



Mid Cornwall Moors SSSI

Supporting Information

A supplement to the notification document

Contact points and further information

This supplement is issued on request by Natural England's Devon, Cornwall and Isles of Scilly Area Team and is intended to be read in conjunction with the notification document for owners, occupiers and other notified parties. Our address for correspondence is:

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Summary

The Mid Cornwall Moors SSSI is notified under section 28C of the Wildlife and Countryside Act 1981 (as amended). The site supports a diverse mosaic of semi-natural habitats, including heaths, fens, grasslands, woodlands, scrub and species-rich hedgerows, with ponds and waterways. It is of special interest for the following nationally important features that occur within and are supported by the wider habitat mosaic:

- wet and dry lowland heathland;
- lowland fens (including habitats often referred to as mires, swamps and bogs);
- wet and dry broad-leaved woodlands;
- species-rich neutral grasslands;
- an assemblage of nationally rare and nationally scarce flowering plants and ferns;
- populations of Cornish eyebright *Euphrasia vigursii*, coral-necklace *Illecebrum verticillatum*, chamomile *Chamaemelum nobile*, lesser butterfly-orchid *Platanthera bifolia*, chaffweed *Centunculus minimus*, lesser water-plantain *Baldellia ranunculoides* and allseed *Radiola linoides*;
- marsh fritillary butterfly *Euphydryas aurinia*;
- assemblage of invertebrates chiefly associated with scrub heath-moorland;
- populations of the water beetle *Hydrochus nitidicollis*, the mud snail *Omphiscola glabra* and the slender amber snail *Oxyloma sarsii*;
- breeding willow tit *Poecile montanus*; and
- geological features that demonstrate the mineralisation which occurs at the latest stage of granitic emplacement.

Parts of the previously notified Goss and Tregoss Moors SSSI, Breney Common SSSI and Red Moor SSSI are not considered to be of special interest. Accordingly, these areas are proposed for denotification under Section 28D of the Wildlife and Countryside Act 1981, as inserted by Schedule 9 to the Countryside and Rights of Way Act 2000.

1. Information used to support the selection of the Mid Cornwall Moors SSSI

Feature	Data source	Author	Date	Content
General	Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapters 2a. Woodlands, 4. Lowland heathland, 7. Fens, 11. Vascular plants, and 17. Invertebrates. Nature Conservancy Council, Peterborough	Nature Conservancy Council	1989	National selection guidelines for biological SSSIs (re-published online by JNCC in 2012)
	Analysis of the remaining resource of the Mid Cornwall Moors. A report to NCC SW Region	Lock, L	1990	Inventory of Mid Cornwall Moors habitat resource with particular reference to wet acid pastures.
	British Plant Communities. Volume 1: Woodlands and scrub. Cambridge University Press	Rodwell, J.S. (ed.)	1991	National Vegetation Classification (NVC) for woodlands and scrub
	British Plant Communities. Volume 2: Mires and heaths. Cambridge University Press	Rodwell, J.S. (ed.)	1991	NVC for mires and heaths
	British Plant Communities. Volume 3: Grasslands and montane communities. Cambridge University Press	Rodwell, J.S. (ed.)	1992	NVC for grasslands and montane communities
	British Plant Communities. Volume 4: Aquatic communities, swamps and tall-herb fens. Cambridge University Press	Rodwell, J.S. (ed.)	1995	NVC for aquatic communities, swamps and tall-herb fens
	Vegetation Survey of Goss Moor NNR: A baseline for assessing the effect of weir construction in the Fal on the surrounding heath/mire complex. Report to English Nature	Dale, M.P. & Dinsdale, J.M. University of Plymouth Dept of Biological Sciences	1996	Baseline vegetation survey at six locations on Goss Moor NNR
	An Ecological Assessment of the Plant Communities and their Associated Soils at Goss Moor NNR – a baseline for monitoring the effect of the Indian Queens Peak Power facility at St Dennis, near St Austell, Cornwall. Report to Indian Queens Power Ltd	Dale, M.P. Dinsdale, J.M. Powe, C. & Ramsay, P. University of Plymouth Dept of Biological Sciences	1997	Baseline vegetation survey, foliage and substrate analyses of plant communities on Goss Moor NNR
	Red Data Book for Cornwall & Isles of Scilly	Spalding, A. (ed)	1997	Threat status of species in Cornwall & Isles of Scilly

Feature	Data source	Author	Date	Content
	Cornwall's Biodiversity: Volume 2 Action Plans	Cornwall Biodiversity Initiative	1998	Cornwall Biodiversity Action Plans
	Red Moor Nature Reserve Management Plan	Howard, A	1998	Cornwall Wildlife Trust management plan
	A391 St Austell to Innis Downs extended Phase 1 Ecological Survey. Report to Cornwall County Council	Wilkins, J. & Davey, S. Cornwall Environmental Consultants (CEC) Ltd	2002	Extended Phase 1 habitat survey of A391 corridor
	Goss Moor Phase 1 & Marsh Fritillary habitat surveys and baseline lichen survey	Wilkins, J. & Davey, S. CEC Ltd	2002	Baseline surveys on Goss Moor for proposed development of Energy from Waste Plant
	Quoit Heath Management Plan. A report to Cornwall Wildlife Trust	Gowenlock, J.	2002	Description and mapping of vegetation communities at Quoit Farm
	Retire Common SSSI NVC Survey. A report to the Mid Cornwall Moors LIFE Project, English Nature	Bright, J.C. & Bennallick, I. J. CEC Ltd	2004	Description and mapping of vegetation communities on Retire Common SSSI
	NVC Survey of Tregonhay Farm. A report to English Nature	Wilson, P.J.	2004	Description and mapping of vegetation communities at Tregonhay Farm
	NVC Survey of Chark Moor. A report to English Nature	Wilson, P.J.	2004	Description and mapping of vegetation communities at Chark Moor
	Guidelines for the removal of an SSSI notification (denotification)	English Nature	2005	National guidelines for identifying cases where denotification may be appropriate
	Criggan Moor County Wildlife Site NVC Survey. Report to Mid Cornwall Moors LIFE Project, English Nature	Bright, J.C. & Adams, S. CEC Ltd	2005	Description and mapping of vegetation communities on Criggan Moor
	Tregonetha and Belowda Downs SSSI NVC Survey. Report to Mid Cornwall Moors LIFE Project, English Nature	Davies, M. & Howie, A. CEC Ltd	2005	Description and mapping of vegetation communities on Tregonetha and Belowda Downs SSSI
	Goss and Tregoss Moors SSSI NVC Survey. Report to Mid Cornwall Moors LIFE Project, English Nature	Davies, M. & Howie, A. CEC Ltd	2006	Description and mapping of vegetation communities on Goss and Tregoss Moors SSSI
	Helman Tor Nature Reserve Management Plan 2008-2013. A report to Cornwall Wildlife Trust	Davies, M. CEC Ltd	2007	Management plan and NVC survey
	State of the Natural Environment 2008. Natural England, Peterborough.	Natural England	2008	Review of the state of England's natural environment

Feature	Data source	Author	Date	Content
	Tregonetha Downs Nature Reserve Management Plan 2008-2013. A report to Cornwall Wildlife Trust	Davies, M. CEC Ltd	2008	Management Plan
	Analysis of Mid Cornwall Moors NVC data. Produced for Natural England	Bennallick, I.J.	2009	NVC breakdown and coverage for each site
	Taxon designation database. Produced for Natural England	Bennallick, I.J.	2009	Summary of species status
	NVC Survey of Tregonhay Farm. A report to Natural England	Sproull, J. & Davies, M. CEC Ltd	2010	NVC surveys and condition assessment reports
	NVC Survey of Blackacre Farm. A report to Natural England	Sproull, J. & Davies, M. CEC Ltd	2010	NVC surveys and condition assessment reports
	NVC Survey of Ennisworkey. A report to Natural England	Sproull, J. & Davies, M. CEC Ltd	2010	NVC surveys and condition assessment reports
	NVC Survey of Mollinis Downs. A report to Natural England	Sproull, J. & Davies, M. CEC Ltd	2010	NVC surveys and condition assessment reports
	NVC Survey of Bryn Moor. A report to Natural England	Sproull, J. & Davies, M. CEC Ltd	2010	NVC surveys and condition assessment reports
	Mid Cornwall Moors notable species database. Produced for Natural England	Bennallick, I.J.	2010	Summary of notable species occurring within the SSSI
	Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra	Lawton, J.H. <i>et al.</i>	2010	Makes recommendations for increasing the coherence of ecological networks in England
	Guidelines for the Selection of Biological SSSIs. Part 1: Rationale, Operational Approach and Criteria for Site Selection. Joint Nature Conservation Committee, Peterborough.	Bainbridge, I., Brown, A., Burnett, N., Corbett, P., Cork, C., Ferris, R., Howe, M., Maddock, A. & Pritchard, S. (eds)	2013	National selection guidelines for biological SSSIs
	Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 3. Lowland grasslands. JNCC, Peterborough	Jefferson, R.G., Smith, S.L.N. & MacKintosh, E.J.	2014	National selection guidelines for SSSIs for lowland grasslands
	Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 14. Birds. JNCC, Peterborough	Drewitt, A.L., Whitehead, S. & Cohen, S.	2015	National selection guidelines for SSSIs for birds

Feature	Data source	Author	Date	Content
	Mid Cornwall Moors NVC and CSM Survey 2015. A report to Natural England	Osmunda Ecology	2016	NVC surveys and condition assessment reports for previously unsurveyed areas
	Goss Moor NNR Management Plan 1 April 2015 to 31 March 2020	Bowler, P.	2016	Goss Moor NNR management plan
Lowland heathland	Specialist support for notification of Mid Cornwall Moors as a SSSI for wet and dry heathland	Isabel Alonso (Natural England)	2016	Support for notifying the site for heathland features from Natural England's senior heathland specialist
Fens	Fen Habitats and the EC Habitats and Species Directive Part 1. Concept and Compass of Selected Fen Habitat Categories. Unpublished report to JNCC, Peterborough	Wheeler, B.D.	1995	EU interpretation manual of fen habitats listed on the EC Habitats and Species Directive
	Fen Habitats and the EC Habitats and Species Directive Part 2. Distribution and Status of Selected Fen Habitats in Britain. Unpublished report to JNCC, Peterborough	Wheeler, B.D. & Shaw, S.C.	1995	Distribution and status of fen habitats in Britain
	File note: Visit to Goss Moor, Cornwall, 17 July 2002	Roger Meade (English Nature)	2002	An evaluation of Transition Mire and Quaking Bog communities at Goss Moor
	Spatial and temporal analysis of vegetation mosaics for conservation: poor fen communities in a Cornish valley mire. <i>Journal of Biogeography</i> 30 : 1427 - 1443	Southall, E.J., Dale, M.P. & Kent, M.	2003	Description and analysis of spatial and temporal variation in sub-communities within patch mosaics of vegetation to inform conservation management
	Specialist support for notification of Mid Cornwall Moors as a SSSI for fens	Iain Diack (Natural England)	2016	Support for notifying the site for fen features from Natural England's senior wetland specialist
Species-rich neutral grassland	Monitoring the condition of lowland grassland SSSIs: Part 1 – English Nature's rapid assessment method. English Nature Research Reports 315	Robertson, H.J. & Jefferson, R.G.	2000	Rationale behind the rapid assessment methodology, describing practical ways of making rapid assessments
	The condition of lowland BAP priority grasslands: results from a sample survey of non-statutory stands in England. English Nature Research Reports 636	Hewins, <i>et al.</i>	2005	Information on the national status of grassland habitats

Feature	Data source	Author	Date	Content
	National assessment of lowland neutral grassland. Paper to the Council of English Nature	Holmes, P., Pinches, C. & Jefferson, R.J.	2005	Strategic review of the conservation of lowland neutral grassland in England
	The European context of British Lowland Grasslands. Report, Joint Nature Conservation Committee 394	Rodwell, <i>et al.</i>	2007	Range of unimproved grasslands in UK and assessment at a European level
	Specialist support for notification of Mid Cornwall Moors as a SSSI for grassland	Jefferson, R.G. (Natural England)	2016	Support for notifying the site for grassland features from Natural England's senior grassland specialist.
Vascular plants	British Red Data Books 1. Vascular plants, 3 rd ed.	Wiggington, M.J.	1999	Threat status of plants
	New Atlas of the British and Irish Flora	Preston, C.D., Pearman, D.A., & Dines, T.D.	2002	Information on plant species distribution
	The vascular plant Red Data List for Great Britain	Cheffings, C.M. & Farrell, L. (eds).	2005	Threat status of plants
	England Red List – A Vascular Plant Red List for England. Botanical Society of Britain and Ireland, Bristol.	Stroh, P.A., Leach, S.J., August, T.A., Walker, K.J., Pearman, D.A., Rumsey, F.J., Harrower, C.A., Fay, M.F., Martin, J.P., Pankhurst, T., Preston, C.D. & Taylor, I.	2014	Threat status of plants
	A tool for assessing the current conservation status of vascular plants on SSSIs in England: May 2006 (ENRR 690)	Leach, S.J. & Rushbridge, D.J.	2006	Updated statuses for Red List, nationally rare and nationally scarce vascular plants
	The status of Coral-necklace <i>Illecebrum verticil/atum</i> L. (Caryophyllaceae) in Great Britain. <i>Watsonia</i> 27 : 143-148	Pearman, D.A.	2008	Assessment of the status of coral necklace
	Survey data. Produced for Natural England	Bennallick, I.J.	2009	Common Standards Monitoring vascular plant survey of Goss and Tregoss Moor SSSI and Retire Common SSSI
	New Flora of the British Isles 3 rd edition	Stace, C.	2010	Updated flora of the British Isles
	Red List Update. <i>BSBI news</i> 116 : p.53	Leach, S.J. & Walker, K.	2010	Revised threat assessment for coral-necklace

Feature	Data source	Author	Date	Content
	Specialist support for notification of Mid Cornwall Moors as a SSSI for vascular plants	Martin, J (Natural England)	2016	Support for notifying the site for vascular plant features from Natural England's vascular plant specialist
Woodland	Woodland surveys in South-west England using the National Vegetation Classification. Published by Nature Conservancy Council	Heath, M. & Oakes, H.	1991	Includes site information for key Cornish sites
	Floristic variation and willow carr development within a south west England wetland. <i>Applied Vegetation Science</i> 6 : 63-72	Southall, E.J. Dale, M.P. & Kent, M.	2003	Evaluation of ecological changes resulting from succession of poor fen to wet willow woodland on Goss Moor NNR
	Specialist support for notification of Mid Cornwall Moors as a SSSI for woodland	Goldberg, E (Natural England)	2016	Support for notifying the site for woodland features from Natural England's woodland senior specialist
Marsh fritillary	The population dynamics of small colonies of the butterfly <i>Euphydryas aurinia</i> University of Oxford unpublished PhD thesis	Porter, K.	1981	Meta-population study of marsh fritillary
	The UK status and suspected metapopulation structure of a threatened European butterfly, the marsh fritillary <i>Euphydryas aurinia</i> . <i>Biological Conservation</i> 67 : 239-249	Warren, M.S.	1994	The UK status of the marsh fritillary
	Pre-species Recovery Project: The Marsh Fritillary Butterfly (<i>Euphydryas aurinia</i>) on the Mid-Cornwall Moors and the Upper Fowey Valley: current status, habitat management and potential sites. A report to English Nature	Hobson, R.	1997	Report summarising distribution status of marsh fritillary within the Mid Cornwall Moors and Bodmin Moor
	Managing damp grassland for the Marsh Fritillary butterfly. Butterfly Conservation Technical Advice Note	Hobson, R.	2000	Marsh fritillary habitat management note
	The Millennium Atlas of Butterflies in Britain and Ireland. Oxford University Press	Asher, J., Warren, M., Fox, R., Harding, P. & Jeffcoate, S.	2001	UK and Ireland butterfly atlas
	Conservation Biology of the Marsh Fritillary <i>Euphydryas</i> . University of Leeds unpublished PhD thesis	Bulman, C.R.	2001	Meta-population study of marsh fritillary

Feature	Data source	Author	Date	Content
	The marsh fritillary in Cornwall: site dossier. Incorporating the Bodmin Moor larval survey 2000. Report No. S01-32, Butterfly Conservation, Wareham	Hobson, R. & Budd, P.	2001	Marsh fritillary site dossier for Cornwall
	The Marsh Fritillary <i>Euphydryas aurinia</i> on the Mid-Cornwall Moors. Report for Ecoscope Ltd.	Hobson, R. (Butterfly Conservation)	2001	A summary report of status
	Dynamic populations in a dynamic landscape: the metapopulation structure of the marsh fritillary butterfly. <i>Ecography</i> 25 : 224-232	Wahlberg, N., Klemetti, T. & Hanski, I.	2002	Study on the population dynamics of the marsh fritillary in a dynamic landscape
	A survey of breeding habitat and potential habitat extensions for the Marsh Fritillary butterfly <i>Euphydryas aurinia</i> between Goss Moor NNR and Breney Common SSSI (cSACs). BSc project	Tildesley, R.W.	2002	Nature and extent of potential breeding habitat between Goss Moor and Breney Common with management recommendations
	Conserving the Marsh Fritillary in Britain. <i>British Wildlife</i> 13 : 404-411	Hobson, R., Bourn, N. & Warren, M.	2002	Status of marsh fritillary in Britain
	Collection of monitoring data for Marsh Fritillary <i>Euphydryas aurinia</i> larval webs on seven sites in Mid Cornwall. Report to LIFE project	Tunmore, M.	2003	Baseline transect data on larval webs across seven LIFE project sites
	A391 St Austell to the A30 Link Road Marsh Fritillary Larval Web Survey. A report to English Nature	Tunmore, M. & Bright, J.	2003	Status of marsh fritillary along the proposed route corridor
	A Survey of Marsh Fritillary <i>Euphydryas aurinia</i> – Mid Cornwall Moors 2003. A report to English Nature	Spalding, A.	2003	Marsh fritillary flight survey at ten Mid-Cornwall Moor sites
	Monitoring the Marsh Fritillary <i>Euphydryas aurinia</i> at Goss Moor and Breney Common cSAC 1996 – 2002: Update 2003. Report to English Nature	Hobson, R. & Bulman, C.R.	2004	Population estimates of marsh fritillary at Goss Moor and Breney Common
	Marsh Fritillary. Survey of adults on the Mid-Cornwall Moors, 2004: A Summary	Tunmore, M.	2004	A summary of field work undertaken during 2004
	Guidance Notes for the Definition and Mapping of Habitat Quality for Marsh Fritillaries. CCW Natural Science Report No. 03/5/01	Fowles, A.P.	2004	Outline of system for standardising the methodology for the identification and mapping of marsh fritillary habitat

Feature	Data source	Author	Date	Content
	Mitigation for the Marsh Fritillary in relation to the A30 Bodmin to Indian Queens Road Improvement proposals	Spalding Associates	2005	An outline of proposed mitigation strategy for marsh fritillary in response to the proposed A30 road improvement
	Marsh Fritillary monitoring on nine sites in Mid Cornwall: flight and larval web surveys April 2005. A report to the Mid Cornwall Moors LIFE Project, English Nature	Tunmore, M., Bright, J., Robinson, F., Hodgson, D. & Hobson, R.	2005	The 2005 status and distribution of marsh fritillary at nine LIFE sites in Mid-Cornwall
	Marsh Fritillary monitoring on nine sites in Mid Cornwall: flight and larval web surveys April 2006. A report to the Mid Cornwall Moors LIFE Project, English Nature	Tunmore, M. , Bright, J., Robinson, F., Hodgson, D. & Hobson, R.	2006	The 2006 status and distribution of marsh fritillary at nine LIFE sites in Mid-Cornwall
	The Mid-Cornwall Moors LIFE Project: Conservation of the Marsh Fritillary <i>Euphydryas aurinia</i> (Rott.) at Landscape Level. <i>Atropos</i> 28 : 57-61	The Mid-Cornwall Moors LIFE Project Team	2006	Summary of the Mid-Cornwall Moors LIFE project
	Mapping the habitat quality of patch networks for the Marsh Fritillary <i>Euphydryas aurinia</i> (Rottemburg, 1775) (Lepidoptera, Nymphalidae) in Wales. <i>Journal of Insect Conservation</i> 10 : 161-177	Fowles, A.P. & Smith, R.G.	2006	Assessment of 35 core marsh fritillary landscapes
	Marsh Fritillary monitoring on nine sites in Mid Cornwall: flight and larval web surveys April 2007. A report to the Mid Cornwall Moors LIFE Project, English Nature	Tunmore, M., Bright, J., Robinson, F., Hodgson, D. & Hobson, R	2007	The 2007 status and distribution of marsh fritillary at nine LIFE sites in Mid-Cornwall
	Marsh Fritillary Monitoring on nine Sites in Mid Cornwall: flight and larval web surveys March 2008. A report to the Mid Cornwall Moors LIFE Project, English Nature	Tunmore, M., Bright, J., Robinson, F., Hodgson, D. & Hobson, R	2008	The 2008 status and distribution marsh fritillary at nine LIFE sites in Mid-Cornwall
	Mid-Cornwall Moors Marsh Fritillary <i>Euphydryas aurinia</i> monitoring 2010 larval web surveys March 2011. A report to Natural England	Tunmore, M., Bright, J., Hodgson, D. & Nelson, J.	2011	The 2010 status and distribution of marsh fritillary on the proposed Mid Cornwall Moors SSSI sites

Feature	Data source	Author	Date	Content
	Mark-recapture on large spatial scale reveals long distance dispersal in the Marsh Fritillary, <i>Euphydryas aurinia</i> . <i>Ecological Entomology</i> 36 : 499-510	Zimmerman, K., Fric, Z., Jiskra, P., Kopeckova, M., Vlasanek, P., Zapletal, M. & Konvicka, M.	2011	Evidence of long range dispersal of marsh fritillary between patches of suitable habitat
	Demography of adults of the Marsh Fritillary butterfly, <i>Euphydryas aurinia</i> (Lepidoptera: Nymphalidae) in the Czech Republic: Patterns across sites and seasons. <i>European Journal of Entomology</i> 108 : 243-245	Zimmerman, K., Blazkova, P., Cizek, O., Fric, Z., Hula, V., Kepka, P., Novotny, D., Slamova, I. & Konvicka, M.	2011	Evidence for the regional persistence of marsh fritillary being dependant on the recolonisation of temporarily vacant sites by dispersing individuals
	Butterflies on the brink: habitat requirements for declining populations of the marsh fritillary (<i>Euphydryas aurinia</i>) in SW England. <i>Journal of Insect Conservation</i> 15 : 153-163	Smee, M, Smyth, W., Tunmore, M., Ffrench-Constant, R. & Hodgson, D.	2010	A statistical analysis of the habitat and management requirements for marsh fritillary in Mid Cornwall
	Mid-Cornwall Moors Marsh Fritillary larval web monitoring. December 2011. A report to Natural England	Tunmore, M., & Bright, J.	2011	The 2011 status and distribution of marsh fritillary on proposed Mid Cornwall Moors SSSI sites
	Mid Cornwall Moors Marsh Fritillary adult monitoring 2012. A report to Natural England	Tunmore, M., & Bright, J.	2012	The 2012 status and distribution of marsh fritillary on proposed Mid Cornwall Moors SSSI sites
	Specialist support for notification of Mid Cornwall Moors as a SSSI for the marsh fritillary butterfly	David Heaver (Natural England)	2016	Support for notifying the site for the marsh fritillary from Natural England's senior invertebrate specialist
Invertebrates	British Red Data Books 2. Insects	Shirt, D.B. (ed)	1987	Status of insect species
	British Red Data Books 3. Invertebrates other than insects	Bratton, J.H. (ed)	1991	Status of invertebrate species other than insects
	Tranche 2 Action Plans. Volume 4 – invertebrates. Report to English Nature	UK Biodiversity Group	1996 - 1999	Invertebrate Action Plans
	The development of ISIS: a habitat-based invertebrate assemblage classification system for assessing conservation interest in England. <i>Journal of Insect Conservation</i> 10 : 179-188	Webb, J.R. & Lott, D.A.	2006	Description of the ISIS Prototype invertebrate assemblage classification system

Feature	Data source	Author	Date	Content
	Surveying terrestrial and freshwater invertebrates for conservation value. Natural England Research Report NERR005	C.M. Drake, D.A. Lott, K.N.A. Alexander & J. Webb	2007	Description of invertebrate sampling surveillance and analysis using ISIS
	Surveying terrestrial and freshwater invertebrates for conservation value. Natural England Research Information Note RIN005 -	C.M. Drake, D.A. Lott, K.N.A. Alexander & J. Webb	2007	Summary of NE Research Report NERR005
	A New Red List of British Butterflies. A report to JNCC	Fox, R., Warren, M. & Brereton, T	2007	Revised status of British butterflies
	Goss and Tregoss Moor NNR invertebrate baseline monitoring report. Report to Natural England	ECOSA	2008	Baseline invertebrate survey of Goss Moor NNR
	Synopsis of ISIS 2009 and its use in Common Standards Monitoring	Lott, D.A.	2008	Description of the ISIS assemblage type classification
	Notable and adhoc invertebrate species database. Produced for Natural England	Bennallick, I.J.	2009	Notable and adhoc species list for Breney Common SSSI and Goss & Tregoss Moors SSSI
	A review of the scarce and threatened Coleoptera of Great Britain Part 3: Water beetles of Great Britain	Foster, G.N.	2010	Status of water beetles for Great Britain
	Survey data produced for Natural England	Saunders, P.	2010	Common Standards Monitoring invertebrate survey of Red Moor SSSI
	Survey data produced for Natural England	Saunders, P.	2010	Common Standards Monitoring invertebrate survey of Goss and Tregoss Moors SSSI
	Incidental invertebrate records produced for Natural England	Saunders, P.	2010	Incidental records for Redmoor SSSI, Breney Common SSSI and Goss & Tregoss Moors SSSI
	Invertebrate proxy habitat survey produced for Natural England	Saunders, .P	2010	Data for Redmoor SSSI, Breney Common SSSI and Goss & Tregoss Moors SSSI
	<i>Hydrochus nitidicollis</i> records. Produced for Natural England	ERCCIS	2011	Database and distribution maps
	<i>Omphiscola glabra</i> records. Produced for Natural England	ERCCIS	2011	Database and distribution maps
	<i>Oxyloma sarsii</i> and <i>Nomada lathburiana</i> records. Produced for Natural England	ERCCIS	2012	Database and distribution maps

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	Goss and Tregoss Moors SSSI, Common Standards Monitoring Assessment Report, Scrub Edge (F001). A report to Natural England	EMEC Ecology	2016	Invertebrate assessment
	Specialist support for notification of Mid Cornwall Moors as a SSSI for invertebrates	David Heaver & Jon Webb (Natural England)	2016	Support for notifying the site for invertebrates from Natural England's senior invertebrate specialists
Birds	Mid Cornwall Moors – Breeding Birds Survey 2013. Report to Natural England	Ecus Ltd	2013	Breeding bird survey of the Mid Cornwall Moors
	Specialist support for the removal of breeding bird assemblage and notification of the SSSI for willow tit	Drewitt, A. (Natural England)	2016	Support for notifying the site from Natural England's senior ornithologist
Geology	An Introduction to the Geological Conservation Review. Geological Conservation Review Series. JNCC, Peterborough.	Ellis, N.V., (ed.), Bowen, D.Q., Campbell, S., Knill, J.L., McKirdy, A.P., Prosser, C.D., Vincent, M.A. & Wilson, R.C.L.	1996	Background information on the Geological Conservation Review and selection guidelines for geological SSSIs
	Geological Conservation Review Volume 36: Mineralogy of South West England. JNCC, Peterborough.	Bevins. R.E. et al	2010	Site details for Belowda Beacon GCR site 669
	Report to Natural England on mineralogical interest at Belowda Beacon	Dr Richard Scrivener	2012	Support for notifying the site for its geological interest from external specialist
	Specialist support for notification of Mid Cornwall Moors as a SSSI for its geological interest	Evans, D. (Natural England)	2016	Support for notifying the site for its geological interest from Natural England's igneous geologist and mineralogist.

2. Explanation of how the Mid Cornwall Moors meet the SSSI selection guidelines

This section explains how the information listed in Section 1 has informed the decision to notify the SSSI, according to the *Guidelines for the selection of Biological SSSIs. Part 1: Rationale, Operational Approach and Criteria for Site Selection* (JNCC, 2013) and *Part 2: Detailed guidelines for habitats and species groups*, hereafter referred to as 'the Guidelines', and the selection guidelines listed in *An Introduction to the Geological Conservation Review* (Ellis *et al.*, 1996). The maps and table in section 7 show the distribution and extent of the priority vegetation communities across the site.

2.1 Dry and wet lowland heath

Lowland heath is widely distributed across the site (see photographs 2, 3 and 11 in section 8), with particularly large areas of dry heath Tregonetha Downs, Belowda Downs, Goss and Tregoss

Moors, Retire Common, Criggan Moor and Breney Common and large areas of wet heath at Breney Common and Red Moor.

The dominant dry heath of the SSSI most closely resembles H4 western gorse *Ulex gallii* – bristle bent *Agrostis curtisii*¹ heath (see photograph 2 in section 8) with H4a bristle bent *Agrostis curtisii* - bell heather *Erica cinerea* sub-community occurring on areas of drier ground. This sub-community has a marked increase in abundance of western gorse, bell heather and heather *Calluna vulgaris*. A higher frequency of cross-leaved heath *Erica tetralix*, purple moor-grass *Molinia caerulea* and deergrass *Scirpus cespitosus*² is found in the H4c cross-leaved heath sub-community and wetter H4d deergrass sub-community.

Areas resembling H8 heather *Calluna vulgaris* – western gorse *Ulex gallii* heath, H10 heather *Calluna vulgaris* – bell heather *Erica cinerea* heath and H1 heather *Calluna vulgaris* – sheep's fescue *Festuca ovina* heath are also present in smaller stands on drier hummocks and on low Cornish hedges/banks dividing areas of swamp and marshy grassland. The H8 community contains abundant western gorse.

The areas of wet heath (see photograph 11 in section 8) are generally fairly species-poor, being dominated by heather and purple moor-grass. Cross-leaved heath generally occurs at high frequencies, but with low cover, with *Sphagnum* bog moss species occurring at low covers and moderate frequencies. These areas are best classified as M16 cross-leaved heath *Erica tetralix* - bog moss *Sphagnum compactum* wet heath and the M16b devil's-bit scabious *Succisa pratensis* - carnation sedge *Carex panicea* sub-community. The differentiation of the two types is based on a greater species-richness and increased frequency of bog myrtle *Myrica gale* in the M16b sub-community and the frequency of bog asphodel *Narthecium ossifragum* in the wetter M16 community.

Areas where water levels remain at or near the surface for much of the year show affinities with M15 deergrass *Scirpus cespitosus* – cross-leaved heath *Erica tetralix* wet heath³. Some of these areas may have previously been areas of open water with the M15b typical sub-community representing locally wetter areas. Areas of M15 wet heath are typically characterised by a dominance of purple moor-grass, with abundant cross-leaved heath, frequent heather and occasional deer grass. Bog myrtle is locally abundant, which is characteristic of the M15a carnation sedge sub-community, and devil's-bit scabious is frequent. The M15b typical sub-community is present locally in wetter areas and is more variable in composition with species poor areas only tending to support purple moor-grass and cross-leaved heath with some bryophytes. Other areas contain all the typical constants expected in M15b, as well as bog asphodel, hard fern *Blechnum spicant*, *Juncus* species and *Carex* species.

The heathland also contains a number of mires which vary in size from a few square metres to several hectares. They are discussed in more detail in section 2.2.

The Guidelines (Part 2, Chapter 4, section 3.1) state that:

'Table 10 indicates.....the main NVC types of lowland heath.....and selection recommendations for each. In most cases all sites over 10 ha should be selected.'

The site supports five (see table 1, below) of the NVC communities listed in table 10 of the Guidelines, some of which are represented by more than one sub-community, adding to the overall diversity of this habitat. Elsewhere they occur as transitions with other vegetation types.

¹ Nomenclature follows Stace 3rd edition 2010 (New Flora of the British Isles)

² *Scirpus cespitosus* is now known as *Trichophorum germanicum*

³ M15 wet heath is not listed in table 10 of the Guidelines and, accordingly is not included in the assessment for the SSSI. However, Chapter 4 of the Guidelines covering the selection of lowland heathland is currently under revision. The draft revised guidelines do list M15 as a community eligible for selection, as well as lowering the threshold for heathland selection in most cases from 10 ha to 5 ha. The Mid Cornwall Moors SSSI includes 40.90 ha of M15.

Table 1 Heathland communities in the Mid Cornwall Moors SSSI

Heathland NVC types listed in table 10 of the Guidelines	Area (ha)
H1 heather <i>Calluna vulgaris</i> – sheep’s fescue <i>Festuca ovina</i> heath	1.61
H4 western gorse <i>Ulex gallii</i> – bristle bent <i>Agrostis curtisii</i> heath	162.69
H8 heather <i>Calluna vulgaris</i> – western gorse <i>Ulex gallii</i> heath	3.85
H10 heather <i>Calluna vulgaris</i> – bell heather <i>Erica cinerea</i> heath	0.33
M16 cross-leaved heath <i>Erica tetralix</i> - bog moss <i>Sphagnum compactum</i> wet heath	10.18
Total:	178.66

In the case of H4 heath, the Guidelines (Part 2, Chapter 4, section 3.1.4) state:

‘Select all areas above 10 ha.’

The SSSI includes 162.69 ha of H4 heath.

For M16 wet heath, the Guidelines (Part 2, Chapter 4, section 3.1.12) state that:

‘Selection will usually be in association with dry heath or valley bog, and any size of area then qualifies.’

The SSSI includes 10.18 ha of M16 wet heath in association with areas of dry heath and valley mire.

The Guidelines (Part 2, Chapter 4, section 3.2) also state for mosaic or composite sites:

‘As previously stated, heathland is often one component of a site. Where the individual components are collectively of interest, even though they may be limited in individual size, the whole area should be treated as a mosaic or composite site...’

The predominant H4 dry heath and M16 wet heath communities occur in combination with 1.61 ha of H1 heath, 3.85 ha of H8 heath and 0.33 ha of H10 heath. The area of lowland heath within the Mid Cornwall Moors SSSI is therefore substantial and covers 178.66 ha, of which 168.48 ha is dry heath and 10.18 ha wet heath.

The Guidelines (Part 2, Chapter 4, section 4.3) state that:

‘On a heathland site, a percentage of tree cover is acceptable, but this should not normally exceed 50% of the area and should usually be less.’

Within the area of the Mid Cornwall Moors SSSI mapped as lowland heath, tree and shrub cover is generally low (approximately 1-5%).

The Guidelines (Chapter 4, section 4.4, p.101) also state that:

‘Wherever practicable, some areas of gorse and juniper should be included within a site...The two smaller gorse species, *Ulex gallii* and *U. minor*, are important constituents of oceanic and southern heath, and selection should ensure that they are well represented in the heathland SSSI series.’

The SSSI contains areas of European gorse and western gorse; the European gorse occurs largely around the margins of the dwarf shrub heath, whilst the western gorse is scattered within the H4 and H8 heath with varying cover depending on management. In general, scrub encroachment of these communities is much slower and is not as far advanced as on the wetter areas, as a consequence very extensive open patches of dwarf shrub heath can still be seen.

2.2 Lowland fens

Many fen types are nationally scarce and only a few sites remain in Cornwall. In the Mid Cornwall Moors area these habitats have been reduced dramatically due to agricultural improvement, with the remaining stands largely found in the SSSI.

The Guidelines (Part 2, Chapter 7, section 3.1) state that:

‘Within each AOS [Area of Search] the complement of fen sites should aim to include examples representing the full range of:

- a) topographical/hydrological fen types;
- b) ground water chemistry, as reflected in plant communities and species; and
- c) associated animal communities and species...

The Guidelines (Part 2, Chapter 7, section 3.2,) also state that:

‘Interrelationships between fen topography, hydrology, water chemistry and vegetation are described in Table 19, as the basis for habitat selection.’

The Mid Cornwall Moors SSSI is considered to be of special interest for its transition mire and quaking bogs, which occur in two hydrotopographical situations: topogenous basins and soligenous mire systems. The presence of transition mire in these two different situations on the same site is of interest in its own right and adds to its significance for the feature.

The following NVC communities listed in table 19 of the Guidelines, and intermediates between them, are particularly characteristic of the Mid Cornwall Moors SSSI (see photographs 2-9 in section 8):

Basin fen/bog pools:

- M1 cow-horn bog-moss *Sphagnum auriculatum* bog pool community
- M2 feathery bog-moss/flat-topped/flexuous bog-moss *Sphagnum cuspidatum/recurvum* bog pool community
- M3 common cottongrass *Eriophorum angustifolium* bog pool community
- M4 bottle sedge *Carex rostrata* – *Sphagnum recurvum* mire
- M5 bottle sedge *Carex rostrata* – *Sphagnum squarrosum* mire
- S3 greater tussock sedge *Carex paniculata* swamp
- S10 water horsetail *Equisetum fluviatile* swamp
- S27 bottle sedge *Carex rostrata* – marsh cinquefoil *Potentilla palustris* tall-herb fen, bottle sedge *Carex rostrata* – water horsetail *Equisetum fluviatile* sub-community

Valley fens and mires (including fen meadows and rush pastures):

- M6 star sedge *Carex echinata* – *Sphagnum recurvum/auriculatum* mire
- M14 black bog-rush *Schoenus nigricans* – bog asphodel *Narthecium ossifragum* mire
- M21 bog asphodel *Narthecium ossifragum* – papillose bog-moss *Sphagnum papillosum* valley mire
- M23 soft-rush *Juncus effusus*/sharp-flowered rush *J. acutiflorus* – common marsh-bedstraw *Galium palustre* rush-pasture
- M25 purple moor-grass *Molinia caerulea* – tormentil *Potentilla erecta* mire
- M27 meadowsweet *Filipendula ulmaria* – wild angelica *Angelica sylvestris* tall-herb fen
- M28 yellow iris *Iris pseudacorus* – meadowsweet *Filipendula ulmaria* mire
- M29 marsh St John’s-wort *Hypericum elodes* – bog pondweed *Potamogeton polygonifolius* soakaway
- M32 philonotis moss *Philonotis fontana* – starry saxifrage *Saxifraga stellaris* spring, Blinks *Montia fontana* – opposite-leaved golden-saxifrage *Chrysosplenium oppositifolium* sub community

Basin fen/bog pools

Small water filled depressions several metres across, formed by tin streaming are scattered over many tens of hectares of the site and the vegetation has now formed floating rafts across the surface of the water. The plant composition of the rafts varies between the depressions, depending on water chemistry and the stage of hydrosere succession they have reached, leading to a wide diversity of vegetation types. The primary species occurring in most of the rafts are marsh cinquefoil, bog bean, water horsetail, purple moor-grass and occasionally bottle sedge. Water horsetail is dominant in some depressions, possibly in those at an earlier stage of succession. In amongst these dominants a range of other species occur, including common valerian, marsh valerian, jointed rush *Juncus articulatus*, star sedge, common cottongrass, greater

bird's-foot-trefoil *Lotus pendunculatus*, ribbed bog moss *Aulacomnium palustre*⁴, *Sphagnum subnitens* and *Sphagnum squarrosum*.

One mat located on Goss Moor is particularly diverse and is dominated by bogbean with widespread *Calliergon cuspidatum*, *Drepanocladus exannulatus* and occasional marsh St John's-wort *Hypericum elodes*, common marsh-bedstraw, *Sphagnum recurvum* and ragged robin *Lychnis flos-cuculi*.

Tussocks around and sometimes within depressions (in some cases a later successional stage of the raft in which rainwater is a more significant component of the water supply) give rise to more acidic heathy vegetation including *Sphagnum subnitens*, *Sphagnum recurvum*, bog asphodel, heather, cross-leaved heath, tormentil *Potentilla erecta* and round-leaved sundew *Drosera rotundifolia*.

Much of the vegetation occurring in these basins is intermediate between various mire communities due to the ongoing hydroseral succession from open water through to, potentially, rain-fed bog. The communities that are present, and the direction of the successional pathway, can simplistically be characterised as S10>S27>M5>M4, going from the earlier successional swamp phase (S10) through to mesotrophic fen (S27), to mesotrophic fen with development of *Sphagnum* carpet (M5) to mesotrophic 'bog' (M4), along reducing gradients of base-richness and nutrient availability. This ongoing succession of mire communities within the many basins is also of scientific interest in its own right and is not seen on any other sites in Cornwall.

Valley fens and mires (including fen meadows and rush pastures) and associated bog pools

Transition mire and quaking bog vegetation is also present in high quality soligenous valley mire systems and associated runnels and pools within the Mid Cornwall Moors SSSI. Tratt *et al.* (2013) identify M14, M21 and M29 as being the core communities of this type of transition mire, with M21 forming the major component of the mire system, with M14 present in base-enriched flushes and M29 in soakways and runnels. Bog pools associated with M21 support M1, M2 and M3. The occurrence of these different vegetation types within the same mire systems is of great interest, and is unmatched elsewhere in Cornwall. Associated with these core mire communities are other soligenous mire vegetation types including M6, M23 M25, M27, M28 and M32. The extent and quality of these habitat types across the SSSI merit the sites status as being of European importance.

The Guidelines (Part 2, Chapter 7, section 3.3.1) state that:

'Within each AOS, at least one (preferably the best) example of every plant community listed in Table 19...should be selected...'

In all respects, the fens within the Mid Cornwall Moors SSSI represent the best examples of their type within the Cornish Killas NCA⁵ and Hensbarrow NCA and are particularly important for supporting the site's meta-population of marsh fritillary butterflies. No other site in the NCAs contains such a range of fen types (in terms of water chemistry and nutrient status) and only at Bodmin Moor North SSSI are they embedded in such expanses of good quality surrounding semi-natural habitat.

The Guidelines (Part 2; Chapter 7, section 3.3.2) state that:

'Within each AOS, the best examples should be selected of clearly developed vegetation mosaics which represent hydroseral zonation or combinations of two or more fen types.'

Most of the fens present within the site occur as vegetation mosaics representing good examples of a hydroseral zonation. With a decrease in altitude the degree of waterlogging increases and a transitional hydrosere of heath – wet heath – mire (fen) – swamp develops. This combination of

⁴ Nomenclature follows Hill (2001) for bryophytes

⁵ National Character Areas (NCAs) divide England into 159 natural areas, each defined by a unique combination of landscape, biodiversity, geodiversity and economic and cultural activity. Mid Cornwall Moors SSSI lies within the Hensbarrow NCA and Cornish Killas NCA. NCAs are now used as 'areas of search' for the purposes of SSSI selection (where appropriate) in England. For more information on NCAs, see <https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making>

communities is considered to be a unique assemblage in the national context. Overall the total area of fen communities (excluding fen woodland) within the SSS is around 397.20 ha. This area has increased in recent years due to considerable efforts to restore the sites to more open habitat mosaics.

The Guidelines (Part 2, Chapter 7, section 3.3.3) state that:

‘All examples of the rare or highly localised communities and sub-communities marked * in Table 19 should be considered for selection, within the total fen mosaic of which they are part.’

The mires dominated by *Schoenus nigricans* on parts of Retire Common and Goss Moor are considered to be representative of M14 mire, a community marked with an asterisk in Table 19 of the Guidelines.

The Guidelines (Part 2, Chapter 7, section 3.3.5) state that:

‘Continuous areas of fen, of any category, which are not appreciably degraded and which individually exceed 10 ha in area should be considered for selection. Fens in the cultivated lowlands are now so scarce that even examples of over 5 ha which are not appreciably degraded should be presumed eligible for selection.’

At 406.75 ha, the overall area of fens within the site clearly exceeds this. In addition, the relatively large size of the commons at Goss Moor, Tregonetha Downs, Retire Common, Criggan Moor and Breney Common, where these communities are largely found, have individual stands of various sizes up to 64 ha.

It is also important to consider the relationships between fen meadows/rush pastures and other vegetation types, particularly heathland and unimproved grasslands but also semi-improved grasslands or other supporting habitats.

The Guidelines (Part 2, Chapter 7, section 8.3) state that:

‘The boundary of valley mires should ideally incorporate all adjacent heathland. Even where the heathland is particularly degraded but still contributes to the whole catchment area, it should be included within the site boundary’.

The close juxtaposition and intimate mosaics of heathland and valley mire communities in the Mid Cornwall Moors have been selected as a single SSSI at the landscape scale to recognise and support the functional relationships between the habitats.

The Guidelines (Part 2, Chapter 7, section 8.5.2) state that:

‘In the selection of SSSIs, due regard should be given to the need to include related grassland types. Where such communities are not of SSSI standard in their own right they may be included within the fen SSSI boundary if:

- (a) they occur as part of an intricate wet/dry mosaic with the fen;
- (b) they form the principal communities of surrounding slopes which may have an important influence on the fen; or
- (c) they form the principal communities of adjacent land regarded as required buffer land.’

The mosaic of habitats and inter-relationships of the grassland and fen-meadow communities in the Mid Cornwall Moors supports their inclusion within a single SSSI that incorporates the whole wetland complex and transitions to adjacent drier habitats.

2.3 Woodlands

The Mid Cornwall Moors SSSI supports extensive areas of long established semi-natural woodland (see photographs 6 and 10 in Section 8). These are predominantly fen woodlands which most closely resemble the following NVC types:

- W1 grey willow *Salix cinerea* – common marsh-bedstraw *Galium palustre* woodland
- W4 downy birch *Betula pubescens* – purple moor-grass *Molinia caerulea* woodland

- W6 alder *Alnus glutinosa* – common nettle *Urtica dioica* woodland

Where conditions are drier the woodland tends towards more oak dominated stands and areas of the following NVC communities occur:

- W10 pendunculate oak *Quercus robur* - bracken *Pteridium aquilinum* - bramble *Rubus fruticosus* woodland
- W11 acid sessile oak *Quercus petraea* - downy birch *Betula pubescens* - wood sorrel *Oxalis acetosella* woodland
- W14 beech *Fagus sylvatica* – bramble *Rubus fruticosus* woodland
- W16 heathy oak *Quercus spp.* - birch *Betula spp.* - wavy hair-grass *Deschampsia flexuosa* woodland
- W17 sessile upland oak *Quercus petraea* downy birch *Betula pubescens* greater fork-moss *Dicranum majus* woodland

These properly reflect the range of diversity on the site and the varied transitions between habitats, which supports a range of species.

The Guidelines (Part 2, Chapter 2a, section 4.7) state that:

‘Within an AOS several examples of most types should be selected to account for the variation in woodland structure, floristic composition of tree and subsidiary layers and animal assemblages, to represent the various ways in which different types may naturally be combined, to give a geographical spread of sites, and to include any special features.’

These woodland vegetation communities are characteristic of those within the Mid Cornwall Moors area. The suite of wet woodland types within the SSSI is particularly important for an abundance of lichen species supported on the willow branches in older stands. Butterflies and moths are also well represented in the woodland habitat, especially in rides and glades. The juxtaposition of woodland, mature hedgerows and wetlands are of considerable value for nature conservation.

The area of the wet woodland stands (clearly definable areas) is over 531.06 ha, with the largest contiguous block totalling over 230 ha at Goss Moor. The area of drier woodland stands is 102.89 ha, with the largest contiguous block totalling just over 17.44 ha at Breney Common. The overall area is somewhat indeterminate as there are areas of ‘secondary’ and transitional woodlands that in the absence of adequate grazing pressure and alterations to the hydrology, have invaded previously open wetlands over the last 50 years. The majority of these woods are younger stands (30-40 years) and not readily identifiable in terms of their NVC type, being more scrub-like. The area these trees have encroached upon is likely to have been high value fen habitat (e.g. M21, M14 and S27) post-World War II, which still retains elements of fen vegetation under tree cover, as well as notable stands in large clearings.

The Guidelines provide the basis for selecting woodland SSSIs in terms of both their floristic composition and their structural form. The Guidelines (Part 2, Chapter 2a, section 1.5) state that:

‘The total area of ancient semi-natural and other woodland selected as SSSIs in each AOS should be sufficient to protect an adequate extent of, as well as the full range of variation in, native woodland communities and features against future threats, independently of other land-use policies.’

The proportion of England’s woodland resource within SSSIs is much less than for many other habitats (between 10 and 25% depending on whether all woodland or Ancient Semi Natural Woodland is considered). The total area of woodland within the SSSI of over 638 ha is of key significance in the Cornish Killas NCA and Hensbarrow NCA. In addition, there is good connectivity with smaller woods, scrub and the extensive networks of hedgerows and wetlands.

When assessing the quality of individual woodland stands and sites, the Guidelines recommend a number of specific attributes which are applicable to the Mid Cornwall Moors. The Guidelines (Part 2, Chapter 2a, section 3.4.1) state that:

‘A basic presumption is that [Natural England] should seek to protect the largest areas available of all the major types in an AOS...Sites with a mixture of types...are important in

a different way, because they demonstrate the relationships between species distributions and historical/ecological factors.'

At over 633 ha the Mid Cornwall Moors supports one of the largest remaining blocks or connected stands of long established semi-natural woodland in the Cornish Killas NCA and Hensbarrow NCA. The woodland is important in terms of its total area but also as part of a functioning habitat mosaic. The Guidelines (Part 2, Chapter 2a, section 3.4.2) further state that:

'Whole woods may be judged...in particular by their size, relative naturalness and diversity'.

The woodland occurring within the Mid Cornwall Moors SSSI forms a number of large stands, most notably at Goss Moor with over 230 ha of wet woodland. Other blocks of wet and dry woodland of between 8 ha and 58 ha occur elsewhere in the SSSI and provide important habitat with ride networks of other important grassland and wetland vegetation. The importance of the woodlands within a habitat mosaic is recognised within the Guidelines and the stands in the SSSI are some of the best and most intact examples within Cornwall. The Guidelines (Part 2, Chapter 2a, section 3.4.5) state:

'Woods which adjoin or are in a mosaic with other habitats tend to be more valuable than those sharply abutted by arable or improved grassland.'

The woodland feature adjoins areas of wet and dry heathland, fens and unimproved neutral grassland throughout the SSSI. Collectively they form an extensive network of semi-natural habitat now unusual in the English lowlands.

With respect to fen woodland, the Guidelines (Part 2, Chapter 7, section 7.1) state that:

'Fen woodland communities (Rodwell 1986) may occur as isolated stands – regarded as woodland habitat – or in association with open fen – regarded as fen habitat...'

Within the Mid Cornwall Moors both types occur, occupying distinct zones and readily invading open fen areas where there has been a cessation of management or disturbance. The Guidelines (Part 2, Chapter 7, section 7.2) state that:

'Selection of isolated fen woodlands should follow recommendations made in Chapter 2. Fen woodland communities associated with open fen should be considered for inclusion in open fen sites.'

The W1, W4 and W6 fen woodland communities have a range of characteristic and different ground floras; in many places similar to the fen and swamp communities described in section 2.2. Southall, Dale & Kent (2002) provided an evaluation of the ecological changes resulting from succession of poor fen (base-poor mire) to wet willow woodland on Goss Moor. Different ages of willow carr⁶ were associated with eight understorey communities. During willow colonisation, there was a progressive decrease in poor fen species in the ground flora and an associated increase in woodland species, which appeared to be related to an increase in canopy cover and therefore shade. The most diverse community was found to be the most recent willow and was dominated by poor fen species. The oldest willow was the second most diverse and was associated with a reduction in poor fen species and an increase in woodland species. The more well established, stable carr-woodland communities are distinct in their own right as examples of riverine forest.

The Guidelines (Part 2, Chapter 2a, section 4.4) state that the selection procedure within each AOS should:

'Identify the best, usually the largest, candidate stands, but taking account also of relative naturalness and diversity...'

The Guidelines (Part 2, Chapter 2a, section 4.5) further state that:

'Woods selected for the presence of more than one type should normally be over 5 ha and preferably over 20 ha and should be mainly semi-natural.'

⁶ A wetland type characterised by peaty soils, which is generally found in low-lying situations, with a distinctive woody vegetation cover, consisting of trees and shrubs such as hazel, alder, and willow.

With over 531 ha of wet woodland and 102 ha of dry woodland, the Mid Cornwall Moors SSSI exceeds the preferable size threshold of 20 ha and is mainly semi-natural in its composition.

Table 2 (below) shows that the Mid Cornwall Moors SSSI contains a larger area of woodland than any other SSSI in the Cornish Killas NCA. No other SSSI in Hensbarrow NCA is notified for woodland.

Table 2 Mid Cornwall Moors SSSI comparison with other woodland SSSIs in the Cornish Killas NCA

SSSI name	NVC woodland types	Woodland area (ha)
Borlasevath and Retallack Moor	W1	23.56 ha (estimate)
Crowhill Valley	W5, W6, W7, W10, W11	41 ha
Malpas Estuary	W11	15 ha (estimate)
Merthen Wood	W7, W8, W10, W16	61 ha
Nance Wood	W9, W16	10.1 ha (estimate)
Park Wood	W1, W6, W10, W16	32.7 ha (estimate)
Redlake Meadows and Hoggs Moor	W1	5.49 ha
River Camel Valley and Tributaries	W1, W7, W8, W10, W11, W16	390.71 ha
Swanpool	W1	Less than 9 ha (total SSSI area)
Tamar Tavy Estuary	W17	Approximately 210 ha (SSSI woodland units)
Upper Fal Estuary and Woods	W5, W6, W8, W10, W16	214.13 ha
Ventongimps Moor	W1	3.8 ha
Mid Cornwall Moors	W1, W4, W6, W10, W11, W14, W16, W17	633.95 ha

2.4 Unimproved neutral grassland

The Mid Cornwall Moors SSSI is considered to be of special interest for its nationally important unimproved pastures characterised by the rare National Vegetation Classification (NVC) type MG5 crested dog's-tail *Cynosurus cristatus* – common knapweed *Centaurea nigra* grassland.

This grassland vegetation community forms part of the lowland meadows priority habitat. In the UK the amount of lowland meadow has recently been estimated to be around 15,000 ha, the majority of which is widespread but highly fragmented mainly across the lowlands of England. MG5 is now nationally scarce with < 6,000 ha remaining in England (Robertson & Jefferson 2000). Individual patches of meadow habitat are now invariably small and only about 20% of the resource comprises areas in excess of 5 ha in size. This habitat forms part of a semi-natural grassland resource that is collectively well represented in the England SSSI series; the Natural England State of the Natural Environment Report 2008 cites an estimate of 68% of the total resource is currently within the SSSI series. It has been estimated that for the NVC grassland type MG5, which forms part of the lowland meadow habitat, approximately 55% of the estimated resource in England has so far been notified as SSSI.

However, unimproved neutral grassland habitat has undergone a considerable decline in the 20th Century, almost entirely due to changing agricultural practice. It is estimated that by 1984 in lowland England and Wales, semi-natural grassland had declined by 97% over the previous 50 years. Losses continued during the 1980s and 1990s, and have been recorded at 2 -10% per annum in some parts of England. The national decline has continued into the 21st Century; an assessment of the condition of semi-natural grassland types in non-statutory sites in England in 2005 found only 16% of lowland hay meadows outside of the SSSI series were considered to be in a favourable condition largely due to neglect or agricultural improvement.

The direct effects of eutrophication (artificial fertilisers) due to agricultural improvement, which over the past century and more have been one of the major factors in the disappearance and degradation of most types of lowland grassland in the UK, continue to make an impact on surviving

stands of these vegetation types where the measure of protection through some sort of designation frame or beneficial influence on management is low.

Lowland grasslands in Cornwall have mirrored these national trends and outside of designated sites have continued to both decline in quality and contract in extent. In Cornwall the exact extent and distribution of remaining unimproved lowland grassland is currently unquantified the remaining resource is now localised, fragmented and characterised by small stands. It is particularly poorly represented in Cornish SSSIs probably reflecting its scarcity in the County.

The continued loss and fragmentation of grassland is recognised by the Guidelines (Part 2, Chapter 3, section 2.1, p. 4) which state that:

‘The ancient semi-natural lowland grasslands have been a particular focus for the processes of agricultural intensification...This has led to a major expansion of more uniform, species-poor, agriculturally productive swards dominated by perennial rye-grass and white clover. Others...have more slowly been converted to semi-improved grassland dominated by a few grass species...The notification of lowland grasslands as SSSIs by the statutory nature conservation bodies continues to be an important mechanism for conserving the remaining semi-natural grassland resource.’

The Guidelines (Part 2, Chapter 3, section 4.9, p.6) state that:

‘Examples of grassland with any of the communities or sub-communities listed in section A of Annex 1, either singly or in combination, should normally be at least 0.5 ha in area to qualify for selection...’

The Guidelines (Part 2, Chapter 3, section 4.10, p.7) further state that:

‘The national extent of any grassland type should be taken into account during the selection of sites for notification from those that qualify for selection. For those grassland communities that are now rare (less than 10,000 ha in Great Britain or less than 10,000 ha in the British lowlands, as shown in section A of Annex 1), the presumption is that all examples which are at least 0.5 ha should be selected for notification, singly or in combination...’

MG5 is identified as being a lowland grassland community of high botanical nature conservation value in section A of Annex 1 of the Guidelines.

The Mid Cornwall Moors SSSI supports 4.47 ha of MG5 crested dog's-tail *Cynosurus cristatus*–common knapweed *Centaurea nigra* grassland at Retire Common and Criggan Moor, which is largely attributable to the MG5c heath-grass *Danthonia decumbens* sub-community. This is a damp heathy form of MG5c mostly occurring as a number of small patches contiguous with or surrounded by heath, fen and mire communities. The occurrence of this grassland in small isolated patches amongst other vegetation types across the site reflects variation in geology, soils, hydrology, former mining and mineral extraction activity and past agricultural management. The transitions between wet, neutral and locally acid soils add considerable ecological interest, and are not represented on other sites within Cornwall. Elsewhere in the Cornish Killas NCA, MG5 grassland is currently significantly under-represented and currently limited to just three other SSSIs: Sylvia's Meadow SSSI, Polruan to Polperro SSSI and Carrine Common & Penweathers SSSI. Mid Cornwall Moors is the only SSSI notified for MG5 in the Hensbarrow NCA.

Table 3 Mid Cornwall Moors SSSI – unimproved neutral grassland (MG5) component, comparison with key sites within the AOS and NCA

SSSI name	Area (ha)	Distance from Mid Cornwall Moors SSSI
Sylvia's Meadow	3.36	43 km
Mid Cornwall Moors	4.47	n/a
Carrine Common and Penweathers	17.32	26.4 km
Polruan to Polperro	32.86	19.6 km

Other lowland grassland types in the SSSI include stands of generally lower botanical interest, namely MG6 perennial rye-grass *Lolium perenne* – crested dog's tail *Cynosurus cristatus*

grassland and MG1 false oat-grass *Arrhenatherum elatius* coarse grassland as well as ranker stands of MG9 Yorkshire fog *Holcus lanatus* - tufted hair-grass *Deschampsia cespitosa* grassland. Smaller stands of wet, inundation grasslands conforming to MG10a Yorkshire fog *Holcus lanatus* – soft rush *Juncus effusus* rush pasture, typical sub-community add further diversity to the site.

The Guidelines (Part 2, Chapter 3, section 4.7, p.6) state that:

‘The NVC grassland communities listed in section B of Annex 1 are generally modified types of lower botanical interest. These should not be used as the basis for SSSI selection unless they have rare plant species or assemblages or special faunal interest (MG9, MG10, MG11 and MG13 may do so, in particular). They can, however, be included within an SSSI where they form a mosaic with more important communities or as part of a practical management unit...’

The semi-improved grasslands of MG6 and stands of MG10 vegetation occur within a mosaic with MG5 grasslands and there are strong indications that a number of fields are more species-rich, reverting to communities with affinities to MG5, with occasional positive indicator herbs. In addition, some of these grasslands support mosaics of fringing, more species-rich vegetation that are particularly important for invertebrates. Taking these factors into account, some of those fields with vegetation mosaics, transitional plant communities and important invertebrates have therefore been included in the SSSI.

2.5 Vascular plants (flowering plants and ferns)

The extensive range of habitats across the Mid Cornwall Moors supports a number of restricted range (nationally rare or nationally scarce) and declining (threatened on either the Great Britain or England Red Lists) species of vascular plant.

The Guidelines (Part 2, Chapter 11, section 3.2) state that:

‘There should be a presumption for selecting vascular plant sites on the following grounds.

3.2 Red Data Book (RDB) species

All RDB species’ localities should be regarded as candidate sites. One RDB species qualifies a site for selection if it has:

3.2.3 A good population of the species in an AOS supporting a substantial proportion of localities for the species’.

It should be stressed that when the Guidelines were written, RDB equated to nationally rare (species recorded from 1-15 10 km x 10 km grid squares in Great Britain). Current vascular plant Red List Assessments follow IUCN Guidelines so threat statuses are based on both rarity and decline. It follows that current nationally rare species may be selected under this guideline, whereas species listed as threatened on the Red Lists might not (unless they are also nationally rare).

The SSSI supports populations of two Nationally Rare (equivalent to RDB in the 1989 guidelines) plant species – Cornish eyebright *Euphrasia vigursii* and coral-necklace⁷ *Illecebrum verticillatum*.

Though only a few plants of Cornish eyebright have previously been found at one location at Retire Common in 1977 and at two locations on Tregonetha Downs in 1987 and 1992, at least 200 plants were counted flowering on Tregonetha Downs in July 2000 and 10 in July 2010.

Coral-necklace has been historically present in the Goss Moor area and was also historically present on surrounding moors including Retire Common, where it was last recorded in 1954 and closer to Goss Moor, southeast of Indian Queens where a few small patches were located on the

⁷ This species has only recently qualified as nationally rare, following an assessment of its status nationally which concluded that only the relatively few (highly threatened) populations in Devon/Cornwall should be treated as native whereas those elsewhere, e.g. New Forest, are invariably fairly recent introductions. Truly ‘native’ coral-necklace is therefore now regarded as both threatened (formerly Vulnerable but now Endangered in the Red List) and nationally rare (rather than nationally scarce) – as such it now qualifies as an ‘RDB species’ in the sense applicable at the time the SSSI Guidelines were written.

edge of a ditch in china-clay spoil in 1992 – unfortunately this site was an area where china-clay spoil was dumped in the late 1990s. Also close to Goss Moor, the species was found in 1987 colonising open ditches in newly dug wet heath, where it was abundant. It was last seen there in 2005 but has ‘disappeared’ as vegetation has enclosed the open ditches.

Although there have been no recent records of coral-necklace, it should be noted that it is a very elusive species and because of the amount of suitable habitat present is considered to be almost certainly still extant on the site.

The Guidelines (Part 2, Chapter 11, section 3) state that:

‘There should be a presumption for selecting vascular plant sites on the following grounds:

3.3 Combination of species occurring in 1-100 10 km squares

A simple scoring procedure is used to assess combinations of species within the two classes, nationally rare and nationally scarce.....Schedule 8 species.....rate 200. Species occurring in 1-15 10 km squares (other than Schedule 8 species) rate 100. Species occurring in 16-100 10 km squares rate 50. A total score of 200 or more qualifies a site for selection.’

Within the Mid Cornwall Moors SSSI, a further ten nationally scarce taxa have been reliably recorded since 1993 and are considered to be naturally occurring. These are listed, along with the two nationally rare species that also qualify in their own right below in table 4 with information on their national status and Red List category. The total score of this combination of species is 700 points, which clearly exceeds the figure of 200 points quoted in the Guidelines.

Table 4 Assemblage of nationally rare and nationally scarce plant species recorded in the Mid Cornwall Moors SSSI

Scientific name	English name	Nationally rare/ nationally scarce	Red list category	Score
<i>Euphrasia vigursii</i>	Cornish eyebright	Nationally rare	Endangered	100
<i>Illecebrum verticillatum</i>	Coral-necklace	Nationally rare	Endangered	100
<i>Cicendia filiformis</i>	Yellow centaury	Nationally scarce	Vulnerable	50
<i>Hypericum undulatum</i>	Wavy St John’s-wort	Nationally scarce	Least Concern	50
<i>Lycopodiella inundata</i>	Marsh clubmoss	Nationally scarce	Endangered	50
<i>Mentha suaveolens</i>	Round-leaved mint	Nationally scarce	Near Threatened	50
<i>Pilularia globulifera</i>	Pillwort	Nationally scarce	Vulnerable	50
<i>Ranunculus tripartitus</i>	Three-lobed crowfoot	Nationally scarce	Endangered	50
<i>Sibthorpia europaea</i>	Cornish moneywort	Nationally scarce	Least Concern	50
<i>Thelypteris palustris</i>	Marsh fern	Nationally scarce	Least Concern	50
<i>Viola lactea</i>	Pale dog-violet	Nationally scarce	Endangered	50
<i>Viola palustris</i> subsp. <i>juressi</i>	Marsh violet (scarce subspecies)	Nationally scarce	Least concern	50

Sources: Red list categories are the highest threat category in either GB (Cheffings & Farrell 2005, as updated by GBRL group) or England (Stroh *et al.*, 2014) Red Lists

Scoring of species has been amended to take account of additional information on national status obtained since the Guidelines were published in 1989, principally a revised list of nationally scarce species and an accompanying revised list of nationally rare species (updated rare/scarce statuses are for the most part those given in Leach & Rushbridge 2006).

The Guidelines (Part 2, Chapter 11, section 3.6) also concern themselves with populations of declining species and species at the edge of their range, and state that:

‘If an AOS contains species which are known to have declined markedly within Britain but are not yet in the nationally rare or nationally scarce category, particularly large populations may be selected...’

The SSSI supports five widespread⁸ declining species (with a threat status on either the GB or England Red Lists due to significant declines): chamomile *Chamaemelum nobile* (assessed as Vulnerable on both the GB and England Red Lists) associated with Breney Common, Goss and Tregoss Moor and Mollinis Downs, Treskilling Downs, Criggan Moor and Tregonhay; lesser butterfly-orchid *Platanthera bifolia* (assessed as Endangered on the England Red List) associated with Breney Common, Criggan Moor, Goss and Tregoss Moor, Red Moor, Retire Common, Tregonetha and Treskilling Downs; chaffweed *Centunculus minimus* (assessed as Endangered on the England Red List) associated with Breney Common, Criggan Moor, Goss Moor and Retire Common; Lesser water-plantain *Baldellia ranunculoides* (assessed as Vulnerable on both the GB and England Red Lists) associated with Goss Moor and allseed *Radiola linoides* (assessed as Vulnerable on the England Red List) associated with Breney Common, Criggan Moor, Goss Moor, Molinnis Moor, Retire Common and Tregonetha Downs. The populations of each of these five species are considered to be good in a south-west context.

2.6 Marsh fritillary butterfly *Euphydryas aurinia*.

The SSSI holds nationally important populations of the marsh fritillary butterfly *Euphydryas aurinia*, (see photograph 12 in section 8). This priority species is nationally scarce and also classed as Vulnerable in the Red List of Butterflies 2010. It is also protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended).

Agricultural improvement or abandonment, and changes in management practices have meant a loss of 92% of south-west England’s damp pasture (Hobson *et al.*, 2001) and other wetland habitats. Having suffered serious declines across most of its range in Europe, the marsh fritillary has undergone a 55% loss over a period of 30 years (Asher *et al.*, 2001) in the UK, which is currently considered a stronghold for the species, supporting 5–15% of the European distribution (van Swaay & Warren 1999). This dramatic decline is mirrored in Cornwall, with 62% of known populations going extinct between 1990 and 2000 (Hobson & Budd 2001). These trends have caused the butterfly to contract to a handful of core geographical areas (Asher *et al.*, 2001), one of these being a set of sub-populations (temporary populations as part of a meta-population) found across the Mid Cornwall Moors.

Marsh fritillary on the Mid Cornwall Moors

Within the SSSI the marsh fritillary breeds in patchworks of damp, tussocky acidic grassland dominated by purple moor-grass *Molinia caerulea* where the larval host plant, devil’s-bit scabious *Succisa pratensis*, is abundant. Within this habitat it prefers swards that are either cattle grazed or un-grazed by domestic stock (Warren 1994). In Cornwall, these grasslands are found in mosaics of fen-meadow (M24) and/or rush pasture (M25 sometimes with M6) with wet heath (M16) and/or rush pasture (M23). They can also occur in mosaics of mire (M25) and acid grasslands (U4) with bracken (Hobson, 2000). One interesting observation to come out of monitoring carried out between 2003 and 2010 is that marsh fritillary may be associated with more NVC types than previously thought. The NVC communities M25 and to a lesser extent M23 appear to be favoured communities. However estimations of suitable habitat for the purposes of population indices calculations may also need to consider U4, H4, H10, M15, MG9 and MG10. It remains possible that in these cases larval webs are present in small unmapped patches of the traditionally suitable communities S27, M5, M6, M16, M23 and M25 (Tunmore, Bright & Hodgson 2010).

For nationally scarce species (including marsh fritillary), the Guidelines (Part 2, Chapter 17b, section 2.3) state that:

‘The sites with the three strongest colonies in each AOS qualify, or up to five colonies in an AOS that contains a substantial proportion of the British colonies.’

⁸ Widespread in this context refers to the fact that the species is neither, Nationally Rare or Nationally Scarce occurring in > 100 10 km squares in GB.

The Mid Cornwall Moors metapopulation is thought to be the most westerly stronghold for the species (Smee *et al.*, 2010) and is the only population found within the Cornish Killas NCA and Hensbarrow NCA. It has declined from more coastal areas in Cornwall, where only a couple of diminishing colonies remain, including one in the Lizard NCA where it can be found on extensive areas of maritime cliff grassland at Mullion Cliff to Predannack Cliff SSSI, approximately 52 km to the south-west of Mid Cornwall Moors. One population exists in the Bodmin Moor NCA on acidic grassland associated with the Bodmin Moor North SSSI, approximately 24 km to the north-east of Mid Cornwall Moors. As such the marsh fritillary meta-population of the Mid Cornwall Moors SSSI is considered to be of strategic importance for the conservation of this species across its current UK range and is especially significant within a Cornish context.

Meta-population structure and how the SSSI conforms to the necessary metrics

The butterfly is relatively sedentary; Porter (1981) recorded average movements of less than 100m within one site. Work in Finland has shown mean dispersal ability to be 645m (± 69) and 467m (± 43) for males and females respectively (Wahlberg *et al.*, 2002). Colonisations have been recorded some distance from known populations, between 5 and 20km in distance (Warren 1994) and a recent mark-recapture study in the Czech Republic in just one season recorded 51 lifetime movements of marsh fritillaries exceeding 5km and 14 of more than 10km (Zimmerman *et al.*, 2011), which suggests that at least some individuals of the species may be more mobile than previously thought.

Bulman (2001) effectively tried to arrive at a viable model that predicted habitat use by marsh fritillary, and connectivity to all marsh fritillary *sub*-populations. The vegetation height and resource area were found to have a positive effect on patch occupancy, with 92% of cases correctly classified by the model (model correctly predicted a patch to be occupied or vacant). Patches are predicted to be occupied if the resource area is high (large patch area and abundant host plant), the vegetation height is tall and they are well connected to other occupied patches.

Conversely, isolated patches that are small in area, with little host plant and short vegetation are less likely to be occupied. With resource area being a significant variable, it is interesting to note that a large patch with a low density of host plant may be no more suitable than a smaller patch with a high density of host plant.

Bulman modelled the distribution and habitat data using the Incidence Function Model (IFM), following the meta-population approach. According to IFM simulations, the threshold network area (or minimum viable meta-population size) was predicted to be 71 ha, to achieve a 95% probability of persistence for 100 years for a network within a 4km by 4km area.

From this Bulman concluded that a functioning marsh fritillary site will have the following 'metrics':

1. Have a functional area in excess of **70 ha**, though subsequent modelling simulations, based on real landscapes suggest the minimum total area should range from 80 to 142 ha.
2. Have a **rich resource of larval food** plant (good devil's-bit scabious density) and be of sufficient patch area and spread across the site complex, as well as have a good adult forage resource.
3. Have the **component land parcels within a 4km x4km area**, and enough of the components to be either at most within 1-2 km of each other to be easily reached, or bridged by other sites to form a chain, as an operational compromise to take account of a building adult butterfly population dispersing locally and adding new individuals to sites. This accords with Lawton's⁹ stepping stones approach.
4. Be principally **cattle grazed**, though ponies, such as Shetlands, Exmoors or Dartmoors are acceptable.
5. Will naturally **accept and experience very localised extinctions** within the complex, and a shift in the core population areas over time.

⁹ In 2010 the results of a review set up and led by Professor Sir John Lawton, to look at England's wildlife sites and the connections between them was published as a report – '*Making Space for nature: a review of England's wildlife sites.*

Table 5 demonstrates how the Mid Cornwall Moors SSSI addresses these metrics.

Table 5 How the Mid Cornwall Moors SSSI meets the five metrics for a sustainable marsh fritillary meta-population

Key metrics (after Bullman)	Mid Cornwall Moors SSSI
1. Functional area in excess of 70 ha	SSSI habitat area capable of potentially supporting marsh fritillary is 603.74 ha
2. Rich resource of larval (& adult food)	Extensive areas of habitat supporting larval food plant (devil's-bit scabious) and also flower-rich resource, suggesting an array of adult butterfly feeding opportunities
3. Component land parcels within a 4 km x4 km area	The site boundary is founded on inclusion of functional land parcels within a tighter boundary framework.
4. Cattle grazed	Site is grazed by cattle and hardy ponies.
5. Accept and experience very localised extinctions	The habitat blocks are both close enough together and linked to allow subsequent re-establishment of populations

The map in section 7 shows the distribution of marsh fritillary habitat in the Mid Cornwall Moors and illustrates both the potential and importance of the site for a functioning meta-population of marsh fritillary and how the sites fits these metrics.

Tregonetha Downs, Ennisworgey, Treskilling Downs, Chark Moor, Halew, Lockengate, Retire Common, Quoit Farm, Mollinis Downs and Tregonhay are all within 2km of the main habitat complex in the SSSI at Goss and Tregoss Moors, Breney Common and Red Moor. The populations at Goss Moor fluctuate from being small to medium and it is likely that in boom years at Goss Moor this population supplements the Breney Common and Redmoor populations.

It is now known that the species is certainly able to disperse over considerably greater distances than the 1-2km radius defined by Bulman. Within the context of the Mid Cornwall Moors therefore the use of the 1-2km radius is recognised as being a *conservative* approach for defining the patches of suitable habitat that form the core of a marsh fritillary meta-population. The patches of suitable habitat in the Mid Cornwall Moors SSSI are well within these distances of each other and accordingly they can be considered to support a single meta-population.

The population within the Mid Cornwall Moors is thought to be centred at Breney Common, which remains the most stable site for this species with smaller colonies at Redmoor, Criggan Moor, Molinnis, Tregonhay and an unconfirmed record from Hallelw in 2015. Elsewhere in the SSSI the population has had a more variable history with a recent decline taking place at Goss Moor, where the species is clearly present at a much lower density than it was in the past. At Quoit Farm, Tregonetha Downs, Retire Common, Lockengate Moor, Treskilling Downs, Chark Moor and Bryn Moor (associated with the River Camel Valley and Tributaries SSSI to the north) records from the 1980s and 1990s indicate that it was previously more common with subsequent decline due to loss of grassland habitat to successional scrub and woodland. The current situation of the relatively stable populations on Criggan Moor and at Mollinis reflects these trends, which despite recent discoveries at new locations are now also showing signs of decline. A visit to Belowda Beacon (part of Tregonetha Downs) in 2010 did not confirm the presence of suitable habitat for marsh fritillary at this site due to its topography and the lack of any primary and secondary habitat.

Flight and larval web surveys of the marsh fritillary have been carried out annually between 2003 and 2007 as part of the Goss Moor LIFE Project on nine of the Mid Cornwall Moor sites as well as during 2008 and 2009 at Red Moor and Breney Common and on all sites during 2010 and 2011, which included an additional five sites (three of which are within the boundary of the Mid Cornwall Moors SSSI). Red Moor and Breney Common continue to be monitored annually by the Cornwall Wildlife Trust (CWT). These surveys show that colonies have historically persisted at Goss Moor, Breney Common and Red Moor where it reappeared after a long absence in 2006. This is particularly important because the colonies have survived here on traditional damp grassland

habitat, whilst they have generally declined or even become extinct on other similar sites located in Cornwall.

Tunmore & Bright 2011 note that:

'Breney Common remains the most stable site for this species with the highest population index of all sites (see Table 7). Criggan Moor and Mollinis also emerge as two of the more stable sites during the period of the monitoring programme, though even here there were declines in 2011. It is unlikely that marsh fritillary has completely disappeared from all areas of Goss Moor, and it is likely that there are unknown populations in pockets of habitat that are less accessible. However, the species is clearly present at a much lower density than it was in the past. The decline in adults and absence of larval webs at Red Moor could also represent the beginning of a population crash, this species being absent here when the LIFE project began and reappearing in 2006. Such severe declines, local extinctions and colonisations are of course a natural part of the population cycle of this species.'

It is important to put the negative picture from Goss Moor and to a lesser extent Red Moor into context; as these are big sites and the transect-based survey methodology will only sample a small part of even the individual survey areas. Also in recent years the survey has been solely reliant upon searching for larval webs with no adult monitoring as part of the monitoring programme (except at Breney and Red Moor which the same surveyor has continually monitored from 2003 to 2011 inclusive). Surveys for adults are most effective at proving presence/absence, but are not necessarily an indicator that the butterfly breeds at a given site and are more prone to weather and seasonal influences; larval webs however remain the most effective measure of population abundance and are definite proof of a breeding population. Monitoring at all sites for larval webs, and habitat suitability recommenced in 2015, in partnership with Butterfly Conservation and CWT.

Some positive results have emerged from the 2011 surveys, including the first record of the species at Criggan Higher Innis and in a new area of Tregonhay suggesting that butterflies are migrating from the 'core' populations to areas of suitable habitat. This demonstrates the potential importance of these sites as part of the meta-population and why with appropriate management the small and erratic presence of marsh fritillary may become more stable.

This species has historically suffered large declines, but scrub management and the reintroduction of cattle grazing, has been shown to be effective at improving its status. Key to this is both site security and fine tuning of the grazing management regimes to optimise sward height and devil's-bit scabious density. The current conservation management work should result in larger scale improvements across the whole archipelago, rather than parts of it.

A population estimate for each of the 13 sites being monitored from 2004 to 2011 (has been derived from the larval web counts using the equation set out in Hobson *et al.* (2001) where:

$$\text{Population Index} = \frac{\text{Total area occupied by a population (ha)}}{\text{Area searched (ha)}} \times \text{Number of larval webs}$$

Table 6 shows the population indices (relative size of a population) for each area. Indices for 2003 could not be calculated due to lack of information on 'Area occupied by population'.

Table 6 Mid Cornwall Moor marsh fritillary population indices (2004 to 2011)

Site	2004	2005	2006	2007	2010	2011
Breney Common	114.25	66.52	34.66	44.64	237.82	124.21
Chark	0	0	0	0	0	0
Criggan Moor	46.6	373.77	86.13	0	168.39	13.89
Goss Moor	1374.92	511.45	454.04	177.18	153	0
Quoit Farm	0	0	0	0	0	0
Ennisworgey	Not surveyed	Not surveyed	Not surveyed	Not surveyed	0	0
Mollinis	Not surveyed	Not surveyed	Not surveyed	Not surveyed	14.51	13.53
Red Moor	0	0	12.34	0	47.06	0
Retire Common	0	0	0	0	0	0
Tregonetha	0	0	0	0	0	0
Tregonhay	43.37	32.11	5.73	0	5.99	5.78

The area searched was calculated by multiplying the length of a transect by 2, reflecting the one metre search area each side of the transect line, and dividing the result by 10,000 to give the area in hectares (ha). The total area occupied by a population is defined as the total area of suitable habitat over the whole of the project site (e.g. within the entirety of Goss Moor) and not just within survey areas within that site. This was calculated by totalling the area of potentially suitable NVC communities (namely S27, M5, M6, M16, M23, M25) present within the project site and then estimating what proportion of these are currently in favourable condition (see table 7).

Table 7 Estimates of areas of potential habitat and habitat in favourable condition for marsh fritillary at each site surveyed between 2003 and 2011

Project site	Area of potential habitat (ha) ¹⁰	% of potential habitat estimated to be in favourable condition	Area of suitable habitat (ha)
Quoit Farm	4.2	10%	0.42
Tregonetha	24	25%	6
Retire Common	15	50%	7.5
Criggan Moor	32.5	10%	3.25
Red Moor	18.7	50%	9.35
Chark	2.8	90%	2.52
Blackacre	3.3	70%	2.31
Molinnis	4.6	70%	3.22
Ennisworgey	2.3	50%	1.15
Brynn Moor	6.4	60%	3.84
Tregonhay	7.4	40%	2.96
Goss Moor	204	50%	102
Breney Common	7.2	75%	5.4

Based on current evidence and a pragmatic view about what distance seems operationally reasonable to go from the main core sites within the Mid Cornwall Moors, Natural England has undertaken a spatial analysis to challenge the proposed site boundary, based on distances between patches, availability of primary and secondary habitats for marsh fritillary (primary being for larval development, secondary for adult forage), historical records, assessed condition, likelihood of improving condition across the wider site, and looked at landform and the likelihood of butterflies easily reaching sites. The current designation is thus the attempt at arriving at a

¹⁰ Potential habitat = suitable NVC type (S27, M5, M6, M16, M23, M25); from NVC surveys as follows: Tregonetha (Davies, 2005), Retire (Bright & Bennallick, 2004), Criggan (Bright, 2005), Red Moor (Davies, 2007), Chark (Wilson, 2004^b), Tregonhay (Wilson, 2004^a), Goss (Bright, 2006) and Breney (Davies, 2007), Quoit (Gowenlock, 2002), Brynn Moor, Ennisworgey, Molinnis and Blackacre (Sproull & Davies, 2010).

sustainable meta-population structure, and is consistent with a Lawton approach to coherent ecological networks.

2.7 Invertebrates

The Guidelines (Part 2, Chapter 17a, section 3.4.5) state that:

‘...any locality supporting the strongest population in Great Britain of a Red Data Book species should be regarded as a candidate site, together with localities within each AOS supporting strong populations of Red Data Book species...’

Red Data Book (RDB) production for invertebrates in the UK has effectively halted, with only a Red List for butterflies in 2007 being at all comparable to the RDB. A number of species status reviews have replaced the formal national RDB and the more recent volumes have been consulted to arrive at contemporary status accounts for a number of species.

The categories for invertebrates under some of the chapter headings have now had to be more broadly interpreted, and species slotted into categories from which they were excluded when the Guidelines were produced in 1989. This is mostly as a consequence of status changes and improvements in understanding within conservation entomology. Nevertheless, the underpinning rationale of selection has been followed.

The Mid Cornwall Moors SSSI supports the extremely rare water beetle *Hydrochus nitidicollis*, with the site holding three of the five known populations on the south-west peninsula, where it is found in association with the exposed sediments of slack water stream edges at Breney Common and has also recently been recorded on the edge of a pond at Goss Moor. The disused quarry pool at Red Moor also has a record. This species was previously listed as Rare RDB3 but this status has now been replaced and the species is classed as IUCN Vulnerable¹¹ (Foster 2010) as well as being a priority species.

The SSSI also supports the slender amber snail *Oxyloma sarsii*, which is nationally rare and listed as near threatened. It is recorded on the margins of water bodies on Goss Moor. Nationally rare status is equivalent to the former RDB categories so the species is eligible for selection under section 3.4.5 of the Guidelines.

The Guidelines (Part 2, Chapter 17a, section 3.4.6) state that:

‘Where possible, all nationally scarce species should be represented in the SSSI series within each AOS where they occur...’

The Mid Cornwall Moors SSSI supports a large and nationally important population of the nationally scarce mud snail *Omphiscola glabra*, which is also a priority species. Breney Common, Red Moor and Goss Moor support a large and nationally important population of this snail is associated with small acidic ponds, pools and ditches in temporary water bodies that dry out over the summer on Breney Common, Red Moor and Goss Moor.

2.7.1 Invertebrate assemblage

The Guidelines (Part 2, Chapter 17, section 3.4.2) state that:

‘Nationally scarce species, known or estimated to occur in 16-100 10 km grid squares in Britain...., should also be represented, where possible, in the SSSI series within each AOS where they occur. In practice, assemblages of nationally scarce species may be identified as of significance...’

¹¹ The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. There are nine categories in the IUCN Red List system: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern, Data Deficient, and Not Evaluated. Classification into the categories for species threatened with extinction (Vulnerable, Endangered, and Critically Endangered) is through a set of five quantitative criteria based on biological factors related to extinction risk.

With reference to both Red Data Book and nationally scarce species, the Guidelines (Part 2, Chapter 17, sections 3.4.5 and 3.4.6) also state that these:

‘...should be conserved as part of rich invertebrate faunal assemblages’.

Assessment of assemblages is mentioned in Part 2, Chapter 17, section 3.5 of the Guidelines:

‘*outstanding assemblages*’ which should be ‘...based on systematic sampling procedures and using community analysis techniques to identify and classify recurrent invertebrate assemblages.’ and go on to state that: ‘*the process of analysing species assemblages, combined with assessing the presence of rare species at localities within a major habitat type, is likely to provide a sound basis for selecting important invertebrate sites in future*’

Invertebrate Assemblages of the Mid Cornwall moors SSSI

The ISIS¹² assemblage¹³ that is shown to be either Favourable or Near favourable, depending on the sample analysed, is the F003 scrub-heath and moorland assemblage. This has, over the past few years, been found to be the principal assemblage and dominant type on the wet heaths of both West Penwith and the Lizard. Its presence on the Mid Cornwall moors is to be expected. Sampling on the wet heath habitat blocks showed a Near Favourable Scrub-heath moorland F003 assemblage, being only one species below the default species score.

The assemblage type is found on nutrient-poor, acid soils where herbaceous or dwarf shrub vegetation is dominant, although trees and taller shrubs can be an important component of the overall habitat. Semi-natural systems supporting important examples of this assemblage type include mature areas of lowland heath, moorland and montane habitats. It occurs on both damp and dry soils, but not when they are heavily fertilised. It is widespread in the uplands and is characteristic of some low nutrient lowland habitats including heath, grassland and open woodland.

This assemblage, whilst showing strong fidelity to the supporting habitat, has a wide species composition nationally, ranging from the common green mirid bug *Orthotylus ericetorum* or the heath damsel bug *Nabis ericetorum*, both on heather, to the petty whin weevil *Exapion genistae*, or the arctic-alpine money spider species *Mecynargus paetulus*, the latter found only from areas in Scotland such as the Cairngorm-Ben Macdui plateaux.

From this species pool, the following were recorded in sampling from wet heath and transition mire from the Mid Cornwall Moors: *Agroeca proxima*, *Bembidion mannerheimii*, *Bibio pomonae*, *Bombus jonellus*, *Columella aspera*, *Micrelus ericae*, *Notiophilus germyni*, *Olophrum piceum*, *Pterostichus rhaeticus*, *Scolopostethus decoratus*, *Sitona regensteinensis*, *Sitona striatellus*, and *Xysticus audax*.

2.8 Willow tit *Poecile montanus*

The Guidelines (Part 2, Chapter 17: Birds, section 3.6) state that:

‘Locations with high numbers and/or densities of rapidly declining and localised bird species, which are included on (i) the country-level lists of species of principal importance...for the conservation of biological diversity (as defined by the lists established under Sections 41/42 of the Natural Environment and Rural Communities Act 2006 (England/ Wales)..., or (ii) Red-listed in the UK Birds of Conservation Concern (Eaton *et al* 2009) and which are poorly covered by SSSIs, should also be considered for selection.’

¹² Since the guidelines were written Natural England has been developing the Invertebrate Species-habitats Information System (ISIS). This is a system which classifies typical invertebrate assemblages found in certain habitats (in the way that the National Vegetation Classification system does for vegetation) so that typicality and changes can be traced. ISIS is a valuable tool for describing and understanding the assemblages of invertebrates that a site supports but it does not provide a means for readily comparing sites and assessing their relative value.

¹³ Although the F001 Scrub edge assemblage was shown as Favourable in some samples, it is felt that inclusion of this assemblage on this suite may be detrimental to the goals of supporting both the marsh fritillary meta-population structure (more open and connected habitat blocks), and also the desire to open up more the mire communities. As such, F001 has not been selected.

The national willow tit population has declined by an estimated 81% during 1995-2013 (Harris *et al.*, 2015) and, following a range contraction of 50% since the early 1970s, now occurs as a probable or confirmed breeding species in only 14% of the 10km squares in Britain (Balmer *et al.*, 2013). The decline is most striking in southern England where the species has virtually disappeared from large parts of its former range. The estimated breeding population in Britain is 3,400 pairs (Musgrove *et al.*, 2013) although numbers could be as few as 1,500 pairs (Holling *et al.*, 2012).

A breeding bird survey of the SSSI undertaken in 2013, specifically investigated the numbers, distribution and breeding status of willow tits. Willow tits were recorded in three of the survey areas, largely in wet woodland habitats, and with the majority of recorded territories on Goss and Tregoss Moors. A conservative estimate of five territories were located on Goss and Tregoss Moors, based on a minimum of two registrations for each territory (Marchant 1983), with two further possible breeding territories at Red Moor and on Retire Common. Given that only around 40% of the habitat potentially suitable for breeding willow tits was surveyed, this should be considered a minimum population estimate (Ecus Ltd. 2013).

Although there are no comprehensive national data for breeding willow tits, it is apparent that the SSSI is an important location for the species. Data held by the Rare Breeding Birds Panel (RBBP) reveal only five other locations in Cornwall, each reported to support 1-2 territories in 2011. Although these data are far from comprehensive, they do provide an indication of the scarcity of the species and the importance of the SSSI as a breeding location. Inclusion of the willow tit as a notified feature will help to secure essential habitat management and effective monitoring for the species which would not necessarily be provided otherwise.

2.9 Geology

The special geological interests within the SSSI were selected for inclusion in the Geological Conservation Review (GCR) of Great Britain. The GCR systematically assessed sites to identify key localities that aid the interpretation of the geological evolution of Great Britain. Each GCR site demonstrates a unique and/or representative feature of this geological evolution, and the relationship between sites is particularly important in building up a picture of landscape evolution, and biological and environmental change over time.

All SSSIs with a geological interest have been assessed through the GCR process and sites described in the Review are selected on the basis of one or more of the following criteria:

- (1) Sites of importance to the **international** community of Earth scientists.
- (2) Sites which are scientifically important because they contain **exceptional** features.
- (3) Sites that are nationally important because they are **representative** of an Earth science feature, event or process that is fundamental to Britain's Earth history

Belowda Beacon forms part of the GCR subject area known as *Mineralogy of Southwest England*. These sites are chosen to illustrate the range of minerals which were associated with the Carboniferous-Permian granites during the Variscan Orogeny and adjacent Triassic basins. This site is chosen to illustrate the superb development of minerals (tourmaline and topaz) formed by late granitic fractionation and Boron-Fluorine metasomatism in the host rocks surrounding the Belowda granite boss. The site meets two of the above criteria:

- Sites which are scientifically important because they contain exceptional features – the mineralogy and the paragenetic sequence displayed in the rocks at Belowda Beacon are unique in south-west England.
- Sites that are nationally important because they are representative of an Earth science feature, event or process that is fundamental to Britain's Earth history – the importance of the site in terms of the magmatic-hydrothermal transition in the Cornubian Batholith and the possibility of further research on related metallogeny are considerable, and of national importance.

St Mewan Beacon GCR site, situated 9km to the south east of Mid Cornwall Moors has a similar geology, but is selected for the petrological features shown by the igneous rocks themselves.

2.10 Site boundary determination

The rationale for the boundary of the Mid Cornwall Moors SSSI (see photograph 1 in section 8) is described below but can be summarised as follows:

- All the best examples of remaining lowland dry and wet heath, including mosaics with basin fen/bog pool communities, valley fens and mires and swamps located around the margins of open water bodies are included because they are important in their own right as. In addition they are important for flowering plants, ferns and invertebrates.
- All the grasslands and fen meadow which support stable populations of marsh fritillary are included, along with sites containing suitable habitats for the species and which therefore have the potential to support colonies as part of a functioning meta-population.
- The woodland areas are included because they are long established semi-natural stands. They are important in their own right and provide habitats for for willow tits, flowering plants, ferns and invertebrates.
- All the best examples of unimproved neutral grassland including mosaics with partially improved stands adjacent to wet woodland and fen meadow are included.
- The GCR site at Belowda Beacon is included as an outstanding example of a site with nationally important geological interest.
- Inclusion of non-contiguous units enhances habitat connectivity and provides an overall habitat/resource for wide ranging species

The heathland and fen communities of the Mid Cornwall Moors are dynamic habitats that are intermixed with one another to form complex mosaics exhibiting the typical range of other habitats associated with succession. These add to the overall biodiversity of the area and include hawthorn *Crataegus monogyna* scrub, gorse *Ulex europaeus* scrub, moderately species-rich wet grassland/rush pasture, dry acidic-neutral grassland and secondary broad-leaved woodland. These communities provide significant habitat diversity and are important for buffering, connecting and supporting the features of special interest, namely the heathland, fens, areas of open water, neutral grassland and their associated assemblages of vascular plants, lichens and invertebrates.

The value of these habitats to species such as the marsh fritillary within a wetland archipelago is that they provide both forage and breeding opportunities which can overcome the stochastic losses which meta-populations of this butterfly are impacted by. The inclusion of resource forage-rich sites within an archipelago very much accords with Lawton's concept of stepping stones, and is important for this reason alone, irrespective of whether their devil's-bit scabious density is enough to support large larval webs. Adult butterflies for example typically forage on betony *Stachys officinalis*, bugle *Ajuga reptans*, buttercup species *Ranunculus* spp., cuckooflower *Cardamine pratensis*, dandelion *Taraxacum* agg, hawkweeds *Hieracium/Hypochoeris*, knapweeds *Centaurea* spp, ragged robin *Lychnis flos-cuculi*, thistles *Cirsium* spp. and *Carduus* spp and tormentil. Bulman's model, described earlier, breaks down if there are insufficient and close habitat patches (either within site and/or between sites) for natural re-colonisation. Whilst distance is an issue, it is clear that individual butterflies can move further than might be considered and having both suitable habitat through which to move and forage in, and to eventually breed in, is important.

The Guidelines (Part 2, Chapter 17a, section 3.2) state that:

'Another requirement of many invertebrates is habitat mosaics, both in terms of a variety of structural conditions within a habitat type...and also through the occurrence of different habitats such as grassland, woodland and wetland in close proximity. This is because some invertebrates live in situations which may be classed as transitional between habitat types or because there is a need for different habitat conditions at different stages of the life history...The increasing fragmentation and isolation of many semi-natural habitats poses particular problems for invertebrates which require habitat mosaics, as well as diminishing the chances of local movement or recolonisation for those invertebrates associated with a single habitat type'.

The habitat mosaics throughout the SSSI are of considerable value for invertebrates. The boundary includes those habitats that are important for the integrity of the site, often supporting important species of flora and/or fauna, providing buffers to other habitats and linking other areas of important habitat.

A number of fields are mosaics of unimproved vegetation stands and semi-improved stands. These fields support plants that are good indicators of unimproved habitats which in turn are particularly important for supporting other interest features, such as invertebrates. In some cases a few fields which are a mix of unimproved and semi-improved grasslands are managed the same way and/or link other areas of habitat of nature conservation importance.

The importance of the SSSI is of further significance in that it includes the largest area of fen meadow, wet woodland and unimproved grassland habitats remaining in this part of Cornwall. Outside of the SSSI there is very little agriculturally unimproved habitat.

The 'damp' grassland habitats are of national importance for marsh fritillary and at one time represented the main habitat for the butterfly in Cornwall. Damper grasslands and related fen-meadows have largely been lost due to agricultural improvement during the 20th century. In this SSSI the boundary includes all the remaining damp grasslands for marsh fritillary in the Mid Cornwall Moors. The importance of the SSSI is significantly enhanced by its strategic role in providing an ecological link between the fifteen sub-sites and Borlasevath and Retallack Moor SSSI located 3km to the north, and the River Camel Valley and Tributaries SSSI 1km to the north at Bryn Moor.

In relation to grasslands, the Guidelines (Part 2, Chapter 3, section 5.4) state that archipelago or composite sites can be justified where:

'the component fields are similar in terms of their vegetation composition and occur on similar soil types/geology within a discrete landscape or occur in similar topographical situations – e.g. disjunct flushes along a valley. There is evidence that local habitat fragmentation has caused the current disjunct nature of the habitat (s) and that the elements would have been formerly linked. Where different vegetation types are present, there is evidence that these once occurred in previously contiguous mosaics and transitions reflecting local changes in soils, hydrology etc, within a similar landscape setting and there is a high likelihood that individual sub-components provide an overall habitat resource for certain wide ranging species.'

In relation to heathlands the revised Lowland Heathland guidance Chapter 4, section 5.4, p.7, states that, the option of combining non-contiguous units into an 'archipelago' site is most likely to be justified when:

'inclusion of non-contiguous units enhances habitat connectivity, for example by protecting stepping stones between larger blocks of habitat or providing foci for habitat restoration and expansion within a key network; the components are similar in vegetation composition within a discrete landscape or occur in similar topographical situations, e.g. patches of wet heathland separated by arable fields; fragmentation has reduced a former stand of a single heathland type, or a former mosaic of different heathland types, into a series of discrete parcels; or when individual components will provide an overall habitat/resource for wide ranging species'.

These principles may be applied to other habitats also. All of the patches within the Mid Cornwall Moors SSSI clearly support similar vegetation communities and either support or have the ability to support a meta-population of marsh fritillary butterfly. They lie on similar soils (in that they are all fairly acidic and able to support lowland wet/dry heath and fen), though they are quite varied in their drainage and degree to which they have been disturbed by historic tin streaming and gravel extraction.

3. Explanation of why parts of the previously notified SSSIs are not considered to be of special interest

This section explains why Natural England is of the opinion that parts of the previously notified Goss and Tregoss Moor SSSI, Breney Common SSSI and Red Moor SSSI are not of special interest, according to the *Guidelines for the removal of an SSSI notification (denotification)* (English Nature, 2005), hereafter referred to as the 'Denotification Guidelines'.

The Denotification Guidelines (section 3.1, p.5) state that:

[Natural England] will adopt a precautionary approach to the question of the existence of special interest in cases where denotification is under consideration and in doing so will apply a set of guiding principles to assess whether a site (or part of a site) is of special interest; these are:

- i. Whether the site meets the requirements of the Guidelines for Selection of Biological SSSIs and the Geological Conservation Review.
- ii. If restoration of the special interest is possible or practicable.
- iii. Where the special interest has moved entirely outside the site, but remains adjacent or in close proximity, the site will not be denotified until the land now containing the special interest is notified.
- iv. Where there is some prospect that natural processes may return the special interest within a reasonable time, the site is unlikely to be denotified.
- v. Where cartographical errors were included in the original notification of the site.
- vi. A change of special interest from that for which it was notified, or a change that will lead to a new special interest, will not usually be a reason for denotification.

Small areas of land that are not considered to be of special interest have been included in the previously notified SSSIs as a result of historical cartographical errors at 22 locations. Seventeen of these are at Goss and Tregoss Moor SSSI (as last notified in 1988), three are at Breney Common SSSI (as last notified in 1986), and a further two are at Red Moor SSSI (as last notified in 1986). The precise locations and descriptions of each area are provided in table 9 below.

The Denotification Guidelines (section 3.3, p.6) state that:

'.....developments or other activities, which may damage features of interest of SSSIs, may after careful consideration be justified and can be legally permitted. This may result in permanently covering over, removing or otherwise destroying the site or part of the site. Activities which may result in permanent loss or damage of the features of special interest may be authorised under legislation such as the Town and Country Planning Act 1990..... Denotification of the site will not, however, be considered in this context until after the special interest of the site has been irreversibly lost, through the implementation of the permission in full.'

Six areas previously notified as parts of Goss and Tregoss Moors SSSI are not considered to be of special interest following the full implementation of legally permitted developments. In 2004, the Highways Agency gave notice of its proposal to realign the A30 north of Goss Moor (see table 8, below). The works were fully completed in 2008 and the land now occupied by the A30 carriageway at these locations is not considered to be of special interest. In 2010, Natural England gave notice of its proposal for the construction of an overwintering cattle pad (see table 8, below). The works were fully completed in 2011 and the land now occupied by this structure is not considered to be of special interest.

Table 8 Land proposed for de-notification

Previously notified SSSI	Description	National Grid Reference	Reference	Area (ha)
Goss and Tregoss Moor	Railway crossing entry and exit	SW9415060327	A	0.004
	Railway crossing entry and exit	SW9434460418	B	0.003
	Railway crossing entry and exit	SW9446560469	C	0.006
	Railway crossing entry and exit	SW9526360751	D	0.005
	Railway crossing entry and exit	SW9560560891	E	0.004
	Section of roadside verge running along route of old A30	SW9539660807	F	1.601
	Section of carriageway along route of 'old' A30	SW9608260966	G	0.007
	Small section of carriageway associated with entrance to A30 flyover	SW9620561126	H	0.021
	Section of roadside verge running along route of old A30	SW9619961018	I	0.213
	The south western boundary of an improved grass field, which contains no special nature conservation interest	SW9375858379	J	0.174
	The north western boundary of an improved grass field, which contains no special nature conservation interest	SW9416458968	K	0.023
	Roadside verge, which contains no special interest	SW9369160085	L	0.020
	Roadside verge, which contains no special interest	SW9384360SW93	M	0.002
	Cattle handling pen	SW9442460341	N	2.306
	Roadside verge, which contains no special interest	SW9610160929	O	0.057
	Garden	SW9732060081	P	0.113
	Garden	SW9734960107	Q	0.051
	Roadside verge, which contains no special interest	SW9559361508	R	0.006
Breney Common	Section of tarmac road surface	SX0524061268	S	0.360
	Section of tarmac road surface	SX0549960255	T	0.289
	The western boundary of an improved grass field, which contains no special interest	SX0603660622	U	0.230

Previously notified SSSI	Description	National Grid Reference	Reference	Area (ha)
Red Moor	The southern boundary of an improved grass field, which contains no special nature conservation interest	SX0751761497	V	0.175
	The southern boundary of an improved grass field, which contains no special nature conservation interest	SX0763461511	W	0.117
Goss and Tregoss Moor	HE A30 amendments	SW9306859608	1	0.737
	HE A30 amendments	SW9354060008	2	1.465
	HE A30 amendments	SW9573361522	3	0.655
	HE A30 amendments	SW9713861505	4	0.194
	HE A30 amendments	SW9811461485	5	0.140

The Denotification Guidelines (section 3.8, p.8) state that:

‘An important part of the notification procedure for biological SSSIs is demonstrating how the site meets the requirements of the *Guidelines for selection of biological SSSIs*. The SSSIs notified prior to 1989, when the current Guidelines were published, contain some of England’s finest habitats and host many of our rarest fauna and flora. However, there are a small number of SSSIs which were notified for features of interest which were not subsequently included in the Guidelines, for example, the semi-improved neutral grassland National Vegetation Classification type MG6. In such cases where information is made available to [Natural England] we will consider whether or not the site is currently of special interest, and for those sites that are we will consider applying sections 28A or 28B where variation of the notification or notification of additional land is required to include the features that are currently considered to be of special interest. Further cases may also arise following any future revision of the selection Guidelines.’

Goss and Tregoss Moor SSSI was notified in 1988 partly for a breeding bird assemblage associated with areas of heathland, scrub and woodland. A survey of breeding birds was undertaken in 2013 for six locations in the Mid Cornwall Moors SSSI: Goss and Tregoss Moors, Retire Common, Red Moor, Tregonetha Downs, Breney Common and Criggan Moor (Ecus Ltd. 2013). These areas represent the majority of the SSSI, with smaller, outlying areas excluded. These excluded areas are unlikely to support any breeding bird species additional to those recorded by the survey. Surveys were undertaken from April to July and employed a standard breeding bird survey methodology (Marchant 1983).

The survey identified forty species for which breeding was at least probable. Whilst many breeding birds use habitats throughout the SSSI an analysis of the evidence upon which the original assemblages were notified confirms that the range of species present does not meet the requirements of the updated breeding bird assemblage guidance in the revised SSSI selection guidelines (Drewitt *et al.*, 2015). The SSSI scores 13.5 for the lowland scrub assemblage compared to the required threshold of 14 and scores 15 for the lowland heathland assemblage compared to the required threshold of 17.5.

Table 9 Revised bird assemblage scores

Lowland Heathland		Lowland Scrub (excluding heath)	
Cuckoo	2.5	Cuckoo	2.5
Nightjar	3	Willow Tit	3
Dartford Warbler	3	Long-tailed Tit	1
Grasshopper Warbler	2	Garden Warbler	1
Stonechat	2	Grasshopper Warbler	2
Tree Pipit	1.5	Linnet	1
Linnet	1	Lesser Redpoll	1
		Bullfinch	1
		Yellowhammer	1
Threshold index score	17.5		14
SSSI score	15		13.5

The available information indicates that the breeding bird assemblages are not of sufficient interest to merit notification although it has been recommended that the scrub assemblage requires further investigation.

4. Current condition of the Mid Cornwall Moors SSSI

This section contains information on the current condition of the SSSI, the distribution of the interest features within the site and the remedial action that needs to be carried out to achieve favourable or recovering condition in those areas of the site where the interest features are currently assessed as being in adverse condition.

Table 10 Distribution of interest features in the Mid Cornwall Moors SSSI by unit

Interest features	Site unit numbers
Dry and wet lowland heath	2-5, 7-9, 11, 12, 14-16, 18-20, 22, 23, 26, 29, 31-37
Fens	1-6, 8-37
Dry and wet (fen) woodland	1-12, 14-37
Neutral grassland	6, 22, 25, 26, 29
Flowering plants and ferns	1-5, 8-13, 16, 18, 20-22, 25-29, 31, 32, 34-37
Invertebrate assemblage	1-6, 8-37
Population of willow tit	12, 16, 22, 36
Marsh fritillary butterfly (Recorded locations of webs and adults)	3, 4, 10-12, 16, 18-20, 22, 25, 28-31, 33-37
Geology	7

Table 11 Current condition of the Mid Cornwall Moors SSSI

Site unit*	Interest features	Reported condition**	Date of last assessment
1	Fens, woodland, flowering plants and ferns, marsh fritillary, invertebrates	Unfavourable recovering	Oct 2015
2	Heathland, fens, woodland, flowering plants and ferns, invertebrates	Unfavourable declining	Oct 2015
3	Heathland, fens, woodland, flowering plants and ferns, marsh fritillary, invertebrates	Unfavourable recovering	Nov 2015
4	Heathland, fens, woodland, flowering plants and ferns, marsh fritillary, invertebrates	Unfavourable recovering	Oct 2012
5	Heathland, fens, woodland, flowering plants and ferns, invertebrates	Unfavourable declining	Nov 2015
6	Fens, neutral grassland, woodland, invertebrates	Favourable	Nov 2015
7	Heathland, geology	Unfavourable recovering	Nov 2012
8	Heathland, fens, woodland, neutral grassland, flowering plants and ferns, invertebrates	Unfavourable declining	Nov 2015
9	Heathland, fens, woodland, flowering plants and ferns, invertebrates	Unfavourable recovering	Dec 2013
10	Fens, woodland, flowering plants and ferns, invertebrates	Unfavourable recovering	Nov 2015
11	Heathland, fens, woodland, marsh fritillary, invertebrates	Unfavourable declining	Dec 2013
12	Heathland, fens, woodland, flowering plants and ferns, marsh fritillary, willow tit, invertebrates	Unfavourable declining	Dec 2013
13	Fens, flowering plants and ferns, invertebrates	Unfavourable recovering	Nov 2015
14	Heathland, fens, woodland	Unfavourable declining	Mar 2013
15	Heathland, fens, woodland, invertebrates	Unfavourable recovering	Oct 2010
16	Heathland, fens, woodland, flowering plants and ferns, invertebrates, willow tit, marsh fritillary	Unfavourable recovering	Nov 2015
17	Fens, woodland, invertebrates	Favourable	Nov 2015
18	Heathland, fens, woodland, flowering plants and ferns, marsh fritillary, invertebrates	Unfavourable recovering	Nov 2015
19	Heathland, fens, woodland, invertebrates, marsh fritillary	Unfavourable recovering	Nov 2009
20	Heathland, fens, woodland, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable recovering	Dec 2013
21	Fens, woodland, flowering plants and ferns, invertebrates	Unfavourable declining	Dec 2013
22	Heathland, fens, woodland, neutral grassland, flowering plants and ferns, willow tit, invertebrates	Unfavourable declining	Nov 2015
23	Heathland, fens, woodland, invertebrates	Unfavourable declining	Nov 2015
24	Fens, woodland, invertebrates, marsh fritillary	Unfavourable declining	Nov 2015
25	Fens, woodland, neutral grassland, flowering plants and ferns, marsh fritillary, invertebrates	Favourable	Sept 2010
26	Heathland, fens, woodland, neutral grassland, marsh fritillary, flowering plants and ferns	Unfavourable recovering	Nov 2015
27	Fens, woodland, flowering plants and ferns, invertebrates	Unfavourable recovering	Nov 2015

Site unit*	Interest features	Reported condition**	Date of last assessment
28	Fens, woodland, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable declining	Nov 2015
29	Heathland fens, woodland, neutral grassland, marsh fritillary, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable recovering	Nov 2015
30	Fens, woodland, marsh fritillary, invertebrates	Unfavourable declining	Nov 2015
31	Heathland, fens, woodland, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable declining	Aug 2015
32	Heathland, fens, woodland, flowering plants and ferns, invertebrates	Unfavourable declining	Aug 2015
33	Heathland, fens, woodland, invertebrates, marsh fritillary	Unfavourable recovering	Aug 2015
34	Heathland, fens, woodland, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable declining	Aug 2015
35	Heathland, fens, woodland, marsh fritillary, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable recovering	Aug 2015
36	Heathland, fens, woodland, marsh fritillary, willow tit, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable recovering	Nov 2015
37	Heathland, fens, woodland, flowering plants and ferns, invertebrates, marsh fritillary	Unfavourable recovering	Oct 2015

* **Site units** are divisions used by Natural England for administrative purposes only.

**** Reported condition**

SSSIs are notified because of special biological or geological features. When these features are being managed so that their special nature conservation interest is being maintained they are said to be in favourable condition. This is a United Kingdom standard and the terminology and definitions are more fully described in 'A Statement on Common Standards Monitoring', produced by the Joint Nature Conservation Committee in 1998.

Table 12 Reasons for adverse condition in those site units assessed as being 'unfavourable declining' condition

Reasons for adverse condition	Remedy mechanism	Remedy status*	Site units
Agriculture – other	Countryside Stewardship – Higher Tier Scheme	Identified	2, 5, 14, 24, 28, 31
Agriculture - other	Partnership project with Highways England	Identified	8
Agriculture - other	Landscape-scale wet grassland project.	Identified	11, 12, 21, 23, 30, 32, 34
Agriculture - other	Enforcement	Agreed	22

***Remedy status**

'Agreed' means that a remedy has been identified by Natural England and has been agreed with the party responsible for implementing the required action. 'Identified' means that the remedy has been identified by Natural England but has not yet been agreed with the party responsible for implementing the required action.

Units 2, 5, 14, 24, 28, 31 are all assessed as 'unfavourable declining' due to the amount of scrub present and lack of structural variation in the vegetation. The remedy is up to eight Higher Tier Countryside Stewardship (CS) agreements to facilitate the removal of scrub and refine current grazing practices. The land managers will be offered a CS agreement to be in place by 2018.

Unit 8 is assessed as 'unfavourable declining' due to lack of structural variation in the vegetation. The remedy is a partnership project with Highways England focussing on the restoration and creation of new habitat links along the soft estate of the A30 corridor. Delivery of this project will be in 2016.

Unit 22 is assessed as 'unfavourable declining' due to non-compliance with HLS agreement options. The remedy is cessation of grazing in 2016/2017. If agreement can be reached the commoners association will be offered a Higher Tier CS agreement in 2018.

Units 11, 12, 21, 23, 30, 32 and 34 are all assessed as 'unfavourable declining' due to the amount of scrub present and lack of structural variation in the vegetation. The remedy is a landscape-scale wet grassland project. If the development round is successful, delivery will take place over 5 years from April 2019. A LIFE funding application (restricted to N2K sites) will be submitted in autumn 2017 to provide additional match.

5. Selection of ‘operations requiring Natural England’s consent’

Natural England selects operations from a master list when determining the list of operations requiring consent for individual SSSIs. The selection is based on the likelihood that the operations may cause damage to the special features that are the reasons for notification of the SSSI. As well as selecting operations from the master list, the precise wording of each operation may be tailored to suit the particular circumstances at the site.

It is not possible to predict every possible eventuality that may arise on a site but the aim is to identify all operations where it is reasonably foreseeable that, if carried out at certain times or in a particular manner somewhere within the SSSI, they are likely to damage the special interest features. The table below records at least one reason justifying the inclusion of each operation in the list for the Mid Cornwall Moors SSSI. It is not intended to be exhaustive and in most cases there will be other ways in which the specified operation is likely to cause damage.

Standard reference number	Type of operation	At least one reason for listing
1.	Cultivation, including ploughing, rotovating, harrowing and re-seeding.	Important habitats could be destroyed
2.	Grazing and alterations to the grazing regime (including type of stock, intensity or seasonal pattern of grazing).	Important habitats sensitive to over or under grazing
3.	Stock feeding and alterations to stock feeding practice.	Could lead to localised nutrient enrichment or poaching which would damage important habitats
4.	Mowing or cutting vegetation and alterations to the mowing or cutting regime (such as from haymaking to silage).	Important habitats sensitive to cutting or mowing
5.	Application of manure, slurry, silage liquor, fertilisers and lime.	Important habitats sensitive to nutrient enrichment
6.	Application of pesticides, including herbicides (weedkillers) whether terrestrial or aquatic, and veterinary products.	Important habitats and associated flora/fauna are all sensitive to these
7.	Dumping, spreading or discharging of any materials.	Risk of obscuring/smothering important habitats
8.	Burning and alterations to the pattern or frequency of burning.	Important habitats and associated flora/fauna are all sensitive to burning
9.	The release into the site of any wild, feral, captive-bred or domestic animal, plant, seed or micro-organism (including genetically modified organisms).	Could lead to unforeseen interactions and changes in community composition
10.	The killing, injuring, taking or removal of any wild animal (including dead animals or parts thereof), or their eggs and nests, including pest control and disturbing them in their places of shelter.	Could lead to unforeseen changes in community composition and direct damage to species interests
11.	Destruction, displacement, removal or cutting of any plant or plant remains, including tree, shrub, herb, hedge, dead or decaying wood, moss, liverwort, lichen, fungal fruiting body, leaf-mould, turf or peat.	Damage to important habitats and risk of incidental damage to other features
12.	Tree and/or woodland management and alterations to tree and/or woodland management (including planting, felling, pruning and tree surgery, thinning, coppicing, changes in species composition, removal of fallen timber).	Direct damage to woodland and scrub and risk of incidental damage to other features.

Standard reference number	Type of operation	At least one reason for listing
13a.	Draining (including moor-gripping, the use of mole, tile, tunnel or other artificial drains).	Important habitats and other features sensitive to drainage
13b.	Modification to the structure of water courses (rivers, streams, springs, ditches and drains), including their banks and beds, as by re-alignment, regrading, damming or dredging.	Could alter drainage and therefore impact on important habitats and their features. Direct damage to important habitats in the immediate vicinity
13c.	Management of aquatic and bank vegetation for drainage purposes.	Direct damage to important habitats
14.	Alterations to water levels and tables and water utilisation (including irrigation, storage and abstraction from existing water bodies and through boreholes). Also the modification of current drainage operations (e.g. through the installation of new pumps).	Important habitats and their features sensitive to water levels
15.	Infilling or digging of ditches, drains, ponds, pools, marshes, pits or shafts.	Direct damage to wetlands and invertebrate habitats
16a.	Freshwater fishery production and/or management, including sporting fishing and angling, and alterations to freshwater fishery production and/or management.	Indirect damage to habitats around open waters and to invertebrates
20.	Extraction of minerals including peat, hard rock, shingle, sand and gravel, topsoil, subsoil and spoil.	Direct loss of important habitats
21.	Destruction, construction, removal, rerouting, or regrading of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, including soil and soft rock exposures or the laying, maintenance or removal of pipelines and cables, above or below ground.	Direct loss of or incidental damage to important habitats
22.	Storage of materials.	Risk of obscuring/smothering important habitats and their features
23.	Erection of permanent or temporary structures or the undertaking of engineering works, including drilling.	Direct loss of or incidental damage to important habitats
24a.	Modification of natural or man-made features and clearance of boulders, large stones, loose rock, scree.	Direct loss of or incidental damage to important habitats
24b.	Battering, buttressing or grading of geological exposures and cuttings (rock and soil) and infilling of pits and quarries.	Direct damage to geological features
25.	Removal of geological specimens, including rock samples, minerals and fossils.	Direct loss of finite geological interests
26.	Use of vehicles or craft other than on made up roads and tracks.	Risk of damage to important habitats, such as through compaction
27.	Recreational or other activities likely to damage or disturb the features of special interest.	Risk of damage to important habitats or disturbance of species
28a.	Game and waterfowl management and hunting practices and alterations to game and waterfowl management and hunting practice.	Inappropriate location and types could damage important habitats and disturb species

6. Site unit map

The map on the following page shows the provisional boundaries of the site units, which are divisions used by Natural England for administrative purposes only.

Remove this page 51/52 and insert site units maps x 11

7. Distribution of key habitats and marsh fritillary within the Mid Cornwall Moors SSSI

Remove pages 73/102 and replace with:

Insert 10 x A3 N VC maps here

Insert Excel spreadsheet here – A3 landscape format in colour x1

Insert marsh frit habitat and buffer map here x 1

Insert Site Unit map x 1 – A3 colour



Photograph 2: This area includes a mosaic of H4 dry heath sub-communities and M25 fen-meadow sub-communities. Cornish eyebright occurs locally (Tregonetha Downs).



Photograph 3: Mature heather within a mosaic of M25 fen meadow and younger stands of W1 woodland and European gorse (Goss Moor).



Photograph 4: Species rich mosaic/stand of M23 and M25 mire and fen (Goss Moor).



Photograph 5: Species rich stand of M23 and M27 Goss Moor.



Photograph 6: S10 water horsetail swamp showing succession to W1 woodland (Lockengate Moor).



Photograph 7: A transitional M25 community occurs in the wetter part the site and is a location for the marsh fritillary butterfly and scarce blue-tailed damselfly (Molinnis).



Photograph 8: Chark Moor.



Photograph 9: M23 and M27 fen meadow (Criggan Moor)



Photograph 10: W1 wet woodland – Goss Moor



Photograph 11: M15 Wet heath Criggan Moor



Photograph 12: Marsh fritillary *Euphydryas aurinia*



Photograph 13: Marsh fritillary (*Euphydryas aurinia*), larval web



Photograph 14:Yellow centaury (*Cicendia filiformis*). A30 roadside verge. Nationally scarce species



Photograph 15:Pillwort (*Pilularia globulifera*). Nationally scarce species



Photograph 16:Wavy St. John's Wort (*Hypericum undulatum*), Bryn Moor. Nationally scarce species.



Photograph 17:Cornish moneywort (*Sibthorpia europea*), Tregonetha. Nationally scarce species.



Photograph 18: Marsh clubmoss (*Lycopodiella inundiata*). Retire Common. Nationally scarce species.



Photograph 20:Marsh fern (*Thelypteris palustris*), Tregonetha. Nationally scarce



Photograph 21: Lesser water-plantain (*Baldellia ranunculoides*), Goss Moor. A widespread declining species assessed as Vulnerable on both the GB and England Red Lists.