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Evaluation of the ornithological importance of the Duddon Estuary in relation to the proposed tidal power barrage

by

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EXECUTIVE SUMMARY

This report represents a preliminary evaluation of the ornithological importance of the Duddon Estuary, in relation to proposals for a tidal power barrage. The report has drawn on existing information, no new fieldwork has been carried out, and the time available did not enable a comprehensive consultation process to obtain information. However, this report provides the basis for a more comprehensive evaluation, and makes recommendations for this process.

The study had three objectives: 1) To evaluate the importance of the Duddon in local, national and international contexts for birds throughout the non-breeding season; 2) To evaluate the usage of intertidal areas by birds within that part of the estuary which would be enclosed by the proposed barrage; 3) To assess the importance of the saltmarshes within the Duddon Estuary for breeding waders and wildfowl.

The Duddon Estuary is a SSSI, and qualifies as a Wetland of International Importance, under the terms of the Ramsar Convention and as a Special Protection Area (SPA) under the EC Directive 79/409/EEC on the Conservation of Wild Birds.

The 1991/92 low tide survey of feeding and roosting birds in the SSSI highlighted several areas, upstream of the proposed barrage line, as key areas for feeding birds.

The available information necessary to address the third objective was sparse and generally qualitative.

This study has proposed several recommendations for further work to provide a comprehensive evaluation of the likely ornithological impacts resulting from the proposed barrage. In particular, there is a need to carry out further surveys of the low tide distribution of birds, in conjunction with an assessment of the extent of interchange between parts of the estuary and between the Duddon and other sites. This approach would enable an appraisal to be made of the potential for relocation of birds which might be displaced by a tidal barrage.

1. INTRODUCTION

A study of the proposed tidal barrage scheme, crossing the mouth of the Duddon Estuary, has been supported by the Energy Technology Support Unit (ETSU) of the former Department of Energy, now part of the Department of Trade and Industry. This report was commissioned by Balfour Beatty to assess the information available on the ornithological importance of the Duddon Estuary in relation to this proposed barrage. This is a product of a five day contract and should, therefore, be regarded only as a preliminary evaluation.

The study had three objectives:

(1)To evaluate the importance of the Duddon in local, national and international contexts. The majority of the data used in these evaluations were obtained from the Birds of Estuaries Enquiry (BoEE).

(2)To evaluate the proportions of birds that are likely to feed within the line of the proposed barrage, *ie* upstream.

(3) To assess the importance of the saltmarshes within the Duddon Estuary for breeding waders and wildfowl.

The first and second objectives are both best covered on a species by species basis, and so are presented together to avoid repetition.

The Duddon Estuary is situated in the southwest corner of the Lake District, near Barrow-in-Furness. In 1991 five separate SSSIs were combined to form a single SSSI of 6814 ha. This covers all the intertidal area; the sand dune areas at North Walney NNR, Sandscale Haws, which is managed by the National Trust, and Haverigg Haws; the RSPB Hodbarrow Lagoon reserve; and the saltmarshes at North Walney and along the flanks of the upper half of the estuary (Figure 1.1). The boundary is as defined by English Nature in their notification of the SSSI on the 27/2/91. Throughout this report the area outlined by the SSSI boundary will be regarded as the Duddon Estuary. This area also coincides with boundaries used for BTO surveys.

At low tide virtually the entire estuary is uncovered, apart from river channels and pools, to expose extensive areas of a mostly sandy substrate. The sand varies in its geomorphology in different parts of the estuary as a result of the present current patterns and tidal regime. The sand grades from highly mobile coarse sand, forming mega-ripples in the central, lower half of the estuary, to fine sand and silt in the sheltered areas upstream of Askam pier.

2.THE IMPORTANCE OF THE DUDDON FOR BIRDS THROUGHOUT THE NON-BREEDING SEASON.

2.1 Criteria for levels of importance

The Duddon Estuary meets the criteria for designation as a Wetland of International Importance under the Ramsar Convention with over 25,000 waders present in winter (the qualifying level being a wader population of over 20,000), and as a Special Protection Area under Article 4 of the EC Directive 79/409/EEC on the Conservation of Wild Birds. The estuary also supports an average winter population of over 5,000 wildfowl. The figures are an average of the past five years (1986/87 - 1990/91) peak winter counts recorded during the Birds of Estuaries Enquiry.

An estuary is also considered Internationally Important if it regularly holds 1% of the individuals in a flyway population of one species or subspecies of waterfowl. Britain and Ireland's wildfowl belong to the north-west European population (Pirot *et al.* 1989), and the waders to the east Atlantic flyway population (Smit and Piersma 1989). A wetland in Britain is considered Nationally Important if it regularly holds 1% of the estimated British population of one species or subspecies of waterfowl (Kirby *et al.* 1990).

Data collected for the BoEE have been analysed to show which species of waterfowl are present on the Duddon during the non-breeding season in internationally or nationally important numbers (Tables 2.1.1 and 2.1.2). The Duddon is of international and national importance for several species of wintering waders and wildfowl, and provides a vital link in the chain of west coast estuaries used by migrating birds.

The existing information at the local level, *ie* within Cumbria, for populations of wintering birds is mainly limited to the BoEE. A measure of the local importance of the Duddon for waders has been calculated from BoEE counts housed at the BTO. For the purposes of this report a wader species is said to be of local importance if more than 30% of the combined wintering population on the Cumbrian estuaries (South Solway, Esk/Irt/Mite, Duddon and North Morecambe Bay) is present on the Duddon Estuary (Table 2.1.3). This 30% threshold has been used because ≤25% of the population could occur by chance on any one of these four estuaries.

During the 1991/92 winter a low tide survey of the Duddon Estuary was carried out by local volunteers. This involved fortnightly counts of feeding and roosting birds around low tide, within the SSSI boundary. The estuary had been divided into 40 count areas for this purpose. Information received from Shawater Ltd on behalf of Balfour Beatty shows the line of the proposed barrage which has been taken for all relevant calculations and comments within this report (Figure 2.1.1). The average number of feeding birds recorded within the estuary over the winter was calculated. The percentage of these which occurred upstream of the line of the barrage was then assessed (Table 2.1.4). Birds which regularly feed upstream of the barrage may be affected by the reduction in area available for feeding and changes in exposure times of intertidal flats in a post-barrage regime. Although waterfowl were recorded on all areas of the estuary, it can be seen from Figure 2.1.2 that some areas held consistently higher numbers of feeding birds. These were on the south shore of the estuary, north and south of Askam pier, and within Scarth Bight, the sheltered bay east of North Walney. This demonstrates that the most important feeding areas lie upstream of the proposed line of the barrage.

2.2 Species Accounts

A special mention is made here of species a) which are of national or international importance and b) for which sufficient data was available at the time of writing to provide a measure of local importance. The following accounts incorporate data from the BoEE and low tide counts, methods for which are given in Prater (1981) and in Clark *et al.* (1990). Tables 2.1.1-2.1.3 summarise the levels of importance for these key species and for those which are not considered in more detail here.

2.2.1Shelduck

Nationally important numbers of Shelduck winter on the Duddon Estuary, with an average peak of over 800 birds. Nearly 70% of these feed on areas upstream of the proposed barrage.

2.2.2 Pintail

Over 1,000 Pintail winter on the Duddon, which is not only of national importance but also of international importance. All the Pintail recorded during the low tide survey were observed within the barrage line, the majority along the edges of the river channel in the upper half of the estuary.

2.2.3 Red-breasted Merganser

Nationally important numbers of Red-breasted Mergansers are present on the Duddon over the winter months, with over 150 birds recorded regularly. On average 16% of these were feeding within the barrage line during the 1991/92 winter. These sawbills were distributed along river channels in the lower half of the estuary.

2.2.4 Oystercatcher

On average over 6,500 Oystercatchers regularly winter on the Duddon Estuary. These constitute 13% of the Oystercatchers on Cumbrian estuaries and are nationally important during the winter and autumn, when they are also close to levels of international importance. Over half of the Oystercatchers recorded as feeding on the Duddon at low tide, use the intertidal areas within the line of the barrage, with most of these being within 3 km of Askam. The central river channel at the mouth of the estuary was also an important feeding area, as was the intertidal zone on the landward side of Walney Island.

2.2.5 Ringed Plover

The Duddon is very important in a local context for Ringed Plover as it holds 40% of those wintering on Cumbrian estuaries. It is also a nationally important site during the winter and spring. Higher numbers are present on spring passage and at this time almost reach levels of international importance. Approximately half of those recorded during the winter were feeding within the barrage line.

This was similar during the spring although birds occurred in more concentrated flocks at this time.

2.2.6 Golden Plover

Between one and two hundred Golden Plover roost regularly on the Duddon in the winter and autumn. These levels comprise about 8% of the local Cumbrian population. This may be an underestimate of the number of this species in the area, as Golden Plover make so much use of adjacent fields for roosting and feeding and many of these areas will not be covered in the BoEE counts. Golden Plover were not recorded in the low tide counts. As Golden Plover are not a typical estuarine species and the majority of birds winter inland, using permanent pasture for feeding and ploughed fields for roosting, (Fuller and Youngman 1979), it is unlikely that they would be seriously affected by a tidal barrage.

2.2.7 Grey Plover

The Duddon Estuary also holds nearly 40% of the local Grey Plover population and is nationally important for this species during the winter. Nearly half of the wintering Grey Plover on the Duddon feed on areas which would be upstream of the line of the proposed barrage. Some of these areas would become subtidal post-barrage and therefore be lost to feeding birds (Figure 2.1.1). Many areas on the seaward side of the barrage were also important for feeding, some of which would also become subtidal.

2.2.8 Lapwing

The Duddon holds 19% of the local population wintering in Cumbria, but as with Golden Plover this may be an underestimate of the population around the Duddon, as they also feed and roost primarily in fields and, hence, are unlikely to be affected by a barrage. Over 90% of Lapwing recorded feeding on the estuary at low tide, used feeding areas upstream of the line of the barrage.

2.2.9 Knot

Approximately one third of the Cumbrian population of Knot winter on the Duddon. This is also a nationally important, and close to internationally important, site for roosting Knot. Very much lower numbers were recorded at low tide and it was thought that many Knot may fly south to feed at Roosecote sands in Morecambe Bay. Of the Knot that did remain to feed on the estuary, nearly 70% fed on areas upstream of the line of the barrage; some of these areas would be subtidal post-barrage.

2.2.10Sanderling

Over half of the local Cumbrian population of Sanderling winter on the Duddon and it is therefore of significant local importance. The Duddon is a nationally

important site for Sanderling in the winter, autumn and spring. The numbers recorded feeding at low tide during the winter were very much lower than in the roosting flocks. This may have been due to a combination of birds being missed on the extensive intertidal flats and birds moving out of the Duddon to feed elsewhere. Of those which did remain, over 90% were recorded as feeding upstream of the line of the barrage; some in areas which would become subtidal post-barrage.

2.2.11 Purple Sandpiper

On average over 40 Purple Sandpiper winter on the Duddon which comprises over 60% of the population wintering on Cumbrian estuaries and is, therefore, of local importance. However, this is primarily a species of the open coast, favouring rocky shores, and so it is likely that the non-estuarine Cumbrian population would reduce the local importance of the Duddon for this species. This does not however qualify for national importance and none were recorded as feeding during the low tide counts.

2.2.12 Dunlin

Nearly 7,000 Dunlin winter on the Duddon. This is approximately 15% of the local population and qualifies the Duddon as a site of national importance for this species. The site is also nationally important for Dunlin during the autumn. Virtually all of these birds remain to feed on the Duddon with similar numbers recorded at low tide. Nearly 90% feed on areas upstream of the line of the barrage, the most favoured areas being close to Askam pier.

2.2.13 Common Snipe

On average about 65 Snipe are recorded regularly on the Duddon. This is approximately 23% of the local Cumbrian population but is not of national importance. Very few were recorded on the low tide counts. Common Snipe is a cryptic species, often overlooked by extensive surveys, such as the BoEE. Consequently, the existing information makes it difficult both to estimate the population on the Duddon and to assess its relative importance for this species.

2.2.14 Bar-tailed Godwit

Approximately 100 Bar-tailed Godwits winter on the Duddon. This comprises 4% of the local population, and is not of importance in the national context. Nearly 90% of the Bar-tailed Godwits recorded feeding on the estuary during the low tide counts were in areas upstream of the line of the barrage.

2.2.15 Curlew

Over 2,000 Curlew were recorded regularly on the Duddon in winter. This comprises 17% of the local population. The Duddon also qualifies as a nationally important site for this species during the winter, spring and autumn. The

highest numbers are present in the autumn when they are close to levels of international importance. Over 80% recorded at low tide were feeding on areas upstream of the line of the barrage. Many of these were on the central sand banks where birds were observed feeding on sand eels.

2.2.16 Redshank

Around 1500 Redshank winter on the Duddon, which qualifies the site for national importance. Higher numbers are present during autumn migration when the site also qualifies as internationally important. Of those birds which feed on the site, nearly 60% feed on areas within the barrage line. The most important areas are adjacent to Askam pier and along the Millom channel.

2.2.17 Turnstone

On average, about 300 Turnstone have been recorded roosting regularly on the Duddon during the winter. This is approximately 19% of the local population. Higher numbers occur on autumn passage and at this time of year reach levels of national importance, close to international importance. Although Turnstone use the Duddon as a roost site, very few were recorded at low tide, and are thought to move out of the estuary to feed.

2.2.18 Other Species

In addition to the species considered, there are also several species which are known to occur on the Duddon but only in low numbers on the intertidal flats e.g. Wigeon. Some of species may be dependent on the saltmarshes in the estuary and their populations may be affected if a barrage changes the frequency of inundation of the saltmarshes e.g. Twite and Wigeon. Others such as Pink-footed Geese, use the estuary mainly for roosting and are less likely to be affected by a barrage. The site is also used in winter by hunting raptors, such as Peregrine and Merlin.

3.THE IMPORTANCE OF THE DUDDON SALTMARSHES FOR BREEDING WADERS AND WILDFOWL

The Duddon SSSI supports the third largest area of saltmarsh in Cumbria after the Upper Solway and Morecambe Bay SSSIs. Consequently, it is of local importance and conservation value (Allport *et al.* 1985). A complete survey of breeding waterfowl has never been carried out on the whole of the Duddon. The data presented here refer to particular species for which breeding surveys have been carried out. Data have therefore been collated here from the various individual species surveys available at the time, and may not be a totally comprehensive summary of all the data. These surveys include: a BTO Register of Ornithological Sites and an NCC breeding Redshank survey, both of which covered North Walney; and a breeding Ringed Plover survey of the whole estuary organised as part of a BTO national survey, which was later followed up in the north west of England by Briggs (Briggs 1983).

Birds which use the Duddon Estuary during the breeding season can be divided into four categories: (1) Those which breed on the saltmarshes, (2) those which breed on the sand dunes, slacks or near the high tide mark, (3) those which breed on the slagbanks *eg* at Borwick rails and (4) those which breed off the estuary but come on to it to feed (D. Radford, Hodbarrow Reserve Warden and P. Carty, Sandscale Reserve Warden, pers comm.). The species which fall into these categories are summarised in Table 3.1. Note that this is not a complete list of breeding birds on the estuary. In particular, many species of passerine breed around the edge of estuary.

The most recent survey of a breeding species on the Duddon was carried out during the 1992 summer and unfortunately the results are not yet available. The survey was specifically to look at breeding Shelduck and was organised by the Wildfowl and Wetlands Trust. Shelduck nest on the edges of the estuary and even on nearby fields. The adults and juveniles then come onto the estuary to feed. The results of this survey may show how many Shelduck nest on the saltmarsh areas.

The BTO Nest Records Scheme holds records of nests found by volunteers around Britain. This is not a quantitative measure of the number of breeding birds in an area as it is dependent on the number of people looking for nests and returning cards. This effort may vary in different parts of the country and in different years. Records show that Ringed Plover, Redshank and Shelduck have bred on the Duddon. The entire Nest Record Scheme has not yet been computerised and a complete assessment of all species would require a more in depth examination.

In the late 1960s and early 1970s the BTO set up a Register of Ornithological Sites, which recorded the habitats and bird species present on certain sites throughout the country during winter, on passage and during the breeding season. One of these sites was at North Walney which is partly sand dune and partly saltmarsh habitat. Twenty-four breeding species were recorded at this time. The wildfowl and waders included in this list were Red-breasted Merganser, Shelduck, Lapwing, Ringed Plover, Snipe and Redshank.

In 1973 the BTO organised a survey of breeding Ringed Plover distribution, to establish a base line for future population studies (Prater 1976). The results indicated that the

main breeding areas were in Scotland, Norfolk, Essex, Cumbria and Lancashire. Briggs carried out a further survey in 1978-1980, concentrating on Ringed Plovers breeding coastally and inland in north-west Britain (Briggs 1983). Five of the sites that were surveyed fell within the Duddon Estuary (Hodbarrow, Millom, Angerton Marsh, Sandscale Haws and North Walney), with between 37 and 26 pairs breeding in the three survey years. Birds on all of these sites may be affected by disturbance or change in their habitats or by people, in a post-barrage situation. Four of these pairs were recorded regularly on Angerton Marsh on the upper estuary. Briggs found that on average those Ringed Plover breeding on saltmarshes had, in the whole of his northwest England study area, increased from 4% to 28% of the total since the 1974-75 survey. This is an important shift, for Ringed Plovers seldom breed on saltmarshes in England (Fuller 1982). This may mean that the saltmarshes on the Duddon will, or may already have increased in importance for breeding Ringed Plovers.

In 1985 the RSPB carried out a survey of breeding Redshank and other breeding birds on 77 study sites. These represented 9% of 40,000 ha Grade 1 and 2 saltmarsh sites in Britain. One of the selected sites was the 39 ha of saltmarsh on the landward side of North Walney Island. North Walney ranked 24th, the 20-21 pairs breeding there having a nesting density of 53 pairs/km^2. Of the sites surveyed this ranked as one of the top ten in the country for density of breeding Oystercatcher, and also for density of breeding Shelduck. This was one of the best of the surveyed saltmarsh sites for diversity of breeding birds, also having breeding Lapwing, Mallard, Eider and Curlew (Allport *et al.* 1985). Any change in the tidal range on this site could have important implications for the saltmarsh habitat and therefore the breeding site for birds.

As shown by this preliminary evaluation the data on breeding birds on the saltmarshes on the Duddon is limited and further work is required before their importance for breeding birds can be fully assessed.

4. DISCUSSION

Although small compared to neighbouring estuaries such as Morecambe Bay and the Solway, the Duddon Estuary is a very important site within Cumbria for wintering waders, particularly for Purple Sandpiper, Sanderling, Ringed Plover, Grey Plover and Knot. It is nationally important for eight species of wader: Oystercatcher (winter and autumn), Ringed Plover (winter and autumn), Grey Plover (winter), Knot (winter), Sanderling (winter, spring and autumn), Dunlin (winter and autumn), Curlew (winter, spring and autumn) and Redshank (winter and autumn) [Table 2.1.1]; and three wildfowl species: Shelduck, Pintail and Red-breasted Merganser [Table 2.1.2]. Pintail winter in internationally important numbers and Redshank also reach levels of international importance during autumn migration. The site is, therefore, also important not only due to its total numbers which qualify it for designation as a Ramsar site and SPA, but also because of its richness in nationally important species.

It may be argued that although significant numbers of birds are recorded at roost sites, they may not all use the estuary as a feeding site. However, preliminary analysis comparing low tide and high tide counts suggests that for many of the above mentioned, nationally important species the Duddon is also very important as a feeding site (R. Treen in prep.). For some species such as Curlew and Redshank which may feed on inland wet fields, the numbers using the estuary may vary with weather conditions. The intertidal flats become of greater importance in severe weather when the topsoil is frozen. The majority of Shelduck, Red-breasted Mergansers, Ringed Plover, Grey Plover and Dunlin invariably remained on the estuary. The number of Pintail, Knot and Sanderling remaining on the estuary varied between counts but the low tide counts could be as high as the roost counts. Up to 50% of the roosting Oystercatchers and 75% of the roosting Turnstone appear to move off the estuary to feed, possibly on the mussel beds and rocky shore on the seaward side of North Walney. However, it must be emphasised that these are preliminary analyses and that a detailed study of more than one winter's data is necessary.

From the summarised distribution of waterfowl on the Duddon, it can be seen that although all areas were used for feeding there were certain areas which were of particular importance. These were between Sandscale Haws and Dunnerholme and in the bay south of Sandscale Haws, known as Scarth Bight, near the proposed landfall for the barrage. Around the sheltered areas of Scarth Bight and adjacent to the north side of Askam pier, fine silts and muds have accumulated and as a result these may provide rich feeding areas.

A detailed sediment survey was not undertaken by the BTO. However, general observations of substrates were made at the time of the low tide counts. Two of the count areas, adjacent to the north side of Askam pier and Scarth Bight, held fine sediments. Studies by McCulloch and Clark (1992) showed that there was a general relationship on many estuaries for increasing Dunlin density on areas which had a higher percentage of silt/clay. The substrates in other important feeding areas ranged from mainly sand near Dunnerholme to sandy mud between Sandscale and Askam pier. The most important feeding areas for Dunlin were between Askam pier and Dunnerholme. Should there be an increased extent of fine sediment post-barrage, Dunlin densities may also increase.

Similar studies have not been carried out for other species, so it is not possible to make predictions for them.

The area adjacent to the north side of Askam pier is below Askam sewer outfall which may further enrich this feeding area. Various studies show that moderate levels of organic input to intertidal areas may enhance the population densities and biomass of invertebrates. This may increase the carrying capacity of intertidal areas for wintering birds populations and attract greater numbers and densities of wading birds (Green *et al.*1992). Without data on the present and post-barrage levels of organic and other inputs it is difficult to say what the effects on feeding birds will be if N.W. Water improve the discharge post-barrage. Studies of estuaries showing declines in organic inputs show correlated declines in wintering bird populations. Although such declines can be shown to be accompanied by decreases in food availability, no author is prepared to say that decreases in organic inputs have been responsible, because of the existence of other, confounding, factors in each case (Green *et al.*1992).

At present the main river channels on the Duddon are known to migrate across the estuary and do not match the channel positions marked on the Ordnance Survey maps. Some species *eg* Redshank and Pintail were often observed along the river channels at low tide and are therefore likely to change their location within the estuary if they move with the migrating river banks. Further information is required on the nature of the river channels post-barrage e.g. whether there will only be one main river channel and therefore fewer river banks and whether it will be sedentary, before any post-barrage distribution of birds can be predicted. If this meandering continued in a post-barrage regime, the location of the areas stated as becoming subtidal may also meander.

Any alteration in the exposure time of the intertidal areas would also have important implications for the feeding waterfowl and may have differing effects depending on the species. Those species which feed on the tide edge would be less likely to be affected than those that feed on exposed mud and sand flats.

It is possible that a proportion of the birds which, currently, feed upstream of the line of the proposed barrage would be displaced as a result of changes to the sediments and exposure times for intertidal areas post-barrage. Therefore, an important aspect for further study would be to investigate the likelihood of birds being accommodated on other estuaries in the region, similar to studies undertaken on the Mersey (Clark *et al.* 1990).

Although the aims of this report were only to cover existing data on breeding waders and wildfowl on the saltmarsh areas, other species also use the estuary as a feeding site during the breeding season. Terns (Sandwich, Common and Little) have been observed flying onto the estuary from the south (probably birds nesting on Walney and Foulney Islands) and from the Hodbarrow Reserve to the north, to fish and leaving on their return journey with food for their young (D. Radford pers comm.). Many of these terns were concentrated at the edge of sand banks in the central estuary on the falling tide, following the tide edge as areas became exposed and presumably feeding on sand eels and shrimp. Sand eels may find the loose sand on these sand banks a suitable habitat in which to burrow as the tide falls. Should these sediments become finer post-barrage there may be an effect on this food source for terns. Terns also use British estuaries as

important stopover sites during migration, particularly during the late summer and autumn. Peak counts of up to 200 Gannets have also been recorded feeding on the estuary during May/June (D.Radford pers comm.). It was thought that they were following fish shoals entering the estuary over high tide. Further work needs to be carried out on the numbers of all seabirds which feed on the estuary, especially during breeding and migration.

There are other species which may use the estuary for which there is little data at present. For example, flocks of Twite, Snow Buntings and Linnets may use upper shores and saltmarshes during the winter.

Scarth Bight, the area around the southern landfall of the proposed barrage, is, as mentioned above, important for feeding birds during the winter. Nearby Sandscale Haws qualifies as a SSSI for several reasons, as twenty-four species of birds breed on the site, it is important botanically and is a breeding site for Natterjack toads. Disturbance caused by the survey, construction and post-construction stages, should a road crossing also be implemented, may have severe impacts on these important local habitats and wildlife communities. The environmental impact on both this area, and other possible landfall sites nearby, should be assessed in detail. This will enable the least environmentally demaging route for the barrage to be identified.

5. RECOMMENDATIONS FOR FURTHER WORK

1.Although the 1991/92 low tide survey provided an excellent baseline of feeding distribution, these distribution patterns may vary between years due to such factors as weather conditions, changes in local habitats or feeding areas, breeding successes and numbers of returning birds. The low tide survey should therefore be repeated, to provide data on between year variability in distribution patterns.

2.A full analysis, comparing BoEE and low tide counts, from more than one year, should be carried out, to determine what proportion of roosting birds remains on the estuary to feed.

3.Although a small estuary, the Duddon holds nationally important numbers of 11 species of waterfowl and of these two species are also internationally important. From an analysis of BoEE counts from several of the top estuaries in Britain, it would be possible to show how important the Duddon is, in terms of densities of birds, compared to other estuaries.

4.The low tide survey provides distribution patterns of birds close to low water, but it does not show how birds move around the estuary or the time birds spend on different areas at different states of the tidal cycle. Detailed observations should be carried out throughout the tidal cycle on key parts of the estuary and movement studies of wintering populations on the Duddon should be carried out on the whole estuary, possibly through the use of colour marking. This would have particular relevance to areas which would become subtidal post-barrage and would assist with assessing the potential for displaced birds to be accommodated on other estuaries.

5.Further to item 4., there should be an appraisal of wader populations on other estuaries in the region which might accommodate any birds which may be displaced, as a result of construction of a tidal power barrage.

6.As shown by this preliminary evaluation, the data on breeding birds is limited as is the data on species other than waders and wildfowl which use the Duddon Estuary SSSI. A full ornithological survey of all species which a) use the estuary as a nesting habitat and b) as a feeding habitat in the breeding, migration and winter periods should be carried out.

7.The alignment proposed for the barrage would landfall near sensitive areas, particularly on the south side near Scarth Bight and Sandscale Haws. It is recommended that the environmental impact on both this area and other possible landfall sites should be assessed in more detail in order to identify the least environmentally damaging route for the barrage.

8.Any impact assessments of the proposed barrage relating to birds would require further data on the post-barrage tidal regime *eg* changes in tidal range (within and without the barrage), channel movement, sediment types and structures, exposure times for the intertidal areas *etc*.

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SPECIES	WINTER			SPRING		
		% of population			% of populatio	
	Average Peak	% British	% E Atlantic Flyway	Average Peak	% British	% E Atlant Flywa
Oystercatcher	6651	**2.38**	0.74	2169	0.77	0
Ringed Plover	255	**1.11**	0.51	267	0.89	0
Golden Plover	186	0.09	0.02	19	0.01	<0
Grey Plover	250	**1.19**	0.17	50	0.24	0
Lapwing	1790	0.18	0.09	246	0.02	0
Knot	3342	**1.52**	0.95	87	0.04	0
Sanderling	455	**3.25**	0.45	717	**2.39**	0
Purple Sandpiper	47	0.29	0.09	40	0.25	0
Dunlin	8045	**1.87**	0.57	729	0.36	0
Bar-tailed Godwit	196	0.32	0.20	32	0.05	0
Curlew	2062	**2.27**	0.59	1012	**1.11**	0
Redshank	1457	**1.94**	0.97	858	0.71	0
Turnstone	305	0.68	0.44	229	0.51	0

Table 2.1.1The national and international importance of the Duddon estuary for waders 1986-1991. Bold entries refer to species qualifying as nationally or internationally important. Data supplied by the Birds of Estuaries Enquiry.

SPECIES		% of population	
	Average Peak	British	NW European
Pink-footed Goose	236.0	0.2	0.2
Greylag Goose	121.6	0.1	0.1
Shelduck	807.2	**1.1**	0.3
Wigeon	891.0	0.4	0.1
Teal	671.0	0.7	0.2
Mallard	984.0	0.2	<0.1
Pintail	1143.4	**4.6**	**1.6**
Pochard	95.4	0.2	<0.1
Eider	105.6	0.2	<0.1
Goldeneye	60.0	0.4	<0.1
Red-breasted Merganser	153.8	**1.5**	0.2
Coot	178.8	0.2	<0.1

Table 2.1.2The national and international importance of the Duddon Estuary for wildfowl 1984-1989. Most recent data available from the Wildfowl and Wetlands Trust; no data for 1987. Bold entries refer to species qualifying as nationally or internationally important.

BoEE WINTER PEAK COUNTS FOR COMBINED ESTUARINE SITES IN CUMBRIA*								
SPECIES	**1986**	**1987**	**1988**	**1989**	**1990**	**5 yrs av. 4 sites***	**5 yrs av. Duddon**	**Duddon % of whole**
Oystercatcher	49133	55145	46313	57206	55379	52635.2	6862	13
Ringed Plover	440	600	888	638	502	613.6	244	40
Golden Plover	1626	456	1830	586	2601	1419.8	110	8
Grey Plover	453	780	901	669	492	659	234	36
Lapwing	12598	7166	11184	9722	8700	9874	1910	19
Knot	15457	16063	13256	8738	25075	15717.8	5194	33
Sanderling	667	879	643	706	684	715.8	393	55
Purple Sandpiper	38	92	58	66	94	69.6	44	63
Dunlin	34280	30936	39337	50758	72066	45475.4	6958	15
Jack Snipe	9	5	13	7	12	9.2	1	11
Common Snipe	214	143	477	321	265	284	66	23
Bar-tailed Godwit	5794	533	5107	539	2195	2833.6	101	4
Curlew	13736	14329	9171	11498	13186	12384	2069	17
Redshank	6944	6822	6423	5443	6228	6372	1486	23
Turnstone	1338	2456	1309	1082	1445	1526	284	19

* North Morecambe, Duddon, Esk/Irt/Mite and South Solway.

Table 2.1.3The local importance of waders on the Duddon Estuary.

Species	A	B	C
Whooper Swan	3	3	(100)
Pink-footed Goose	349	349	100
Greylag Goose	48	48	100
Shelduck	365	253	69
Wigeon	35	27	77
Teal	1	1	(100)
Mallard	47	40	85
Pintail	136	136	100
Eider	153	69	45
Long-tailed duck	1	1	(100)
Goldeneye	60	30	50
Red-breasted Merganser	68	11	16
Oystercatcher	2136	1177	55
Ringed Plover	76	40	53
Grey Plover	130	57	44
Lapwing	83	76	92
Knot	142	94	66
Sanderling	86	80	93
Dunlin	6731	5935	88
Snipe	3	0	(0)
Bar-tailed Godwits	27	24	89
Curlew	784	641	82
Redshank	690	404	59
Turnstone	45	13	29
Heron	2	2	(100)
Cormorant	2	1	(50)

A =The average number of each species feeding on the entire estuary over the winter period (Dec-Mar 1991/92).

B =The average number of each species feeding within the proposed line of the barrage over the winter period (Dec-Mar 1991/92).

C =The percentage of each species which feeds within the proposed line of the barrage.

Table 2.1.4The average proportion of wintering waterfowl which feed within the line of the proposed barrage.

1. Saltmarsh	2.Dunes, slacks & High Tide Line	3. Slagbank	4. Off estuary
Oystercatcher Ringed Plover Lapwing Dunlin? Redshank Common Sandpiper Black-headed Gull	Shelduck Eider Mallard Oystercatcher Ringed Plover Lapwing Common Snipe Redshank Red-breasted Merganser	Oystercatcher Ringed Plover Lapwing Black-headed Gull Sandwich Tern Common Tern Little Tern	Great Crested Grebe Grey Heron Shelduck Teal Mallard Curlew Red-breasted Merganser Peregrine Sparrowhawk Buzzard Kestrel Herring Gull Lesser Black-backed Gull Greater Black-backed Gull Sandwich Tern Common Tern Little Tern

? = Dunlin may have bred, but unconfirmed record.

Table 3.1Breeding birds on the Duddon Estuary (not including passerines). N.B. This is not a complete list.

Figure 1.1The Duddon Estuary SSSI.

Figure 2.1.1The Duddon Estuary, predicted post-barrage construction scenario. Data supplied by Shawater Ltd.

Figure 2.1.2The average number of all waterfowl species combined feeding at low tide on each count area during the 1991/92 winter.