A66 Northern Trans-Pennine Project

TR010062

Annex 1: Outline Blanket Bog Compensation and Management Plan

Annex 1 - to the Applicant's Habitats Regulations Assessment: Information submitted without prejudice to support a Derogation case

27 October 2023

Planning Inspectorate Scheme Reference	TR010062
Author:	A66 Northern Trans-Pennine Project, Project Team, National Highways

Version	Date	Status of Version
Rev 1	27 October 23	Issue

CONTENTS

1 Introduction

1.1.1 This North Pennine Moors SAC Outline Blanket Bog Compensation and Management Plan (OBCMP) accompanies the (without prejudice) Habitats Regulations Assessment (HRA) Stage 3 Derogation case, with respect to delivering compensation in line with Test 3 of the derogation.

1.1.2 This OBCMP sets out how a compensation site will be identified, secured, delivered and monitored in line with best practice guidance for blanket bog restoration[1] [2] [3] and where relevant NE's Site Improvement Plan that covers the North Pennine Moors SAC[4], should the Secretary of State (SoS) deem compensation measures are required.

1.1.3 Once a compensation site has been identified the detail in this OBCMP will be developed into a Detailed Blanket Bog Compensation and Management Plan (DBCMP) which will be subject to a further approval process by the SoS under the provisions of article 53 of the DCO.

2 Adverse Effect on Site Integrity – Driver for Compensation

2.1.1 There is no development proposed within or adjacent to the North Pennine Moors SAC. The SAC lies outside any of the Project scheme areas, but the Project Affected Road Network (ARN) bisects the SAC.

2.1.2 The only pathway for effect carried forward to appropriate assessment was an increase in air pollution associated with increased traffic flows resulting from the Project. The impact does not arise from a particular scheme, rather the Project (i.e. all schemes) in combination with other sources of air pollution (i.e. background growth and committed development) which have been included in the modelling.

2.1.3 The assessment of potential air quality impacts on the North Pennine Moors SAC resulting from operation of the road (expected to be open in 2029) are described in detail in the HRA and supporting documents[5].

[1] Thom, T., Hanlon, A., Lindsay, R., Richards, J., Stoneman, R., and Brooks, S. (2019). Conserving Bogs: The Management Handbook.
[2] Nature Scot Forest to Bog Restoration Methods. Available at https://www.nature.scot/doc/peatland-action-technical-compendium-restoration-8-forest-bog-restoration
[3] Moors for the Future on behalf of the Upland Management Group (2017) Blanket Bog Land Management Guidance available at: https://www.moorsforthefuture.org.uk/our-work/our-projects/moorlife2020/conservation-works/blanket-bog-land-management-guidance
[4] Natural England (2014) Site Improvement Plan North Pennines Group, available at http://publications.naturalengland.org.uk/publication/6534899699810304
[5] HRA Documents
- 3.5 Habitat Regulations Assessment Stage 1 Likely Significant Effects Report, document APP-234
- 3.6 Habitat Regulations Assessment Stage 2 Statement to Inform Appropriate Assessment, document APP-235
- 7.52 Habitats Regulations Assessment Supplementary Note – North Pennine Moors SAC/SPA, document REP9-036
- 8.5 Change Application – Habitats Regulations Assessment (HRA) Technical Note, document CR1-018

2.1.4 These are summarised below with respect to each of the pollutants assessed.

2.1.5 With respect to nitrogen oxides (NOx), there are no exceedances of the Critical Level (30µg/m^3) as a result of the Project within 200m of the A66.

2.1.6 With respect to NOx, the modelled points which fall within the North Pennine Moors SAC predicts an increase in NOx critical level above the 1% criterion (>0.3µg/m^3)[6] during operation up to 65m from changes in traffic flows to the north of the existing A66 and 37m to the south of the existing A66. Predicted changes in nitrogen deposition (N dep) up to these two distances are also predicted to exceed the 1% change criteria for the lower critical load for blanket bog at this location. The maximum impact in N dep at North Pennine Moors SAC is predicted to be 0.9 kg N/ha/year 5m from the A66. The change in nitrogen deposition reduces moving away from the road to a change of 0.2 kg N/ha/yr at 65m (1.1% in relation to do-minimum (without Project) nitrogen deposition). Beyond 65m the impact of air pollution is considered to be imperceptible.[6]

2.1.7 With respect to ammonia (NH_3), the maximum increase in concentrations as a result of the Project in the opening year 2029 is predicted to be 0.1µg/m^3 at a location 5m from the edge of the road. Beyond 65m the impact of air pollution is considered to be imperceptible.

2.1.8 To define the potential area of blanket bog that could be impacted within the North Pennine Moors SAC as result of the modelled pollution, the area of blanket bog (including blanket bog recorded in a mosaic with acid/marshy grassland) within the maximum potential zone of impact (i.e., 65m north and 37m south of the A66) was calculated based on habitat mapping undertaken in 2021 (Appendix A).

2.1.9 The area of blanket bog that could be impacted totals 8.28 hectares* (ha), which is comprised of 3.18ha of blanket bog and 5.11ha of blanket bog in a mosaic with acid grassland. In line with the precautionary principle and following consultation with NE, blanket bog recorded in a mosaic was assumed to be qualifying blanket bog (7130) (a priority habitat).

3 Identifying and Securing Land for Compensation

3.1.1 During consultation with NE, they have indicated that a compensation area of approximately 10 hectares of blanket bog, based on a compensation ratio of marginally more than 1:1 would be appropriate as the effect is a deterioration in blanket bog condition as opposed to complete loss.

- 8.4 Habitat Regulations Assessment Technical Note (Rev 2) (Clean), document REP7-172
- HRA Second Supplementary Note (Annex I to Applicant's response to the Secretary of State's Request for Information dated 11 August 2023) issued 25 August 2023 (post Examination)

[6] Changes in annual mean NOx below 0.3µg/m3 are considered to be imperceptible and therefore potential impacts on nitrogen deposition (N dep) below this criterion are not considered to be significant.

* Subject to rounding

3.1.2 The joint Defra, Welsh Government, Natural England and Natural Resources Wales Habitats regulations assessments: protecting a European site[7] guidance notes that:

"Compensatory measures can include creating or restoring the same or very similar habitat on areas of little or no conservation value:

- *within the same site - if it exists*
- *at a suitable location outside the site*

If the area providing compensatory measures is not within the European site, it should become designated as part of the European site. Until that happens, it's protected by government planning policy. "

3.1.3 The compensation site therefore may be located within the North Pennine Moor SAC boundary, adjacent to the SAC boundary, or in other areas of blanket bog where restoration would provide maintained or improved overall coherence of the national site network.

3.1.4 The guidance also states that the compensatory measures "…*will need to fully offset the damage which will or could be caused to the site*." and that the Applicant does "…*not need to consider more compensation than is needed*".

3.1.5 The North Pennine Moors SAC Conservation Objectives Supplementary Advice[8] identifies that approximately 38% of the North Pennine Moors SAC supports blanket bog. The North Pennine Moors SAC covers an area of approximately 103,109.42ha. Therefore, blanket bog within the North Pennine Moors SAC covers an area of approximately 39,181.58ha.

3.1.6 The North Pennines Area of Outstanding Natural Beauty (AONB) contains almost 30% of England's blanket bog habitat [9]. There is around 90,000ha of peatland in the North Pennines and most of this is blanket bog[10].

3.1.7 National Highways is in discussion with the North Pennines AONB Partnership regarding a potential delivery mechanism for the compensatory measures. The AONB Partnership has nearly 20-years experience of delivering successful blanket bog restoration within the North Pennines AONB, and are well placed, with existing landowner relationships, to identify a suitable location as well as having the capacity to deliver the required measures. National Highways will continue to engage with NE, the North Pennines AONB Partnership, landowners and other appropriate stakeholders to identity an area of blanket bog that could be restored to

[7] Defra, Welsh Government, Natural England and Natural Resources Wales (2021) Habitats regulations assessments: protecting a European site

[8] Natural England (2022) *European Site Conservation Objectives: Supplementary advice on conserving and restoring site features North Pennine Moors Special Area of Conservation (SAC) Site Code: UK0030033 Sup Advice.*

[9] IUCN Peatland Programme: North Pennines AONB Partnership Peatland Programme. Available at: https://www.iucn-uk-peatlandprogramme.org/projects/north-pennines-aonb-partnership-peatland-programme#:~:text=The%20North%20Pennines%20has%20almost,and%20carbon%20stores%20in%20Europe.

[10] North Pennines AONB Partnership: Peatland Restoration. Available at: https://www.northpennines.org.uk/what_we_do/peatland-programme/

deliver the necessary compensation measures to protect the overall coherence of the national site network, and details will be included in the DBCMP.

3.1.8 The compensation site will be identified in accordance with the provisions of article 53 of the DCO, and based on the following criteria:

- Distance from area of impact (preference for suitable sites that are closer over those that are further away)
- Location in relation to the boundary of SAC (this could be a site within the SAC boundary, however sites outside will be considered where the compensatory measure would ensure the overall coherence of the National Site Network). In particular, a site within the fragmentation action zone[11] of the SAC would be prioritised within the SAC, or a site in the network enhancement zone[11] outside of the existing SAC boundary, where the proposed compensation would reduce fragmentation and improve the resilience of the blanket bog.
- Current status of the habitat, the pressures leading to it being of minimal conservation value and the ability to provide measurable and meaningful improvement as compensation
- Site ownership status and ability to reach agreement on implementation and long-term management
- Ensuring that the compensatory measures will not themselves have a negative effect on the National Site Network.

3.1.9 The compensation site will be chosen to avoid the potential for any significant adverse effects on environmental receptors to arise as a result of the implementation of the compensation measures. Annex 2 (Addendum to the Environmental Statement in relation to the OBCMP) will be reviewed and updated specific to the site selected and included in DBCMP.

3.1.10 The DBCMP will provide maps showing the location of the compensation site location in relation to the SAC boundary and the extent of the compensation site.

4 Compensation Plan

4.1 Introduction

4.1.1 The aim of the compensation plan is to offset the impacts of the A66 Project arising from air quality on the North Pennine Moor SAC.

4.1.2 This OBCMP sets out the approach to baseline survey and data collation to inform the design of blanket bog restoration, the types of compensation measures that will be employed, the expected outcomes and the approach to monitoring of the compensation measures.

4.2 Data Collation and Baseline Survey

4.2.1 To inform the design of blanket bog restoration within the compensation site and select the most appropriate measures for a given site location, the

[11] As defined by the Habitat Networks (England) spatial data set published by Natural England Available at: https://www.data.gov.uk/dataset/0ef2ed26-2f04-4e0f-9493-ffbdbfaeb159/habitat-networks-england

Applicant will liaise with relevant stakeholders, including but not limited to NE, the North Pennines AONB Partnership, and landowners to gather existing information related to blanket bog condition. The review of desk study information and available reports will be supplemented with baseline surveys and restoration opportunity mapping.

4.2.2 Baseline surveys will be required, both to inform the design of mitigation, and to measure the efficacy of the restoration actions. Surveys will include but not be limited to National Vegetation Classification (NVC) survey[12], Common Standards Monitoring (CSM) for blanket and upland habitats (JNCC, 2009)[13], and bog and peat depth profiles. Given the nature of the surveys (to identity opportunities for restoration), targeted sampling where damaging activities are known to occur are likely preferred in line with CSM guidance[13]. Aerial photographs will be used in advance of site visits to determine survey and compensation focus areas.

4.2.3 In addition, depending on the compensation site and the information available for the site, it may be necessary to undertake protected species surveys, which will be seasonally constrained, such as breeding and wintering bird, invertebrate or reptile surveys to identify any constraints on the timing of the implementation of the compensation measures.

4.2.4 The DBCMP will identify the results of surveys undertaken to understand the baseline conditions of the site and inform the compensation design.

4.3 Proposed Compensation Measures

4.3.1 Table 1 describes the potential blanket bog restoration measures that would be employed, where relevant and applicable, at the Compensation Site(s). The table has been guided by Conserving Bogs: The Management Handbook (Thom et al., 2019)1 Nature Scot bog restoration methods2 and Moors for the Future's Blanket Bog Land Management Guidance[3]. The table also sets out what the expected benefit would be of each restoration measure.

4.3.2 Each of the measures listed is in accordance with and supportive of the 'Issues and Actions' listed in NE's '*North Pennines Group: Site Improvement Plan*' (SIP1540)[4]. The SIP identifies 19 key issues affecting the North Pennines designated sites and identifies actions required to address each issue; these include hydrology, grazing and agricultural / human management (tracks, cutting, burning, forestry etc.).

The DBCMP will include detail of the exact compensation measures to be implemented within the compensation site including maps illustrating where the measures will be implemented. The DBCMP will include a programme

[12] Rodwell, J.S. (2006) NVC Users' Handbook. Joint Nature Conservation Committee, Peterborough.
[13] JNCC (2009) Common Standards Monitoring Guidance for Upland Habitats, available at https://data.jncc.gov.uk/data/78aaef0b-00ef-461d-ba71-cf81a8c28fe3/CSM-UplandHabitats-2009.pdf

for the implementation of the measures and details of the roles and responsibilities for the implementation of the measures.

Table 1 Potential Blanket Bog Restoration Measures that could be employed at the Compensation Site

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
Managed rotational burning	**Priority Issue for North Pennine Moors SAC[14]** Peatland sites that experience the practice of managed rotational burning can have poor quality vegetation community composition and structural diversity. These areas often favour the growth of grassland species and outcompete peatland forming species such as Sphagnum.	Managed rotational burning contributes to the presence of bare peat levels, increases the presence of inappropriate grassland species as the top layer of peat dries out becoming less suitable for peatland forming species e.g. Sphagnum. This therefore reduces available habitat for peat forming species through drying out of the top layer of peat. On sites with Sphagnum (or that have had Sphagnum), this can have a deleterious effect. Flailing heather stands with machinery i.e. tractors, in areas of wet peat can generate rutting damage exposing the peat and drying out the top layer of peat soil.	Cease all managed rotational burning on all areas of deep peat with a depth of at least 40cm or more.	Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.* Improved physical structure to blanket bog, reduction in ground disturbance. Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire.
	Priority Issue for North Pennine Moors SAC[14] Areas that undergo managed rotational burning can experience 'hot burns' which are resultant from historic burning exercises and		Where the blanket bog comprises dry modified bog and is dominated by heather, consider undertaking cutting (as a one off) to remove the dense canopy. Alternatively, cease all management activities and allow the	Fully functioning blanket bog does not require any management. Where the bog is degraded, cutting could help reduce heather dominance (which dries out and out shades peat building species)

14 The Site Improvement Plan for North Pennine Group, including the North Pennine Moors SAC identifies 'Managed Rotational Burning' as a priority issue that requires addressing. 'Managed Rotational Burning is identified as a priority pressure within the document. Document accessed at https://publications.naturalengland.org.uk/publication/6534899699810304 October 2023

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
	additionally, the practice of 'flailing' by machinery can contribute to the presence of bare peat'.		heather to progress to the late degenerate phase and open out naturally.	Increases blanket bog resilience through higher water levels within the peat. Improved key structural, influential and distinctive species e.g. sundew, common cotton-grass, assemblage of sphagnum mosses.
Inappropriate Grazing	**Priority Issue** Livestock Peatland sites are often grazed by livestock, predominantly sheep. Potential exists for sheep grazing to occur on site, resulting in pressures such as bare ground or overgrazing.	Where grazing occurs, this can be more deleterious in winter when trampling from heavy grazing (>1 sheep/ha) can invoke erosion, and a reduction in target species. In wetter areas, dominated by Sphagnum, damage can be seen in much reduced densities. Summer grazing can reduce scrub encroachment and grasses offering benefits. However, there is a trade off with stocking density between trampling and grass / scrub control. Where historic grazing levels have been high the blanket bog can lack structural diversity i.e. tend to be very flat and there are no hummock and hollows.	Light seasonal grazing may be beneficial in degraded bogs. Grazing by wild animals is usually the only necessity in blanket bog, with nothing other than light seasonal grazing having a negative effect.	Improved physical structure to blanket bog, reduction in ground disturbance leading to peat erosion. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.* Improved structural diversity as features of blanket bog e.g. vegetation cover and surface patterning.
			Livestock may be restricted from certain areas using fencing. However, this can be expensive and have visual landscape effects. Virtual fencing may be an option.	Reduction of grazing pressures on regenerating blanket bog. Improved physical structure i.e. reduction in presence of bare ground and peat erosion Improved structural diversity as features of blanket bog e.g.
		Additional feed (potentially in the presence of hay, fodder etc.) is	Rotational low-intensity grazing management. Avoids the provision of	

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
		usually also required due to the low nutrient status of bog, leading to localised enrichment around feeding stations. Additionally, fodder can cover heather stands reducing functionality and contribute to localised grazing pressure where supplied.	supplementary feed for livestock, thereby avoidance of impacts related to feed points. Cessation of overwintering of livestock on peatland to avoid point source impacts of bare ground, trampling and poaching.	vegetation cover and surface patterning
	Deer Peatland habitats are known to support wild populations of deer species. Where present, grazing and trampling by deer can present a pressure to habitat condition such as degrading bare peat and exposing bare peat particulates to watercourses.	Although not usually an issue where only non-farmed animals graze on bog sites, when sheep are also present, this will exacerbate the risks of overgrazing. However, when mainly wild deer, this can aid in reducing scrub encroachment. The presence of deer can also introduce point source pressures such as bare ground through trampling. Exposed bare peat can in-turn degrade and following rainfall, enter watercourses and result in degraded water quality.	This mitigation is linked with farmed animals grazing. On blanket bog, wild deer usually have a positive effect of reducing grass and scrub invasion where there is little livestock. Potential to introduce deer-control measures following consultation with statutory bodies to reduce the movement of deer through the site, in particular, the areas that have been restored.	Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.* Improved physical structure to blanket bog, reduction in ground disturbance leading to peat erosion.

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
Hydrological Changes	**Priority Issue** Drains	Some drains may have areas of bare peat. Given that a bog should be around 80%+ water, exposure leads to a drying out of the surrounds.	A block with peat plugs, coir rolls, stone dams or heather bales[15] can add to the look of the system, whilst also being locally sourced. (Plastic or corrugated iron may be utilised where vegetation / soil is not sufficient.)	Blanket bog structure and function is restored, allowing the habitat's natural hydrological conditions to improve peatland species formation and prevent habitat degradation. Improved physical structure to blanket bog, reduction in ground disturbance that can lead to peat erosion. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.*
		Drains also impact geomorphology. The immediate dryness leads to a squeezing of the adjacent peat, thus leading to a squeezing out of water, similar to compressing a sponge.	Peat depth probes can assess whether these wet heaths are as a result of water table lowering or as a result of peat being >0.5m. Installation of piezometers can assess the underground water pressure and water table levels.	

[15] Whilst heather bales are not traditionally used locally, this method, when using locally sourced material arising from changes in heather management, could provide an on-site solution to two issues –hydrological and rotational burning.

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
		Drying can reduce the water table from the more natural drier hummocks and wet pits to a vegetation where the water table is all below the 'topsoil', leading to a change in surface vegetation.	Moderate dams may possibly be blocked with peat, although plastic/wood is more likely. Large drains require the advice of an engineer to reinstate and reprofile the dam.	Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire.
	Priority Issue Grips and gullies	The presence of grips and gullies can mean peat is more susceptible to erosion. They can inhibit sphagnum growth. Gullies and grips can become deeper and wider through water erosion. They carry eroded peat affecting water quality, contributing to higher quantities of dissolved organic carbon which can impact freshwater species downstream.	Gully and grip blocking through dam installation. Potential dam types: coir rolls, peat dams, plastic dams, stone dams, timber dams. Dam placed at start of the gully and works downstream. Height of the block dependent on aims (i.e., whether the intention is for rewetting and water retention then the block should be level with the existing surface. If the aim is to trap sediment, the block should be lower). Methods - impermeable dam (to raise water table) or permeable (designed to slow water flow and trap sediment)	

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
	Priority Issue Hags and Peat Banks	The presence of hags and vertical peat banks from drains contributes to hydrological changes within surrounding peat layers. Hags and peat banks are generally a source of bare peat and low structural and vegetation diversity.	Peat bank and hags reprofiling through mini excavator use can reduce the presence of bare peat. Increased connectivity to the peat surface layer and water table encourages growth of peat forming species thereby reducing presence of bare peat. Recommended to be conducted in tandem with sphagnum inoculation/transfer.	
Game Management	**Priority Issue** **Tracks** The presence of tracks can be historic or current access routes through peatland sites, access for managed rotation burning, livestock access or peat cutting.	Tracks contribute to a level of bare peat, reduce the structural integrity of peat, reduce diversity of plant species, contribute to drier levels of peat and scar the landscape and fragment habitats.	Tracks (permanent or temporary) should be rerouted outside of sensitive areas i.e., where active peat formation is ongoing.	Blanket bog structure and function is restored, allowing the habitat's natural hydrological conditions to improve peatland species formation and prevent habitat degradation. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.* Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.*

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
				Improved physical structure to blanket bog, reduction in ground disturbance leading to peat erosion.
Bare Peat	**Priority Issue** Any potential areas that may have been cut for peat (historical or current)	Peat cutting is a practice of removing peat for a source of fuel. The repeated removal of peat can contribute degradation of the peat, reduce the amount of available water for species such as sphagnum moss and reduce the overall habitat coverage.	Cease all peat cutting. Bank reprofiling in addition to drain blocking through the installation of dams as outlined under Hydrological Changes.	Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats preventing the natural regeneration of characteristic site native species. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.* Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire. Improved physical structure to blanket bog, reduction in ground disturbance.
			Marginal bunds can be constructed on cutover areas on the margins surrounding blanket bog. This retains a shallow area of water (e.g. 0-20cm behind it to promote establishing sphagnum on the cutover areas). Water depth should not exceed 50cm as above this depth Sphagnum growth is inhibited. Marginal bunds can additionally reduce the hydraulic gradient between the water table in high bog peat and underlying inorganic substrate - reduces downward seepage losses. Bunds typically developed from highly humified peat and include a low permeability core/liner to limit water flowing through and underneath the dam.	
	Priority Issue Bare Peat due to erosion	Bare peat present due to previous management practices e.g. moor gripping or the erosion from weather.	Inoculation with Sphagnum. Where suitable hydrological conditions occur. Preparation of the	

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
			surface area of the peat required - remove oxidised layer of bare peat and vegetation to create flat surface. Sphagnum harvested from donor area and spread across prepared surface at ratio of 1:10. Site covered with straw to regulate moisture and temperature. Water table needs to be within 10cm of the ground surface.	
Nitrogen Deposition	On-site factors from livestock i.e., sheep. Off-site factors from air pollutants, intensive agriculture.	Atmospheric inputs are the primary source of nutrients for sphagnum species and excess nitrogen deposition can reduce sphagnum production.	A combination of the methods in this table can contribute to healthier ecosystems for sphagnum species e.g. drain blocking, inoculation with sphagnum, reduction in heather heights, removal of invasive species etc., providing increased resilience of existing habitats and or aiding in their restoration.	Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats preventing the natural regeneration of characteristic site native species. Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire.
Invasive Species	Dominance of rushes on moorland fringes	Spread of non-peatland forming species onto moorland fringes contributes to degradation in peatland species diversity and reduces the structural integrity of blanket bog.	Control of spread and removal of invasive species through cutting and weed wiping of regrowth with appropriate herbicide.	Reduction in unwanted species, improved vegetative structural diversity. Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
			Whilst cutting and weed wiping regrowth has been traditionally used to control invasive species, the potential for control of invasive species through low intensity cattle grazing could be explored depending on site specific conditions. Cattle will trample and reduce the percentage cover of rushes. Drain blocking, peat reprofiling to be conducted following grazing period to re-establish water levels. Potential to inoculate areas with sphagnum	preventing the natural regeneration of characteristic site native species. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.*
	Bracken control	Presence of bracken outcompeting peatland forming species contributing to degradation of peatland species diversity	Manual cutting or rolling. Livestock management through cattle grazing can reduce the cover of bracken.	
	Spread of non-native species e.g. *Rhododendron ponticum* etc,.	Reduces the overall blanket bog habitat coverage and quality. Outcompetes native species resulting in decrease in vegetation community composition and structural diversity.	Control of spread and removal of non-native species. Remove saplings of non-native species through mechanical means. Avoid chemical means of removal. Translocation of sphagnum species in areas where water depth is consistently an average of 20cm. Species could include *S.cuspidatum, S.fallax, S.fimbriatum, S.palustre, S.papillosum* which can be translocated onto bare, treated and intact substrates.	Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats preventing the natural regeneration of characteristic site native species. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.*

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
			Sphagnum propagule source could be applied thickly onto a mobile peat surface. Dependent on sufficient water table height and source.	Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire. Improved physical structure to blanket bog, reduction in ground disturbance. Reduction in presence or cover of woody species.
Fly-tipping	Potential to occur on site.	Degradation of habitat composition and structure.	No fly-tipping permitted. Any existing fly tipping removed.	Improved physical structure to blanket bog, reduction in ground disturbance.
Heather Heights	Potential to occur on site.	Where heather heights exceed 35cm, this can contribute to a higher risk of wildfire (normally caused by rotational burning). Dense heather canopies can outcompete ground floor species, shade out blanket bog species and its shed leaves provide a dry surface inhospitable to wetland species. Can contribute to lowered water tables due to deep root systems. Dense canopy can also	Mowing and/or cutting by mechanical means. Potential to produce heather bales that can be used in-situ for drain blocking.	Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats preventing the natural regeneration of characteristic site native species. Improved structure and function of blanket bog forming species, influencing the potential re-generation of Annex I habitat species including *Calluna vulgaris, Erica tetralix, Empetrum nigrum, Drosera spp.,and Eriophorum angustifolium.*

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
		reduce rainwater reaching lower vegetation layers and bog surface.	Cutting and mulching heather - finely mulched heather left on bog surface can create a mulch to provide a damp seed bed ideal for sphagnum and other mosses to establish on dry peat surface.	Reduction in presence or cover of woody species. Reduction in undesirable species. Improved physical structure to blanket bog, reduction in ground disturbance. Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats preventing the natural regeneration of characteristic site native species. Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire.
Commercial Afforestation	Pre-existing commercial forestry on peatland Encroachment of conifer species on blanket bog	Contributes to lowered water table, reduction in species composition and structure of blanket bog forming species.	Tree Mulching and Stump/Root plate mulching Potential impacts of mulching on the surface of the bog should be considered before implementation	Cutting and mulching heather - finely mulched heather left on bog surface can create a mulch to provide a damp seed bed ideal for sphagnum and other mosses to establish on dry peat surface.

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
			Used to treat trees that act as barriers to access for subsequent re-wetting treatments. Tackles legacy plough and planting ridges from surface. Mulched material is left scattered across the surface. Keeps surface moist and insulated and can help the recolonisation by bog plant species. Mulch particle sizes recommended to be between 5-30cm. Spread mulched material where there is no existing or only sparse ground cover of peatland species. Material needs to be spread evenly to allow light penetration. For stump and roots, only mulch within the looser surface of peat layer – reduces impacts on intact peat. Mulched material can be used as a temporary blocking material in drains and furrows.	Reduction in presence or cover of woody species. Reduction in undesirable species. Improved physical structure to blanket bog, reduction in ground disturbance. Improved structure and function of the blanket bog habitat. Improved structural diversity of the habitats preventing the natural regeneration of characteristic site native species. Improvement in vegetation community composition including M1 *Sphagnum auriculatum* bog pools, M2 *Sphagnum cuspidatum* bog pool, M18 *Erica tetralix-Sphagnum papillosum*, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket and raised mire.
			Furrow blocking (This method can raise the water table and reduce erosion)	

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
			Similar methodology to drain blocking and drain reprofiling. Timber trunks and brash from tree harvesting methods can be used to infill the furrows. Pet dams MUST be used in conjunction and installed first. Crushing brash into furrows with excavator buckets helps to break up drainage lines. Block all outflows from existing furrows and install silt traps along collector drains. Dam installation should be placed 10-20m apart along furrows and drains.	
			Ground Smoothing Aim is to remove the ridges and furrows and create a flatter topography that recreates more natural peatlands. On previously afforested areas the following methods may be carried out to achieve this: Stump flipping: Carefully pulling shallow root systems from peat, flipping them over and compressing them upside down in furrows with the back of excavator bucket.	

Factor / Pressure	Prioritisation of Issues	Impact	Compensation measure	Outcome
			Furrow reprofiling following furrow blocking: Rotten tree roots and stumps are the only material to be used in this scenario. Recently harvested sites do not comply with this method.	

4.4 Outcome – Measure of Success

4.4.1 The measures of restoration success will be specific to a given site and a particular intervention; these will be developed further as part of future iterations of the DBCMP.

4.4.2 Active blanket bog typically contains:

- a mosaic of associated communities and habitats,
- a pool and hummock system with an appropriate mix of indicator *Sphagnum* species (with cover being at least frequent to dominant),
- some heather presence and diversity,
- scrub or tree encroachment being rare,
- little to no gully erosion,
- drains or bare peat associated with human impacts, and
- grass cover usually not frequent.

4.4.3 Moors for the Future's *Blanket Bog Land Management Guidance*[3] outlines that *'a good blanket bog is functioning and actively accumulating carbon. It will be identified by having a high water table (within 10cm of the surface for most of the year) and the presence of a range of species which should include abundant sphagnum species, cotton grasses and a range of dwarf shrubs, including heather. The peat is generally wet at the surface. There should be no large scale bare peat surfaces.'*

4.4.4 Natural England have indicated during ongoing consultation that hydrological conditions along with achieving limited areas of bare peat and a non-grass dominated habitat are key to the functioning of active blanket bog and will be a focus for defining a successful outcome.

4.4.5 The DBCMP will set out the specific measures of success which the compensation measures will be monitored against, depending on the selected compensation site, and details of how these will be monitored, as discussed in more detail below. Natural England will be consulted on these measures during the development of the DBCMP.

4.5 Monitoring and Adaptive Management

4.5.1 Monitoring will be required to understand the success of the implemented compensation measures.

4.5.2 As outlined in *A review of techniques for monitoring the success of peatland restoration* (Bonnett et al, 2011)[16] there are three phases of monitoring:

- Baseline or pre-restoration monitoring - this initial phase monitors the site prior to restoration, providing a baseline or control to assess restoration success, see Section 4.1;

[16] BONNETT, S.A.F., ROSS, S., LINSTEAD, C. & MALTBY, E. 2009. A review of techniques for monitoring the success of peatland restoration. University of Liverpool. Natural England Commissioned Reports, Number 086.

- Post-restoration monitoring - this phase monitors the success over a period after the implementation of restoration measures on the environmental conditions of the site; and
- Longer-term monitoring - to understand the effectiveness of longer-term site management and/or sustainability of restoration in terms of the biogeochemical functioning of the site.

4.5.3 Post intervention monitoring of the compensation site will likely involve fixed point photography and repeat CSM monitoring quadrat surveys along with site visits to ensure agreed land-use practices (i.e., grazing, burning and farming practices) are being adhered to.

4.5.4 Rotational burning and hydrological interventions will be monitored, as appropriate, through remote sensing measures and through the installation of piezometers (hydrological interventions). Piezometer data could be used to demonstrate that the desired bog forming conditions (or supporting processes) have been delivered at a given intervention site.

4.5.5 Monitoring will inform the need for adaptive management. Adaptive management is an iterative process in which management actions are followed by targeted monitoring which informs where additional measures may need to be implemented, should desired outcomes of a specific compensation or restoration measures not be met, or where they could be improved through further interventions.

4.5.6 The DBCMP will specify the types, locations, frequency and duration of the monitoring to be implemented along with a specified process for adaptive management (to ensure the measures are effective). In addition, the DBCMP will identify the legal arrangements in the event monitoring identifies that land-use practices are not being adhered to, as well as the roles and responsibilities for monitoring and the implementation of any required adaptive management.

5 Legal arrangements for implementing, monitoring and maintaining compensation measures on land

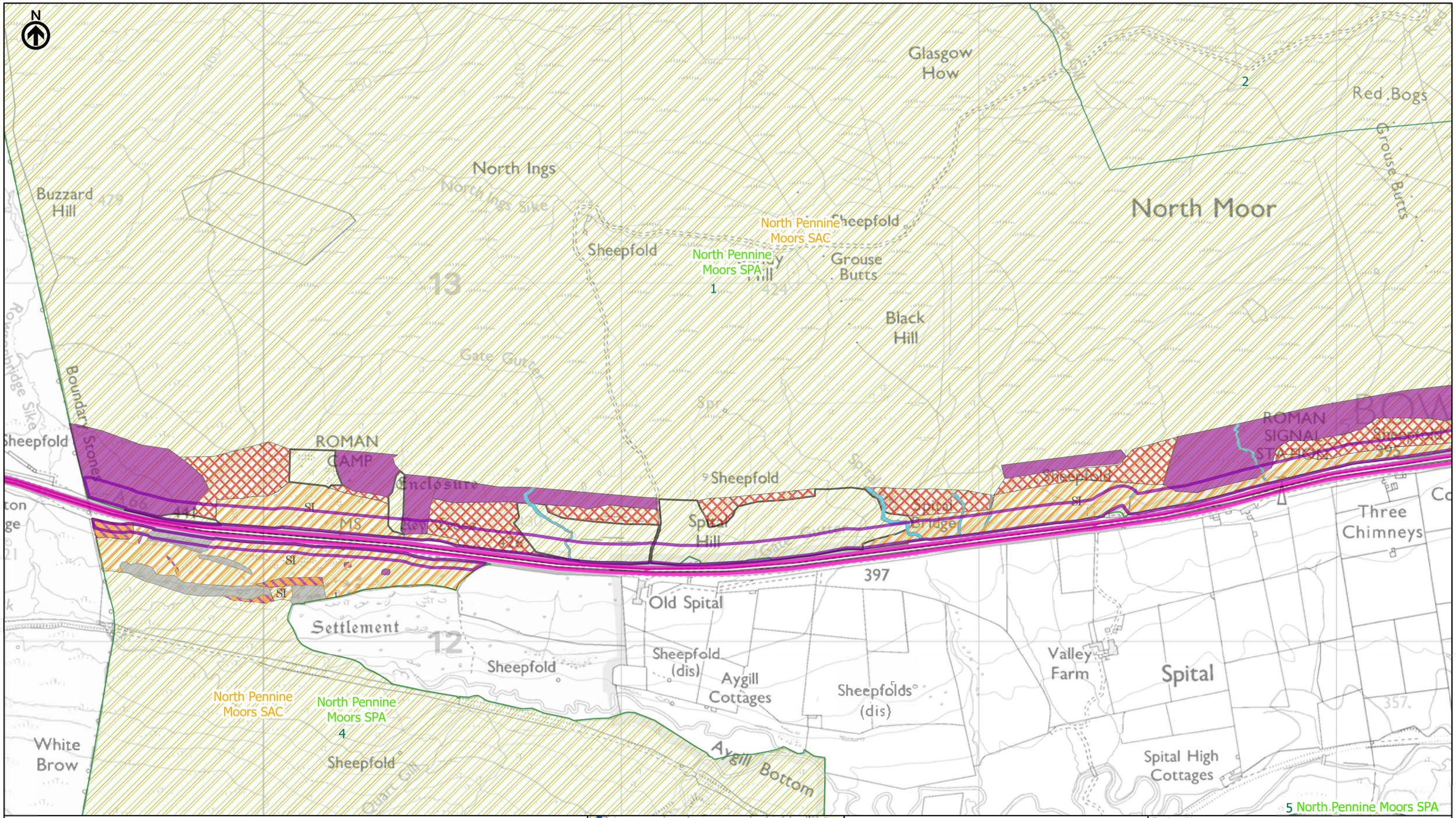
5.1.1 There are wide range of legal arrangements that may be appropriate for securing the implementation, monitoring and maintenance of the compensation measures. Depending on the nature of the compensation measures taken this could include but not be limited to, the acquisition of, or a lease over, the land, the imposition of restrictions prohibiting the carrying out of damaging activities or suitable management agreements. The details of such arrangements will be negotiated with the relevant persons with interests in the land on a bespoke basis and so it is not practicable to prescribe in detail in this OBMCP the form of the legal arrangement.

5.1.2 The DBCMP will explain the legal arrangements entered into with the persons with interests in the land comprised in the compensation site sufficient to enable the compensation measures to be implemented and thereafter monitored and maintained in accordance with the requirements

of the DBCMP for which approval is sought. Where legal arrangements are entered into with third parties to deliver the implementation, monitoring or maintenance of the compensation measures, these will also be explained in the DBCMP.

Appendix A

North Pennine Moors Survey Map



Existing A66

Affected Road Network (ARN)

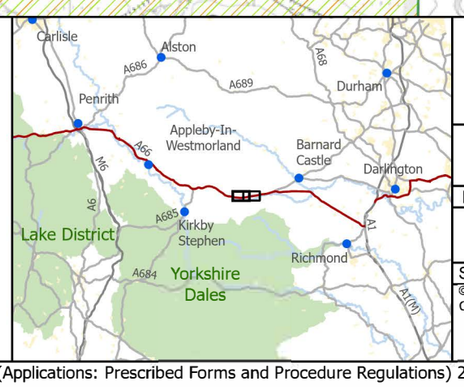
Area Where a Change in Nitrogen Deposition Exceeds 1% of the Critical Load, as Defined by the Air Quality Modelling Data

Statutory Designated Sites

- Special Area of Conservation
- Special Protection Areas
- Site of Special Scientific Interest Units (With IDs)

SAC Survey Habitat Description

- Blanket Bog - Assumed to be Annex 1 following Phase 1 survey methodology
- Blanket Bog Habitat Mosaic
- Acid Grassland
- Acid/Marshy Grassland Mosaic
- Marshy Grassland
- Rock Exposure and Waste
- Watercourse
- Flush and Spring



national highways

3 Piccadilly Place
Manchester
M1 3BN

Revision	Created	Checked	Reviewed	Approved	Authorised
P02	First Issue				
	CESL	LHAN	THOU	AWAR	KW HA
	12/04/22	19/04/22	20/04/22	21/04/22	21/04/22

Kilometres
0 0.25 0.5

Scale @ A3: 1:10,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
North Pennine Moors Survey Map Appleby to Brough to Bowes Bypass

Sheet 1 of 2

Map Number

Project	Originator	Volume	Location	Type	Role	Number
HE565627	AMY	EBD	S00	MP	LB	003354

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) and 5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6

Existing A66

Affected Road Network (ARN)

Area Where a Change in Nitrogen Deposition Exceeds 1% of the Critical Load, as Defined by the Air Quality Modelling Data

Statutory Designated Sites

Special Area of Conservation

Special Protection Areas

Site of Special Scientific Interest Units (With IDs)

SAC Survey Habitat Description

Blanket Bog - Assumed to be Annex 1 following Phase 1 survey methodology

Blanket Bog Habitat Mosaic

Acid Grassland

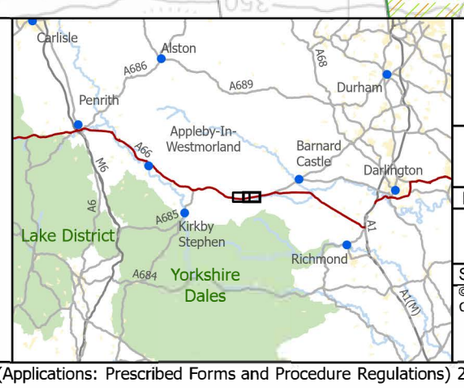
Acid/Marshy Grassland Mosaic

Marshy Grassland

Rock Exposure and Waste

Watercourse

Flush and Spring



national highways

3 Piccadilly Place
Manchester
M1 3BN

	First Issue				
P02	CESL	LHAN	THOU	AWAR	KWHA
	12/04/22	19/04/22	20/04/22	21/04/22	21/04/22
Revision	Created	Checked	Reviewed	Approved	Authorised

Kilometres
0 0.25 0.5

Scale @ A3: 1:10,000 | Project Ref No HE565627 | Stage: Stage 3

Project Name
A66 Northern Trans-Pennine Project

Map Title
Figure 1.1
North Pennine Moors Survey Map Appleby to Brough to Bowes Bypass
Sheet 2 of 2

Map Number

Project	Originator	Volume
HE565627	AMY	EBD

Location	Type	Role	Number
S00	MP	LB	003324

Suitability	Suitability Description	Revision
S4	FIT FOR STAGE APPROVAL	P02

This Environmental Statement Figure meets the requirements of Regulation 5(2)(g) and 5(2)(l)(i) of the Infrastructure Planning (Applications: Prescribed Forms and Procedure Regulations) 2009.

PINS Reference Number: TR010062/APP/3.6