

Proposed dredging and beach nourishment at Magheraroarty pier and beach

Marine Intertidal Survey to inform Appropriate Assessment



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1.0 INTRODUCTION

Ecofact was commissioned by Donegal County Council to undertake a Marine Survey at Magheraroarty Harbour in County Donegal. The survey was requested to inform Appropriate Assessment (AA) of proposed dredging and beach nourishment works at Magheraroarty Harbour.

The proposed project involves dredging at Magheraroarty Pier and deposition of dredged material onto the adjacent strand as beach nourishment, on an annual basis over a period of 5 years. Annual dredging activity at Magheraroarty Pier has been carried out previously as ongoing maintenance of the harbour. These works have not been subject to AA. The site of the proposed works is within the Ballyness Bay Special Area of Conservation (SAC) and adjacent to the Falcarragh to Meenlaragh Special Protection Area (SPA). The location of the proposed works areas and the local Natura 2000 sites are shown in Figure 1 and 2 below.

Donegal County Council wants to apply for a foreshore licence for continuing these works. In the licence application process a screening for Appropriate Assessment was carried out which determined there was a need for a Natura Impact Statement (Appropriate Assessment) for the proposed project. The current report is intended to inform the NIS for the proposed works. It is noted that the dredging and beach nourishment works had already taken place in early June 2020 in advance of the current survey and assessment. This was not known at the time of the current survey.

1.1 Project description

The proposal is for the annual dredging and beach nourishment at Magheraroarty Pier, Dooley Strand in County Donegal. Magheraroarty Harbour is used by the Tory Island Ferry, commercial fishing boats and local charter boats. In order to maintain safe, navigable depths, which is a charted depth of -2.5m for the Tory Island Ferry, and the use of the slipway, dredging in the Magheraroarty Harbour is required on an annual basis. Annual maintenance dredging and beach nourishment have been undertaken at Magheraroarty, under licence, since 2008. However no AA have ever been completed.

The proposed works comprise the removal of up to a maximum of 20,000 tonnes of sediment a year from the foreshore at the pier for a 5-year period. The dredging will be undertaken in a foreshore area of 0.85ha where there is an accumulation of deposited sediment. The sediment at Dooley Strand has been classified as clean and uncontaminated (Doran Consulting, 2013). The removed material, which is expected to comprise mainly of recently deposited sand with no significant sub-benthic community present in it, shall be deposited on an intertidal area of 7.3ha on Dooley Strand. The proposed deposition area is subject to erosion from wave and wind action and longshore drift. It is understood that by depositing the dredged material to the shore it is being returned to its original location where it had been eroded from. The material will be evenly spread over the 7.3ha intertidal, deposition area on Dooley Strand.

It is proposed that the dredging and deposition works will take place during March / April each year. The build up of material deposited during winter storms can then be removed and the navigable depths will be reinstated for the use of the harbour during the busy summer season. The works will take place during spring tides to ensure the efficient removal of material and deposition on the foreshore can take place.

There are two options proposed for the dredging and deposition works: either a land-based procedure or a marine based procedure. The land-based option involves a tracked excavator loading the material onto a dump truck to be transported along the foreshore at low-mid tide and dumped at the proposed disposal site on the adjacent beach in the intertidal zone. This method minimises the potential for sediment plumes and is a controlled and precise method of removing the material. This



method has been used in the previous dredging activity in the harbour and has proved successful and efficient. The marine based option involves the removal of material by a long reach excavator on a barge and transported to and deposited at the agreed deposition area during high tide, either by pumping or dumping the material in the intertidal zone. This method would provide a controlled and precise way of removing the material and eliminating the need for plant on the foreshore (Doran Consulting, 2013).

A Screening for Appropriate Assessment report was carried out by Greentrack Environmental Consultants in 2019 for the proposed dredging works (Greentrack Environmental Consultants, 2019). The surveys carried out for this report included a walkover by two ecologists. The subject site is classified as a sand shore (LS2) which contains the Annex I habitat of mudflats and sandflats not covered by seawater at low tide [1140] (Greentrack Environmental Consultants, 2019). The report also notes that Embryonic shifting dunes border the strand and no flora or fauna of interest was noted in the area due to the nature of the site. The Screening for Appropriate Assessment notes the potential threat to this mudflats and sandflats habitat through mechanical activity during the transportation of sand by dump trucks to the agreed site. The report therefore recommended that a Natura Impact Statement be carried out for the proposed dredging works at Magheraroarty pier (Greentrack Environmental Consultants, 2019). This has not been completed to date and further dredging and beach nourishment works took place at this site in advance of the current survey.

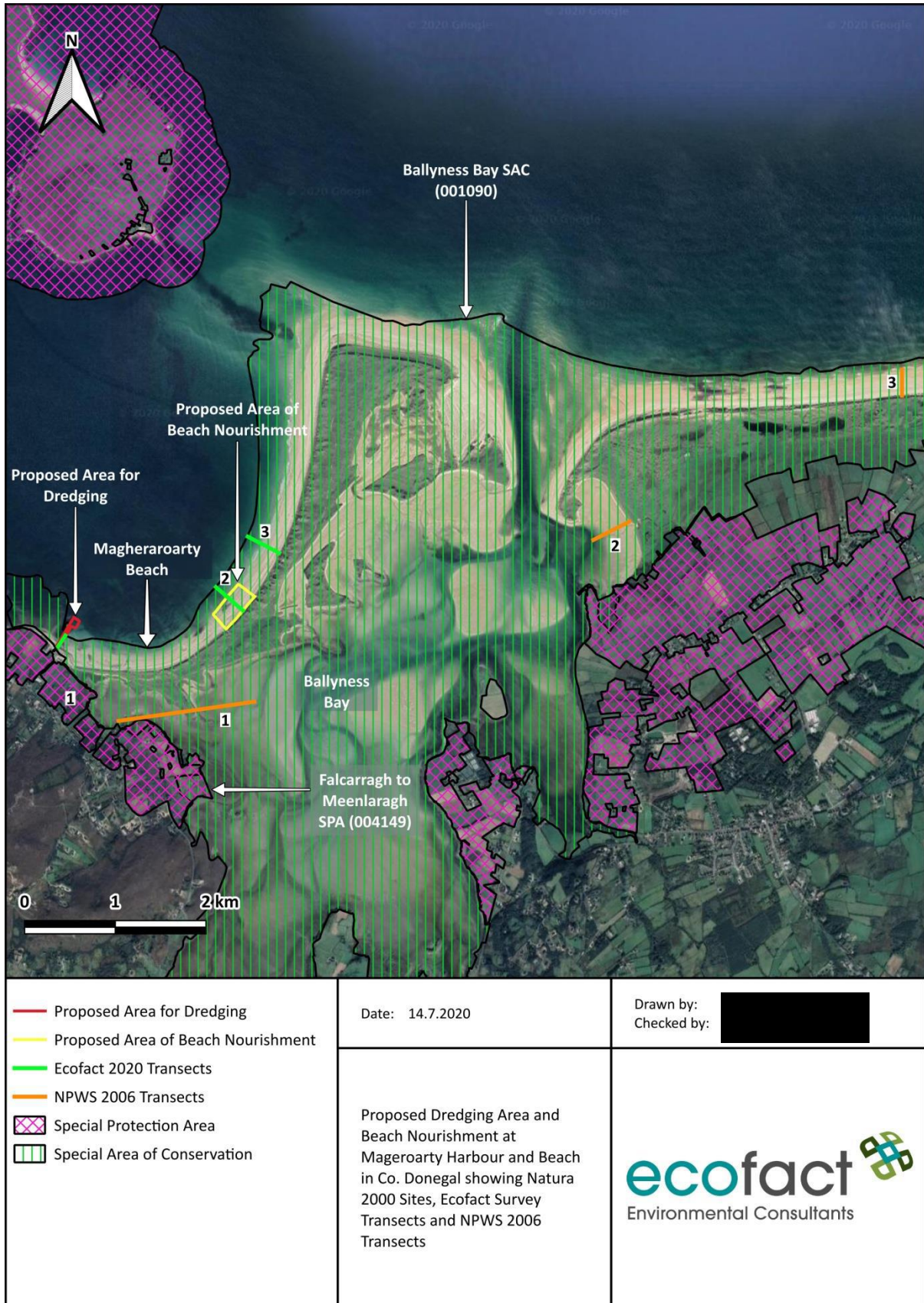


Figure 1 Location of the proposed dredging and beach nourishment areas at Magheraroarty harbour and beach, also showing survey transect positions.

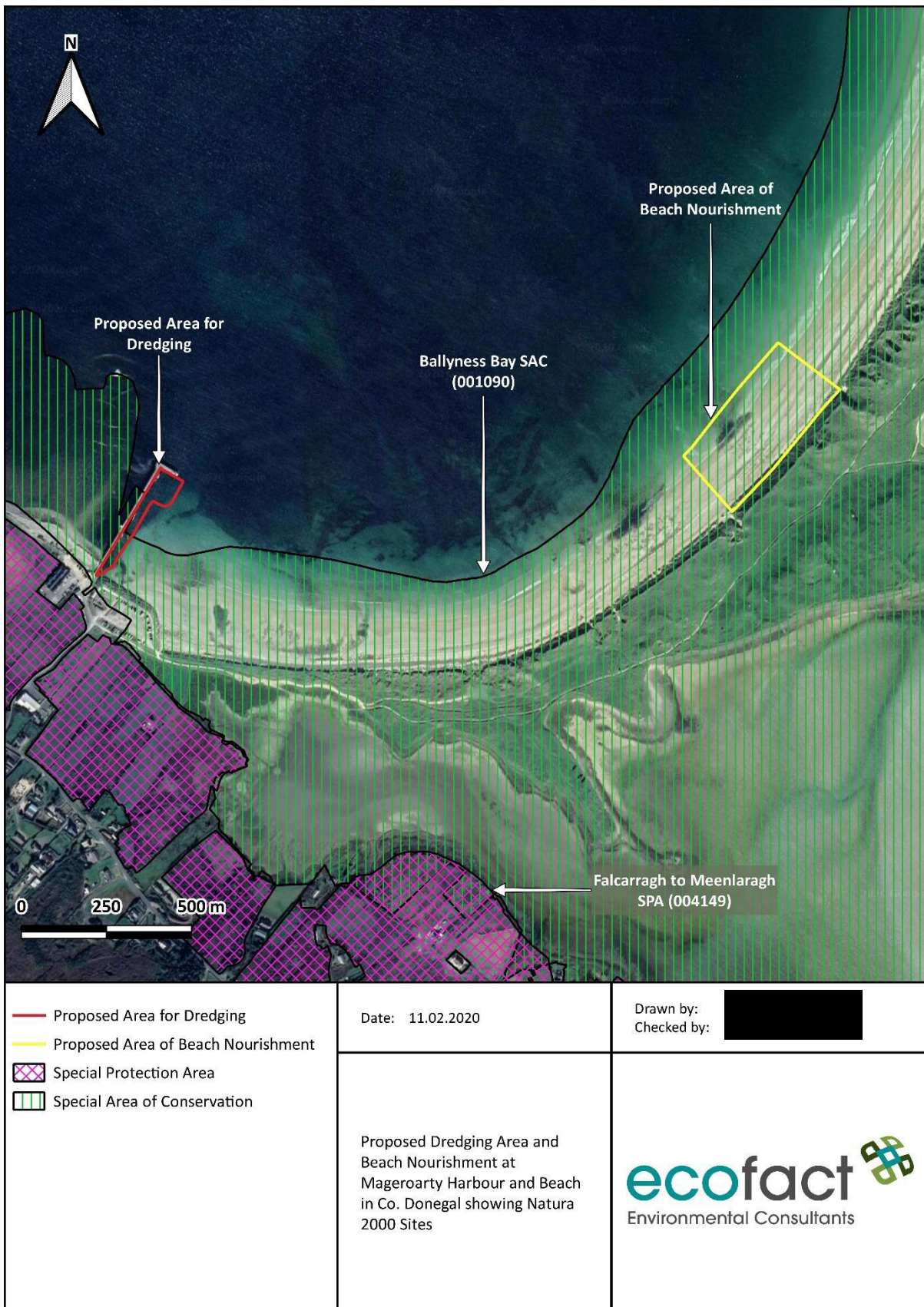


Figure 2 Proposed dredging and beach nourishment areas at Magheraroarty harbour and beach, with Natura 2000 sites and aerial photography.



2.0 METHODS

The current assessment included a detailed desk-based assessment and a site visit and survey on the 8th and 9th June 2020. The desk study included a review of previous surveys at the site, and the sources used in the study are listed in the references section.

The site was visited during calm / bright weather conditions during a spring tide cycle. A walkover survey of the site and surrounds was first undertaken survey first to visually assess marine habitats and the ecology of the general area, and also to select a suitable reference (control) site(s) for sampling.

Three transect areas were selected and these are indicated on Figure 1. The surveys were completed on the outgoing tide each day and 5 sub-sites (replicate samples) and extensive qualitative surveys were completed in each site/area. The survey was undertaken using standard intertidal survey methodology using a 0.25 m² quadrat and trowel to dig to a depth of 15cm. Sieving was completed in the field and macroinvertebrates were counted and identified in the field when possible, or fixed in isopropanol for subsequent identification in the laboratory. During the current survey, five replicate samples were taken at each transect.

The features of the sample sites were recorded and evaluated. These features included surface relief, firmness, stability, sorting and anoxic layer. Furthermore, notes were made if any mounds/ casts, burrows/holes, tubes, algal mats etc. were present and the physical attributes of each site were recorded.

It is noted that dredging works had taken place at the site immediately prior to the visit and this was not known at the time. There was no obvious evidence of dredging and beach “nourishment” works at the time of the survey. There was no machinery on the site and there was not an elevated area of sand / substrate at the receptor site. However, water quality and visibility was very poor and underwater cameras could not be used. It is not clear if this was due to the dredging that occurred or related to previous unsettled weather. The pier area also had anoxic substrates exposed which was likely to have been evidence of dredging. However, at the time this was attributed to the large build-up of rotting seaweeds at this location. Very few macroinvertebrates were recorded however at any of the sites. At the time this was attributed to the general sandy nature of the site, which is a beach, and this the probably primarily the reason for the low numbers of fauna recorded. During the walkover survey far more suitable areas for marine invertebrates were recorded in the main Ballyness Bay area with very high densities of worms and casts visible along with high densities of cockles and other molluscs.



3.0 RESULTS

3.1 Desk Study

3.1.1 Magheraroarty Pier

Magheraroarty pier is the location for the proposed dredging works and beach nourishment. This pier is located within Magheraroarty harbour and is located to the western end of the strand. Site access to the pier is off the adjacent L11331 local road which is just off the main R257 regional road. Most of the surrounding area consists of residential dwellings / holiday homes and extensively managed grassland. The subject site itself is within the village of Meenlaragh.

Magheraroarty pier is the point at which some touristic ferry crossings embark for trips to Tory Island and Inishbofin Island. The pier is frequently used for these trips all year round. The pier is also used frequently by small numbers of fishermen. The Department of the Marine and Natural Resources granted a dredging licence / foreshore lease in 2001, which included dredging works as well as an extension of the existing pier, new sheet piled walls, new wave walls, new decking and marshalling area and associated works (Department of the Marine and Natural Resources, 2001). This application also notes that an EIS was completed for the works in 2001 by Kirk McClure Morton, Consulting Engineers on behalf of Donegal County Council. This EIS is not available online and was not reviewed as part of the current assessment. Doran Consulting also completed a Foreshore Licence Application for Magheraroarty Pier in 2013 (Doran Consulting, 2013). This foreshore licence application was for the following activities: remove recently deposited sand from Magheraroarty harbor and deposit the material on Dooley strand as beach nourishment. This application was for a period of 5 years annual dredging, permitting 20,000 tonnes of material to be dredged from the harbor per annum (Doran Consulting, 2013). No Appropriate Assessment has been completed – and one is required to bring these works into compliance with the EU Habitats Directive.

According to the County Donegal Development Plan 2018-2024, the subject site is based in a Structurally Weak Rural Area. Planning no. 19/50962 includes for the proposed extension to the car park at the Magheraroarty Community Centre and the construction of a children's play area which is located c. 180m from the subject site. This planning application was granted and was subject to a Natura Impact Statement.

In relation to other activities in the general area, there are multiple licenses for the use of Ballyness Bay for private, commercial and industrial shellfish production. These licenses have been for the production of Oysters in Ballyness Bay SAC, and there has been some opposition to the granting of these licenses. An appeal has been put forward by 'Save Ballyness Bay' action group, including multiple submissions by An Taisce and ecologists. An Taisce has reviewed the multiple licenses and have submitted concerns over traffic across protected habitats, as well as disturbance to Grey Seals and the mobile sand community.

3.1.2 Designated Sites

3.1.2.1 *Ballyness Bay SAC 001090*

Ballyness Bay SAC is located in north-west Donegal, adjacent to the towns of Falcarragh and the village of Gortahork. This SAC is a large and very shallow estuarine complex, with extensive areas of sandflats which are exposed at low tide. This SAC is designated for the presence of Estuaries, Tidal Mudflats and Sandflats, Embryonic Shifting Dunes, Marram Dunes (White Dunes), Fixed Dunes (Grey



Dunes), Humid Dune Slacks and Geyer's Whorl Snail (*Vertigo geyeri*). The intertidal sandflats are noted in the site synopsis to often have a rich macro-invertebrate fauna with notable populations of Lugworm *Arenicola marina* and Common cockle *Cardium edule* (now *Cerastoderma edule*). Ballyness bay is almost completely cut off from the sea by two large sand dune covered spits. The Dooney sand dunes are highly dynamic and have grown to a considerable height near the tip of the spit. The site synopsis notes that they contain what is probably the largest unvegetated sand dune in the country. The fixed dunes that occur along the length of the Dooney sand are found east of a large band of mobile Marram *Ammophila Arenaria* dunes and are of particular importance. The site synopsis described the dunes dominated by Marram as being well developed (NPWS, 2013). It is noted that the conservation objectives document for the SAC illustrate the presence of the Mudflats and Sandflats habitat at the proposed dredging site and area for 'beach nourishment' (NPWS, 2014a).

Both of the beaches in the site are used for recreational purposes. Beach buggies and quad bikes are driven across the dunes. The Dooney dunes in particular are used for camping. Sea angling and sailing occur on a small scale in the Bay with servicing piers at Magheraroarty and at Ballyness. Some littering occurs on the dunes and beaches. A football pitch has been developed at the Magheraroarty end of the Dooney dunes. A well-worn track runs the length of the Dooney Peninsula. It is used for access to livestock, as well as by recreational users. Other tracks intersect to allow traffic access to the dunes. Licensed fishing for salmon by draft netting (ring netting) takes place in Ballyness Bay. Lobster potting and crabbing boats also use the pier to land catches. Mussels are also collected from certain areas of Ballyness Bay (NPWS, 2005).

The Ballyness Bay SAC is also considered to be important for waterfowl. Species of note include the Ringed Plover, Brent Goose, Red-breasted Merganser, Wigeon, Oystercatcher, Curlew, Sanderling and Greenshank. The populations of Ringed Plover and Sanderling are of national importance. Large numbers of lapwing have been recorded as well as Golden Plover and Chough. Land use within the bay comprises fishing and sailing on a small scale with the surrounding dunes and grassland grazed by sheep and cattle (NPWS, 2013). The Standard Data Natura 2000 form for the SAC notes the threats and pressures currently having an impact on the qualifying interests. This document notes that walking, horseriding and non-motorised vehicles are currently having a high impact on the SAC. The threats and pressures listed as having a medium impact on the SAC are as follows: grazing, removal of beach materials, sports pitches, urbanized areas and human habitation, discharges and marine and freshwater aquaculture (NPWS, 2019). In the Ballyness Bay SAC Conservation objectives supporting document for coastal habitats it is noted that the Dooney Sand dunes, which are also sometimes referred to as the Magheraroarty Dunes, are highly dynamic and have grown to a considerable height near the tip of the spit. The habitat maps included in the conservation objectives are based off results from the Coastal Monitoring Project (CMP) and the Sand Dunes Monitoring Project (SDMP), as listed in the document (NPWS, 2014b). Table 1 below details the total area of each sand dune habitat within the SAC obtained from NPWS (2014a).

Table 1 Total areas of Sand dune habitats in Ballyness Bay SAC obtained from NPWS (2014b).

Habitat	Ballyness (CMP)	Dooney (SDM)	Total area (ha) of habitat within the SAC Boundary
Embryonic shifting Dunes	2.26	4.81	7.07
Shifting dunes along the shoreline with <i>Ammophila arenaria</i>	14.15	8.98	23.13
Fixed coastal dunes with herbaceous vegetation	90.95	97.04	187.99
Humid dune slacks	13.87	-	13.87
Total	121.23	110.83	232.06

**Table 2** Qualifying Interests of Ballyness Bay SAC.

Qualifying Interest	Code
Estuaries	1130
Mudflats and sandflats not covered by seawater at low tide	1140
Embryonic shifting dunes	2110
Shifting dunes along the shoreline with <i>Ammophila Arenaria</i> (white dunes)	2120
Fixed coastal dunes with herbaceous vegetation (grey dunes)	2130
Humid dune slacks	2190
Geyer's Whorl Snail <i>Vertigo geyeri</i>	1013

3.1.2.1.1 NPWS Conservation Plan – Ballyness Bay

NPWS have completed a conservation plan for Ballyness Bay SAC in Co. Donegal for the period of 2005-2010 (NPWS, 2005). This conservation plan was set out when the SAC was just a candidate SAC, and it provides a very detailed description of the SAC, its qualifying interests and main conservation objectives. The main management issues listed for the SAC at this time were dumping, erosion, grazing and supplementary feeding, reclamation, recreation and sewage disposal. The main strategies employed at the time for achieve the objectives set out by NPWS were to implement sustainable grazing practices, regulate the access to the Dooley peninsula by recreational users, increase control of other damaging practices including supplementary feeding, dumping and littering, monitor potential damaging activities to all the habitats and the status of animal species and to liaise with various organizations and groups regarding the management of the site (NPWS, 2005).

The physical and biological features of Ballyness Bay are discussed in detail in the conservation plan. Physical features are discussed under climate, geology and geomorphology, soils and soil processes and hydrology and water quality. Table 3 below provides the details given for Annex I habitats in the SAC, their percentage coverage and a detailed description.

In terms of Fauna present at the site, a BIOMAR survey was carried out for invertebrates (NPWS, 2005). The sand flat / mud flat fauna present were considered to be typical of these types of habitat types. The invertebrate species recorded in Ballyness Bay during the BIOMAR sampling are provided in Table 4 below.

Salmon are noted to be present in the Tullaghobegly River, which enters Ballyness Bay just west of Falcarragh. Sea trout is also noted to occur within rivers in the site. Common frog is noted as being present and are known to breed within waterbodies on the site. A long list of bird species is noted in the conservation plan to occur within the site. However, it is specifically noted that Grey Plover and Sanderling are present in nationally important numbers (population >1% of the national population). During the BIOMAR survey, Sandwich tern and little tern were recorded using Drumnatinny beach. Chough are noted to use the short grassland habitats and up to 60 Greenland White-fronted Geese were counted on the edge of the site at Drumnatinny during the spring of 1998. Large numbers of lapwing have been recorded breeding on the dune slacks as well as a pair of Buzzards. Common seal is regularly seen at the site as well as Otters. A porpoise carcass was noted on the beach near Keadew during a site visit in 1998. Irish hare, foxes and rabbits are also present on the site (NPWS, 2005).

The conservation plan for Ballyness bay details the specific land use for the site which is given as the following: grazing, recreation / tourism, dumping / littering, dredging, removal of beach material, seaweed harvesting, fishing / shellfish harvesting, marram grass harvesting and tracks / access. It is noted in the plan that both dune systems are used for grazing livestock. The Dooley dunes are used to graze 30-50 sheep. Small numbers of cattle are also sometimes grazed here. It is noted that localized



overgrazing does occur on Drumatinny dune and ring-feeders were still used in 2003. For recreational purposes, the beaches are mostly used in July and August. The Dooley dunes are used for camping as well as numerous campfire locations throughout the peninsula, particularly at the Magheraroarty end. Beach buggies, quad bikes and touring caravans also use the area. Sea angling and sailing are also noted to occur in Ballyness Bay but on a small scale, with activity noted on Magheraroarty pier. New abandoned cars were noted to be appearing despite local parish council groups organizing clean ups before the summer

Table 3 Annex I habitats in the Ballyness Bay SAC, as detailed in the NPWS conservation plan (NPWS, 2005).

Annex I Habitat	Coverage within SAC	Description
Fixed Coastal Dunes with herbaceous vegetation [2130]	15% of total site area or 185ha	The site is dominated by the large sand dune system of the Dooley peninsula. This system is extremely dynamic, with substantial sand movement, both by wind and water action. Fixed coastal dunes occur along the length of the Dooley peninsula. They are surrounded by mobile dunes on the seaward side and other habitats such as saltmarsh and sand flat on the Ballyness Bay side. The typical plant species of the fixed dunes include Marram Grass (<i>Ammophila arenaria</i>), Red Fescue (<i>Festuca rubra</i>), Ribwort (<i>Plantago lanceolata</i>), Creeping Thistle (<i>Cirsium arvense</i>), Common Ragwort (<i>Senecio jacobaea</i>), Thyme (<i>Thymus drucei</i>) and the mosses, <i>Tortula ruralis</i> and <i>Homalothecium</i> sp. There are also fixed dunes across the Bay, at Drumnatiny. The vegetation is similar to that described above. These dunes have been fenced.
Mudflats and sandflats not covered by water at low tide [1140] and Estuaries [1130]	(60% of total site area or 742ha)	Most of Ballyness Bay is exposed at low tide, leaving extensive sand flats. Lugworm (<i>Arenicola marina</i>) casts are abundant and the flats are important for foraging waders. These sand flats are generally un-vegetated, but green algae (<i>Enteromorpha</i> sp.) and wracks (<i>Fucus</i> spp.) occasionally occur. Several small Eelgrass (<i>Zostera</i> sp.) beds also occur in the northern part of Ballyness Bay. Permanent water channels occur where the rivers (described below) enter and flow through the Bay. These represent the estuarine habitat. The intertidal areas provide important feeding and roosting habitat for wintering and resident seabirds and waterfowl.
Mobile dunes (including shifting dunes along the shoreline (2110) and embryonic shifting dunes (2120))	(4% of total site area or 49ha)	There are considerable areas of mobile dunes in the Dooley system. This includes one of the largest un-vegetated sand dunes in the country. Constant movement of sand prevents the establishment of vegetation. This dune, known locally as 'Big Dune', is currently eroding at a considerable rate. The seaward side of the dunes form steep un-vegetated sand cliffs. Behind these, the patchy vegetation is dominated by Marram Grass. Other species include Red Fescue, Colt's-foot (<i>Tussilago farfara</i>) and Red Clover (<i>Trifolium repens</i>). The mobile dunes at Drumnatiny are also dominated by Marram Grass.
Humid dune slacks (2190)	(1% of total site area or 12ha)	An area of wet dune slack lies adjacent to the dry grassland described below. The dominant grass species here are Creeping Bent (<i>Agrostis stolonifera</i>) and Crested Dog's-tail (<i>Cynosurus cristatus</i>). Sedge species (<i>Carex</i> spp.) and Silverweed (<i>Potentilla anserina</i>) are also common. Part of this area floods in winter. The dune slacks provide feeding habitat for Greenland White-fronted Geese and Barnacle Geese and roosting habitat for other waders and wildfowl during bad weather.

seasons. Littering and dumping are noted to also occur throughout the site. Dredging at Magheraroarty pier is specifically mentioned as well as spoil being dumped on adjacent land. Small



scale removal of beach material is also noted in the plan. On the eastern side of the Dooley peninsula, some seaweed harvesting is noted to occur. Licensed fishing for salmon by draft (ring netting) is said to take place in Ballyness Bay, as well as crab/lobster fishermen operating from Magheraroarty pier. Mussels are also collected from certain areas of Ballyness Bay. Marram grass is harvested during the winter from Dooley on a small scale. Regarding tracks and access, well-worn tracks are used to gain access to livestock, as well as by recreational users (NPWS, 2005).

Table 4 Invertebrate species recorded in Ballyness Bay during BIOMAR Sampling for the Ballyness Bay Conservation Plan (NPWS, 2005).

Location	Species
Drift Line / saltmarsh	<i>Orchestia gammerillus</i>
	<i>Talorchestia dishayesii</i>
	<i>Ligia oceanica</i>
Mid shore sand flat	<i>Sigalica mathildue</i>
	<i>Arenicola marina</i>
	<i>Clymenaria clyperata</i>
	<i>Urothae brevicornis</i>
	<i>Haustoris arenarius</i>
	<i>Cerastoderma edule</i>
	<i>Angulus tenuis</i>
Lower shore	<i>Glycera tridactyla</i>
	<i>Arenicola marina</i>
	<i>Clyminera clypeata</i>
	<i>Haustoris arenarius</i>
	<i>Crangon crangon</i>
	<i>Angulus tenuis</i>
	<i>Ammodytes lobianus</i>
	<i>Nephtys longosetosa</i>

The conservation plan also outlines the conservation value of the Ballyness Bay cSAC. This provides clarity on the status of protected habitats and species in the Bay and their importance nationally and internationally. It is noted in the plan that Ballyness Bay SAC represents between 2-15% of the total area of the 'fixed dunes with herbaceous vegetation' habitat in Ireland. This occurs along the Dooley peninsula and at Drumnatinny. This habitat is surrounded by the 'mobile dunes including shifting dunes along the coastline with *Ammophila arenaria* (white dunes)' habitat and the 'Embryonic shifting dunes' habitat. The plan notes that this area includes one of the largest unvegetated sand dunes in Ireland, representing <2% of the total habitat in the country. The Humid dune slacks near the fixed dune habitat at Drumnatinny is considered to be a good example and represents >2% of the total area of this habitat in the country. Part of this area is noted to flood in winter and therefore creates suitable habitat for wintering birds such as Barnacle geese. The intertidal mudflats and sandflats at the site are noted to represent 2-15% of this habitat in Ireland, with the estuary's habitat representing <2% of this habitat in Ireland. Several eelgrass beds are noted to occur in the intertidal zone and are said to support a rich macro-invertebrate fauna. The importance of the site for avian fauna is also noted again, with nationally important numbers of Grey Plover and Sanderling (NPWS, 2005).

The conservation plan also sets out conservation objectives for the site, which have now been superseded with an earlier version in 2014 (NPWS, 2014a). Furthermore, the plan explores the management issues with the site, which are noted as the following: Corncrake conservation, dumping, erosion, grazing, lack of information for the public, reclamation, recreation, sewage disposal and supplementary feeding. Corncrake have since been designated in the nearby Falcarragh to Meenlaragh SPA, discussed individually below. Dumping is noted to be likely polluting the habitats at



the site. Erosion is noted to occur on the Dooley dune system and peninsula, exacerbated by the use of this area by traffic, quad bikes, etc. Overgrazing is noted on the Drumnatiny dune system. The public are noted to not be aware of its designation and the ecological importance of the site, in 2005. Regarding reclamation, an area of the Dooley peninsula was noted to be flattened and reseeded to be used as a football pitch. Recreation is noted to exacerbate erosion and littering as well as disturbance, particularly to bird species. Untreated sewage from Gortahork and Falcarragh flows into Ballyness Bay and the feeding stations for cattle and sheep and noted to contribute to trampling of the habitats at the site (NPWS, 2005).

NPWS set out specific strategies to achieve the conservation objectives set out in the conservation plan for the Ballyness Bay cSAC. Again, it is noted that these conservation objectives have been superseded (NPWS, 2014a). The most recent conservation objectives for Ballyness Bay SAC are provided in Table 5. Nonetheless, the specific strategies for the conservation plan comprise the following: manage grazing on commonages; manage grazing on private land; regulate access to Dooley peninsula; monitor rabbit grazing; evaluate impact of and treat sewage discharge; monitor dumping on site margins; maintain mudflats, sandflats and estuary habitats; control supplementary feeding; maintain beach, saltmarsh, shingle, scrub, woodland, reedbed and drainage ditch; maintain rivers and streams; prevent further dumping; maintain the status of other notable species; maintain the status of chough; liaise with interested parties and liaise with REPS planners (NPWS, 2005). Finally, the conservation plan details the Zoning for the site, into natural zones, active management zones, intensive use zone and impact zones to help with management of the site (NPWS, 2005).

Table 5 Conservation objectives for Ballyness Bay SAC (NPWS, 2014a). Specific attributes and targets for each qualifying interest can be found in the conservation objectives document.

Qualifying Interest	Conservation Objective
Estuaries [1130]	To maintain the favourable conservation condition of Estuaries in Ballyness Bay SAC (defined by a specific list of attributes and targets)
Mudflats and sandflats not covered by seawater at low tide [1140]	To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Ballyness Bay SAC (defined by a specific list of attributes and targets)
Embryonic shifting dunes [2110]	To maintain the favourable conservation condition of Embryonic shifting dunes in Ballyness Bay SAC (defined by a specific list of attributes and targets)
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (White dunes) [2120]	To maintain the favourable conservation condition of Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (White dunes) in Ballyness Bay SAC (defined by a specific list of attributes and targets)
Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]	To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Ballyness Bay SAC (defined by a specific list of attributes and targets)
Humid dune slacks [2190]	To maintain the favourable conservation condition of Humid dune slacks in Ballyness Bay SAC (defined by a specific list of attributes and targets)
Geyer's Whorl Snail <i>Vertigo geyeri</i> [1013]	To maintain the favourable conservation condition of Geyer's Whorl Snail <i>Vertigo geyeri</i> in Ballyness Bay SAC (defined by a specific list of attributes and targets)

Table 6 Qualifying Interests of Falcarragh to Meenlaragh SPA and conservation objectives (NPWS, 2020).

Qualifying Interest	Code	Conservation Objectives
Corncrake	A122	To maintain or restore the favourable conservation condition of the bird species in this SPA



3.1.2.2 Falcarragh to Meenlaragh SPA

The Falcarragh to Meenlaragh SPA is located on the eastern and western sides of Ballyness Bay on the north-west coast of Donegal. This large site encompasses three areas of mixed agricultural grassland. This SPA is designated for the presence of the Annex II Corncrake. This site has supported a breeding population of Corncrake, with 9 pairs being the five year mean peak between 2003 and 2007. This site is regularly used by nationally important numbers of breeding Corncrake (NPWs, 2014c).

Corncrake migrate northwards from southern and eastern Africa to reach their breeding ground from early April onwards, and leave in August and September. This species requires a cover of tall vegetation throughout their breeding cycle and are strongly associated with meadows that are harvested annually. This protected bird is listed on the 2010 International Union for Conservation of Nature (IUCN) Red List of Threatened Species. This is due to the population and range declines of more than 50% in the last 25 years across significant parts of its range (NPWS, 2014c).

The Standard Data Natura 2000 form for the SPA notes the threats and pressures currently having an impact on the qualifying interests. This document notes that mowing / cutting of grassland as well as grazing are having a high impact on Corncrakes in the SPA. Cultivation and discontinuous urbanization are noted as having a low impact on the SPA (NPWS, 2018).

3.1.3 Intertidal Mudflats and Sandflats Survey

In 2006, a survey of the Intertidal mudflats and sandflats in Ireland as undertaken by NPWS (Aquafact International Services Ltd., 2006). This survey included selected shores within the 8 cSAC sites: Boyne Coast and Estuary, Baldoyle Bay, South Dublin Bay, Ballyteigue Burrow, Great Island Channel, Clew Bay Complex, Ballyness Bay and Lough Swilly. The aim of the project was to collect sediment samples at 8 locations for biological and granulometric analyses, record field data for each location including latitude and longitude and sediment characteristics such as colour, surface texture, qualitative description, depth of redox and biological features, make a photographic record of each site, carry out biological analyses of four samples per station to quantitatively document the species present, prepare a set of voucher specimens of all taxa recorded to be housed in the National Museum of Ireland, prepare a per sample species list, carry out particle size analysis of one sample per station, carry out organic carbon analysis of one sample per station and to prepare a report containing all the results (Aquafact International Services Ltd., 2006).

One of these sites surveyed as part of the project was Ballyness Bay in Co. Donegal which included 3 transects, each with three stations within the transect, of the lower shore, mid shore and upper shore. Two of these transects were situated in Ballyness Bay itself while one transect was located on Tramore beach just west of the mouth of the Ray River.

Transect 1 in this survey was located within Ballyness Bay and is very sheltered, almost completely enclosed on its northern face by a long sand dune peninsula that broadens to the north-east leaving only a narrow draining gap. This transect was located on the southern end of a peninsula which separates the transect from Maheraroarty beach where the proposed development site is. At transect 1 revealed a band of algae on the upper shore ranging from the 2m wide band of *Pelvetia canaliculata* to a narrow band of mixed *Fucus cernoides* and *Fucus spiralis* followed by a band c. 20m wide of *Ascophyllum nodosum* (70%) and *Fucus cernoides* (20%). Fauna observed at transect 1 during the survey included numerous green crabs *Carcinus maenas* on the upper shore, tubes of spionids and some clumps of mussels *Mytilus edulis*. The report notes that no talitrids were recorded from the



strand line, but 4 specimens were recorded from the core samples taken in the upper shore station. The total number of fauna recorded was 26, 11 and 9 for the upper, mid and lower shores of transect 1 respectively. Flora diversity was noted as 3, 1 and 0 respectively for the upper, mid and lower shores. For transect 1, total organic carbon ranged from 0.07% to 0.24%. Sediment type was found to be mostly medium sand and fine sand.

Transect 2 was located near the opening gap of Ballyness Estuary, in an area consisting of sandflats backed by sand dunes dominated by marram. Some cobbles were recorded on the lower shore with attached *Fucus vesiculosus*. No other algae were evident and very few fauna were recorded during the transect. The only signs of faunal activity were the casts of the lugworm *Arenicola marina* present in low densities. Talitrid amphipods were abundant on the strand line. Transect 2 had total organic carbon results ranging from 0.07% to 0.16% and the majority of sediment types recorded were medium sand, fine sand and coarse sand. Fauna diversity at Transect 2 was recorded as 0, 8 and 6 respectively, while no flora were recorded at any site.

Transect 3 was located in the eastern end of a long strand backed by a sand dune system and extending from the outer side of the gap of Ballyness Bay and ending c. 5km east. The narrow strand is completely exposed north to the Atlantic Ocean. Talitrid amphipods were recorded on the strand line and a sample was collected. The results of transect 3 showed that numerous specimens of the buoy barnacle *Dosima fascicularis* were observed stranded along the lower shore. Transect 3 was located off Finlay's bar or Tramore beach, which was the most exposed out of the three transects. Total organic carbon was not carried out for this site, but the sediment type was found to be dominated by medium sand, following by fine sand and coarse sand. Fauna diversity ranged from 1, 0, 0 and 1 for the shoreline, upper, mid and lower shores respectively.

Table 7 details the species recorded during the 2006 Aquafact survey in Ballyness Bay, and which transect these species were recorded at (Aquafact International Services Ltd., 2006). The report states that overall, the fauna recorded from the different substrate types was typical for Irish coastal waters and substratum types. It also notes that species numbers were the lowest overall at the upper and mid shore stations for the exposed shore off Ballyness. This shore is the closest habitat type to Magheraroarty beach.

3.1.4 Water Quality

The coastal area near Magheraroarty and the pier is considered to be 'Not At Risk' according to the water framework directive. The Coast Water Quality for the period 2010-2012 was noted as 'Unpolluted', according to the EPA online maps. Additionally, the Coastal Waterbody WFD status for the period of 2013-2018 was noted as 'High'.

The Gortahork Wastewater Treatment Plant (Registration Number A0295-01) discharges into Ballyness Bay and provides primary treatment. The design population equivalent (p.e.) is given as 380 while the agglomeration was noted to be treating a p.e. of 424 in 2011 (Irish Water, 2011). It was noted in the Inspectors Report that a screening should be carried out for the plant to assess the potential impact of the discharge on the designated sites downstream.

The Falcarragh Wastewater Treatment Plant (Registration Number D0343-01) also discharges into Ballyness Bay. The storm water overflow is located in a stream tributary of the River Ray (Irish Water, 2015). The EPA Inspectors report notes that has a design p.e. of 1,225 and an actual p.e. of 1,722. This indicates that the plant is currently overloaded, with the treatment type listed as 'none'.



Table 7 Summary of the fauna recorded at each transect in Ballyness Bay during the 2006 survey (adapted from Aquafact, 2006).

Taxon Name	Transect 1	Transect 2	Transect 3
<u>Annelida</u>			
Polychaeta			
<i>Arenicola marina</i>		✓	
<i>Hediste diversicolor</i>	✓		
<i>Nephtys cirrosa</i>			✓
<i>Nephtys sp.</i>	✓		✓
<i>Nephtys hombergii</i>	✓		
<i>Scoloplos armiger</i>	✓	✓	✓
<i>Aricidea catherinae</i>	✓		
Spionidae	✓		
<i>Malacoceros vulgaris</i>	✓		
<i>Pygospio elegans</i>	✓	✓	✓
<i>Spio sp.</i>	✓	✓	
<i>Capitella capitata</i>	✓		
<i>Capitellidea giardia</i>	✓		
<i>Manayunkia aestuarina</i>	✓		
Annelida Clitellata			
Tubificidae sp.	✓	✓	
<i>Tubificoides spp.</i>	✓		
<i>Tubificoides benedii</i>	✓		
<i>Tubificoides pseudogaster</i>		✓	
Enchytraeidae indet.	✓		
<u>Arthropoda</u>			
Crustacea, Malacostraca			
Crangonidae		✓	
<i>Crangon crangon</i>		✓	✓
<i>Synchelidium maculatum</i>	✓		
<i>Talitrus saltator</i>	✓		
<i>Chaetogammarus marinus</i>	✓		
<i>Megaluropus agilis</i>	✓		
<i>Corophium sp.</i>	✓		
<i>Corophium arenarium</i>	✓		
<i>Jaera albifrons</i>	✓		
<i>Carcinus maenas</i>	✓		
<i>Urothoe brevicornis</i>			✓
<i>Bathyporeia tenuipes</i>			✓
<i>Bathyporeia gracilis</i>			✓
<u>Mollusca</u>			
Bivalvia			
<i>Angulus tenuis</i>	✓	✓	✓
<i>Cerastoderma edule</i>		✓	
<i>Macoma balthica</i>		✓	
<i>Parvicardium minimum</i>	✓		



3.2 Site Survey, June 2020

The site of the proposed works at Magheraroarty Harbour determined that there was very limited biodiversity both at the dredging area by the pier and on the shore at the proposed nourishment section. Only a few species recorded along both the transect at the nourishment area and the control transect during the intertidal surveys. It was predominantly polychaete worms (lower shore) and sand hoppers (upper shore) that were found. Water quality at the pier seemed poor, with low visibility and a greyish colour observed. The substrate by the pier at low tide appeared to be grey, anoxic sand. There was seaweed left on the shore by the pier when the tide was out. The seaweed was decaying and possible enriching the area at this part of the harbour. There were no obvious signs that beach nourishment had taken place on the shore.

3.2.1 Transect 1

Transect 1 was located at the proposed dredging area immediately to the east of the pier. This area is backed by rock armouring and a car park to the south, and the pier to the west. There is a deep channel adjoining the pier and it was only found out after the survey that this area had been dredged immediately prior to the site visit. There was no visual evidence that dredging had taken place. However, the water in the channel was very turbid and there were exposed anoxic sediments. There was also a large amount of rotting seaweed at in this area and at the time of the visit the anoxic sediments and visibly poor water quality was attributed to this. There were no machine tracks or any evidence that dredging has already taken place so the survey was completed. The substrate was dominated by fine sand and there was extensive areas of unattached seaweeds. The site was surveyed on the outgoing spring tide. The substrate consisted of fine sand and this is the western side of Magheroarty beach. Very few invertebrates were found on the mid and upper shore areas, apart from occasional sand hoppers (*Talitrus saltator*). Sampling at the edge of the mid-shore channel (dredged area) did not yield any invertebrates. The lower shore area also had a very low diversity with a few cockles recorded along with a very occasional worm (recorded in additional searches).

3.2.2 Transect 2

Transect 2 was located at the proposed beach nourishment area immediately to the east of the pier. This area is backed by sand dunes. Again it was only found out after the survey that dredged material had been placed here immediately prior to the site visit. However, there was no visual evidence that this work had taken place. As with Transect 1, there were no machine tracks or any evidence that dredging has already taken place, so the survey was completed. The substrate at this transect was also dominated by fine sand. The site was surveyed on the outgoing spring tide. The substrate consisted of fine sand and this is Magheroarty beach. Almost no invertebrates were found on the mid and upper shore areas - only occasional sand hoppers. The lower shore area again had a very low diversity with a few individual invertebrates recorded only. This is not unusual for sandy beaches like this – but the fauna here was likely to have been even more impoverished due to the fact that beach nourishments works has been undertaken prior to the survey. However, again there was no visual evidence of this and during the survey we did not see any evidence of machine tracks, elevated beach areas or any other evidence that works had taken place. The main difference between this area and areas of the beach to the west of this was the absence of beach-cast seaweed debris. However, this was also considered to be a natural occurrence as the beach areas to the east of the proposed nourishment area are also clean. Water clarity at this site was poor however – and no underwater photos could be taken due to the turbidity. However, it was clear that at low tide that the subtidal substrates in this area were the same as those surveyed.



3.2.3 Transect 3

Transect 3 was located at the reference areas further east along Magheroarty beach. This was a similarly impoverished sandy area backed by the sand dunes. Despite this being a reference area the numbers and diversity of organisms recorded here was also very low and was similar to the other sites. Although this area could have potentially been affected by the recent beach nourishment works, there was no evidence of this and no signs of any impacts or use of machinery and movement of dredged material in the previous days. There were extensive sand ripples on the lower shore in this area and this was probably the only difference between here and transect 2. Table 8 provides a list of the macroinvertebrates recorded in the transects and there are no significant differences in the results obtained.

Overall the results obtaining show that both biodiversity and biomass were very low in the surveyed transects, and much lower than the 2006 survey. However, different areas were surveyed in 2006 and these areas (especially the Ballyness Bay area) are clearly far more important for marine invertebrates than the beach area.

Table 8 Fauna recorded at each transect during the June 2020 survey.

Taxon Name	Transect 1 (Pier)	Transect 2 (Receptor)	Transect 3 (Reference)
Annelida			
Polychaeta			
<i>Arenicola marina</i>		*	*
<i>Nephtys sp.</i>	*		*
<i>Scoloplos armiger</i>			*
<i>Pygospio elegans</i>	*		*
Arthropoda			
Crustacea, Malacostraca			
<i>Crangon crangon</i>			*
<i>Talitrus saltator</i>	*	*	*
<i>Corophium sp.</i>	*	*	*
<i>Carcinus maenas</i>	*		
<i>Bathyporeia spp.</i>		*	*
Mollusca			
Bivalvia			
<i>Angulus tenuis</i>			*
<i>Cerastoderma edule</i>	*		*

3.2.4 Other observations

Multiple trails were noted across the sand dune habitat, appeared to have been worn and exposed by walkers. During the site survey vehicles were noted in the bay which seemed most likely to have gained access by traversing the dunes. Semi-commercial bait digging appeared to be taking place and vans had driven out on the beach on low tide. Livestock were present grazing the dunes. Rabbits were very abundant across the dunes also. The back strand area (Ballyness bay) was clearly much more important for marine invertebrates than the areas surveyed on Magheroarty beach. Thousands of lugworm casts were visible on the beach and significant densities of cockles were present. This area was not sampled as (1) it is not affected by the dredging / beach nourishment works, and (2) it is not a similar habitat to areas affected on Magheroarty beach.



4.0 DISCUSSION

4.1 Diversity on sandy beaches

The site of the proposed works at Magheraroarty Harbour has very limited infaunal biodiversity and biomass. Sandy shore beaches are harsh environments that can be difficult to survive in due to their transient nature with wind, water and sediment constantly in motion. They are high-energy environments with significant exposure to wind and wave action which drives sand transport. This causes loose and mobile substrate which makes it difficult for vegetation to establish itself. Species in this environment also have to endure and adapt to tides and high salinity levels.

Beaches are considered to be physically controlled environments because they lack biogenic structures and are extremely dynamic. Aquatic and semi-terrestrial sandy-beach species essentially must be adapted to adapt. These species are unable to modify their environment to their advantage; the adaptations of these species are dictated by the harsh and complex cycles of changing environmental conditions (McLachlan & Defeo, 2018). Although there are biological factors playing some role in interspecies interaction and distribution in the sandy shore environment, such as commensalism, predation, competition etc., the influence of these are limited to a small scale and don't determine the overall community structure. The physical factors are considered to override the biological factors in general. The physical environmental conditions that shape sandy beach communities can be extremely harsh and complex and overall, there is a correlation between decreased exposure of the beach with increased diversity (Little, 2000). The dynamic habitats of sandy shores means that only some species are specifically adapted to these environments and sandy beaches therefore have a restricted number of common species (McLachlan & Defeo, 2018; Little, 2000).

Sandy beach habitats can have high levels of diversity in terms of types of organisms but they tend to have low biomass (Little, 2000). Differences in adaptations can result in variation in macrofauna communities between different beaches but generally sandy shore habitats display little uniqueness or endemism (McLachlan, 1991). McLachlan (1991) also noted that coastal dunes are 'geologically young' systems due to the exposure to varying conditions and the dynamic coastal environment in general. As a result of the continuous changeability there would have been little time for the development of unique species in individual coastal dune habitats.

Studies have shown that in general a sandy beach would not typically have more than 20 or 30 macrofauna species present, and in fact would often have much less. Dominant macrofauna include crustaceans, polychaetes, and mollusks. Regarding meiofauna, nematodes and harpacticoid copepods are the most common.

The sandy shore environment is harsh and naturally does not support major biodiversity and there is very little richness and / or abundance of macrofauna present. It is noted that dredging and beach "nourishment" works took place immediately before the current intertidal survey which could potentially affect the results. However, for the other aforementioned reasons similar results would be expected should there have been no dredging.

The NPWS' intertidal survey recorded higher levels of diversity in Ballyness Bay, however the locations of the transects away from the exposed shore was likely the reason for this. Transect 3 of the NPWS survey was on exposed shore to the north-east of the proposed works area, similar to the habitat at the proposed nourishment site, and the lowest diversity of the NPWS survey was recorded



at the mid and upper sections on this transect. However, this site is also closer to where the river flows out and has many physical differences from the sites in the current survey.

It is also acknowledged that with such limited macrofauna community along the intertidal area at the proposed works site there would not be suitable food availability to support waterbirds either. During the current walkover survey far more suitable areas for marine invertebrates were recorded in the main Ballyness Bay area with very high densities of worms and casts visible along with high densities of cockles and other molluscs. This area would be potentially important for wintering birds – and is already being disturbed by people walking with loose dogs. During the current survey semi-commercial bait digging was observed with vans driving out on the intertidal area and extensive digging of lugworm taking place.

4.2 Beach Nourishment

Beach nourishment, also referred to as beach or sand replenishment comprises the artificial placement of sand onto eroded shore with the aim to maintain the amount of sand present in the foundation of the coast. The main function of beach nourishment is to compensate for natural erosion and protect coastal areas from storm surges. It can also serve economic purposes by maintaining wide beaches for tourism and recreational use (ERDC, 2007). Beach nourishment is also used to protect sand dunes and enhance dune defences; it can raise the beach level, protecting frontal dunes from wave impact and erosion and can promote aeolian deflation and frontal dune growth. Beach nourishment has been widely practiced in Europe since the early 1950s and is common practice in the Netherlands, Germany, Spain, France, Italy and Denmark and on a small scale in the UK (Pye *et al.*, 2007; Matias *et al.*, 2005).

The process involves dredging sand / sediment from a source and depositing it at the eroded site. The deposited material can be spread on the shore surface to be naturally distributed by wind action on the shore and dunes. Generally, the dredged material should match the sediment type of the deposition site in terms of quality, composition and grain-size etc. for it to be effective in maintaining the natural processes and biota. An example of a case in Hel Peninsula in Poland highlighted the importance of this when sand was dredged from a nearby beach and the grain size was much smaller than that of the deposition site. As a result, the sand was easily dispersed, and erosion continued even with large amounts of sediment deposited. Sand from open sea sites and nearby breakwaters proved more effective after investigation.

The characteristics of the sediment used as nourishment material for the beach and dunes can also influence aeolian transport rates, in turn influencing beach levels and dune development. Van der Wal (2000) demonstrated that aeolian transport from nourished beaches in The Netherlands was lower than that of unnourished beaches due to the nourishment material being more poorly sorted and coarser in nature compared to the native sand. This indicates the need to assess and consider the grain size and distribution characteristics of nourishment material. Mangor *et al.* (2001) suggests that the nourishment sediment should be as coarse as, or coarser than, the native sand so that it is not immediately eroded too easily.

Beach nourishment can be viewed as a productive way of re-using material that has been extracted for another purpose including port dredging to facilitate navigation. <https://climate-adapt.eea.europa.eu/metadata/adaptation-options/beach-and-shoreface-nourishment/#source>

Using the material dredged from the harbour at Magheraroarty for the nourishment of the adjacent beach may be a useful way to utilise the dredged material for maintaining the beach and coastal dune



habitats if done in the appropriate way. The material should be a suitable sediment match to that of the deposition area as it is understood to comprise mainly of the eroded material from the adjacent shore which has accumulated at the pier due to littoral drift.

Ideally coastal systems and dune habitat should be allowed to respond naturally to changes in forcing factors and sediment supply conditions. However, where beaches are affected by strong negative beach sediment budget, dune dissipation is likely to occur if nourishment with fine-grained sand and artificial dune profiling are not undertaken. The placement of the nourishment material should be carefully considered to ensure the benefits of the nourishment are achieved. According to Magnor (2001), there are three main methods of nourishment placement: backshore; beach; shoreface. Placement of the nourishment material at the backshore at the foot of the dunes is generally aimed at preventing dune erosion. Placement of the material on the main beach is typically used to supply an increased sediment budget for recreational value and maintenance. Placing the material at the outer part of a beach, generally on the seaward side of a barrier, shoreface nourishment, can help to strengthen the coastal profile and also add to the overall sediment budget (Mangor, 2001).

The method of deposition can also vary. The proposal presents two options: to transport the material along the shore with dumper trucks at low tide; or to pump the material into the intertidal zone at high tide. The first method would minimise the risk of sediment plumes in the water and has been used for the previous dredging activity at the site. However, the second would mean that there would be no machinery traversing and disturbing the sandy shore.

According to Pye *et al.* (2007) a detailed Geomorphological Evaluation Study should be undertaken at dune sites to assess the requirements and identify the most appropriate methods of the proposed dredging and nourishment and the best management strategy of the vulnerable habitat, taking nature conservation and other interests into account. It is also advised that systemic monitoring programmes should be in place to identify early warning of dune changes. The importance of beach change modelling in predicting the performance of beach nourishment projects is becoming increasingly apparent (Galofre *et al.*, 1995). Depending on the scale of projects several models may be used to analyse the various processes acting on the sediment movement of a beach due to the complexity of the coastal environment.

Dunes are dynamic habitats, the nature and extent of dune habitat depends on the balance of environmental forcing factors (wind, wave, tide, sediment supply, precipitation); and dunes are influenced by fluctuations in these factors. Human activity can also have an influence on dune habitat. Anthropogenic influences, such as the construction of structures like harbour walls, piers, jetties, pipelines etc., can impede long-shore drift and affect erosion and accretion dynamics and alter sediment supply and mobility. This interferes with the natural sediment supply to the dune system.

Pye *et al.* (2007) discusses how beach nourishment is implemented in different ways depending on the site and the specific requirements. Often, the purpose of beach nourishment being carried out is to sustain and enhance the flood defence value of frontal dunes. It can be used as a method of reducing wave attack of the frontal dune by raising the beach levels. Beach nourishment can also promote aeolian deflation and frontal dune growth. The sediment deposits for the replenishment of the beach may be placed directly in the fore-dune area in order to raise the level of low spots. Alternatively it may be deposited behind the frontal dune ridge to create a secondary line of defence. On shores that are particularly exposed to wind, nourishment material is placed on the upper beach, allowing natural aeolian processes to transport it into the dunes. Deflation is enhanced by placing the nourishment material in multiple small mounds on the mid and upper beach. This creates instability in the local wind field and causes increased turbulence to move the sand, and supply the sediment to



the dunes. In situations where little or no dune ridge is present, an entire wash over dune or low barrier dune system may be constructed by large-scale beach nourishment and re-profiling using heavy machinery.

4.3 Dredging and nourishment in Natura 2000 sites

Activities requiring consent (ARCs) are specific activities which have the potential to damage a Special Area of Conservation (SAC) or Special Protection Area (SPA), collectively termed 'European sites' or 'Natura 2000 sites'. The NPWS lists 38 ARCs, ranging from "Reclamation, including infilling" to "Lighting up caves, buildings or other places used by bats for roosts". The specific ARC(s) for a particular Natura 2000 site depends on the habitats and / or species for which the site is designated. ARCs are not prohibited but consent must be granted prior to the activity by the Minister for Culture, Heritage and the Gaeltacht ('the Minister') or by another relevant public authority to which the consent function for that activity falls. The requirement for prior consent ensures that the Minister (or the relevant competent authority) completes the necessary environmental assessment to determine if the activity can take place and if any conditions should be attached to any granted consent. It is an offence to carry out an ARC without prior consent.

The terms 'notifiable actions', 'notifiable activities' and 'operations requiring consent' were used before the term 'activities requiring consent' was adopted. These terms often appear on older statutory instruments or on the information included in the site pack sent to landowners of sites not yet formally designated. The terms 'notifiable actions', 'notifiable activities' and 'operations requiring consent' have the same meaning as 'ARCs'; these are all terms used for activities that require the consent of the Minister or another relevant public authority before the activity can be carried out. NPWS have listed the 'notifiable actions' associated with certain habitats and species; including those specific sand dunes and machair habitat. As stated in the Notice of Notifiable Actions for sand dunes or machair "Under STATUTORY INSTRUMENT 94 of 1997, made under the EUROPEAN COMMUNITIES ACT 1972 and in accordance with the obligations inherent in the COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 (the Habitats Directive) on the conservation of the natural habitats and species of wild fauna and flora, all persons must obtain the written consent, of the Minister for The Environment and Local Government before performing any of the operations on, or affecting, the specified habitats where they occur on lands / waters within the candidate Special Area of Conservation". The listed notifiable actions related to protected sand dune habitat is as follows:

SECTION A

THE MINISTER FOR THE ENVIRONMENT AND LOCAL GOVERNMENT IS REQUIRED TO BE NOTIFIED IN RELATION TO THE FOLLOWING ACTIVITIES AND SUCH ACTIVITIES SHOULD NOT PROCEED WITHOUT PRIOR CONSENT

- *causing erosion by any means (e.g. driving vehicles, riding horses etc.)*
- *grazing of livestock above a sustainable density (as defined in approved farm plans)*
- *grazing by livestock treated within the previous week with a pesticide which leaves persistent residues in the dung*
- *supplementary feeding of stock (e.g. with hay, silage, concentrates, roots etc.)*
- *cropping or removal of plants*
- *reclamation, infilling, ploughing or land drainage*
- *reseeding, planting of trees or any other species*
- *application of fertiliser, lime or organic materials*
- *dumping, burning or storing any materials*



- *use of any pesticide or herbicide*
- *alteration of the banks, bed or flow of watercourses*
- *operation of commercial recreation facilities (e.g. pony trekking)*
- *introduction (or re-introduction) into the wild of plants or animals of species not currently found in the area*
- *any other activity of which notice may be given by the Minister from time to time*

SECTION B

(NO REQUIREMENT TO NOTIFY IF ALREADY LICENSED BY ANOTHER MINISTER/BODY)

- *construction of fences or embankments*
- *removal of soil, mud, gravel, sand or minerals*
- *construction of buildings or sewerage facilities*
- *construction of roads or car parks or access routes*
- *developing leisure facilities including golf courses, sports pitches, caravan or camping facilities*

The proposed dredging and beach nourishment activity at Magheraroarty Pier would fall under Section A of the above list. It is therefore essential that the relevant assessments (NIS and Appropriate Assessment) are carried out and the appropriate consent and licence is obtained before the commencement of the proposed works.

4.4 Other Dune Management Considerations

The use of beach nourishment in sand dune protection is often used in combination with other methods (ERDC, 2007). For example, hard structures such as groins can be put in place to help shore and dune stabilisation. These structures can help reduce the movement of sediment along the shore and slow down local erosion. Again, it is noted however, that like nourishment material placement, these structures must be strategically placed based on an understanding of the processes of sediment movement on the particular beach, informed by the relevant surveying and modelling. Integrating hard structure with beach nourishment may be an effective method of reducing the shore erosion as efficiently as possible. If hard structures were found to be effective enough, they may even reduce / eliminate the need for dredging over time. Beach change modelling can help to predict the performance and influence such mitigation may have; but ongoing monitoring should also be practiced to account for changes in the coastal processes as the coastal environment can be unpredictable (Galofre, 1995).

Grazing, which can be considered a human activity too, is another important contributing factor the maintenance and also to the loss of sand dunes. The right balance on grazing levels is important as over-grazing leaves dunes exposed and vulnerable to erosion while under-grazing can result in scrub and bracken encroachment and loss of dune habitat also. There is a significant rabbit population of the coastal dunes at Ballyness Bay as well as the presence of grazing livestock. Rabbits are a non-native species in Ireland. Rabbits were introduced to sand dune habitat in the past and used to raise rabbits as a food source. Rabbits then became naturalised on sand dunes across the country. The influence of rabbits on dunes, however, varies greatly depending on the population density, there may be positive negative or neutral impacts from rabbit grazing. Rabbits can have positive influence on dunes where other grazing animals are absent, and the rabbit population is not excessive. Rabbit grazing of the sand dunes helped to maintain the habitat and reduced the rate of succession towards scrub. The reduction in rabbit populations due to myxomatosis and rabbit haemorrhagic disease resulted in vigorous grass growth and scrub development on dunes in Ireland (Provoost et al., 2011).



On the other hand, if rabbit populations are uncontrolled overgrazing and burrowing can be problematic and cause damage to sand dune structures. Hunting of rabbits in such cases can be used, and has had positive results, as a management strategy to prevent overgrazing and excessive rabbit-damage to dunes (Delaney *et al.*, 2013). Similarly, livestock grazing can be beneficial to dune habitat however it is essential to establish the appropriate overall level of grazing as localised overgrazing can be detrimental, affecting the dunes structure and vulnerability as well as impacting natural the vegetation structure (Howe, Wales Coastal Ecosystem Group Priority Action). There are significant numbers of rabbits at the Ballyness Bay site.

Other human activities impacting sand dune ecology and geomorphology in the past and currently are crop growing, military use, recreation and coastal defence. Recreational use of the sand dunes in Ballyness Bay was apparent in the current survey with multiple walking trails worn across the dunes. Driving of vehicles on the sand dunes may also be impacting the dunes in the designated site. According to a 2013 monitoring survey of sand dunes in Ireland (Delaney *et al.*, 2013), the most frequent reason for deterioration of sand dune habitat was continued loss of habitat due to anthropogenic activities. This highlights the need for control and management of such activities at Ballyness Bay.



5.0 CONCLUSIONS

There was very little species present on the sandy shore areas surveyed with low species richness and abundance at both the transect at the proposed nourishment area and the reference transect surveyed just north of it. The areas surveyed will probably provided limited feeding opportunities suitable for wading birds associated with the SPA due to the fact that there is limited food availability on the beach with the limited sandy shore macrofauna community. There is more suitable habitat on the landward side of the dunes at Magheraroarty harbour which provides better feeding opportunities for wintering birds.

It is considered that the proposed dredging and beach nourishment works would not be directly impacting wildlife significantly if relevant mitigation measures were in place for the project as the site. It is noted however, that the proposed works would be affecting the overall coastal processes and the associated habitat. Therefore, the protection and maintenance of the coastal habitats, in particular the sand dune habitat, and the Natura sites which are of importance to wildlife near the proposed works is essential. The proposed beach nourishment should be done in a way that most effectively provides protection and maintains a sediment replenishment source for the dunes. At the time of the survey dredging and nourishment had recently taken place (not known at the time of the survey) but there was no evidence of the nourishment on the shore, it may have been rapidly flattened by the spring tides. This raised the question of whether the proposed nourishment would raise the beach level enough to successfully serve the function of protecting the dunes. Other surveying and beach change modelling may be necessary to determine this.

In order to ensure the most effective and valuable method of carrying out the beach nourishment is applied there must be cognisance of the characteristics of the beach such as beach shape, the type of native sand, berm height and width, dune height and off-shore slope etc.; and the behaviour of the system in terms of erosion and accretion patterns, and sediment dispersal processes, including the volume, rates causes sediment movement etc. (ERDC, 2007). Detailed and targeted surveys and modelling of such features and processes would inform the engineering of the project to ensure that it is carried out with minimal adverse impacts, particularly on the water quality and the natural flow and sediment movement, and maximum beneficial effects in terms of protecting and stabilising the dune habitat.

Also, the beach nourishment activity should be integrated into a larger scale plan for the management of the dunes at Ballyness Bay. Incorporating some hard structure erosion mitigation such as groins could have positive impacts and help to reduce the littoral drift and erosion along the shore. It is also acknowledged that another major threat to the dunes at Ballyness Bay is impacts from anthropogenic recreational activity. Walking trails traverse the dunes along multiple paths in all directions. There is no designated walking route over the dunes. Fencing and marking out a designated walking route over the dunes would help to confine and contain the activity thereby limiting or controlling the impacts on the dunes. Vehicles driving over the dunes is more damaging and likely causing destabilising and erosion impacts. This activity should also be curtailed. Grazing by livestock (and rabbits) should be maintained but in a controlled manner, with careful management and rotation to maintain the dune grassland while preventing over-grazing or damage due to over-use and trampling from the livestock.



5.0 RECOMMENDATIONS

5.1 Appropriate Assessment

It has been determined from the Screening for Appropriate Assessment that the proposed project at Magheraroarty Harbour requires an Appropriate Assessment (Greentrack Environmental Consultants, 2019). It is therefore noted that the required NIS must be complete before any more of the proposed dredging and beach nourishment works are carried out. If the proposed works were to commence prior to the completion of the NIS and / or without the relevant Foreshore Licence being obtained this practice would be an offence under the European Communities (Birds and Natural Habitats) (Amendment) Regulations (2015).

5.2 Mitigation during dredging

It is important that strict water quality protection measures are in place for the duration of the dredging and nourishment works. Silt curtains should be used around dredging and nourishment areas to prevent additional aggravated sediment becoming suspended in the water of the harbour.

It is advised that works should not take place during the winter period as there is potential to impact on the wintering bird populations in the general area.

5.3 Investigate Sediment Processes and Specific Requirement

It is recommended that further surveys should be carried out on the coastal processes and the characteristics of the harbour at Magheraroarty. These can help in understanding the movement of sediment, predict affects and determine the most beneficial approach.

A detailed Geomorphological Evaluation Study should be undertaken to assess the requirements and identify the most appropriate management strategy for the beach and the dunes. Scientific evidence should be gathered to inform and support the methods of the dredging and nourishment activity, including to determine whether the nourishment material should be transported via machinery on the shore or pumped from a barge, and increase the probability of success. Beach change modelling should be used based on the information obtained to predict the performance of the beach nourishment project.

5.4 Additional Mitigation

It is strongly recommended that a long-term integrated management plan is put into place at Ballyness Bay to protect the sand dunes habitat in particular. Beach nourishment would be a part of the overall management strategy, but additional measures should be incorporated. It is recommended that walking on the dunes should be restricted to a designated marked and fenced route. This will help to ensure greater area of the sand dunes habitat may be left undisturbed by human activity. Also measures should be taken to prevent access onto the dunes by vehicles; erecting of barriers is a straight forward measure that can deal with this issue.

Rabbits and livestock grazing maintain dune grassland and prevent scrub encroachment. However, excessive over-grazing can cause major damage to dune habitat also. The grazing of the dunes should be carefully monitored. Livestock grazing should be limited and managed appropriately to prevent over-grazing. If the rabbit population becomes excessive and problematic culling may be required to prevent significant damage and over-grazing.



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PLATES



Plate 1 The marine intertidal survey was completed during low water of spring tides on the 8th and 9th June 2020.



Plate 2 The subject pier area was dredged prior to the visit. This was not known at the time of the visit and there was no visual evidence that dredging had taken place.



Plate 3 The subject pier (alternative view).



Plate 4 The subject pier. Water quality / visibility was poor and there was a large accumulation of rotting seaweeds. Sediments were anoxic.



Plate 5 beach area to the east of the pier looking towards the pier.



Plate 6 Some localised mixed substrate on the beach (not affected by the dredging) has higher biodiversity than the subject transect areas.



Plate 7 Other example of a localised mixed substrate area on the beach (not affected by the dredging).



Plate 8 Looking east to the 'beach nourishment area'. Sand and dead seaweed and very impoverished fauna.



Plate 9 The 'beach nourishment area'. It is understood that sand had been placed here immediately prior to the survey. But most areas of the beach had a very impoverished fauna.



Plate 10 The 'beach nourishment area' looking east to the reference survey area.



Plate 11 Reference survey area at low tide on the 8th June 2020. This area was not disturbed but also had a very impoverished faunal community.



Plate 12 Upper shore near the reference survey area, with sand dunes visible in the background,



Plate 13 The Ballyness Bay area (back shore area behind Magheraroarty beach).



Plate 14 The Ballyness Bay area – vans had driven out on the shore during low tide with several people engaged in bait digging.



Plate 15 The Ballyness Bay area – this area is significantly more important for marine intertidal fauna than the Magheraroarty beach area. Very high densities of *Arenicola marina* were present.