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

Roydon Common and Dersingham Bog Special Area of Conservation (SAC)
Site code: UK0012801

Dersingham Bog M2 Bog Pool. AR Murray

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About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Roydon Common and Dersingham Bog SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

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.

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.

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.

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	Roydon Common and Dersingham Bog Special Area of Conservation (SAC)
Location	Norfolk
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1 April 2005
Qualifying Features	See below
Designation Area	351.83
Designation Changes	Not applicable
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Roydon Common SSSI Dersingham Bog SSSI
Relationship with other European or International Site designations	Dersingham Bog Ramsar Roydon Common Ramsar

Site background and geography

This is a composite site comprising two distinct areas; Roydon Common and Dersingham Bog. Despite being located 3.2 miles apart from one another, these sites represent the only remaining vestiges of what was once an extensive mosaic of heathland, mire and fen linking the north Norfolk coast to the Brecks. They lie within the very open, rolling topography of the North West Norfolk National Character Area (NCA). The sites are also managed as National Nature Reserves in recognition of their nature conservation importance.

Over the last one hundred years, however, these habitats were much reduced and fragmented, leaving Roydon Common and Dersingham Bog as semi-natural oases set amid a landscape dominated by conventional arable farming, softwood forestry production or secondary woodland. Despite their present geographical isolation from one another, Roydon Common and Dersingham Bog continue to share many similarities in terms of the species and the habitats they support.

On the free-draining high ground, dry heath has developed. As a result of ongoing management, this is dominated by Ling *Calluna vulgaris*. However, in the absence of regular active management, Bracken *Pteridium aquilinum,* Silver Birch *Betula pendula*, Scots Pine *Pinus sylvestris* and, at Dersingham Bog, *Rhododendron ponticum* would quickly become dominant.

At the foot of the escarpment, the gently sloping ground becomes increasingly damp as it comes into closer contact with the groundwater. This promotes a switch from dry heath into wet heath; characterised by the appearance of Cross-leaved Heath *Erica tetralix*, Purple Moor Grass *Molinia caerulea* and the scarce bog mosses *Sphagnum compactum* and, at Dersingham Bog, *Sphagnum molle*.

The lowest lying parts of both component sites have a high, relatively constant ground water supply that has resulted in the development of a diverse range of peatland habitats. Where the groundwater is sourced directly from the underlying Sandringham Sands aquifer, the acidic, nutrient poor waters have favoured the development of large expanses of sphagnum moss 'lawns', interspersed with bog pools. These areas support an astounding assemblage of bog building *sphagnum* mosses, including many which are very scarce in eastern England, as well as high densities of insectivorous sundews *Drosera rotundifolia* and *Drosera intermedia*, Cranberry *Vaccinium oxycoccus* and Bog Asphodel *Narthecium ossifragum*.

In parts of the site where more basic, higher pH groundwater flows occur, calcareous fen has developed. These areas are characterised by a range of species that are intolerant of the lower pH and base-statuses found elsewhere within the site. Lush tussocks of Black Bog Rush *Schoenus nigricans* tower above the adjacent calcium loving sedges that carpet the ground, such as Long-stalked Yellow-sedge *Carex lepidocarpa*.

In some areas, there is a gradual transition between the acid valley mire and calcareous fen vegetation, whilst in other parts there is a clear cut-off between the two. The rich mosaic of different mire communities resulting from the contrasting groundwater inputs makes this site of outstanding importance.

Site hydroecology and influence on designated habitats:

Both component sites are located on an outcropping sequence of Upper Jurassic and lower Cretaceous strata which, collectively, form part of a wider geological feature often referred to as the Lower Greensand ridge. The acidic, nutrient poor water that issues out of these strata has given rise to a distinctive suite of heathland and mire communities, of which, Roydon Common and Dersingham Bog represent the largest and most intact surviving examples in the east of England.

In addition to receiving groundwater from the Greensands, both sites also receive water from more calcium-rich strata in the surrounding area. Where waters issuing from these more calcareous deposits irrigate the peatland, this has led to the development of floristically-rich calcareous fen, as well as gradients between this and the more acidic mire communities. The term 'transition mire' is applied to vegetation that, in terms of its floristic composition and general ecological characteristics, is transitional between acid mire and alkaline fen and applies to many of the habitats present at this site. Transition mire is a priority Annex 1 habitat (7140 *Transition Mires and Quaking Bogs*).

The citation for Roydon Common and Dersingham Bog SAC highlights that the site supports a 'complex series of plant communities grading from wet heath through to valley mire to calcareous fen' and that 'this gradation is of outstanding interest', however, this range of habitats is not explicitly captured in the qualifying habitats in the designation.

In many cases, UK NVC plant communities cannot be easily equated to Annex 1 habitats. Some NVC communities are included in multiple Annex 1 habitat types, whilst some Annex 1 habitats are not encompassed completely by the NVC system. For example, there is a not satisfactory UK NVC plant community to describe situations where the Annex 1 habitat (H7150) Depressions on peat substrates of the *Rhynchosporion* occurs in disturbed ground alongside tracks.

Whilst the plant communities occupying the transition mire, calcareous fen and alkaline fen do not fit comfortably within the listed qualifying habitats in the site designation, it is clear from the SAC citation description that the implicit intention was that these more base-rich, less acidic habitats should be considered within the scope of the primary Annex 1 habitats listed in the designation, viz: H7150. Depressions on peat substrates of the *Rhynchosporion* and H4010 Northern Atlantic wet heaths with *Erica tetralix*. However, a more developed understanding of these communities would now see them as the following distinct Annex 1 habitats: H7230 Alkaline Fen, H7140 Transition Mire and Quaking Bog and H7210 Calcareous Fens with *Cladium mariscus* and species of the *Caricion davallianae* (Tratt *et al.* 2017).

Furthermore, two of the listed Annex 1 habitats (H7150 and H4010) in the designation often occur in small patches as integral parts of the wider fabric of 'parent' NVC communities or as mosaics within more extensive plant communities. As such, in order to maintain the integrity of the SAC's listed Annex 1 habitats *sensu stricto,* it is vital that the parent habitats, within which they are nested, are also successfully conserved.

As described above, variations in water inputs to the site have resulted in the formation of an exceptionally diverse mosaic of vegetation types. Many of the species and communities which the SAC supports are highly sensitive to changes in water supply (volumes and timing), water chemistry (pH, base-status) and water quality (nutrient status). Even small changes to the hydrology and hydrochemistry of the waters which feed the site can exert significant detrimental effects on the species and communities it supports.

The mire and fen communities on the site have suffered from the historical effects of drainage, a historical lack of active management and externally sourced nutrient enrichment. This led to changes in vegetation structure and species composition, the wetland areas becoming drier and both dry and wet habitats becoming subsumed beneath a dense carpet of scrub. Historically, peat digging may have exerted a significant influence upon the site. These small scale workings may well have served to diversify the range of conditions present e.g., by increasing the amount of open water and pool edge habitats.

At Dersingham Bog, an un-lined landfill occupies part of the former dry heath and acid valley mire.

Scrub and tree removal and the reversal of former drainage infrastructure in recent years has allowed suppressed plant communities to re-assert themselves and it has become apparent that the site now supports more habitats of European importance than was previously recognised.

The long-term restoration of the sites to achieve the best outcomes for the SAC features requires re-naturalisation of the hydrological processes that created them, in terms of both water quality/chemistry and the water supply mechanisms, including groundwater and surface water regimes

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:

- **H4010. Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath**

This wet heath habitat occurs on permanently wet, acidic substrates that are nutrient deficient, such as peats or sandy soils. The vegetation is typically dominated by Cross-leaved Heath *Erica tetralix*, Ling *Calluna vulgaris*, Purple Moor Grass *Molinia caerulea* and the bog mosses *Sphagnum compactum, Sphagnum tenellum* and, at Dersingham Bog, *Sphagnum molle* (at one of only three locations in Norfolk). In some parts of the site, this habitat supports an important range of *Cladonia* lichens, including several geographically restricted species.

At Roydon Common and Dersingham Bog, Cross-leaved Heath *Erica tetralix* and Ling *Calluna vulgaris* are frequently accompanied by abundant Deer Grass *Trichophorum cespitosum* and Purple Moor Grass *Molinia caerulea.*

Variants occur across the site depending upon the degree of ground elevation and localised differences in the water chemistry.

The H4010 feature at this SAC consists of the following wet heath UK NVC plant communities: M16a *Erica tetralix- Sphagnum compactum* wet heath (typical sub community), M16b *Erica tetralix- Sphagnum compactum* wet heath*, Succisa pratensis-Carex panicea* community*,* M16c *Erica tetralix- Sphagnum compactum* wet heath*, Rhynchospora alba-Drosera intermedia* sub-community*,* M16e *Erica tetralix* wet heath, species poor sub-community, lacking *Sphagna.*

One of the wet heath NVC sub communities present on the site includes White Beak-sedge *Rhynchospora alba*. These areas are best considered as part of the Annex 1 habitat H7150 Depressions on Peat Substrates of the *Rhynchosporion*, or at least a matrix of this and H4010 Northern Atlantic wet heaths with *Erica tetralix.*

Wet heath is very susceptible to changes in water supply. Even small reductions in the groundwater surface can have significant detrimental effects to the quality of the habitat, driving a switch to Ling *Calluna vulgaris* domination, at the expense of Cross-leaved Heath *Erica tetralix* and other associates. It is highly likely that a historic reduction in groundwater levels, resulting from the installation of drainage ditches for peat digging, resulted in the loss of key invertebrate species associated with this habitat, such as Large Marsh Grasshopper *Stethophyma grossum* (last seen in Norfolk at Dersingham Bog in 1968).

In order to restore and maintain the integrity of this feature, it is essential that water quality, quantity and supply mechanisms are kept as natural as possible and that former changes to the sites' hydrology e.g., ghost ditches, are reversed.

- **H4030. European dry heaths**

This habitat typically occurs on freely-draining, acidic to circumneutral, nutrient poor soils. The most abundant plant present is Ling *Calluna vulgaris*. Almost all lowland dry heath is semi-natural; being the result of centuries of active management, following clearance of woodland at some point in the past. At Roydon Common and Dersingham Bog, a particularly species poor form of dry heath has developed, conforming to the NVC plant community H1 *Calluna vulgaris – Festuca ovina* heath.

Apart from bracken, a range of other characteristic dry heath species occur, including: Sheep's Sorrel *Rumex acetosella,* Common Mouse-ear *Cerastium fontanum* and Heath Bedstraw *Galium saxatile*. At Dersingham Bog, species such as Dodder *Cuscuta epithymum* and Bell Heather *Erica cinerea* add

variety to the mix of species in the dry heath. In addition to flowering plants, the dry heath is also important for a range of lichens and mosses, some of which have very restricted distributions in the east of England.

In the absence of continual active management to control scrub and bracken cover, this habitat would quickly become dominated by scrub, leading to its eventual climax to woodland.

- **H7150. Depressions on peat substrates of the *Rhynchosporion***

Depressions on peat substrates of the *Rhynchosporion* is a rare habitat type in the UK and has a restricted geographical distribution. This habitat type has a very discontinuous distribution, being found in largest quantity on heaths in southern England and on blanket and raised bogs in western Britain. The habitat at Roydon Common and Dersingham Bog SAC represents an outlier to its main distribution in the UK.

This habitat generally occurs as a pioneer community of plants on bare wet sand or peat along the edges of seasonal bog pools, flushes on the edge of valley mires and even artificial exposures resulting from former peat cuttings. It often occurs as small patches amongst more extensive 'parent' habitats (which can make it difficult to estimate its overall extent). As such, it occurs as an integral component of lowland wet heath, valley mire vegetation communities and transition mires which are irrigated by base-poor groundwater.

The vegetation of this feature is typically very open and sparse and is usually characterized by an abundance of White Beak-sedge *Rhynchospora alba*. The fact that White-beaked sedge occurs in a wide-range of situations means that, as a habitat, the *Rhynchosporion* is not easily defined by the UK's National Vegetation Classification.

In some situations, White Beak-sedge occurs in contexts for which there is no distinct NVC plant community or sub community e.g. as a pioneer community on bare peat or sand. As such, any attempts to determine extent based on 'parent' NVC communities will tend to underestimate the overall resource.

Given that *Rhynchospora alba* is prone to large fluctuations in abundance and extent from year to year, a generally adopted approach has been to use its occurrence, either alone or in combination, with several other species to identify this Annex 1 habitat. The Interpretation Manual of European Union Habitats (2013) cites the following associates of this habitat type: Brown Beak-sedge *R. fusca*, Round-leaved Sundew *D. rotundifolia*, Oblong-leaved Sundew *D. intermedia*, Marsh Clubmoss *Lycopodiella inundata*. However, the geographical distribution of one of these, Brown Beak-sedge, does not extend to Norfolk and another, Marsh Clubmoss, has declined significantly in its range and is no longer a reliable constant for recognising this habitat in Norfolk.

At Roydon Common and Dersingham Bog, this Annex 1 habitat is generally associated with the UK National Vegetation Classification (NVC) types M21, M16 and M2, but overlaps with M1, M14, M16 and M29. It is clear that, given the relatively poor conformity to NVC types and the complex mosaics and transitions which occur across this site, the only way to ensure the integrity of this habitat at Roydon Common and Dersingham Bog is to maintain the entire suite of wetland habitats present across the site, including the full range from acidic mires through to alkaline fen. This is necessary to ensure that this pioneer habitat has a continuity of locations with suitable conditions to allow it to move throughout the site in response to natural fluctuations in the site's hydrology. This is not a habitat which can be considered 'fixed' to a particular location or series of locations within the site and any attempt to do so would inevitably lead to its loss or degradation.

In the UK, this habitat occurs on humid, bare or recently exposed peat. As such, in order to maintain the extent, structure and composition of this habitat, it is essential that the hydrology is maintained in a natural state and that the 'parent' habitats (of which it exists as part of the wider wetland matrix) are managed to maintain them and the processes that provide niches for the pioneer habitat. It is essential to note that even very small changes to the water supply to the site would have significant impacts on the designated interest. Any reduction in ground water levels will affect the designated interest and even

very small changes, up to 30mm draw-down would result in the loss of peat depressions and wet heath communities, resulting in a significant decrease in extent of these features.

Whilst in most situations, this habitat occurs under the influence of base-poor water, it is important to note that the influence of more base-rich inputs can provide important local variation in the associated species present. The presence of slightly more basophilous or, at least, base-tolerant species, such as *Drosera anglica* and *Pinguicula vulgaris* may be indicative of slightly more base-rich water inputs. The former has been recorded from both component sites (last seen at Roydon Common in 2000), whilst the latter has only been recorded from Roydon Common (last seen 2002, but reappeared in 2017). The loss or reduction of these species is almost certainly an indication of site degradation and the restoration of the SAC should endeavor to provide the conditions for these species to return to the site.

References

RODWELL J.S. (1991) *British Plant Communities. Vol 2 Mires and Heaths*. Cambridge University Press.

Table 1: Supplementary Advice for Qualifying Features: H4010. Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath

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**	Restore the total extent of the H4010 feature.	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, except where this is as the result of natural change resulting from the restoration of natural processes on the site. For example, a decline in extent may be desirable where it involves a switch to other habitats as a result of the restoration of natural hydrological processes within the site. A switch from wet heath to (H7150) Depressions on peat substrates of the *Rhynchosporion* (and associated parent habitats/communities) would be desirable where it occurred as the result of natural water flows having been restored. However, a switch of wet heath to dry heath as a result of the site drying out because of water abstraction would viewed as an adverse impact. 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. There is a need to restore the full natural extent of this habitat, following historic damage, including drainage, fires and nutrient enrichment. No quantitative target is currently provided for this objective. Restoration works carried out over the last three decades have restored large areas of this feature, but habitats formerly obscured or inhibited by a former lack of management are continuing to emerge, making it difficult and inadvisable at present to develop a total area for this feature.	BOYD, W. (2015). DANIELS, R.E. (1969). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution and configuration of the H4010 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	BOYD, W. (2015) DANIELS, R.E. (1969). MURRAY, AR. (2015). STEVENSON, CR &

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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.	MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Vegetation community transitions**	Restore any areas of transition between the H4010 feature and communities which form other heathland-associated habitats, such as dry and humid heaths, mires, acid grasslands, scrub and woodland.	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. At this SAC, this is an important attribute as many characteristic heathland species utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle.	BOYD, W. (2015). DANIELS, R.E. (1969). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are broadly referable to and characterised by the following National Vegetation Classification types; M16 (sub-communities M16a, M16b, M16c, M16e) and as mosaics with grassland type M25.	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 (ie, the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). Note that, in some situations on the site (as a result of fire, scrub encroachment or changes to the hydrology), M25 represents degraded M16 and, in such situations, the objective should be to restore the M16 to its natural extent.	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its	**Vegetation structure: cover of dwarf**	Restore an overall cover of dwarf shrub species which is	Variations in the structure of the heathland vegetation (vegetation height, amount of canopy closure, and patch structure) is needed to maintain high niche diversity and hence high species richness of characteristic heathland plants and	BOYD, W. (2015) MURRAY, AR. (2015).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)	**shrubs**	typically between 25-90%.	animals. Many species also utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. The structural character of the heathland feature is strongly influenced by the growing habits of its dominant species which in most cases will be ericoids (ie, plants that look like heathers, including members of the *Ericaceae* and *Empetraceae* families). The ericaceous species present on site and typical of this habitat include; ling *Calluna vulgaris* and cross-leaved heath *Erica tetralix*.	STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Vegetation structure: heather age structure**	Restore a diverse age structure amongst the ericaceous shrubs typically found on the site.	Each phase of growth associated with the characteristic heathers which dominate this feature also represents different microclimatic conditions and microhabitats which may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of heather in different phases of growth. Typically this age structure will consist of between 10-40% cover of (pseudo) pioneer heathers; 20-80% cover of building/mature heathers; <30% cover of degenerate heathers and less than <10% cover of dead heathers.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Vegetation structure: cover of gorse**	Maintain a low cover of common gorse typically at <10%.	Gorse as a component of heathland can be a very valuable wildlife habitat. Both dense and spiny, it provides good, protected cover for many wildlife species: birds, mammals and reptiles; breeding habitat for rare or declining bird species, and excellent winter roosting. The flowers, borne at a time of year when other sources of pollen or nectar are in short supply, are particularly good for insects and other invertebrate pollinators. However gorse may cause problems if unchecked by dominating an area, eliminating other typical heathland species. Mature stands may also be serious fire hazards. Two species of gorse occur in this habitat on site: European Gorse *Ulex europaeus* and Western Gorse *Ulex gallii.* European Gorse is vigorous and, left unchecked, can spread rapidly. Western Gorse occurs at Dersingham Bog and tends to be less prone to spreading, often forming a mosaic with Ericoids. Western Gorse is scarce in west Norfolk, being more associated with an Oceanic climate.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Vegetation structure: tree cover**	Restore the open character of the H4010 feature, with a typically scattered and low cover of trees and scrub (<20% cover).	Scrub (mainly trees or tree saplings above 1 m in height) and isolated trees are usually very important in providing warmth, shelter, cover, food-plants, perches, territorial markers and sources of prey for typical heathland invertebrates and vertebrates. But overall cover of scrub and trees across this habitat feature should be maintained or restored to a fairly sparse level, with a structurally complex edge and with characteristic heathland vegetation as ground cover.	BOYD, W. (2015) MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			The area of scrub/tree cover should be stable or not increasing as a whole.	STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Vegetation composition: bracken cover**	Maintain a low coverage of dense bracken, typically at <5%.	The spread of bracken *Pteridium aquilinum* is a problem on many lowland heathlands. The unpalatable nature and density of bracken as a tall-herb fern, and its decomposing litter, can smother and shade out smaller and more characteristic heathland vegetation. Usually active management of bracken is required to reduce or contain its cover across this habitat feature. But this fern has also some nature conservation value, providing bare ground for nesting Nightjar *Caprimulgus europaeus*, as well as habitat for a range of invertebrate species, such as Glow-worm *Lampyris noctiluca*.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Key structural, influential and/or distinctive: flora and fauna**	Restore the abundance of the 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 NVC community type which forms a key component of a SAC habitat, including *Calluna vulgaris, Cladonia* spp., *Erica tetralix, Myrica gale, Ulex gallii, Vaccinium oxycoccus, Sphagnum compactum, S. tenellum, S. molle, Rhynchospora alba, , Trichophorum cespitosum*	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.	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) . STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation: undesirable species**	Reduce (restore) 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;	Undesirable non-woody and woody vascular plants species 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. Undesirable species include: *Rhododendron ponticum, Gaultheria shallon, Fallopia japonica, Apium nodiflorum, Cirsium arvense, Digitalis purpurea, Epilobium* spp. (excl. *E. palustre*), *Glyceria fluitans, Juncus effusus, J. squarrosus, Oenanthe crocata, Phragmites* spp., *Ranunculus repens, Fallopia japonica, Senecio jacobaea, Rumex obtusifolius, Typha* spp., *Urtica* spp. *Alnus glutinosa, Betula* spp., *Prunus spinosa, Pinus* spp., *Rubus* spp., *Quercus* spp. *Acrocarpous mosses* <occasional.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site.	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 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.	BOYD, W. (2015). MURRAY, AR. (2015).
Structure and function (including its typical species)	**Adaptation and resilience**	Restore the H4010 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 within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected	BOYD, W. (2015). MURRAY, AR. (2015). NATURAL ENGLAND, 2015b. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being moderate, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be vulnerable overall but moderately so. This means that some adaptation action for specific issues may be required, 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.	('NBCCVAs') for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360].
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the H4010 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 Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	BOYD, W. (2015). MURRAY, AR. (2015). NATURAL ENGLAND, 2015a
Supporting processes (on which the feature relies)	**Soils, substrate and nutrient cycling**	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 H4010 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.	
Supporting processes (on which the feature relies)	**Air quality**	Maintain the concentrations and deposition of air pollutants at below the	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	More information about site-relevant Critical Loads and Levels for this SAC is available by using

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	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. Critical loads for this feature within the SAC are currently within acceptable limits however there are concerns about impacts of future increases in deposition levels on the H4010 feature.	the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Water quality**	Restore water quality and quantity to a standard which provides the necessary conditions to support the H4010 feature.	Maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities (volume and timing) 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.	BOYD, W. (2015). Roydon Common NNR management plan 2015-2020. MURRAY, AR. (2015). Dersingham Bog NNR management plan 2015-2020.
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level restore the natural hydrological regime to provide the conditions necessary to sustain the H4010 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.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 2: Supplementary Advice for Qualifying Features: H4030. European dry heaths

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**	Restore the total extent of the H4030 feature.	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, except where this is as the result of natural change resulting from the restoration of natural processes on the site. 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 reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another SAC feature, Natural England will advise on this on a case-by-case basis. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. For example, at this SAC a decline in extent may be acceptable where it involves a switch to other habitats as a result of the restoration of natural hydrological processes within the site. A switch from dry heath to (H7150) Depressions on peat substrates of the *Rhynchosporion* or H4010 Northern Atlantic wet heaths with *Erica tetralix* (and associated parent habitats/communities) would be desirable where it occurred as the result of natural water flows having been restored. However, a loss of dry heath to acid grassland as a result of nutrient enrichment would be considered detrimental. There is a need to restore the full natural extent of this habitat, following historic damage, including drainage, fires and nutrient enrichment. No quantitative target is currently provided for this feature. Restoration works carried out over the last three decades have restored large areas of this feature, but habitats formerly obscured or inhibited by a former lack of management are continuing to emerge, making it difficult and inadvisable at present to develop a total area for this feature.	
Extent and distribution of the feature	**Spatial distribution of the feature**	Restore the distribution and configuration of the H4030 feature,	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	BOYD, W. (2015). DANIELS, R.E. (1969).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	within the site	including where applicable its component vegetation types, across the site.	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.	MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the H4030 feature are referable to and characterised by the following National Vegetation Classification types; H1 *Calluna vulgaris-Festuca ovina* heath	This habitat feature comprises 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 (ie, the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). H1 *Calluna vulgaris – Festuca ovina* heath is found as part of a mosaic with U1 *Festuca ovina - Agrostis capillaris - Rumex acetosella* grassland with the latter community generally occupying the more enriched valley bottoms.	BOYD, W. (2015). DANIELS, R.E. (1969). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Vegetation community transitions**	Restore any areas of transition between the H4030 feature and communities which form other heathland-associated habitats, such as dry and humid heaths, mires, acid grasslands, scrub and woodland.	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. This is an important attribute as many characteristic heathland species utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle.	BOYD, W. (2015). DANIELS, R.E. (1969). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Vegetation structure: cover of dwarf shrubs**	Restore an overall cover of dwarf shrub species which is typically between 25-90%.	Variation in the structure of the heathland vegetation (vegetation height, amount of canopy closure, and patch structure) is needed to maintain high niche diversity and hence high species richness of characteristic heathland plants and animals. Many species also utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. The structural character of the heathland feature is strongly influenced by the growing habits of its dominant species which in most cases will be ericoids (ie, plants that look like heathers, including members of the *Ericaceae* and *Empetraceae* families). The ericaceous species heather or ling *Calluna vulgaris* and bell heather *Erica cinerea* (only found on Dersingham Bog) are the commonest and most characteristic dwarf-shrubs of this site. *Calluna* is usually the most abundant.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b)
Structure and function (including its typical species)	**Vegetation composition: bracken cover**	Maintain a low coverage of dense bracken across the H4030 feature, typically <5%.	The spread of bracken *Pteridium aquilinum* is a problem on many lowland heathlands. The unpalatable nature and density of bracken as a tall-herb fern, and its decomposing litter, can smother and shade out smaller and more characteristic heathland vegetation. Usually active management of bracken is required to reduce or contain its cover across this habitat feature. But this fern has also some nature conservation value, for example on sites where fritillary butterflies occur and utilise bracken litter habitat.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b)
Structure and function (including its typical species)	**Vegetation structure: cover of gorse**	Maintain a low cover of common gorse *Ulex europaeus* at <5% and the combined cover of *U. europaeus* and *U. gallii* at <7.5%.	Gorse as a component of heathland can be a very valuable wildlife habitat. Both dense and spiny, it provides good, protected cover for many wildlife species: birds, mammals and reptiles; breeding habitat for rare or declining bird species, and excellent winter roosting. The flowers, borne at a time of year when other sources of pollen or nectar are in short supply, are particularly good for insects and other invertebrate pollinators. However gorse will cause problems if unchecked by dominating an area, eliminating other typical heathland species. Mature stands may also be serious fire hazards. Gorse has always been a very small component of the dry heath on these sites, hence these low coverage targets.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation structure: tree cover**	Restore the open character of the H4030 feature, with a typically scattered and low cover of trees and scrub (<20% cover).	Scrub (mainly trees or tree saplings above 1 m in height) and isolated trees are usually very important in providing warmth, shelter, cover, food-plants, perches, territorial markers and sources of prey for typical heathland invertebrates and vertebrates. But overall cover of scrub and trees across this habitat feature should be maintained or restored to a fairly sparse level, with a structurally complex edge and with characteristic heathland vegetation as ground cover. If scrub is locally important for any associated species with their own specific conservation objectives, then a higher level of cover will be acceptable. The area of scrub/tree cover should be stable or not increasing as a whole.	BOYD, W. (2015). MURRAY, AR. (2015). . STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Vegetation structure: heather age structure**	Restore a diverse age structure amongst the ericaceous shrubs typically found on the site.	Each phase of growth associated with the characteristic heathers which dominate this feature also represents different microclimatic conditions and microhabitats which may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of heather in different phases of growth. Typically this age structure will consist of between 10-40% cover of (pseudo) pioneer heathers; 20-80% cover of building/mature heathers; <30% cover of degenerate heathers, and less than <10% cover of dead heathers. Much of the restoration work carried out on the site has been in the last two decades, resulting in large areas of uniformly-aged heather. Heather should now be managed to create a more varied age structure.	BOYD, W. (2015). MURRAY, AR. (2015). STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Vegetation: undesirable species**	Reduce/restore 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:	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. Undesirable species include: *Rhododendron ponticum,* Wood Small-reed *Calamagrostis epigejos* Ragwort *Senecio jacobaea*, Bramble *Rubus spp*, Creeping Thistle *Cirsium arvense*, Broom *Cistus scoparius*, *Campylopus stellatus*.	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b)
Structure and function (including its typical	**Key structural, influential and/or**	Restore the abundance of the species listed below to enable each of them to be a viable	See the supporting/explanatory notes for this attribute above in Table 1.	BOYD, W. (2015). MURRAY, AR. (2015).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)	**distinctive species: flora and fauna**	component of the H4030 habitat: The constant and preferential plants of the H1 NVC community type including *Calluna vulgaris*, *E. cinerea* (Dersingham Bog only), *E. tetralix*		STEVENSON, CR & MASSON, J. (2013a). STEVENSON, CR & MASSON, J. (2013b).
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the H4030 feature site.	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, watercourses and verges, outside of the 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. The site has been the focus of a lot of restoration works involving tree removal. A restore target has been set as the soil profile is still in a very disturbed state and is lacking the natural stability provided by long-established soils, such as a developed humic layer to increase water retention in the soils. As a result, the dry heath is very prone to droughts and secondary pathogen attack e.g. by heather beetle. Over time, the objective should be to restore soil function which will, in turn, increase resilience to increased climatic extremes.	BOYD, W. (2015). MURRAY, AR. (2015).
Structure and function (including its typical species)	**Adaptation and resilience**	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 the supporting/explanatory notes for this attribute above in Table 1.	BOYD, W. (2015). MURRAY, AR. (2015).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	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 H4030 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. The site has been the focus of a lot of restoration works involving tree removal. The soil profile is still in a very disturbed state and is lacking the natural stability provided by long-established soils, such as a developed humic layer to increase water retention in the soils. As a result, the dry heath is very prone to droughts and secondary pathogen attack e.g. by heather beetle. Over time, the objective should be to restore soil function which will, in turn, increase resilience to increased climatic extremes.	BOYD, W. (2015). MURRAY, AR. (2015).
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to 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. Maintain low nutrient levels to maintain high numbers of species through the management activities of grazing, burning, mowing, sod-cutting and scrub/tree cutting. 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 ground/peat where it is not too frequently disturbed by vehicles or feet.	NATURAL ENGLAND, 2015.
Supporting processes (on which the feature relies)	**Air quality**	Maintain the concentrations and deposition of air pollutants at 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 the supporting/explanatory notes for this attribute above in Table 1. Critical loads for this feature within the SAC are currently within acceptable limits however there are concerns about impacts of future increases in deposition levels on the H4030 feature.	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).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature relies)	**Water quality**	Where associated features or mosaics are dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the H4030 feature.	Whilst this habitat is xerophytic, in order to ensure that mosaics and transitions are maintained, maintaining the quality and quantity of water supply to the site 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. A restore target has been set as part of the SAC is located on a former landfill site which produces a leachate plume with elevated levels of several pollutants, including N compounds.	BOYD, W. (2015). MURRAY, AR. (2015).
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 H4030 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 mosaics and transitions from the feature to the other designated habitats on this site. 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.	
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: n/a				

Table 3: Supplementary Advice for Qualifying Features: H7150. Depressions on peat substrates of the *Rhynchosporion*

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**	Restore the total extent of the H7150 feature.	See the supporting/explanatory notes for this attribute above. This Annex 1 feature is difficult to map due to both the small size of individual patches and the transitory nature of elements of the habitat (e.g., when on disturbed shallow peat/sand). As a result, the extent, or even presence, on protected sites is difficult to measure. No quantitative target is provided for this feature. Restoration works carried out over the last three decades have restored large areas of this feature, but habitats formerly obscured or inhibited by a former lack of management are continuing to emerge, making it difficult and inadvisable at present to develop a total area for this feature.	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a) STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution and configuration of the H7150 feature, including where applicable its component vegetation types, across the site.	Distribution includes the spatial pattern or arrangement of this habitat feature, and its component vegetation types, across the site. Changes in distribution may affect the nature and range of the vegetation communities present, the operation of the physical, chemical, and biological processes in the system and the resiliency of the site and its features to changes or impacts.	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a) STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Vegetation community composition**	Maintain the composition of the vegetation communities within which the H7150 feature occurs	This habitat feature comprises 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. These features do not always confirm to the UK NVC plant communities and, in some cases individual NVC communities may occur across several different Annex 1 habitats. Maintaining or restoring these characteristic and distinctive vegetation types, and the	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			range of types as appropriate, will be important to sustaining the overall habitat feature. This habitat feature occurs in small scattered patches, often as an integral component of other larger 'parent' communities. As a result, this habitat is not well defined by NVC plant communities and it may be better to take a wider view of the structure and function with regards to water supply (volumes, timing, quality), micro-topography (depressions that bring the substrate surface in contact with the groundwater surface) and vegetation community structure (unmanaged transition mires may become too rank to support this habitat).	STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species: flora and fauna**	Restore the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; White Beak-sedge *Rhynchospora alba*, the bog moss *Sphagnum papillosum*, Bog Asphodel *Narthecium ossifragum*, Round-leaved Sundew *Drosera rotundifolia*, Oblong-leaved Sundew *Drosera intermedia*, Great Sundew *Drosera anglica,* Marsh Violet *Viola palustris*, Butterwort *Pinguicula vulgaris*, Bog Orchid *Hammarbya paludosa* and, in relatively base-rich sites, brown mosses such as *Drepanocladus revolvens* and *Scorpidium scorpioides*. Large Marsh Grasshopper *Stethophyma grossum.*	See the supporting/explanatory notes for this attribute above.	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a) STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Invasive, non-native and/or introduced species**	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the H7150 feature.	Invasive or introduced non-native species can be a serious potential threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g., use of broad spectrum pesticides).	BOYD, W. (2015). MURRAY, AR. (2015). RODWELL J.S. (1991) STEVENSON, CR & MASSON, J. (2013a) STEVENSON, CR & MASSON, J. (2013b). YAXLEY, R., (1999).
Structure and function (including its typical species)	**Presence/cover of woody species**	Restore a very low cover (<1% of the area) of scrub or trees within stands of H7150.	Native trees and shrubs occur naturally on bog and fen surfaces but an abundance of scrub and trees on bogs and fens is detrimental because they are indicators and perpetrators of drying out and cause damage to vegetation structure through shading effects. Birch, alder, pine, willow and rhododendron (an invasive non-native species) are the main species of concern. The seeds of most invasive woody species are wind dispersed.	BOYD, W. (2015) MURRAY, AR. (2015).
Structure and function (including its typical species)	**Exposed substrate**	Maintain a low cover of exposed substrate of between 5-10% across the H7150 feature.	For this wetland habitat type, maintaining some continuous extent of exposed, open ground surface is required to support the establishment and supply of those component species which often rely on wet and sparsely-vegetated conditions.	BOYD, W. (2015). MURRAY, AR. (2015).
Structure and function (including its typical species)	**Hydrology**	At a site, unit and/or catchment level restore natural hydrological processes to provide the conditions necessary to sustain the H7150 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. The hydrological status of H7150 is largely dependent on the overall hydrological integrity of the larger peatland in which it is found. Wheeler *et al*. (2009) provide range and mean for summer & winter water levels for those wetland NVC types constituting Annex 1	BOYD, W. (2015) MURRAY, AR. (2015).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			habitats. This provides a rough guide to appropriate levels, but it is critical that individual sites and their needs are considered as there is considerable variation within the NVC communities listed and recorded water levels.	
Structure and function (including its typical species)	**Water chemistry**	Restore the surface water and groundwater supporting the H7150 feature at a low nutrient status.	UKTAG (2012) provides threshold values for nitrate concentration in groundwaters for different wetland types. The threshold values will mainly be used in the characterisation of GWDTE status for the WFD, primarily as a risk screening tool, to assess if sites are 'at risk' or 'not at risk' from groundwater mediated nutrient pressure. Due to the complex cycling of nutrients within many GWDTE, these threshold values are less well suited for application within sites but rather just to groundwater that is directly feeding the site.	
Structure and function (including its typical species)	**Hydrology**	Maintain a high piezometric head and permanently high water table (allowing for natural seasonal fluctuations) on groundwater dependent sites.	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. Some examples of H7150 may be wholly or partly groundwater dependent. Others have a greater dependence on surface water or rain water inputs. It is critically important to understand the eco-hydrological context of all sites.	BOYD, W. (2015). MURRAY, AR. (2015).
Structure and function (including its typical species)	**Adaptation and resilience**	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 the supporting/explanatory notes for this attribute above in Table 1.	BOYD, W. (2015). MURRAY, AR. (2015).
Structure and function (including its typical species)	**Supporting off-site habitat**	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the H7150 habitat.	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	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			('metapopulations'), pollination or to prevent/reduce/absorb damaging impacts from adjacent land uses e.g., pesticide drift, nutrient enrichment. This habitat occurred as part of a vast mosaic of heath, mire and fen along the base of the scarp slope marking the western edge of the Sandringham Sands outcrop. Remnants of this habitat still cling on at Ingoldisthorpe Common, Cat's Bottom, Castle Rising Old Fen, Castle Rising Ling Common and adjacent Golf-course, Sugar Fen and Bawsey Country Park. Other sites, lost to scrub/drained at an earlier date include: Ken Hill, Babingley and Derby Fen. The water supply from the Sandringham Sands aquifer is still relatively intact (volumes and quality). The potential for restoration of even severely degraded sites in the area is therefore high.	
Supporting processes (on which the feature relies)	**Air quality**	Restore the concentrations and deposition of air pollutants to within 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 the supporting/explanatory notes for this attribute in Table 1 above. The lower critical loads for nitrogen and acid deposition are currently being exceeded for this feature of the SAC. In addition, the lower critical level for Ammonia is being exceeded for this feature.	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 the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain or restore the structure, functions and supporting processes associated with the H7150 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. This habitat in most cases requires ongoing cutting or grazing maintain its open character.	BOYD, W. (2015). MURRAY, AR. (2015). NATURAL ENGLAND, 2015.
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