European Site Conservation Objectives: supplementary advice on conserving and restoring site features

North Northumberland Dunes Special Area of Conservation (SAC)
Site Code: UK0017097

Date of Publication: February 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to North Northumberland Dunes SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

Where this site overlaps or abuts other European Sites you should also refer to the separate European Site Conservation Objectives and Supplementary Advice provided for those sites.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site'

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	North Northumberland Dunes Special Area of Conservation (SAC)
Location	Northumberland
Site Map	The designated boundary of this site can be viewed here on the MAGiC website
Designation Date	1 April 2005
Qualifying Features Designation Area	1147.56 ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System for this SAC
Names of component Sites of Special Scientific Interest (SSSIs) (this SAC may form all or part of these SSSI)	Alnmouth Saltmarsh and Dunes SSSI Bamburgh Coast and Hills SSSI Bamburgh Dunes SSSI Lindisfarne SSSI Newton Links SSSI Northumberland Shore SSSI Warkworth Dunes and Saltmarsh SSSI
Relationship with other European or International Site designations	Berwickshire and North Northumberland Coast SAC (locally adjacent) Lindisfarne SPA & Ramsar (locally adjacent) Northumberland Marine SPA (largely adjacent) Northumbria Coast SPA (locally over lapping or adjacent)

Site background and geography

North Northumberland Dune SAC is formed of a number of separate dune areas located along about 45 miles of the North Sea coast of Northumberland, in north-east England, between Amble in the south and Berwick-upon-Tweed to the north. The largest complex within the SAC includes the dunes from Bamburgh to Berwick including the dunes on Lindisfarne Holy Island and those bordering the surrounding intertidal flats.

Geologically the blown sand forming the dunes is predominantly over glacial tills deposited on the solid geology of successive Carboniferous sediments; mostly limestones with millstone grits outcrops and, in the south, coal measures. At Lindisfarne and Bamburgh the Whin Sill dolerite intrusion outcrops through the Carboniferous sediments effectively backing the local dune systems, at Bamburgh this results in higher climbing dune system. Inland the Carboniferous limestones form the rolling hills between the dunes and the more distant ancient volcanic features of the Cheviot Hills.

Access to the dunes of this SAC is via a number of small roads and tracks from the A1 north of Belford, the Northumberland Coastal Route and the coastal footpath network. The Northumberland Coastal Path which runs along the coastline from Berwick-upon-Tweed to Cresswell in the south and connects with the England Coastal Path allows public access to most of the SAC.

This SAC is situated entirely within the Northumberland Coast AONB and North Northumberland Coastal Plain National Character Area (NCA Profile 001). Many areas are managed by the County Council and the National Trust have properties at Newton and Lindisfarne. Much of the SAC north of Bamburgh is within the Lindisfarne National Nature Reserve and managed by Natural England. There are a number of historic designations within this SAC including Medieval Farmstead on Holy Island and a number of listed buildings and other features recognised in the Selected Heritage Inventory for Natural England (SHINE) elsewhere along the coast.

The North Northumberland Dunes SAC comprises a number of interlinked qualifying dune habitats within a wider complex of dune and associated coastal habitat features including intertidal foreshore and saltmarsh areas.

The embryonic and shifting dune vegetation along and above the high tide line is both extensive and varied, with examples of all the main embryonic dune types. Lyme-grass *Leymus arenarius* communities are particularly strongly represented, with sand couch *Elytrigia juncea* communities and strandline species also present. Structurally most of these Northumberland dune systems are usually stable in prevailing conditions, and are fronted by accreting shifting dunes which are held by the deep rooting system of marram grass.

Progressing inland through the dunes this site also includes extensive calcareous fixed dunes locally grading into more acidic fixed dune vegetation and dune heath. Particularly characteristic of the north-east coast of England is the presence of three plants within the fixed dune area; the bloody crane's-bill *Geranium sanguineum*, lesser meadow rue *Thalictrum minor* and the burnet rose *Rosa pimpinellifolia*. Creeping willow *Salix repens* ssp. *argentea* dominates the more mature dune slacks on Holy Island and at Ross Links, and a number of rare plant species are associated with this type of vegetation. Holy Island also contains a number of calcareous, species-rich dune slacks, which support rare species, such as coralroot *Corallorhiza trifida*, Lindisfarne helleborine *Epipactis sancta* and seaside centaury *Centaurium littorale*. Active slack formation is continuing at this site and a range of successional stages are present. The humid dune slacks of nearby Ross Links contain vegetation typical of more acidic conditions. The site as a whole contains an exceptional range of humid dune slack vegetation types. A rare liverwort, Petalwort *Petalophyllum ralfsii*, has been recorded from Holy Island and from two locations on the mainland.

Land use inland of this European Site is mostly agricultural, mainly pasture with some arable, with some coastal or rural tourist attractions and accommodation including caravan parks, other stretches are backed by rural roads or the East Coast railway line.

Currently, there are a variety of risks to the condition of the site and the qualifying features. These may be locally specific to particular features or arise from impacts on the wider dune structure and ecology. These include inappropriate grazing management with dunes and vegetation potentially liable to local damage by both intensive overwintering of stock and under grazing. The invasion of fixed dune habitats by the non-native plant pirri-pirri burr *Acaena novae-zealandiae* is a problem in some areas; spreading due to seed dispersal by snagging on animal fur and visitors clothing. This low growing plant is difficult to control or eradicate and overcomes the specialist dune flora. Other negative impacts can result from recreational activities within the dune systems and erosion due to access to the beach through the dunes. Coastal squeeze where development, including transport routes, limits or prevents natural dune movement and there natural succession inland is also an issue along many areas of the Northumberland coastline. The dune systems will also be susceptible to changes in sediment transfer along the coast which may result from changing climatic conditions or changes to marine, coastal and land use.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H2110 Embryonic shifting dunes**

Embryonic shifting dune vegetation exists in a highly dynamic state and is dependent on the continued operation of physical processes at the dune/beach interface. It is the first type of vegetation to colonise areas of incipient dune formation at the top of a beach. On a prograding dune system this vegetation may be the precursor to the main dune-building vegetation dominated by marram *Ammophila arenaria*. In most cases embryonic shifting dune vegetation is transient and will either be displaced by marram-dominated vegetation as the dunes develop (2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")) or will be washed away by storms. The continued supply of new sand from the beach plain into the dune system is therefore vital to the continued existence of this community, even if this sand is derived from within the same system. The habitat type is of exceptional importance as an indicator of the general structural and functional 'health' of a dune system. Creation of new dune habitat, and indeed the long-term survival of the dune system at which it occurs, is often dependent upon the survival of this habitat type.

Embryonic shifting dunes are inherently species-poor and have a limited range of floristic variation. The predominant plants are strandline species such as sea rocket *Cakile maritima* and the two salt-tolerant, sand-binding grasses: lyme-grass *Leymus arenarius* and sand couch *Elytrigia juncea*. These grasses generally occur slightly higher up the beach profile than the true strandline species. There is some geographical variation, even within this very simple vegetation type. While both dune-binding grasses have a wide geographical range, lyme-grass is more abundant in the north and east of Britain and sand couch is more abundant in the south and west. Marram *Ammophila arenaria* is a common constituent of the habitat type throughout its range.

In the UK the majority of vegetation which conforms to this type belongs to NVC type SD4 *Elymus farctus* ssp. *boreali-atlanticus* foredune community, but certain stands of SD2 *Honkenya peploides – Cakile maritima* strandline community (on sand) and SD5 *Leymus arenarius* mobile dune community may also be referable to this Annex I type when they occur in close association with the *Elymus* community.

By their very nature embryonic shifting dunes are restricted in the area they can occupy. They are made even scarcer by the fact that only a relatively small number of dunes are actively prograding, the condition under which this habitat type develops best. Embryonic shifting dunes are also particularly vulnerable to trampling by beach users and to mechanical cleaning of beaches, and this may well be a significant factor in limiting their extent.

This habitat type rarely occurs in isolation, because it may initiate dune succession, and it is invariably one of several Annex I habitat types to be found on a dune system.

- **H2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes). (Shifting dunes with marram)**

Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") encompasses most of the vegetation of unstable dunes where there is active sand movement. Under these conditions sand-binding marram *Ammophila arenaria* is always a prominent feature of the vegetation and is usually dominant. In the UK the majority of such vegetation falls within NVC type SD6 *Ammophila arenaria* mobile dune community. This is a dynamic vegetation type maintained only by change. It can occur on both accreting and eroding dunes, but will rapidly change and disappear if stability is imposed. It rarely occurs in isolation because of its dynamic nature and because it is successionally related to other dune

habitats. The habitat type excludes the low, embryonic dunes where occasional exposure to saltwater flooding constrains the growth of marram and where plants of the strandline mingle with salt-tolerant, sand-binding grasses; such vegetation is referable to Annex I type 2110 Embryonic shifting dunes.

The species composition of shifting dunes is constrained by the harsh conditions, but the vegetation is by no means uniform. The most marked floristic variation relates to the degree of instability. Where sand accretion is extremely rapid it is possible to find vegetation that consists only of *A. arenaria*. As rates of sand deposition decline the marram is joined by more species, first by other specialised dune plants, then by less specialised grasses, drought-tolerant annuals and a restricted number of specialised bryophytes such as the moss *Tortula ruralis ssp. ruraliformis*. This moss plays an important part in completing the stabilisation of the sand surface. Towards the seaward edge of the zone of shifting dunes, salt-tolerant plants such as sea sandwort *Honckenya peploides* may be prominent, along with the sand-binding sand couch *Elytrigia juncea*. Further inland these species are rarely prominent.

There is also geographical variation in the floristic composition of the habitat type. A number of typical shifting dune plants such as Portland spurge Euphorbia portlandica and sea-holly *Eryngium maritimum* are mostly confined to the south of the UK, while lyme-grass *Leymus arenarius* is much more abundant in the northern half of Britain, where the vegetation may fall within the NVC type SD5 *Leymus arenarius* mobile dune community.

- **H2130 Fixed dunes with herbaceous vegetation (grey dunes). (Dune grassland)***

Fixed dune vegetation occurs mainly on the largest dune systems, being those that have the width to allow it to develop. It typically occurs inland of the zone dominated by marram *Ammophila arenaria* on coastal dunes, and represents the vegetation that replaces marram as the dune stabilises and the organic content of the sand increases. In the UK the vegetation corresponds to the following NVC types:

SD7 *Ammophila arenaria – Festuca rubra* semi-fixed dune community
SD8 *Festuca rubra – Galium verum* fixed dune grassland
SD9b *Ammophila arenaria – Arrhenatherum elatius* dune grassland, *Geranium sanguineum* sub-community
SD11 *Carex arenaria – Cornicularia aculeata* dune community
SD12 *Carex arenaria – Festuca ovina – Agrostis capillaris* dune grassland.

Fixed dunes are an extremely complex habitat type. For the purposes of the Habitats Directive, Fixed dunes with herbaceous vegetation ("grey dunes") has been divided into a series of sub-types (European Commission DG Environment 1999). The UK is particularly important for Atlantic dune (*Mesobromion*) grasslands.

The herbaceous vegetation of fixed dunes in the UK exhibits considerable variation. The most widespread type is Atlantic dune grassland, consisting of a short sward characterised by red fescue *Festuca rubra* and lady's bedstraw *Galium verum* and typically rich in species of calcareous substrates. The vegetation shows considerable variation both from north to south and from east to west. A taller type of dune grassland vegetation, in which bloody crane's-bill *Geranium sanguineum* is prominent, is particularly characteristic of north-east England.

- **H2170 Dunes with *Salix repens ssp*. argentea (*Salicion arenariae*). (Dunes with creeping willow)**

This habitat type comprises dunes or parts of dunes where creeping willow *Salix repens* ssp. *argentea* is dominant, forming prominent, low scrubby growth. Creeping willow is found on dunes throughout the UK. It grows predominantly in and around dune slacks, though on some sites it may spread up the drier ridges.

This type of vegetation marks the mature phase in the life cycle of calcareous dune slacks. When found with other wetland and dry dune vegetation it indicates that successional processes are still active and that the structure and function of the dune system are well-conserved. On most of the highest-quality

sites this habitat type occurs alongside a number of others, particularly 2190 Humid dune slacks, calcareous and acidic fixed dune vegetation and, locally, dune heath.

Creeping willow is often found in dune slack vegetation, and the boundaries between Dunes with *Salix repens* ssp. *argentea* and 2190 Humid dune slacks are often diffuse and difficult to define on the ground. The examples which have been selected to represent the former habitat type in the UK sites series are those where creeping willow is dominant and forming prominent, low, scrubby growth, sometimes referred to as 'hedgehog dunes'. Much of this habitat corresponds to NVC type SD16 *Salix repens – Holcus lanatus* dune slack community, although not all examples of SD16 are referable to this Annex I type.

This type of vegetation tends to occur in and around mature slacks where there has been little or no sand movement for some time and where grazing is light. Creeping willow tends to grow most vigorously at the drier end of the spectrum of slack vegetation types and it is also mainly associated with calcareous dune sites.

- **H2190 Humid dune slacks**

Dune slacks are low-lying areas within dune systems that are seasonally flooded and where nutrient levels are low. They occur primarily on the larger dune systems in the UK, especially in the west and north, where the wetter climate favours their development when compared with the generally warmer and/or drier dune systems of continental Europe. The range of communities found is considerable and depends on the structure of the dune system, the successional stage of the dune slack, the chemical composition of the dune sand, and the prevailing climatic conditions.

Creeping willow is often found in dune slack vegetation and the boundaries between Humid dune slacks and 2170 Dunes with *Salix repens* ssp. *argentea* are often diffuse and difficult to define on the ground. While Humid dune slacks include creeping willow, the Annex I type excludes those sites where the species is dominant. It is variously associated with Yorkshire-fog *Holcus lanatus* and the bryophytes *Campylium stellatum* and *Calliergon cuspidatum*. A further community is typified by silverweed *Potentilla anserina* and common sedge *Carex nigra.* In the UK the predominant NVC types include:

SD13 *Sagina nodosa – Bryum pseudotriquetrum* dune-slack community,
SD14 *Salix repens – Campylium stellatum* dune-slack community,
SD15 *Salix repens – Calliergon cuspidatum* dune-slack community,
SD16 *Salix repens – Holcus lanatus* dune-slack community,
SD17 *Potentilla anserina – Carex nigra* dune-slack community

True dune slacks are fed mainly by rain water and are characterised by a pattern of pronounced annual fluctuation of the water table, related to the landform of the dune system as well as climate and the nature of the underlying sediment – whether porous shingle or impervious clay. Variations in the extent and duration of flooding of the dune surface are very important in determining the vegetation and influence the breeding of aquatic species, including the rare natterjack toad *Bufo calamita*. Humid dune slacks occur on calcareous sand, where the slack vegetation is similar to that of small sedge mires (mires with low-growing sedges), or on acidic dunes where the vegetation may have affinities to wet heath.

Dune slacks are often rich in plant species, particularly rare and local species. Several species, such as the Annex II 1395 Petalwort *Petalophyllum ralfsii*, 1903 Fen orchid *Liparis loeselii*, and round-leaved wintergreen *Pyrola rotundifolia*, are found mainly in this habitat type.

Qualifying Species:

- **S1395 Petalwort *Petalophyllum ralfsii***

Petalwort *Petalophyllum ralfsii* is a pale green thalloid liverwort with erect lamellae on its upper surface that grows in open, damp, calcareous dune slacks, often on low hummocks rather than on the very wet ground, on compacted sandy/muddy bryophyte-rich turf. Most localities are referable to Annex I type 2190 Humid dune slacks. It has occasionally been recorded in other coastal grassland where conditions are similar. Closely associated species may include the mosses *Barbula convoluta*, *Bryum* spp., *Didymodon tophaceus*, *Ditrichum flexicaule* (*sensu lato*), *Hypnum lacunosum*, glaucous sedge *Carex flacca*, the grasses common bent *Agrostis capillaris*, red fescue *Festuca rubra* and Yorkshire-fog *Holcus lanatus*, and buck's-horn plantain *Plantago coronopus*. At some sites, it appears to be increasing as a result of trampling and soil compaction. At one site, the area where *P. ralfsii* grows is used by vehicles and it can be found on the sides of paths. It does not grow in water-filled slacks or in slacks where willow *Salix* spp. scrub predominates.

Table 1: Supplementary Advice for Qualifying Features: H2110. Embryonic shifting dunes

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature at approximately 28Ha In most areas this will be approximately 2 meter width along the dune / beach interface	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. This is the most dynamic, naturally changing, zone of the dune system. Its extent may vary seasonally and through the years. This natural functioning is critically dependent on no interruption of sand movement to and from the foredunes and the beach. Where beaches are narrow or prevailing winds not onshore, this Annex 1 habitat may be limited in extent. Evidence of natural changes to extent should not justify further direct or indirect loss to development.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015. Natural England (Various) Definitions of Favourable Condition for underpinning component SSSIs (Available on request from Natural England)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the naturally dynamic distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This zone of shifting dunes occurs between the beach plane and the usually more stable and fully vegetated older dunes. Communities may be dynamic in their distribution and are linked the sedimentary processes, particularly sand movement, operating at the site. The embryotic dunes extend throughout the length of this SAC, with the complex coastal area around Lindisfarne supporting the most extensive lines of the embryotic fore dunes. This is a particularly mobile component of the dune system, and will respond rapidly to local circumstances including tide, wind and storm conditions.	This attribute will be periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015.
Extent and distribution of the feature	**Future extent of habitat within the site and ability to respond to seasonal changes**	Maintain the ability to absorb seasonal and periodic fluctuations in the extent of the habitat	This recognises the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. This ability depends on a continuing linkage between the beach and this Annex 1 habitat, together with the ability of dune building grasses to respond in periods of net sand input. This can be impacted by long or short term changes in sediment availability along the coast along with the presence and nature of structures, including developments, which can change the coastal energy systems which carry and deposit sediments along the foreshore and contribute to dune systems.	This attribute will be periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015. Foster-Smith, R, *et al.* 2011 MESL, 2015.
Structure and function (including its typical species)	**Dune topography**	Maintain a natural dune topography, and allow natural change that is wind driven (some change may be necessary to maintain the continuity of slacks).	Dune topography in this zone can change seasonally and through the years due to wind and tidal events. Accumulations of drift-line organic material are important for trapping sand and initiating dune formation. See also attribute for 'Functional connectivity with wider coastal sedimentary system'	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Presence of un-vegetated surfaces**	Maintain an extent of bare sand of varying sizes in a mosaic with the vegetation (up to 50% of the feature extent)	In these developing, dynamic zones, bare sand should be expected. Lack of bare sand would suggest an artificially stabilised system. Blow-throughs are a natural element of this zone. If extent of un-vegetated sand is towards the upper end of the range, it will become important to assess whether recreational or other pressures are over-riding natural dynamics.	Environment Agency, 2015.
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types: • SD2 *Honkenya peploides* - *Cakile maritima* strandline community • SD4 *Elymus farctus* ssp. Boreali-atlanticus foredune community • SD5 *Leymus arenarius* mobile dune community • SD6 *Ammophila arenaria* mobile dune community	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	This attribute will be periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015. Radley, G.P. 1994
Structure and function (including its typical species)	**Vegetation structure: zonation of dune vegetation**	Maintain the cover of this feature at or to 95% of the wider dune frontage	The coastal sand dune ecosystem has a characteristic range of natural features, representing different stages of natural succession and positions within the dune system. The full representation of these stages should be maintained or where appropriate restored. On some sites there may be specific natural factors that limit continuous coverage, related to broader scale sediment budgets. Where *Leymus arenarius* is present, there can be a continuous floristic transition to marram dominated mobile dunes (Shifting dunes along the shoreline with *Ammophila arenaria*).	Environment Agency, 2015.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation composition: trees and scrub**	Ensure scrub and tree cover is absent in the embryonic shifting dune habitat	Dense cover of trees and shrubs can smother and shade out smaller and more characteristic vegetation of this habitat feature, and interrupt naturally occurring dune processes. Usually active management is required to reduce or contain its cover across this habitat feature. The presence of trees and shrubs would usually indicate an artificially stabilised system.	Environment Agency, 2015.
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread. The invasive pirri-pirri burr *Acaena novae-zealandiae* Sea buckthorn *Hippophae rhamnoides,*	Two types of negative species can occur: invasive non-natives, or species indicative of poor condition (e.g. nettle or creeping thistle). For known or likely invasive species, there should be zero tolerance. Where sea buckthorn is native species, it is not counted as a negative indicator, however it has been widely introduced in the Northumberland Dunes and can prove very invasive at the expense of the qualifying dune habitats.	Environment Agency, 2015. Robson, I. 2018
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. This is maintained by the natural deposition and erosion of wind and tidal born sand with associated biological material. See also 'Functional connectivity with wider coastal sedimentary system'	Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat: • The constant and preferential plants of the SD2, SD4, AD5 and SD6 dune NVC community type which form a key component of a H2120 SAC habitat present on this site.	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	This attribute will be periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015. Radley, G.P. 1994
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature	Foster-Smith, R *et al,* 2011 MESL, 2015 Natural England, 2015b Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			within a site. The vulnerability and response of features to such changes will vary. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being high taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. A site based assessment should be carried out as a priority. This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability.	
Supporting processes (on which the feature relies)	**Functional connectivity with wider coastal sedimentary system**	Maintain adequate movement of sediment from all key sediment sources (directly from the beach, indirectly from offshore, and onshore, eroding coastline etc.).	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features outside of the designated site boundary which are either important for the continuous supply of sediment (such as soft eroding coastline, dunes, offshore sand banks) or for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. This Annex 1 habitat is an integral element of the 'coastal foredune' (the beach-dune sand-sharing system). However, it is also important that sediment transport that feeds the beach from offshore is also not interrupted. In some cases sand may come from marram-dominated dunes landward (Shifting dunes along the shore with *Ammophila arenaria*).	
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Maintain the natural movement of sand within the site, resulting from wind blow-outs and blow-throughs.	Allowing natural wind-blow (or 'aeolian') processes to operate and to allow active movement of dry sand is important. Blow-throughs are a natural element of the dynamics of this zone. However, excessive recreational pressure can inhibit vegetation growth in sand building phases.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. On a few sites, the development of new Embryonic shifting dunes can lead to new primary dune slacks forming.	Environment Agency 2016 Gregor, G *et al, 2009*
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain or restore as necessary water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases	Gregor, G *et al, 2009* Environment Agency 2016 Mill, A. (2009)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	
Supporting processes (on which the feature relies)	**Air quality**	Maintain, or restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk)
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain or, as necessary, restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature	Where active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. For this feature, direct habitat and species management is not expected to take place in this zone. However, excessive	This attribute will be periodically monitored as part of Natural England's site condition assessments Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			recreational activity can be damaging and may need to be managed.	
Version Control: N/A				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' and 'restore' objectives. This is because this SAC is a complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request.				

Table 2: Supplementary Advice for Qualifying Features: H2120. Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain or, as necessary, restore the total extent of the feature at approximately 76 Ha In most areas this will be approximate to the dune face rising from the dune / beach interface.	See explanatory notes for this attribute in Table 1.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015. Natural England (Various) Definitions of Favourable Condition for underpinning component SSSIs (Available on request from Natural England)
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain or, as necessary, restore the naturally dynamic distribution and configuration of the feature, including where applicable its component vegetation types, across the site.	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. For this feature, this strongly relates to the coastal processes (sand deposition by wind, tideline debris to initiate	Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			sand trapping and lack of disturbance during growing season) as well as seed/propagule supply that determine the presence of the habitat. Distribution of habitat relates to the availability of blown sand from the beach plain, as well as seed/propagule supply that determine the presence of the habitat. *Ammophila arenaria* (Marram grass) plants also have a mycorrhizal association. • Annex 1 habitat to be present where relevant sedimentary and wind conditions occur.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type • SD6 *Ammophila arenaria* mobile dune community.	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring the presence, variety and composition of these vegetation types at this site will help to conserve the typical species composition of the SAC feature at this site at appropriate levels (recognising natural fluctuations). There are a number of sub-communities and there will be natural fluxes in the transition between the mobile dunes and fixed dunes seaward as sand deposition changes.	This attribute is periodically monitored as part of Natural England's site condition assessments Radley, G.P. 1994 Environment Agency, 2015a.
Structure and function (including its typical species)	**Vegetation: undesirable species**	Reduce the frequency and cover and prevent further spread of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. For this feature, two types of negative species can occur: invasive non-natives, or species indicative of poor or declining condition (e.g. (nettle or creeping thistle). For known or likely	Environment Agency, 2015 Natural England, 2015 Robson, I. 2018

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			invasive species, there should be zero tolerance. Invasive non-native species may be an issue, the presence of non-natives and other undesirable species could be an indication of increased stability. Some species are potentially more invasive into areas of bare sand and will require specific management on site. Sea buckthorn *Hippophae rhamnoides* is not considered native within this SAC. Within the North Northumberland Dune SAC the main undesirable / invasive species are: Bracken *Pteridium aquilinum,* rosebay willowherb *Chamaenerion angustifolium* and Pirri-pirri bur *Acaena novae-zealandiae*	
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain or, as necessary, restore the full natural range of vegetation zones and the transitions between them.	Zonations are seen as indicative of good conservation of structure and function. It is essential that the relationship between this habitat and other elements of the sand dune system are recognised. As much of the dune frontage as possible should have intact zonation to the next stage in succession (generally fixed dunes). This target needs to be determined at a site level, as there may be specific factors that naturally limit continuous coverage.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015
Structure and function (including its typical species)	**Dune topography**	Maintain a natural topography to the shifting dune feature.	Dune topography may be influenced by the operation of geomorphological processes, which should be allowed to continue in order to maintain the dune system in its naturally dynamic form. Maintaining this zone in a natural form, and as part of the wider dune zonation, will provide optimal conditions for the full range of characteristic flora and fauna. The low shifting dunes on the foreshore provide a vital structural element to any dune system: the varied natural topography provides important means of dune-building and progradation seawards. Key dune-building plants such as *Ammophila arenaria* (Marram grass) is sensitive to salinities over 1.5% so only persists on higher dune ridges.	Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain the extent of bare sand which typically covers up to 50% of the feature extent, of varying sizes, in a mosaic with the vegetation.	• In these developing, dynamic zones, bare sand should be expected. Lack of bare sand would suggest an artificially stabilised system. Blow-throughs are a natural element of this zone. If extent of sand is towards the upper end of the range, it will become important to assess whether recreational pressures are over-riding natural dynamics.	Environment Agency, 2015
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat: • The constant and preferential plants of the SD6 dune NVC community type which form a key component of a H2120 SAC habitat present on this site.	See explanatory notes for this attribute in Table 1.	This attribute is periodically monitored as part of Natural England's site condition assessments
Structure and function (including its typical species)	**Supporting off-site habitat**	Maintain or, as necessary, restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the feature Including maintaining coastal and marine sediments and patterns which feed the dune system	The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. This supporting habitat may be critical to the typical species of the feature to support their feeding, breeding, roosting, population dynamics ('metapopulations'), pollination or to prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment.	Environment Agency, 2015
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Maintain or, as necessary, restore the overall extent, quality and function of any supporting features within the local landscape which provide a	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the	Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		critical functional connection with the site	designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain or, as necessary, restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See explanatory notes for this attribute in Table 1.	Natural England, 2016 Natural England, 2015 MESL, 2015 Foster-Smith, R. *et al.* 2011
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain or, as necessary, restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status.	Natural England, 2016
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain or, as necessary, restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable,	Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		to maintain or restore as necessary the structure, functions and supporting processes associated with the feature.	supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Management should consider the structures on and functions of the site as a whole.	
Supporting processes (on which the feature relies)	**Air quality**	Maintain or, as necessary, restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk)
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain or, as necessary, restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	Gregor, G *et al, 2009* Environment Agency 2016
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, maintain or restore as necessary the natural hydrological regime to provide	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the	Gregor, G *et al, 2009* Environment Agency 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		the conditions necessary to sustain the feature within the site	assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts.	
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Maintain the ability of wind-blow processes to transport sand from the beach plain to the foredune.	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term conservation. The beach plain needs to be dry to allow sand to be transported into the dune system.	Gregor, G *et al, 2009* Environment Agency 2016
Version Control: Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' and 'restore' objectives. This is because this SAC is a complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request.				

Table 3: Supplementary Advice for Qualifying Features: H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland *

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature at approximately 600Ha In most areas this will be the main dune area behind the dune initial dune slope behind the dune / beach interface	See explanatory notes for this attribute in Table 1. For this feature if loss (or gain) of area is from natural causes dynamism this is not a decline in condition, but any significant loss due to human interference (e.g. sand extraction, visitor impacts, ploughing or conversion to improved grassland) is to be regarded as unfavourable. Increase in area is favourable unless related to coast protection. In a naturally functioning dune system there is likely to be varying proportions of fixed and mobile dune communities over time.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Natural England (Various) Definitions of Favourable Condition for underpinning component SSSIs (Available on request from Natural England)
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain or, as necessary, restore the naturally dynamic] distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. For this feature it is also important to maintain transitions between fixed/semi-fixed dunes and other dune/terrestrial habitats to seaward or landward.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types SD7 *Ammophila arenaria – Festuca rubra* semi-fixed dune community SD8 *Festuca rubra – Galium verum* fixed dune grassland SD9b Ammophila arenaria – Arrhenatherum elatius dune grassland, *Geranium sanguineum* sub-community	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	This attribute is periodically monitored as part of Natural England's site condition assessments Radley, G.P, 1994
Structure and function (including its typical species)	**Vegetation: undesirable species**	Reduce the frequency and cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread;	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. Species such as Common stingy nettle *Urtica dioica, Creeping thistle Cirsium arvense* and Spear thistle *C. vulgare* are indicative of poor condition because of enrichment. Ragwort *Senecio jacobaea* is a natural constituent of dune vegetation and should only to be included as a negative indicator where extensive dense stands of robust plants are present. The non-native invasive plant New Zealand Pirri-pirri Burr *Acaena novae-zealandiae*, is established in many dune areas in Northumberland and spreads, particularly along pathways	Environment Agency, 2015 Robson, I. 2018

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and other open areas within the dunes, as the hooked seed burrs are readily trapped and carried on footwear, clothing and animals including stock and pet dogs. This small plant displaces the characteristic ground flora of the dunes. There is ongoing evaluation of control methods, the most effective being hand weeding. The objective is to prevent further spread both within the SAC and other sand dune systems. Sea buckthorn *Hippophae rhamnoides* is not considered native within this SAC. *Rosa* species are considered undesirable species within dune system; with the exception of Burnet Rose *Rosa pimpinellifolia* which is a characteristic species of the north-eastern dune systems and should not be considered undesirable Within the North Northumberland Dune SAC the main undesirable / invasive species are: Bracken *Pteridium aquilinum,* rosebay willowherb *Chamaenerion angustifolium* and Pirri-pirri bur *Acaena novae-zealandiae*	
Structure and function (including its typical species)	**Vegetation community transitions (range and zones)**	Restore where degraded and maintain the patterns of natural zonations/transitions; the full zonation from beach inland to fixed dune should be intact over at least 95% of dune coastal frontage.	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. Some dunes are on naturally sediment-deficit coasts: on these there is likely to be less than 95% frontage of strandline and embryo dunes.	Environment Agency, 2015
Structure and function (including its typical species)	**Vegetation structure diversity**	Maintain or, as necessary, restore variation to sward structure, so that typically 30%-70% of sward comprises species-rich short turf (between 2 and 10cm tall).	A varied vegetation structure and a succession of flowers and seeds through the year are important for maintaining the habitat's diversity. Targets for ratio of short to taller vegetation should be set on a site-specific basis. In addition, a proportion of the short turf area should be <5cm tall. The ratio of short to tall vegetation can be lower (but not <30%) in semi-fixed dune	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			grassland (SD7) where *Ammophila arenaria* (Marram grass) is still abundant. Levels and timing of any stock grazing should be sufficient to allow adequate seed production.	
Structure and function (including its typical species)	**Dune topography**	Maintain a natural topography to the fixed dune feature.	Dune topography may be influenced by the operation of geomorphological processes, which should be allowed to continue in order to maintain the dune system in its naturally dynamic form. Fixed dunes occur where the dune stabilises and the organic content of the soil increases. Maintaining this zone in a natural form, and as part of the wider dune zonation, will provide optimal conditions for the full range of characteristic flora and fauna.	Environment Agency, 2015
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain or, as necessary, restore an appropriate cover of bare ground or sand, which is typically between 5-20% and in patches in a mosaic with vegetated surfaces.	Patches of bare sand are essential for a wide range of typical dune invertebrates and 'dune annual' plants. For semi-fixed/fixed dunes the range of bare ground/sand is typically between 5-20%. Areas of bare sand which are maintained by frequent human disturbance should not increase in extent.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat: The constant and preferential plants of the SD7, SD8 and SD9b dune NVC community type which form a key component of a H2130 SAC habitat present on this site	See the explanatory notes for this feature in Table 1	Natural England (Various) Definitions of Favourable Condition for underpinning component SSSIs (Available on request from Natural England)
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Maintain or, as necessary, restore the overall extent, quality and function of any supporting features within the local landscape which provide a	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the	This attribute is periodically monitored as part of Natural England's site condition assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		critical functional connection with the site	designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	Environment Agency, 2015 Gregor, G *et al, 2009*
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain or, as necessary, restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See explanatory notes for this attribute in Table 1.	Natural England, 2016 Natural England, 2015 MESL, 2015 Foster-Smith, R. *et al.* 2011
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	Natural England, 2016 Dargie, T. 2004 Mill, A. 2009
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain or, as necessary, restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain or, as necessary, restore the structure, functions	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement	Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		and supporting processes associated with the feature	Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. For this feature, appropriate management may include: reduction of nutrient levels to maintain high numbers of species through the management activities of grazing, burning, mowing, sod-cutting and scrub cutting. The reworking of sand through cultivation or sand-drift may help to conserve the dynamic habitat. Management of succession is a critical aspect of management for this habitat, by a combination of active processes and grazing/cutting. A range of invertebrates and plants require bare sand where it is not too frequently disturbed by vehicles or feet. Where damage initiates a blow-out, this can be a positive outcome in over- stabilized dunes, where sea defence concerns or critical infrastructure are not comprised.	
Supporting processes (on which the feature relies)	**Air quality**	Maintain or, as necessary, restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain or where necessary restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework	Gregor, G *et al, 2009* Environment Agency 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level maintain or where necessary restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. For this feature, hydrology can be influenced by dune topography, vegetation, substrate, flow regimes.	Gregor, G *et al, 2009* Environment Agency 2016 Natural England, 2016
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Maintain the ability of wind-blow processes to transport sand from the beach plain to the	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term conservation. The beach plain needs to be dry to allow sand to be transported into the dune system.	
Version Control: Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' and 'restore' objectives. This is because this SAC is a complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request.				

Table 4: Supplementary Advice for Qualifying Features: H2170. Dunes with *Salix repens ssp. argentea* (*Salicion arenariae*); Dunes with creeping willow

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature at approximately 10Ha This tends to be confined to the more complex dune systems and occupies the floors of drier dune hollows	See explanatory notes for this attribute in Table 1. Dunes with Creeping willow *Salix repens* is part of a broader dune wetland vegetation community. It is characteristic of older, drier dune slacks. In a naturally functioning dune system some dune slacks will, over time, dry out leading to localised losses of Dunes with Creeping willow *Salix repens*. However new slacks will be created by sand blow (secondary slacks) or by beach development (primary slacks), some of which in time will develop into Dunes with Creeping willow *Salix repens*. Therefore, this Annex 1 habitat needs to be assessed in combination with H2190 - Humid dune slacks which represents the wetter and early succession elements of dune wetlands. All elements of the wet-dry and early-late succession spectrums should be represented on the site. Evidence of natural changes to extent should not justify further loss to development.	Environment Agency, 2015
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain or, as necessary, restore the naturally dynamic and configuration of the feature, including where applicable its component vegetation types, across the site.	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the typical and more specialist species associated with the Annex I habitat feature. In the short term, dune wetland features are fixed in space determined by dune topography and hydrology. However, in a naturally functioning dune system topography can change leading to localised losses and gains in dune wetlands, including Dunes with Creeping willow *Salix repens*.	
Extent and distribution of the feature	**Future extent of habitat within the site and ability to respond to seasonal changes**	Maintain or, as necessary, restore the ability to absorb seasonal and periodic fluctuations in the extent of the habitat	This recognises the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. Dunes with Creeping willow *Salix repens* are buffered from short term natural variations in hydrology including dry seasons. However, artificial drainage or a longer series of dry years with lowered water table will lead to early succession away to non-dune wetland habitat. In the medium term, a degree of dune dynamics is required to create new dune slacks, some of which over time will develop into Dunes with Creeping willow *Salix repens*.	Environment Agency, 2015
Structure and function (including its typical species)	**Dune topography**	Maintain or, as necessary, restore a natural dune topography, and allow natural change that is wind driven.	It is possible that on some sites there are over-riding constraints that will not allow natural dune dynamics to proceed. On these sites it may be necessary to artificially lower ground surface levels in slacks to extend their lives. See also 'Within-site sedimentary processes' component.	Environment Agency, 2015
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain or, as necessary, restore patches of bare sand of varying sizes in a mosaic with the vegetation (5%-10% of the feature extent)	Bare sand is less characteristic of Dunes with Creeping willow *Salix repens* than of Humid dune slacks. Nevertheless some bare sand should be expected even in this late succession community. Its location can change over time in response to localised dune dynamics and rabbit activity.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency 2015
Structure and function (including its	**Vegetation community composition**	Maintain or, as necessary, restore the species composition of component vegetation	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil	This attribute is periodically monitored as part of Natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)		communities and associated transitions, allowing for successional changes in response to natural processes.	conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). The NVC type SD16 - *Salix repens - Holcus lanatus* is a characteristic community of this habitat. Although this vegetation type is dominated by creeping willow and can appear uniform, there is natural variation related to dampness and levels of grazing (including rabbits).	England's site condition assessments Radley, G.P. 1994
Structure and function (including its typical species)	**Vegetation structure: zonation of dune vegetation**	Maintain or, as necessary, restore the cover of this Annex 1 habitat to typically comprise between 10% and 50% of the overall dune wetland resource on the site	The coastal sand dune ecosystem has a characteristic range of natural features, representing different stages of natural succession. The full representation of these stages should be maintained or where appropriate restored. This Annex 1 habitat needs to be considered in combination with Humid dune slacks which represents the wetter and early succession elements of dune wetlands. All elements of the wet-dry and early-late succession spectrums should be represented on the site.	Radley, G.P. 1994 Environment Agency, 2015
Structure and function (including its typical species)	**Vegetation composition: trees and scrub**	Maintain or, as necessary, restore Scrub and tree cover of locally native species, excluding creeping willow, to no more than 10% of this habitat, scattered and in small groups.	Dense cover of trees and shrubs can smother and shade out smaller and more characteristic vegetation of this habitat feature, and interrupt naturally occurring dune processes. Usually active management is required to reduce or contain its cover across this habitat feature. Trees and shrubs would usually indicate an artificially stabilised system. On some sites it may be appropriate to allow natural succession to native	This attribute is periodically monitored as part of Natural England's site condition assessments Radley, G.P, 1994 Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			woodland to proceed on a small proportion of the Annex 1 habitat.	
Structure and function (including its typical species)	**Vegetation: undesirable species**	Reduce the frequency and cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.	Two types of negative species can occur: invasive non-natives (e.g. Michaelmas daisy), or species indicative of poor condition (e.g. nettle or creeping thistle). Ragwort *Senecio jacobaea* is a natural constituent of dune vegetation. However, in dune slacks an abundance indicates over-stocking. Sea buckthorn *Hippophae rhamnoides* is not considered native within this SAC. *Rosa* species are considered undesirable species within dune system; with the exception of Burnet Rose *Rosa pimpinellifolia* which is a characteristic species of the north-eastern dune systems and should not be considered undesirable Within the North Northumberland Dune SAC the main undesirable / invasive species are: Bracken *Pteridium aquilinum,* rosebay willowherb *Chamaenerion angustifolium* and Pirri-pirri bur *Acaena novae-zealandiae*	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Robson, I, 2018
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain or, as necessary, restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. As dune slack vegetation succession progresses, soils develop in structure and nutrient status. The soils under Dunes with Creeping willow *Salix repens* represent some of the more mature natural soils to be found on dunes.	Natural England, 2016
Structure and function	**Key structural,**	Maintain the abundance of the typical species listed below to	See the explanatory notes for this feature in Table 1	Natural England (Various) Definitions of Favourable

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	**influential and/or distinctive species**	enable each of them to be a viable component of the Annex 1 habitat: The constant and preferential plants of the SD16 dune NVC community type which form a key component of a H2170 SAC habitat present on this site		Condition for underpinning component SSSIs (Available on request from Natural England)
Structure and function (including its typical species)	**Vegetation structural diversity**	Maintain or, as necessary, restore a suitable variation in vegetation height across the feature.	Even for a vegetation community dominated by Creeping willow *Salix repens*, a uniform canopy will not be typical. And a wide range of invertebrates in particular depend on both a varied vegetation structure and a succession of flowers and seeds.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015
Supporting processes (on which the feature relies)	**Functional connectivity with wider coastal sedimentary system**	Maintain or, as necessary, restore adequate movement of sediment from all key sediment sources (directly from the beach, indirectly from offshore, eroding coastline etc.).	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features outside of the designated site boundary which are either important for the continuous supply of sediment (such as soft eroding coastline, dunes, offshore sand banks) or for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. Although Dunes with Creeping willow *Salix repens* does not depend in the short term on continued inputs of sand, its	Gregor, G *et al, 2009*

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			medium/long term survival does. Primary slacks can occur on the beach plane with sufficient input of sand.	
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Maintain or, as necessary, restore the natural movement of sand within the site, resulting from wind blow-outs and blow-throughs.	Allowing natural wind-blow (or 'aeolian') processes to operate and to allow active movement of dry sand is important. Current dune topography, including hollows reaching damp sand where slacks occur, has resulted from past within-site dune movement. Although Dunes with Creeping willow *Salix repens* does not depend in the short term on new dune mobility, its medium/long term survival does. Secondary slacks are created where overlying sand is blown away down to the water table/wet sand.	Gregor, G *et al, 2009*
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level Maintain or, as necessary, restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. All dune wetland vegetation communities, including Dunes with Creeping willow *Salix repens*, are influenced by the water table. Each community reflects a particular past and current hydrological regime. Water table monitoring should be present on all sites with dune wetlands.	Gregor, G *et al, 2009* Natural England, 2016
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Maintain or, as necessary, restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type.	Gregor, G *et al, 2009* Environment Agency 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	
Supporting processes (on which the feature relies)	**Air quality**	Maintain or, as necessary, restore, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain or, as necessary, restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain or, as necessary, restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Although 'natural processes' are given a high priority in sustaining site and feature integrity in dunes, active management (including livestock grazing) is sometimes required.	Natural England, 2016
Version Control: Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' and 'restore' objectives. This is because this SAC is a complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request.				

Table 5: Supplementary Advice for Qualifying Features: H2190. Humid dune slacks

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature at approximately 73Ha This tends to be confined to the more complex dune systems and occupies the wetter areas of dune hollows/ slacks	See explanatory notes for this attribute in Table 1. For this feature if loss (or gain) of area is from natural physical dynamism this is not a decline in condition, but any significant loss due to human interference (e.g.. sand extraction, visitor impacts, ploughing or conversion to improved grassland) is to be regarded as unfavourable. In a naturally functioning dune system some dune slacks will, over time, dry out but new ones will be created by sand blow (secondary slacks) or by beach development (primary slacks). Humid dune slacks represents the wetter and early succession elements of dune wetlands. All elements of the wet-dry and early-late succession spectrums should be represented on the site. Evidence of natural changes to extent should not justify further loss to development. H2170 - Dunes with Creeping willow *Salix repens* are characteristic of older, drier dune slacks, therefore, this Annex 1 habitat needs to be assessed in combination with it.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Natural England (Various) Definitions of Favourable Condition for underpinning component SSSIs (Available on request from Natural England)
Extent and distribution of the feature	**Dune topography**	Maintain or, as necessary, restore a natural dune topography, but allow natural change that is wind driven (some change may be necessary to maintain the continuity of slacks).	It is possible that on some sites there are over-riding constraints that will not allow natural dune dynamics to proceed. On these sites it may be necessary to artificially lower ground surface levels in slacks to extend their lives. See also 'Within-site sedimentary processes' component.	Environment Agency, 2015
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain or, as necessary, restore the naturally dynamic / distribution and configuration of the feature, including where applicable its component vegetation types, across the site.	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move	Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. In the short term, dune wetland features are fixed in space determined by dune topography and hydrology. However, in a naturally functioning dune system topography can change leading to localised losses and gains in dune wetlands, including Humid dune slacks.	
Extent and distribution of the feature	**Future extent of habitat within the site and ability to respond to seasonal changes**	Maintain or, as necessary, restore the ability to absorb seasonal and periodic fluctuations in the extent of the habitat.	This recognises the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. Humid dune slacks are buffered from short term natural variations in hydrology including dry seasons. However, artificial drainage or a longer series of dry years with lowered water table will lead to early succession away to non-dune wetland habitat. In the medium term, a degree of dune dynamics is required to create new dune slacks.	Environment Agency, 2015
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain or, as necessary, restore an extent of bare ground or sand which is no more than 20% of the total dune slack area.	Patches of bare sand are essential for a wide range of dune invertebrates and colonisation by some bryophytes.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation community composition**	Maintain or, as necessary, restore the component vegetation communities and associated transitions, allowing for successional changes in response to natural processes. There are 4 humid dune slack communities: SD13 *Salix repens-Bryum pseudotriquetrum* dune slack community SD14 *Salix repens-Campylium stellatum* dune slack community SD15 *Salix repens-Calliergon cuspidatum* dune slack community SD17 *Potentilla anserina-Carex nigra* dune slack community Various MG communities are also found on the sand.	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). For this feature it is unlikely that all slack communities will be represented in a single slack. It is more usual for individual slacks to be at different stages in vegetation succession, and to have slightly different hydrological regimes. The target relates to the humid dune slack resource across the whole site.	This attribute is periodically monitored as part of Natural England's site condition assessments Radley, G.P. 1994
Structure and function (including its typical species)	**Vegetation structure: zonation of dune vegetation**	Maintain or, as necessary, restore succession of dune slack stages (early, middle and later). All humid slack communities should be present – from embryonic dune slacks with a high % of bare ground to those with more closed vegetation and	The coastal sand dune ecosystem has a characteristic range of natural features, representing different stages of natural succession. The full representation of these stages should be maintained or where appropriate restored. The target relates to the humid dune slack resource across the whole site. The latter end of the dune slack succession which is dry dune slack is covered by H2170 Dunes with Creeping willow *Salix repens*.	Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		up to 33% cover of Creeping willow *Salix repens.* Early dune slack successional stages at least occasional.	There are different types of dune slacks - pioneer, young/moderate and old, and stages within these: dune slack community sub-types: dune slack pools (permanent water bodies); dune slack pioneer swards; dune slack fens (calcareous, occasionally acidic); dune slack grasslands (humid grasslands and rushbeds); dune slack reedbeds, sedgebeds and canebeds. Not all slack communities will be represented in a single slack. It is more usual for individual slacks to be at different stages in vegetation succession, and to have slightly different hydrological regimes. A mosaic of other wetland vegetation communities are: frequently present within dunes (swamp/mire/tall herb fen). These are all important elements of the dune system and may have hydrological connectivity with the dune slack habitats.	
Structure and function (including its typical species)	**Vegetation composition: trees and scrub**	Maintain or, as necessary, restore scrub and tree cover of locally native species to between 5% and 10%, scattered and in small groups. Cover of Creeping willow *Salix repens* not more than 33%.	Dense cover of trees and shrubs can smother and shade out smaller and more characteristic vegetation of this habitat feature, and interrupt naturally occurring dune processes. Usually active management is required to reduce or contain its cover across this habitat feature. Apart from sea buckthorn (where it is native), other trees and shrubs would usually indicate an artificially stabilised system. The 'humid dune slack' community requires soil to be wet enough and not too dominated by creeping willow (*Salix repens*) for a diverse range of forbs and some grasses to be also present. The target relates to the humid dune slack resource across the whole site.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015
Structure and function (including its typical species)	**Vegetation composition: forb/grass ratio**	Maintain or, as necessary, restore a typically low vegetation sward with >30% cover of forbs and <50% cover of grasses, and occasional bryophytes (e.g. *Calliergon cuspidatum, Campylium stellatum*).	Low swards required by species such as fen orchid. Drying and eutrophication of the slack can be indicated by increase in 'grassiness'.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation: undesirable species**	Reduce the frequency and cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.	Undesirable species may include: Common stingy nettle *Urtica dioica,* Creeping thistle *Cirsium arvense*, Spear thistle *C. vulgare*, Perennial ryegrass *Lolium perenne,* Ragwort *Senecio jacobaea,* Bracken *Pteridium aquilinum* or Rosebay willow-herb *Chamaenerion angustifolium,* Pirri-pirri bur *Acaena novae-zealandiae*, Ragwort *Senecio jacobaea* is a natural constituent of dune vegetation. However, in dune slacks an abundance of *Senecio jacobaea* indicates over-stocking. Within the North Northumberland Dune SAC the main undesirable / invasive species are: Bracken *Pteridium aquilinum,* Rosebay willowherb *Chamaenerion angustifolium* and Pirri-pirri bur *Acaena novae-zealandiae* • If Creeping willow *Salix repens* covers more than 33% it is potentially indicative of drying out, and this should trigger further investigation to determine why this might be shifting to a different Annex I habitat. Sea buckthorn is not considered native within this SAC. *Rosa* species are considered undesirable species within dune system; with the exception of Burnet Rose *Rosa pimpinellifolia* which is a characteristic species of the north-eastern dune systems and should not be considered undesirable.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Robson, I. 2018
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat: The constant and preferential plants of the following NCV communities:	See the explanatory notes for this feature in Table 1	Natural England (Various) Definitions of Favourable Condition for underpinning component SSSIs (Available on request from Natural England) Environment Agency, 2015 Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		SD13 *Salix repens-Bryum pseudotriquetrum* dune slack community SD14 *Salix repens-Campylium stellatum* dune slack community SD15 *Salix repens-Calliergon cuspidatum* dune slack community SD17 *Potentilla anserina-Carex nigra* dune slack community These are all community types which form a key component of a H2190 SAC habitat present on this site.		
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain or, as necessary, restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. As dune slack vegetation succession progresses, soils develop in structure and nutrient status. The soils under Humid dune slacks represent less to moderately develop natural soils to be found on dunes.	Natural England, 2016
Supporting processes	**Functional connectivity**	Maintain or, as necessary, restore adequate movement of	Although Humid dune slacks do not depend in the short term on continued inputs of sand, its medium/long term survival	MESL, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature relies)	**with wider coastal sedimentary system, including seed/ propagule dispersal.**	sediment from all key sediment sources (directly from the beach, indirectly from offshore, eroding coastline etc.).	does. Primary slacks can occur on the beach plane with sufficient input of sand.	Foster-Smith, R. *et al* 2011
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Maintain or, as necessary, restore the natural movement of sand within the site, resulting from wind blow-outs and blow-throughs.	Allowing natural wind-blow (or 'aeolian') processes to operate and to allow active movement of dry sand is important. Current dune topography, including hollows reaching damp sand where slacks occur, has resulted from past within-site dune movement. Although Humid dune slacks does not depend in the short term on new dune mobility, its medium/long term survival does. Secondary slacks are created where overlying sand is blown away down to the water table/wet sand.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary Maintain or, as necessary, restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. All dune wetland vegetation communities are influenced by the water table. Each community reflects a particular past and current hydrological regime. Water table monitoring should be present on all sites with dune wetlands. Humid dune-slacks are extremely rich and specialised habitats which are very threatened by the lowering of water tables (Interpretation Manual - EUR28). They require a period of wetting, with inundation to shallow depth in winter and dry in summer. Permanent pools will sometimes occur in association with dune slacks, and can be hydrologically linked to the humid dune slack feature.	Gregor, G *et al, 2009* Environment Agency 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			There will be a suite of dune slacks within a site, all at different stages in vegetation succession, and although all linked to the same dune aquifer, may have slightly different hydrological regimes due to variations in age, elevation and management.	
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain or, as necessary, restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	Gregor, G *et al, 2009* Environment Agency 2016
Supporting processes (on which the feature relies)	**Air quality**	Maintain or, as necessary, restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain or, as necessary, restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain or, as necessary, restore the structure, functions	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement	Natural England, 2016 Plassman, K. 2009.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		and supporting processes associated with the feature	Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Although 'natural processes' are given a high priority in sustaining site and feature integrity in dunes, active management (including livestock grazing) is sometimes required. Management includes scrub cutting, mowing, grazing, turf-stripping and re-wetting. Mowing can prolong the younger species-rich stage of slack succession but cannot reverse the process. Reverse the fall in water tables (if anthropogenic) and/or removal of trees and scrub combined with follow-up grazing management. Management should focus on creating new successional cycles to provide habitat for early successional species and replace that lost by accelerated succession. Stimulation of germination from the seed bank through management may contribute to the conservation of both characteristic and threatened species typical of dune slacks. (Plassmann *et al*., 2009) Management practices that remove nutrients (N) from the system can mitigate the effects of N inputs but may damage fragile components. A range of invertebrates and plants require bare sand, usually naturally created by wind blow, but sometimes where it is infrequently disturbed by vehicles or feet.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' and 'restore' objectives. This is because this SAC is a complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request				

Table 6: Supplementary Advice for Qualifying Features: S1395. *Petalophyllum ralfsii*; Petalwort

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance**	Maintain or, where necessary, restore the abundance of the population to a level which is above baseline mean peak count or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of	Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available.	
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain or, as necessary, restore the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability.	This attribute is periodically monitored as part of Natural England's site condition assessments
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Restore the total extent of the habitats which support the Petalwort feature	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data.	Environment Agency, 2015 Natural England, 2016
Supporting habitat: structure/ function	**Bare Ground and Vegetation Structure**	Ensure areas supporting *P.ralfsii* contains at least 5% bare ground and the height of overall vegetation structure is predominantly short.	*P. ralfsii* tolerates only light shading, and most sites supporting the species have persistently very low vegetation that includes many small perennials, which is maintained by low nutrient levels and often by intense grazing by rabbits, plus on some sites light trampling pressure. Most sites also have at least some bare ground, commonly 10-50% bare sandy ground amongst low vegetation, although *P. ralfsii* can grow in a very thin low cover of grasses and low	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			herbs. Grazing by rabbits is often important in the maintenance of this low structure. If such grazing becomes reduced or is not sufficient, then periodic clearance of tall vegetation and scrub with removal of arisings may be required.	
Supporting habitat: structure/ function	**Hydrological regime**	Maintain or, where necessary, restore water levels at sites supporting *P. ralfsii* at or to a level sufficient to support the species, in particular water tables should not be lowered and should be allowed to naturally fluctuate. Water tables in dune slack sites should be at or above the ground surface during the majority of the winter months.	*P. ralfsii* favours damp sites with the water table at or near the surface. Most sites are dry for parts of a normal summer and wet or flooded during at least some winters. Ponds dug or deepened in dune slacks for conservation purposes for amphibians, should be sited far enough away from *P. ralfsii* populations to prevent the damage that might be caused directly or e.g. by increasing trampling levels nearby.	Gregor, G *et al, 2009* Environment Agency 2016 Natural England, 2016
Supporting habitat: structure/ function	**Nutrient status**	Maintain or, where necessary, restore the nutrient status to naturally expected levels, avoiding pollution and activities that increase nutrient levels which promote algal growth in dune slacks, or an increase in species such as common nettle and rye grass.	This feature is particularly sensitive to small-scale changes in its supporting habitat's structure. Raised nutrient levels through pollution is likely to be damaging, and increased nutrient levels will promote the growth of other vegetation that will out-compete and shade out the diminutive *P. ralfsii*. Excessive algal growth in dune slacks and an increase in species such as common nettle and rye grass are likely to be indicative of raised nutrient levels.	
Supporting habitat: structure/ function	**Scrub and tree cover**	Manage the cover of scrub and trees within dune slacks and other sandy ground supporting *P. ralfsii* at less than 5%, and absent from the primary areas supporting *P. ralfsii*.	Invasive scrub is very harmful to *P. ralfsii*, which tolerates only light shading. Scrub species that can be a particular problem in dune slacks include sea buckthorn, bramble and birch, and excessive creeping willow is also undesirable with regard to *P. ralfsii.*	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Natural England, 2016
Supporting habitat:	**Soils, substrate and**	Maintain or, as necessary, restore the properties of the	Soil supports basic ecosystem function and is a vital part of the natural environment. Its properties strongly influence the	Environment Agency, 2015

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
structure/ function	**nutrient cycling**	underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, within typical values for the supporting habitat.	colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature.	Natural England, 2016 Plantlife. 2018.
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Maintain or, as necessary, restore the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site.	See explanatory notes for this attribute in Table 1.	Environment Agency, 2015 Natural England, 2016
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain or, where necessary, restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Maintain or, as necessary, restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain or restore as necessary the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	Natural England, 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Maintain or, where necessary, restore light to moderate trampling which benefit the feature	*P. ralfsii* requires firm or compacted substrates and avoids very loose or mobile sand, thus excessive disturbance will be harmful. There is a narrow zone of disturbance intensity that provides the right conditions for *P. ralfsii* - too much and the ground remains too unstable for establishment, whilst too little and the ground may become overgrown by a closed turf. There should be no excessive disturbance to dune slacks or other sandy ground supporting *P. ralfsii*, for example caused by excessive trampling or jogging, or the use of vehicles or scrambler motorbikes.	This attribute is periodically monitored as part of Natural England's site condition assessments Environment Agency, 2015 Natural England, 2016
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, Maintain or, as necessary, restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	Gregor, G *et al, 2009* Environment Agency 2016
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: The targets for some attributes listed above include both 'maintain' and 'restore' objectives. This is because this SAC is a complex of geographically-separate component sites which are currently in different states of condition. Overall, both objectives will be applicable to the SAC but these will differ between each component site depending on its particular circumstances. Natural England will able to provide further specific advice on request.				

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