

NPWS

Akeragh, Banna and Barrow Harbour SAC
(site code: 000332)

**Conservation objectives supporting document-
Coastal habitats**

Version 1

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Please note that the opinions expressed in the site reports from the Saltmarsh Monitoring Project (SMP), Coastal Monitoring Project (CMP) and the Sand Dunes Monitoring Project (SDM) are those of the authors and do not necessarily reflect the opinion or policy of NPWS.

Please note that this document should be read in conjunction with the following report: NPWS (2017) Conservation Objectives: Akeragh, Banna and Barrow Harbour SAC 000332. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

1 Introduction

Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (European Commission, 2013). It is defined in positive terms, such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Akeragh, Banna and Barrow Harbour SAC is a relatively large SAC covering a 10km stretch of coastline, from Ballyheige southwards to Barrow Harbour, Co. Kerry. The SAC supports a diversity of coastal habitats including intertidal sand and mudflats, rocky shore, shingle and sandy beaches, saltmarshes, sand dunes, dry heath, dry grassland, wet grassland and reedbeds. Akeragh Lough is a shallow lough where the water level has dropped and now contains extensive freshwater and brackish marsh vegetation. The underlying geology is limestone, which outcrops in the southern part of the SAC. Elsewhere, calcareous sand with high shell fragment content is predominant with occasional development of peat (NPWS, 2013).

Akeragh, Banna and Barrow Harbour SAC covers two separate sand dune systems, Ballyheige to the north and Banna Strand to the south, with the two contiguous sites separated by the river outflow at Black Rock. Ballyheige extends southwards from Ballyheige town for approximately 4km to Black Rock. Banna Strand extends southwards from Black Rock for approximately 5.5km, where it eventually narrows into a sandbar lying to the seaward side of the sandflats and saltmarsh of Carrahane strand. Banna Strand is within Tralee Bay and is a large site located approximately 3.5km west of Ardfert and 2km north of Barrow Harbour (Delaney *et al.*, 2013).

The saltmarsh at Ballyheige is located 3.5km south of Ballyheige town and is relatively small (McCorry and Ryle, 2009).

The SAC overlaps with Tralee Bay Complex Special Protection Area (SPA) (004188). The SPA is internationally important for wintering waders and wildfowl. NPWS (2014) provides details of bird usage within the SPA. The Annex I bird species cough (*Pyrhcorax pyrrhcorax*) was noted in the SAC (Delaney *et al.*, 2013).

The primary human land-uses in Akeragh, Banna and Barrow Harbour SAC are recreational and agricultural. Ballyheige and Banna Strand are very popular holiday destinations, particularly during the summer, and the dunes are used to graze cattle.

Akeragh, Banna and Barrow Harbour SAC (site code: 000332) is selected for European dry heaths and saltmarsh and sand dune habitats. The following eight coastal habitats are included in the list of Qualifying Interests for the SAC (* denotes a priority habitat):

- 1210 Annual vegetation of drift lines
- 1310 *Salicornia* and other annuals colonising mud and sand
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- 2110 Embryonic shifting dunes
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*
- 2190 Humid dune slacks

Habitats 1310, 1330 and 1410 are saltmarsh habitats and the remaining five habitats occur within sand dune systems. All eight of these habitats are usually found in close association with each other.

The distribution of saltmarsh habitats within Akeragh, Banna and Barrow Harbour SAC is presented in Appendix I and that of sand dune habitats is presented in Appendix II.

2 Conservation Objectives

A conservation objective aims to define the favourable conservation condition of a habitat or species at a particular site. Implementation of the objective will help to ensure that the habitat or species achieves favourable conservation status at a national level.

This supporting document sets out the conservation objectives for the eight coastal habitats listed above in Akeragh, Banna and Barrow Harbour SAC, which are defined by a list of parameters, attributes and targets. The main parameters are (a) Range (b) Area and (c) Structure and Functions, the last of which is broken down into a number of attributes, including physical structure, vegetation structure and vegetation composition.

The targets set for the **saltmarsh habitats** are based primarily on the results of the Saltmarsh Monitoring Project (SMP) (McCorry and Ryle, 2009) and this document should be read in conjunction with that report.

The SMP surveyed, mapped and assessed one sub-site associated with Akeragh, Banna and Barrow Harbour SAC (McCorry and Ryle, 2009):

Ballyheige (SMP site ID: SMP0077)

The distribution of saltmarsh habitats within Akeragh, Banna and Barrow Harbour SAC is presented in Appendix I. As part of the SMP, a detailed individual report and habitat map were produced for the Ballyheige sub-site and these are included in Appendix III. The conservation objectives for the saltmarsh habitats in Akeragh, Banna and Barrow Harbour SAC are based primarily on the findings of the SMP.

There are additional areas of saltmarsh known to be present within the SAC. The National Inventory of Saltmarshes in Ireland (Curtis and Sheehy Skeffington, 1998) identified three saltmarsh sites within this SAC: 1. Ballyheige, 2. Carrahane/Banna and 3. Barrow Harbour.

As it is estimated that the Ballyheige sub-site as surveyed by the SMP represents approximately 1.86% of the total estimated area of saltmarsh within Akeragh, Banna and Barrow Harbour SAC, the conservation objectives for the saltmarsh habitats within the entire SAC are quite generic and may be adjusted in the future in light of new information.

The targets set for the **sand dune habitats** are based primarily on the results of the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009) and the Sand Dunes Monitoring Project (SDM) (Delaney *et al.*, 2013). This document should be read in conjunction with those reports.

The CMP was a comprehensive national baseline survey of all known sand dune systems in Ireland. Two sub-sites associated with Akeragh, Banna and Barrow Harbour SAC were surveyed, mapped and assessed (Ryle *et al.*, 2009):

1. Banna Strand
2. Ballyheige

As part of the CMP (Ryle *et al.*, 2009), detailed individual reports and habitat maps were produced for all sub-sites and those compiled for the Ballyheige sub-site (CMP site ID: 078) is included in Appendix IV at the end of this document.

The SDM reviewed and modified the methodology used during the CMP to map and assess the conservation status of dune habitats. A subset of 40 sites, including Banna Strand, was selected as a representative sample of the national dune resource for the SDM survey. As part of the SDM (Delaney *et al.*, 2013), detailed individual reports and habitat maps (a revised baseline habitat map and an updated habitat map) were produced for each sub-site and the relevant ones for the Banna Strand sub-site (SDM site ID: 077) are included in Appendix V.

The conservation objectives for the sand dune habitats in Akeragh, Banna and Barrow Harbour SAC are based on the findings of both the CMP (Ryle *et al.*, 2009) and the SDM (Delaney *et al.*, 2013), combined with the results of Gaynor (2008). It is thought that the two sub-sites as surveyed by the CMP and the SDM represent the total area of sand dunes within Akeragh, Banna and Barrow Harbour SAC.

3 Saltmarsh habitats

Saltmarshes are stands of vegetation that occur along sheltered coasts, mainly on mud or sand, and are flooded periodically by the sea. They are restricted to the area between mid neap tide level and high water spring tide level. In Ireland, there are four saltmarsh habitats listed under Annex I of the EU Habitats Directive (92/43/EEC):

- ***Salicornia* and other annuals colonising mud and sand (1310)**
- **Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) (1330)**
- **Mediterranean salt meadows (*Juncetalia maritimi*) (1410)**
- Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*) (1420)

The three habitats indicated in bold above are listed as Qualifying Interests for Akeragh, Banna and Barrow Harbour SAC. The last habitat is restricted in its distribution to sites in the south-east of Ireland.

The SMP surveyed, mapped and assessed the following saltmarsh sub-site associated with Akeragh, Banna and Barrow Harbour SAC (McCorry and Ryle, 2009):

Ballyheige (SMP site ID: SMP0077; see Appendix III)

The National Inventory of Saltmarshes in Ireland (Curtis and Sheehy Skeffington, 1998) identified three saltmarsh sites within this SAC: 1. Ballyheige, 2. Carrahane/Banna and 3. Barrow Harbour.

The first two are sandflat type saltmarshes while the third is an estuary type saltmarsh with a muddy substrate.

The distribution of saltmarsh habitats within Akeragh, Banna and Barrow Harbour SAC is presented in Appendix I. Detailed descriptions of each habitat in the Ballyheige sub-site as recorded by McCorry and Ryle (2009) can be found in Appendix III.

3.1 Overall Objectives

The overall objective for '*Salicornia* and other annuals colonising mud and sand' in Akeragh, Banna and Barrow Harbour SAC is to '*maintain the favourable conservation condition*'.

The overall objective for 'Atlantic salt meadows' (ASM) in Akeragh, Banna and Barrow Harbour SAC is to '*restore the favourable conservation condition*'.

The overall objective for 'Mediterranean salt meadows' (MSM) in Akeragh, Banna and Barrow Harbour SAC is to '*maintain the favourable conservation condition*'.

These objectives are based on an assessment of the recorded condition of each habitat under a range of attributes and targets. The assessment is divided into three main headings: (a) Area (b) Range and (c) Structure and Functions.

It is important to note that the conservation objectives for the saltmarsh habitats within the entire SAC are generic and may be adjusted in the future in light of new information.

3.2 Area

3.2.1 Habitat area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. The target is that there is no decrease from the baseline which was established by McCorry and Ryle (2009). Bearing in mind that coastal systems are naturally dynamic and subject to change, this target is assessed subject to natural processes, including erosion and succession.

A baseline habitat map of all known saltmarsh in the Ballyheige sub-site was produced based on the findings of the SMP (McCorry and Ryle, 2009) and is presented in Appendix III. A total of 1.02ha of saltmarsh habitat was mapped by the SMP within the SAC at Ballyheige and additional areas, totalling 53.90ha, of potential saltmarsh habitat were identified using aerial photographs. This gives a total estimated area of 54.92ha within Akeragh, Banna and Barrow Harbour SAC.

The total areas of each saltmarsh habitat within the Ballyheige sub-site as mapped by the SMP and the total areas of each habitat within the SAC are presented in the following tables.

There are a number of differences in the figures below. Most of the differences can be explained by the fact that the SMP mapped the total saltmarsh resource at Ballyheige and not all of the saltmarsh mapped is contained within the SAC boundary. In addition, the total area within the SAC can be greater than given in the SMP as the SMP did not include any mosaics when calculating their total areas. The following rules were applied when calculating the areas for the SAC's conservation objectives:

1. Where a polygon was identified as a mosaic of an Annex I habitat and a non-Annex I habitat, then the entire area was counted as the Annex I habitat.
2. Where a polygon was identified as a mosaic of two Annex I habitats (including potential habitat mosaics), the area was divided 50:50 for each habitat.

Sub-site	Total area (ha) of <i>Salicornia</i> mudflats (excluding mosaics) from SMP	Total area (ha) of <i>Salicornia</i> mudflats within SAC boundary (including mosaics)
Ballyheige	0.00	Unknown

Source	Total area (ha) of ASM (excluding mosaics) from SMP	Total area (ha) of ASM within SAC boundary (including mosaics)
Sub-site: Ballyheige	1.31	1.02
Potential ASM/MSM Mosaic	-	18.04
Potential ASM	-	3.20
Total	1.31	22.26

Source	Total area (ha) of MSM (excluding mosaics) from SMP	Total area (ha) of MSM within SAC boundary (including mosaics)
Sub-site: Ballyheige	0.00	0.00
Potential MSM/ASM Mosaic	-	18.04
Potential MSM	-	14.62
Total	66.00	32.66

The general target for this attribute is that the area of each saltmarsh habitat should be stable or increasing, subject to natural processes including erosion and succession.

3.3 Range

3.3.1 Habitat distribution

The saltmarsh at Ballyheige adjoins Ballyheige Bay and the shoreline of this bay is dominated by a large sand dune system and sandy beach that extends from Ballyheige south along Banna Strand to Carrahane Bay (McCorry and Ryle, 2009).

The saltmarsh at Ballyheige covers a small area opposite Black Rock located about midway along the sand dune system in Ballinprior Townland. The landscape of this area is dominated by low-lying flat farmland. The saltmarsh has developed along a drainage channel in a small area behind the sand dunes. This drainage channel drains the Lough Akeragh area to the north of the site and flows into the bay via a small break in the sand dunes at Black Rock (McCorry and Ryle, 2009).

Only one Annex I saltmarsh habitat was recorded as present in the Ballyheige sub-site, i.e. Atlantic salt meadows (ASM). ASM does not cover an extensive area of this sub-site, but is found on both sides of the outflow channel on low-lying land that is still flooded by high tides. This channel is quite deep and between 10-20m wide. The saltmarsh is divided into two main sections by an access road leading to the dunes. This road crosses the outflow channel over a bridge, through the dunes and onto the beach (McCorry and Ryle, 2009).

Salicornia flats and Mediterranean salt meadows (MSM) were not recorded within the Ballyheige sub-site during the SMP (McCorry and Ryle, 2009).

Two additional sites listed on the National Inventory of Saltmarshes in Ireland (Curtis and Sheehy Skeffington, 1998) are located within this SAC: Carrahane/Banna and Barrow Harbour. Both these sites are located south of Ballyheige and potentially contain more extensive saltmarsh habitats. Saltmarsh at Carrahane Strand is particularly well-developed and it also occurs at Barrow Harbour (McCorry and Ryle, 2009). *Salicornia* flats and MSM are likely to occur in these two saltmarsh systems.

The distribution of the surveyed and potential saltmarsh habitats within Akeragh, Banna and Barrow Harbour SAC is presented in Appendix I.

The target is that there should be no decline or change in the distribution of these saltmarsh habitats, unless it is the result of natural processes, including erosion, accretion and succession.

3.4 Structure and Functions

The location, character and dynamic behaviour of saltmarshes are governed by sediment supply, tidal regime, wind-wave climate and sea level change. The slope of the saltmarsh allows the development of several ecological gradients such as tidal submergence and salinity, and this influences the development of distinctive zones of halophytic and salt-tolerant plant communities. Maintaining the favourable conservation condition of the saltmarsh habitats in Akeragh, Banna and Barrow Harbour SAC in terms of their structure and functions depends on a range of attributes for which targets have been set as outlined below.

3.4.1 Physical structure: sediment supply

Accretion and erosion are natural elements of saltmarsh systems. Maintaining the sediment supply is vital for the continued development and natural functioning of a saltmarsh system. Interruption to the sediment circulation through physical structures can starve the system and lead to accelerated erosion rates.

There are no indications of any loss of habitat due to erosion in the saltmarsh habitat at the Ballyheige sub-site. The saltmarsh along the channel is quite sheltered and is not subject to significant erosional pressure. However, the position of the outflow channel restricts any growth of saltmarsh further seaward (McCorry and Ryle, 2009).

The target is to maintain, or where necessary restore, the natural circulation of sediment and organic matter, without any physical obstructions.

3.4.2 Physical structure: creeks and pans

Saltmarshes can contain a distinctive topography with an intricate network of creeks and pans occurring on medium to large-sized sites. Creek density is influenced by vegetation cover, sediment supply and tidal influence. Creeks absorb tidal energy and assist with delivery of sediment into the saltmarsh. The efficiency of this process depends on creek pattern. Creeks allow pioneer vegetation to become established along their banks higher up into the saltmarsh system. Major erosion of saltmarsh is indicated by internal dissection and enlargement of the drainage network, ultimately leading to the creation of mud basins.

The saltmarsh topography is poorly developed at the Ballyheige sub-site and there is little development of typical drainage features. The saltmarsh topography has also been disturbed by several tracks that divide the habitat. There are few signs of typical saltmarsh topography in this area, although there are several small pans present (McCorry and Ryle, 2009).

The target is to maintain creek and pan networks where they exist and to restore areas that have been altered.

3.4.3 Physical structure: flooding regime

The regular ebb and flow of the tide brings salinity, but also nutrients, organic matter and sediment, which are central to the development, growth and indeed survival of saltmarshes. Saltmarsh vegetation consists of a limited number of halophytic (salt-tolerant) species that are adapted to regular immersion by the tides. Species in the lowest part of the saltmarsh require regular inundation, while those higher up on the marsh can only tolerate occasional inundation.

At Akeragh Lough, the main drainage channel has been artificially modified and the drainage works are quite old. The construction of the sluice to control water levels in Lough Akeragh has prevented tidal inundation into this area. This has significantly reduced the former extent of saltmarsh that had developed along this outflow behind the dunes. Historically, the extent of tidal inundation was quite far (0.7km) up this outflow, but only a small portion of the former saltmarsh is still present (McCorry and Ryle, 2009).

The target is to maintain a flooding regime whereby the lowest levels of the saltmarsh are flooded daily, while the upper levels are flooded occasionally (e.g. highest spring tides).

3.4.4 Vegetation structure: zonation

Saltmarshes are naturally dynamic coastal systems. In order to ensure the ecological functioning of all of the saltmarsh habitats, it is vital to maintain the zonations and transitions to other habitats, including intertidal, shingle and sand dune habitats.

At Akeragh, Banna and Barrow Harbour SAC, there are zonations and transitions between the associated habitats. Zonation occurs in the ASM habitat at Ballyheige, with the lower zone communities found along the edge of the channel. The lower sections along the southern channel are vegetated by a sward of common saltmarsh-grass (*Puccinellia maritima*). This vegetation transitions to a band dominated by common scurvy-grass (*Cochlearia officinalis*) and sea plantain (*Plantago maritima*) (McCorry and Ryle, 2009).

At the Ballyheige sub-site, the ASM on the western side of the outflow channel is situated adjacent to fixed dunes and there are natural unmodified transitions between the saltmarsh and the fixed dune vegetation. ASM along the eastern side is situated on low-lying land adjacent to the channel and there is a natural unmodified succession to transitional type brackish/wet grassland (McCorry and Ryle, 2009).

On Carrahane Strand, at the back of the spit, fragments of embryonic shifting dunes merge into saltmarsh (Delaney *et al.*, 2013).

The target is to maintain the range of coastal habitats, including transitional zones, subject to natural processes including erosion and succession.

3.4.5 Vegetation structure: vegetation height

A varied vegetation structure is important for maintaining species diversity and is particularly important for invertebrates and birds. Grazing is often used as a tool for maintaining structural diversity in the sward but stocking levels need to be appropriate. Overgrazing can lead to loss of species and destruction of the vegetation cover, while undergrazing can lead to a loss of plant diversity due to competitive exclusion.

In Akeragh, Banna and Barrow Harbour SAC, the fixed dunes and adjacent saltmarsh at Ballyheige are grazed as commonage although, at the time of the SMP survey, the intensity was low and there was no damage. Some grazing by cattle on the western side of the outflow channel was recorded, but the saltmarsh on the east side of the channel was not grazed (McCorry and Ryle, 2009).

The target is to maintain structural variation within the sward. A general guideline is that there should be a sward ratio of 30% tall: 70% short across the entire saltmarsh.

3.4.6 Vegetation structure: vegetation cover

Vegetation cover can have a major effect on saltmarsh development by reducing the velocity of the tide and thereby enhancing the deposition of sediment. Excessive bare mud, however, is often a sign

of overuse by livestock or humans and can lead to destabilisation and accelerated erosion of the system.

At Ballyheige, several access tracks spilt the saltmarsh into sections, which allow vehicular access to the sand dune system and the beach south of the outflow. The tracks are sandy with saltmarsh along the edges, which is being eroded away in places. These tracks also allow vehicles to park on part of the saltmarsh and there are signs of damage from wheel ruts (McCorry and Ryle, 2009).

The target is to maintain 90% of the area outside of the creeks vegetated.

3.4.7 Vegetation composition: typical species and sub-communities

Saltmarshes contain several distinct zones that are related to elevation and frequency of flooding. The lowest part along the tidal zone is generally dominated by the most halophytic (salt-tolerant) species including common saltmarsh-grass (*Puccinellia maritima*) and species more usually associated with *Salicornia* muds. The mid-marsh zone is generally characterised by thrift (*Armeria maritima*), sea plantain (*Plantago maritima*) and sea aster (*Aster tripolium*). This mid-zone vegetation generally grades into an herbaceous community in the upper marsh, dominated by red fescue (*Festuca rubra*), sea milkwort (*Glaux maritima*) and saltmarsh rush (*Juncus gerardii*).

Below are lists of typical species for the different saltmarsh zones, although some of these species have a restricted distribution nationally and may not occur in the Akeragh, Banna and Barrow Harbour SAC area.

Typical species

Lower marsh	Low-mid marsh	Mid-upper marsh
<i>Salicornia</i> spp.	<i>Puccinellia maritima</i>	<i>Festuca rubra</i>
<i>Suaeda maritima</i>	<i>Triglochin maritima</i>	<i>Juncus gerardii</i>
<i>Puccinellia maritima</i>	<i>Triglochin maritima</i>	<i>Armeria maritima</i>
<i>Aster tripolium</i>	<i>Plantago maritima</i>	<i>Agrostis stolonifera</i>
	<i>Atriplex portulacoides</i>	<i>Limonium humile</i>
	<i>Aster tripolium</i>	<i>Glaux maritima</i>
	<i>Spergularia</i> spp.	<i>Seriphidium maritimum</i>
	<i>Suaeda maritima</i>	<i>Juncus maritimus</i>
	<i>Salicornia</i> spp.	<i>Triglochin maritima</i>
	<i>Glaux maritima</i>	<i>Blysmus rufus</i>
	Turf fucoids	<i>Eleocharis uniglumis</i>
		<i>Leontodon autumnalis</i>
		<i>Carex flacca</i>
		<i>Carex extensa</i>
		Turf fucoids

The species diversity in the saltmarsh habitat at Ballyheige is typical of ASM and several different vegetation communities were recorded at this sub-site that have developed on quite sandy

substrate. Most of the saltmarsh contains mid-marsh and mid-upper marsh communities (McCorry and Ryle, 2009).

At Ballyheige, towards the channel side, there is some transition with sea plantain (*Plantago maritima*) becoming more predominant and other species such as sea aster (*Aster tripolium*) appearing. The saltmarsh is dominated by a lower marsh community towards the mouth of the outflow and the saltmarsh vegetation is somewhat fragmented with sea plantain (*Plantago maritima*) and common saltmarsh-grass (*Puccinellia maritima*) dominating (McCorry and Ryle, 2009).

The thin strip of saltmarsh on the east side of the Ballyheige sub-site is dominated by red fescue (*Festuca rubra*) and frequent common scurvy-grass (*Cochlearia officinalis*) and the abundance of this species is notable. Other species present include sea milkwort (*Glaux maritima*), sea plantain (*Plantago maritima*), greater sea-spurrey (*Spergularia media*), sea beet (*Beta maritima*) and orache (*Atriplex lacinata*) (McCorry and Ryle, 2009).

At Ballyheige, an upper saltmarsh community is found on the eastern side of the channel that is dominated by creeping bent (*Agrostis stolonifera*) and saltmarsh rush (*Juncus gerardii*). Other species present include sea arrowgrass (*Triglochin maritimum*), sea milkwort (*Glaux maritima*), sea plantain (*Plantago maritima*) and common scurvy-grass (*Cochlearia officinalis*) (McCorry and Ryle, 2009).

The saltmarsh north of the bridge within the Ballyheige sub-site is better developed. There is some low-mid vegetation in this area as the adjacent land is quite low-lying. This is dominated by sea plantain (*Plantago maritima*) and common saltmarsh-grass (*Puccinellia maritima*). Sea club-rush (*Bolboschoenus maritimus*) is also spreading into the saltmarsh vegetation in places (McCorry and Ryle, 2009).

In the past, a number of scarce species associated with the saltmarsh have been recorded in the SAC, notably hard-grass (*Parapholis strigosa*), saltmarsh flat-sedge (*Blysmus rufus*), strawberry clover (*Trifolium fragiferum*) and sea-lavender (*Limonium recurvum*) (NPWS, 2013).

The target for this attribute is to ensure that a typical flora of saltmarshes is maintained, as are the range of sub-communities within the different zones.

3.4.8 Vegetation composition: negative indicator species

The only invasive and non-native species recorded on saltmarshes during the SMP was common cordgrass (*Spartina anglica*) (McCorry, 2007; McCorry and Ryle, 2009).

There are few negative indicators in the saltmarsh habitat within the Ballyheige sub-site. Common cordgrass (*Spartina anglica*) was noted in the ASM and had colonised a small channel through the ASM. Common cordgrass has not formed extensive swards with only a few isolated clumps noted in one small area of the saltmarsh and adjacent sandflats. There are no indications of any other loss of habitat due to the spread of common cordgrass (McCorry and Ryle, 2009).

The aim is that negative indicators, such as common cordgrass, should be absent or under control. The current target for this particular SAC is no significant expansion, with no new sites and an annual spread of less than 1% where it is already known to occur.

4 Sand dune habitats

Sand dunes are hills of wind-blown sand that have become progressively more stabilised by a cover of vegetation. In general, most sites display a progression through strandline, foredunes, mobile dunes and fixed dunes. Where the sandy substrate is decalcified, fixed dunes may give way to dune heath. Wet hollows, or dune slacks, occur where the dunes have been eroded down to the level of the water table. Transitional communities can occur between dune habitats and they may also form mosaics with each other. Dune systems are in a constant state of change and maintaining this natural dynamism is essential to ensure that all of the habitats present at a site achieve favourable conservation condition.

In Ireland, there are nine sand dune habitats (including annual vegetation of drift lines) listed under Annex I of the EU Habitats Directive (92/43/EEC) (* denotes a priority habitat):

- **Annual vegetation of drift lines (1210)**
- **Embryonic shifting dunes (2110)**
- **Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (2120)**
- **Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130) ***
- Decalcified dunes with *Empetrum nigrum* (2140) *
- Atlantic decalcified fixed dune (Calluno-Ulicetea) (2150) *
- Dunes with *Salix repens* subsp. *argentea* (Salicion arenariae) (2170)
- **Humid dune slacks (2190)**
- Machairs (21A0) *

Five sand dune habitats were recorded by Ryle *et al.* (2009) and Delaney *et al.* (2013) from Ballyheige (CMP site ID: 078) and Banna Strand (SDM site ID: 077) and these five dune habitats, indicated in bold above, are listed as Qualifying Interests for Akeragh, Banna and Barrow Harbour SAC. These habitats include mobile areas at the front as well as more stabilised parts of dune systems.

Annual vegetation of drift lines is found on beaches along the high tide mark, where tidal litter accumulates. It is dominated by a small number of annual species (i.e. plants that complete their life-cycle within a single season). Tidal litter contains the remains of marine algal and faunal material, as well as a quantity of seeds. Decaying detritus in the tidal litter releases nutrients into what would otherwise be a nutrient-poor environment. The habitat is often represented as patchy, fragmented stands of vegetation that are short-lived and subject to frequent re-working of the sediment. The vegetation is limited to a small number of highly specialised species that are capable of coping with salinity, wind exposure, an unstable substrate and lack of soil moisture. Typical species include spear-leaved orache (*Atriplex prostrata*), frosted orache (*A. laciniata*), sea rocket (*Cakile maritima*), sea sandwort (*Honckenia peploides*) and prickly saltwort (*Salsola kali*).

Embryonic dunes are low accumulations of sand that form above the strandline. They are sometimes referred to as foredunes, pioneer dunes or embryo dunes, as they can represent the primary stage of dune formation. They are characterised by the presence of the salt-tolerant dune grasses sand couch (*Elytrigia juncea*) and lyme-grass (*Leymus arenarius*), which act as an impediment to airborne sand. Strandline species can remain a persistent element of the vegetation.

Where sand accumulation is more rapid than in the embryonic dunes, marram grass (*Ammophila arenaria*) invades, initiating the transition to mobile dunes (Shifting dunes along the shoreline with *Ammophila arenaria*). Marram growth is actively stimulated by sand accumulation. These unstable and mobile areas are sometimes referred to as 'yellow dunes' (or 'white dunes' in some European countries), owing to the areas of bare sand visible between the tussocks of marram.

Fixed dunes refer to the more stabilised area of dune systems, generally located in the shelter of the mobile dune ridges, where the wind speed is reduced and the vegetation is removed from the influence of tidal inundation and salt spray. This leads to the development of a more or less closed or 'fixed' carpet of vegetation dominated by a range of sand-binding species (Gaynor, 2008).

Humid dune slacks are wet or moist depressions between dune ridges. They are characterised by the occurrence of a water table that is maintained by a combination of groundwater (which may or may not be slightly saline), precipitation and an impermeable layer in the soil. In the winter, the water table normally rises above the soil surface and inundation occurs. In spring and summer, the water table drops, but the top layer of the soil remains wet. Proximity of the water table to the surface is evidenced in the vegetation, in which rushes, sedges and moisture-loving herbs such as marsh pennywort (*Hydrocotyle vulgaris*), bog pimpernel (*Anagallis tenella*), grass of Parnassus (*Parnassia palustris*), common marsh-bedstraw (*Galium palustre*) and marsh helleborine (*Epipactis palustris*) are obvious features. The frequency and duration of flooding, as well as the level of salinity, determines the vegetation composition. In addition, nutrient-enrichment can occur as a result of leaching from the surrounding dune ridges (Gaynor, 2008).

All of the dune habitats indicated above occur as a complex mosaic of constantly changing and evolving vegetation communities. They are inextricably linked in terms of their ecological functioning and should be regarded as single geomorphological units. As such, no dune habitat should be considered in isolation from the other dune habitats present at a site, or the adjoining semi-natural habitats with which they often form important transitional communities.

Detailed descriptions from the Coastal Monitoring Project (Ryle *et al.*, 2009) of each sand dune habitat found at Ballyheige (CMP site ID: 078) are presented in Appendix IV. Detailed descriptions from the Sand Dunes Monitoring Project (Delaney *et al.*, 2013) of each sand dune habitat found at Banna Strand (SDM site ID: 077) are presented in Appendix V.

A total of 170.25ha of sand dune habitat was mapped within Akeragh, Banna and Barrow Harbour SAC, all 9 of which represents habitats that are listed as Qualifying Interests for this particular SAC.

4.1 Overall objectives

The overall objective for 'Annual vegetation of drift lines' in Akeragh, Banna and Barrow Harbour SAC is to '*maintain the favourable conservation condition*'.

The overall objective for 'Embryonic shifting dunes' in Akeragh, Banna and Barrow Harbour SAC is to '*maintain the favourable conservation condition*'.

The overall objective for 'Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)' in Akeragh, Banna and Barrow Harbour SAC is to '*restore the favourable conservation condition*'.

The overall objective for 'Fixed coastal dunes with herbaceous vegetation (grey dunes)' in Akeragh, Banna and Barrow Harbour SAC is to '*restore the favourable conservation condition*'.

The overall objective for 'Humid dune slacks' in Akeragh, Banna and Barrow Harbour SAC is to '*restore the favourable conservation condition*'.

These objectives are based on an assessment of the recorded condition of each habitat under a range of attributes and targets. The assessment is divided into three main headings: (a) Area (b) Range and (c) Structure and Functions.

4.2 Area

4.2.1 Habitat area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. Baseline habitat maps were produced for the sand dune habitats at both Ballyheige and Banna Strand sub-sites in Akeragh, Banna and Barrow Harbour SAC during the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009). The baseline map for Ballyheige is included with the individual site report from the CMP in Appendix IV at the end of this document. During the SDM, the baseline map for Banna Strand was checked and revised to account for changes in habitat interpretation and omissions. Updated maps were then produced to reflect the current situation on the ground. The revised and updated maps for Banna Strand are included with the individual site report from the SDM in Appendix V. The data from the CMP and the SDM have been combined to produce the Akeragh, Banna and Barrow Harbour SAC sand dunes habitat map which is presented in Appendix I

The baseline habitat map for Ballyheige from the CMP (Ryle *et al.*, 2009) is included with the individual site report in Appendix IV at the end of this document. The revised baseline habitat maps and updated habitat maps for Banna Strand from the SDM (Delaney *et al.*, 2013) are included with the individual site report in Appendix V.

The total areas of each sand dune habitat at Ballyheige as estimated by Ryle *et al.* (2009) and at Banna Strand as estimated by Delaney *et al.* (2013) are presented in the second and third columns of the following table. These figures were subsequently checked and adjusted to take into account some overlapping polygons and mapping errors. The adjusted figures for each sand dune habitat within in Akeragh, Banna and Barrow Harbour SAC are presented in the fourth and fifth columns and the totals in the final column.

Habitat	Total area (ha) of habitat from CMP at Ballyheige	Total area (ha) of habitat from SDM at Banna Strand	Area (ha) of habitat within SAC boundary (Ballyheige)	Area (ha) of habitat within SAC boundary (Banna Strand)	Total area (ha) of habitat within SAC boundary
Annual vegetation of drift lines (1210)	0.01	0.56	0.01	0.47	0.48
Embryonic shifting dunes (2110)	0.02	2.38	0.00	2.38	2.38
Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (2120)	0.62	5.32	0.59	5.32	5.91
Fixed coastal dunes with herbaceous vegetation (2130)*	42.36	140.51	22.81	133.02	155.83
Humid dune slacks (2190)	0.40	5.29	0.40	5.25	5.65
Totals	43.41	154.06	23.81	146.44	170.25

The dunes at the Banna Strand sub-site had increased in area since the CMP baseline survey (Ryle *et al.*, 2009) due to the natural processes of accretion and succession. The baseline area of humid dune slacks increased at the expense of fixed dunes (grey dunes) (Delaney *et al.*, 2013).

Annual vegetation of drift lines at Banna Strand increased in area from 0.01ha (CMP) to 0.56ha (SDM). There was no indication of habitat loss and no impacts were recorded in this habitat (Delaney *et al.*, 2013).

The area of embryonic shifting dunes increased from 2.10ha (CMP) to 2.38ha (SDM). There was no evidence of loss of habitat due to anthropogenic factors (Delaney *et al.*, 2013).

The area of marram dunes (white dunes) at Banna Strand decreased from 6.78ha (CMP) to 5.32ha (SDM). The main reason for the reduction in habitat area was succession to fixed dunes (grey dunes), which increased from 138.57ha (CMP) to 140.51ha (SDM) (Delaney *et al.*, 2013).

There has been a slight decrease in the area of humid dune slacks in the Banna Strand sub-site from 5.31ha (CMP) to 5.29ha (SDM). One small slack mapped during 2009 was no longer present in 2011. It was not possible to state for certain whether this loss was related to anthropogenic factors (Delaney *et al.*, 2013).

The general target for this attribute in the case of each habitat is that the area should be stable, or increasing. Bearing in mind that coastal systems are naturally dynamic and subject to change, this target is always assessed subject to natural processes, including erosion and succession.

4.3 Range

4.3.1 Habitat distribution

The distribution of sand dune habitats within Akeragh, Banna and Barrow Harbour SAC is presented in Appendix II. The distribution of sand dune habitats at Ballyheige as mapped by Ryle *et al.* (2009) is presented in Appendix IV. The distribution of sand dune habitats at Banna Strand as mapped by Delaney *et al.* (2013) is presented in Appendix V.

Strandline vegetation at Ballyheige is confined to a very small area in the south-west tip of the dunes, where the habitat forms a 3-4m wide strip and roughly 50m in length (Ryle *et al.*, 2009). A patch of annual vegetation of drift lines has also developed in front of a car park at the main access point to Banna Strand and another patch was present on the western side of the sand spit (Delaney *et al.*, 2013).

Embryonic dunes are confined to the northern and southern ends of the Banna Strand sub-site. A band of young, embryonic dunes is present, rounding the seaward tip of Carrahane Strand (Ryle *et al.*, 2009; Delaney *et al.*, 2013).

The mobile dunes at the Ballyheige sub-site consist of a narrow strip of scarcely more than 2m wide, confined to the southern half of the sub-site. These mobile dunes occur in front of or overlying eroded fixed dune (Ryle *et al.*, 2009). At Banna Strand, mobile marram (*Ammophila arenaria*) dunes are best developed in the north and south of the sub-site and are absent or form a very narrow band for the central part of the sub-site, around the main access point (Delaney *et al.*, 2013).

Fixed dune habitat is the most extensive habitat in both the Ballyheige (Ryle *et al.*, 2009) and the Banna Strand (Delaney *et al.*, 2013) sub-sites. Carrahane Strand, at the southern end of Banna Strand supports the most intact and species-rich part of the fixed dunes. A long sand spit encloses Carrahane Strand and this is the most natural, untouched part of the dune system (Delaney *et al.*, 2013).

In the Ballyheige sub-site, four separate humid dune slacks were recorded, the largest of which was over 0.25ha in extent. All of the slacks, which are similar in terms of vegetation structure, are located in the southern half of the sub-site (Ryle *et al.*, 2009).

The fixed dunes at Banna Strand contain a number of humid dune slack areas, these being best developed on the landward side of the dunes. Typically, the slacks were wet in nature and occupied a considerable area in comparison to many sites surveyed along the south and south-western coasts (Ryle *et al.*, 2009).

The target is that there should be no decline or change in the distribution of these sand dune habitats, unless it is the result of natural processes, including erosion, accretion and succession.

4.4 Structure and Functions

The location, character and dynamic behaviour of sand dunes are governed by a combination of geographic, climatic, edaphic and anthropogenic factors. Sand dunes are highly complex, dynamic systems, where the habitats occur in a complex and constantly evolving and changing mosaic. They function as systems in terms of geomorphology and hydrology and maintaining the favourable conservation condition of the habitats present depends on allowing these processes to continue unhindered. Maintaining the favourable conservation condition of all of the sand dune habitats in Akeragh, Banna and Barrow Harbour SAC in terms of structure and functions depends on a range of attributes for which targets have been set as outlined below.

4.4.1 *Physical structure: functionality and sediment supply*

Coastlines naturally undergo a constant cycle of erosion and accretion. There are two main causes of erosion: (a) those resulting from natural causes and (b) those resulting from human interference. Natural causes include the continual tendency towards a state of equilibrium between coasts and environmental forces, climatic change (particularly an increase in the frequency of storms or a shift in storm tracks), relative sea level rise and natural changes in the sediment supply. Human interference is usually associated with changes in the sediment budget, either directly, through the removal of beach or inshore sediment, or indirectly, by impeding or altering sediment movement. It is important to recognise that the process of coastal erosion is part of a natural tendency towards equilibrium. Natural shorelines attempt to absorb the energy entering the coastal zone by redistributing sediment.

Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Sediment supply is especially important in the embryonic dunes and mobile dunes, as well as the strandline communities where accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. The construction of physical barriers such as sea defences can interrupt longshore drift, leading to beach starvation and increased rates of erosion. Sediment circulation and erosion also has a role to play in the more stabilised dune habitats. Cycles of erosion and stabilisation are part of a naturally functioning dune system, where the creation of new bare areas allows pioneer species and vegetation communities to develop, thus increasing biodiversity. The construction of physical barriers can interfere with the sediment circulation by cutting the dunes off from the beach resulting in fossilisation or over-stabilisation of dunes.

At Ballyheige, natural erosion is a feature of the fixed dunes, although the impact of high recreational pressures and poor mobility due to sediment starvation within the system, has exacerbated the impacts of erosion. According to Ryle *et al.* (2009), these pressures continue to inhibit the likelihood of foredune development at the sub-site.

At Banna Strand, an area of rock armour was noted surrounding a section of Tralee Golf course on the southern shores of Carrahane strand. It is not known if this has had a significant impact on sediment dynamics. In addition, a small section of training wall has been constructed at the northern boundary of the sub-site to channel the river away from adjacent property (Ryle *et al.*, 2009).

The spit at Carrahane is important as it shelters and helps to maintain a tidal system of saltmarsh and mudflats (Delaney *et al.*, 2013).

The target for this attribute is to maintain the natural circulation of sediment and organic matter throughout the entire dune system, without any physical obstructions.

4.4.2 Physical structure: hydrological and flooding regime

The conservation of dune slacks is inextricably linked with the local hydrological regime. Dune slacks are characterised by the proximity of a groundwater table that is maintained by the combination of an impermeable layer in the soil, or deeper salt water and precipitation. Most dune slacks are fed by a range of water sources, including precipitation, surface water or groundwater. The last two sources are usually somewhat calcareous while the first is acid.

The most important influence on the nature and vegetation of a dune slack is the groundwater table, which can fluctuate considerably throughout the year. The frequency and duration of periods of flooding or inundation determines the vegetation composition. The water table depth has been identified as the primary determining factor in vegetation variation, followed by weak trends in calcium and sodium availability. Other contributing factors include stage of development, precipitation, distance from the sea, the grazing regime, recreational pressure, nature of the sediment, soil pH and the porosity of the sediment.

Dune slack habitats should never be considered in isolation, but as part of the larger dune system that functions as an eco-hydrological unit. Dune slacks are highly sensitive to human influences on their hydrology, either through water abstraction or drainage works. Generally, the maintenance of a naturally functioning dune slack depends on both the amount of (a) precipitation and (b) groundwater discharge. Water abstraction interferes with the local hydrology, potentially having serious implications for the plant and animal communities of slacks. Abstraction can lower the level of the groundwater table, causing the slacks to dry out. It can also lead to saline infiltration in slacks formed close to the front of a dune system and particularly where the underlying substrate is highly permeable (e.g. shingle).

In the south of Banna Strand in Akeragh, Banna and Barrow Harbour SAC, a small dune slack merges into an area of upper saltmarsh. This part of the site includes an interesting flora with yellow bartisia (*Parentucellia viscosa*) and strawberry clover (*Trifolium fragiferum*) present (Delaney *et al.*, 2013).

The target is to ensure that the hydrological regime continues to function naturally and that there are no increased nutrient inputs in the groundwater.

4.4.3 Vegetation structure: zonation

The range of vegetation zones on a dune system should be maintained. Gaynor (2008) highlights the highly transitional nature of much of the vegetation; therefore, it is important that the transitional communities are also conserved, including those to the saltmarsh communities.

At Ballyheige, the zonation of sand dune habitats is quite poor, with an almost total absence of embryonic dunes and the mobile dunes confined to the southern end of the sub-site. Along the front of the dunes, strandline vegetation and embryonic dunes are absent (Ryle *et al.*, 2009).

At the back of the fixed dunes at Ballyheige, there is a transition to the wet grassland and marsh vegetation of Akeragh Lough. Much of the wet grassland is dominated by common reed (*Phragmites*

australis), while marsh species include sea aster (*Aster tripolium*), sea milkwort (*Glaux maritima*), sea plantain (*Plantago maritima*) and annual sea-blite (*Suaeda maritima*) (Ryle *et al.*, 2009).

Of ecological interest at Banna Strand, in Akeragh, Banna and Barrow Harbour SAC, is the gradation from fixed dune and humid dune slack to saltmarsh at Carrahane Strand. The fixed dune vegetation grades into saltmarsh towards the sandflats (Ryle *et al.*, 2009). At Carrahane Strand, the spit is narrow and all of the fixed dunes (grey dunes) vegetation is in close proximity to the sandy beach to the west (Delaney *et al.*, 2013).

The target is to maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession.

4.4.4 Vegetation structure: bare ground

This target applies to the fixed dunes and humid dune slacks. It does not apply to the other habitats present in the SAC where high levels of bare sand are a natural component of the habitat. In the fixed areas some degree of instability is vital. Constant cycles of erosion and stabilisation provide the necessary conditions for the establishment of pioneer species and species that favour open conditions including invertebrates, helping to increase biodiversity.

At Ballyheige, intensive recreational use is the most obvious threat to the integrity of the sand dune habitats. The beach and dunes are popular as a holiday resort, with much of the northern end of the site bordered by mobile home parks. Walking and related activities place considerable pressure on the dunes, and pedestrian tracks and blowouts are common throughout the site. Although blowouts are a natural feature of sand dunes, it would appear that many are exacerbated here by excessive use. One area of the fixed dunes had an excessive amount of bare ground. However, because of the large area of fixed dunes, there are areas that are relatively free of recreational pressures (Ryle *et al.*, 2009).

Sand removal is thought to be an on-going problem at Ballyheige, which may also contribute directly to erosion. In addition, such activities may disrupt the natural dynamics of the sand dune system through sediment starvation. Foredune development at the site is currently very poor, and erosion in places has extended into the fixed dunes (Ryle *et al.*, 2009).

Erosion is naturally occurring for long stretches of Banna Strand in Akeragh, Banna and Barrow Harbour SAC. The strong tidal influence along much of the strand ensures that strandline and foredune vegetation is absent for much of the strand and fixed dunes are often fronted by an eroding face. This erosion is most noticeable at access points, where it is compounded by recreational pressure (Ryle *et al.*, 2009).

At Banna, the most obvious signs of disturbance are also located close to access roads and car parks (Delaney *et al.*, 2013). Improved access has been provided with car-parking facilities and dedicated access points to facilitate the large number of people. However, many unofficial tracks and pathways exist some of which are heavily trafficked. This has damaged the integrity of the vegetation cover in places (Ryle *et al.*, 2009).

There is no direct vehicular access to the spit at Carrahane and the dunes here are undisturbed in comparison to the centre and northern parts of the site (Delaney *et al.*, 2013).

The target is to not exceed 10% bare sand in the fixed dunes. Bare ground should not exceed 5% of dune slack habitat, with the exception of pioneer slacks which can have up to 20% bare ground. These targets are assessed subject to natural processes.

4.4.5 Vegetation structure: sward height

This attribute applies to the fixed dune and humid dune slack habitats where a varied vegetation structure is important for maintaining species diversity and is particularly important for invertebrates and birds. The ecological benefits of moderate levels of grazing on dunes have been well-documented (Gaynor, 2008). Moderate grazing regimes lead to the development of a species-rich vegetation cover. The animals increase biodiversity by creating micro-habitats through their grazing, dunging and trampling activities. Grazing slows down successional processes and in some cases reverses them, helping to achieve a diverse and dynamic landscape. The effects of trampling assist the internal movement of sand through the development of small-scale blowouts, while dunging can eutrophicate those dune habitats whose nutrient-poor status is crucial for the survival of certain vegetation types. Many species, from plants to invertebrates, benefit immensely from the open and diverse system created by a sustainable grazing regime. Many dune species are small in size and have relatively low competitive ability. Consequently, the maintenance of high species diversity on a dune system is dependent on the existence of some control to limit the growth of rank coarse vegetation (Gaynor, 2008).

At Ballyheige, Ryle *et al.* (2009) noted that the fixed dunes had an average sward height in excess of the maximum desirable limit of 20cm with a mix of long marram (*Ammophila arenaria*) dominated sward, with lesser amounts of fescue (*Festuca*) dominated short turf grassland. In areas of short turf, the diversity generally increases with species such as sand timothy (*Phleum arenarium*), dodder (*Cuscuta epithimum*) and the moss *Syntrichia ruralis* subsp. *ruraliformis* recorded (Ryle *et al.*, 2009).

Rabbits are plentiful throughout the Ballyheige sub-site, as can be seen in the abundance of burrows in both the northern and southern parts of the dunes. Rabbits may play a role in maintaining short turf areas in the fixed dunes (Ryle *et al.*, 2009).

On the sand spit at Carrahane, the vegetation is tall because of marram (*Ammophila arenaria*), but it is not rank and positive indicator species were plentiful. Rabbit grazing has a positive effect on the vegetation here, as it is not grazed by cattle (Delaney *et al.*, 2013).

Fixed dunes (grey dunes) habitat is rank and undergrazed in the northern part of the Banna Strand sub-site. The habitat had also been damaged by disturbance, and this relates to the effects of trampling and incomplete recovery from sediment extraction (Delaney *et al.*, 2013).

Lack of grazing, paths and tracks and trampling were recorded as negative impacts in the fixed dunes (grey dunes) at Banna Strand. The vegetation of the humid dune slacks is very rank and some of the slacks are damaged due to agricultural activities (Delaney *et al.*, 2013).

Cattle grazing was recorded as a neutral impact in the fixed dunes at Banna Strand because, although it was associated with some negative indicator species, it was also helping to maintain the structural diversity of the sward (Delaney *et al.*, 2013).

The target for this attribute is to maintain structural variation within the sward.

4.4.6 Vegetation composition: plant health of dune grasses

This attribute applies the embryonic dunes and mobile dunes where blown sand is a natural feature. The health of the dune grasses (particularly *Ammophila arenaria* and *Elytrigia juncea*) is assessed by the plant parts above the ground (they should be green) and the presence of flowering heads. This gives a clear indication of the status of the supply of blown sand, which is required for these species to thrive.

The vegetation of the embryonic dunes in Banna Strand in Akeragh, Banna and Barrow Harbour SAC was generally healthy with few negative indicator species present. It was characterised by the presence of sand couch (*Elytrigia juncea*), sea rocket (*Cakile maritima*) and sea spurge (*Euphorbia paralias*) (Ryle *et al.*, 2009).

Much of the mobile dune vegetation at Ballyheige was dead or of an unhealthy appearance (Ryle *et al.*, 2009). The presence of marram (*Ammophila arenaria*) on the sand spit at Carrahane is likely to be related to continued sand input (Delaney *et al.*, 2013).

The target for this attribute is that more than 95% of the dune grasses should be healthy.

4.4.7 Vegetation composition: typical species and sub-communities

Species diversity and plant distribution in dunes is strongly controlled by a range of factors, including mobility of the substrate, grazing intensities, moisture gradients, nutrient gradients and human disturbance. In the younger, more mobile dunes, marram (*Ammophila arenaria*) is common, while groundsel (*Senecio vulgaris*), sea rocket (*Cakile maritima*) and dandelion (*Taraxacum* spp.) are also present. The fixed, more stable dune vegetation includes lady's bedstraw (*Galium verum*), common bird's-foot trefoil (*Lotus corniculatus*), wild thyme (*Thymus polytrichus*), kidney vetch (*Anthyllis vulneraria*), wild pansy (*Viola tricolor*) and biting stonecrop (*Sedum acre*).

Strandline vegetation at Ballyheige includes species such as frosted orache (*Atriplex laciniata*), sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*) and prickly saltwort (*Salsola kali*) (Ryle *et al.*, 2009). During the CMP, annual strandline vegetation at Banna Strand was characterised almost exclusively by sea rocket (*Cakile maritima*) and spear-leaved orache (*Atriplex prostrata*), although a clump of sand couch (*Elytrigia juncea*) was located at its centre (Ryle *et al.*, 2009).

Embryonic dunes at Banna Strand in Akeragh, Banna and Barrow Harbour SAC contain such species as sand couch (*Elytrigia juncea*), sea spurge (*Euphorbia paralias*) and sea rocket (*Cakile maritima*) (Ryle *et al.*, 2009).

Small patches of embryonic dune type vegetation recorded among the saltmarsh habitat of Carrahane strand to the landward side of the fixed dune habitat are dominated by sand couch (*Elytrigia juncea*), although saltmarsh species such as thrift (*Armeria maritima*), red fescue (*Festuca rubra*) and buck's-horn plantain (*Plantago coronopus*) occasionally occur (Ryle *et al.*, 2009).

Mobile dunes at Ballyheige consist of a narrow band of marram (*Ammophila arenaria*). Sand couch (*Elytrigia juncea*) was also noted in the habitat along with excessive dead or unhealthy marram (Ryle *et al.*, 2009).

While marram (*Ammophila arenaria*) dominated, sand couch (*Elytrigia juncea*), field bindweed (*Convolvulus arvensis*), dandelion (*Taraxacum officinale* agg.) and cat's ear (*Hypochaeris radicata*) were common throughout the mobile dune habitat at Banna Strand during the CMP (Ryle *et al.*, 2009). Other species were indicative of the erosion of the dune system with remnants of other habitats, including sea rocket (*Cakile maritima*) and sea mayweed (*Tripleurospermum maritimum*), occasionally recorded in the lower sections of the mobile dunes. These are present due to the underlying shingle substrate (Ryle *et al.*, 2009).

In the fixed dunes at Ballyheige, there is a good diversity of typical species including eyebright (*Euphrasia officinalis* agg.), red fescue (*Festuca rubra*), lady's bedstraw (*Galium verum*), cat's ear (*Hypochaeris radicata*), ribwort plantain (*Plantago lanceolata*) and yellow rattle (*Rhinanthus minor*). Interesting species noted at the sub-site included squinancywort (*Asperula cynanchica*), dewberry (*Rubus caesius*) and strawberry clover (*Trifolium fragiferum*) (Ryle *et al.*, 2009).

At Banna Strand, much of the fixed dunes are characterised by the high frequency of marram (*Ammophila arenaria*), while red fescue (*Festuca rubra*), common bird's-foot trefoil (*Lotus corniculatus*) and ribwort plantain (*Plantago lanceolata*) are common. Many other characteristic species of fixed dunes are also present including sand sedge (*Carex arenaria*), lady's bedstraw (*Galium verum*) and dandelion (*Taraxacum* agg.). In areas of short turf, the diversity generally increases, with species such as sand timothy (*Phleum arenarium*), dodder (*Cuscuta epithimum*) and *Syntrichia ruralis* subsp. *ruraliformis* (Ryle *et al.*, 2009).

The humid dune slack vegetation at Ballyheige, characterised by species such as sand sedge (*Carex arenaria*), glaucous sedge (*Carex flacca*), marsh pennywort (*Hydrocotyle vulgaris*), fairy flax (*Linum catharticum*), water mint (*Mentha aquatica*), silverweed (*Potentilla anserina*), selfheal (*Prunella vulgaris*), red clover (*Trifolium pratense*), grey willow (*Salix cinerea*) and spear moss (*Calliergonella cuspidata*), was mostly considered to represent a wet stage in slack development (Ryle *et al.*, 2009). However, certain areas contained species such as knotted pearlwort (*Sagina nodosa*) and jointed rush (*Juncus articulatus*) that are associated with a pioneer stage in development (Ryle *et al.*, 2009).

Along with common fixed dune species, other species recorded in humid dune slacks at Banna Strand include marsh pennywort (*Hydrocotyle vulgaris*), silverweed (*Potentilla anserina*), common sedge (*Carex nigra*), glaucous sedge (*C. flacca*), creeping bent (*Agrostis stolonifera*), red clover (*Trifolium pratense*) and water mint (*Mentha aquatica*) (Ryle *et al.*, 2009).

The target for this attribute is to maintain a typical flora for the particular sand dune habitat.

4.4.8 Vegetation composition: cover of creeping willow (*Salix repens*)

The only habitat where this is a specific attribute is humid dune slacks, where that target is to maintain less than 40% cover of creeping willow (*Salix repens*). This species forms a natural component of many dune slack communities in Ireland. However, high cover of this shrub can lower the level of the water table causing the slacks to dry out. It can also form a dense canopy that shades out slack species leading to a reduction in biodiversity.

At Akeragh, Banna and Barrow Harbour SAC, creeping willow (*Salix repens*) was noted in some humid dune slacks, although it did not exceed 1% of the total area of any slack (Ryle *et al.*, 2009).

The target is to keep the cover of creeping willow (*Salix repens*) below 40%.

4.4.9 Vegetation composition: negative indicator species

Negative indicators include non-native species (e.g. *Hippophae rhamnoides*), species indicative of changes in nutrient status (e.g. *Urtica dioica*) and species not considered characteristic of the habitat. Sea buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled.

The main invasive species identified in Gaynor (2008) were bracken (*Pteridium aquilinum*) and sea buckthorn (*Hippophae rhamnoides*). The invasion of non-native species compromises the typical plant community structure. Bracken is becoming increasingly dominant, particularly where sites have been abandoned or where grazing levels have been significantly reduced. The vegetation retains many elements of the original vegetation cover, but there is a reduction in biodiversity. As the canopy becomes taller and ranker, many of the low-growing species disappear. In this case, the vegetation is treated as a sub-community of the original community that was invaded. This is always the case unless the original vegetation cover has been completely destroyed, as can happen with sea buckthorn, which can form dense impenetrable thickets.

At Ballyheige, considerable portions of the fixed dunes are highly disturbed, with an abundance of agricultural 'weed' species and other species of disturbance such as common ragwort (*Senecio jacobaea*), common nettle (*Urtica dioica*) and bramble (*Rubus fruticosus* agg.). Although the vegetation composition is typical of an overgrazed sward, there is a lack of short turf grassland with high species diversity. It would appear that a long period of overgrazing that promoted the growth of nitrophilous species, has recently given way to a less intensive grazing regime, in which a tall undergrazed marram (*Ammophila arenaria*) sward is thriving over floristic diversity (Ryle *et al.*, 2009).

At the southern end of Ballyheige, around Black Rock, bare sand has been re-vegetated by species such as common ragwort (*Senecio jacobaea*) and sea rocket (*Cakile maritima*). This may be partly due to dredging activities, in which material from the river channel is mixed with strandline material and collected in heaps at the edge of the dunes (Ryle *et al.*, 2009).

At Banna Strand, inland from the strand, the taller dunes consist of fixed dune vegetation that is generally modified. Much of the northern end of the site is characterised by the presence of agricultural grasses and weeds throughout the sward. In areas that are heavily used by cattle, common ragwort (*Senecio jacobaea*), creeping thistle (*Cirsium arvense*) and nettle (*Urtica dioica*) are abundant. In addition, knotweed (*Polygonum aviculare*) is frequently associated with nutrient enrichment where cattle congregate and along tracks (Ryle *et al.*, 2009).

There were signs that some attempt had been made to agriculturally improve parts of the fixed dune habitat at Banna Strand in the past, but agricultural species were not too frequent and where they occurred, they were not exceptionally abundant. However, because of the presence of negative indicator species and excessive sward height, the habitat is considered damaged (Delaney *et al.*, 2013).

A notable amount of common ragwort (*Senecio jacobaea*) was recorded in one slack at Banna Strand, which may be attributable to soil nitrification (Ryle *et al.*, 2009).

The target is that negative indicators (including non-native species), such as sea buckthorn, should represent less than 5% of the vegetation cover.

4.4.10 Vegetation composition: scrub/trees

This attribute only applies to the fixed dunes and humid dune slack habitats. Scrub encroachment leads to reduction in dune biodiversity and needs to be controlled. The presence of scrub and trees which have deep roots can also lower the groundwater table which can have significant impacts on the slack communities.

At Ballyheige, creeping willow (*Salix repens*) was noted in some humid dune slacks, although it did not exceed 1% of the total area of any slack. Grey willow (*Salix cinerea*) was also recorded in the dune slack vegetation at Ballyheige (Ryle *et al.*, 2009).

The target for this attribute therefore is that the cover of scrub and tree species should be under control or represent no more than 5% of the vegetation cover.

5 References

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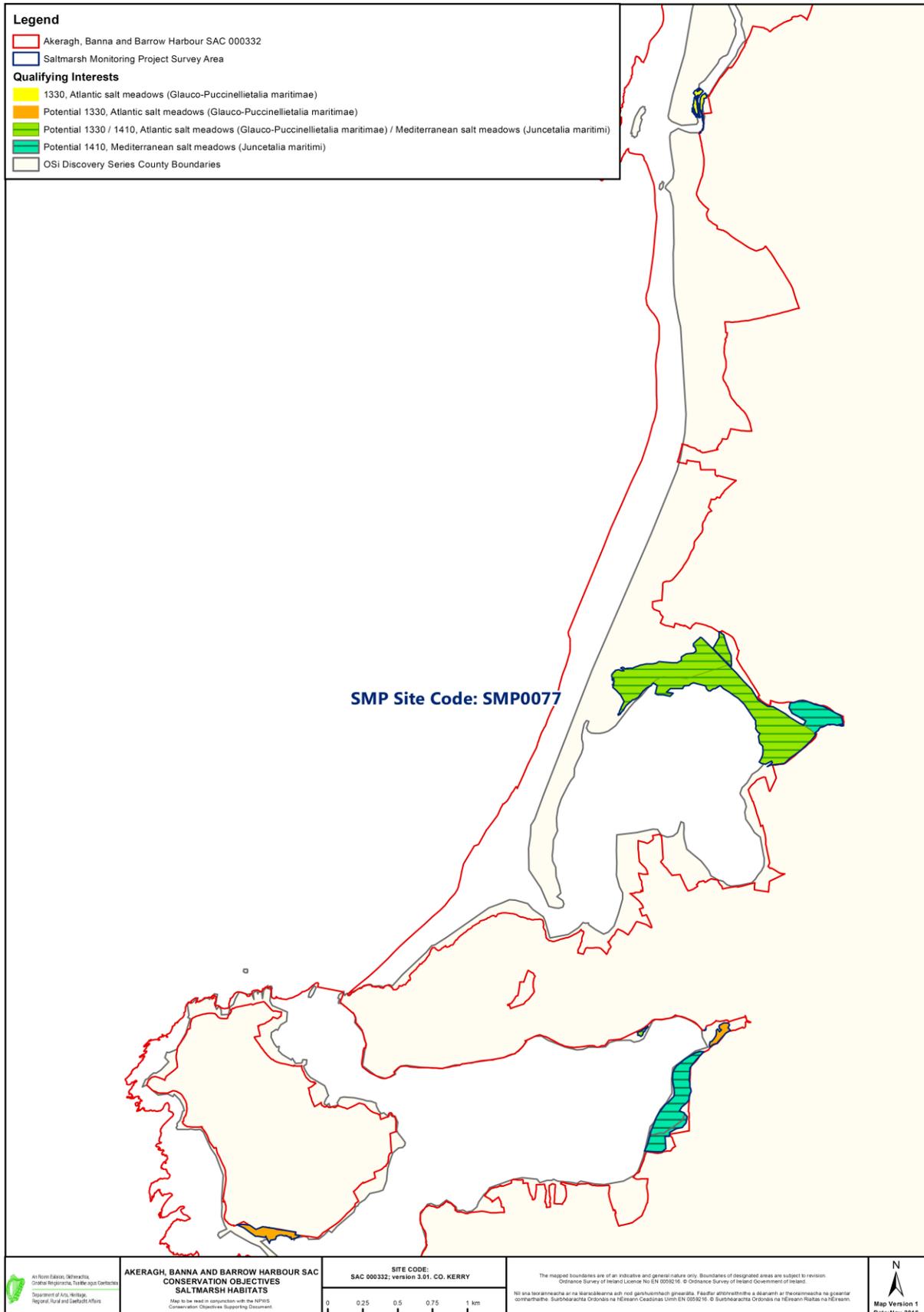
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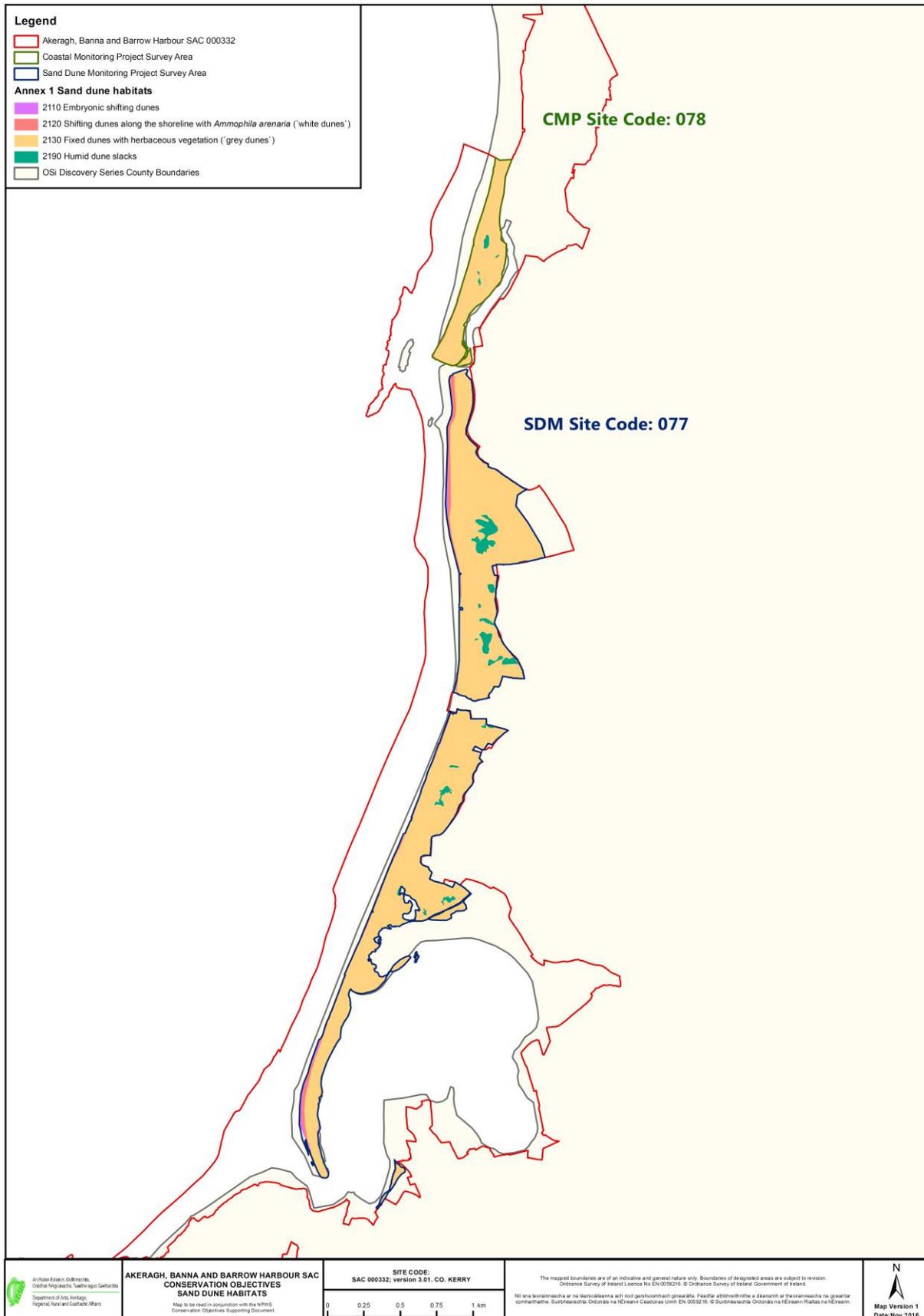
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Appendix I – Distribution map of saltmarsh habitats within Akeragh, Banna and Barrow Harbour SAC



Appendix II – Distribution map of sand dune habitats within Akeragh, Banna and Barrow Harbour SAC



Appendix III – Ballyheige site report and habitat map from the Saltmarsh Monitoring Project (McCorry and Ryle, 2009)

1 SITE DETAILS

SMP site name: Ballyheige	SMP site code: SMP0077	
Date of site visit: 10/05/2008	CMP site code: 78	
SM inventory site name: Ballyheige	SM inventory site code: 154	
NPWS Site Name: Akeragh, Banna and Barrow Harbour		
NPWS designation	cSAC: 000332	MPSU Plan: draft 2 old format
	pNHA: 000332	SPA: 004079
County: Kerry	Discovery Map: 71	Grid Ref: 075210, 125020
Aerial photos (2000 series): O 5332-B,D	6 inch Map No: Ke 014, 020	
Annex I habitats currently listed as qualifying interests for Akeragh, Banna and Barrow Harbour cSAC:		
H1310	<i>Salicornia</i> and other annuals colonizing mud and sand	
H1330	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)	
H1410	Mediterranean salt meadows (<i>Juncetalia maritimi</i>)	
Other SMP sites within this SAC/NHA: none		
Saltmarsh type: Sandflats	Substrate type: Sand	

2 SITE DESCRIPTION

Ballyheige saltmarsh is located in north Co. Kerry, 3.5 km south of Ballyheige Town. This site adjoins Ballyheige Bay and the shoreline of this bay is dominated by a large sand dune system and sandy beach that extends from Ballyheige Town south along Banna Strand to Carrahane Bay. This system was surveyed by the CMP survey in 2005 (Ryle *et al.* 2009). This SMP survey site is much smaller and covers a small area opposite Blackrock located about midway along the sand dune system in Ballinprior Townland. The landscape of this area is dominated by low-lying flat farmland. There are frequent scattered dwellings and farm houses along the main road between Ardfert and Ballyheige Town and along minor access roads connected to this road (R551). Ballyheige/Banna Strand is also a popular amenity beach and there are several caravan parks located along this sand dune system (although there are none adjacent to this survey site).

The saltmarsh has developed along a drainage channel in a small area behind the sand dunes. The drainage channel drains the Lough Akeragh area to the north of the site and flows into the bay via a small break in the sand dunes at Blackrock. Lough Akeragh is a shallow lough where the water level has dropped and now contains extensive freshwater and brackish marsh. There is also extensive development of wet grassland and brackish habitats along the outflow behind the sand dune system, north of the site. Drainage channels to the north and the south of this site have been significantly modified by the office of Public Works in the past for the purposes of controlling water levels and drainage in the adjacent low-lying farmland, much of which has been reclaimed and improved in the past, and preventing significant tidal inundation. Most of the wet grassland south of the site and adjacent to the sand dunes has been improved in the past. Water levels and tidal inundation along the channels are controlled with sluices. There is also an embankment across the Akeragh outflow. This means that the saltmarsh development along the channel is not extensive and there is no typical saltmarsh found north of the main sluice controlling the Lough Akeragh outflow. There is some development of brackish vegetation north of this sluice.

The site is located within the Akeragh, Banna and Barrow Harbour cSAC (0000332). Only one Annex I saltmarsh habitat is present at this site, Atlantic salt meadows (ASM). This habitat is listed as a qualifying interest for this cSAC in addition to *Salicornia* flats and Mediterranean salt meadows. However, these two latter habitats are not present at the survey site. Two other sites listed on the SM inventory (Curtis and Sheehy-Skeffington 1998) are located within this cSAC, Currahane/Banna and Barrow Harbour. Both these sites are located south of Ballyheige and contain more extensive saltmarsh habitat.

Most of the saltmarsh habitat is located within the cSAC boundary. However, most of the saltmarsh habitat on the east side of the outflow channel is located outside the boundary and is excluded from the cSAC. This is because the edge of the outflow channel marked on the OSI 6 inch map was used to draw the cSAC boundary.

The site was easily accessed via tracks leading to the sluices on the Akeragh outflow.

3 SALTMARSH HABITATS

3.1 General description

The only Annex I habitat found at this site was ASM (Table 3.1). This does not cover an extensive area. Common Cordgrass is also found at the site but it has not formed extensive swards at the site and only a few clumps were noted in the saltmarsh and adjacent sandflats. There is much more extensive development of brackish vegetation with stands of Sea Club-rush along the outflow channel, particularly north of the embankment. These stands have been classified and mapped as CM2 or other Non-Annex saltmarsh vegetation in accordance with the SMP project classification. This area was not examined in detail.

ASM is found on both sides of the outflow channel on low-lying land that is still flooded by high tides. This channel is quite deep and between 10-20 m wide. The banks of the channel have been modified by drainage works and some spoil taken from the channel has been deposited on the adjacent saltmarsh to create some raised mounds with disturbed vegetation.

The saltmarsh is divided into two main sections by an access road leading to the adjacent dunes that crosses the outflow channel over a bridge, and to the beach. The largest area of saltmarsh is located between this access road and the sluice and embankment across the Akeragh outflow located 200 m further north. The ASM on the western side of the outflow channel is situated adjacent to fixed dunes and there are some natural unmodified transitions between the saltmarsh and the fixed dune vegetation. ASM along the eastern side is situated on low-lying land adjacent to the channel and there is a natural unmodified succession to a transitional type brackish/wet grassland vegetation community.

The saltmarsh south of the access road is positioned on a narrow strip of land between the channel and an adjacent farmyard. A track along the edge of the farmyard that connects to the beach marks the upper boundary of the ASM. This strip of saltmarsh follows the channel as it bends and extends onto an area of bare sandflats where the channel flows out to the sea. A smaller channel draining the area to the south meets the main outflow at this location. This channel is also quite deep and there is no low-lying land situated adjacent to it. There is very minor saltmarsh development along the steep banks of this channel. Drainage through this channel is also controlled by a sluice near the outflow.

Table 3.1. Area of saltmarsh habitats mapped at Ballyheige.

EU Code	Habitat	Area (ha)
1330	Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)	1.309
non-Annex	<i>Spartina</i> swards	0.001
	Total	1.310

* note that saltmarsh habitat may continue outside the mapped area.

3.2 Atlantic salt meadows (H1330)

There are several ASM communities present at this site that have developed on quite sandy substrate. Most of the saltmarsh contains mid-marsh and mid-upper marsh communities. Some zonation is present with the lower zone communities found along the edge of the channel. The thin strip of saltmarsh on the east side of the site is dominated by red fescue (*Festuca rubra*) and frequent common scurvy-grass (*Cochlearia officinalis*). The abundance of common scurvy-grass in this area is notable. Other species present include sea milkwort (*Glaux maritima*), sea plantain (*Plantago maritima*), greater sea-spurrey (*Spergularia media*), sea beet (*Beta maritima*) and orache (*Atriplex lacinata*). This saltmarsh transitions to disturbed coastal grassland towards the north-east corner with species such as sea mayweed (*Tripleurospermum maritimum*) and sand couch appearing in the vegetation. Towards the channel side there is some transition with sea plantain becoming more predominant and other species such as sea aster (*Aster tripolium*) appearing. The saltmarsh is dominated by a lower marsh community towards the mouth of the outflow and the saltmarsh vegetation is somewhat fragmented with sea plantain and common saltmarsh-grass (*Puccinellia maritima*) predominant. Common cordgrass (*Spartina anglica*) is present in this section and has colonised a small channel through the ASM. There are also several small clumps of common cordgrass isolated on the sand adjacent to the saltmarsh. There are few signs of typical saltmarsh topography in this area, although there are several small pans present.

The lower sections along the southern channel are vegetated by a sward of common saltmarsh-grass. This vegetation is zoned and transitions to a band dominated by common scurvy-grass and sea plantain.

The saltmarsh north of the bridge is better developed. There is some low-mid vegetation in this area as the adjacent land is quite low-lying. This is dominated by sea plantain and common saltmarsh-grass. Sea club-rush (*Bolboschoenus maritimus*) is also spreading into the saltmarsh vegetation in places. An upper saltmarsh community is found on the eastern side of the channel that is dominated by creeping bent (*Agrostis stolonifera*) and saltmarsh rush (*Juncus gerardii*). Other species present include sea arrowgrass (*Triglochin maritimum*), sea milkwort, sea plantain, and common scurvy-grass. The saltmarsh topography is poorly developed on both sides of the outflow channel.

There are some signs of disturbance to the saltmarsh vegetation with species such as sea beet on the site. There are also scattered rocks over the saltmarsh in places.

4 IMPACTS AND ACTIVITIES

There is some grazing of cattle (140) on the western side of the channel. The fixed dunes and adjacent saltmarsh are grazed as commonage although the intensity was low and there was no damage. The saltmarsh on the east side of the channel was not grazed.

Some spoil dredged from the outflow channel has been dumped on the saltmarsh recently creating mounds with disturbed vegetation (860). These mounds are unlikely to develop saltmarsh vegetation due to their height. This activity has permanently reduced the extent of saltmarsh as these piles of spoil are unlikely to be removed and there are indications that this practise has occurred before along the banks of the outflow. There are signs from the 1995 and 200 series aerial photos that there was regular disturbance to the saltmarsh habitat along the edges of the channel.

Several tracks split the saltmarsh into several sections (501). These tracks allow vehicular access to the sand dune system and the beach south of the outflow. The tracks are sandy with saltmarsh along the edges being eroded away in places. These tracks also allow vehicles to park on part of the saltmarsh adjacent to the farmyard and there are signs of damage from wheel ruts in places. There is also some dumping of sand/rubble (422), possibly from construction waste, on to coastal grassland adjacent to the saltmarsh and these tracks. The NPWS Conservation management plan noted that

there has been significant sand removal from the dunes at this location in the past and this would account for heavy traffic and disturbance along the tracks.

The construction of the sluice to control water levels in the Lough Akeragh area has prevented tidal inundation into this area. This has significantly reduced the former extent of saltmarsh that had developed along this outflow behind the dunes. The 2nd edition 6 inch map indicates that the extent of tidal inundation was quite far (0.7 km) up this outflow so only a small portion of the former saltmarsh is still present. The impacts of drainage modifications on the saltmarsh are not assessed as they occurred prior to the current monitoring period. The drainage works in this area are quite old.

There are no indications of erosion (900) at this site. The saltmarsh along the channel is quite sheltered and is not subject to significant erosional pressure. An examination of the aerial photo series shows that there has been no measurable loss or growth of saltmarsh during the current monitoring period. The position of the outflow channel restricts any growth of saltmarsh further seaward.

The main Impacts and activities around the site are related to farming such as mowing/cutting (102), fertilization (120) and grazing (140). Other impacts include dispersed habitation (403), minor roads (502) and amenity use of the beach (622). These activities have little or no measurable impact on the saltmarsh habitats.

Table 4.1. Intensity of various activities on saltmarsh habitats at Ballyheige.

EU Habitat Code ¹	Activity code ²	Intensity ³	Impact ⁴	Area affected (ha)	Location of activity ⁵
1330	140	C	0	0.8	Inside
1330	501	C	-1	0.05	Inside
1330	860	C	-2	0.05	Inside

¹ EU codes as per Interpretation Manual.

² Description of activity codes are found in Appendix III, Summary Report 2007-2008.

³ Intensity of the influence of an activity is rated as A = high, B = medium, C = low influence and D unknown.

⁴ Impact is rated as -2 = irreparable negative influence, -1 = reparable negative influence, 0 = neutral, +1 = natural positive influence and +2 = strongly managed positive influence.

⁵ Location of activity: Inside = activities recorded within and directly impacting the saltmarsh habitat, outside = activities recorded outside but adjacent to saltmarsh habitat that are impacting the saltmarsh habitat.

5 CONSERVATION STATUS

5.1 Overall Conservation Status

The conservation status of a site is assessed on the condition of the site and on baseline information. The main source of baseline information for this site is the NHA survey, the 1995, 2000 and 2005 OSI aerial photo series. The baseline information from the NHA survey is generally limited to some descriptions of saltmarsh habitat and does not record the specific condition of the saltmarsh during the survey at this site.

Ballyheige is a relatively small saltmarsh with few features of conservation interest. The overall conservation status is assessed as *unfavourable-inadequate*. The habitat is in relatively good condition. However there has been some damage from dumping of spoil dredged from the channel and from continual vehicle use of tracks that dissect the saltmarsh. Saltmarsh was likely to have been more extensive in the past and was likely to have been distributed along the channel north of the sluice and embankment. However, this area has been significantly modified by drainage works. Brackish habitats predominate north of the sluice and embankment.

This site is located within Akeragh, Banna and Barrow Harbour cSAC. An old format management plan is available for this cSAC but is now out of date.

Table 5.1. Conservation status of Annex I saltmarsh habitats at Ballyheige.

Habitat	EU Conservation Status Assessment			Overall EU conservation status assessment
	Favourable	Unfavourable - Inadequate	Unfavourable - Bad	
Atlantic salt meadows (1330)		Extent, Structure and functions, Future prospects		Unfavourable - Inadequate

5.2 Atlantic salt meadows (H1330)

5.2.1 Extent

The extent of this habitat is assessed as *unfavourable-inadequate*. A small amount of habitat has been destroyed with spoil dredged from the channel dumped on the saltmarsh. This spoil has created a low narrow ridge only several metres wide. However, as the site is relatively small this equates to a loss of about 3-4% of habitat. There are no indications of any other loss of habitat due to the spread of Common Cordgrass or erosion within the current monitoring period.

5.2.2 Habitat structure and functions

The structure and functions of this habitat are assessed as *unfavourable-inadequate*. Four monitoring stops were carried out in this habitat and they all passed. Most attributes required for favourable conservation status reached their targets. The structure and functions of the ASM are in generally good condition. There are few negative indicators. Common cordgrass is present in the ASM but is quite rare overall with less than 1% cover on the saltmarsh in total and is only found in one small area. The saltmarsh topography is poorly developed at this site and there is no development of typical drainage features. The saltmarsh topography has also been disturbed by several tracks that dissect the habitat. This is the main reason for the assessment of habitat structure and functions as *unfavourable-inadequate*. The main drainage channel has also been artificially modified.

The species diversity in this habitat is typical of ASM and several different vegetation communities were recorded at this site. ASM zonation is also present. There is also natural unmodified succession of vegetation from saltmarsh habitat to fixed dune vegetation and to a brackish/wet grassland vegetation type.

5.2.3 Future prospects

The future prospects of this habitat are assessed as *unfavourable-inadequate*. This assessment assumes that the current management activities and level of impacts such as grazing continue in the near future. The habitat is not affected by any significantly damaging impacts or activities. However, the saltmarsh is likely to be continually disturbed by drainage works along the channel. It is also negatively affected by vehicle use which has created tracks that have dissected the habitat.

The saltmarsh is not likely to be vulnerable to the spread of common cordgrass in the future as this habitat is well-established on sandy substrate and is dominated by mid and mid-upper saltmarsh communities. Common cordgrass is not suited to colonising these communities and Ballyheige saltmarsh consists of an extremely sandy substrate.

6 MANAGEMENT RECOMMENDATIONS

There are no specific management recommendations for this site.

7 REFERENCES

Curtis, T.G.F.C. and Sheehy-Skeffington, M.J. (1998). The salt marshes of Ireland: An inventory and account of their geographical variation. *Biology and Environment: Proceedings of the Royal Irish Academy* **98B**, 87-104.

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APPENDIX I

Table 8.1. Areas of SMP habitats mapped using GIS.

SM Habitat code	SM habitat description	Mapped Area (ha)	Area (ha)				
			1310	1330	1410	1420	Spartina swards
1	1310 <i>Salicornia</i> flats						
2	Spartina swards						
3	1330 Atlantic salt meadow	1.293		1.293			
4	1410 Mediterranean salt meadow						
5	ASM/MSM mosaic (50/50)						
6	ASM/ <i>Spartina</i> mosaic	0.003		0.002			0.001
7	1330/other SM (CM2) mosaic	0.028		0.014			
8	1330/coastal grassland mosaic						
9	Other (non saltmarsh)	2.310					
10	<i>Spartina</i> clump/mudflat mosaic (50/50)						
11	Isolated <i>Spartina</i> clumps on mud (5%)						
12	pioneer 1330/1310/ <i>Spartina</i> mosaic						
13	1410/other SM (CM2) mosaic						
14	<i>Spartina</i> sward dominated, with some ASM						
15	1310/ <i>Spartina</i> mosaic						
16	ASM dominated with some <i>Spartina</i>						
17	1330/sand dune mosaic						
18	Other SM (CM2)	0.66					
19	1330/rocky shore mosaic						
20	1420 Mediterranean scrub						
21	1310/1330 mosaic						
	Total	4.3		1.309			0.001



 <p>Comhaltas, Oifigeamhainne agus Idirleas Árainn Binntráil, Héiteige agus Iarscoil Binntráil National Parks and Wildlife Service</p>	<p>Saltmarsh Monitoring Project 2007-2008</p>	<p>Ballyheige</p>	<p>SMP code: SMP0077</p>	<p>0 50 100 150 200 250 Meters</p> 	<p>Date of production: 20/02/2009 Map version: 1</p>	<p>Original Drawing Size: 297 x 420 (A3) Scale 1:3250</p> 
		<p>Akeragh, Banna and Barrow Harbour SAC (000332)</p>	<p><small>This habitat map was created with a combination of fieldwork, GPS and interpretation of aerial-photos. Boundaries of designated areas are subject to revision. Produced from Ordnance Surveyy material by permission of the Government (Permit number 5953)</small></p>			

Appendix IV – Ballyheige site report and habitat map from the Coastal Monitoring Project (Ryle *et al.*, 2009)

BALLYHEIGE

SITE DETAILS

CMP05 site name: Ballyheige **CMP05 site code:** 078 **CMP map No.:** 77
County: Kerry **Discovery map:** 71 **Grid Reference:** Q 075 126
6 inch Digital Maps: Ke 014 & 020
Aerial photographs (2000 series): O 5272-C, D; O 5332-B, D
NPWS Site Name: Akeragh, Banna & Barrow Harbour
NPWS designation: **pNHA:** 000332 **cSAC:** 000332 **SPA:** 004079
Other designations: Blue Flag Beach
Ranger Area: Southwest
MPSU Plan: Draft 2: Public Consultation -Short Format
Report Author: Kieran Connolly

SITE DESCRIPTION

The sand dunes at Akeragh, Banna & Barrow Harbour cSAC extend for approximately 9 km, from Ballyheige in the north to Barrow Harbour in the south. Divided into Ballyheige in the north and Banna (site 77) in the south, the two contiguous sites are separated for the purposes of this project by the river outflow at Black Rock. The division is prominently marked on the site digital map. Whilst all of the sand dunes at Banna are included in the cSAC, the more northerly part of Ballyheige dunes is excluded, reflecting the greater diversity in physiography and vegetation found in the more southerly site. Banna also contains a considerably greater area of humid dune slacks, and an interesting transition from fixed dune and dune slack to salt marsh communities. Nevertheless, there are a number of Annex I sand dune habitats at Ballyheige, including a considerable expanse of the priority fixed dune habitat (Table 78A).

The cSAC is also notable for the large area of wet grassland in Akeragh Lough, which supports important wintering wildfowl populations. Internationally important numbers of Brent geese are known, as are nationally important numbers of several species including ringed plover, lapwing and bar-tailed godwit. However, the ornithological importance of the Lough has been somewhat diminished by the controlling of the water level by a sluice on the outflow. Other habitats in the cSAC include intertidal sand and mud flats, rocky shore and reed beds, dry heath and dry grassland.

Table 78A Areas of EU Annex I habitats mapped at Ballyheige

EU Code	EU Habitat	Area (ha)
H2130	Fixed coastal dunes with herbaceous vegetation	42.361
H1210	Annual vegetation of drift lines	0.013
H2110	Embryonic shifting dunes	0.024
H2120	Shifting dunes along the shoreline with <i>Ammophila arenaria</i>	0.616
H2190	Humid dune slacks	0.404
	Total Sand dune habitat	43.418

Fixed Dunes (H2130)

The fixed dunes at Ballyheige extend to over 42 ha (Table 78A) and are composed of a mix of long marram-dominated sward, with lesser amounts of *Festuca*-dominated short turf grassland. There is a good diversity of typical species including *Euphrasia officinalis* agg. (eyebright), *Festuca rubra* (red fescue) *Galium verum* (lady's bedstraw) *Hypochaeris radicata* (cat's ear), *Plantago lanceolata* (ribwort plantain) and *Rhinanthus minor* (yellow rattle). Interesting species noted at the site included *Asperula cynanchica* (squinnancywort), *Rubus caesius* (dewberry) and *Trifolium fragiferum* (strawberry clover).

Considerable portions of the fixed dunes are highly disturbed, with an abundance of agricultural 'weed' species and other species of disturbance such as *Senecio jacobaea* (common ragwort), *Urtica dioica* (common nettle) and *Rubus fruticosus* (bramble). Although the vegetation composition is typical of an overgrazed sward, there is a lack of short turf grassland with high species diversity. It would appear that a long period of overgrazing that promoted the growth of nitrophilous species, has recently given way to a less intensive grazing regime, in which a long marram-dominated sward has come to dominate.

At the southern end of the site around Black Rock, bare sand has been re-vegetated by species such as *Senecio jacobaea* (common ragwort). This may be partly due to dredging activities, in which material from the river channel is mixed with strandline material and collected in heaps at the edge of the dunes. Wide vehicular tracks from these activities are readily visible in the aerial photograph.

At the back of the fixed dunes, there is a transition to the wet grassland and marsh vegetation of Akeragh Lough. Much of the wet grassland is dominated by *Phragmites australis* (common reed), while marsh species include *Aster tripolium* (sea aster), *Glaux maritima* (sea milkwort), *Plantago maritima* (sea plantain) and *Suaeda maritima* (annual sea-blite).

Annual vegetation of drift lines (H1210)

Strandline vegetation at Ballyheige is confined to a very small area in the southwest tip of the dunes, where the typical species *Atriplex laciniata* (frosted orache), *Cakile maritima* (sea rocket), *Honckenya peploides* (sea sandwort) and *Salsola kali* (prickly saltwort) form a 3-4 m wide strip, of roughly 50 m in length. Along the stretch of strand between Black Rock and Ballyheige, there are isolated strandline plants – mostly of *C. maritima* – but nowhere do these occur in sufficient density to warrant consideration as worthwhile habitat. That which is mapped here as strandline habitat was not assessed for conservation status, due to its very limited area.

Embryonic dunes (H2110)

Zonation of habitats at the site is quite poor, with an almost total absence of embryonic dunes; and mobile dunes confined to the southern end of the site. The mapped area of embryonic dunes, at only 0.024 ha and extending over only a tiny portion of the site, is scarcely worthy of consideration as a habitat. Strandline vegetation and embryonic dunes are typically absent along the front of the dunes. Due to the very limited extent of embryonic dunes, they are not assessed for conservation status, although the factors contributing to their poor representation are considered under the site impacts.

Mobile dunes (H2120)

Mobile dunes at Ballyheige consist of a narrow strip of scarcely more than 2m width, confined to the southern half of the site. The total mapped area was just over 0.6 ha, much of which consisted of a narrow band of *Ammophila arenaria* (marram) in front of or overlying eroded fixed dune. Sand couch (*Elytrigia juncea*) was also noted in the habitat. Neither of the two monitoring stops carried out met the minimum requirements, due to the excess of dead or unhealthy marram.

Humid dune slacks (H2190)

Four separate dune slacks were mapped, the largest of which was over 0.25 ha in extent (Photo 4). Four monitoring stops, all of which passed the attribute criteria, were split between 3 of the slacks – 2 in one of the larger and 1 each in 2 of the other areas. All of the slacks, which are similar in terms of vegetation structure and composition, are located in the southern half of the site, within the cSAC boundary.

The slack vegetation, characterised by species such as *Carex arenaria* (sand sedge), *Carex flacca* (glaucous sedge), *Hydrocotyle vulgaris* (marsh pennywort), *Linum catharticum* (fairy flax) *Mentha aquatica* (water mint), *Potentilla anserina* (silverweed), *Prunella vulgaris* (selfheal), *Trifolium pratense* (red clover), *Salix cinerea* (grey willow) and *Calliergonella cuspidata* (spear moss), was mostly considered to represent a wet stage in slack development. However, certain areas contained species such as *Sagina nodosa* (knotted pearlwort) and *Juncus articulatus* (jointed rush), that are associated with a pioneer stage in development. Also noted in some slacks was *Salix repens* (creeping willow), although it did not exceed 1% of the total area of any slack.

Some of the ground in the dune slacks – particularly the larger ones – was somewhat poached, although the damage was not severe enough to result in bare patches.

IMPACTS

Activities observed or known to be impacting on the sand dune habitats at Ballyheige are shown in Table 78B.

Intensive recreational use is among the most obvious threats to the integrity of the sand dunes at Ballyheige. The beach and dunes are popular as a holiday resort, with much of the northern end of the site bordered by mobile home parks. Walking and related activities (code 622) place considerable pressure on the dunes, and pedestrian tracks and blowouts are common throughout the site. However, because of the large area of fixed dune, there are areas that are relatively free of recreational pressures. Although blowouts are a natural feature of sand dunes, it would appear that many are exacerbated here by excessive use. Sand removal (code 300) is thought to be an on-going problem at the site, which may also contribute directly to erosion (code 900). In addition, such activities may disrupt the natural dynamics of the sand dune system through sediment starvation. Foredune development at the site is currently very poor, and erosion in places has extended into the fixed dunes.

Table 78B Intensity and impact of various activities on sand dune habitats at Ballyheige

EU Habitat Code ¹	Activity Code ²	Intensity ³	Impact ⁴	Area affected/ha	Location of Activity ⁵
H2130	143	C	-1	40	Inside
H2130	171	A	-1	0.5	Inside
H2130	300	B	-1	Unknown	Inside
H2130	421	C	-1	1	Inside
H1210	622	A	-1	0.01	Inside
H2110	622	A	-1	0.02	Inside
H2120	622	A	-1	0.5	Inside
H2130	622	B	-1	30	Inside
H2110	900	A	0	0.0	Inside
H2120	900	A	0	0.02	Inside
H2130	900	A	0	5	Inside

¹ EU Codes as per Interpretation Manual. Code 21BB is an additional code used to signify the entire dune habitat.

² Description of activity codes are found in Appendix 3

³ Intensity of the influence of an activity is rated as: A= high, B = medium, C = low influence and D = unknown.

⁴ Impact is rated as: -2 = irreparable negative influence, -1 = repairable negative influence, 0 = neutral, +1 = natural positive influence and +2 = strongly managed positive influence

⁵ Location of activity: Inside = activities recorded within and directly impacting the sand dune habitat. Outside = activities recorded outside but adjacent to sand dune habitat that are impacting the sand dune habitat

Stock grazing (code 143) has been noted as one of the major management features at the site. The NATURA 2000 report includes grazing pressure as one of the immediate threats to the site, although whether this is more applicable to Banna or Ballyheige is unclear. On the survey date, there were no cattle grazing on the dunes, although several horses were noted in the northern section. Winter grazing of cattle probably accounts for the poached ground noted in the dune slacks. Although there is an abundance of nitrophilous species such as *Cirsium arvense* (creeping thistle) and *Senecio jacobaea* (common ragwort) in the fixed dunes, the current grazing pressure may be quite light in places, as much of the sward is marram-dominated.

Stock feeding (code 171) is not a major feature of the site, although one small area where the remnants of hay bales were noted had been slightly affected.

Rabbits are plentiful throughout the site, as can be seen in the abundance of burrows. Both the northern and southern parts of the dunes are marked as rabbit warrens on the old 6'' map. Rabbits may play a role in maintaining short turf areas in the fixed dunes.

There were many instances of small scale littering and dumping (code 421) throughout the site.

CONSERVATION STATUS

The overall conservation status assessment of each habitat at Ballyheige is based on a combination of *Extent, Structure & Functions*, and *Future Prospects* assessments (Table 78C).

Table 78C Conservation status assessment of Annex I sand dune habitats at Ballyheige

Habitat ¹	EU Conservation Status Assessment			Overall EU conservation status assessment	Proposed Irish conservation status system ²
	Favourable	Unfavourable - Inadequate	Unfavourable - Bad		
Fixed Dune (H2130)		Extent	Structure & functions/ Future Prospects	Unfavourable - Bad	Unfavourable - Declining
Mobile Dune (H2120)			Extent/ Structure & functions/ Future Prospects	Unfavourable - Bad	Unfavourable - Declining
Dune Slack (H2190)	Extent/ Structure & functions	Future Prospects		Unfavourable - Inadequate	Unfavourable - Unchanged

¹ EU Codes as per Interpretation Manual

² Ratings are Favourable (Enhanced, Maintained, Recovered, Declining), Unfavourable (Recovering, Unchanged, Declining) and Destroyed (Partially destroyed, Completely destroyed and Unknown)

Details of the numbers and pass/failure rates of monitoring stops used to assess habitat structure & functions are shown in Table 78D.

Table 78D Pass/Fail results of monitoring stops for Annex I sand dune habitats at Ballyheige

Habitat	Monitoring stops		Conservation status
	Pass	Fail	
Fixed dune (H2130)	9	7	Unfavourable - Bad
Mobile dunes (H2120)	0	2	Unfavourable - Bad
Dune slack (H2190)	4	0	Favourable

Problems arise in the assessment of conservation status, in that previous sources of information, such as the NATURA 2000 report, deal with the cSAC as a whole and do not distinguish between Ballyheige and Banna. Such information is therefore limited in its applicability to this survey and subject to interpretation. The total cSAC area is reported as 1204.22 ha in the NATURA 2000 report, of which 33% is accounted for by sand dune and beach habitats.

Fixed Dunes (H2130)

Natural erosion is a feature of the site, although the impact of high recreational pressures, and poor mobility due to sediment starvation within the system, has certainly exacerbated the negative effects. Habitat zonation at the site is poor and foredune development is particularly retarded. Consequently, erosion in places has extended into the fixed dunes, resulting in a loss of habitat area. For this reason, habitat extent is rated as *unfavourable – inadequate*.

Sixteen monitoring stops were carried out in the fixed dunes. Only 9 satisfied the target criteria and attained a pass rating, indicating an *unfavourable – bad* conservation status assessment for habitat structure and functions. Of the 7 stops that failed, all had an average sward height in excess of the maximum desirable limit of 20cm. Six of these also failed the negative indicator species criteria. Common ragwort, *Senecio jacobaea*, accounted for most of the cover of total negative indicator species in the stops. A number of stops also had less than the minimum number of typical species, while one had an excessive amount of bare ground.

As various recreational and agricultural activities are likely to continue unabated at the site, the future prospects of fixed dunes are considered to be *unfavourable – bad*. This view is reinforced by the exclusion of the greater part of the site from the cSAC.

As 2 of the 3 parameters of conservation status assessment were *unfavourable – bad*, the overall habitat conservation status assessment is also *unfavourable – bad*.

The Irish conservation status that best corresponds to the EU assessment is *unfavourable – declining*.

Mobile dunes (H2120)

Zonation of habitats is poor at Ballyheige, and mobile dunes are currently confined to the southern half of the dune system. The consequences of heavy amenity use of the dunes have probably included an exacerbation of the effects of natural erosion on the mobile dunes. The habitat is therefore thought to be *unfavourable – bad* for habitat extent.

Only 2 monitoring stops were carried out due to the limited size of the habitat. As both stops failed to meet the necessary minimum pass standards, vegetation structure and functions are *unfavourable – bad*. Much of the vegetation in the stops was dead or of an unhealthy appearance.

As erosion, compounded by the negative effects of recreational pressures, continues to inhibit the likelihood of foredune development at the site, the future prospects for mobile dunes are also considered *unfavourable – bad*.

As all elements of conservation status assessment are *unfavourable – bad*, that is the assessment that applies to the habitat as a whole.

The Irish conservation status that corresponds to the EU assessment is *unfavourable – declining*.

Humid dune slacks (H2190)

In the absence of any indication of a recent trend of loss of area, habitat extent for dune slacks is considered *favourable*.

As all 4 monitoring stops passed the necessary criteria, vegetation structure and functions are rated as *favourable*.

The future prospects of dune slacks are considered *unfavourable – inadequate*. Although the slacks that are currently present at the site are within the cSAC, and are in an area where recreational

pressures are somewhat less intense than elsewhere, they are subject to particular pressures which give rise to uncertainty as to their future integrity. The habitat may be more susceptible to the effects of stock grazing than other habitats, due to the softer nature of the soil. Poaching was observed in dune slacks at the site, and may be having a deleterious impact on species diversity. In addition, although all monitoring stops passed the necessary criteria, there was a notable amount of *Senecio jacobaea* (ragwort) in one slack, which may be attributable to soil nitrification.

As the 3 components of conservation status are a combination of *favourable* and *unfavourable – inadequate*, the overall habitat conservation status assessment is *unfavourable – inadequate*.

The Irish conservation status assessment thought most appropriate is *unfavourable – unchanged*, as the habitat has probably been quite stable in area and integrity over recent time.



	SAC 332
Habitats	
	Strandline
	Embryonic Dune
	Mobile Dune
	Fixed Dune
	Dune Slack
	Other (Undefined)

 Comhaltas, Oidhroinnta agus Inbhar Ainm Environmental, Heritage and Local Government National Parks and Wildlife Service	Coastal Monitoring Project 2004-2006	Ballyheige	CMP code: 078	0 200 400 600 800 1000 Meters 	N
		Akeragh, Banna Strand and Barrow Harbour (SAC 332)	<small>The habitat map was created with a combination of fieldwork, GPS and interpretation of aerial photos. Boundaries of designated areas are subject to revision. Produced from Ordnance Survey material by permission of the Government (Item number: 9932).</small>	Date of production: 25/11/2008 Map version: 1	

Appendix V – Banna Strand site report and habitat map from the Sand Dunes Monitoring Project (Delaney *et al.*, 2013)

SITE 077 BANNA STRAND

The following individual site report should be read in conjunction with the main report (Delaney *et al.*, 2013). Please note that CMP refers to the Coastal Monitoring Project (Ryle *et al.*, 2009) and SDM refers to the Sand Dunes Monitoring Project (Delaney *et al.*, 2013). Unless otherwise stated, the baseline maps refer to the habitat maps produced during the CMP. These baseline maps were revised, to account for discrepancies in the original survey, before comparisons were made with the habitat maps produced during the SDM (see section 2.3 in SDM main report). These revised maps are referred to as the revised baseline maps in the following text.

1 SITE DESCRIPTION

Banna Strand is a large site located approximately 3.5 km west of Ardfert and 2 km north of Barrow Harbour, Co. Kerry. The site is part of the Akeragh, Banna and Barrow Harbour SAC (SAC 000332). Five Annex I sand dune habitats (* indicates a priority habitat) were recorded here during the CMP: **1210 Annual vegetation of drift lines**, **2110 Embryonic shifting dunes**, **2120 Marram dunes (white dunes)**, ***2130 Fixed dunes (grey dunes)** and **2190 Humid dune slacks** (Ryle *et al.*, 2009). Other Annex I habitats that are associated with the sand dunes at Banna Strand include **1310 *Salicornia* and other annuals colonising mud and sand**, **1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)** and **1410 Mediterranean salt meadows (*Juncetalia maritimi*)**. During the SDM notable plant species such as *Parentucellia viscosa* (yellow bartsia), *Cuscuta epithimum* (dodder), *Trifolium fragiferum* (strawberry clover) and *Spiranthes spiralis* (autumn lady's-tresses) were recorded, as was the Annex I bird species chough. The Annex II liverwort *Petalophyllum ralfsii* (petalwort) has been previously recorded on this site (Ryle *et al.*, 2009), but was not found during the CMP or SDM. The primary land-use for the site is as an amenity. There are several caravan parks within close proximity of the site, and numerous access roads.

2 CONSERVATION ASSESSMENTS

2.1 Overview

Banna Strand was surveyed on the 30th and 31st of August 2011. Part of the site occurs south of Carrahane Strand, but it was not surveyed during the SDM due to time constraints. The unsurveyed area is 1 ha in extent. All five of the Annex I sand dune habitats recorded on site during the CMP were recorded in 2011. The habitats found at Banna Strand and the results of the conservation assessments are presented in Table 1. **1210 Annual vegetation of drift lines** and **2110 Embryonic shifting dunes** were assessed as Favourable, while the remaining habitats were assessed as Unfavourable-Inadequate. **1210 Annual vegetation of drift lines** was not assessed during the CMP and therefore no trends could be established for this habitat.

Table 1. Conservation assessment results for all Annex I dune habitats surveyed at Banna Strand, Co. Kerry.

Habitat	Area	Structure & Functions	Future Prospects	Overall result
1210 Annual vegetation of drift lines	Favourable	Favourable	Favourable	Favourable
2110 Embryonic shifting dunes	Favourable (Stable)	Favourable (Stable)	Favourable (Stable)	Favourable (Stable)
2120 Marram dunes (white dunes)	Favourable (Stable)	Unfavourable- Inadequate (Improving)	Unfavourable- Inadequate (Stable)	Unfavourable- Inadequate (Improving)
*2130 Fixed dunes (grey dunes)	Unfavourable- Inadequate (Stable)	Unfavourable- Inadequate (Improving)	Unfavourable- Inadequate (Stable)	Unfavourable- Inadequate (Improving)
2190 Humid dune slacks	Favourable (Stable)	Unfavourable- Inadequate (Deteriorating)	Unfavourable- Inadequate (Stable)	Unfavourable- Inadequate (Deteriorating)

2.1.1 Area

The areas of Annex I sand dune habitats at Banna Strand are presented in Table 2. The difference between the baseline area and revised baseline area of **2120 Marram dunes (white dunes)** is an artefact of mapping. The baseline area of **2190 Humid dune slacks** was increased at the expense of ***2130 Fixed dunes (grey dunes)**. Parts of the ***2130 Fixed dunes (grey dunes)**, **2190 Humid dune slacks** and **2110 Embryonic shifting dunes** were reclassified as saltmarsh. The site has increased in size since the baseline survey due to the natural processes of accretion and succession.

Table 2. Areas of Annex I dune habitats originally mapped at Banna Strand during the baseline survey (Coastal Monitoring Project), the revised baseline areas and areas mapped during the Sand Dunes Monitoring Project in 2011.

Habitat	Baseline survey (ha)	Revised baseline (ha)	Sand Dunes Monitoring Project (ha)
1210 Annual vegetation of drift lines	0.01	0.01	0.56
2110 Embryonic shifting dunes	2.24	2.10	2.38
2120 Marram dunes (white dunes)	6.79	6.78	5.32
*2130 Fixed dunes (grey dunes)	143.93	138.57	140.51
2190 Humid dune slacks	3.36	5.31	5.29
Total	156.33	152.77	154.06

2.1.2 Structure and Functions

Structure and Functions were assessed for five habitats at Banna Strand. Table 3 shows the results of the Structure and Functions assessment. All of the criteria passed for **1210 Annual vegetation of drift lines** and **2110 Embryonic shifting dunes** and were therefore assessed as having favourable Structure and Functions. One criterion failed for both **2120 Marram dunes (white dunes)** and **2190 Humid dune slacks** and two criteria failed for ***2130 Fixed dunes (grey dunes)**. These three habitats were assessed as Unfavourable-Inadequate.

Table 3. Annex I sand dune habitats at Banna Strand for which Structure and Functions were assessed, with the number of monitoring stops, assessment criteria and the number of criteria that failed.

Habitat	No. monitoring stops	Total no. assessment criteria	No. failed criteria
1210 Annual vegetation of drift lines	2	6	0
2110 Embryonic shifting dunes	4	7	0
2120 Marram dunes (white dunes)	8	7	1
*2130 Fixed dunes (grey dunes)	16	11	2
2190 Humid dune slacks	8	11	1

2.1.3 Future Prospects

Impacts and activities recorded at Banna Strand are presented in Table 4. Impact codes are assigned according to Ssyanck (2010). No impacts were recorded for **1210 Annual vegetation of drift lines** or **2110 Embryonic shifting dunes**. Of the remaining habitats, ***2130 Fixed dunes (grey dunes)** had the most impacts recorded, with a lack of grazing, camping and caravans and trampling the most significant negative impacts. Tracks, walking, and trampling were the negative impacts recorded for **2120 Marram dunes (white dunes)**. Undergrazing, rabbit damage and motorised vehicles were significant negative impacts recorded for **2190 Humid dune slacks**. No positive impacts were recorded for any of the sand dune habitats recorded in 2011.

Table 4. Impacts recorded in Annex I sand dune habitats at Banna Strand in 2011. Source refers to whether the impact being scored originates inside or outside the Annex I habitat being assessed.

Habitat code	Impact code	Impact description	Intensity	Effect	Percent of habitat	Source
1210	X	No impacts	-	-	100	-
2110	X	No impacts	-	-	100	-
2120	D01.01	Paths and tracks	High	Negative	5	Inside
2120	G01.02	Walking	Medium	Negative	25	Inside
2120	G05.01	Trampling	High	Negative	5	Inside
*2130	A04.02.01	Non-intensive cattle grazing	Medium	Neutral	40	Inside
*2130	A04.03	Lack of grazing	Medium	Negative	30	Inside
*2130	D01.01	Paths, Tracks	High	Negative	1	Inside
*2130	D01.03	Car parks	Low	Negative	1	Outside
*2130	G01.02	Walking	Medium	Neutral	10	Inside
*2130	G01.03.02	Off-road driving	Medium	Negative	1	Inside
*2130	G02.08	Camping/caravans	Medium	Negative	5	Inside
*2130	G05.01	Trampling	Medium	Negative	10	Inside
*2130	G05.09	Fences	Low	Neutral	1	Inside
*2130	H05.01	Litter	Low	Negative	1	Inside
*2130	K04.05	Rabbit activity	Medium	Neutral	5	Inside
2190	A04.02.01	Non-intensive cattle grazing	Low	Neutral	75	Inside
2190	A04.03	Undergrazing	Medium	Negative	15	Inside
2190	A05.02	Stock feeding	High	Negative	1	Inside
2190	G01.03.02	Off-road driving	Medium	Negative	5	Inside
2190	K04.05	Rabbit damage	Medium	Negative	5	Inside

2.2 Annex I habitat assessments

The conservation status of the Annex I habitats at Banna Strand are discussed below. The conservation status in 2011 is compared with the baseline status. If a habitat is not in Favourable conservation status, the main reasons for the Unfavourable assessment are given. Areas recorded in 2011 are compared with the revised baseline areas. It should be borne in mind that natural processes such as erosion, deposition and succession are primary drivers of change on coastal habitats.

2.2.1 1210 Annual vegetation of drift lines

The habitat was found in two areas. A patch of **1210 Annual vegetation of drift lines** had developed in front of a car park at the main access point to the site and another patch was present on the western side of the sand spit. No assessment was carried out in this habitat during the CMP owing to its limited extent.

Area

1210 Annual vegetation of drift lines increased in area from 0.01 ha during the CMP to 0.56 ha during the SDM. There was no indication of habitat loss since the CMP, and Area was assessed as Favourable.

Structure and Functions

All of the criteria passed in the Structure and Functions assessment. Structure and Functions were assessed as Favourable.

Future Prospects

No impacts were recorded in this habitat and Future Prospects were assessed as Favourable.

Conservation assessment

All of the parameters were assessed as Favourable. The conservation status of **1210 Annual vegetation of drift lines** at Banna Strand was assessed as Favourable.

2.2.2 2110 Embryonic shifting dunes

This habitat was mainly found in the northern and southern parts of the site, and there is a break in the habitat around the car park that marks the main entrance to the site. On Carrahane Strand, at the back of the spit, fragments of **2110 Embryonic shifting dunes** merge into saltmarsh.

Area

The area of **2110 Embryonic shifting dunes** increased from 2.10 ha during the CMP to 2.38 ha during the SDM. There was no evidence of loss of habitat due to anthropogenic factors. During the CMP, Area was assessed as Unfavourable-Inadequate because the extent of the habitat was limited, but there is no indication that this was the result of human activities. Area would probably have been assessed as Favourable under the current methodology. Area was assessed as Favourable (stable) during the SDM.

Structure and Functions

All of the criteria passed in the Structure and Functions assessment. Structure and Functions were assessed as Favourable during the CMP. Structure and Functions were assessed as Favourable (stable) during the SDM.

Future Prospects

No impacts were recorded for this habitat in 2011. During the CMP, Future Prospects were assessed as Favourable. Future Prospects were assessed as Favourable (stable) during the SDM.

Conservation assessment

All of the parameters were assessed as Favourable during the SDM. During the CMP, Structure and Functions and Future Prospects were assessed as Favourable, and Area would have been assessed as Favourable if the current methodology had been applied. The conservation status of **2110 Embryonic shifting dunes** was assessed as Favourable (stable) during the SDM.

2.2.3 2120 Marram dunes (white dunes)

2120 Marram dunes (white dunes) are best developed in the north and south of Banna Strand and are absent or form a very narrow band for the central part of the site, around the main access point.

Area

The area of **2120 Marram dunes (white dunes)** decreased from 6.78 ha during the CMP to 5.32 ha during the SDM. The main reason for the reduction in habitat area was succession to ***2130 Fixed dunes (grey dunes)**. Area was assessed as Unfavourable-Inadequate during the CMP and was described as "a narrow discontinuous habitat, much of it was confined to the eroding front face of the dune system". The CMP GIS does not indicate any fragmentation of the habitat, and for a site with such heavy amenity use, there is little evidence of erosion exacerbated by human activities on the 2005 aerial photographs. There are access points which were established prior to designation, and although these can result in localised erosion, there is no sign that this was occurring during the CMP. It is difficult to identify any human impact on the extent of **2120 Marram dunes (white dunes)** which would have resulted in an Unfavourable assessment if the current methodology had been employed during the SDM. Area was assessed as Favourable (stable) during the SDM.

Structure and Functions

The criterion assessing damage due to disturbance failed the Structure and Functions assessment in 2011. During the CMP, the habitat was assessed as Unfavourable-Bad because of poor health of the vegetation and the presence of excessive cover of *Cirsium arvense* in two of 14 monitoring stops. Aerial photographs dating to 2005 would suggest that there was some disturbance to the habitat during the CMP survey. During the SDM, flowering and fruiting was noted in every monitoring stop in the habitat and the cover of negative indicator species was not excessive in either of the stops where they were recorded. Structure and Functions were assessed as Unfavourable-Inadequate (improving) during the SDM.

Future Prospects

Trampling, walking and paths and tracks were recorded as high-intensity negative impacts affecting **2120 Marram dunes (white dunes)** at Banna Strand. During the CMP, Future Prospects were assessed as Unfavourable-Inadequate because of erosion, although erosion is listed as a neutral impact for the habitat and there were no negative impacts listed. Because trampled tracks leading to the beach through the **2120 Marram dunes (white dunes)** are visible in the 2005 aerial photographs, Future Prospects of **2120 Marram dunes (white dunes)** at Banna Strand were assessed as Unfavourable-Inadequate (stable) during the SDM.

Conservation assessment

During the SDM, two of the parameters were assessed as Unfavourable-Inadequate and one was assessed as Favourable. Structure and Functions were assessed as Unfavourable-Bad and Future Prospects were assessed as Unfavourable-Inadequate during the CMP, while Area would probably have been assessed as Favourable under the current methodology. The conservation status of **2120 Marram dunes (white dunes)** was assessed as Unfavourable-Inadequate (improving) during the SDM.

2.2.4 *2130 Fixed dunes (grey dunes)

***2130 Fixed dunes (grey dunes)** is the most extensive habitat at Banna Strand and are subject to varying management types. Transitions to saltmarsh are partially intact in the south of the site.

Area

The area of ***2130 Fixed dunes (grey dunes)** increased slightly from 138.57 ha during the CMP to 140.51 ha during the SDM. This increase in area is due to succession from **2120 Marram dunes (white dunes)**. Roads and car parks are located on ***2130 Fixed dunes (grey dunes)** but their presence on the dunes appears to have occurred prior to designation and Area was assessed as Favourable during the CMP. There were also caravan parks on the site in 2005, when the CMP was carried out, and it appears that all of these were assumed to have been present prior to implementation of the Habitats Directive. Investigation of aerial photographs dating from 2000 to 2005 shows the development of a caravan park on habitat which was previously mapped as ***2130 Fixed dunes (grey dunes)**. As the site was surveyed for the CMP in August 2005 and the caravans appear in aerial photographs dating to 2005, it appears that the development had most probably occurred prior to the CMP survey and the correct assessment at that time would have been Unfavourable-Inadequate. The loss in area is equal to 0.18 ha, which is less than 1% loss per year since designation. No other loss of Area was observed during the SDM. Area was assessed as Unfavourable-Inadequate (stable) during the SDM. It should be noted that this loss in area occurred outside of the SAC boundary.

Structure and Functions

Two of the criteria failed during the Structure and Functions assessment. Two stops contained very few positive indicator species, and this was related to the habitat being rank and undergrazed in the northern part of the site. The habitat had also been damaged by disturbance, and this relates to the effects of trampling and incomplete recovery from sediment extraction. There were signs that some attempt had been made to agriculturally improve parts of the habitat in the past, but agricultural

species were not too frequent and where they occurred, they were not exceptionally abundant. During the CMP, Structure and Functions were assessed as Unfavourable-Bad because of the presence of negative indicator species and excessive sward height. Although damage was not noted in the Structure and Functions assessment, the habitat description indicates that the structure of the habitat had been undermined by the trampled tracks running through the dunes. Structure and Functions were assessed as Unfavourable-Inadequate (improving) during the SDM because the effects of agricultural intensification had abated since the CMP.

Future Prospects

Lack of grazing, paths and tracks, car parks, off-road driving, caravans and camping, trampling and litter were recorded as negative impacts in the ***2130 Fixed dunes (grey dunes)** at Banna Strand in 2011. Cattle grazing was recorded as a neutral impact because although it was associated with some negative indicator species, it was also helping to maintain the structural diversity of the sward. During the CMP, Future Prospects were assessed as Unfavourable-Inadequate with negative impacts including overgrazing by cattle, undergrazing, stock feeding, camping and caravans and walking. Future Prospects were assessed as Unfavourable-Inadequate (stable) during the SDM.

Conservation assessment

All of the parameters were assessed as Unfavourable-Inadequate during the SDM. The conservation status of Area and Future prospects has not changed, but there appears to have been some improvement in the status of Structure and Functions which was assessed as Unfavourable-Bad during the CMP. The conservation status of ***2130 Fixed dunes (grey dunes)** was assessed as Unfavourable-Inadequate (improving) during the SDM.

2.2.5 2190 Humid dune slacks

This habitat does not occur on the sand spit in the south of Banna Strand, but is common farther north. In the south, a small dune slack merges into an area of upper salt marsh. This part of the site includes an interesting flora with *Parentucellia viscosa* (yellow bartsia), and *Trifolium fragiferum* (strawberry clover) present.

Area

There has been a slight decrease in the area of **2190 Humid dune slacks** from 5.31 ha during the CMP to 5.29 during the SDM. One small slack mapped during the CMP was no longer present in 2011. It was not possible to state for certain whether this was related to anthropogenic factors, although monitoring of the dunes in the long run may show whether accelerated drying out is taking place. During the CMP, Area was assessed as Favourable. Area was assessed as Favourable (stable) during the SDM.

Structure and Functions

The criterion assessing the presence of positive indicator species failed the Structure and Functions assessment. The vegetation was very rank in stop two and only two positive indicator species were present. Although that was the only criterion to fail, the criterion assessing damage due to disturbance was close to failing as some of the slacks are damaged due to agricultural activities. Some agricultural weeds were present but did not represent a threat in 2011. Structure and Functions

were assessed as Favourable during the CMP. Structure and Functions were assessed as Unfavourable-Inadequate (deteriorating) during the SDM.

Future Prospects

Negative impacts recorded during the SDM included stock feeding, undergrazing, motorised vehicles and rabbit activity. Non-intensive cattle grazing was recorded as a neutral impact as it helped to maintain an appropriate sward height but was also associated with some negative effects such as poaching and the spread of ruderal species. During the CMP, Future Prospects were assessed as Unfavourable-Inadequate because of increasing amounts of agricultural weeds and stock feeding in the slacks. Future Prospects were assessed as Unfavourable-Inadequate (stable) during the SDM.

Conservation assessment

Area was assessed as Favourable during the SDM while Structure and Functions and Future Prospects were assessed as Unfavourable-Inadequate. During the CMP, both Area and Structure and Functions were assessed as Favourable, while Future Prospects were assessed as Unfavourable-Inadequate. The conservation status of **2190 Humid dune slacks** was assessed as Unfavourable-Inadequate (deteriorating) during the SDM.

3 DISCUSSION

3.1 Qualifying Interests for SAC

The Natura 2000 standard data form for Akeragh, Banna and Barrow Harbour SAC (SAC 000332) records nine Annex I habitats as Qualifying Interests, five of which are Annex I sand dune habitats. These are shown in Table 5. The conservation status of **1210 Annual vegetation of drift lines** and **2110 Embryonic shifting dunes** is more positive in 2011 than in the Natura 2000 standard data form, while that of **2120 Marram dunes (white dunes)** and ***2130 Fixed dunes (grey dunes)** is less positive in 2011. **2190 Humid dune slacks** is in line with the conservation assessment in the Natura 2000 standard data form.

Table 5. Relevant Qualifying Interests for Akeragh, Banna and Barrow Harbour SAC 000332 (NPWS, 1999)

Habitat	Area (%)	Representativity	Relative surface	Conservation status	Global assessment
1210 Annual vegetation of drift lines	1	C	C	C	C
2110 Embryonic shifting dunes	1	C	C	C	C
2120 Marram dunes (white dunes)	1	B	C	B	B
*2130 Fixed dunes (grey dunes)	17	A	B	B	B
2190 Humid dune slacks	1	B	C	C	C

3.2 Amenity use

Banna Strand is the closest beach to Tralee, and it is well served with access roads and car parks. There are numerous holiday homes and caravan parks located on or in close proximity to the sand dune system. As a result, the site receives high numbers of visitors in summer, which causes damage to the dune habitats. The main signs of damage are paths and tracks through the dunes, but littering and off-road driving also occur. The ***2130 Fixed dunes (grey dunes)** habitat had not yet fully

recovered from historic sand extraction in 2011. The most obvious signs of disturbance are located close to access roads and car parks. Tracks providing access from holiday homes and caravan parks are particularly vulnerable.

3.3 Grazing

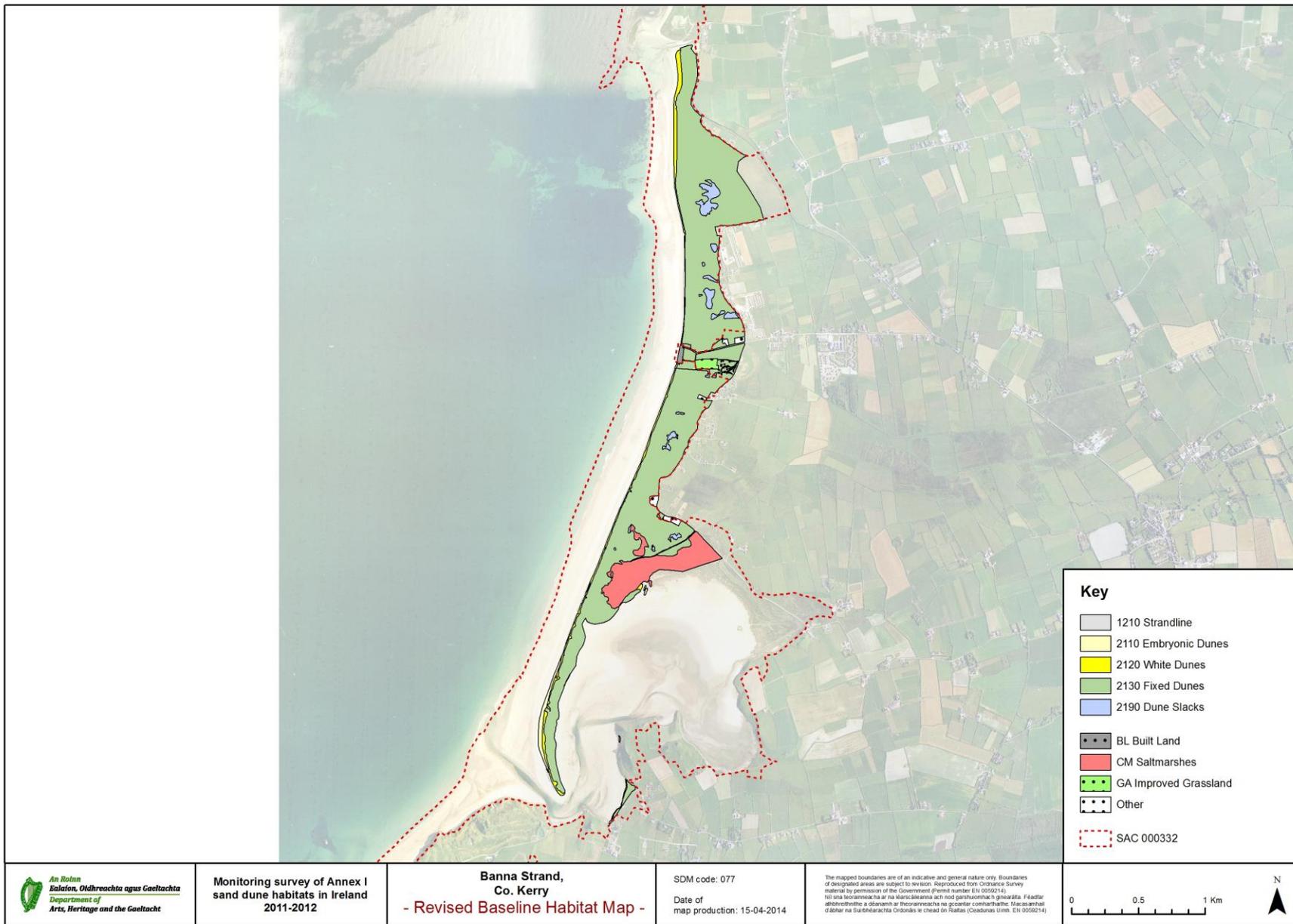
There are multiple land owners at Banna Strand, and the management of the dune habitats varies. Parts of the site show signs of having been fertilised in the past and are actively grazed. The Structure and Functions assessments indicate that the negative effects of agricultural intensification are dwindling and current management in these areas is more suitable than it was in the past. In the north of the site, the ***2130 Fixed dunes (grey dunes)** vegetation has become rank and species poor in the absence of grazing mammals. This area will require management if the habitat is to attain Favourable status at Banna Strand. One of the dune slacks in the northern part of the site also failed because of rank, species poor vegetation.

3.4 Sand spit

A long sand spit encloses Carrahane Strand. This is the most natural, untouched part of the dune system. The vegetation is tall because of the presence of *Ammophila arenaria*, but it is not rank and positive indicator species were plentiful. The presence of *Ammophila arenaria* is likely to be related to continued sand input as the spit is narrow so all of the ***2130 Fixed dunes (grey dunes)** vegetation is in close proximity to the sandy beach to the west at low tide. Rabbit grazing has a positive effect on the vegetation here as it is not grazed by cattle. There is no direct vehicular access to the spit, and the dunes here are undisturbed in comparison to the centre and northern parts of the site. The spit is also important as it shelters Carrahane Bay and helps to maintain a tidal system of salt marsh and mudflats.

4 REFERENCES

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Key

- 1210 Strandline
- 2110 Embryonic Dunes
- 2120 White Dunes
- 2130 Fixed Dunes
- 2190 Dune Slacks
- BL Built Land
- CM Saltmarshes
- GA Improved Grassland
- Other
- SAC 000332

An Roinn
Balafon, Oldhreachta agus Gaeltachta
 Department of
Arts, Heritage and the Gaeltacht

**Monitoring survey of Annex I
 sand dune habitats in Ireland
 2011-2012**

**Banna Strand,
 Co. Kerry**
- Revised Baseline Habitat Map -

SDM code: 077
 Date of
 map production: 15-04-2014

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