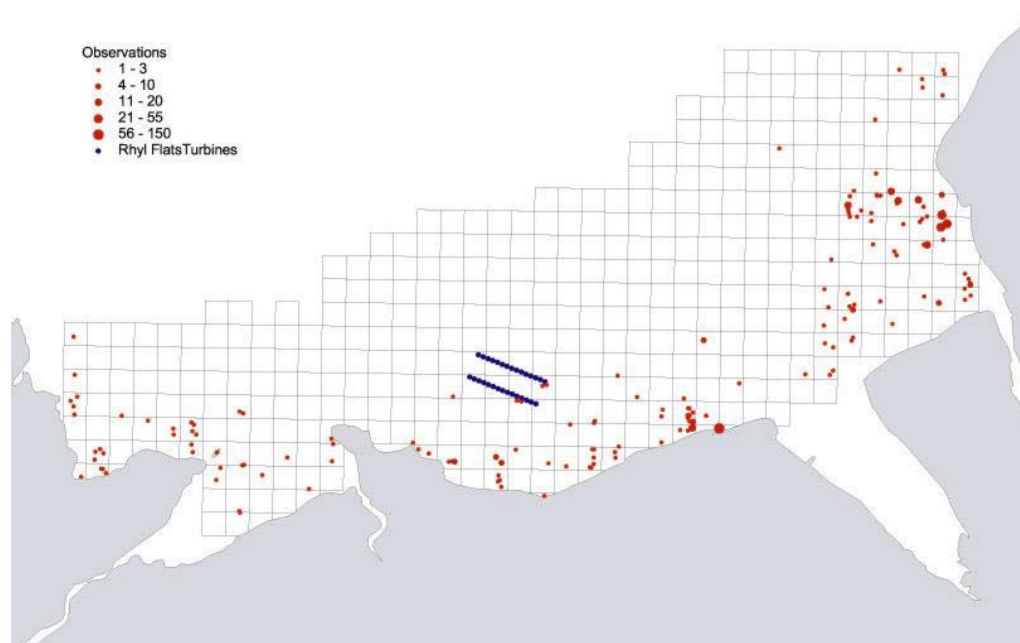


Figure 7.14 Relative Density of Cormorant/Shag from Aerial Surveys (November 2001 to January 2002b)

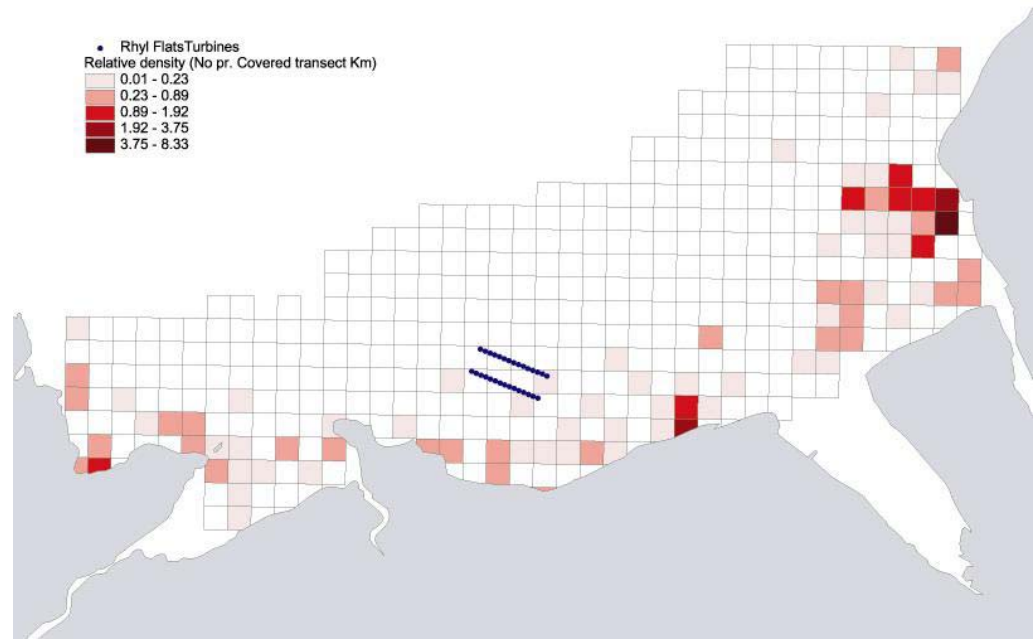
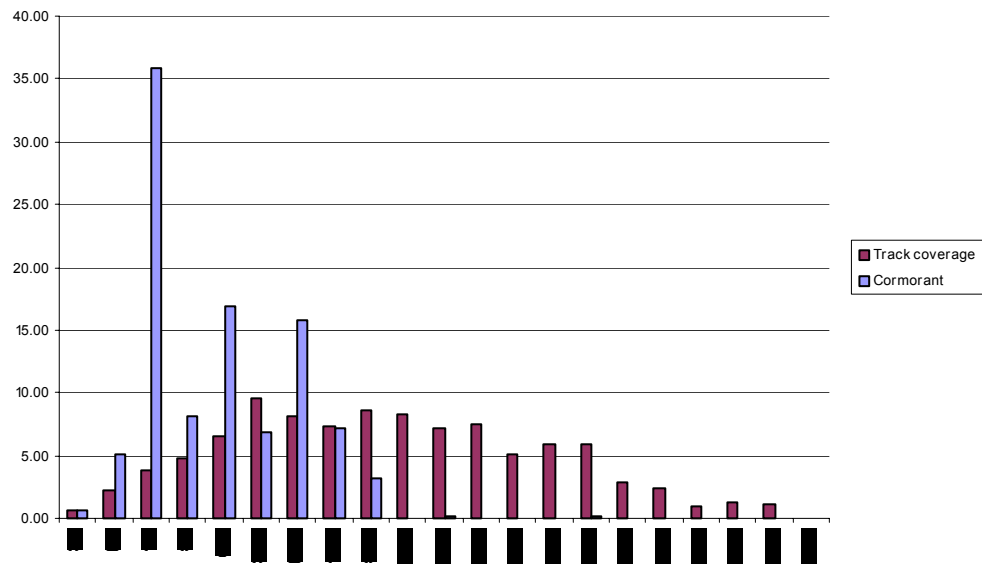


Figure 7.15 Percentage Frequency of Cormorant/Shag Distribution with Varying Water Depth (in 2 metre intervals) from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)



- Common scoter is a regular winter visitor to the waters off the North Wales coast of Liverpool Bay with records of up to 10,000 birds off Llanddulas in mid March 1995 (see Figure G2.3 and local bird reports ⁽¹⁾). Their continued presence in the study area was confirmed by an aerial survey undertaken for CCW in the winter of 2000/2001 (Oliver *et al*, 2001), although as discussed in

(1) Clwyd Bird Reports 1989 - 1999, Clwyd Bird Recording Group.

Section 6.6, the precise numbers and distribution of the birds shown in the report are considered to have been influenced by the survey methodology (which is likely to have displaced birds, increasing the risk of birds being missed or double counted ⁽¹⁾).

It is a species that typically occurs in waters relatively close to land in the winter months and in highest densities between January and April (Stone *et al*, 1995 ⁽²⁾ (also see Table G2.5 in Annex G); Kirby *et al*, 1993; WeBS counts (see Annex G); local bird reports). The WeBS data suggests that peak numbers occur generally in December, although it is uncertain how many birds were further offshore beyond the limit of visibility ⁽³⁾. Given the limitations of the 2000/2001 aerial surveys and land and boat based surveys in recording common scoter, emphasis in this baseline section has been placed on the findings of the 2001/2002 aerial surveys between November 2001 and January 2002. The data show that the numbers of birds recorded increased between November and December 2001, but then remained relatively stable into January 2002 (see Table 7.8 above). Population estimates for the survey dates in the areas surveyed are given in Table 7.8 (see above) and suggest that a minimum 8,000 common scoter are present in the study area during the winter.

The WeBS data that covers inshore waters only indicates a main concentration in Colwyn Bay, an area that, with the exception of common scoter (five-year mean peak count of 1395, see WeBS information in Annex G), generally supports only small numbers of waterfowl, but also Conwy Bay, Red Wharf Bay/ Traeth Coch ⁽⁴⁾ and to the east off the Clwyd Estuary ⁽⁵⁾ (see Annex G). Statistical analyses of the available aerial survey data indicated that common scoter show a significant avoidance of the wind farm site and an area of up to 2km surrounding it. Data from Stone *et al* (1995) suggest that common scoter occurred in densities of up to 5 birds per km² in the area of the wind farm in the winter months ⁽⁶⁾. Data from the first three of this winter's aerial surveys, identified clear concentrations of common scoter out to about 7km offshore at the mouth of the Menai straits, west of Great Ormes Head, in Colwyn Bay, off Prestatyn, off the Wirral and off the Formby coast (see Figures 7.16 and 7.17 and Fox & Petersen, 2002b).

(1) The conclusion of a review of the methodology by the Department of Coastal Zone Ecology, National Environmental Research Institute (NERI), Denmark (Fox, Petersen & Clausager, 2001).

(2) JNCC data have been recorded by grid square (of size 15' latitude by 30' longitude) but do provide some indication of the relative importance of areas, although they are relatively coarse in relation to the wind farm site.

(3) Probably no more than 4km offshore.

(4) WeBS five-year mean peak count of 293 in this area.

(5) WeBS five-year mean peak count of 1401 in this area.

(6) This is consistent with data observed from the aerial survey

Figure 7.16 *Distribution of Common Scoter from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*

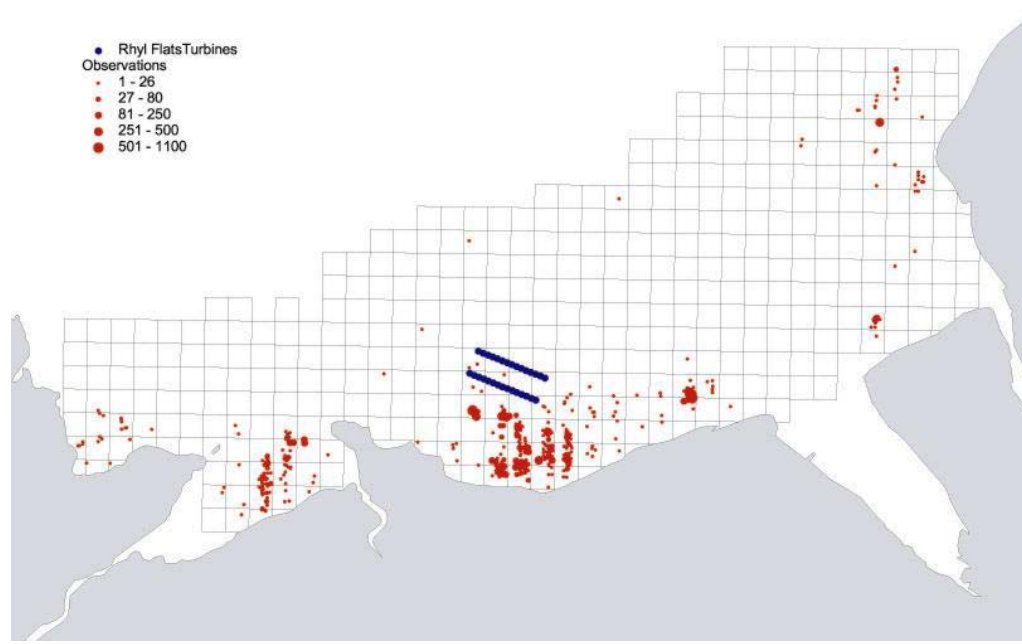
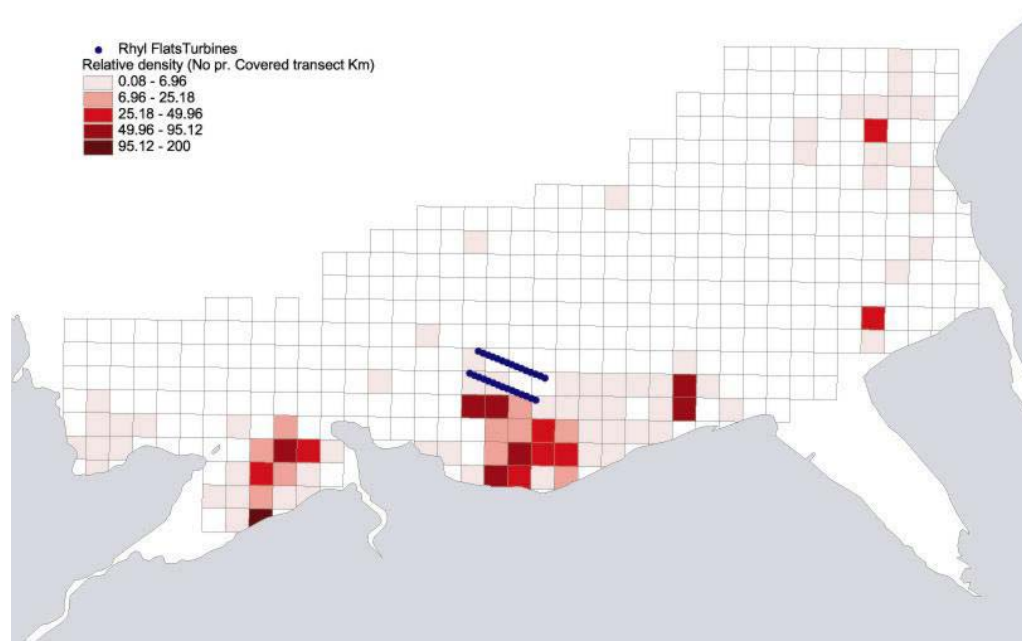


Figure 7.17 *Relative Density of Common Scoter from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*



A number of factors are known to influence the distribution of common scoter in coastal waters (see Fox & Petersen, 2002b) including:

- extent and availability of food with a preference for bivalve molluscs ⁽¹⁾ of a suitable shell size class ⁽²⁾ and those which live in sandy substrates;
- water depth as most observations of scoter indicate they dive in waters between 2 and 20 metres deep, with some studies recording deeper dives as the winter progresses (suggesting local food depletion);
- water current with lower water currents being favoured as strong currents will increase the sediment levels in the water and reduce the stability of the seabed sediments, both of which are likely to affect filter feeding bivalves and increase the energy costs of birds in trying to reach them; and
- a preference for low levels of disturbance.

The following sections consider the distribution of common scoter in the study area based on the data from the 2001/2002 aerial surveys and the extent to which their distribution in the Rhyl Flats project study area is influenced by the factors listed above.

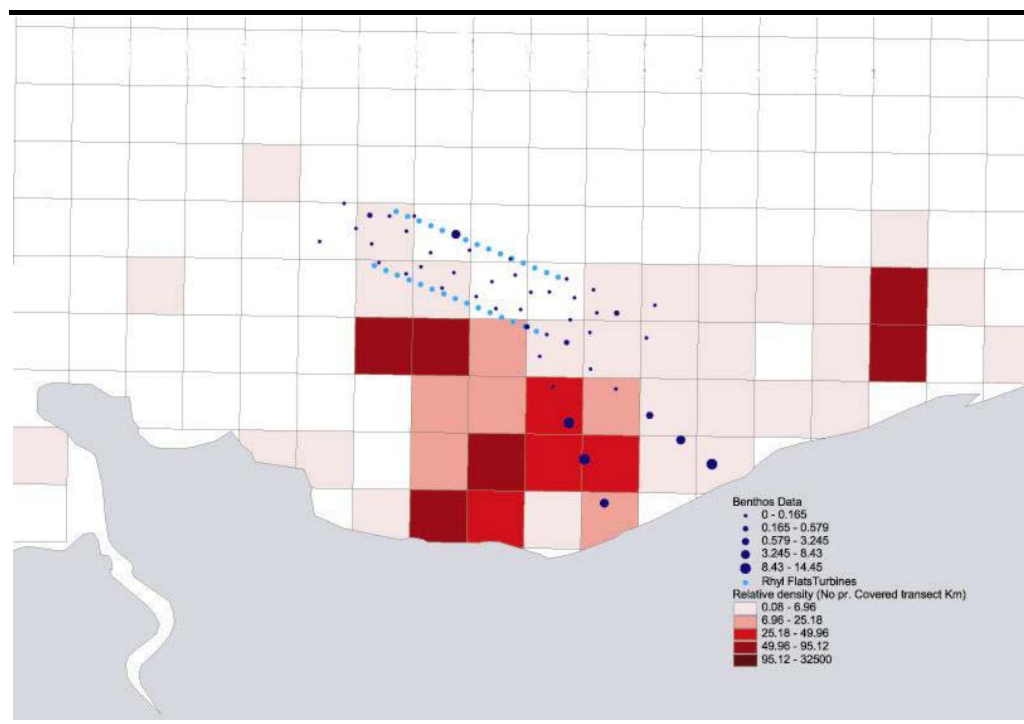
- The two dominant benthic communities in the shallower water in the study area both support bivalve species and polychaete worms (see *Section 7.4*). These communities are the *Venus* community that occurs widely in nearshore sands throughout the Irish Sea, and the *Abra* community that occurs in localised patches in nearshore muddy/sands and muds throughout the Irish Sea (see *Figure 7.6* and *Section 7.4.2*). More detailed benthic samples taken from within the project area by Titan for ERM do, however, show distinct differences in the bivalve densities present. Those taken from the central and south eastern ends of the sub-sea cable routes (linking the wind farm site to the shore) contained the highest bivalve biomass of any of the samples taken in the area (in the *Donax vittatus* / *Lagis koreni* communities) and included bivalve species that are frequently encountered in the diet of common scoter (see *Figure 7.18*; Fox & Petersen, 2002b and *Section 7.4*). These areas also comprised fine sand sediments and coincided with the areas where the aerial surveys recorded concentrations of common scoter. In comparison the samples from the remainder of the project area contained very low bivalve biomass and low infauna ⁽³⁾ biomass generally, although most showed the sediments to be dominated by fine sands (see *Section 7.4*). This does suggest that the extent of the bivalve food resource this winter was greater in Colwyn Bay than on the wind farm site and the densities of scoter recorded during the 2001/2002 aerial surveys were consistent with this (see *Figure 7.18*).

(1) An invertebrate species with two shells hinged together that enclose a soft unsegmented body.

(2) Studies have shown that bivalve molluscs comprise in excess of 80% of their prey items and they take those with a shell size of between 1 and 30-40mm (see Annex O).

(3) Burrowing species.

Figure 7.18 Comparison of Relative Density of Benthos from Benthic Survey in 2001 ⁽¹⁾ with Relative Density of Common Scoter from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)



- The importance of suitable bivalve communities to benthic feeding birds, and the effects of yearly changes in these bivalve communities on the distribution of the birds, has been demonstrated recently in Denmark. A study of eider duck was undertaken at the Tunø Knob wind farm. Here the absence of eiders in the vicinity of the newly constructed wind farm was shown to be due to the absence of the bivalve *Mytilus* that formed a key food resource for the birds. Subsequent spat ⁽²⁾ settlement occurred and the eiders returned (Guillimette *et al*, 1998). Previous research from coastal areas including off the Northumberland coast has shown that annual fluctuations in benthic communities occur and population densities of different benthic species can fluctuate widely depending on whether recruitment of larvae occurs are documented (Gray, 1981). Given that local bird reports and WeBS counts throughout the 1990s include regular records of common scoter in inshore waters in Colwyn Bay and that concentrations of birds have been recorded off the North Wales coast in both the winters of 2000/2001 and 2001/2002, it would appear that a regular bivalve food resource of a suitable size class has been present in at least part of the study is area to sustain flocks of wintering common scoter on an annual basis over a number of years.
- Well over 90% of the common scoter records in the study area during the 2001/2002 aerial surveys (most of which were undertaken at high tide), were from waters with depths between 2 and 18 m (see *Figures*

(1) Samples were taken from the wind farm project area, full details are provided in *Section 7.4*

(2) Spawn of shellfish.

7.19 and 7.20 and Fox & Petersen, 2002b). Statistical analyses of the data showed that common scoter showed a significant preference for shallower waters (see Fox & Petersen, 2002b).

Figure 7.19 *Percentage Frequency of Common Scoter Distribution with Varying Water Depth (in 2 metre intervals) from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*

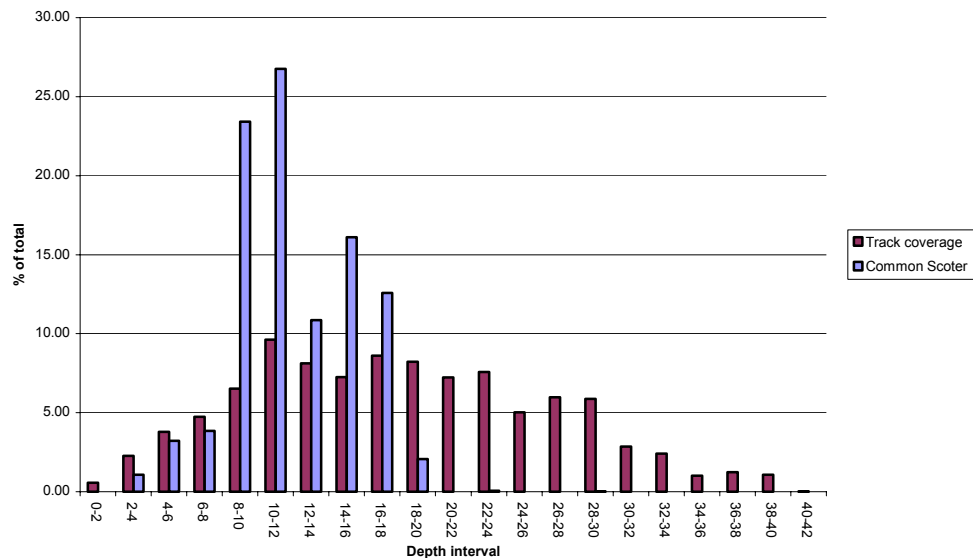
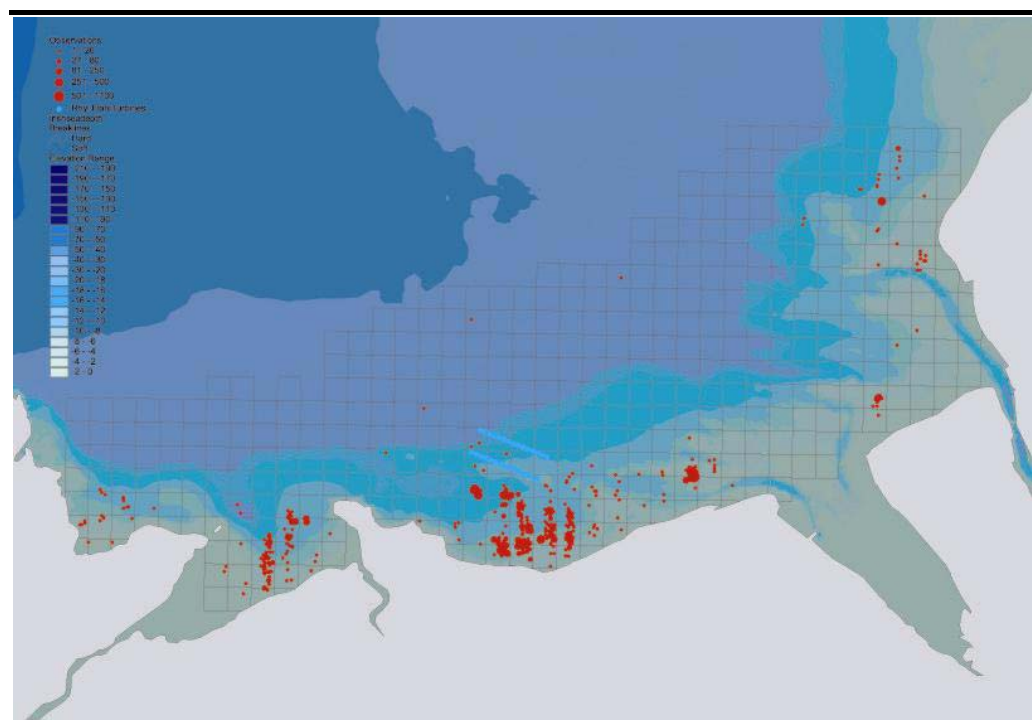


Figure 7.20 *Distribution of Common Scoter Relative to Water Depth from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*



- There is evidence from extensive aerial survey work over two winters in the Kattegat, in Denmark, that common scoter disperse and forage in increasingly deeper water as the winter progresses, suggesting that

food depletion has occurred in shallower waters (see Fox & Petersen, 2002b). If this was to occur in the study area it is possible that common scoter could move closer to the wind farm site. However, given the very low bivalve biomass recorded from samples taken on the wind farm site in 2001, the apparent avoidance of the wind farm site by common scoter which has been shown (see above and Annex G), and the regular records from areas further inshore, it is considered unlikely that common scoter would move into the wind farm area in any great numbers.

- The peak water velocities of the ebb and flow tides in the study area have been modelled by HR Wallingford in *Figure 7.21*. A comparison of these data with the distribution of common scoter recorded from the 2001/2002 aerial surveys indicates that in general that the flocks of common scoter were recorded in waters with weaker currents (see *Figure 7.22*). Modelling of the ebb tide current fluxes in the positions where common scoter were recorded indicated that they showed a significant preference for waters in the study area where the ebb tide current was low (see Fox & Petersen, 2002b).

Figure 7.21 Peak Ebb and Flow Tide Water Velocities in the Study Area (Source: HR Wallingford Ltd, 2002)

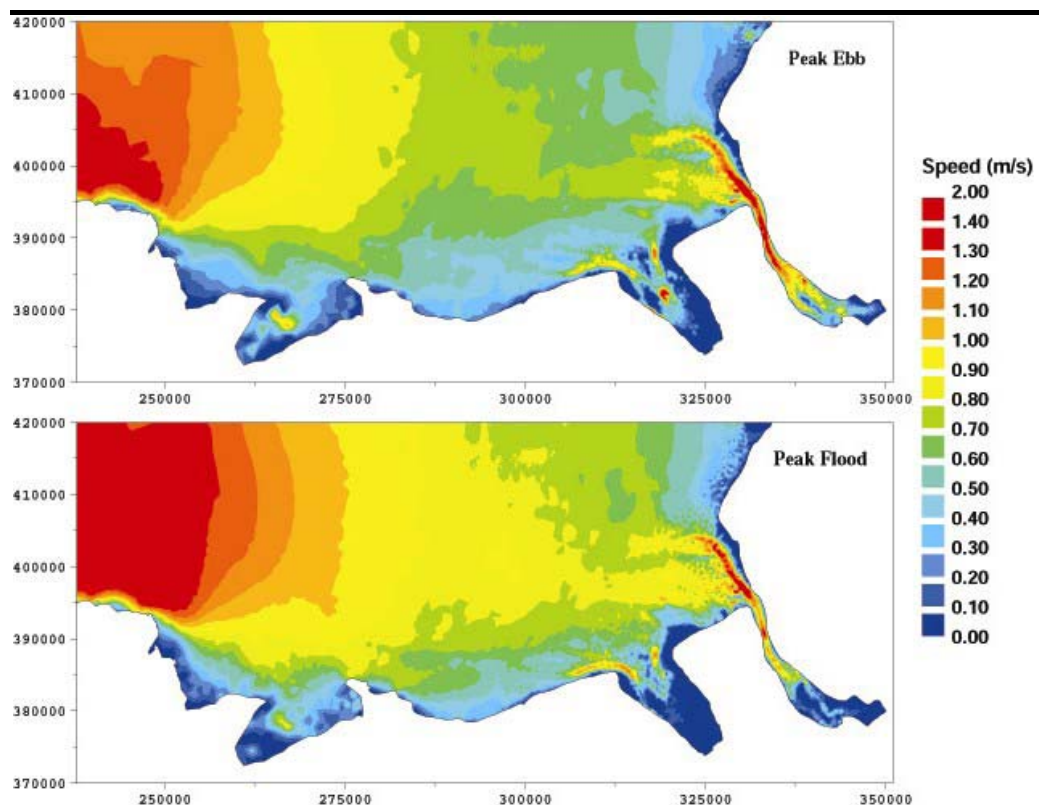
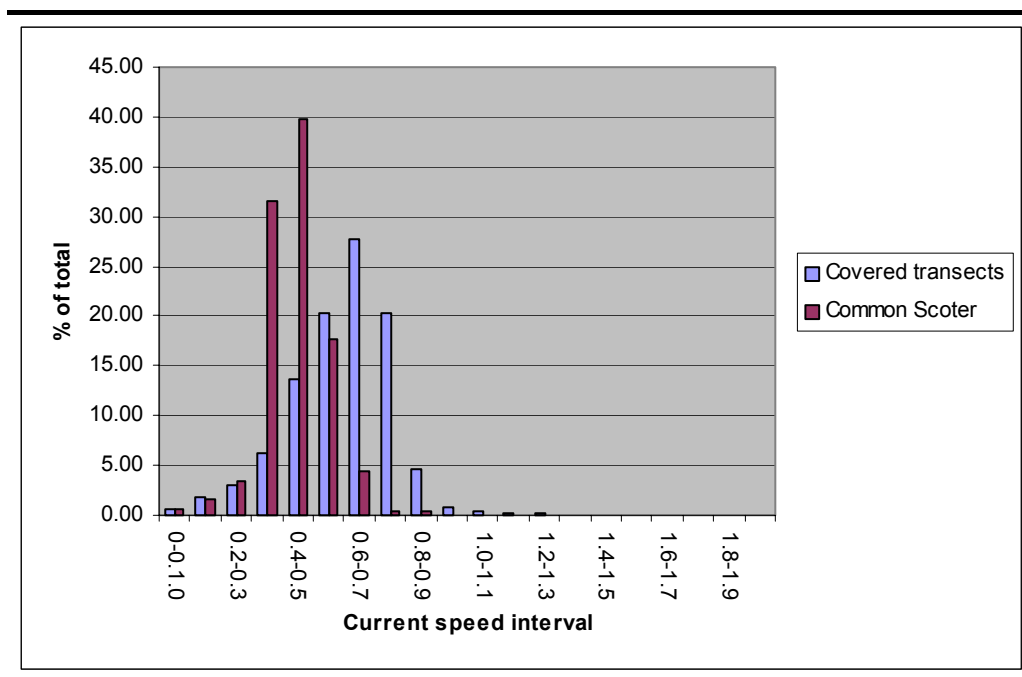


Figure 7.22 *Frequency of Common Scoter Distribution from Aerial Surveys (November 2001 to January 2002) with Varying Current Speed (Source: Fox & Petersen, 2002)*



- A number of potential sources of disturbance were recorded during the aerial surveys in 2001/2002 (see *Figure 7.23*). Analyses of the distances of the ten closest sources of human activity from birds recorded in each of the grid cells in the study area (see *Figure 7.24*) has not shown any significant effects of disturbance on the distribution of birds. This may reflect the lower densities of common scoter compared with populations in Denmark where disturbance effects have been demonstrated.

Figure 7.23 *Human Activity Sources in the Study Area Recorded by the Aerial Surveys of November 2001 – January 2002 (Source: Fox & Petersen, 2002b)*

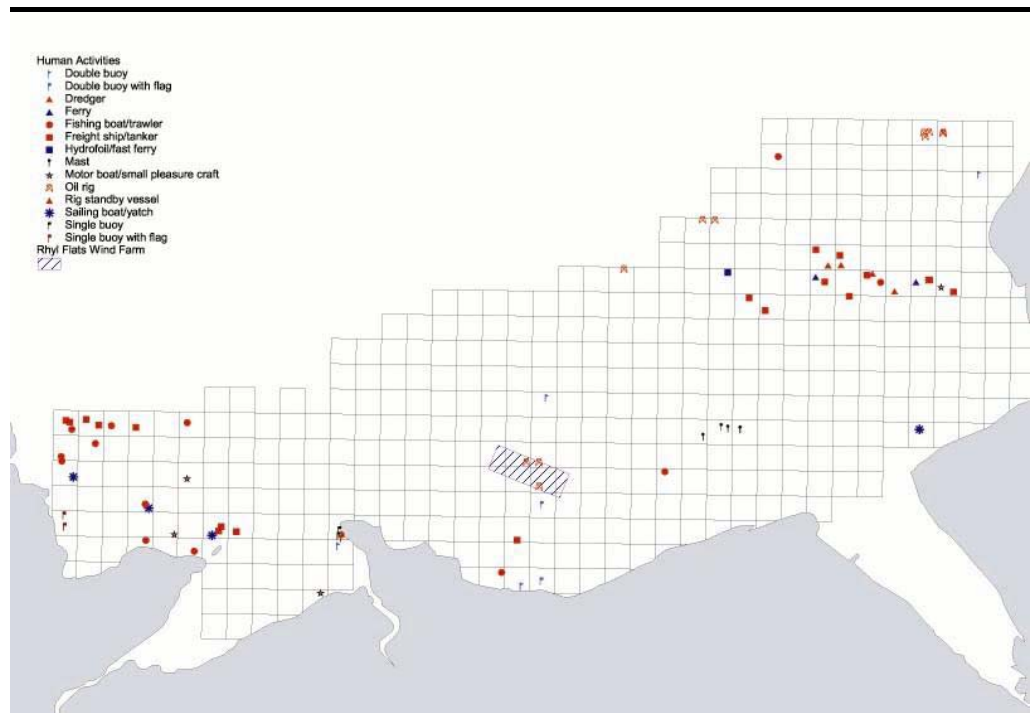
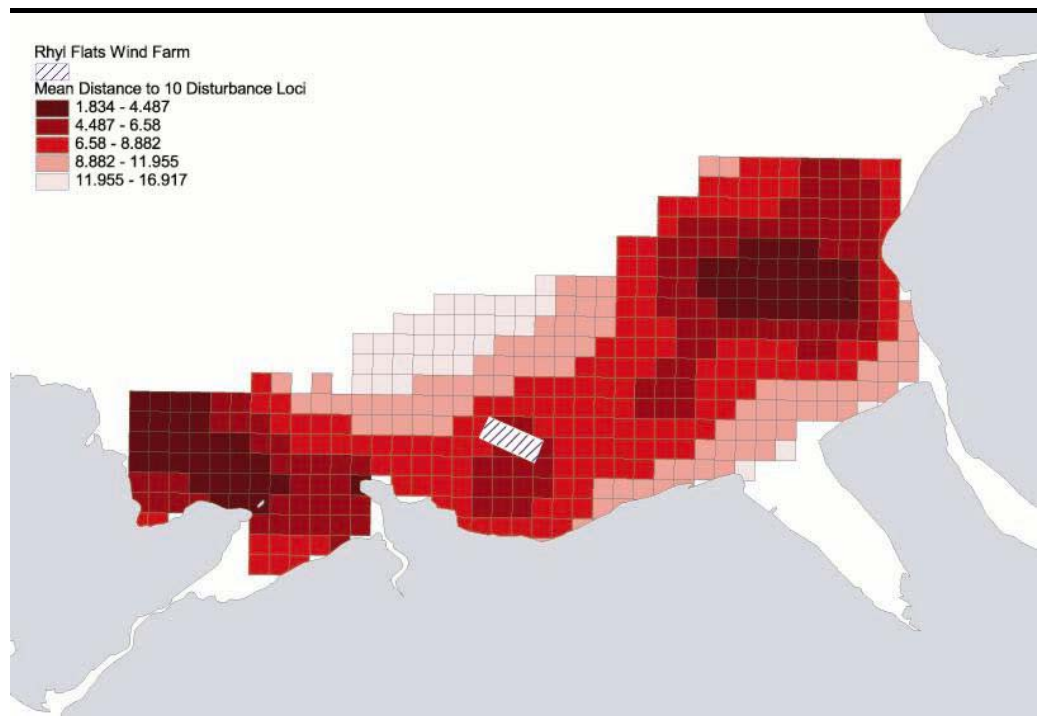


Figure 7.24 *Mean Distance (km) to the 10 Closest Sources of Human Disturbance in the Study Area Recorded by the Aerial Surveys of November 2001 – January 2002 (Source: Fox & Petersen, 2002b)*

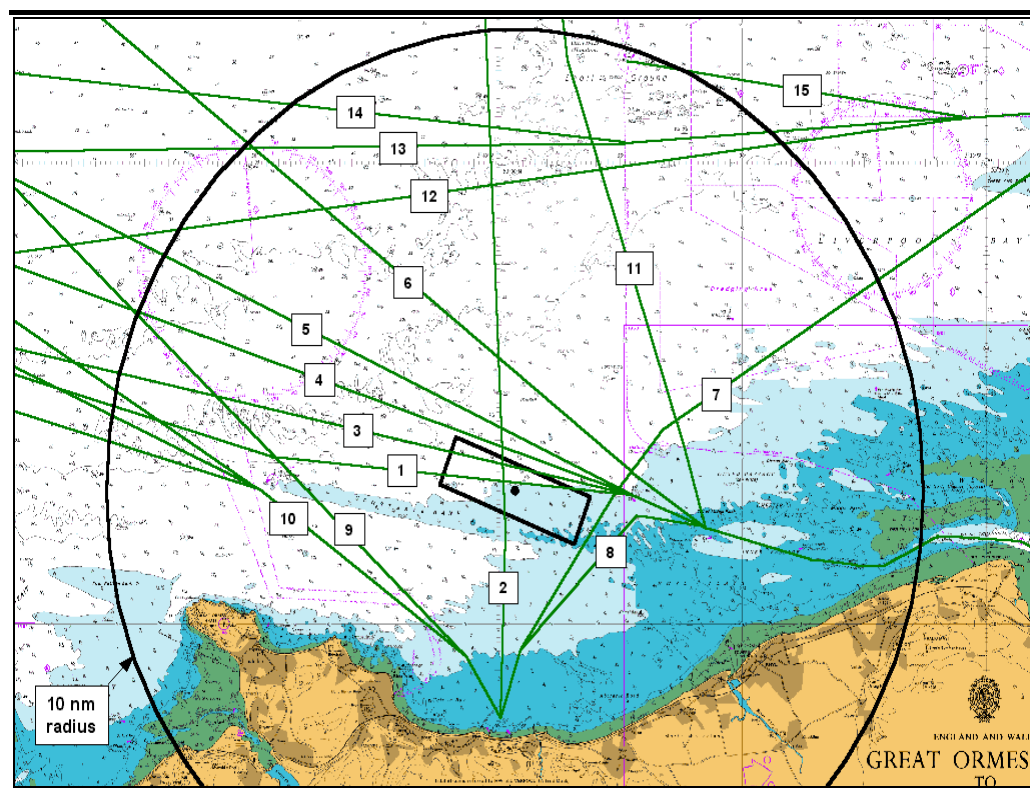


- There is existing shipping activity across and around the proposed wind farm site including the Dublin to Mostyn ferry service (see *Figure 7.25*). This is a new fast ferry service, that travels at speeds of up to 26 knots, and it has been in operation since November 2001 and

crosses the proposed wind farm site four times a day Tuesday to Saturday, and twice a day on Sunday and Monday.

- There is evidence of effects from fast ferries on eider and common scoter in the southern Kattegat Sea in Denmark (Larsen & Laubeck in press). The findings of this research suggest major effects on habitat use by eider within 500 m of the ferry route, whilst the effects on common scoter, were less conclusive due to smaller sample sizes. The largest concentrations of common scoter were recorded at between 1-2 km from the ferry route. Virtually all flocks of common scoter took flight within 200 m of the approaching ferry and a “notable proportion” of the flocks took flight at up to 1 km from the ferry route, although the sample sizes were considered insufficient to generate robust conclusions at distances beyond 500 m. There is evidence also from boat surveys used for seabird recording that common scoter fly at distances of approximately 2 km from an approaching boat.¹

Figure 7.25 Shipping Routes Across and Around the Rhyl Flats Wind Farm Site (see footnote for details of lanes ⁽²⁾)(source Anatec UK Ltd, 2001)



In summary it is clear from the above, that the factors that are known to influence the distribution of common scoter from previous research abroad, do appear to be influential also in the distribution of common scoter off the North Wales coast. For the purposes of this baseline assessment we are

(1)¹ Environmental Statement for *The North Hoyle Wind Farm Site* & pers comm. John Clarke, 2002.

(2) 1=Mostyn-Dublin; 2 = Solway Firth - Llanddulas; 3 = Skerries TSS - Mostyn; 4 = Mostyn-Skerries TSS; 5 = Dundalk to Mostyn; 6 = Mostyn - North Channel; 7 = Liverpool - Llanddulas;; 8 = Mostyn - Llanddulas;; 9 = North Channel - Llanddulas; 10 = Llanddulas - Skerries TSS; 11 = Mostyn - Solway Firth; 12 = Point Lynas - Liverpool; 13 = Skerries TSS - Liverpool; 14 = Liverpool - Skerries TSS; 15 = Douglas (BHP) - Liverpool.

assuming that these factors will continue to be influential in the distribution of common scoter in coming years. From the information available it is not possible to predict whether there will be any significant annual variation in the bivalve communities and whether this may influence the distribution of common scoter in the study area. As discussed above the continuing records of common scoter in inshore waters from the WeBS data throughout the 1990s do suggest that an annual food resource does occur within the study area. The WeBS data do not show any significant trend in peak numbers of common scoter over time, but do show that the annual peak has varied greatly between years ⁽¹⁾ (see *Annex G*).

Existing data indicate common scoter to be present in the study area in smaller numbers during the late spring and early autumn passage periods compared with the winter months (see *Annex G* and Stone *et al*, 1995). Moulting ⁽²⁾ common scoter are known to occur in waters off the west coast of Britain (*pers comm* Percival, 2002), but it is unclear whether they occur off the North Wales coast, or elsewhere, in Liverpool Bay. Data from Stone *et al* (1995) show common scoter records several kilometres east of the Rhyl Flats wind farm site, in the period May through to September, which could suggest the presence of moulting birds in the area. The WeBS data show records also of scoter in inshore waters during the period July – September. Other experience from Alborg Bugt in Denmark has shown that the areas in which common scoter moult continue to be important areas for the birds during the winter months (*pers comm* Tony Fox, 2002).

However, in the Environmental Statement for the North Hoyle offshore windfarm, which lies approximately 10 km east of Rhyl Flats, NWP state that they recorded no common scoter during their boat surveys between April and August 2001 ⁽³⁾. In addition, a trial aerial survey ⁽⁴⁾ over the eastern part of the Rhyl Flat project study area in September 2001, recorded common scoter in flight, indicating that these birds had moulted already. These findings suggest that the birds had moulted either before their arrival in the study area, or that they moulted elsewhere within the study area and were not recorded by these specific surveys.

The use of the wind farm site by moulting common scoter may be influenced greatly by existing levels of disturbance, as they are known to be more sensitive during the moulting period. Unpublished data from Alborg Bugt has suggested that human disturbance may have a significant effect on the distribution of foraging flocks of moulting common scoter (Fox & Petersen, 2002b) and birds are known to have moved into deeper water possibly to avoid disturbance, with records of moult flocks up to 13 km

(1) Likely that this reflects the distribution of the birds at the time and their proximity to the shore rather than population changes and that peak counts coincided with good counting conditions and the birds being located close inshore.

(2) Common scoter undergo an annual moult of their flight feathers, rendering them flightless for about 3-4 weeks. This moult usually occurs away from the breeding grounds, and sometimes in the birds' wintering areas. Males generally moult between mid-July – September, whilst the females moult later, mainly in September/October (Cramp, 1998).

(3) *Op cit*.

(4) Undertaken prior to the 2001/2002 CCW surveying commencing.

offshore in Danish waters (OUP, 1998). The precise effects of the Mostyn – Dublin fast ferry that crosses the wind farm site, on any moulting common scoter in the study area, are uncertain, as the service has started only recently (November 2001) ⁽¹⁾. However, previous research in Denmark has recorded disturbance effects on common scoter by fast ferries (see above). It is likely that the presence of the fast ferry (Mostyn to Dublin) may make the wind farm site unfavourable for the moulting common scoter.

- Great crested grebe is a winter visitor to the waters off the North Wales coast, with counts of over 250 recorded in local bird reports and during WeBS counts. Particular concentrations are known at Lavan Sands approximately 35 km south west of the proposed wind farm site, where there is the largest known regular autumn moulting population in Britain ⁽²⁾. The aerial surveys of 2000/2001 regularly recorded this species further west of the wind farm site. Grebes were rarely encountered in the study area during the 2001/2002 aerial surveys with only single birds recorded during the November 2001 and January 2002 surveys respectively and none in December 2001. Only two birds were recorded during the boat surveys, one in the wind farm area in early March 2002 and a single bird in the waters between Constable Bank and Colwyn Bay in January 2002 (see *Annex G*).
- Red-breasted merganser is a winter visitor to the North Wales coast (see local bird reports) and known to occur in nationally important numbers at Traeth Lafan (Musgrove *et al*, 2001). None were recorded by the aerial surveys, or on the wind farm site from the boat surveys during January 2002, although several birds were recorded further inshore in the waters of Colwyn Bay during the boat surveys (see *Annex G*).

In addition to the species considered above ⁽³⁾, a range of other seabirds and waterfowl species were recorded during the aerial surveys (see *Table 7.7* above). These species are considered to be ones that were unlikely to be affected by the proposals, of less conservation concern, or more widespread and common across the study area. Auks in particular were widely distributed across the study area including in areas of deeper water, but few birds were recorded from the wind farm site (see *Figures 7.26* and *7.27* and Fox & Petersen, 2002b). Their corrected distribution (taking into account survey effort) showed a clear association between their feeding areas and breeding colonies, especially off Great Ormes Head and Puffin Island (see below). Gulls were present in low densities throughout the study area and few if any were recorded on the wind farm site. Small numbers of kittiwakes were recorded on the wind farm site, but in general they were widely dispersed with no obvious association with particular areas of coast and many were encountered well offshore (see *Figures 7.28* and *7.29*).

(1) This service began over the winter months and it has not been possible to monitor its effect through the 2001/2002 aerial surveys as it crosses the wind farm site in the dark.

(2) Recent counts of 260, although 520 were recorded in 1976.

(3) Red-throated diver, cormorant/shag and common scoter.

Figure 7.26 *Distribution of Auks from Aerial Surveys (November 2001 to January 2002)*
(Source: Fox & Petersen, 2002b)

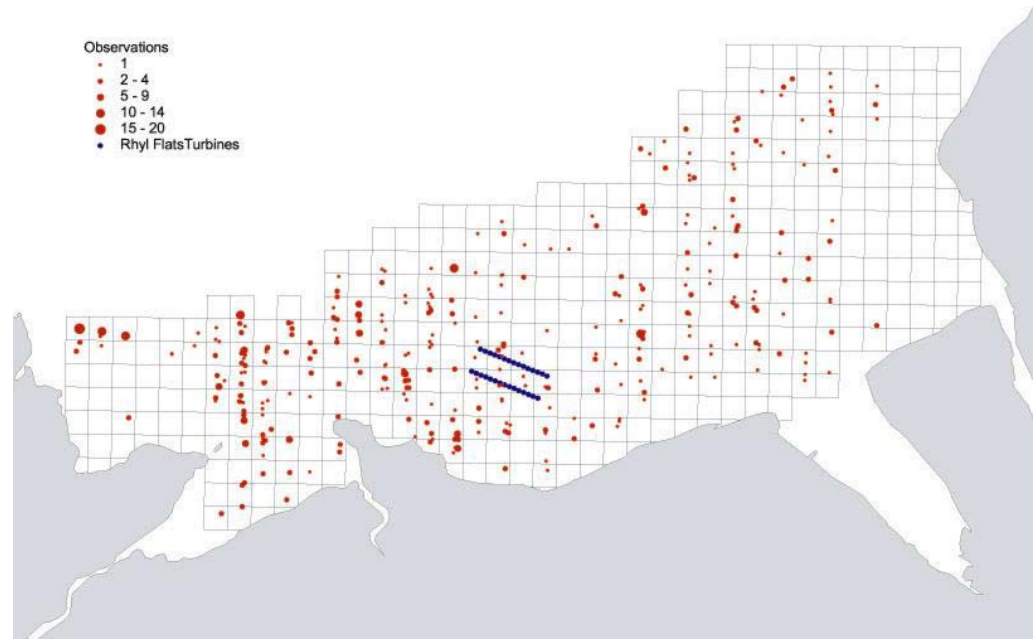


Figure 7.27 *Relative Densities of Auks from Aerial Surveys (November 2001 to January 2002)*
(Source: Fox & Petersen, 2002b)

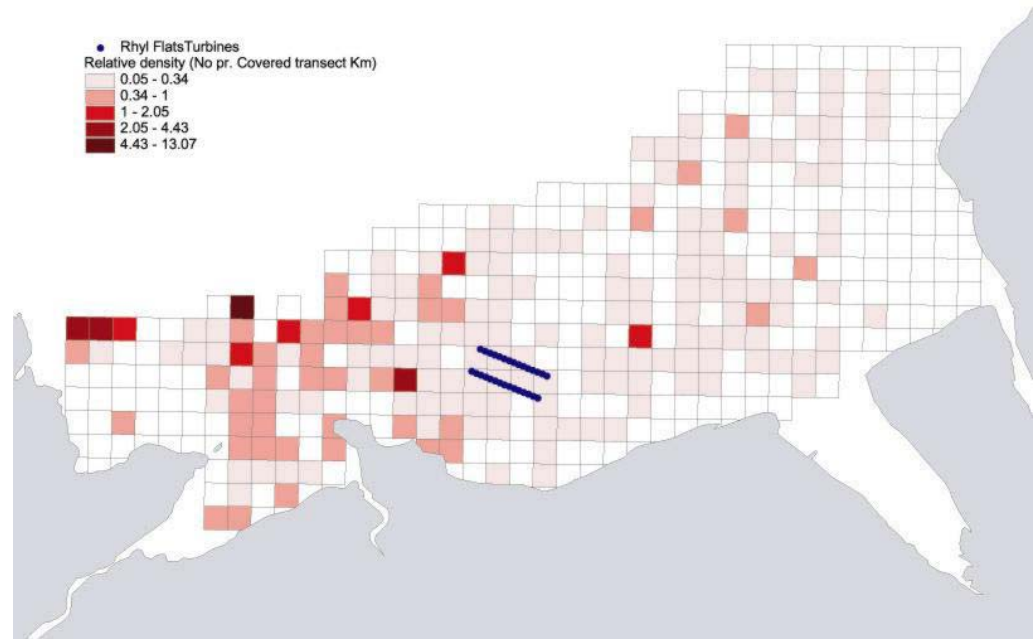


Figure 7.28 *Distribution of Kittiwakes from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*

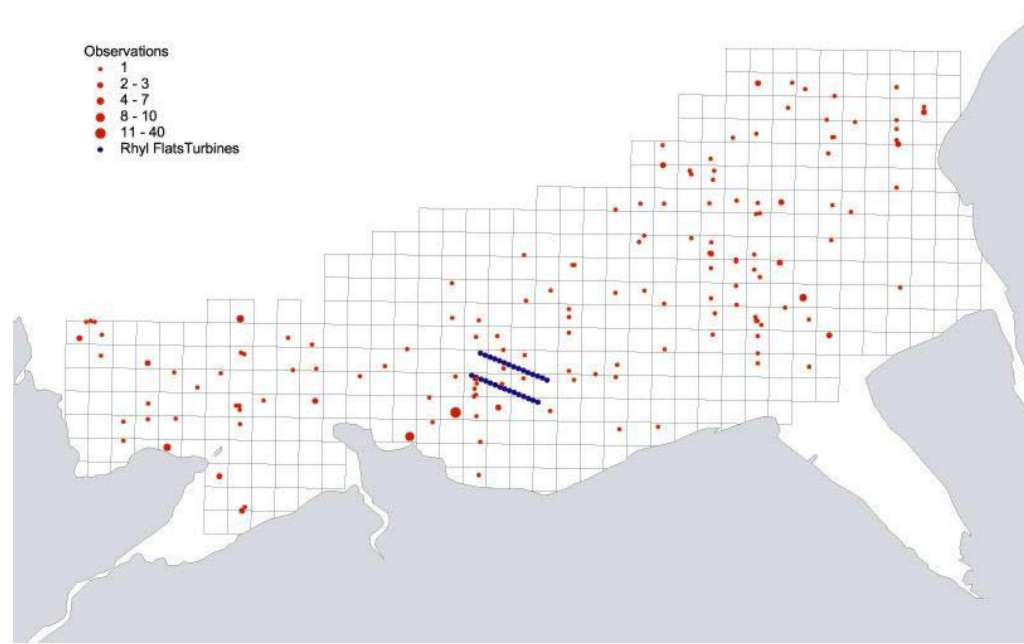
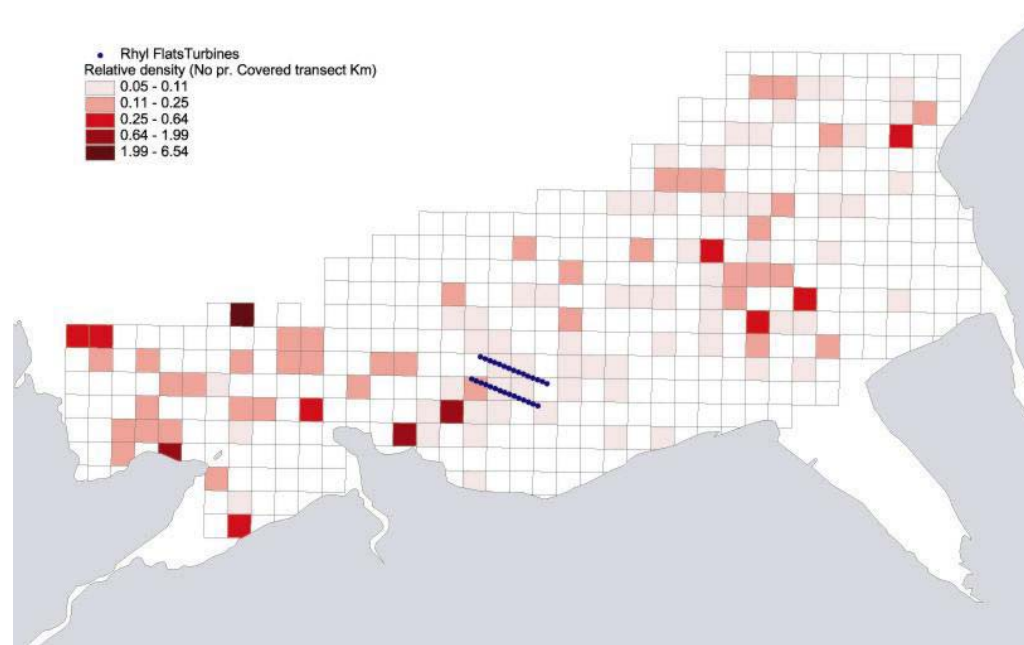


Figure 7.29 *Relative Density of Kittiwakes from Aerial Surveys (November 2001 to January 2002) (Source: Fox & Petersen, 2002b)*



Breeding Birds

There are several breeding seabird colonies within the study area (see Figure 7.30).

The most important breeding seabird populations are:

- cormorants on Puffin Island (internationally important) and Little Orme Head (nationally important);
- little terns at Gronant (nationally important); and
- the common tern colony in the Shotton steelworks on the Dee Estuary (nationally important).

The population sizes of each seabird species at each colony in the study area, based on the most recently published population estimates are given in *Table 7.9* (also see *Annex G*). *Table 7.9* also shows the likely use of the wind farm site for foraging based on the location of the wind farm site from the breeding colonies and known foraging ranges and typical water depths in which the birds are known to forage. Only cormorant from the Little Ormes Head SSSI is considered likely to make a moderate to high usage of the site, although other species from the Great Ormes Head and Rhyl Prestatyn could also forage on the site. All of these species are predominantly fish eaters, scavengers or opportunists.

Figure 7.30 *Breeding Seabird Colonies in the Study Area (Source: Steve Percival, 2002)*

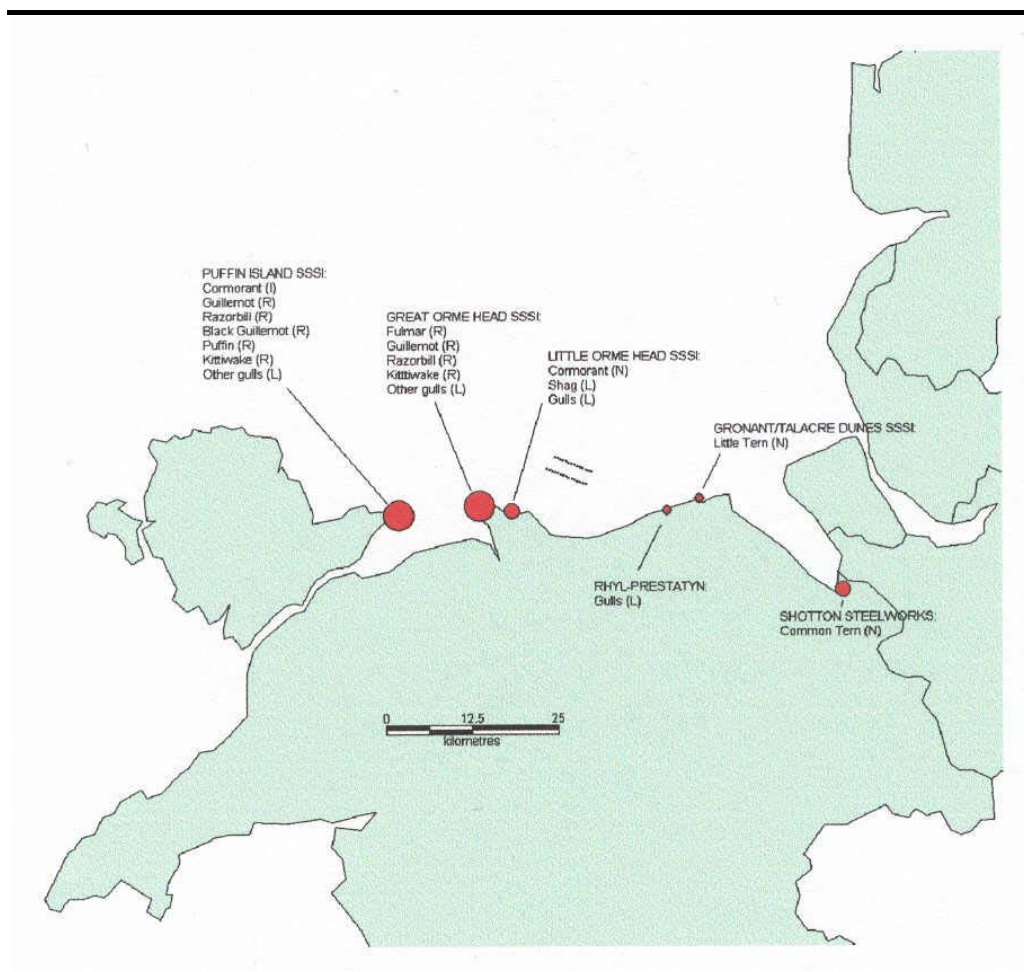


Table 7.9 Seabird Foraging Preferences and Likely Importance of the Wind Farm Site for Foraging Birds

Site and Species	Breeding Population (no of pairs)	Distance from Wind Farm Site (km)	Usual Foraging Range (km)	Typical Foraging Water Depth (m)	Likely Importance of Wind Farm Site for Foraging
Puffin Island (Ynys Seiriol) SSSI					
Cormorant	400	23	1-10	Average 1-3, but up to 10	Negligible
Lesser black-backed gull	54+		50	Surface feeder	Low
Herring gull	171+		50	Surface feeder	Low
Great black-backed gull	1-11		50	Surface feeder	Low
Kittiwake	101-1000		5-40	Surface feeder	Low
Guillemot	101-1000		20-50	20	Low
Razorbill	101-1000		15-20	10	Negligible
Black guillemot	4		4	20	None
Puffin	11-100		10	15	Negligible
Little Orme Head (Creigiau Rhiwledyn) SSSI					
Cormorant	171	8	1-10	Average 1-3, but up to 10	Moderate/high
Lesser black-backed gull	13-53		50	Surface feeder	Low
Herring gull	60-170		50	Surface feeder	Low
Shag	1-8		1-10		Low
Gronant SSSI					
Little tern	86	16	6 (within 1.5km of shore)	2	None
Black-headed gull	1-14		12-30	Surface feeder	Low
Dee Estuary (Shotton steelworks)					
Common tern	433	40	3-10	Surface feeder	Negligible
Great Ormes Head SSSI					
Fulmar	c.1000	11	100+	Surface feeder	Moderate
Kittiwake	c.3000		5-40	Surface feeder	Moderate
Guillemot	c.3000		20-50	20	Moderate
Razorbill	30		15-20	10	Moderate
Lesser black-backed gull	13-53		50	Surface feeder	Moderate
Herring gull	60-170		50	Surface feeder	Moderate
Great black-backed gull	3-10		50	Surface feeder	Moderate
Rhyl-Prestatyn					
Lesser black-backed gull	13-53	12	50	Surface feeder	Moderate
Herring gull	15-59		50	Surface feeder	Moderate

The site and immediate surrounds form a small part of the summer spawning areas of some fish species including sprat, sole, plaice and whiting (see

Section 7.5.2) and many of these species are favoured by birds such as cormorant, kittiwake and the auks (OUP, 1998). However, cormorant feed predominantly on flatfish from the seabed and typically dives between 1 and 3 metres, although dives to depths approaching 10 metres have been recorded. Given that the water depth is up 21 metres LAT at the western end of the project area, it is unlikely to forage across the whole of the wind farm site.

None of the species breeding in the colonies along the coast were recorded in the grid square in which the wind farm site lies during the breeding season, in densities greater than 1 bird per km² (Stone *et al*, 1995). Similarly the data do not show any important concentrations of seabirds during the breeding season in the grid squares that adjoin the square in which the wind farm site lies.

Recent surveys in parts of the west coast of Britain away from Liverpool Bay have recorded good numbers of common scoter during the summer months (*pers comm* Percival, 2002). Previous surveys in the waters off the North Wales coast during the summer months have recorded common scoter (see WeBS counts ⁽¹⁾ in Annex G and Stone *et al*, 1995). However, the records are from grid squares to the north east between May and June and to the east between July and September (Stone *et al*, 1995 and Annex G) and there are none on the wind farm site. The Environmental Statement for the North Hoyle wind farm, which lies to the east of the Rhyl Flats site, reports that no common scoter were recorded during their boat surveys between April and August 2001. All these data suggest that numbers of summering common scoter in the study area likely to be much less than the wintering numbers and there is no evidence to date that suggests they are present on the wind farm site.

(1)A few scoter were recorded between April and September.

7.8 SOCIO-CULTURAL ENVIRONMENT

7.8.1 Commercial Fisheries

Overview

Liverpool Bay supports a fish fauna that is generally similar to that of neighbouring seas, although the fish yield per unit area is 40-60% less than that of the North Sea. The reason for this is unclear. However, a lower recruitment per unit area is considered the main reason. The low recruitment may possibly be caused by the characteristic short, late plankton production cycle (Nash, 1993).

Table 7.10 lists the main demersal and pelagic fish species throughout the Irish Sea which are exploited by fishermen. The demersal species are divided into four groups; elasmobranchs (sharks, skates and rays), gadoids (the cod family), flatfish and other demersal fish.

Table 7.10 Main Exploited Demersal and Pelagic Species in Liverpool Bay (Pawson and Robson 1996)

	Demersal	Pelagic
Elasmobranchs	Basking Shark <i>Cetorhinus maximus</i> Spurdog <i>Squalus acanthias</i>	Mackerel <i>Scomber scombrus</i> Horse Mackerel <i>Trachurus trachurus</i>
Gadoids	Thornback ray <i>Raja clavata</i> Cod <i>Gadus morhua</i> Whiting <i>Merlangius merlangus</i> Haddock <i>Melanogrammus aeglefinus</i> Pollack <i>Pollachius pollachius</i> Ling <i>Molva molva</i> Saithe <i>Pollachius virens</i> Hake <i>Merluccius merluccius</i>	Herring <i>Clupea harengus</i> Sprat <i>Sprattus sprattus</i>
Flatfish	Plaice <i>Pleuronectes platessa</i> Dab <i>Limanda limanda</i> Dover sole <i>Solea solea</i> Turbot <i>Psetta maxima</i> Brill <i>Scophthalmus rhombus</i> Lemon sole <i>Microstomus kitt</i> Flounder <i>Platichthys flesus</i>	
Other demersal fish	Bass <i>Dicentrarchus labrax</i> Grey mullet <i>Liza, Cranimugil</i> Spp Angler (monkfish) <i>Lophius piscatorius</i> Conger eel <i>Conger conger</i> Gurnards <i>Aspitrigla, Eutrigla</i> Spp Wrasse <i>Labrus, Crenilabrus</i> Spp Sandeels <i>Ammodytes, Gymnammodytes, Hyperoplus</i> Spp	

The most numerous fish in the shallow inshore zones, such as the proposed lease area, tend to be juvenile flatfish and sandeels whereas typical offshore species include whiting, cod and herring.

Of the pelagic species present in the Liverpool Bay, herring are locally the most abundant especially during spawning from August to September. Juvenile herring are often found in inshore areas within the region, mixed with juvenile sprat, together known as whitebait.

Elasmobranch species produce relatively small numbers of live young or eggs on the seabed close to their nursery areas. Several species of shark have been recorded throughout the bay during their summer migrations off the west coast. The most commercially important local ray species is the thornback ray, which spawns in shallow inshore bays in the North Wales coast and Liverpool Bay areas.

Of the gadoids, cod is the most widely distributed in the North Wales coast and Liverpool Bay area, spawning throughout the bay from January to April. Whiting are also widely distributed throughout the bay both spawning and using the bay as a nursery area for juveniles. Haddock, ling, pollock and saithe are less abundant and tend to be more locally distributed especially around rocky reefs and wrecks.

Of the flatfish, plaice and dab are the most abundant. They occur predominantly on sandy areas of seabed with juveniles living close inshore in nursery areas before moving further offshore as they grow.

Other demersal species of importance in the North Wales coast and Liverpool Bay areas include sandeels. Sandeels are distributed widely throughout the bay and although they are not directly commercially important they do represent an important food source for other commercial fish species and also bird species.

In addition to the fish species there are a significant number of shellfish species present within the North Wales coast and Liverpool Bay areas, many of which are commercially exploited. Scallops (*Pecten maximus*) and Queen scallops (*Aequipecten opercularis*) are widely distributed in offshore gravelly areas predominantly between Galloway and North-West Wales and around the Isle of Man. The Norway lobster *Nephrops norvegicus* is found on muddier sediments in the deeper zones to the east and west of the Isle of Man. The shallow sandy estuaries around Liverpool Bay periodically contain large populations of cockles, mussels and brown shrimps, while edible crabs and lobsters are harvested from the more exposed parts of the coast. The number of edible crabs and lobsters taken are small however compared with other parts of the UK. Native oysters, whelks, spider crabs, deep water prawns and pink prawns are present in the Liverpool Bay. The main concentrations of whelk lie to the east of Anglesey adjacent to the proposed wind farm and to the north in the Solway Firth.

Many of these species also provide an essential food source for other species, such as fish and birds, for example migrant and over wintering waders and wildfowl.

For the purpose of fisheries management, all open waters are divided into International Council for the Exploration of the Sea (ICES) statistical divisions. These management blocks are divided into subsquares which can then be further divided into four quarters. The proposed Rhyl Flats lease area is located within subsquare 35E6. Data from this subsquare have been obtained and analysed for the purpose of this study.

UK DEFRA overflight data are collected on a regular basis by surveillance aircraft throughout the UK's Exclusive Economic Zone. Data recorded for each vessel observed include the location, type of vessel and activity at the time of observation.

Landings statistics are compiled at a national level and collated by ICES at an International level. ICES use these statistics to form a basis for economic analysis and for monitoring Total Allowable Catch (TAC) values for quota species. Whilst it is recognised that these data sources provide a reasonable comparative index of fish catch, in absolute terms they are often under-represented by a significant margin. It should also be noted that only quota species landings are required by law and that data collation and interpretation vary between member states. Nevertheless the landings data sets provide the most comprehensive indication of the main fish species being caught by vessels operating off the north coast of Wales.

Overflight Data

Figure 7.31 summarises the distribution of vessel types in the vicinity of the proposed wind farm (ICES subsquare 35E6). This data presents a summary of 51 records taken over a five year period between October 1996 to Sept 2001. Table 7.11 indicates that the majority of sightings were recorded in quarter one (75%), in comparison to quarter two (25%). This may possibly not be a reflection of lower fishing activity within quarter two, but an artefact of the flight path adopted.

Table 7.11 *Fishing by Quarters for ICES 35E6 (from Overflight Data)*

Quarter	% sightings (number)	Predominant Gear Type (% of sightings)
1	75% (38)	Beam Trawler (47%), Gill Netter (13%)
2	25% (13)	Beam Trawler (69%), Shrimper (15%)

The overflight data also offer the opportunity to explore seasonal variations in fishing activities undertaken by different vessels within ICES subsquare 35E6.

On the basis of this distribution, indicates that the majority of fishing activity is undertaken between April and June. These three months combined, account for approximately 60% of total fishing activity between 1996-2001.

Figure 7.31 Geographical Distribution of Overflight Data

Separate A4 Figure KXS

Table 7.12 *Seasonality of Main Fishing Activities (from Overflight Data)*

Month	%Total fishing activity	Predominant gear type for each month (% of all sightings within ICES 35E6)
Jan	2%	Stern Trawler (100%)
Feb		
March	6%	Beam Trawler (66%), Potter/Whelker (33%)
April	26%	Beam Trawler (39%), Rod and Line (15%), Gill Netter (15%)
May	18%	Beam Trawler (77%)
June	15%	Gill Netter (50%), Shrimper (25%)
July	6%	Beam trawler (33%), Stern (33%), Trawler (33%)
Aug		
Sept	4%	Potter/Whelker (50%), Trawler (50%)
Oct	4%	Beam Trawler (50%), Side Trawler (50%)
Nov	12%	Beam Trawler (84%)
Dec	8%	Beam trawler (100%)

Beam Trawling is undertaken throughout the year, but in particular in March and May and in November and December, when it accounts for the majority of sightings. Gill netting activities become more prevalent in June accounting for 50% of all observations within this month. On the evidence of the overflight data, fishing activity decreases in the winter months between December and March, which could be associated with lower fish abundance.

Figure 7.32 provides an indication of the spatial distribution of vessel observations for different months of the year between 1996-2001. It should be noted that the overflight data might not be a true reflection of fisheries activity as they are a discontinuous series of spot observations, rather than being a definitive record of all fisheries activity in the North Wales coast and Liverpool Bay area.

Effort Data

Fishing effort can be determined through cross-referencing the overflight data with vessel operator log books. The intensity of fishing activities can thus be analysed for different gear types between 1996-2001.

Table 7.13 provides an indication of fishing effort in terms of number of hours fished for different gear types. Unfortunately, the data for gear type are sparse and it is therefore not possible to comment on trends in total fishing effort.

Figure 7.32 Seasonality of Overflight Sightings

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Table 7.13 *Number of hours fished by gear type*

Gear Type	1996	1997	1998	1999	2000
Beam trawl	1231	681	827	637	305
Danish anchor seine		4			
Long lines		1333	769		191
Mid water demersal trawl	270	164			
Power dredge	894		565	252	1168
Scottish fly seine					340
Twin <i>Nephrops</i> otter	75				
Unspecified dredge	563	67	53	162	665
Unspecified otter trawl	1701	780	601	1041	542
Grand Total	4734	3029	2815	2092	3211

Figure 7.33 provides an indication of fishing effort for vessel types where more comprehensive data are available.

Figure 7.33 *Fishing Effort by Gear Type*

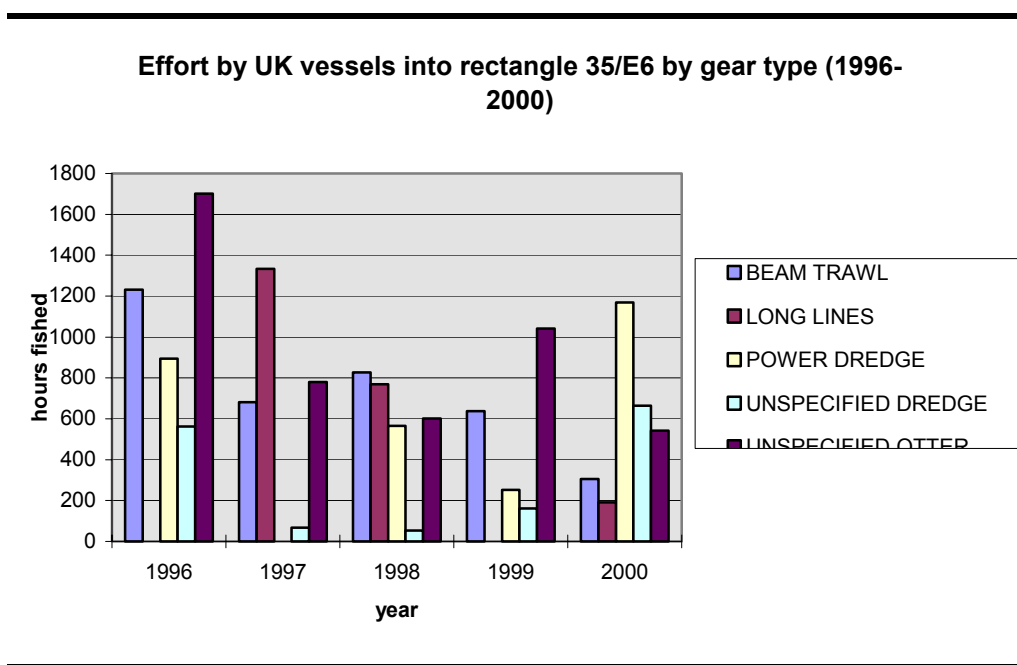


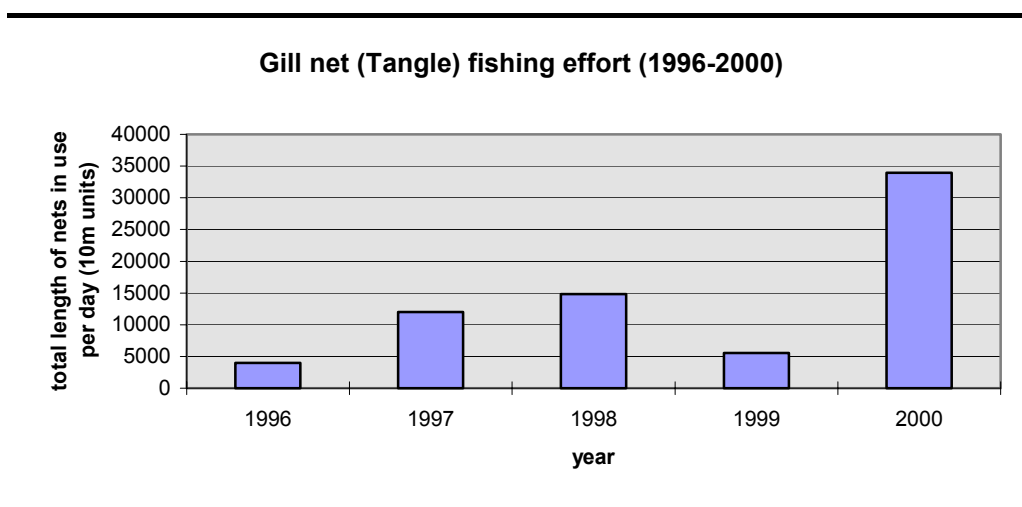
Figure 7.33 suggests that beam trawling effort, which is concentrated in the north of quarter one, has been progressively decreasing since 1998. The reduction in beam trawling effort is likely to be as a result of a reduction in numbers of small beam trawlers (five vessels in 1996 to one vessel in 2000) from Fleetwood and a reduction in the nomadic beam trawl fleet from Brixham and Plymouth (Clarkson *pers. comm.* 2001). Beam trawlers caught approximately 90% of the available quota of Soles in 1999 and approximately 70% of the available quota in 2000.

In contrast power dredging (predominantly for scallops) has experienced a dramatic increase in effort in subsquare 35E6 in 2000. However, power dredgers do not feature in the overflight data (Table 7.12) despite representing a considerable amount of the local fishing effort. It should be noted that the reliability of these data is questionable since the increase for 2000 is not in proportion to minor fluctuations in previous years.

Fishing with unspecified otter trawls represents a large proportion of the total effort between 1996 and 2000. This effort has gradually been declining since 1996, when a total of 1701 hours was recorded from vessel log books. Otter trawls, like power dredgers, are not identified in *Figure 7.31*, however they are associated with stern and side trawlers (Clarkson *pers. comm.* 2001). Sightings for both of these vessel types are generally associated with the main beam trawling activity in the northwest and northeast of subsquare 35E6, quarter 1.

Effort data for gill nets, which is the predominant gear type in the month of June (50% of sightings), is represented in *Figure 7.34*. The data indicate that gill net fishing activity dramatically increased in 2000. As with power dredgers, the reliability of these data is questionable.

Figure 7.34 Gill Net Fishing Effort 1996-2000



Effort data for pots, rod and line fishing are incomplete therefore no trends or patterns in effort can be made from the limited data available.

Fish Landings Data

In the UK, data collected by DEFRA give an indication of the main target species fished in the North Wales coast and Liverpool Bay area. Landings data by UK vessels (for subsquare 35E6 between 1996-2000) are represented by both live-weight (tonnage) and by monetary value (£).

Calculating average live weight and average value for individual species between 1996-2000 is problematic, because the data set is sparse (*ie* landings data recorded by value are provided only for certain species). Further, where weight data are available it is provided for certain years and not others and may or may not be accompanied by the corresponding value data, and vice versa. The reason for these data gaps may be because some of the data relate to vessels under 10 m in length (Clarkson *pers comm.* 2001), which have no statutory requirement to declare their catches.

The information shown in *Table 7.14* indicates that more than 80% of landings by weight are of these species.

Table 7.14 Top Ten Species Landings by Weight 1996-2000 (ICES 35E6)

Species	Total Weight (Tonnes)	% of overall Total Weight
Mussels	419	42%
Cockles	264	26%
Skate and Rays	137	13%
Queen Scallops	99	10%
Scallops	51	4%
Whelks	37	3%
Plaice	16	1%
Whiting	20	1%
Cod	4	<1%
Sole	2	<1%
<i>Total Weight of all recorded species</i>	981	

Landings data suggest that the highest weight of live fish landed between 1996 and 2000 was mussels followed by cockles, skate and rays and queen scallops. The quantity of mussels, cockles, skates and rays caught is not reflected in the overflight data. However, there is a relationship between effort (hours fished) and total live weight landings, as dredging activities which target cockles, mussels and scallops are relatively high compared to other operations.

The top ten landed species defined by value are presented *Table 7.15*.

Table 7.15 Top Ten Species Landings by Value between 1996-2000 (ICES 35E6)

Species	Total Value (£)	% of Total Value
Skate and Rays	142,568	22%
Cockles	132,356	20%
Mussels	94,400	14%
Scallops	72,866	11%
Lobsters	33,941	5%
Queen Scallops	30,425	5%
Whelks	23,320	4%
Bass	27,960	4%
Plaice	20,446	3%
Turbot	7,231	1%
<i>Total value of all recorded species</i>	659,059	

Skates and rays represent the predominant catch composition for bottom gill netters¹, but they are also caught by beam trawlers (Clarkson *pers comm.* 2001). The overflight data indicate that gill netters are located predominately in the north-east corner of quarter one (subsquare 35E6). The data also suggest that they are most active in April and June in this area.

The other high revenue species including cockles, mussels and scallops are caught by dredgers, whereas lobsters are caught by potters. The overflight data suggest that scallop dredging is minimal in comparison to other fishing activities. These vessels operate in the south-west and north-west of quarter 1. In comparison, potters operate in the north of quarter one mainly in March

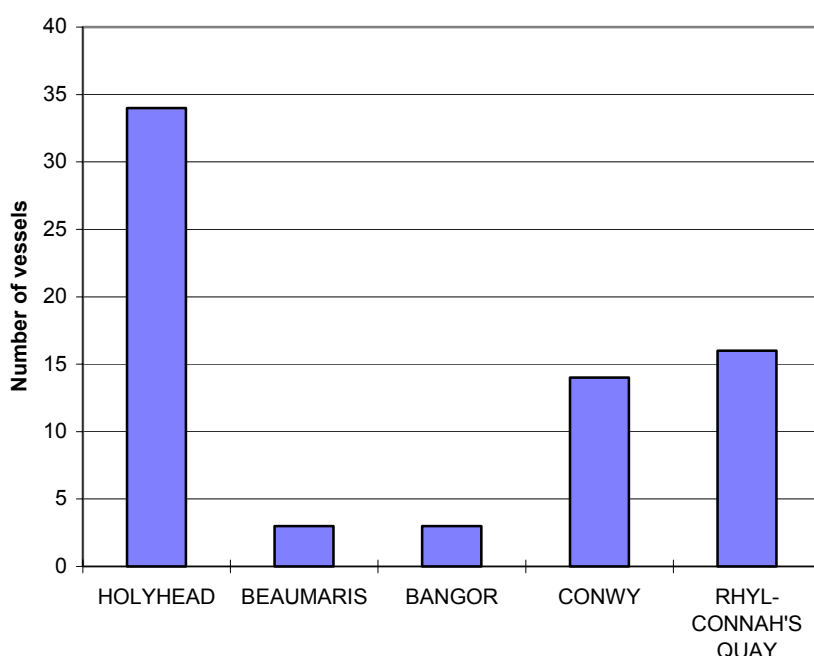
¹ Bottom gill netting, unlike conventional pelagic gill netting, is a relatively non-specific technique targeting a wide range of benthic species including sole, plaice, dab, skates and rays.

and September. However, these assumptions are based on only a few sightings and may not be representative of their distribution.

Landing data suggest that demersal species including sole and plaice that are commonly targeted by beam trawlers do not feature significantly. This may be because beam trawlers do not land their catch in any of the ports along the North Wales coast, and are thus not represented in the above analyses.

Figure 7.35 indicates the main ports along the North Wales coast into which the landings data is reported. The data are arranged relative to the proposed wind farm site. The port of Holyhead is the most distant, while Rhyl is the closest.

Figure 7.35 *Fishing Activity at Welsh Home Ports*



Fisheries Consultation

Although the formal statistics detailed above provide an indication of the level of use of the proposed lease area, first hand experience is invaluable in allowing an accurate judgement of the patterns in a particular area to be accurately assessed. In addition, fishing vessels less than 10 m in length are generally not included in the official government statistics, hence the need for direct consultation with local vessel operators in order to complete the picture.

An experienced independent fisheries liaison officer (FLO) was appointed by COWL in mid-2001 to undertake detailed consultation with relevant fisheries interests. In the first instance, the following fisheries umbrella organisations were contacted to broadly identify any potential commercial fishermen and/or sea anglers that might be affected by the proposals;

- National Federation of Fishermen's Organisations (NFFO);
- Lancashire and Western Sea Fisheries Committee (SFC);
- Fleetwood Fish Producers Organisation;
- Cornish Fish Producers Organisation;
- Northern Ireland Fish Producers Organisation;
- South Western Fish Producers Organisation; and
- Anglo-North Irish Fish Producers Organisation.

Subsequent consultations have been undertaken with commercial fishing organisations/individuals thought to be operating in the vicinity of the proposed wind farm area. Each of these operators was asked a number of questions regarding their use of the area, their perception of the potential impacts of the wind farm proposals on them and whether they knew of any other operators that fished the waters in the vicinity.

Only two vessel operating companies have been identified as fishing full time in the vicinity of the proposed wind farm area. A third vessel operates in the area carrying out both commercial fishing and sea angling.

Historically, visiting beam trawlers (approximately half of which are members of the NFFO), have fishing in the vicinity of the proposed wind farm. It has been reported that it is no longer common to see visiting beam trawlers in the proposed wind farm area (Lancashire and Western Sea Fisheries Committee *pers comm.* 2001). This is also demonstrated by the overflight data which suggests that beam trawling is preferentially carried out further to the north and north-west of the proposed wind farm area.

Approximately ten commercial angling vessels operate from Rhyl, Rhos-on-Sea and Conwy. These vessels report fishing regularly in the vicinity of the proposed wind farm.

Conclusions

In summary, overflight data, effort data and landings data can be used to provide an indication of the frequency, intensity and corresponding output in terms of landings, for individual fishing activities.

Findings presented in this analysis suggest that the majority of fishing activity takes place between April and June. Fishing activity is reduced in the winter months between November and February although December is a peak beam trawling period. Beam trawling is the predominant fishing activity undertaken throughout the majority of the year but most intensively between March and May and November and December. Gill netting activities are more prominent in June. The majority of fishing activities by all vessels are undertaken in the north of subsquare 35E6, quarter one.

Fishing effort data suggest that power dredging is the most effort intensive fishing activity, followed by otter trawling and beam trawling.

Landings data for both weight and value suggest that skates and rays, mussels and cockles are the key groups. Combined, they account for 56% of total landings value and 81% of total landings weight.

Gaps in data records, particularly for effort and landings has limited the scope for data manipulation in this analysis. However, the data used represent the most reliable information currently available.

Consultation carried out with commercial fisheries operators indicate that there are only two vessels that spend the majority of their time fishing commercially in the vicinity of the proposed wind farm. A third vessel spends approximately half its time fishing and half sea angling in the proposed wind farm area. There is some suggestion that there may be some nomadic beam trawlers that use the wider area, however, the numbers of vessels is thought to have declined over the past decade. Approximately ten commercial angling vessels operate in the vicinity of the proposed wind farm area.

7.8.2 *Shipping and Navigation*

Commercial Ports

The main ports within the vicinity of the proposed wind farm area are Liverpool and Mostyn. Liverpool is one of the major ports in the UK associated with major vessel activity for passenger and freight services. Liverpool is also one of North Europe's top 10 container ports, handling approximately 25% of all box traffic, crossing between the UK and North America. Mostyn is an example of a small commercial port, which usually has a small workforce and relies on a single cargo for existence. A new terminal has recently been developed in Mostyn, for ferrying passengers to Dublin, a route which commenced in November 2001. Additional vessel movements in the future may be associated with the expansion of activity at Port of Mostyn.

Several jetties (Raynes jetty and Llysfaen jetty) are used for aggregate collection are located adjacent to Llanddallus Quarries to the north of Colwyn Bay (*Figure 7.36*). Vessels serving as aggregate wharves on the north Wales coast also pass to the south of the project area.

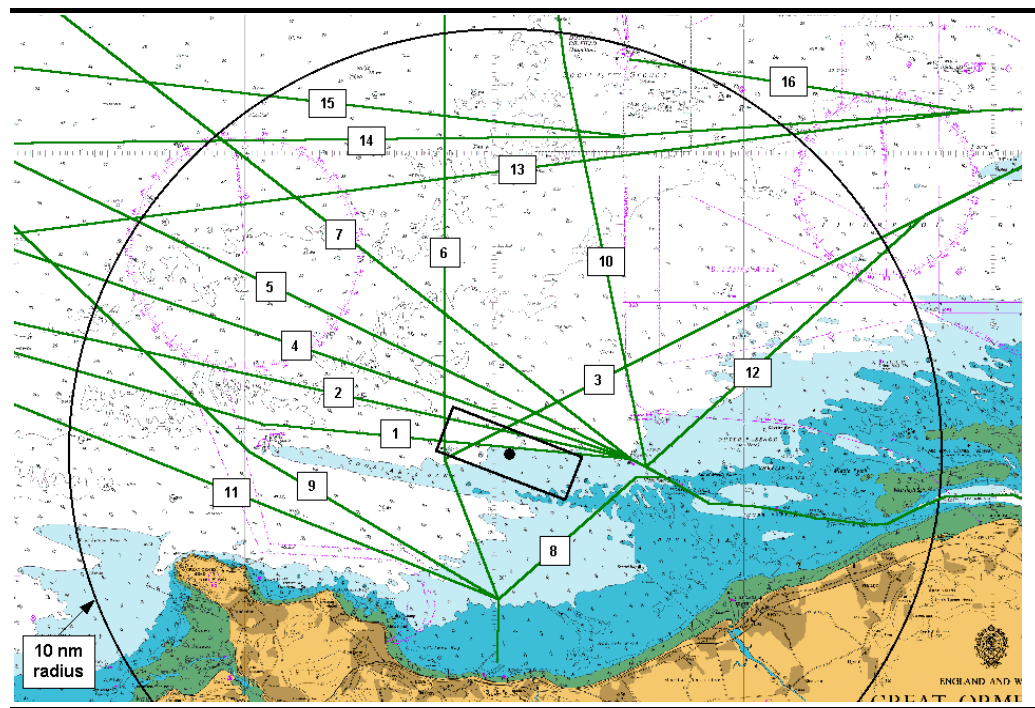
Commercial Shipping Routes

A shipping risk study carried out by Anatec has identified 16 commercial shipping routes within approximately 18.5km (10m) of the proposed lease area (*Figure 7.36*) as follows (Anatec 2002):

- Mostyn-Dublin (1);
- Skerries TSS-Mostyn (2);
- Liverpool-Llanddulas (3);
- Mostyn-Skerries TSS (4);
- Dundalk-Mostyn (5);
- Solway Firth-Llanddulas (6);
- Mostyn-North Channel (7);

- Mostyn-Llanddulas (8);
- North Channel-Llanddulas (9);
- Mostyn-Solway Firth (10);
- Llanddulas-Skerries TSS (11);
- Mostyn-Liverpool (12);
- Point Lynas-Liverpool (13);
- Skerries TSS-Liverpool (14);
- Liverpool-Skerries TSS (15); and
- Douglas (BHP)-Liverpool (16).

Figure 7.36 *Shipping Routes within a 18.5 km Radius of the Proposed Lease Area (from Anatec 2002)*



The total volume of traffic operating on these routes is estimated to be 8,929 vessels, an average of 24 vessels per day (Anatec 2002). Over half the vessels operating in the area are merchant vessels (50%), tankers comprise 33%, ferry comprising 16% and offshore vessels comprising 1%.

All vessels passing within 8 km of the proposed lease area are associated with Mostyn or Llanddulas. The closest passing route to the survey area is the Mostyn to Dublin P & O ferry service (route 1) which passes through the proposed lease area. Approximately 1,440 ferry movements per year are associated with this route (Anatec 2000b).

Routes between the Skerries TSS and the Port of Mostyn (routes 2 and 4) are used by an estimated 70 cargo vessels per year in each direction. The mean position of the eastbound route from the Skerries TSS to Mostyn (route 2) passes through the north-west corner of the lease area, whilst westbound vessels (route 4) pass just to the north of the lease area.

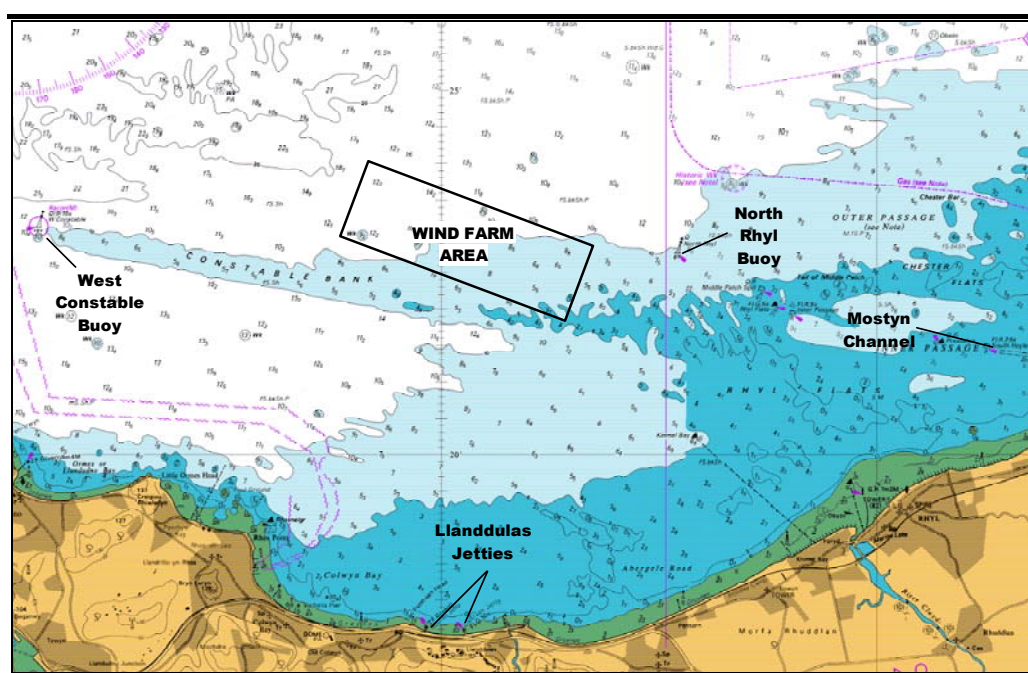
The Liverpool to Llanddullas route (route 3) also passed through the proposed lease area and is used by an estimated 84 cargo vessels per year (Anatec 2002).

The busiest routes identified within 16km of the proposed lease area were associated with Liverpool (routes 12-16), which pass approximately 9-16 km to the north of the centre of the proposed lease area. There are approximately 18 vessels per day on these routes, which accounts for 75% of the total traffic within 16 km.

Navigational Markers

Constable Bank is a shallow bank which lies at between 5 and 6 m depth (LAT) immediately to the south and south-west of the licence area. The Bank is marked to the north and west by cardinal buoys (*Figure 7.37*).

Figure 7.37 *Navigational Markers in the Vicinity of the Project*



A new marker buoy will be located to the north-west corner of the wind farm. This buoy marks the edge of the commercial shipping route.

The end of two sewage outfall pipes in Kinmel Bay and at Rhyll are marked with buoys.

7.8.3 *Other Marine Users*

Oil and Gas Industry Activities

For over thirty years oil and gas exploration has been undertaken in the eastern Irish Sea including Liverpool Bay. Eight fields have been developed, six of which are gas fields (associated with Morecambe south, Morecambe north, Hamilton and Hamilton north) and two are oil fields (Douglas and Lennox) (BHP Billiton 2001).

The proposed lease area falls within oil and gas blocks 110/17 and 110/18 which were originally licensed to Marathon Petroleum. Both of these licences have now been surrendered due to lack of interest in oil and gas at this location.

The closest hydrocarbon interest currently exploited is the Douglas field operated by BHP Billiton which is located approximately 20km north of the proposed lease area. A gas pipeline runs between Douglas Field and the Point of Ayr and passes approximately 2.5 km to the north-east of the proposed lease area. Hamilton and Lennox fields are located further to the north-east and are both operated by BHP Billiton.

Dredging and Aggregate Extraction

Intensive sand and gravel extraction has taken place within Liverpool Bay and the Mersey regions. In addition to this, over three million tonnes of material are dredged from the Mersey Docks and channels each year and disposed of at various scattered sites in Liverpool Bay.

The closest marine dredging area lies approximately 4.5km to the north-east of the proposed lease area (*Figure 7.38*).

Waste Disposal and Dumping

Liverpool Bay has been used as a disposal site for sewage, dredged materials and other wastes since 1874. The practice of dumping sludge offshore stopped in 1998. No historical dumping sites are located within the proposed licence area.

The practice of sewage disposed through long sea outfalls continues in Liverpool Bay (Crumpton and Goodwin 1996). There are several outfalls within the vicinity of the proposed lease area (*Figure 7.38*) including a marked outfall pipe in Kinmel Bay (approximately 3 km to the south-east of the proposed lease area).

Submarine Cables

Three disused submarine cables are located approximately 4.5 km to the south-west of the proposed lease area. The landfall crossing is on the eastern side of Rhos Point in Colwyn Bay (*Figure 7.38*).

7.8.4

Marine Archaeology

Morphology, Geology and Seascape

The development area lies north-west of Rhyll Flats and comprises an area of seabed that rises gently inshore from approximately 19m below Lowest Astronomical Tide (LAT) in the north-west to 3m below LAT in the south-east where it crosses the eastern end of Constable Bank. As noted above, the development area lies to the east of the Creuddyn and Conwy Landscape of

Outstanding Historic Interest and falls within the sea area visible from Great Ormes Head and Little Ormes Head.

Landward of the development area, the seabed drops to approximately 6m below LAT before rising gently through Abergele Road to the beach, which is backed by a seawall that is immediately seaward of the railway. The seawall trends west-south-west to east-north-east from Abergele to Rhyl, and forms the northern edge of an extensive triangle of low-lying land formerly mapped as Rhuddlan Marsh. The southern edge of the triangle is defined by a line of hills trending west-north-west to east-south-east and rising to approximately 150m. The eastern edge of the triangle is broadly defined by the River Clwyd which, together with the River Elwy, follow the edge of undulating land from St. Asaph to Rhuddlan and to Rhyl. Rhuddlan Marsh is cut by the River Gele, which flows eastward from Abergele to the River Clwyd. The River Clwyd itself meets the sea at Foryd, to the west of Rhyl.

Although the general form of the coastal landscape has remained largely unchanged since the earliest available large scale maps and charts (*eg* Collins c. 1690), it is apparent that fairly extensive changes have occurred that have a bearing on the archaeological heritage of the area.

While Richard Blome's map of North Wales (1673) indicates the River Clwyd as a relatively narrow inlet, Humphrey Lhuyd's map of Wales (1573-80) suggests a wider inlet as far inland as Rhuddlan and St. Asaph. The numerous drainage channels and regular field patterns apparent throughout Rhuddlan Marsh certainly indicate that it was improved and perhaps reclaimed in earlier times. The Clwyd would have formed a much broader, shallow estuary or delta prior to improvement, even if the main channel has not changed from its present route to Foryd. The small and irregularly shaped fields east of Abergele between the River Gele and the coast contrast with the large and regular fields south of the River Gele and east of Towyn.

This patterning suggests that reclamation proceeded from west to east, comprising relatively small-scale informal reclamation followed by large-scale formal schemes (*cf.* Rippon 1996: 40). References to canalisation of the Clwyd and/or the Gele at the time of Edward I may provide some dating on this process, and indicate that the main channel of the Clwyd was confined to a single course at this time.

If Rhuddlan Marsh did comprise a broad estuarine inlet in the Medieval period, then this too might have been a relatively recent feature caused by rising sea-level and storm flooding. In the later prehistoric and Roman periods when relative sea-level was lower, the area may have comprised low-lying freshwater marsh or even dry land, with the contemporary coastline approximating the current coastline.

Recorded prehistoric discoveries, palaeo-environmental investigations and field observations at Rhyl and Abergele attest to the presence of landsurfaces with associated archaeological material in the study areas (*see* Manley 1981; 1989; Anon. 1913; Glen 1926; Bibby 1940). Details are set out in the summary

of known sites below, it being sufficient here to note that Mesolithic, Neolithic, Bronze Age and Roman artefacts have been found on the foreshore, sometimes in association with peat horizons. Outcrops of peat/organic material were apparent during site visits at Abergele and (possibly) Rhyl (see *Figure 7.39*).

Earlier still, the contemporary coastline lay seaward of the current coastline; in the Early Holocene, coincident with the re-occupation of Britain following the Devensian glaciation, sea-level is likely to have been c. 30-50 m lower than at present, with the effect that much of Liverpool Bay would have been 'dry' land. In general terms, sea level rose rapidly during the Late Upper Palaeolithic and Early Mesolithic, and as the bed of Liverpool Bay is fairly flat the coastline would have moved towards the present shore over a relatively short period. Small variations in local topography may have had a considerable effect on patterns of inhabitation and habitation sites may have tended towards higher ground.

Figure 7.38 Physical Marine Constraints

INSERT A3 MAP

The form of the early prehistoric landscape within the study area (see *Section 6, Figure 6.1*) is not known, but some indications are available. Peaty silt has been identified in at least one borehole (70/07) off Llandudno, which is considered to represent reed swamps adjacent to open water dating to before 9200 BP (Early Mesolithic) (Jackson *et al.* 1995: 96). The horizon has been interpreted as forming a peat/peaty clay layer in a basin between the shore and Constable Bank (BGS Sheet 53°N-04°W Liverpool Bay, Sea Bed Sediments and Quaternary Geology: Section 3) and is attributed to the SL2 member of the Surface Sands Formation (Jackson *et al.* 1995: 96). The Surface Sands Formation overlies a basin cut into the pre-Quaternary bedrock, whose northern edge is broadly reflected in the position of Constable Bank. During the Devensian and earlier glaciations, the bedrock would have been cut down by rivers as they drained down to the sea, up to 100-130 m lower than at present. As the climate improved and sea-level rose, huge volumes of sediment would have been deposited. The BGS sheet indicates that the deposition of till and clay off the North Wales coast reflects the underlying depression in the pre-Quaternary bedrock, perhaps marking an east to west route of the palaeo-Clwyd parallel with the current shore and inshore of the present position of Constable Bank.

The onset of more stable conditions within the palaeo-Clwyd would have enabled the formation of the peaty clays intercepted off Llandudno, and similar deposits might be expected to survive elsewhere between the current shore and Constable Bank. The landsurface formed by the till, clay and peat would have been inhabitable until sea-level rose yet further, causing the reworking and deposition of gravels and sands – including Constable Bank, which is an active tidal sand ridge – by marine processes. Geophysical survey by Fugro-UDI Ltd. indicates areas of considerable reworking of the glacial till, though sub-bottom profiling also suggests the presence of water cut channels (*ie* pre-inundation palaeo-channels) including one in the east of the development area that is roughly 300 m wide (Fugro-UDI Ltd. Jan 2002).

If this interpretation is correct, then the development area would appear to overlie the northern margin of the palaeo-Clwyd, and possibly its watershed with the palaeo-Dee. The proposed submarine cables will traverse the palaeo-Clwyd to the present shoreline. However, the degree to which any material of archaeological interest is implicated by the development depends on the depth of construction relative to the depth of marine sediments overlying any surviving former landsurfaces (see below).

Known Sites

Known sites are shown on *Figure 7.40* and discussed below.

Discoveries on the Foreshore - As noted above, a range of discoveries have been made on the foreshore at Rhyl and Abergelge. The finds from Rhyl are mostly from around Splash Point (NGR 302000 382500). They include: an antler mattock attributed to the Mesolithic (WA 359); three Neolithic axes of Graig Lwyd stone, comprising two polished axes and one macehead (WA 271); a bronze tanged chisel found in peat layers in 1913 (WA 295); a bronze socketed

spearhead (WA 269); and a Roman coin found in 1937 (WA 272). In addition, an undated causeway of angular stones has been recorded, being c. 5-8m wide and visible for a length of 15m that disappeared into the rising beach (WA 270).

The area has been subject to palaeo-environmental investigation (WA 308) and ten marine transgressions have been inferred from the Mesolithic to the Medieval periods (WA 273). Further evidence for peaty horizons associated with the Clwyd estuary is provided by the discovery of a cattle jawbone in a peat deposit in west Rhyl (WA 70). An anvil stone possibly dating to the Bronze Age was found on an old ground surface on the beach at Abergele (WA 16), and a single outcrop of peat, less than 25mm thick, was observed overlying blue clay during the site visit to Abergele in September 2001 (*Figure 7.39*).

A partly buried rounded timber was also observed on the foreshore at Rhyl (*Figure 7.39*) and may indicate buried forest material, although many other modern driftwood timbers were also observed on the beach. Further details of the artefacts and deposits of Rhyl, Rhuddlan and Abergele have been published (see Manley 1981; 1989; Anon. 1913; Glen 1926; Bibby 1940).



A. Abergele



B. Rhyl

Wesscx Archaeology 18/01/02 KMN ref50081/2



Figure 2
Peat deposits on Abergele foreshore
and roundwood on Rhyll foreshore

Wrecks - A total of fifteen wrecks has been recorded, including three within the Clwyd estuary at Foryd. Summary details are set out in *Annex A2 (Volume V)*.

There are six named wrecks offshore:

- the early submarine *Resurgam* (2006);
- *Guardian Angel* (2002);
- *SS Penrhos* (2003);
- *Four Brothers* (possibly) (2004);
- *FV Rhos Anna* (2011); and
- *Viking* (2012).

There are a further three unnamed wrecks (2007, 2008, 2009), a possible wreck or obstruction (2010) and a fastening reported by fishermen (2001). The fuselage of an Avro Anson (2005) is also reported.

Only the *SS Penrhos* - a vessel carrying stone chippings that was mined with the loss of four crew in 1942 - lies within the development area. Its position is known and was confirmed by the recent sidescan survey. A large wreck was easily identified on the traces from two tracks and was recorded as Sites 3004 and 3010, as follows:

3004	39.00 x 9.30 x 4.41	Probable wreck of the <i>SS Penrhos</i> (elongated contact see ID10 for improved position)
3010	34.00 x 10.60 x unidentified	<i>SS Penrhos</i> (probably), aligned n/s

The *Guardian Angel* (a wreck reported to the UKHO in 1926) lies within 130m of the sub-sea connection options. However, the wreck was not located by the UKHO in searches in 1970 and 1988.

The reported positions of the *Four Brothers* and the Avro Anson lie just outside the development area. The UKHO regards the wreck of the *Four Brothers* as 'live', indicative of it being an extant wreck. However, the wreck was also not located on the sidescan traces despite lying only 28m away from the centreline of a track. This suggests that the wreck may be buried below the seabed or has broken-up since the last UKHO survey. The wreck of the Avro Anson was not located on the sidescan traces and as the UKHO regards the wreck as being 'dead' after failing to locate it, and the presence of the aircraft at this location is questionable.

The position of the *Resurgam* is confirmed and lies to the north-east of the development area. The *Resurgam* is an historic wreck, being the world's oldest known surviving submarine, built at Birkenhead in 1879. An area 300m radius around the wreck has been designated under the *Protection of Wrecks Act 1973* (see below). The wreck may have been moved from its original sinking position and the conning tower hatch cover has not been located.

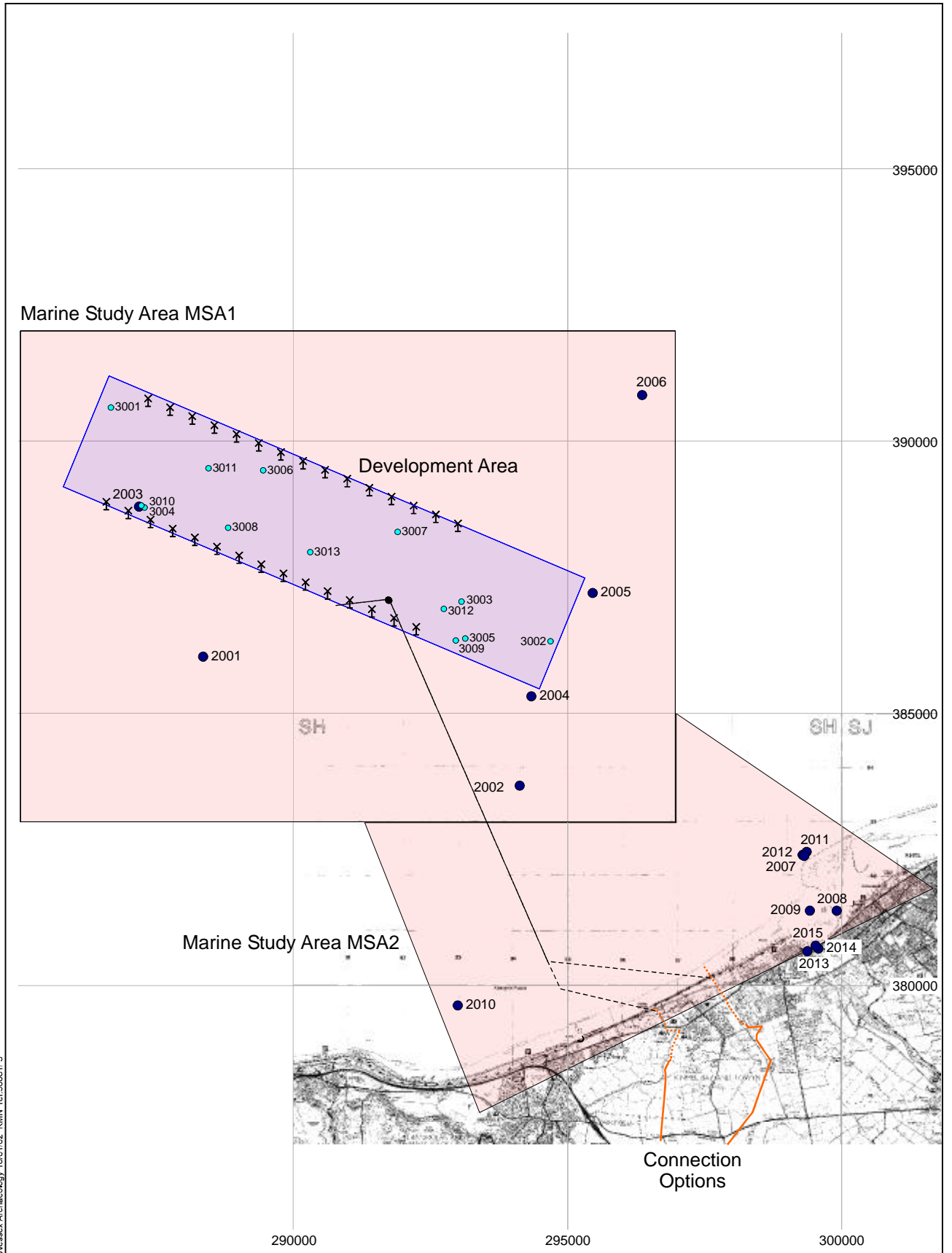
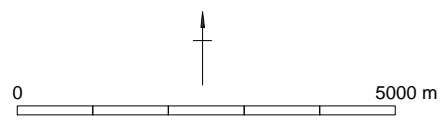


Figure 3
Marine Study Area



- ✕ Turbines
- Wreck locations
- Sidescan anomalies

The former harbour at Foryd is now greatly silted, but there are two, possibly three, wrecks lying in the mud there. The two known wrecks comprise the *City of Ottawa* (2014), and the *Alice* (2013). The third 'wreck' has been identified by several timbers protruding from the mud at low water at the north end of the harbour.

In addition to confirming the presence of the SS *Penrhos* (3004, 3010), eleven 'new' anomalies were identified from the sidescan data. All lie within the development area and comprised isolated contacts on an otherwise featureless seabed that do not display any particular distribution, see *Table 7.16*.

Table 7.16 *Anomalies Identified by the Sidescan Data*

Site no.	Dimensions of Contact in Metres (LxWxH)	Description
3001	6.00 x 2.00 x 0.4	• two isolated rectangular objects
3002	3.00 x 1.00 x 0.65	• numerous individual objects (general size noted)
3003	16.00 x 6.00 x 1.20	• unidentified contact, on flat seabed
3005	13.00 x 3.00 x unidentified	• two isolated amorphous objects within scour
3006	6.00 x 1.00 x 0.15	• pair of medium/hard contacts on flat seabed
3007	7.00 x 2.00 x 0.42	• linear hard contact
3008	30.00 x 8.80 x 0.60	• 'boat' shaped contact, aligned NE-SW
3009	7.00 x 5.60 x 0.53	• small, scattered linear contacts (probable fish 'noise')
3011	8.70 x 4.00 x 1.00	• isolated hard contact, on rock outcrop
3012	5.00 x 4.00 x 0.83	• isolated hard contact possibly in two parts, on flat seabed
3013	7.00 x 4.00 x unidentified	• isolated medium contact, on flat seabed

The most distinctive contact is Site 3008, which is a 'boat' shaped contact aligned north-east/south-west, located to the west of the centre of the development area. The scatter of small contacts forming Site 3009 is likely to comprise fish 'noise'. Fugro-UDI note that a number of prominent targets may be interpreted as boulders washed out of glacial till (Fugro-UDI Ltd. Jan 2002).

Interpretation of the generally sandy seabed within the development area noted that it is relatively featureless but contains an area of clay to the north-east and mega-ripples (huge undulating sand waves up to 12m wide) to the north and west.

No sidescan anomalies were identified on the proposed cable routes surveyed by Fugro-UDI Ltd, though it is noted above the anticipated final section to shore has not been surveyed.

Archaeological Potential

Prehistoric - It seems likely that the former landsurfaces indicated by peat horizons on the foreshore and in boreholes are reasonably extensive and may underlie the development area, the subsea cable routes, and the areas where the subsea cables come ashore. As well as providing direct, datable palaeo-environmental evidence of the development of the landscape in the Holocene,

previous discoveries of artefacts suggest that more artefacts, if not entire sites, may be found in association with the landsurfaces. The character and extent of these postulated landsurfaces is largely unknown.

Maritime - In view of the low number of recorded maritime sites within the marine study areas and the difficulties of desktop identification of older wreck sites, it is appropriate to consider the potential for as yet unrecorded archaeological material in terms of past maritime activity in the vicinity of the River Clwyd, Abergele Roads and Rhyl Flats.

The River Clwyd was navigable at least as far as Rhuddlan during the Medieval period. When Rhuddlan castle was built by Edward I in 1277, sandstone was brought up the Clywd (Harris 1996). Wynne Jones notes that Edward had the river diverted during the building of the castle dock, two miles from the sea. This diversion facilitated the accommodation of ships of up to 40 tons. Consequently, Rhuddlan received ships from Liverpool, Bristol, Fowey and Plymouth during the Middle Ages (Wynne Williams 1983) and navigation was undertaken regularly by vessels of up to 50 tons until the mid nineteenth century (Wynne Jones 1973). A 'Topographical and Historic Description of North Wales' undertaken in 1819 also notes that the River Clwyd was navigable up to Rhuddlan, and that small vessels took in corn, timber and local produce at its mouth (Jones 1976). In 1841 a timber-bonded port was constructed at Rhuddlan but the gradual silting up of the Clywd caused the town to decline from 1844 (Harris 1996). Trade was then concentrated through the Foryd harbour at Rhyl.

In 1566 *Foryd* is mentioned as a small creek able to receive barges and boats with a small fishing village of 40 poor households exporting farm produce and lead ore (Harris 1996). Its name is derived from the 1490 name *Forryd* - a combination of 'Mor' (sea) and 'Rhyd' (ford) meaning ford by the sea. Foryd is mapped as Vovid by Collins in c. 1690. By the eighteenth century Foryd was exporting large amounts of timber and farm produce (Harris 1996), and became the harbour at Rhyl (WA 102) with the advent of passenger ships in early nineteenth century (Jones 1976).

The main quay was on the west side of the river, although there was a quay with moorings on the east side. The 1843 *Sailing Directions for the Coast of Wales* notes that the small quay (Foryd) on the River Clwyd is accessible to small craft with 13ft of water at High Water (Sheringham, Robinson and Denham 1843). Larger craft may have already started to avoid Foryd because of the hazard presented by the shallow water. Between 1858 and 1922 large volumes of gravel were dredged from the harbour, initially as ballast for the local railway, but later for export (Harris 1996). Notably, a shipbuilding yard and landing stages are recorded on the 1914 Ordnance Survey map.

Rhyl itself was a small fishing port until early nineteenth century but by 1839 had become a seaside resort with many hotels and roads serviced by a regular steam packet service from Liverpool (Jones 1976).

The Welsh coast is not well provided with natural harbours (Hill *et al.* 2001) and the relative shelter offered by the Clwyd and the Abergele Roads would have provided a useful staging point. The need for shelter is illustrated by Harris's account of a vessel wrecked on the 20th January 1309 whilst running for the Clwyd (Harris 1996) during a sudden gale.

The 1843 *Sailing Directions for the Coast of Wales* note the shore off Rhuddlan Marsh as 'low and flat, with a shingle beach a third of a mile in breadth to the low-water mark, where it becomes fine sand'. Constable Bank is described in the same directions, including 'some two fathom patches' near its eastern end and 'a narrow ridge of sand 3½ miles in length, and carrying no where less than 2 1/3 fathoms, but generally called the Three Fathoms Ridge' (Sheringham, Robinson and Denham 1843).

Another hazard noted within the *Directions* is the Chester Flats, an area of seabed to the immediate north-east of the Rhyl Flats, that 'must be left to eastward by vessels approaching the Clwyd from the northward. The Chester Bar within the Flats was of sufficient danger to be identified as a large crescent-shaped bar in Grenville Collins' *Great-Britain's Coasting Pilot* of c.1690. Mackenzie later recorded the Bar as drying at low-water spring tides thus posing a further navigational hazard (Mackenzie 1776). The volume of shipping losses off of the Rhyl coast is reflected by the establishment of a lifeboat station there in 1852 (Morris 1995).

The presence of both destinations and hazards for maritime traffic dating at least to the Medieval period and the documented maritime trade, suggest that many more wrecks are likely to have occurred than the relatively small number of modern wrecks so far recorded. As well as unknown and undocumented wrecks, it would appear that there is potential for stray finds of items lost or thrown overboard from various periods within the marine study areas.

In considering the potential for shipwrecks, it should be noted that such sites often occupy an extended area beyond the confines of any remaining hull, depending on the circumstances of loss and the effects of post-depositional processes. The extended area may contain significant elements of structure, artefacts and stratified deposits and has to be considered as an integral part of the wreck site.

Aircraft - In most cases, records of aircraft lost on military service do not indicate their place of loss as this was often unknown. Given the proximity of development area to the industrial areas of Merseyside and the seaplane base at Beaumaris, east Anglesey, which were subject to air attack during WWII, there is the potential for aircraft or related material to be present in addition to the Avro Anson so far reported.

Previous Disturbance

Prehistoric - The main processes militating against the survival of prehistoric landsurfaces and any associated sites are the reworking of those deposits in

the course of marine inundation. Wave and tidal action are likely to have repeatedly eroded and deposited former terrestrial material, washing out fine sediments, abrading otherwise robust artefacts and exposing organic materials to chemical and biological decay. Nonetheless, the presence of peat in offshore boreholes and on the present foreshore suggests that locally some soft deposits may have survived, sometimes in association with datable artefacts.

Wreck - The process of wreck formation is itself likely to be the main source of previous disturbance to wrecks within the marine study areas, as vessels reaching the seabed are likely to suffer various forms of collapse and decay before stabilising. The main post-depositional processes active in the area are likely to be sand movement and trawling. Sand movement may expose and re-bury wrecks, causing periodic instability that leads to physical, biological and chemical decay. Trawling may have an occasional catastrophic effect on wreck exposed on the seabed, with physical disruption leading to biological and chemical decay.

Designations

There is one site designated under the terms of the *Protection of Wrecks Act 1973* within MSA#1, namely the submarine *Resurgam* (2006).

The only known vessel within the marine study areas that sank while in military service or due to military action is the *SS Penrhos*. Although the *SS Penrhos* might be regarded as a 'war grave', this term has no meaning in law. The vessel has not been designated as a 'protected place' or 'controlled site', hence the site-specific provisions of the *Protection of Military Remains Act 1986* do not apply.

Any aircraft that have crashed while in military service are automatically protected by the *Protection of Military Remains Act 1986*. The remains of the Avro Anson, or of any other military aircraft located in the course of construction, would be protected.

7.8.5 *Tourism and Amenity*

Overview

The North Wales and Lancashire coasts are dominated by traditional seaside resorts providing a significant income for the region and tourism is a major employer. Many land-based activities are undertaken along the coast, including walking and birdwatching. Despite strong tides and some pollution problems in Liverpool Bay, this region is moderately important on a national scale for water-based leisure including yachting, power boating and dingy sailing. Marina facilities exist locally at Rhyl and also on a larger scale in the Dee and Mersey estuaries. Other important water sports practiced in the region include wind surfing, jet skiing, canoeing, and wind surfing. Angling takes place from shore and at sea (Dunbar et al 1993).

Recreational Boating

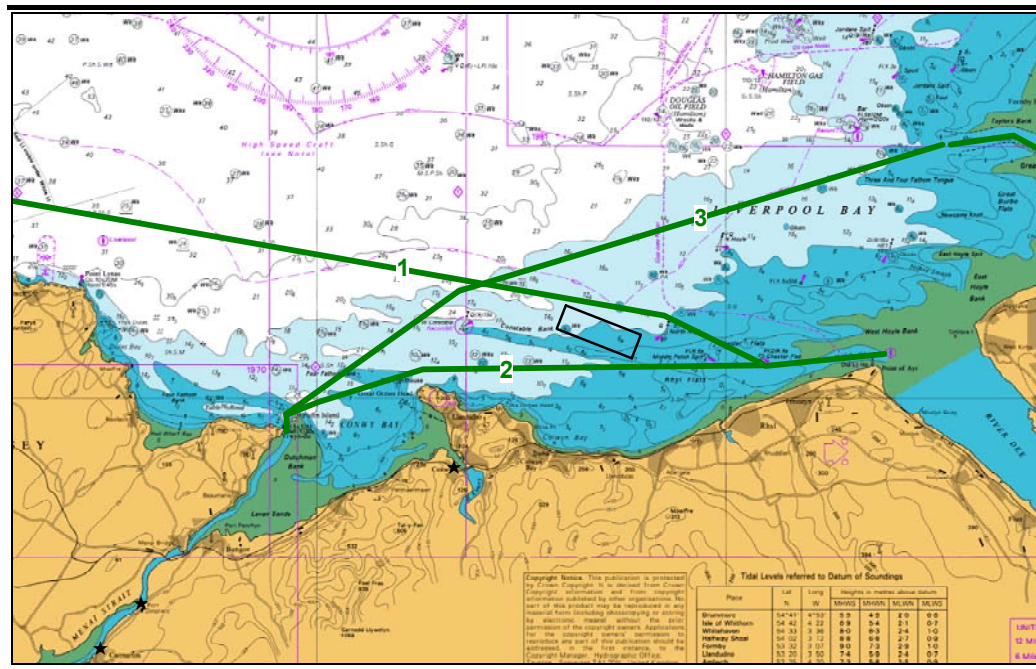
Consultation with the Royal Yachting Association (RYA) has indicated that the North Wales coast is not as popular with boat users in comparison with the very popular south and south-east coast of England (Anatec 2001).

The key recreational pleasure craft routes in the vicinity of the proposed lease area are as follows:

- River Dee to north Coast of Anglesey (1);
- River Dee to Menai Strait (2); and
- Mersey to Menai Strait (3).

These routes are shown in *Figure 7.41*

Figure 7.41 *Recreational Pleasure Craft Routes in the Vicinity of the Proposed Lease Area (Anatec 2001b)*



Recreational vessels in the vicinity probably embark from one of 12 marinas in north-west England and North Wales (comprising approximately 2,000 berths). The nearest to the proposed lease area include Liverpool Marine, Albert Dock, Fiddlers Ferry Yacht Haven, Conwy Marina and Holyhead Marina. There are also a number of more informal moorings in the area including the Conwy estuary.

Diving Interests

The North Wales coast is locally important for diving, particularly the coast of Anglesey, where diving takes place mainly between April and November (Dive Anglesey *pers comm.* 2002).

Introduction

To assess the potential noise impact of the proposed development, it is appropriate to undertake a study of the existing noise environment at locations along the coast where turbine noise might be audible. The DTI Working Group on noise from wind turbines recommendations propose that background noise measurements, $L_{A90,10\text{min}}$ should be undertaken and correlated with wind speed measurements made at site. At the time the noise survey was performed, no anemometer was located at the proposed site location.

To allow an assessment of the wind speed during the survey period, two sources of wind speed data were obtained. The first was an onshore anemometer located at Happy Days holiday Camp, Kinnel, grid ref: 297594 379935. The anemometer was located at 10 m above ground level and logged both the wind speed and direction as a 10 minute average. A second source of wind speed data were obtained from an offshore gas rig located 15 miles north of the coastline. The wind speed data provided from this source were as 3 hour averages of wind speed and direction. The wind speed data were supplied in knots.

Comparisons of the measured data indicate that during periods of relative calm, *ie* a measured wind speed of less than 6m s^{-1} onshore, wind speeds offshore were as high as 17m s^{-1} . This indicates that wind speed measured offshore may be significantly higher than wind speed measurements made onshore. The anemometer is 61 m above MSL. It is unclear where the anemometer is located on the gas rig and, as such, the anemometer may have been affected by localised wind speed acceleration caused by rig structures.

Background noise measurement locations were selected on the basis of preliminary noise predictions. These indicated that at a wind speed of 10m s^{-1} , the potential highest levels of turbine noise may occur along the sea fronts of Rhos-on-Sea to the west, Llanddulas, due south of the site and towards Rhyl to the east. Predicted maximum noise levels at this wind speed at these locations was 30 – 32 dB L_{Aeq} . The DTI NWG Recommendations indicate that, for locations where predicted turbine noise levels are below 35 dB L_{A90} (~ 37 dB L_{Aeq}), background noise surveys may not be necessary.

The baseline noise survey was conducted between 6th – 18th December 2001, a total measurement period of 13 days. Measurements were performed using Larson-Davies LD-820 Type I sound level meters which were set to log noise data using ten minute measurement periods. Apart from the background $L_{A90,10\text{min}}$ noise levels, data was collected for the following indices for each 10 minute period, L_{A05} , L_{A10} , L_{A50} , L_{A75} , L_{A95} , L_{A99} , L_{Amax} , L_{Amin} , L_{Apeak} , L_{peak} , L_{ASEL} and L_{Aeq} , although only the $L_{A90,10\text{min}}$ and $L_{Aeq,10\text{min}}$ have been used in the analysis.

Noise Survey Locations

Rhos-on-Sea - The measurements performed at the Rhos-on-Sea measurement location were undertaken at 27 Kayley Promenade. The dwelling is located on the sea front and looks out across Colwyn Bay towards the site. The measuring microphone was located on the southern façade of the building. This location was selected as it was likely to be the most sheltered position from onshore wind. *Figure 7.42* details the location of the measurement position and the location of the measuring equipment.

Larson-Davies LD-820 Serial No. 1253 was installed at this location. The meter was calibrated before and after the noise survey and the calibrated level was found to have not deviated reading 93.7dB at the start and end of the survey period.

Audible sound at this location included the passing vehicular traffic along the surrounding roads, sea gulls, dogs barking, building works being performed at nearby dwelling and the A55 coast road. The A55 is situated 400 metres to the south of the dwelling and was found to be the most dominant noise source at this location. It was not possible to hear the lapping of waves on the sea shore due to this dominant source of noise. The tide was in when the equipment was installed and removed, and the sea state was calm.

Old Life Boat House, Llanddulas - The measurements performed at the Llanddulas measurement location were undertaken at the Old Life Boat House, Llanddulas. The house is located on the sea front, and is the only dwelling at this location on the seaward side of the A55 and the coastal railway line. It is currently experiencing improvement works, however this work was located on the eastern side of the building whereas the measurement position was on the western end of the building within the garden. *Figure 7.42* shows the location of the measurement position and the location of the measuring equipment. The measurement position was within the garden to the west of the dwelling, away from the works in the building to the east.

Figure 7.42 Noise Monitoring Locations

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Larson-Davies LD-820 Serial No. 1252 was installed at this location. The meter was calibrated before and after the noise survey and the calibrated level was found to have deviated by 0.4dB reading 93.8dB at the start and 93.4dB at the end of the survey period. This change in level is within the tolerance of the measuring equipment and is therefore acceptable.

Audible sound at this location included passing vehicular traffic along the minor road, sea gulls, dogs barking, passing trains along the coastal railway line and the A55 coast road. The A55 is situated 250m to the south of the dwelling but there is no direct line of sight due to the presence of the high railway embankment. Therefore, noise from the A55 was not as dominant as that found at Rhos-on-Sea and it was possible to just hear the sound of the sea. Train noise was clearly audible at this location, but the noise from trains is transient in nature and is unlikely to have any affect upon the measured background noise levels. It was just possible to hear the lapping of waves on the sea shore. The tide was in when the equipment was installed and removed, and the sea state was calm.

Kinmel Bay/Rhyl - The measurements performed at the Kinmel Bay / Rhyl measurement location were undertaken at the Happy Days Holiday Camp, Towyn/Kinmel Bay. The site is a large mobile home camp site with the normal services associated with such developments, (shower blocks, club house *etc*). The holiday camp was not operating during the site survey and the noise levels at this location will be indicative of the lower levels of noise that might occur on the site were it to be occupied during the summer months. The previous section details the location of the measurement position and the location of the measuring equipment. The measurement position was within the camp site, close to the main reception between mobile homes. This location was selected to reduce any potential effects of the sea upon the measurement location and to allow shelter to the microphone from the mobile home structures. The onshore anemometer was located within this camp further to the north at a distance of 100 m from the sound level meter.

Larson-Davies LD-820 Serial No. 0679 was installed at this location. The meter was calibrated before and after the noise survey and the calibrated level was found to have not deviated reading 93.8dB at the start and end of the survey period.

Audible sound at this location included the passing vehicular traffic along the camp access roads, vehicular traffic along the coastal A548, sea gulls, dogs barking, passing trains along the coastal railway line and the A55 coast road. The A55 is situated 4km to the south and west of the measurement location and is audible source of noise at the measurement location. Train noise was clearly audible at this location, but the noise from trains is transient in nature and is unlikely to have any effect upon the measured background noise levels. The tide was in when the equipment was installed and removed, and the sea state was calm.

Results of Background Noise Measurements

Time history figures of all the measured data are contained within *Annex I (Volume V)*. These figures detail the measured $L_{Aeq,10min}$ and $L_{A90,10min}$ noise levels and the corresponding 10 minute average wind speed measured by the onshore anemometer.

Rhos-on-Sea : Rhyl TH / 1 – 13 - The measured data collected at the measurement position at Rhos-on-Sea indicate that traffic noise from the A55 was the dominant noise source in the vicinity. Background noise levels increase from 0530 hrs to a level of 45 – 50dB $L_{A90,10min}$ by the morning rush hour at 0800hrs. Noise levels then remain between 40 – 50dB $L_{A90,10min}$ until early the following morning, 0200 hrs. The location of the sound level meter at the sea front should lead to changes in noise level which are associated with the tide, *ie* as the water line approaches and then recedes from the shore, one would expect to see an associated change in noise level.

Such an effect is not clear within the measured data due to the presence of the A55 traffic noise. However, the data collected between 13th and 17th December 2001 (Rhyl TH / 4 – 12) may contain this effect. At midnight on the 13th December 2001, noise levels start at 50dB L_{A90} and gradually fall to 44dB L_{A90} . In the following early morning period, the background peak occurs just after midnight, a level of 49dB L_{A90} . On the 16 and 17th December, this peak occurs at 0140 and 0240 hrs, with levels of 52dB and 50dB L_{A90} respectively. This change in peak noise level with time is indicative of the timing of high tide. The lowest levels measured occurred on 8th December 2001, Rhyl TH / 3. This low level occurred at 0400 hrs on Saturday morning and is likely to have coincided with low tide at this time. Therefore, the combination of low traffic noise and low tide resulted in the minimum background noise measurement at this location during the survey at this location.

The Old life Boat House, Llanddulas : Rhyl TH / 14 – 27 - The measured data collected at the measurement position at Llanddulas indicates that traffic noise from the A55 was the dominant noise source in the vicinity. Background noise levels increase from 0530 hrs from a level of 33 – 35dB L_{A90} to a level of 45 – 55dB $L_{A90,10min}$ by the morning rush hour at 0800hrs. Noise levels then remain between 40 – 50dB $L_{A90,10min}$ until early the following morning, 0200 hrs. There also appears to be an evening rush indicated within the data with a secondary peak in the background noise levels around 1600 – 1900 hrs. The highest peak occurs on the Monday morning where weekend traffic leaving the area might also be expected.

Unlike the measurements at Rhos-on-Sea, the measured L_{Aeq} values are at times significantly above the measured L_{A90} noise levels. These L_{Aeq} peaks are associated with the passage of trains along the coastal railway. On Sunday mornings, 9th December and 16th December, there are few morning trains with the first L_{Aeq} increase occurring at around 1100 am. It may also be seen that during some nights, regular trains passages occur at 0100, 0250 and 0500 hrs. Some nights there may be two or three more additional train movements and Saturday night/Sunday morning there are no train movements.

Happy Days Holiday Park, Kinmel Bay / Towyn : Rhyl TH /27 – 39 - The measured data collected at the measurement position at Kinmel Bay indicates that daytime noise levels are dominated by noise from A587 and A55. The location of the measurement position some 4000 metres from the A55 has ensured that the lower levels during the night fall to 25 – 30dB L_{A90} . The morning rush hour results in an increase in measured levels from around 30 dB L_{A90} at 0530 hrs to 45 – 50dB L_{A90} at 0800 hrs. The background noise level then stays fairly constant through the day and begins to fall after 1800 hrs reaching a minimum between 0200 hrs and 0400 hrs.

The measured L_{Aeq} levels show an indication that train noise has affected the L_{Aeq} but not to the same extent as was found at the Llanddulas measurement position. Furthermore, movement of vehicles within the holiday camp may have resulted in these increased levels.

Regression Analysis of Background Noise Levels

Following the guidance within the DTI NWG Recommendations, the measured background noise levels have been sorted into quiet daytime and night-time period data. The measured background noise levels have been correlated with the onshore wind speed measurements. This detailed analysis (*Figures Rhyl Regression / 1 – 9, Annex I (Volume V)*) show that there is little correlation of background noise levels with wind speeds. This is, in the main, due to the dominant effect of the A55 upon the noise environment at all three measurement locations.

In quiet rural environments, wind effects upon vegetation will cause an increase in background noise level at wind speeds of 2– 4m s^{-1} . However, these effects will cause background noise levels to rise from 20 – 25dB L_{A90} to 25 – 30dB L_{A90} . The level of noise from the A55, *ie* between 45 – 55dB L_{A90} , completely masks these noise increase due to wind speed.

Measurements undertaken by Hayes McKenzie Partnership at other numerous locations in the UK indicate that wind noise upon surrounding structures and vegetation rarely exceeds 50 – 55dB L_{A90} until a wind speed of 12 – 15m s^{-1} has been exceeded at the anemometer location. Therefore, the noise environment at the measurement locations will not show any correlation with wind speed unless the wind exceeds a velocity of 12 – 15m s^{-1} . The highest wind speed measured during the survey period was 8.38m s^{-1} .

In general, all three locations experienced a similar level of prevailing background noise of 40 – 45dB L_{A90} . When undertaking the noise impact assessment, the derived prevailing background noise level for each of the measurement locations have been used. For locations where background noise measurements have not been performed, the location which most closely resembles one of the three measurement locations has been used.

Finally, a significant amount of the data collected during the noise survey was for wind speeds of less than 3 – 4m s^{-1} when measured at a height of 10m

Although the final selection of the turbine to be installed has not been made, it is unlikely that a wind turbine experiencing this level of wind will operate. However, the wind data collected from the gas platform might indicate that even if onshore wind speeds are low, offshore wind speeds are sufficient to allow generation of electricity. For the purpose of our assessment we have assumed that the turbines will only generate once wind speed exceeds 3.5m s^{-1} . If the turbines were to operate at a lower wind speed, the assessment will not be invalid as the prevailing background noise levels at these low wind speeds is still in the 40 – 45dB L_{A90} region as the noise is generated by the A55 and not the wind.

7.8.7 *Traffic and Transport*

Description of the Adjoining Highway Network

The road network in the immediate vicinity of the Port of Mostyn is shown to a scale of 1:50,000 on *Figure 7.43*. The principal roads in the vicinity are the A548, A55 and A550.

The A548 runs north-westwards towards Prestatyn and Rhyl, and south-eastwards towards Flint and Connah's Quay.

The A55 North Wales coast road runs in a general east-west direction some five kilometres south of the Port of Mostyn, serving Colwyn Bay, Conwy, Llandudno, Bangor and Holyhead to the west and by-passing Chester to the east before joining the M53 and M56 motorways.

The A550 links the A55 to the M56 approximately 20 kilometres east of Mostyn Docks.

The A548 road that passes south-west of Mostyn Docks is a high standard single carriageway subject to a 40 mph speed restriction in the vicinity of Mostyn. The junction of the Mostyn Docks approach road, with this section of A548, is constructed to a high standard with the provision of a right turning lane when approaching from Flint and is traffic light controlled.

The A548 is a principal road and is part of the Flintshire County Council primary route network.

There are no programmed road improvements in the current *Flintshire Local Transport Plan*. The Local Transport Plan indicates the road improvements on a five year plan basis. Nothing is programmed for the Mostyn area but the council have made a bid for funding to the Welsh Assembly to undertake a "*North East Wales Dock Transport Strategy*". This would look at a multi modal strategy for the assessment of transportation as a result of the docks development, to include road, rail, public transport and cycling/walking. The bid has been successful and the work could start in April/May 2002 with a view to a report by the end of the year 2002.

Mostyn Docks is connected to the North Wales coastal rail network serving Shotton to the south-east and Prestatyn to the north-west. Rail sidings are located within the docks. COWL will investigate the possibility of utilising the rail sidings to bring construction materials of an appropriate size and weight to the site, as well as removing items from the site where required, if Mostyn Docks are selected as the preferred port.

Standard of Highway

The unclassified roadway serving the Port of Mostyn is approximately 7 m wide with a footpath on the southern side for approximately 200 m then crossing to the northern side, and of an intermittent nature. There is street lighting leading from the junction towards the P & O Ferry Terminal and the road is subject only to a localised 48kph (30mph) restriction.

There are no residential properties along the access roadway between the Port access and the A548.

The junction of this unclassified road with the A548 is to a high standard, with visibility of at least 4.5m x 90m in either direction.

The A548 is built to a modern standard and over most of its length it has an 8 m wide carriageway. Some 10km north-west of the junction with the Dock Road there is a junction with the A547 road. To the south-east lie junctions with the B5152 at approximately 4.5 km and the A5206 at approximately 7.1km.

The A548 road provides a mixed single and dual carriageway link between Mostyn Docks and Rhyl to the north and has mixed single and dual carriageway between the Dock and the A550 road to the south-east. Throughout these sections of roadway the speed limits vary from 48kph (30mph), through 64kph (40mph) and on to national limits.

Figure 7.43 Local Road Network

KXS to insert. A4 colour page figure

Include and edge roads in red. (1:50,000 scale)

. A548

. A55

. A550

Baseline Traffic Flows

The daily (24 hour) traffic flows on the Dock Road were observed to be between 775 and 826 vehicles. The 18 hour flows (0700 to 1900 hours) varied between 523 and 549 vehicles. Surveys during the Christmas holiday period, when the docks were relatively inactive, indicated lower daily flows of between 237 and 569 vehicles (24 hours) and 190 and 415 vehicles (18 hours).

Traffic flows along the A548 have been recorded by Flintshire County Council south of Ffynnongroyn approximately three kilometres north-east of Mostyn. The results of these surveys, between January 2000 and December 2001, indicate that total daily traffic flows vary from 7277 vehicles in November 2000 to a maximum of 12,692 during August 2001.

7.9 SEASCAPE, LANDSCAPE AND VISUAL AMENITY

7.9.1 Introduction

This section provides a description, characterisation and evaluation of the seascape, landscape and visual context of the study area.

7.9.2 Seascape Character

Introduction

The six seascape units in the greater study area are shown on *Figure 7.44*. These have been defined in accordance with the methodology described in *Annex K2 (Volume V)* and are:

- Red Wharf Bay Seascape Unit;
- Conwy Bay Seascape Unit;
- Llandudno Bay Seascape Unit;
- Colwyn Bay Seascape Unit;
- Dee Estuary Seascape Unit; and
- Liverpool Bay Seascape Unit.

Red Wharf Bay Seascape Unit

The Red Wharf Bay Seascape Unit is shown on *Figure 7.44*. The coastline that defines this unit extends from Ynys Moelfre to Black Point (on the Isle of Anglesey).

The desk study/fieldwork assessment of this seascape unit is presented in *Annex K3 (Volume V)* and the key characteristics and evaluation of the marine, coastal and hinterland zones are as set out in the table below.

Table 7.17 Key Characteristics and Evaluation of Red Wharf Bay Seascape Unit Zones

Zone	Characteristics
<i>Marine Zone</i>	Open with very few installations.
<i>Coastal Zone</i>	A series of bays, cliffs and headlands, with a very broad intertidal zone in the bays and a very narrow intertidal zone around the base of the cliffs. Coastline is generally rural, with evidence of small-scale coastal activities (past and present). Very limited access to the coast (roads tend to be dead ends and the coastal footpath is between Moelfre and Benllech only). Very limited development, concentrated into two settlements, which are mainly residential.
<i>Hinterland</i>	Two main different character areas. Moelfre to Red Wharf Bay which is a relatively low, undulating, rural area with the two main settlements (Moelfre and Benllech), and Penmon which is a more open, exposed promontory between Red Wharf Bay and Black Point, with only scattered farmsteads and a high point at Bwrdd Arthur which rises to 164m AOD.
<i>Evaluation</i>	The Red Wharf Bay Seascape Unit has a clear and obvious character, where the various elements are well integrated, the natural and manmade elements are harmonious and generally in good condition. There are very few detractors, such as the disused quarries and the radio masts, but also some very attractive features, such as Red Wharf Bay and the views along the coast. This seascape unit has a strong sense of place and a pleasant, in some places beautiful, scenic quality and, overall the seascape quality is high.

Conwy Bay Seascape Unit

The Conwy Bay Seascape Unit is shown on *Figure 7.44*. The coastline that defines this unit extends from Black Point to the Menai Bridge (on the Isle of Anglesey) and then from the Menai Bridge to Great Ormes Head (on mainland Wales), a distance of approximately 39km.

The desk study/fieldwork assessment of this seascape unit is presented in *Annex K3* and the key characteristics and evaluation of the marine, coastal and hinterland zones are as follows.

Table 7.18 Key Characteristics and Evaluation of Conwy Bay Seascape Unit Zones

Zone	Characteristics
<i>Marine zone</i>	Partially enclosed, with only minor installations.
<i>Coastal zone</i>	Has the appearance of an elongated bay or estuary with a broad intertidal zone and a relatively enclosed seaward entrance. Coastline is generally rural, with evidence of small-scale coastal activities (past and present). Transport routes along the coast (roads and railway) tend to separate the coastal zone from the hinterland. Development concentrated into several settlements, which are mainly residential.
<i>Hinterland</i>	Three main different character areas. Black Point to Bangor is a low, undulating, rural area with concentrated settlements (Beaumaris, Menai Bridge and Bangor) and scattered farmsteads. Bangor to Llanfairfechan has a broad rural, coastal zone backed by steep mountainsides, with only a few scattered farmsteads. Llanfairfechan to Great Ormes Head has the steep mountainsides almost meeting the sea, with settlements nestled between the spurs.

Zone	Characteristics
<i>Evaluation</i>	The Conwy Bay Seascape Unit has a very clear and distinctive character, where the various elements are quite well integrated, the natural and manmade elements are balanced and generally in very good condition. There are some detractors, such as the quarries, the main roads and the railway line so close to the coast, but also some particularly attractive features, such as Beaumaris and Penrhyn Castles, and the backcloth of Snowdonia. This seascape unit has a strong sense of place and the scenic quality is beautiful in most parts so, overall, the seascape quality is high.

Llandudno Bay Seascape Unit

The Llandudno Bay Seascape Unit is shown on *Figure 7.44* and in more detail on *Figure 7.44*. The coastline that defines this unit extends from the old lighthouse on Great Ormes Head to Little Ormes Head, a distance of approximately 8 km.

Figure 7.44 Seascape Units (key plan)

Plans in preparation. A3 colour.
i.e. Two pages and starting on an odd page.

Figure 7.45 Llandudno Bay and Colwyn Bay Seascape and Landscape Units

Plans in preparation

A4 colour

The desk study/fieldwork assessment of this seascape unit and the descriptions of the component landscape units are presented in *Annex K3 (Volume V)*. The key characteristics and evaluation of the marine, coastal and hinterland zones of this seascape unit are as follows.

Table 7.19 *Key Characteristics and Evaluation of Llandudno Bay Seascape Unit Zones*

Zone	Characteristics
<i>Marine zone</i>	Open with only minor installations within the seascape unit but with views of the Douglas oil platform (when visibility permits).
<i>Coastal zone</i>	A series of small open bays, with a narrow intertidal zone. Coastline is partly undeveloped steep, rocky cliffs (around the Great and Little Ormes) and partly urban seaside town (Llandudno).
<i>Hinterland</i>	There are two different characters to the hinterland. The Great Orme, Mynydd Pant and Little Orme, are open uplands with a coastal cliff-top feel, although the development on the Great Orme detracts somewhat from this. Llandudno and Craigside are low-lying and densely developed. Great Orme and Llandudno have visitors and activity virtually all year round.
<i>Evaluation</i>	The Llandudno Bay Seascape Unit has several clear, distinctive and contrasting characters. In parts, the natural and manmade elements are harmonious and in very good condition. However, the over-development of the Great Orme has resulted in some discordance between the natural and manmade elements, and the intensive use by the public means that some of the natural and manmade elements are in only fair condition. Also, in Llandudno, the built development has virtually obscured the natural elements (topography and coastal edge). There are some detractors, such as the overhead cables, the car park and the buildings on top of the Great Orme, but also some particularly attractive features, such as the steep cliffs, the pier and the Victorian seafront architecture. Despite this variability, this seascape unit has a strong sense of place and a pleasant scenic quality so, overall, the seascape quality is high/medium.

Colwyn Bay Seascape Unit

The Colwyn Bay Seascape Unit is shown on *Figure 7.44* and in more detail on *Figure 7.45*. The coastline that defines this unit extends from Little Ormes Head to the old lighthouse at Point of Ayr, a distance of approximately 31km.

The desk study/fieldwork assessment of this seascape unit and the descriptions of the component landscape units are presented in *Annex K3 (Volume V)*. The key characteristics and evaluation of the marine, coastal and hinterland zones of this seascape unit are as follows.

Table 7.20 *Key Characteristics and Evaluation of Colwyn Bay Seascape Unit Zones*

Zone	Characteristics
<i>Marine zone</i>	Very open, with a northerly aspect and only minor installations within the seascape unit but with views of the distant Douglas oil platform and Hamilton gas field (when visibility permits). More marine activities than the previous two seascape units, with marine dredging, commercial shipping and ferry routes, and a limited amount of recreational angling, sailing and water sports.

Zone	Characteristics
Coastal zone	One small open bay and one very long section of open, sweeping coastline, with a relatively narrow intertidal zone at the western end of the unit, increasing to quite a broad intertidal zone at the eastern end. Coastline is generally low-lying, with its landward edge defined by the near continuous line of the coastal roads, promenades, railway line and seawall. The sweep of the coastline is broken by numerous coastal structures – piers, breakwaters, groynes, and jetties with gantries. Activities along the coast are mainly seaside recreation and tourism with shops, holiday villages, camping and caravanning, car parking, promenading, walking, cycling, amusements, indoor recreation (with views of the sea), golf and beach activities.
Hinterland	There are five different characters to the hinterland – the relatively gentle and built up coastal slopes around Rhos-on-Sea, Colwyn Bay and Old Colwyn, the steep, undeveloped but heavily quarried limestone cliffs behind Llanddulas, the low-lying, almost continuous ribbon development on the coastal flats that extend from Abergele to Prestatyn, the extensive area of agricultural coastal flats that extend inland in a roughly triangular shape either side of the River Clwyd, behind the developed coastal strip, and the relatively undeveloped and elevated limestone hills – Bryn Euryn, Mynydd Marian, Graig Fawr and Prestatyn Hillside.
Evaluation	The Colwyn Bay Seascape Unit has a vague, almost muddled and indistinct character. The A55 (T), the railway line and the seawall sever the hinterland from the coastal zone, and the unit is broken into a series of fragments along the coast by the quarrying and the near continuous ribbon development. As a result, in general, there is discordance between the natural and manmade elements, with the manmade elements virtually obscuring the natural elements (topography and coastal edge), many of which are only in fair to poor condition. There are many detractors, such as the A55 (T), the poor condition of the Colwyn Bay pier, the quarries and associated infrastructure behind Llanddulas, the concrete seawall, and the extensive caravan parks and amusement arcades. However there are also a few attractors, such as Gwrych Castle and grounds, seaward and coastal views from the A55(T) and railway, and the rural hinterland. As a result of all these, this seascape unit has a weak sense of place. Its scenic quality is pleasant in places and poor in others and so, overall, the seascape quality is low.

Dee Estuary Seascape Unit

The Dee Estuary Seascape Unit is shown on *Figure 7.44*. The coastline that defines this unit extends from Point of Ayr to south of Flint (on mainland Wales) and from Connah’s Quay to Hilbre Point at the entrance to the River Dee (on the Wirral, mainland England), a distance of approximately 38km.

The desk study/fieldwork assessment of this seascape unit is presented in *Annex K3 (Volume V)* and the key characteristics and evaluation of the marine, coastal and hinterland zones are as follows.

Table 7.21 *Key Characteristics and Evaluation of Dee Estuary Seascape Unit Zones*

Zone	Characteristics
Marine zone	Partially enclosed, with only minor installations.

Zone	Characteristics
Coastal zone	An elongated estuary with a broad intertidal zone and a relatively enclosed seaward entrance. The coastline is mainly industrial on the western bank with a mix of residential and rural recreational activities on the eastern bank. Along the western bank, transport routes (roads and railway) tend to separate the coastal zone from the hinterland and there is very limited access to the shoreline. There is good access to the shoreline on the eastern bank.
Hinterland	Two slightly different character areas. The western bank is a low, undulating, rural area with concentrated settlements and scattered farmsteads. The western bank is also low and undulating, but contains large residential areas, interspersed with small areas of agriculture and other open land uses.
Evaluation	The Dee Estuary Seascape Unit has a rather mixed and fragmented character. On the western bank, the A548 and the railway line sever the hinterland from the coastal zone, and both the western and eastern banks are broken into a series of fragments along the coast by the industrial and residential areas. In places, there is some discordance between the natural and manmade elements, some of which are only in fair condition, with the manmade elements obscuring some of the natural elements (particularly the coastal edge). There are several detractors, such as the industrial areas, but also some attractors, such as the rural hinterland on the western bank, the extensive areas of salt marsh and the attractive countryside between the residential areas on the eastern bank. As a result of all these, this seascape unit has a good (but in some places weak) sense of place and a generally pleasant (but in places poor) scenic quality and, overall, the seascape quality is medium.

Liverpool Bay Seascape Unit

The Liverpool Bay Seascape Unit is shown on *Figure 7.44*. The coastline that defines this unit extends from Hilbre Point at the entrance to the Dee to the Rock Lighthouse at the entrance to the River Mersey, a distance of approximately 12 km.

The desk study/fieldwork assessment of this seascape unit is presented in *Annex K3 (Volume V)* and the key characteristics and evaluation of the marine, coastal and hinterland zones are as follows.

Table 7.22 *Key Characteristics and Evaluation of Liverpool Bay Seascape Unit Zones*

Zone	Characteristics
Marine zone	Open with minor installations, with views of the offshore oil and gas fields, and more marine activity than the other seascape units.
Coastal zone	An exposed but short length of low-lying coastline, with a broad intertidal zone. The coastline is separated from the hinterland by a seawall along most of its length. There is good access to the shoreline via roads and parking areas, but few footpaths.
Hinterland	Generally low-lying and mainly residential, with a Coastal Park and a golf course. Has remnants of its agricultural and horticultural past, and is scarred by former clay extraction and waste disposal activities.

Zone	Characteristics
<i>Evaluation</i>	The Liverpool Bay Seascape Unit has a vague and indistinct character that is fragmented by the seawall, the railway line and the built development. In general, there is discordance between the natural and manmade elements, many of which are only in fair condition, with the manmade elements obscuring some of the natural elements (particularly the coastal edge and the remnant dunes). There are several detractors, such as the industrial works, and very few attractors. As a result, this seascape unit has a rather weak sense of place and a fairly poor scenic quality so, overall, the seascape quality is medium/low.

7.9.3

Landscape Designations

National Designations

The national statutory designations in the study area are:

- Snowdonia National Park;
- Isle of Anglesey Area of Outstanding Natural Beauty (AONB);
- Clwydian Hills AONB.

There is also a non-statutory designation, defined by local authorities in consultation with the Countryside Council for Wales, which is outside any national statutory designations:

- Great Ormes Head Heritage Coast.

The sections of these designations that are within the greater study area are shown on *Figure 7.44* and their locations purposes/objectives and special characteristics are described in *Tables 7.23* and *7.24* below.

Table 7.23 *National Statutory Designations*

Designated Site	Description
<i>Snowdonia National Park</i>	<p>Snowdonia National Park is partly within the local authority area of Gwynedd and partly within the local authority area of Conwy. The National Park is a very extensive area in North Wales and is mainly inland and upland. Within the study area, it has a very small coastal component, with the northern boundary touching the coast at Penmaen-bach Point, in Conwy Bay.</p> <p>The purposes of National Parks are defined in the National Parks and Access to the Countryside Act 1949, as amended by The Environment Act 1995 (Sweet & Maxwell 2000). These purposes are:</p> <ul style="list-style-type: none"> • preserving and enhancing the natural beauty, wildlife and cultural heritage of [the National Park]; • promoting opportunities for the understanding and enjoyment of the special qualities of [the National Park] by the public.

Designated Site	Description
<i>Isle of Anglesey and Clwydian Hills AONBs</i>	<p>The special characteristics of the landscapes of Snowdonia National Park include the high, rugged mountainsides and the spectacular long distance views of the surrounding countryside and coastline that are possible from the more elevated and open locations.</p> <p>The Isle of Anglesey AONB is located entirely within the local authority area of the Isle of Anglesey and extends around almost the entire coastline of the island. The section that is within the greater study area is the section from Moelfre to just short of the Menai Bridge, which is in the northeast corner of the island.</p> <p>The Clwydian Hills AONB is located inland of Prestatyn and, within the greater study area, is located within the local authority areas of Denbighshire and Flintshire.</p> <p>Under s87 of the 1949 Act (as amended by the Environmental Protection Act 1990), CCW (in Wales) can designate an area as an AONB if it appears to them to be of such outstanding natural beauty that it is desirable that the provisions of the 1949 Act should apply. Therefore, AONBs share one of the purposes of National Parks, that is, they are designated for the purpose of preserving and enhancing their natural beauty, but differ from National Parks in that they are not designated for the purpose of promoting opportunities for understanding and enjoyment of their special qualities by the public.</p> <p>Both AONBs are relatively undeveloped.</p>

Table 7.24 *Non-statutory Designation*

Designated Site	Description
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Designated Site	Description
Great Ormes Head Heritage Coast	<p>The Great Ormes Head Heritage Coast is an area of approximately 4km², located entirely within the study area and the local authority area of Conwy. It is managed as a Country Park.</p> <p>The objectives of a Heritage Coast designation (PPG20) are:</p> <ul style="list-style-type: none"> • To conserve, protect and enhance the natural beauty of coasts, including their terrestrial littoral and marine flora and fauna, and their heritage features of architectural, historical and archaeological interest; • To facilitate and enhance their enjoyment, understanding and appreciation by the public by improving and extending opportunities for recreational, educational, sporting and tourist activities that draw on, and are consistent with the conservation of their natural beauty and the protection of their heritage features; • To maintain, and improve where necessary, the environmental health of inshore waters affecting heritage coasts and their beaches through appropriate works and management measures; and • To take account of the needs of agriculture, forestry and fishing, and of the economic and social needs of the small communities on these coasts, through promoting sustainable forms of social and economic development, which in themselves conserve and enhance natural beauty and heritage features. <p>In the case of the Great Ormes Head Heritage Coast area, its popularity with the public and the resulting level of development, have partially obscured the natural beauty of the hinterland, although the coastal cliffs remain relatively undeveloped.</p>

Local Landscape Designations

There are several local landscape designations defined in the statutory (adopted or approved) local development plans for the study area. These include Landscape Conservation Areas, and Special Landscape Areas. However, the following points should be noted.

- All the local landscape designations are under review as part of the Unitary Development Plan (UDP) process currently being undertaken by all these local authorities, and each UDP is at a different stage in the consultation /adoption process.
- Most of the draft UDPs propose some fundamental changes to the names, locations, extents and purposes of the current local landscape designations (as defined in the various Adopted Local Development Plans).
- Most of the draft UDPs will be adopted by 2004, so the *current* local landscape designations will not apply for the majority of the life of the projects.

- The boundaries of the *proposed* landscape designations may change during the review process, and so may not apply at all in their current form during the life of the projects.
- There is at least 8km between the offshore developments and the onshore local landscape designations.
- The effects on the character of the landscape units (that underpin the current landscape designations in the Llandudno and Colwyn Bay Seascape Units) have been examined in this assessment.

As a consequence of all the above factors, it has not been considered necessary to examine the potential effects of the projects on the purposes and special characteristics of the local landscape designations (current or proposed).

7.9.4

Visual Receptors

As indicated by the Zone of Visual Influence (ZVI) maps (*see Section 8.8*), the main locations in the study area where visual receptors may currently gain views of the sea of either or both of the proposed wind farms (at Rhyl Flats and North Hoyle) are those listed below.

Fixed Viewpoint Receptors

- Settlements – residents and tourists in Moelfre, Benllech, Llandudno, Penrhyn Bay, Rhos-on-Sea, Colwyn Bay, Old Colwyn, Llanddulas, Abergele, Pensarn and Belgrano, Towyn, Kinmel Bay, Rhyl, Prestatyn, West Kirby and Hoylake.
- Promenades – motorists, cyclists, walkers and others on the promenades in Llandudno, Colwyn Bay and Rhyl.
- Beaches – tourists on the beaches at Benllech, Llandudno, Penrhyn Bay, Llandrillo-yn-Rhos, Colwyn Bay, Llanddulas, Abergele, Towyn, Kinmel Bay, Rhyl, Prestatyn, Point of Ayr and Hoylake.
- Tourist facilities – tourists on the Great Orme (ski centre, cable car, tramway, restaurant, visitor centre), on Llandudno and Colwyn Bay piers, at the various holiday centres, camping and caravan parks, at the Sky Tower, Oceanarium and Sun Centre (Rhyl) and at the Nova Centre (Prestatyn).
- Elevated vantage points – walkers in Snowdonia National Park, on the Great Orme, on the Little Orme, on Bryn Euryn, on Mynydd Marian, on Moelfre Isaf, on Graig Fawr, at Prestatyn Hillside viewpoint and on Thurstaston Hill.

Linear Route Receptors

- A roads – motorists, motorcyclists, passengers on buses, lorry drivers, walkers, and other users of the A55(T), A547, A548, A525, A5151, A540.
- B roads - motorists, motorcyclists, passengers on buses, lorry drivers, walkers, and other users of the B5113, B5115, B5118, B5119, B5383, B5429.
- Minor, unclassified roads and urban - motorists, motorcyclists, passengers on buses, lorry drivers, walkers, and other users of the network of minor, unclassified and urban roads.
- Railway – travellers on the coastal Colwyn Bay – Prestatyn - Flint line and the West Kirby to New Brighton line.
- Sustrans cycle route – cyclists on the Colwyn Bay to Prestatyn cycle path (National Route 5).
- National Trails and Recreational Paths - walkers on the Great Ormes Head to Prestatyn section of the North Wales Path, and walkers on the Offa's Dyke Path through the Clwydian Hills AONB.

Marine Based Receptors

- Shipping and ferry routes - passengers on the Mostyn to Dublin, Liverpool to Belfast and Liverpool to Dublin ferry routes, plus seamen on the shipping routes through the study area.
- Inshore waters – fishermen, yachtsmen, recreational sailors and water sports enthusiasts in and around Llandudno Bay, Colwyn Bay and Liverpool Bay.

All these locations and receptor groups have been examined in the preliminary viewpoint analysis (*Annex K, Volume V*) and a selection of these locations have then been used to assess the potential effects of the developments on the main receptor groups.

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