Nenthead (Caplecleugh) Mine Water Treatment

EIA Scoping Report

The Coal Authority

25 February 2019

Quality information

Prepared by	Checked by	Verified by	Approved by
J Graham – Graduate Environmental Scientist	S B Banks – Associate Environmental Scientist	I M Campbell – Associate Environmental Scientist	

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Prepared for:

The Coal Authority

Prepared by:

AECOM Infrastructure & Environment UK Limited
5th Floor, 2 City Walk
Leeds LS11 9AR
United Kingdom

T: +44 (0)113 391 6800
aecom.com

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1. Introduction

1.1 Overview

1.1.1 The Coal Authority (referred to herein as 'the Applicant') is proposing to submit a planning application to Cumbria County Council's Mineral Planning Authority (MPA) for a Mine Water Treatment Scheme for the Nenthead Mine.

1.1.2 The Mine Water Treatment Scheme (referred to herein as the 'Development') would be located on a site 0.9km to the south east of Nenthead, at OS National Grid Reference 378591E 543232N.

1.1.3 The planning application will be accompanied by an Environmental Statement (ES), which will be prepared in accordance with the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (the 'EIA Regulations').

1.1.4 AECOM Infrastructure & Environment UK Ltd has been commissioned by the Applicant to prepare an Environmental Impact Assessment (EIA) Scoping Report to inform the scope and content of an EIA for the Proposed Development.

1.2 Need for the Development

1.2.1 The EU Water Framework Directive (WFD) sets out a legislative framework for the analysis, planning and management of water bodies. It is delivered through River Basin Management Plans (RBMPs), which describe baseline waterbody conditions and objectives for their improvement. The Northumbria River Basin Management Plan sets out legally binding objectives for each quality element within every water body.

1.2.2 The Nent catchment fails to reach good status or good potential under the Northumbria River Basin Management Plan due to high concentrations of some metals, in particular zinc, cadmium and lead. The sources of these metals are former mine workings and associated mine water discharges located at the top of the catchment. For the River Nent water body, objectives include reducing metal concentrations to improve the quality in this water body towards good status by implementing measures to limit the input of metal to the river and to manage metal-contaminated sediments already in the river.

1.2.3 Drainage from abandoned metal mines is an acute and pervasive form of aquatic pollution. Based on assessment by the Environment Agency, these discharges of metals including cadmium, lead and zinc pollute up to 1,500 kilometres (km) of rivers in England. Consequently, there is a need to tackle these issues in pursuance of improved national water quality and, in particular, of meeting the objectives of the WFD.

1.2.4 The Nenthead site has been identified as a significant source of metals within the River Nent catchment. The Proposed Development has potential for significant environmental benefits through improving the quality of water discharging from Nenthead to the River Nent through the removal of metals (notably zinc, lead and cadmium), which would contribute to the waterbody meeting the River Basin Management Plan objective of Good Potential by 2027.

1.2.5 The Department for Environment, Food and Rural Affairs (Defra) and the North East Local Enterprise Partnership have allocated funding for the Coal Authority and the Environment Agency to implement a programme of measures to minimise pollution from abandoned metal mines (the Water and Abandoned Metal Mines programme (WAMM). The Proposed Development forms part of this programme. A pilot mine water treatment scheme which is in operation at Force Crag and the Nent-Haggs Mine Water Treatment Scheme, for which full planning consent has been recommended by Cumbria County Council (CCC) for approval subject to a legal s106 agreement (planning application *3/18/9001*) also form part of this programme.

1.3 Environmental Impact Assessment

The Need for an EIA

1.3.1 The Proposed Development, which would require an area of land of approximately 20 ha, would constitute Schedule 2 development under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended 2018 (herein referred to as the 'EIA Regulations) as:

i. it meets the description and criteria within Schedule 2 of the EIA Regulations for 11 c) Waste-water treatment plants for which the area of development exceeds 1000 m^2; and

ii. it would be within a sensitive area - as it is located within an Area of Outstanding Natural Beauty (AONB) and is partly within land classified as a Scheduled Monument and as a Site of Special Scientific Interest (SSSI).

1.3.2 AECOM therefore considers that the Proposed Development constitutes EIA development by virtue of the potential of the Proposed Development to have significant effects on a Scheduled Monument, SSSI and AONB. It also has potential to have significant effects on other receptors as identified within this scoping report.

1.3.3 An EIA will therefore be undertaken and an ES produced and submitted in support of the Planning Application to be submitted for the Proposed Development.

EIA Scoping

1.3.4 Although not mandatory, submission of this Scoping Report to CCC commences the EIA process and represents the first notification to CCC, as the Mineral Planning Authority, that the Applicant will undertake an EIA in respect of the Proposed Development and produce an ES to report the findings of the EIA.

1.3.5 Scoping forms a key stage of the EIA process, providing a framework for identifying likely significant environmental effects arising as a result of the Proposed Development and distinguishing the priority issues needing to be addressed within the ES. The Scoping Report also identifies those matters which do not need to be assessed in detail. Scoping also provides key stakeholders with an early opportunity to comment on the proposed structure, methodology and content of the EIA.

1.3.6 The EIA will assess the likely significant effects the Proposed Development could have on the site and surrounding area through detailed baseline studies and technical assessments of issues which require detailed assessment. It will propose mitigation measures and further monitoring, as required. This information will be used to produce an ES and will inform the design of the Proposed Development.

1.3.7 In accordance with Regulation 15(1) of the EIA Regulations, by submission of this Scoping Report, the Coal Authority has requested that CCC states its opinion as to the information to be provided in the ES, by adopting an EIA scoping opinion. By this Scoping Report, the Coal Authority is also giving notice to CCC pursuant to Regulation 17(1) of the EIA Regulations – that requires CCC to give notice to the 'consultation bodies' that the Coal Authority intends to submit an environmental statement and that those bodies have a duty (pursuant to Regulation 17(4)) to make relevant information they hold available to The Coal Authority.

1.3.8 This Scoping Report sets out the information which the Coal Authority is required to provide in accordance with Regulation 15(2)(a) of the EIA Regulations in support of this request (and which also covers that required by EIA Regulation 17(2)), namely:

- a plan sufficient to identify the land (refer to the Figure 1 - Site Location Plan);
- a brief description of the nature and purpose of the Proposed Development, including its location and technical capacity;
- an explanation of the likely significant effects of the Proposed Development on the environment; and
- such other information or representations as the person making the request may wish to provide or make.

1.3.9 The information requirements are met by this EIA Scoping Report, which considers the environmental context of the Proposed Development and its potentially significant environmental effects. This Scoping Report identifies those topics which require inclusion in the ES (i.e. which are ‘scoped in’) and discusses the proposed methods of assessment and the proposed structure of the ES. It also identifies those topics which need not be assessed (i.e. are ‘scoped out’).

2. Development Description

2.1 Site Location and Environmental Context

2.1.1 The Proposed Development site is located approximately 0.9 km to the south-east of Nenthead village (refer to the Figure 1.1 - Site Location Plan).

2.1.2 The Capelcleugh adit is located at the Nent Mines car park adjacent to the Nenthead Mines Heritage Centre. The main treatment site is to be located to the south-east of the adit, upstream of the current mine water discharge location and is bounded to the north by the A689 and to the south by a quarry track. The western edge of the Proposed Development site steeply slopes down to the mine museum and to the east is open countryside. Part of the main treatment site is within the Scheduled Monument (SM), list entry number 10158582 “Lead mines, ore works and smeltmill at Nenthead”. The Smallcleugh Mine SSSI is located adjacent to the southern boundary of the main treatment site.-

2.1.3 The wider area is rural in character and dominated by farmland / pasture. A number of farm properties, including residential buildings are located within 500 m of the site including Mill Cottage, Hilltop Cottages, Nenthead House, Eastern House, Thornleigh and Granary Cottage.

2.1.4 Key environmental constraints are shown in Figure 2.1 – Environmental Constraints Plan. Statutory designated sites present within 2 km of the Proposed Development boundary are listed in Table 2.1 below.

Table 2.1: Statutory Designated Sites Within 2 Km

Designation	Site Name	Distance from Site Boundary (km)	Direction from Site Boundary
Area of Outstanding Natural Beauty	North Pennines AONB	0	
Special Area of Conservation (SAC)	Tyne and Nent SAC	0.7	W/SW
	North Pennine Moors SAC	1.1	NE
Special Protection Area (SPA)	North Pennine Moors SPA	1.1	NE
Site of Special Scientific Interest	Smallcleugh Mine SSSI	0	S/SW
	Haggs Bank SSSI	2	NW
	Allendale Moors SSSI	1.1	NE
	Whitesike Mine and Flinty Fell SSSI	0.7	W/SW
	Coalcleugh lead rake	1.3	NE

Designation	Site Name	Distance from Site Boundary (km)	Direction from Site Boundary
	Lead mines, ore works and smeltmill at Nenthead	0	
	Perry's Dam	1.2	S
	Lead rake workings on Flinty Fell, 800m north west of Flinty Quarry	1.5	SW
Scheduled Monuments	Lead mines, ore works and smeltmill at Nenthead (List entry no. 1015858)	0	
	Lead rake workings on Flinty Fell, 800m north west of Flinty Quarry (List entry no. 1017448)	1.5 and 2km	SW
	Perry's Dam (List entry no. 1015859)	1.4	S
	Coalcleugh lead rake (List entry no. 1015833)	1.4	NE
Listed Building (Grade II)	Milestone to North east of Hilltop	0.05	NE
	Ivy House	0.15	N
	Dene Terrace	0.1	W
	Former powder magazine 150m south west of Chapel Houses	0.3	N
	Reading room, adjoining west end of ivy house	0.15	N
	3rd house from west end of road	0.2	N
	Memorial pump and canopy	0.15	N
	Milepost about 100m east of Killhope head Bridge	2	E

Designation	Site Name	Distance from Site Boundary (km)	Direction from Site Boundary
	Milestone to north of woodbrae	1	NW
	Killhope cross	0.9	E
	Boundary stone c2000 yards south east of Nenthead in field on north side of road	1.6	SW
	Forecourt walls, gate piers and central gate to front of Ivy House	0.15	N
	Boundary stone C1600 yards south west of Nenthead in field on south side of road	1.3	SW
	The Beeches	0.8	NW
	Nenthead Methodist Church	0.15	N

2.2 The Proposals

2.2.1 The Proposed Development is a water treatment scheme which would improve the quality of water discharging from the Caplecleugh adit to the River Nent through the removal of metals (notably zinc, lead and cadmium), which contribute to heavy metal pollution of the River Nent and the downstream South Tyne catchment.

2.2.2 The Proposed Development site was selected by the Coal Authority as the preferred treatment site following a review of three potential sites[1]. The site was selected as it represented the best value for money and had a number of distinct advantages including: fewer nearby receptors, good accessibility, shorter pipeline routes away from public highways, reasonable topography, availability of space, potential for a partnership with Nenthead Mines Conservation Society. Whilst the site has a number of constraints, including archaeology and visual impacts, a meeting held between the Coal Authority and Historic England concluded with there being broad agreement that a scheme could be built whilst being sensitive to the historic features and landscape.

2.2.3 A description of the Proposed Development is set out below and an indicative layout plan is provided in Figure 2.2. These would be subject to detailed design and any requirements for mitigation identified through the environmental impact assessment process.

2.2.4 The main treatment site is likely to comprise: three compost based treatment ponds (CBTPs), one balancing pond, one wetland, a single storey, pitched roof, stone clad building housing plant for chemical dosing and welfare facilities, access and maintenance tracks. The Proposed Development would also include a mine water capture structure, pumping station, transfer pipelines to and from the

[1] Coal Authority, 2018. Nenthead (Caplecleugh) Mine Water Treatment Scheme Sites 23, 100 and 101 Feasibility.

main treatment site and a new outfall to the River Nent. The Proposed Development will be accessed from the A689 by an existing track .

2.2.5 Water discharging from the Caplecleugh adit would be intercepted by a capture structure at the Caplecleugh adit, which would collect the untreated mine water before it enters the river. Captured mine water would then be transferred across the river via an above water level pipeline underneath the bridge to a pumping station where a pumped rising main would transfer the water flows to the treatment site. On entering the treatment site, the mine water flow would be split into three and would flow through the CBTPs before draining via gravity to a “polishing” wetland comprising shallow reed beds. The treated water would then be returned back to the river via a gravity pipeline. It is intended that the treated mine water would be discharged back into the River Nent via a new outfall at a location close to the existing discharge point.

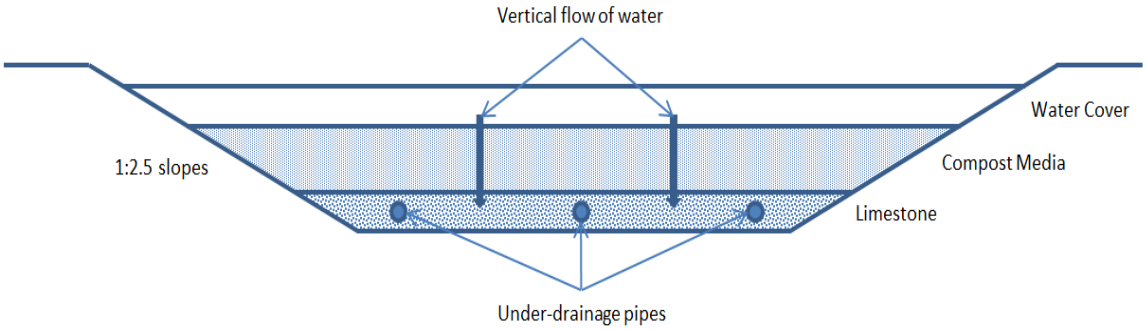
2.2.6 Odour dosing plant would also be provided as part of the Proposed Development to allow for management and treatment of any excess hydrogen sulphide which may be generated by the treatment process and which has potential to give rise to malodours if not managed. The odour dosing plant would be housed in a single-storey, pitched, stone-clad building. The same building wold also house essential welfare facilities for maintenance staff when visiting the operational site.

2.2.7 The proposed treatment scheme is based on the same technology as the Nent-Haggs mine water treatment scheme which Cumbria County Council has recommended is granted planning consent, subject to a Section 106 legal agreement and planning conditions (planning application 3/18/9001). This technology relies upon the chemical reduction of sulphate (SO_4^{2-}), which is typically found in elevated concentrations in mine water, to sulphide (S^{2-}). The sulphide that is generated then reacts with the dissolved metals in the mine water to precipitate low solubility metal sulphides. The precipitated solid metal sulphides are retained within the compost-based treatment media, thus removing the metal pollutants from the mine water.

2.2.8 The reduction of sulphate is facilitated by the action of sulphate-reducing bacteria, a process referred to as Bacterial Sulphate Reduction. In the reactions taking place during metal sulphide precipitation the molar ratio of SO42- to divalent metal (e.g. zinc (Zn2+), lead (Pb2+)) is 1:1 (i.e. for every one ‘part’ (mole) Zn2+ removed 1 ‘part’ (mole) SO42- (or S2-) is removed).

2.2.9 Plate 2.1 below shows the generalised form of a CBTP. Mine water is piped into the pond at the upper water surface; whilst treated water is removed from the base of the pond through a limestone under-drainage blanket. A network of under-drainage pipes establishes a downwards vertical water flow through the reactive compost media which forms the treatment cell. The pond water cover is typically 400 mm deep, which allows an even flow of water across the surface of the pond and an even distribution of the vertical flows through the compost bioreactor layer.

Plate 2.1 General CBTP Composition



2.2.10 The type of treatment system that would be used in the Scheme has successfully removed heavy metals from mine water at a pilot unit located in the grounds of the Nenthead Mines Heritage Centre and in full scale application at Force Crag mine in Cumbria. Odour monitoring and engineering control and dosing trials undertaken on-site at Force Crag mine in 2017 were used to inform the design of the Nent-Haggs Mine Water Treatment Scheme and would be used to inform the design of the Proposed Development Development.

2.3 Development Programme

Subject to planning consent being granted, the current programme for the Proposed Development is for construction to start in 2019 and to become operational in 2021.

3. EIA Scoping - Approach and Methodology

3.1 Introduction

3.1.1 This Scoping Report identifies the topics that will be covered in the ES and provides details on how they will be assessed, to ensure that:

- features of environmental importance that could be affected by the proposed scheme are investigated and evaluated;
- analysis of the impacts and potential effects during construction and operation are undertaken to the necessary level of detail;
- appropriate mitigation measures are identified;
- the significance of effects are assessed; and
- cumulative effects are considered.

3.1.2 The environmental assessment will also be used to inform the Proposed Development design process and aid in the Proposed Development of appropriate mitigation measures.

3.2 Determining the Scope of the EIA

3.2.1 The EIA will consider the potential effects of the Proposed Development on the environment during construction, operation and maintenance. At this stage it is assumed that the mine water will continue to discharge and need to be treated in the future. There is, therefore, no intention at this stage to decommission the treatment scheme after a set period of time. As it is not possible to predict what the baseline environmental conditions may be if and when the treatment scheme is decommissioned, the EIA will not include an assessment of the potential effects during decommissioning. Any environmental impacts and effects of decommissioning would therefore need to be assessed at the appropriate time.

3.2.2 Regulation 4 of the EIA Regulations requires that the EIA must identify the indirect and direct significant effects on:

- population and human health;
- biodiversity, with particular attention to protected species and habitats;
- land, soil, water, air and climate;
- material assets, cultural heritage and the landscape;
- the interaction between the above factors.

3.2.3 Based on an evaluation of the baseline environmental information that exists for the site and surrounding area and the potential environmental effects of the Proposed Development, it is proposed that the EIA will include assessments of the following technical topic areas. Further information on these topics is provided within Section 5 of this report:

- Landscape and Visual Amenity
- Noise and Vibration
- Air Quality and Odour

- Traffic and Transport
- Cultural Heritage
- Biodiversity
- Ground Conditions and Hydrogeology
- Hydrology and Flood Risk
- Waste Management
- Climate Change

3.2.4 The assessment of alternative sites and designs will be included within the scope of the EIA to ensure the Proposed Development site and design are optimal however due to the set location of the Nenthead mine the requirement to transfer mine wastewater to other sites if selected must be considered.

3.2.5 In undertaking the EIA, and to meet the requirements of the 2017 EIA Regulations for climate change adaptation to be considered, the individual technical assessments will, where appropriate, include consideration of the effects of climate change. The effects of climate change will then be summarised in a separate chapter within the ES.

3.2.6 A further requirement introduced by the 2017 EIA Regulations, to assess impacts on human health, will be addressed within the individual technical assessments and reported within relevant chapters of the ES including: Air Quality and Odour; Noise and Vibration; Ground Conditions and Hydrogeology; and Hydrology and Flood Risk.

3.2.7 The need to consider the vulnerability of the Proposed Development to major accidents or disasters has been scoped out of the EIA as the most likely event would be a major flood event and a separate Flood Risk Assessment (FRA) will be undertaken by the design team which will address the potential for the Proposed Development to be affected by flooding. The full FRA will be included as a Technical Appendix to the ES and the findings of the FRA referred to within the technical assessment of Hydrology and Flood Risk.

3.2.8 A number of other assessments, common to the EIA process, are not considered relevant to the EIA of the Proposed Development as no significant environmental effects are anticipated to occur. The term ‘significant’ is an important distinction because a development may cause minor impacts to occur which do not have significant environmental effects. Table 3.1 below provides a summary of those topics proposed to be scoped in or out of the EIA, together with the reasons for this. Both construction effects and operational effects have been considered. Within Table 3.2, reference to ‘Operation’ includes both routine operation and maintenance of the Proposed Development. In identifying likely significant effects of the Proposed Development, consideration has been given to the findings of the ES for the Nent-Haggs Mine Water Treatment Scheme[2], in particular where the Proposed Development and its potential impacts would be similar to those for the Nent-Haggs scheme.

3.2.9 In addition to the technical topic areas identified in Table 3.2, an assessment of cumulative effects is required. This is discussed further in Section 5.12.

3.2.10 Further details with regards to the information take into consideration in determining the scope of the EIA, including potential impacts, classification of effects and how consideration is given to known mitigation measures, are provided in the sections following Table 3.1. Further information on the environmental baseline, potential impacts and effects of the Proposed Development on the environment and proposed topic-specific assessment methodologies are provided in Section 5. Further information on those topics and / or environmental aspects scoped out of the EIA are provided in Section 6.

[2] AECOM, 2018. Nent Haggs Mine Water Treatment Scheme. Environmental Statement. February 2018, submitted to Cumbria County Council with planning application 3/18/9001.

Table 3.1: Topics Scoped In and Scoped Out of the EIA

Topic	Scoped IN/OUT	Reason
Landscape and Visual Amenity	IN (Construction and Operation)	The local area is predominantly rural and therefore there are large open views meaning the buildings required for the Proposed Development would be widely visible and could have significant landscape and visual effects. In addition, the site and its surroundings sit within the North Pennines Area of Outstanding Natural Beauty.
Noise and Vibration	IN (Construction and Operation)	The site is located in a rural area with low baseline noise levels and is therefore susceptible to changes in noise and vibration. An assessment of potential noise and vibration impacts due to construction activities is required to determine whether there would be any significant effects that would require mitigation. Assessment of potential noise impacts associated with construction traffic is also required. Part of the Proposed Development, including the pumping station, would be within approximately 50-75m of occupied buildings. An assessment of operational noise associated with the pumps is required to determine whether there would be any significant effects of noise on sensitive receptors which would require mitigation. Operational traffic noise is unlikely to give rise to significant effects due to the infrequent nature of vehicle movements to and from the site. Assessment of noise impacts associated with operational traffic movements is therefore scoped out.
Air Quality and Odour	IN (Construction – Air Quality; Operation – Odour)	The site is located in a rural area with good air quality. An assessment of potential impacts on air quality due to construction activities is required to determine whether there would be any significant effects that would require mitigation. During operation there is potential for odour to be generated during operation, therefore an odour assessment is required. Significant air quality effects during operation, other than odour, are not likely due to the infrequent nature of vehicle movements to and from the site and therefore the limited potential for impacts from vehicle emissions. Assessment of air quality impacts associated with operational traffic movements are therefore scoped out.
Traffic and Transport	IN (Construction only)	The construction of the Proposed Development would require vehicles entering and exiting the site. Material quantities are yet to be defined, therefore an assessment of

Topic	Scoped IN/OUT	Reason
		the potential impacts associated with construction traffic is required to determine whether there would be significant effects. During operation, vehicles would only be required for maintenance checks and removal of waste and would be relatively infrequent. Whilst it is not currently known how many vehicle movements would be required for the removal of waste, given that this is only expected to occur once every ten to fifteen years, this is unlikely to cause significant effects. Assessment of operational Traffic and Transportation for the nearby Nent Haggs Mine Water Treatment Scheme concluded that there would be no significant effects. On the basis that operational traffic for the Proposed Development would be similar to that for Nent Haggs, an assessment of operational traffic has been scoped out.
Cultural Heritage	IN (Construction and Operation)	The main treatment site is situated partly within the Scheduled Monument “Lead mines, ore works and smeltmill at Nenthead” (List entry no. 1018582)
Biodiversity	IN (Construction and Operation)	The polluting metals entering the River Nent from the site contribute to the presence of Caliminarian grasslands within the Tyne and Nent SAC. A Phase 1 Habitat Survey completed for the site outlined a number of legally protected species.
Ground Conditions and Hydrogeology	IN (Construction only)	The Proposed Development is located within a former mine area and would require the excavation of ground which may include mining spoil and has the potential to be contaminated by heavy metals. An assessment of the potential impacts on human health and the environment is required to determine whether there would be significant effects which would require mitigation during construction. The Proposed Development would be designed with embedded mitigation similar to that provided for the Nent-Haggs Mine water Treatment Scheme such that there should be no adverse impacts or therefore significant effects on ground conditions or hydrogeology during the operation of the Proposed Development. Assessment of effects on ground conditions and hydrogeology during operation is therefore scoped out.
Hydrology and Flood Risk	IN (Construction and Operation)	A section of the site is situated within flood zone 3, therefore a Flood Risk Assessment is required. There would also be some works to construct the outfall to the River Nent, plus there are other water bodies (first order watercourses and a disused reservoir with the site). There may also be a groundwater resource. Overall, as there is the potential

Topic	Scoped IN/OUT	Reason
		for adverse impacts during both construction and permanently during operation, an assessment is required and this topic has been scoped into the Environmental Statement.
Socio-Economics	OUT (Construction and Operation)	Socio-economic impacts of the Proposed Development would be similar to those for the nearby Nent-Haggs mine water treatment scheme, for which no significant effects were identified.
Waste Management	IN (Construction and Operation)	The Proposed Development has potential to generate waste materials both during construction (excavated material) and during operation (used compost). Assessment is required to determine whether this would result in significant effects in terms of waste management.
Climate	IN (Construction and Operation)	There is potential for projected climate changes and extreme weather to impact upon the resilience of the Proposed Development and for the Proposed Development to have impacts on greenhouse gas emissions particularly during construction. It is expected that impacts and effects would be similar to those for the nearby Nent-Haggs Mine Water Treatment Scheme and would be mitigated by embedded mitigation and environmental management measures similar to those to be implemented on that scheme, however there is also opportunity for greenhouse gas emissions to be reduced by, for example, the implementation of solar panels for power generation during operation.
Health Impact Assessment	OUT	Health impacts of the Proposed Development would be similar to those for the Nent-Haggs mine water treatment scheme, for which no significant effects were identified. Any temporary impacts during construction, e.g. due to dust or noise generation, will be assessed within the Air Quality and Noise assessments. The Proposed Development is not considered likely to have any significant adverse effects on drinking water.
Major Accidents and Disasters	OUT	Limited potential for major accidents and disasters. Potential impacts associated with flood risk will be addressed within the Hydrology and Flood Risk assessment and the Climate Change assessment.

Identification of Potential Impacts and Effects

3.2.11 An EIA should determine the potential impacts of each aspect of at Proposed Development likely to have a significant effect on the environment, including its location and management.

3.2.12 Distinction is drawn between characteristics of 'impacts' and the significance of 'effects', as not all impacts identified have a potentially 'significant' effect on the environment. Impacts and effects are defined as follows:

- 'impacts' are the predicted changes to the baseline environment attributable to the project (e.g. land take, change in noise levels, visual changes); and
- 'effects' result from the consequences of impacts on environmental resources or receptors of particular value or sensitivity (e.g. displacement of business due to land take, sleep disturbance of local residents due to construction noise, loss of amenity caused by visual intrusion).

3.2.13 Effects associated with the Proposed Development may take the following forms:

- Direct - directly attributable to the Proposed Development
- Indirect - resulting indirectly as a consequence of the Proposed Development
- Construction phase - usually short term and reversible being associated with the construction activities; and
- Operational phase - caused by every day operation of the Proposed Development.

3.2.14 Construction of the Proposed Development would require the activities listed below which may result in impacts and effects on environmental receptors:

- Vegetation clearance, soil removal.
- Construction of temporary access and haul route, which would become the permanent access and service track for operation and maintenance.
- Construction of temporary site offices, compounds, storage areas and worksites.
- Ground and excavation works.
- Construction of permanent site buildings (treatment site), pumping station and mine water interception structure.
- Construction of the mine water transfer pipeline.;
- Routing of services and utilities to the treatment site.
- Temporary site drainage.
- Construction traffic movements.

3.2.15 Operation and maintenance of the Proposed Development would require the following activities which may result in impacts and effects on environmental receptors:

- Operation of the pumping station.
- Discharge of the treated mine water back into the River Nent.
- Removal and disposal of accumulated metal-rich sediments from the treatment ponds.
- Maintenance of the ponds, e.g. should issues arise which affect system operation/ performance.
- Vegetation management within the treatment site.
- Odour management.

Classification of Effects

3.2.16 In determining the scope of the EIA, the potential impacts of the activities identified above have been taken into account together with the value of the relevant receptors and whether potential impacts and effects would be short or long-term, temporary or permanent, localised or with a wider zone of influence, direct or indirect, reversible or non-reversible. Table 3.2 below presents a matrix for the

generic classification of effects which will be used in the EIA assessment when preparing the ES. For the purposes of the scoping process a preliminary assessment has been made using a similar approach. Further details on the findings of the preliminary assessment are provided under the technical topic headings in Section 5 of this report.

Table 2.2: Classification of Effects

Sensitivity of Resource /Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible
Very Low	Minor	Negligible	Negligible	Negligible

Design, Mitigation and Impact Assessment

3.2.17 In undertaking the preliminary assessment of potential impacts and whether these are likely to give rise to significant effects, consideration has been given to the mitigation measures that would be incorporated into the design of the Proposed Development (i.e. 'embedded mitigation') – where these are known at this stage – as well as to legal requirements and to good practice measures that are accepted industry best practice. Aspects of embedded mitigation have been informed by the design of the Nent-Haggs Mine Water Treatment Scheme where this would be similar to the Proposed Development proposed at Nenthead to treat the mine water from the Caplecleugh adit.

3.2.18 Embedded mitigation will be refined and / or added to during the on-going design process and the impact assessments undertaken for the ES will take into account all mitigation measures that have been incorporated into the Proposed Development prior to planning submission, as well as best practice management activities. Such mitigation measures are likely to include, for example, new planting, habitat creation/ restoration and sympathetic finishes of development infrastructure.

3.2.19 The final detailed design of the Proposed Development will, where appropriate and practicable, incorporate environmental mitigation identified during the EIA process and agreed with the Coal Authority. The EIA will therefore determine the significance of predicted residual effects that would remain after the proposed and agreed design mitigation measures have been implemented.

3.3 Other Considerations

Habitats Regulations Assessment

3.3.1 An Appropriate Assessment or Habitat Regulations Assesment (HRA) has previously been undertaken by the Environment Agency in accordance with the Habitats Regulations (which looked at the potential effects of a number of mine water treatment works on the Tyne & Nent SAC and the Tyne & the Allen River Gravels SAC.[3]. Treatment of mine water from the Caplecleugh adit at Nenthead was one of the mine water treatment works included in the HRA. The HRA specifically includes consideration of the effects of the Proposed Development on the SACs, in particular the potential effect on calaminarian grasslands for which the Tyne and Nent SAC is designated. The presence of calaminarian grasslands (assemblages of metal tolerant plant communities) was described in Cumbria County Council's screening opinion on the Nent-Haggs Mine Water Treatment Scheme as the 'primary and sole reason for selection of the River Tyne and Nent as a Special Area of Conservation (SAC)' (Cumbria County

[3] Environment Agency, 2014. Form HR02: Proforma for Stage 3 Appropriate Assessment and appendices. Land Drainage Consent for Mine Remediation Schemes

Council, 2015[4]). The screening opinion commented that the reduction in heavy metals within the river water, as a result of the mine water treatment could lead to a reduction in contaminated river sediments being deposited on downstream river gravels which could then result in a loss of calaminarian grassland and an adverse effect on the SAC.

3.3.2 Measures designed to mitigate or avoid adverse effects on the SAC as a result of removal of metals from mine discharges were previously agreed with Natural England[5] (refer to Appendix C). The measures proposed would be applied to Blagill SSSI (within the Tyne and Nent SAC) and would include new disturbance of vegetated sediments in the floodplain, thereby removing mesotrophic vegetation covering 'old' sediments in strategic locations and providing sites for the recolonisation of calaminarian grassland. It was subsequently agreed between the Coal Authority, the Environment Agency and Natural England that monitoring of Blagill SSSI would be undertaken and mitigation measures implemented if it was found to be necessary.

3.3.3 With the agreed and resourced mitigation strategy in place, the conclusion of the HRA was that the mine water treatment works, would not result in degradation of the physical, chemical or biological processes that support habitats and species for which the Tyne & Nent SAC has been designated. The findings of the HRA continue to be relevant to the treatment of the mine water from Caplecleugh adit and will therefore be referred to within the ES.

Water Framework Directive

3.3.4 Whilst the Proposed Development is being implemented in order to meet WFD objectives, the overall effect of the Proposed Development will be assessed in the context of the WFD to: 1) demonstrate that it contributes to the River Nent waterbody (and downstream water bodies) meeting WFD objectives; and 2) to ensure no other aspect of WFD compliance is compromised as a result of the Proposed Development.

3.3.5 The WFD assessment will evaluate whether the Proposed Development upholds WFD objectives and will, where appropriate, provide recommendations for mitigating any potential deterioration in the aquatic environment which might occur from implementation of the Proposed Development. The assessment will primarily involve biological, and hydromorphological (physical) elements, for surface water and groundwater bodies at the site of interest and for connecting waterbodies.

3.3.6 The WFD assessment for the Proposed Development will report on whether the Proposed Development could:

- cause deterioration in ecological status/potential of the waterbody;
- prevent the waterbody from meeting its objective of good ecological status/potential;
- prevent or compromise WFD objectives being met in other waterbodies;
- cause failure to meet good groundwater status, or result in a deterioration of groundwater status; and
- prevent the implementation of mitigation measures which define the hydromorphological designation of heavily modified waterbodies.

3.3.7 The WFD assessment will include consultation with the Coal Authority, the Environment Agency and other relevant stakeholders.

[4] Cumbria County Council, Screening Opinion, 6th October, 2015. . Mine Water Treatment Scheme on Land adjacent to the south-west side of the A689, Nentsberry, Alston, Cumbria.
[5]Calaminarian Grassland HRA Monitoring Strategy

4. Legislative and Planning Policy Context

4.1 Legislation

4.1.1 The following key pieces of legislation are of relevance to the Proposed Development:

- The Town and Country Planning act 1990
- The Water Resources Act 1991
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- The Groundwater (Water Framework Directive) (England) Direction 2016
- Habitats Directive 92/44/EEC; and
- Mining Waste Directive 2006/21/EC

4.1.2 The above list is not exhaustive; other legislation of relevance to the Proposed Development will be identified and referenced as appropriate within the ES.

4.2 Planning Policy

4.2.1 National and local planning policies relevant to the Proposed Development and the accordance of the Proposed Development with those policies will be discussed within the Planning Statement, which will form part of the planning submission. For information, the main policies of relevance to the Proposed Development are identified below. For the purposes of the EIA, brief reference will be made within the ES to these and / or any other specific polices where appropriate and relevant to the EIA.

National Planning Policy Framework, 2018

4.2.2 The publication of the National Planning Policy Framework (NPPF) in March 2012 provided a new starting point for the determination of applications and appeals. Many of the Planning Policy Guidance Notes and Planning Policy Statements that once were material considerations have now been cancelled, although in some circumstances the essential policy elements relating to previous national policy remain unchanged. The NPPF also has a bearing on the weight to be accorded to local plans. It is therefore a significant consideration in the decision making process. The NPPF, which was revised in 2018, will be reviewed and appropriate policies identified which may have a bearing on the decision making process.

National Planning Practice Guidance

4.2.3 On 6th March 2014, the Department for Communities and Local Government (DCLG) published its Planning Practice Guidance (PPG), which consolidated and revised a large number of practice guidance documents. Since its initial publication, the PPG has been the subject of a number of updates. Guidance outlined in the PPG will be considered in preparing the full planning application for the Proposed Development.

Local Development Plan

Although the Proposed Development site lies within the administrative boundary of Eden District Council (EDC), the full planning application will be determined by CCC as the nature of the Proposed Development falls within its jurisdiction as the MPA. In determining the full planning application, the MPA will take into account the development plans for both CCC and EDC. The relevant development plan documents for both authorities are identified below. The Cumbria Minerals and Waste Local Plan 2015 - 2030 was adopted on 6 September 2017. The adopted plan replaces the Cumbria Minerals and Waste Development Framework's Core Strategy and the Generic Development Control Policies documents that were adopted in 2009.

Cumbria County Council – Adopted Development Plan

- Cumbria Minerals and Waste Local Plan 2015-2030[6]

Eden District Council – Adopted Development Plan

- Eden Local Plan 2014 to 2032 adopted 11 October 2018[7]

4.2.4 Relevant policies of the adopted documents include Cumbria County Council Minerals and Waste Local Plan Strategic Policies; SP1 (Presumption in favour of sustainable development), SP15 (Environmental Assets) and SP16 (Restoration and Aftercare), and Development Control Policies DC2 (General Criteria), DC6 (Cumulative Environmental Impacts), DC16 (Biodiversity and Geodiversity), DC18 (Landscape and Visual Impact), DC19 (Flood Risk) and DC20 (The Water Environment).

4.2.5 Relevant policies within the adopted Eden Local Plan include policies DEV1 (General Approach to New Development), DEV2 (Water Management Flood Risk), ENV1 (Protection and Enhancement of the Natural Environment, Biodiversity and Geodiversity), ENV2 (Protection and Enhancements of Landscapes and Trees), ENV3 (The North Pennines AONB)), ENV5 (Environmentally Sustainable Design), ENV8 (Land Contamination), ENV9 (Other Forms of Pollution) and ENV10 (The Historic Environment).

[6] Cumbria Minerals and Waste Local Plan 2015-2030. Available at: https://www.cumbria.gov.uk/planning-environment/policy/minerals_waste/MWLP/Adopted.asp
[7] Eden District Council (2018) Adopted Eden Local Plan 2014 to 2032 . Available at: https://www.eden.gov.uk/planning-and-building/planning-policy/eden-local-plan/eden-local-plan-adoption/

5. Environmental Assessment Scoping

5.1 Overview

5.1.1 The following sections present a discussion of the likely significant environmental effects associated with the Proposed Development that will be considered as part of the EIA. The methodology and assessment criteria that will be used to assess the potential significance of the identified effects are outlined alongside the potential mitigation measures that may be considered for implementation following assessment.

5.2 Landscape and Visual Amenity

Baseline Conditions

5.2.1 The Proposed Development lies within the North Pennines AONB. The primary purpose of the AONB designation is to conserve and enhance the natural beauty of the landscape. Secondary aims of the designation include meeting the need for quiet enjoyment of the countryside and having regard for the interests of those who live and work there.

5.2.2 The site was formerly within the North Pennines Environmentally Sensitive Area (ESA). ESAs were designated for areas of the countryside where the landscape, wildlife or historic interest is of particular importance and where environmental features could be affected by farming operations. The ESA designation was superseded by the Environmental Stewardship scheme in 2005 and the formal ESA designation became invalid in 2014 following completion of the 10 year ESA Management Plan periods. The site currently has an Entry Level Stewardship agreement in place.

Potential Effects

5.2.3 There are a number of potential effects arising from the Proposed Development on landscape character and visual amenity. The building required on the main treatment site would introduce built form in a rural landscape but would be of sympathetic design using materials appropriate within the rural context within the AONB. In other respects the Proposed Development would comprise mainly ground-level structures and features including an interception chamber, pump house (situated within a small building), pipeline route and ponds / wetland with accompanying landform modification.

5.2.4 Potential effects include a perceived industrialisation in the local area, as well as the addition of construction, landform modification and built structures into views from the surrounding area. There would be no significant removal of vegetation characteristic to the AONB landscape and opportunities would be available within the developing design for appropriate earthworks mitigation and landscape planting to integrate the Proposed Development into the landscape.

Landscape

5.2.5 Notwithstanding the AONB (as discussed in the relevant section above), no landscape constraints have been identified in respect of the Proposed Development site.

Visual

5.2.6 A small number of potential sensitive visual receptors, both residential and recreational (users of National Trails and Public Rights of Way), have been identified within the area, including Isaac's Tea Trail adjacent to the site and the Nenthead Mines Heritage Centre – a tourist attraction which is located to the south of the site. It is anticipated that where potential views of the Proposed Development may be experienced, mitigation opportunities exist in the form of sympathetic building design and pond layout, naturalised earthworks and screening vegetation to minimise adverse impacts.

Assessment Methodology

5.2.7 The landscape and visual assessment will be undertaken in accordance with the following guidance:

- Guidelines for Landscape and Visual Impact Assessment (LVIA), Third Edition (2013) Landscape Institute and Institute of Environmental Management and Assessment.

5.2.8 Two site visits will be undertaken and photo viewpoint panoramas will be recorded from a selection of up to twelve viewpoint locations, to be agreed with the MPA. Viewpoint locations will be used to demonstrate the presence or absence of a view in 'winter' and 'summer' seasons (in February / March to record views in winter and in July/ August / September to record the summer views). The field survey will also aid in the identification of visual receptors, key views, and local landscape characteristics to inform the assessment.

5.2.9 A Zone of Theoretical Visibility (ZTV) will be computer generated to refine the study area for assessment. The accuracy of the ZTV will be verified on site.

5.2.10 A series of drawings will be produced illustrating viewpoint locations and the ZTV, topography and hydrology, landscape character and landscape designations within the study area, derived from published data. The viewpoint photography will also be stitched into panoramas for inclusion within the Landscape and Visual Impact Assessment.

5.2.11 The LVIA will identify both adverse and beneficial impacts and assess the effect on landscape and visual amenity by comparison of the magnitude of impact with sensitivity of the receptor. The outcomes of the assessment will inform the requirement for any landscape mitigation to be integrated into the Proposed Development. An assessment will also be included at year 15 to allow for the maturation of any proposed landscape mitigation treatments.

5.3 Noise and Vibration

Baseline Conditions

5.3.1 The Proposed Development site is located in a rural area where baseline noise levels are considered to be low.

5.3.2 The nearest potentially sensitive receptors to the treatment site are properties at Mill Cottage, Hilltop Cottages, Fairhill Farm, Nenthead House and Bevan Terrace and the Nenthead Mines Heritage Centre. .

5.3.3 Sensitive ecological receptors within the vicinity of the Proposed Development will be identified in conjunction with the ecology assessment.

Potential Effects

5.3.4 The Proposed Development is located in a rural area where baseline noise levels are considered to be low. Construction of the Proposed Development may therefore give rise to temporary noise impacts upon the closest noise sensitive receptors. There may also be noise impacts associated with construction traffic movements to and from the site. It is therefore proposed that an assessment of construction noise and vibration is scoped into the assessment. Mitigation of noise and vibration will largely rely on the implementation of a Construction Method Statement which would detail measures to mitigate potential noise and vibration effects.

5.3.5 With careful consideration of the location of any noise producing equipment (e.g. pumps) and the incorporation of appropriate mitigation measures (where required), operational noise impacts are not anticipated to be significant. Pumps at the pumping station would be located underground in a wet well with the control cabinet likely to be above ground within a stone structure. However, it is proposed that an assessment of the noise impacts associated with fixed plant and the temporary de-silting of the settling ponds is included within the scope of the assessment. Should further noise attenuation measures be required, these will be identified by the assessment. No vibration effects are anticipated to occur during the Proposed Development operational phase. Due to the infrequent nature of vehicle movements to and from the site, operational traffic noise impacts are not expected to be significant and assessment of these is therefore scoped out.

Assessment Methodology

Baseline Noise Survey

5.3.6 Baseline noise monitoring locations and the monitoring regime to be employed will be agreed in advance with the Local Authority Environmental Health Department and MPA. The monitoring procedures will conform to the requirements of BS 7445: 1991 'Description and Measurement of Environmental Noise'.

5.3.7 It is proposed to undertake short-term attended monitoring at locations representative of the closest sensitive receptors to the treatment site and the pumping station. Unmanned monitoring will also be performed at two locations representative of the treatment site and pumping station respectively, in order to measure typical noise levels over a 24 hour period. The measured baseline noise levels will feed into the assessment of construction and operational noise impacts.

5.3.8 It is assumed that there are no existing sources of vibration and therefore a baseline vibration survey is scoped out.

Construction

5.3.9 Noise and vibration levels associated with the construction works will be calculated (at chosen sensitive receptors) using the data and procedures given in BS 5228 2009+A1:2014 'Code of practice for noise and vibration control from construction and open sites, Part 1: Noise and Part 2: Vibration'. It is recognised that ground borne vibration may be significant, given the requirement for ground compaction works to construct the Proposed Development.

5.3.10 Additionally, noise increases at sensitive receptors due to any construction traffic on public roads will be calculated according to the method given in Calculation of Road Traffic Noise.

5.3.11 Resultant noise and vibration levels will be assessed using the guidance provided in BS 5228, or as agreed with the Local Authority.

5.3.12 If necessary, an assessment of specific mitigation options will be provided (in addition to recommendations for best practice working).

Operation

5.3.13 Operational noise is likely to be limited to noise generated by pumps to convey water from the pipeline to the ponds and/ or to pressurise water in order for it to pass through the odour abatement system.

5.3.14 The impact of any fixed plant associated with the Proposed Development will be predicted using the methodology provided in ISO 9613-2 1996 'Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation', based on information on the operating conditions and the levels of noise generated by the plant. If a schedule of plant is not available, suitable criteria (based on baseline noise measurements) will be provided, applying the assessment method given in British Standard BS 4142: 2014 'Method for rating and assessing industrial and commercial sound'. BS 4142 is interpreted differently by different local authorities. Therefore, subject to approval from the client, the assessment methodology will be discussed with the relevant Environmental Health Department to determine any local requirements.

5.3.15 There would also be noise associated with the removal of waste from the ponds every ten to fifteen years. Given the infrequency of such de-silting of the ponds, it is proposed that noise levels will be assessed with regard to the advice given in BS 5228. Where necessary, an assessment of mitigation options will be provided.

5.4 Air Quality and Odour

Baseline Conditions

5.4.1 The proposed site is located in a rural area of good air quality, which is not at risk of exceeding any air quality limit values or objectives.

5.4.2 The nearest potentially sensitive receptors are properties at Mill Cottage, Hilltop Cottages, Fairhill Farm, Nenthead House and Bevan Terrace.

Potential Effects

5.4.3 During the construction phase, there would be the potential for earthworks and the movement of vehicles on unsurfaced ground to result in fugitive emissions of dust and particulate matter crossing the Site boundary (in the absence of appropriate control measures).

5.4.4 During the Proposed Development operational phase hydrogen sulphide (H_2S) is likely to be generated within the treatment process and would be contained within the process pipework and infrastructure. However, any release of hydrogen sulphide into the ambient environment could have the potential to result in a perceptible odour impact on amenity at locations outside of the site boundary. To control the risk of odour emissions from the treatment process, abatement measures would be included within the Development design to mitigate the potential effects. The abatement measures would comprise established mitigation techniques commonly applied within the waste water treatment industry, such as collection and treatment of off-gases using a treatment system designed for the purpose similar to the system to be implemented at the Nent-Haggs Mine Water Treatment Scheme.

Assessment Methodology

Construction Assessment

5.4.5 Dust impacts during the construction phase will be assessed by providing a qualitative assessment of the potential construction sources and effects, together with a risk assessment to identify those receptors most at risk. The assessment will be based on the Institute of Air Quality Management (IAQM) Guidance for assessing impacts from construction activities.

5.4.6 Mitigation of dust impacts will largely rely on the establishment of a Working Method Statement incorporating management measures to minimise emissions at source and to protect sensitive receptors (IAQM, 2014)[8].

5.4.7 The Proposed Development is located in a rural area of good air quality. It is considered unlikely that the increase in traffic flows during the construction works would generate a significant impact on local air quality and therefore it is considered that a quantitative assessment of potential impacts on local air quality with regards to human health is not required. Temporary vehicle emissions from construction traffic would be scoped out of any quantitative assessment of human health-related impacts using recognised screening criteria. Construction plant emissions are also not considered to require quantitative assessment.

5.4.8 During the construction phase of the Proposed Development, emissions to air from additional construction traffic using the A689 route could temporarily increase rates of nitrogen deposition on vegetation within the Haggs SSSI to the north-west of Nenthead. Screening modelling will therefore be carried out to quantify the likely impact of additional road trips on baseline rates of nutrient nitrogen and acid deposition, in order to inform the ecology assessment of the significance of effects on designated sites of ecological importance.

Operational Phase Traffic Assessment

5.4.9 It is considered unlikely that the Proposed Development would generate significant volumes of HGV traffic during the operational phase. It is therefore considered that the need for a quantitative assessment of operational phase traffic effects can be scoped out of the assessment.

[8] IAQM (2014), *Assessment of dust from demolition and construction*, www.iaqm.co.uk

Operational Odour Assessment

5.4.10 Odour dispersion modelling and assessment of the residual emissions from the Proposed Development will be carried out, based on a model developed and validated for the pilot project at the Force Crag site.

5.5 Traffic and Transportation

5.5.1 The Traffic and Transportation section of the ES will assess the impacts and effects of the Proposed Development during construction only.

Baseline Conditions

5.5.2 The Proposed Development would be accessed from, the A689, approximately 6.5 km south-east of Alston. The A689 is a rural road, with the A689 connecting the A69 at Brampton to the west with the A68 at Crook to the east.

5.5.3 It is proposed that the study area will include an assessment of the change in traffic numbers on the A689 only in the immediate vicinity of the site access.

Potential Effects

5.5.4 Transport impacts from the Proposed Development would be limited to the construction phase. The key issues will be in relation to:

- providing an appropriate access;
- the bulk import of clay to line the lagoons; and
- an assessment of effects relating to highway capacity / road safety.

5.5.5 The likely impacts associated with transport would be temporary in nature and can be readily mitigated through the Proposed Development design which would embed mitigation and adopt appropriate traffic management measures to control the timing and routing of HGVs.

Assessment Methodology

5.5.6 The assessment methodology will follow the current best practice as set out in paragraph 007(reference ID: 42-007-20140306) and paragraph 015 (reference ID: 42-015-20140306) of the Planning Practice Guidance first published by the Department of Communities and Local Government (DCLG) in March 2014 and the Institute of Environmental Assessment guidance set-out in Guidance Note 1: Guidelines for Environmental Assessment of Road Traffic (1993). Data from a new traffic survey of the A689 and existing collision data will be used to inform the assessment.

5.5.7 An estimate of the number of temporary construction workers employed at the Proposed Development site over the construction period will be produced and the peak selected for assessment. A profile of the number of heavy goods vehicles bringing construction materials to the Proposed Development site will also be produced.

5.5.8 The assessment will then calculate the percentage increase in flow in the morning and evening peaks and over 24 hours on the A689 adjacent to the Proposed Development at the peak of construction.

5.6 Cultural Heritage

5.6.1 Cultural heritage encompasses the above- and below-ground archaeological resource, built heritage, the historic landscape and any other elements which may contribute to the historical and cultural heritage of the area. The aim of this section is:

- to describe the known cultural heritage assets within the study area and the surrounding vicinity;
- to identify the potential cultural heritage issues that may arise as a result of the Proposed Development; and
- to outline the methods and assessment to be undertaken for inclusion within the ES.

Baseline Conditions

5.6.2 A detailed historic environment baseline for the Proposed Development area will be established as part of the full EIA. This will cover all sites within 1 km of the boundary of the Proposed Development as well as considering designated sites up to 3 km from the boundary for the assessment of effects on the setting of heritage asset. Some assets beyond this distance may also be considered where elements of their setting extend closer to the Proposed Development.

5.6.3 As part of this scoping exercise, a high-level search has been undertaken with material collected from online sources for designated and undesignated assets within the Proposed Development. These included:

- Heritage Gateway website (www.heritagegateway.org.uk); and
- the Historic England Website (https://historicengland.org.uk).

5.6.4 A search of designated assets of a wider area of approximately 3 km from the Proposed Development has also been undertaken to identify potential situations where the Proposed Development might result in an impact on setting.

Designated Assets

5.6.5 There is one designated asset within the site boundary, this being the Lead mines, ore works and smeltmill at Nenthead (List entry no. 1018582). This scheduled monument covers multiple areas of a large landscape around Nenthead, with parts of the site boundary falling within the eastern scheduled area (Figure 2.1).

5.6.6 There are 12 Grade II listed buildings within 1 km of the Proposed Development (refer to Figure 2.1 – Environmental Constraints and to Table 2.1).

5.6.7 No World Heritage Sites, Registered Battlefields or Registered Parks and Gardens were identified within the 1 km study area.

5.6.8 The scheduled monument consists of extensive remains associated with lead mining in the Nenthead area. Although small scale mining had taken place from at least the 12th century, large-scale mining activity did not start until the 17th century, with the majority of the remains recorded dating to the post-medieval period.

5.6.9 The listed buildings are largely concentrated in the settlement of Nenthead and include workers cottages (LB1107220 and LB1144973) as well as larger houses such as Ivy House with its associated reading room and surrounding walls and gates piers (LB1107214, LB1326975 and LB1144971). Other listed buildings within the 1 km study area include public buildings such as the Methodist Church (LB1408095), as well as a memorial pump and associated canopy (LB1144997) and the powder magazine linked to the mining industry (LB1144925).

Undesignated Heritage Assets

5.6.10 A full search of the Cumbria Historic Environment Record was not undertaken as part of the scoping exercise; however a review of online sources would suggest that a number of undesignated heritage assets have been recorded in the 1 km study area. The Alston area was investigated by Historic England's (then English Heritage) North Pennines National Mapping Programme project in 2009-2011. This project identified extensive prehistoric, Roman, medieval and later activity from aerial photography, LiDAR data analysis and field survey.

Potential Effects

5.6.11 The Proposed Development has the potential to affect heritage assets in the following ways

- partial or total removal of heritage assets;
- compaction of archaeological deposits by construction traffic and structures; and
- adverse effects arising from changes to the setting of heritage assets including visual intrusion, noise, air quality, severance, access and amenity as a result of construction works.

5.6.12 During the operation of the Proposed Development the ponds would change the visual appearance of the site however they can be blended into the surroundings through planting and grassland. There would be temporary maintenance works during the 10-15 yearly removal and replenishment of compost material in the ponds.

Assessment Methodology

5.6.13 A study area of 1 km from the Proposed Development will be used to provide detailed baseline information for the assessment. A wider study area will be used to identify assets which may have their setting affected. The study area for the assessment on setting will be limited to 3 km, and will be limited to assets which fall within the ZTV prepared by the Landscape and Visual team.

5.6.14 Baseline data to inform the EIA will be gathered from the following sources:

- Cumbria Historic Environment Record (HER);
- National Heritage List for England (NHLE);
- Alston Library;
- Carlisle Library local history collection;
- Cumbria Archives, Carlisle;
- aerial photographs held by Historic England;
- published and unpublished literature;
- British Geological Survey (BGS) Geology of Britain Viewer; and
- an archaeological walkover survey.

5.6.15 The walkover survey will be conducted to assess known sites and to determine the potential for previously unrecorded heritage sites. This will not be an exhaustive survey of the entirety of the site boundary and will focus on the pond areas and other associated infrastructure.

5.6.16 Information collected from the sources will be used to describe the known archaeology and built heritage of the 1 km study area. The results of the desk-based research and the design layout will be discussed with Cumbria County Council's archaeological representative to agree any requirement for additional field evaluation, such as geophysical survey or evaluation excavation, prior to determination.

5.6.17 The value of a heritage asset (i.e. its heritage significance) is guided by its designated status but is also derived from its heritage interest which may be archaeological, architectural, artistic or historic (NPPF Annex 2, Glossary).Using professional judgement and the results of consultation, heritage assets will be assessed on an individual basis and regional variations and individual qualities are taken into account where applicable.

5.6.18 The assessment of effects will be based on asset value, the magnitude of impact, having taken into consideration any embedded mitigation. In accordance with EIA methodology, major and moderate effects will be considered significant. Within the NPPF, impacts affecting the value of heritage assets are considered in terms of harm, and there is a requirement to determine whether the level of harm amounts to 'substantial harm' or 'less than substantial harm'. There is no direct correlation between the classification of effect as reported in the ES and the level of harm caused to heritage significance. A major (significant) effect on a heritage asset would, however, more often be the basis by which to determine that the level of harm to the significance of the asset would be substantial. A moderate (significant) effect is unlikely to meet the test of substantial harm and would therefore more often be the basis by which to determine that the level of harm to the significance of the asset would be less than substantial. A minor or negligible (not significant) effect would still amount to a less than substantial harm, which triggers the statutory presumptions against development within s.66 of the Planning (Listed Buildings and Conservation Areas) Act 1990 (HMSO 1990); however, a neutral effect is classified as no harm. In all cases, the determination of the level of harm to the significance of the asset arising from development impact is one of professional judgement.

5.7 Biodiversity

Baseline Conditions

5.7.1 The description of baseline conditions for biodiversity has been informed by the findings of a desk study. Extended Phase 1 habitat survey and additional ecology surveys undertaken for parts of the Proposed Development site in 2018 and reported in the Preliminary Ecological Appraisal Report (PEA) for the main treatment site[9] and in a further PEA for proposed embankment stabilisation works at Nenthead Car Park[10]. Copies of these PEAs are provided in Appendices A and B of this scoping report.

Tyne and Nent SAC

5.7.2 The Tyne and Nent SAC is situated approximately 0.75 km southwest and around 2 km to the northwest of the Proposed Development.

5.7.3 The SAC is primarily designated for its varied assemblage of heavy metal tolerant plants. The notable feature of the SAC is the Annex I habitat 'Calaminarian grasslands of the *Violetalia calaminariae* (Grasslands on soils rich in heavy metals)'. This grassland type relies on periodic inundation with sediments containing high concentrations of metals such as lead, cadmium and zinc to allow the metallophyte flora to outcompete other species. Since these metallophytes rely on metal rich sediments being deposited, it is unclear whether mine water treatment (which only removes dissolved rather than particulate metals) will affect this habitat.

5.7.4 The SAC comprises four Sites of Special Scientific Interest (SSSI); two of which are on the South Tyne upstream of confluence with the River Nent. The other two are the Haggs Bank SSSI and the Nent at Blagill SSSI.

Tyne and Allen River Gravels SAC

5.7.5 The Tyne and Allen River Gravels SAC is situated some 13km to the north west of the Development

5.7.6 This SAC is similarly designated for the presence of caliminarian grassland again has several constituent SSSIs. Similar to the Tyne and Nent SAC, effects on the features for which the SAC is designated would be lowering of heavy metal concentrations.

North Pennine Moor SPA/SAC

5.7.7 The North Pennine Moor SPA/SAC is situated approximately 1.1 km north-east of the Proposed Development. It is designated as a SAC due to the presence of numerous Annex 1 habitats including:

- Dry heath
- Juniper communis formations on heaths or calcareous grasslands
- Blanket bog
- Petrifying springs with tufa formation (Cratoneurion)
- Siliceous rocky slopes with chasmophytic vegetation
- Old sessile oak woods with Ilex and Blechnum

5.7.8 This area qualifies as a SPA due to the presence of internationally important assemblages of Annex I bird species, including: hen harrier, merlin, peregrine and golden plover. Breeding pairs of short-eared owl and Montagu's harrier are also known to be present within the site.

Sites of Special Scientific Interest

5.7.9 There are four SSSIs situated within 2 km of the Proposed Development and one SSSI situated around 6 km from the Proposed Development.

[9] AECOM, 2018. Nenthead Site 101. Preliminary Ecology Assessment (including upland wader survey, water vole survey, detailed botanical survey and pond assessments), February 2019.
[10] AECOM, 2018. Nenthead Carpark Embankment Stabilisation Works. Preliminary Ecology Assessment

5.7.10 The Haggs Bank SSSI is a constituent site of the Tyne and Nent SAC as discussed above. The Haggs Bank site is designated for its varied assemblage of metal tolerant vegetation, which has occurred as the result of past mining activity and ground contamination. Large spoil heaps, mainly in the east of the site, hold open and probably more heavy metal tolerant vegetation. The vegetation to the west of the site, including the steep stream banks and adjacent wet areas, is a more closed sward. No impacts are foreseen on the SSSI as it is located approximately 2 km from the Proposed Development on the other side of the village and is not reliant on heavy metals discharged into the River Nent for maintenance of the calaminarian grassland communities.

5.7.11 The Allendale Moors SSSI underpins the North Pennine Moors SAC/ SPA (as discussed above) and is designated due to its important breeding bird assemblages, extensive blanket mire habitat, heath, flush and upland grassland communities. No impacts are foreseen on the SSSI, based on the reasons given above for the SAC/SPA.

5.7.12 Smallcleugh Mine SSSI is designated as the largest and most detailed example of limestone flat-type mineralisation in the country and is the only site for the minerals melanterite and epsomite (Natural England, 1994). This is designated solely on geological grounds.

5.7.13 Whitesike Mine and Flinty Fell SSSI is a constituent site of the Tyne and Nent SAC and is designated due to its extensive and varied assemblage of heavy metal tolerant plants (metallophytes) in addition to its important transitions from this metal tolerant community to both species rich calcareous grassland of the sheep's fescue, common bent (*Agrostis capillaris)* and wild thyme (*Thymus polytrichus)* community and the heather (*Calluna vulgaris)*, bilberry (*Vaccinium myrtillus)* acidic heath community (Natural England, 2000[11]) ; however, the watercourses associated with this area flow into the River South Tyne so no impact is foreseen and no works within the SSSI are proposed.

5.7.14 The Nent at Blagill SSSI (6 km to the northwest of the Proposed Development) is designated solely on geological grounds but forms a constituent site of the Tyne and Nent SAC because calaminarian grassland is present on the riverbanks. Reduction in heavy metals entering the River Nent may impact on the calaminarian grassland at this site.

Habitat

5.7.15 The Phase 1 Habitat Survey of the main treatment site (refer to the PEA for Site 101 in Appendix A) found that the main areas showing a calaminarian influence were to the north of the reservoir and towards the old mine workings, although there were some small patches on an old spoil mound to the south of the site (east of the reservoir).

5.7.16 There are also areas of acid grassland and heath, along with several small areas of mire community, across the proposed main treatment site and its surroundings and patches of rush dominated ground to the north and south and along ditches. These areas would be impacted by the Proposed Development, however, like the heath and grassland discussed above, these areas would not be considered a significant constraint given the limited extent and extensive areas of similar habitat in the wider landscape.

5.7.17 There are four ponds on or local to the main treatment site and one pond near the access track to the west of the site; none of which would be impacted or lost to the Proposed Development.

5.7.18 There are four ditches on site which run to or from the reservoir. There was some botanical interest in these, but this is only of local interest. Any impact on these would be likely to be minimal, with the habitat being maintained during and beyond the Proposed Development. The ditches that run from the reservoir to the River Nent and the reservoir itself would not be impacted by the Proposed Development.

National Vegetation Classification Survey

5.7.19 In addition to the Phase 1 Habitat Survey, a National Vegetation Survey (NVC) of the main treatment site was carried to consider the habitats on site in more detail. The NVC survey indicated that the site is, in general, a mosaic of heath and acid grassland, which also grades into mire to the north and

[11] Natural England (2000). Whitesike Mine and Flinty Fell. Available from: https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/2000420.pdf

southwest and open/ephemeral metalliferous communities above the reservoir in the north and west. The following is a summary of the findings:

- The acid grassland areas appeared to be good quality acid grassland with various indicator species such as heath bedstraw and heath woodrush with acid grass species such as wavy hair grass. The grassland grades into heath, open communities and mire across the site and is considered that the grassland best fits the U5b community. The U5 grassland type in itself is not a Habitat of Principal Importance (under S41 of the NERC Act); however, whilst not the defining grassland type, it is included within the habitat definition of the Annex 1(Habitats Directive 1992; The Conservation of Habitats and Species Regulations 2017) Habitat 6230 Species-rich Nardus grassland, on siliceous substrates in mountain areas (and sub-mountain areas in continental Europe). Whilst the grassland on site does contain several of the species associated with this community type it is unlikely the habitat on site would be designated as an Annex 1 grassland, particularly given the defining grassland communities within the habitat type CG10 (*Festuca ovina–Agrostis capillaris–Thymus praecox* grassland) and CG11 (*Festuca ovina–Agrostis capillaris–Alchemilla alpina* grassland) were not considered to be present. In addition, there are extensive areas of similar habitat in the wider landscape and with habitat management or creation as part of a mitigation package any loss of this grassland is not considered to be a significant constraint.

- The heath community was, like the acid grassland, found across the central part of the site to the east of the reservoir, with patches amongst grassland and mire in the north and west. In general, these areas appeared to be good quality heathland dominated by heather along with species such as bilberry. However, the more detailed assessment has shown that the heathland vegetation is more transitional towards the U5 acid grassland type. These areas would in general be lost to the Proposed Development, however it is unlikely that the heathland areas would be considered priority habitat and there are extensive areas of similar habitat in the wider landscape. Any loss of heather/acid grassland on the site is not considered likely to have a significant effect.

- There were several small areas of mire community across the site with an area with *Sphagnum* hummocks in the north and to the east of the reservoir towards the south of the main development area. There were also patches of rush dominated ground to the north and south and along ditches across the site. However, some of the *Sphagnum* areas appeared to be drying and may become replaced by acid grass/heath in the future. The closest community type was M18, which is a Habitat of Principal Importance type but the very limited extent and transitional nature of the community suggests that it is not of the quality to be considered priority habitat. These areas would be impacted by the Proposed Development, however, as they are of limited extent and given the extensive areas of similar habitat in the wider landscape, this would not have a significant effect.

- The main areas showing a calaminarian influence were to the north of the reservoir and towards the old mine workings, although there were some small patches on an old spoil mound to the south of the site (east of the reservoir). These were more of an open ephemeral nature rather than a closed grassland community and will be highly influenced by the heavy metal content of the spoil form the old mine workings. This is a rare plant community (OV37; Annex 1 Habitat 6130 Calaminarian grasslands of the *Violetalia calaminariae*) and is in part the reason for designation of several of the nature conservation sites local to the Proposed Development area. The Proposed Development may impact on the community to a certain extent (to the northwest of the site) although there is similar habitat outside the Proposed Development footprint. It is recommended that this community along with acid grassland (and mire areas where appropriate) should be the focus of habitat creation/management as part of the Proposed Development.

Protected Species

5.7.20 The Phase 1 Habitat Survey and ecology survey of the Nenthead car park area undertaken in relation to proposed embankment stabilisation works (refer to Appendix B), identified the presence or potential for the presence of several legally protected species, all of which were recorded in the PEA for the main site (refer to Appendix A).

5.7.21 Twenty-one bat records were found within 1 km of the site with roosts found in Nenthead itself and Caplecleugh adit (0.6km west of the site) and Rampgill adit (0.1 km north of the site).

5.7.22 Breeding birds were found within 1 km of the site.

5.7.23 Sand Martins were not recorded in the desk study however a colony of sand martins is known to utilise the river bank for nesting local to the western side of the site near the Nenthead car park.

5.7.24 Red squirrels have been recorded within 1 km of the site.

5.7.25 Water voles have been recorded within 1 km of the site including Galligill Burn and Hardedge.

5.7.26 The habitats present suggest that reptile species such as adder and common lizard may utilise the site, although there are no records for reptiles within 1 km of the site.

5.7.27 Whilst not a legally protected species, Alpine pennycress *Noccaea caerulescens*; a species of principle importance has been recorded on site and south of Caplecleugh adit.

5.7.28 Additional protected species surveys undertaken in 2018 as part of the PEA for the Proposed Development (PEA for Site 101) included:

- Upland wader survey
- Riparian mammal survey
- eDNA survey of the ponds in or near the main site for evidence of great crested newts

5.7.29 The upland wader survey suggested possible breeding of oystercatcher and common sandpiper on the Proposed Development site and certainly the habitat present is ideal for oystercatcher.

5.7.30 No evidence of water vole or otter was seen on the Proposed Development site during the survey. The ditches referred to in paragraph 5.7.17 were not ideal for water vole but this species is known in the wider area. It is also likely that otters utilise the watercourses for movement, although there was little potential for resting up areas or breeding holts.

5.7.31 No evidence of great crested newts was recorded in the ponds and reservoir in or local to the site and all the eDNA tests returned negative for this species.

Potential Effects

Tyne and Nent SAC

5.7.32 The aim of the Proposed Development is to limit the input of metals from Nenthead Mine to the River Nent, which will in turn reduce the supply of heavy metal material to the areas of calaminarian grassland for which the Tyne and Nent SAC is designated. A HRA was undertaken by the Environment Agency to assess the potential for significant effects in these grasslands from reducing heavy metal loads into the river from several proposed schemes including the Proposed Development (refer to Appendix C). Mitigation for assessed effects of the schemes was designed, costed and agreed with Natural England. It is assumed that a programme of monitoring of the calaminarian grasslands within the SAC would be agreed with CCC and implemented, similar to what has been proposed for the Nent-Haggs Minewater Treatment Scheme. Based on the HRA undertaken by the EA this should ensure that significant adverse effects on the integrity of the SAC are avoided.

The North Pennine Moor SPA/SAC

5.7.33 The SPA at its nearest to the Proposed Development is 1.2km to the north east. No significant impacts are predicted on the features for which the SPA is designated; the species recorded have generally large foraging ranges and none were recorded during the breeding bird surveys undertaken in 2018.

5.7.34 No impacts on the habitats for which the SAC is designated are predicted; the SAC is located upslope from the Proposed Development and there are no pathways for the habitats for which the SAC is designated to be affected.

SSSIs

5.7.35 The Proposed Development would not result in any significant adverse effects on any of the SSSIs identified in Section 5.7.9. to 5.7.14 for the reasons provided in 5.7.9 to 5.7.14.

Habitats and Species

5.7.36 There is potential for the Proposed Development to have an impact on several habitats and species, most notably the calaminarian grassland, heathland, acid grassland and mire communities recorded on site. The PEA (refer to Appendix A) includes the following recommendations to reduce the potential impacts of the Proposed Development:

- It is recommended that measures are taken to make the habitat unsuitable for reptiles prior to any development occurring under the supervision of an ecologist.
- A check for bat roost potential would be required of the Caplecleugh adit from which water would be diverted to the treatment site. Whilst it is considered unlikely that any bats, if present, would be affected by the Development it is recommended that a check of the adit is undertaken and any potential for impacts on bats assessed when further design details are available.
- Potential effects would be limited largely to the construction phase and would be the loss of grassland, mire and heath habitat. The Proposed Development would be designed to minimise land taken and areas that are retained can be managed sympathetically for nature conservation. Best practice measures would be implemented during construction works involving soil stripping and handling to avoid any short-term potential for run-off into the River Nent of surface water with high sediment loads.
- It is recommended that a habitat management plan for the site is developed to ensure the better quality and higher conservation value communities are maintained on and around the site to mitigate any loss of the plant communities. This should focus on the calaminarian and acid grasslands found on and local to the site.
- Any works carried out in the bird nesting season should not be carried out until a check for nests has been undertaken by a suitably experienced ecologist. If a nest was found, then a buffer zone would be required around the nest site and works in that area would not be able to proceed until the young have fledged.

5.7.37 Standard mitigation measures for nesting birds and reptiles would be identified within the Construction Environmental Management Plan. In addition, a habitat management plan would be produced which would include measures to be implemented during both the construction and operational phases of the Proposed Development.

Assessment Methodology

5.7.38 The ecological baseline for the Proposed Development has been described for the purposes of the scoping exercise.

5.7.39 Whilst most of the Proposed Development area has been surveyed, there are now several additional areas that will need to be surveyed prior to works going ahead. However, these areas comprise similar habitats to those already surveyed and it is unlikely the recommendations in 5.7.34 will change significantly. The further survey works required comprise:

- The land now included within the revised and expanded red line boundary that has not been surveyed to have a Phase 1 Habitat Survey;
- a bat roost potential survey of the adit where mine water would be intercepted;
- an assessment of the riverbank where any headwall/outfall into the River Nent would be placed;

5.7.40 The ecological impact assessment will assess potential impacts of the Proposed Development on habitats and protected species identified in this report and the further survey works but will exclude any sites, habitats or protected species that have been identified by the scoping exercise unlikely to be affected by significant adverse effects. Mitigation for any potential significant effects will be identified in the ES and incorporated into the habitat management plan as recommended above.

5.8 Ground Conditions and Hydrogeology

Baseline conditions

5.8.1 The area has historically been used for lead mining and there appears to be a number of mine shafts, adits and leats in the area. Mine shafts have been identified within the area of the proposed mine water treatment site. A leat is thought to extend below the proposed pumping station site. A flue associated with the smelting works has been identified in the north of the site and is likely to be at risk of weather damage and collapse.

5.8.2 The Proposed Development is partly located within the Smallcleugh Mine SSSI, designated on geological grounds as the largest and most detailed example of limestone flat-type mineralisation in the country and is the only site for the minerals melanterite and epsomite (Natural England, 1994[12]). The Smallcleugh Mine is also designated under the Geological Conservation Review.

5.8.3 The soils in the area are described as slowly permeable wet very acid upland soils with a peaty surface and impeded drainage (Soilscape data from the MAGiC website accessed 18th February 2019). Soils in the area of mine workings may contain concentrations of metal species that may be hazardous to human health and/or the environment.

5.8.4 Given the historical mining activity on the site there is likely to be made ground present. Made Ground is most likely to be present in the lowland sections such as the levelled area comprising the adit car park and banks of the river Nent. There are also spoil tips present associated with the former mining activity. Typically the spoil tips will comprise granular material ranging from sand to cobble size rock fragments occasionally with metal ore or gangue mineral content. The mine tips at Nenthead have been subject to secondary working to remove ore left by earlier less effective extraction and only a little metalliferous ore is likely to be found in the spoil tips. Peat has been excluded from the 1:50,000 solid and drift edition geological map because it is very widespread and would obscure detail of the underlying geology. A persistent layer of peat covers the ground across the upland area around and above the reservoir. Superficial deposits in upland areas of the site are likely to be thin.

5.8.5 Superficial geology is recorded beneath the western end of the site below the proposed mine water capture structure, pumping station and pipeline route. These deposits are glacial till comprising clay to boulder size material, typically consisting of slight sandy or sandy, slightly gravelly clay with a variable cobble and boulder content.

5.8.6 The superficial geology (where present) has been classified as being Secondary (undifferentiated) Aquifer due to the variable characteristics of the rock type.

5.8.7 Bedrock geology includes: The Stainmore Formation (thick sequence of interbedded sandstones, including sandstones, siltstones, mudstones, limestones and some thin coal seams) across the majority of the site underlain by the Great Limestone Member of the Alston Formation, (blue-grey, thickly bedded Limestone (bioclastic packstone) with thin shaley mudstone partings along uneven or wavy bedding planes) which outcrops around the River Nent and on land to the west of the Handsome Mea Reservoir. The Great Limestone is underlain by a thick sequence of sandstone, siltstone, mudstone and limestone, in the Alston Formation which outcrops in the valley of the River Nent downstream of the site.

5.8.8 Faults are shown to cross the site in a north west / south east orientation (BGS Geoindex accessed 18th February 2019).

5.8.9 The bedrock geology is described as a Secondary A aquifer. These aquifers are permeable strata capable of supporting water supplies at a local rather than a strategic scale. The groundwater vulnerability map for the area shows the site to be within a 'Minor Aquifer Low' area indicating low vulnerability of groundwater.

5.8.10 The anticipated depth to the water table in the bedrock aquifer, i.e. the thickness of the unsaturated zone, is anticipated to be in the order of 50 m. The regional direction of groundwater flow is expected to be to the southwest. However it is possible that localised perched water may also be present in the

[12] Natural England (1994) Smallcleugh Mine. Available from: https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1005631.pdf

shallower bedrock strata. This will be discussed further in the Phase 1 Geo-Environmental & Geotechnical Desk Based Assessment (refer to Assessment Methodology section below)

Potential Effects

5.8.11 The Proposed Development is not anticipated to result in significant permanent adverse effects on the ground conditions or hydrogeology of the Proposed Development site or surrounding area. Potential effects will be limited largely to the construction phase and will be related to the footprint of the Proposed Development. Embedded construction mitigation and best practice will avoid any short term potential for impacts to the River Nent or surrounding residents/ land owners.

5.8.12 Potential impacts on ground and groundwater during operation include the potential for effluent release from the final wetland, potential for adverse impacts through the use and storage of hydrogen peroxide which would form part of the odour management system, adverse impacts through replacement of treatment media used in the ponds and adverse impacts that may arise as a result of treatment system or pumping station failure. These would be mitigated by embedded mitigation measures, including measures similar to those for the Nent-Haggs Mine Water Treatment Scheme (refer to section 6)

Assessment Methodology

5.8.13 A Phase 1 Geo-environmental and Geotechnical Assessment will be undertaken for the full planning application area.

5.8.14 The Phase 1 Geo-environmental and Geotechnical assessment will collate information to inform the assessment, including: historical uses of the site; the potential for contamination; geotechnical conditions, such as likely depth to bedrock; and potential for buried structures. Potential sources of contamination may include past and current uses of the site and surrounding land, in the context of the environmental sensitivity of the site setting (i.e. mining). The Phase 1 assessment will include a shallow mining risk assessment.

5.8.15 A site walkover has been undertaken to identify the potential for contamination and geotechnical constraints and to gather information on the context of the site during the preparation of the Phase 1 Assessment.

5.8.16 A ground investigation is to be undertaken for geo-environmental and geotechnical purposes at all relevant locations within the redline boundary. All intrusive site work will be undertaken following a subsurface utility survey using all available service plans and historic map records. The intrusive works will also be undertaken under an ecological watching brief. The ground investigation will include assessment of shallow and deeper strata and testing for environmental and geotechnical purposes. The investigation will provide general information for the site as a whole and also more location specific requirements based on the proposed development in that area. Geo-environmental and geotechnical interpretative reports based on the results of the ground investigation will be prepared to inform the ES baseline and to support the design stages.

5.8.17 The ES will be informed by and will make reference to the following information:

- the Phase 1 Desk study – including a shallow mining risk assessment
- the ground investigation factual report
- the ground investigation interpretative report

5.8.18 A conceptual site model will be developed as part of the Phase I assessment and will be updated following the ground investigation to identify viable source, pathway and receptor contaminant linkages at the Proposed Development site. This will be used to assess potential impacts and to identify any significant effects which would require additional mitigation.

5.9 Hydrology and Flood Risk

Baseline Conditions

5.9.1 The Proposed Development is within the catchment of the River Nent, which is within the Northumbria River Basin District. The River Nent flows in a northwest direction and into the River South Tyne approximately 3 km downstream in the small town of Alston. Within the study area there are other first

and second order tributaries of the River Nent which may also be affected by the Proposed Development (potentially via Rampgill Burn).

5.9.2 Parts of the Proposed Development would be within the River Nent floodplain. The main section of the site where the three CBTPs and wetland are located will be situated within flood zone 1. The mine water capture structure, pumping station, rising main and gravity pipeline would all be located within flood zone 3. Therefore an FRA will be required for the Proposed Development.

5.9.3 The River Nent from Source to South Tyne is a heavily modified water body and has an overall WFD classification of Moderate Ecological Potential and failing to meet good chemical status (2016) with the overall objective of obtaining Good Ecological Potential by 2027. The current failure to meet Good Ecological Potential is due to not all mitigation measures being in place and fish biodiversity, concentrations of cadmium, lead and zinc not being at Good status.

5.9.4 Further baseline desk study and a site walkover survey will be undertaken during the impact assessment. This will cover water quality, water resources, ecological survey information and presence of water dependent nature conservation sites, and other socio-economic attributes, so that the importance of each waterbody reflects their full range of characteristics. Records of any surface water Private Water Supplies will also be obtained from the local Environmental Health Department.

Potential Effects

5.9.5 At this stage it is not thought that the main treatment site is susceptible to surface water flooding, though this will be determined during the FRA, which will consider all forms of flood risk. Given that the Proposed Development is being designed for water storage and treatment with controlled release to the River Nent, this is unlikely to be a significant issue. The Proposed Development has the potential to impact on flood risk due to increased surface water runoff as a result of the increase in the impermeable area of the treatment site, especially in those sections of the site within Flood Zone 3, unless surface water is managed appropriately. The construction of any new structures or the discharge of water to watercourses (such as from new outfalls) can have hydromorphological impacts unless it is appropriately designed and takes into account the character of the receiving watercourse.

5.9.6 There is potential for projected climate changes and extreme weather to impact the susceptibility of the Proposed Development to surface water flooding. Climate change may lead to an increase in substantial precipitation events that could lead to flash flooding, it may also lead to periods of decreased precipitation resulting in water scarcity. Both of these climate parameters are considered to have the potential to affect the impacts of the project on surrounding land and will be assessed as part of the EIA.

5.9.7 During construction, there is potential for contamination of surface waters (e.g. from suspended solids, accidental discharge of pollutants held on site, piling or excavation works, or release of extant contaminated materials). This risk is greatest where works are close to watercourses, especially on steep slopes. Consideration of any local surface water Private Water Supplies is also required when developing mitigation and monitoring for the construction phase.

5.9.8 Based on information from the operational Force Crag mine water treatment scheme in Cumbria, during the initial commissioning of the treatment site there is the potential for effluent released from the final wetland to exert a Biochemical Oxygen Demand and a Chemical Oxygen Demand on the receiving watercourse. There is also the potential for adverse impacts on the water environment associated with the use and storage of hydrogen peroxide which would form part of the odour management system, for adverse impacts on water quality during any replacement of treatment media used in the ponds and for adverse impacts that may arise as a result of treatment system or pumping station failure.

5.9.9 Once fully operational, the Proposed Development has the potential for significant environmental benefits, given that it is designed for water quality improvement.

Assessment Methodology

Flood Risk Assessment

5.9.10 The ES will refer to a separate FRA which will be prepared for the Proposed Development and included as a technical appendix to the ES. The FRA will demonstrate that all potential flood risks to

the Proposed Development have been considered and describe risk management measures required to provide an appropriate level of protection throughout the lifetime of the Proposed Development, including protection for the effects of climate change.

Water Framework Directive Assessment

5.9.11 A WFD assessment will be undertaken to demonstrate how the Proposed Development moves the River Nent waterbody (and connected water bodies) towards its required WFD objectives, but also to evaluate whether the Proposed Development could have any negative effect on other WFD sub-elements for the Nent waterbody (and connected waterbodies) through construction and operation that could potentially lead to non-compliance.

5.9.12 At this stage, only a preliminary and qualitative assessment is proposed that will include consideration of biological, physico-chemical (water quality) and hydromorphological (physical) elements, for surface water and groundwater bodies at the site of interest, taking into account any relevant Protected Areas, and for connecting waterbodies. This will be issued to the Environment Agency for consultation and any further more detailed assessment agreed. The WFD assessment report will be provided as a technical appendix to the ES.

Environmental Impact Assessment

5.9.13 The spatial extent of the studies to inform the EIA will cover the Proposed Development as well as nearby water bodies which could potentially be impacted by the Proposed Development. This will include desk studies to obtain and evaluate readily available data and information and a site visit.

5.9.14 The identification of impacts will be undertaken using the source-pathway-receptor model. This model identifies the potential sources or 'causes' of impact as well as the receptors (e.g. surface water resources) that could potentially be affected. The presence of a potential impact, source and a potential receptor does not always infer an impact; there needs to be an impact pathway or 'mechanism' via which the source can have an impact on the receptor.

5.9.15 The significance of an effect will be assessed by considering how important or how sensitive the receptor is and the likely magnitude or extent of the impact on the receptor, taking into account any mitigation embedded within the Proposed Development design. By combining these two elements, the significance of an effect can be derived. If significant adverse effects are identified, mitigation measures will be proposed to offset them.

5.10 Waste and Materials

Baseline Conditions

5.10.1 The Waste Disposal Authority covering the site is Cumbria County Council, which is also the,mineral and waste planning authority. In this role, it is responsible for determining planning applications and also for preparing planning policy for those types of development. The draft Cumbria Minerals and Waste Local Plan was submitted for examination by the planning inspectorate in Sep 2016 and the inspector's final report was published in June 2017. The submitted plan includes details of the county's waste arisings and existing permitted facilities. Although there are few sources of waste generation at present within the immediate vicinity of the proposed treatment site, in 2014 Cumbria was estimated to generate approximately 1,463,300 tonnes of waste per year, of which 356,900 tonnes is from industrial activities.

5.10.2 Waste management facilities in the vicinity of the treatment site, or which have the potential to accept waste from the site, will be identified as part of the waste management report; although it is noted that the contractor carrying out the works will be able to choose which management facilities to use, provided that they comply with relevant waste management regulations (including duty of care requirements).

Potential Effects

5.10.3 The potential effects from waste management may include:

- local nuisance effects arising from the handling and temporary storage of wastes, such as wind-blown litter; and

- regional effects due to utilisation of capacity at off-site waste management facilities.

Assessment Methodology

5.10.4 A review of the types and quantities of waste likely to be generated by the Proposed Development during construction and operation will be carried out and a draft Site Waste Management Plan (SWMP) will be prepared.

5.10.5 The draft SWMP will consider wastes generated during construction and operation, of which the operational waste (from periodic CBTP emptying every 10 to 15 years) is likely to be the largest waste stream. The draft SWMP will:

- identify the likely types and quantities of waste (including potentially hazardous waste during operation) that will be generated;
- describe the potentially suitable management routes that are available for dealing with these wastes, and confirm that they offer sufficient capacity for the project wastes; and
- describe the mitigation measures that will be adopted to minimise waste generation; to facilitate reuse or recycling of wastes; and to prevent exposure to potentially harmful material and nuisance during the collection, temporary storage and transportation of wastes.

5.11 Climate

5.11.1 The EIA Regulations require that the EIA includes consideration of climate mitigation and adaptation. In line with the requirements, three aspects have been considered:

- the resilience of the project to climate change impacts;
- the combined impact of the Proposed Development and potential climate change on the receiving environment ('in-combination effects'); and
- the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions);

Resilience

5.11.2 The ES is required to include a statement on the resilience of the Proposed Development to climate change impacts. This will be provided within the description of the Proposed Development. The climate resilience review will provide commentary on how climate change has been considered within the design of the Proposed Development and therefore provide commentary on its overall resilience to climate change.

5.11.3 The Proposed Development's resilience to climate change will be considered qualitatively. This will be completed in liaison with project design team and the other ES technical specialists by considering the climate projections for the geographical location and timeframe of the Proposed Development. The significance of climate resilience will not be assessed.

5.11.4 With respect to the resilience of the Proposed Development to climate change, sea level rise (due to location) and wind (due to the low lying nature of the development) are not considered relevant and have been scoped out. However, commentary will be made regarding the resilience of the Proposed Development to temperature (for instance the efficiency of the treatment solution) and extreme weather and other changes (for instance, flood prevention measures etc.). The commentary will take into account the embedded mitigation that will be incorporated into the design of the Proposed Development – including measures similar to those for the Nent-Haggs Mine Water Treatment Scheme.

In-combination effects

5.11.5 Given the nature of the Proposed Development it is not considered likely that there would be any in-combination effects of the Proposed Development in combination with change in temperature, wind, or sea level rise. However, climate change may lead to an increase in substantial precipitation events that could lead to flash flooding and may also lead to periods of decreased precipitation resulting in water scarcity. Both of these climate parameters are considered to have the potential to affect the impacts of

the project on surrounding land. These will be addressed within the Hydrology and Flood Risk assessment as part of the EIA.

Greenhouse gas emissions

5.11.6 The potential impacts of the Proposed Development on greenhouse gas emissions during both construction and operation of the Proposed Development will be assessed and reported within a separate Climate chapter in the ES. As the assessment of climate within EIA is evolving, the approach taken will follow new and emerging guidelines, including those developed and issued by the Institute of Environmental Management and Assessment (IEMA), as well as proven good practice from other similar projects. The potential to reduce carbon emissions during operation, for example through the use of solar panels in line with Coal Authority's Sustainability Strategy, will also be given consideration.

Baseline Conditions

5.11.7 The GHG emissions baseline is a 'business as usual' scenario where the Proposed Development is not implemented i.e. the GHG emissions from the current site use and activities.

Potential Effects

5.11.8 Potential GHG impacts resulting from the construction and operational phases for the Proposed Development would be expected to include embodied carbon in the materials used to construct the treatment plant, emissions from the use of transport but on and off site (i.e. logistics) as well as ongoing energy to run the plant.

Assessment Methodology

5.11.9 The GHG assessment will follow project lifecycle approach to calculate the estimate GHG emissions from the construction and operation and identified associated "hot spots" for mitigation as appropriate. The calculations will follow internationally recognised protocols (as recommended by the IEMA guidance) and consider the seven Kyoto gases. The calculated additional emissions associated with the development will be assessed in terms of the extent to which carbon mitigation has been integrated into the Proposed Development as well as the impact of the Proposed Development on the UK's ability to meet its GHG emission targets (carbon budgets).

5.12 Cumulative and Combined Effects

5.12.1 As part of the environmental impact assessment, the European EIA Directive (83/337/EEC, as amended by 2014/52/EU), requires that the predicted effects of the Proposed Development are considered alongside the effects of other development schemes that may have effects within the relevant study area. Consultation will be undertaken to establish the projects and proposals that require consideration within the assessment.

5.12.2 For the cumulative impact assessment, two types of impact will be considered:

- the combined impacts of several development schemes which may, on an individual basis be insignificant but, cumulatively, have a significant effect; and
- the combined effect of individual impacts, for example noise or pollutants, on a single receptor.

5.12.3 Cumulative effects are those that accrue over time and space from a number of development activities. The impact of the Proposed Development will be considered in conjunction with the potential impacts from other projects or activities which are both reasonably foreseeable in terms of delivery (e.g. have planning consent) and are located within a realistic geographical scope where environmental impacts could act together to create a more significant overall cumulative effect.

5.12.4 The Proposed Development is part of the wider 'Water and Abandoned Metal Mines' programme of works being devised in the Northern Pennines. The assessment of cumulative effects will include consideration of relevant committed works under the WAMM programme, including the nearby Nent Haggs Mine Water Treatment Scheme which, subject to when planning consent is granted, may be under construction at the same time as the Proposed Development at Nenthead.

5.12.5 A review of the Planning Register will be undertaken to identify other consented developments that are of such a nature and proximity to the site to have the potential to generate cumulative impacts when considered in context with the Development.

6. Topics Scoped Out of EIA

Traffic and Transport – Operation

6.1.1 It is anticipated that operational traffic would be similar to the operational traffic predicted for the nearby Nent Haggs Mine Water Treatment Scheme[13] as described below. The traffic and transport assessment for the Nent Haggs project found that all traffic and transport effects were negligible and therefore not significant.

6.1.2 Once operational it is expected that there would be regular visits to the Nenthead site by one vehicle to monitor the operation of the Scheme. On-site parking would be provided. Occasional maintenance would be required involving such activities as grass cutting, reed cutting and equipment replacement. The frequency of maintenance and monitoring visits is currently unknown; however, these are likely to be daily at first, then weekly then monthly. There would be two to three light goods vehicle deliveries of the dosing chemicals per month for the first four months of operation, which would reduce to one delivery a month thereafter.

6.1.3 Once operational, the Scheme would periodically give rise to waste when the compost material requires removing and replacement. This may require drainage of the ponds, excavation of the material and removal to a licenced waste disposal site. The ponds would then be re-instated and new compost material would be brought in. This process would occur once every ten to fifteen years.

6.1.4 Over the course of a single day, the HGV movements would be no worse than the construction phase. As such there are no specific traffic and transport effects associated with the maintenance of the Scheme.

6.1.5 The traffic and transport assessment reported in the ES for the nearby Nent Haggs Mine Water Treatment Scheme demonstrated that all operational traffic and transport effects were negligible and therefore not significant. On the basis that the operational traffic associated with the Proposed Development would be similar to that for the Nent Haggs scheme and that both sites are located in a rural area, operational traffic and transport effects have been scoped out of the EIA for the Nenthead Proposed Development.

Noise and Vibration – Operational Traffic Noise

6.1.6 As stated above, operational traffic for the Proposed Development would be similar to the operational traffic predicted for the Nent Haggs Mine Water Treatment Scheme. The assessment of operational traffic noise was scoped out for the Nent-Haggs scheme on the basis that the operational traffic volumes and hence the associated operational traffic noise generation would be too low to adversely affect local noise levels. This would also be the case for the Proposed Development and therefore an assessment of operational traffic noise has been scoped out.

Ground Conditions and Hydrogeology – Operation

6.1.7 The Scheme would be operated under an Environmental Permit regulated by the Environment Agency.

6.1.8 There is potential for groundwater to be impacted during operation of the Proposed Development via leaks and spills of contaminated compost material during removal from the ponds (anticipated to be on a 10-15 year frequency) and replacement. Best practice and embedded mitigation would reduce the risk and magnitude of leaks and spillages reaching the soils and groundwaters and as such impacts are not predicted to occur. Embedded mitigation is likely to include, though not necessarily be limited to, measures applied to the Nent-Haggs Mine Water Treatment Scheme. These include:

- all pipe runs would use HDPE pipe with welded joints;
- liner leakage testing, both during commission and at regular intervals;

[13] AECOM, 2018. Nent Haggs Mine Water Treatment Scheme. Environmental Statement. February 2018, submitted to Cumbria County Council with planning application 3/18/9001.

- operational monitoring of mine water quality of under drainage – to monitor for increased metal concentrations that could be indicative of liner leakage;
- installation of automated level and flow monitoring telemetry equipment for remote data review and level alarms;
- all dosing chemicals to be stored in a suitably secure dry and contained area and adhere to best practice for storage and handling;
- appropriate environmental controls for handling chemicals and oils (including COSHH (Control of Substances Hazardous to Health) assessments etc. would be implemented and operatives/ users would be trained in the application and use of dosing chemicals;
- planned maintenance and inspection of chemical dosing plant and equipment would be carried out. A written maintenance programme would be developed, as well as a record of maintenance;
- oil and/ or chemical spills would immediately be cleared up and documented. The Environment Agency would be notified of any large spillages of fuel or chemicals;
- compost material from the ponds would be removed from the Site and disposed of in a waste landfill in accordance, where appropriate, with the Hazardous Waste Regulations (HMSO, 2005);
- high level overflow/ decant points are to be incorporated in the ponds such that the water level in the ponds would not be able to overtop;
- isolation of any compost based treatment pond suspected of integrity failure; and
- regular maintenance and substrate replenishment as required to present short-circuiting of system

6.1.9 With the implementation of best practice measures, embedded mitigation and any operational conditions required under the Environmental Permit, operation of the Proposed Development should have no significant effects on ground conditions and hydrogeology.

Socio-economics – Construction and Operation

6.1.10 The Proposed Development falls within Lower Super Output Area Eden 001A which is the same area as the Nent Haggs Mine Water Treatment site. Given the similarity of the nature, scale and location of the Proposed Development and the Nent-Haggs scheme, it is expected that the socio-economic impacts and effects would also be similar.

6.1.11 During construction there is potential for positive effects of the Proposed Development to include employment opportunities within the local area.

6.1.12 Construction of the Proposed Development would generate short-term disruption to the amenity of receptors in the Direct Impact Area, including disruption to visual amenity, increased noise and construction dusts. Detailed assessments of impacts on landscape and visual amenity, noise, and construction dust during construction of the Proposed Development will be included within the EIA for the Proposed Development but are not likely to have significant effects in terms of socio-economics.

6.1.13 As for the Nent Haggs scheme, operation of the Proposed Development would require personnel for maintenance and monitoring checks. Theseduration but have potential to generate a small number of employment opportunities.

6.1.14 During the operational phase, the Proposed Development would result in changes to visual amenity, whilst air quality and odour impacts would require appropriate management particularly during the removal and replacement of compost material in the CBTPs. As with the construction impacts outlined above these topics will be assessed within the relevant chapter in the ES.

6.1.15 As the socio-economic effects are likely to be similar to those for the Nent Haggs scheme and are not likely to be significant, socio-economics has been scoped out of the EIA.

Health Impact Assessment – Construction and Operation

6.1.16 The Nenthead site is located within the same Lower Super Output Area as Nent Haggs. The HIA undertaken for the Nent Haggs project assessed the principle health benefits of that scheme as:

- increased job opportunities and improved accessibility to jobs with indirect benefits on mental health and well-being; and
- the enhancement of biodiversity through the introduction of the scheme, which would limit the input of metals from Haggs Mine to the River Nent, and reduce the supply of heavy metal contaminated material to the SAC with indirect benefits on well-being of local residents through improvements to the natural environment.

6.1.17 The key recommendation relevant to health and well-being associated with the Nent Haggs scheme was to ensure that opportunities are provided to local residents by seeking a contractor who would implement requirements or company policies to offer training and employment opportunities for residents within the local community. No significant adverse health effects were identified for the Nent Haggs scheme.

6.1.18 No significant adverse health impacts are expected for the Proposed Development. It has therefore been scoped out of the EIA.

Major Accidents and Disasters – Construction and Operation

6.1.19 The need to consider the vulnerability of the Proposed Development to major accidents or disasters has been scoped out of the EIA as the most likely event would be a major flood event and a separate FRA will be prepared which will address the potential for the Proposed Development to be affected by flooding.

7. The Environmental Statement

7.1.1 Subject to the outcome of the Scoping Opinion, the EIA will be undertaken in accordance with the proposed scope (refer to Section 3) and reported in an ES. The significance of effects will be determined using the generic classification matrix presented in Table 3.1. Where necessary, this matrix will be adapted by individual topic specialist leads to suit their particular topic and its characteristics and to align with their respective published topic guidance. Classification of Effects

7.1.2 As described in Section 3.2, the impact assessments undertaken for the ES will take into account the mitigation measures that have been incorporated into the Proposed Development, as well as best practice management activities. The final detailed design of the Proposed Development will, where appropriate and practicable, incorporate environmental mitigation identified during the EIA process and agreed with the Coal Authority. The EIA will therefore determine the significance of predicted residual effects that would remain after the proposed and agreed design mitigation measures have been implemented.

7.1.3 In order to provide a consistent approach to expressing the outcomes of the various studies undertaken as part of the EIA, and thereby enable comparison between impacts upon different environmental components, the following terminology will be used in the ES to define residual effects:

- Adverse - Detrimental or negative effect to an environmental resource or receptor; and
- Beneficial - Advantageous or positive effect to an environmental resource or receptor

7.1.4 For the purpose of the EIA, moderate and major effects will be deemed ‘significant’. Where significant environmental effects are identified, measures to mitigate these effects will be proposed and any remaining residual effects identified.

Assessment Years

7.1.5 The ES will consider environmental conditions in the following assessment years:

- 2019 – Existing Baseline Conditions – No Development
- 2020 – Future Baseline Conditions – No Development, Construction begins
- 2021 – Future Conditions – With Development, Opening Year
- 2036 – Future Conditions – With Development, 15 years after Opening Year

7.1.6 For the purposes of the EIA it is assumed that baseline conditions in 2020, i.e. at the start of construction, would be similar to those existing in 2019, subject to no other major developments / changes to the environmental context occurring.

Proposed Structure of the Environmental Statement

7.1.7 In accordance with Schedule 4 of the Regulations, the ES will present:

- a description of the Proposed Development comprising information on the site, design and size of the Proposed Development;
- a description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects;
- the data required to identify and assess the potential effects which the proposed scheme is likely to have on the environment;
- an outline of the main alternatives studied and an indication of the main reasons for the selection of the Proposed Development, taking into account the environmental effects; and
- a Non-Technical Summary (NTS) of the information provided.

7.1.8 The ES will comprise the principal document including drawings, an NTS and technical appendices.

7.1.9 The NTS will summarise the proposal, its likely environmental effects and proposed mitigating measures. The NTS will be available separately as a stand-alone document.

7.1.10 The EIA topics addressed in the ES will be those that have been scoped in as detailed within this report, taking into account any further requirements from consultees. For each technical discipline, baseline conditions will be used to inform the assessments. The environmental impacts and effects of the Proposed Development will be determined for each of the scoped in technical issues.

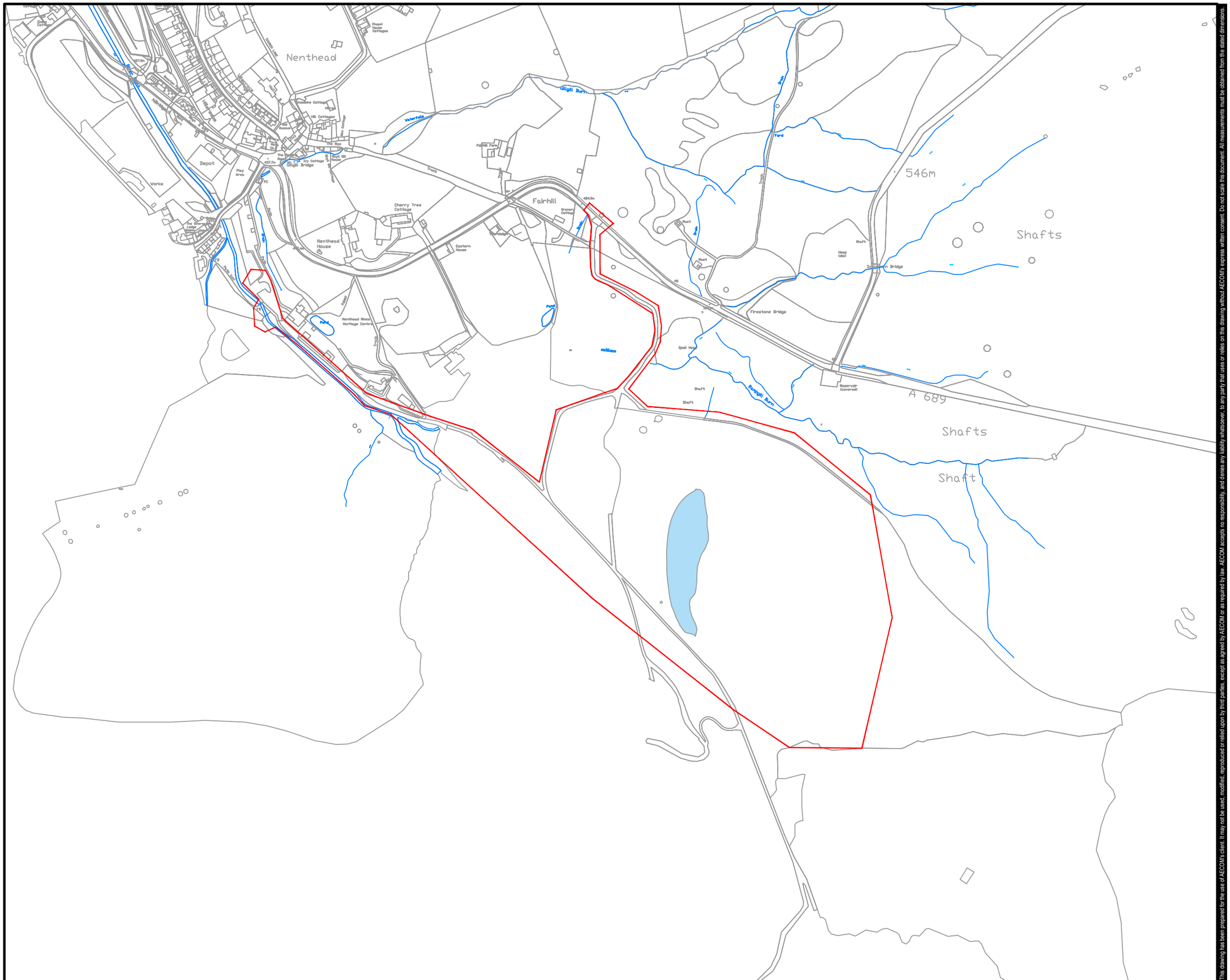
7.1.11 Details of the consultation process followed throughout the environmental assessment and in the previous site selection process will be set out in the ES.

7.1.12 The following documents will be prepared separately and will be used to inform the EIA and will be cross referred to in the ES as appropriate. These documents will be included as technical appendices to the ES:

- Transport Assessment
- Flood Risk Assessment;
- WFD Assessment; and
- Drainage Strategy

7.1.13 The planning support statement which will be submitted with the application will fully assess the application proposals against the Development Plan, the NPPF and other material considerations. The ES will contain reference to the policies relevant to the assessments within each specialist topic section.

Figures



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AECOM

PROJECT

Nenthead MWTS

CLIENT

The Coal Authority

CONSULTANT

AECOM
1st Floor, 2 City Walk
Leeds, LS11 9AR
+44 (0) 113 391 6000 tel
+44 (0) 113 391 6899 fax
www.aecom.com
leedsadminteam@aecom.com

ISSUE/REVISION

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-	10/01/2019	FOR INFORMATION

Proj Mgr : TB	Status :
Date Created : 09/01/2019	Scale : 1:2500

PROJECT NUMBER

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REQUIRED TOPO AREA

SHEET NUMBER

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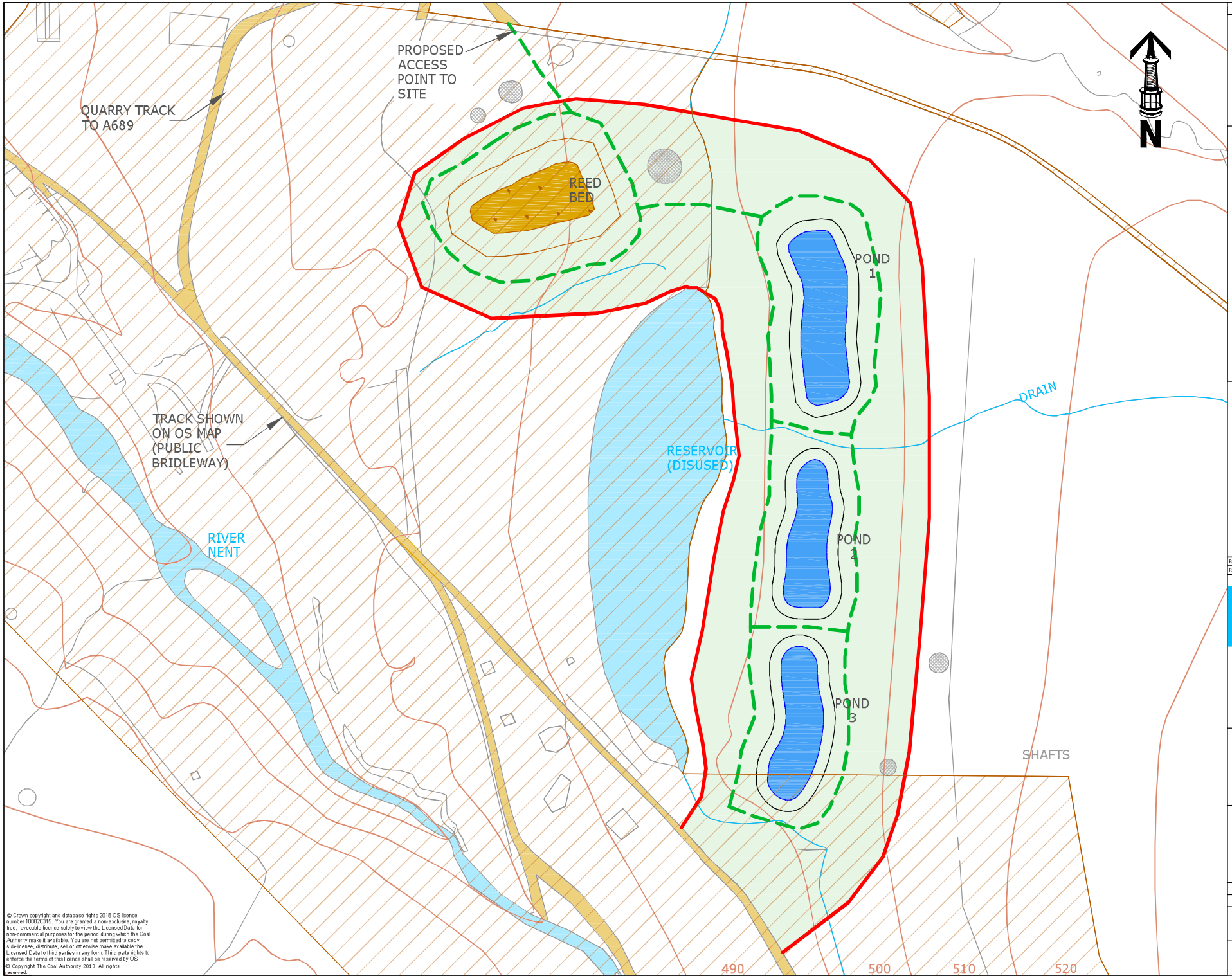

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- TRACK
- SCHEDULED ANCIENT MONUMENT

Rev	Date	Details of issue / revision	Drw	Rev
R1	28.02.18	REPORT ISSUE	KH	PT

ISSUES & REVISIONS

The Coal Authority
Engineering
200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG
Tel. 01623 637000

Project Title.
NENTHEAD FEASIBILITY STUDY

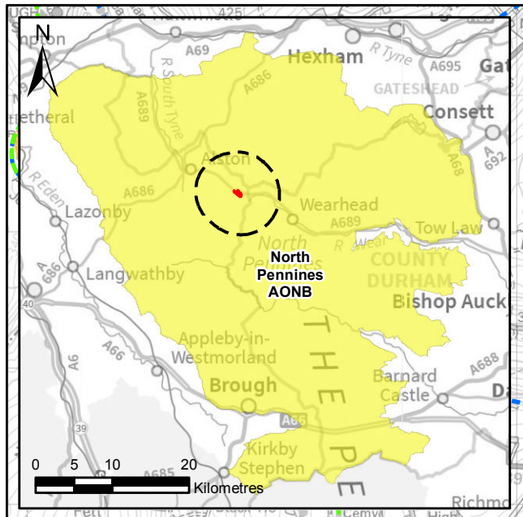
Drawing Title.
FIGURE 4 - SITE 101

Scale	1:1500	Drawn	KH
Size	A3	Reviewed	PT

Drawing Status.
REPORT

Drawing No.
EV000116-FIG.4

Revision
R1



Whitfield Moor, Plenmeller and Ashholme Commons SSSI
North Pennine Moors SPA
Allendale Moors SSSI
Blagill Mine SSSI
Tyne & Nent SAC
River Nent at Blagill SSSI
Haggs Bank SSSI
Tyne & Nent SAC
Alston Shingle Banks SSSI
Tyne & Nent SAC
Pennine Way
Whitesike Mine and Flinty Fell SSSI
Tyne & Nent SAC
Whitesike Mine and Flinty Fell SSSI
Smallcleugh Mine SSSI
River South Tyne and Tynebottom Mine SSSI
Moorhouse and Cross Fell SSSI
Moor House-Upper Teesdale SAC
North Pennine Moors SPA
Moorhouse and Cross Fell SSSI
Moor House-Upper Teesdale SAC
North Pennine Moors SPA
Hartley Cleugh SSSI
North Pennine Dales Meadows SAC
White Ridge Meadow SSSI
Allendale Moors SSSI
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Project Management Initials: GIS: AB Checked: JG Approved: SB ISO A3 297mm x 420mm

AECOM

PROJECT

NENTHEAD MWTS

CLIENT

THE COAL AUTHORITY

200 Lichfield Lane
Mansfield
NG18 4RG
+44 (0) 1623 637 000

CONSULTANT

AECOM
1st Floor, 2 City Walk
Leeds LS11 9AR
+44 (0) 113 391 6000 tel
+44 (0) 113 391 6899 fax
www.aecom.com

LEGEND

- Planning Application Boundary
- 5km Study Area centred on (378588, 543287)

Environmental Designations

- Area of Outstanding Natural Beauty (AONB)
- Site of Special Scientific Interest (SSSI)
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- National Trail
- Issac's Tea Trail

Historic Designations

- Grade I Listed Building
- Grade II* Listed Building
- Grade II Listed Building
- Scheduled Monument

ISSUE/REVISION

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0	21.02.2019	DRAFT

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Figure 2.1 Environmental Contraints Plan

SHEET NUMBER

MWTS-AEC-NC-XX-DR-Y-3000

Appendix A – Preliminary Ecological Appraisal Report, Site 101

Nenthead Site 101

Preliminary Ecology Assessment (including upland wader survey, water vole survey, detailed botanical survey and pond assessments)

The Coal Authority

MWTS-AEC-NC-XX-RP-Y-3104

Project Number: 60543055

February 2019

Quality information

Prepared by	Checked by	Approved by
Mark Hampton Principal Ecologist	Paul Benyon Associate	Tim Benson Associate

Revision History

Revision	Revision date	Details	Authorized	Name	Position
P1	October 2018	Vegetation Survey results added	17/10.2018	Tim Benson	Project Manager
P2	October 2018	Client comments resolved	31/10/2018	Tim Benson	Project Manager
P3	February 2019	Reptile recommendations updated	04/02/2019	Tim Benson	Project Manager

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Prepared for:

The Coal Authority
200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

Prepared by:

AECOM Infrastructure & Environment UK Limited
Royal Court
Basil Close
Derbyshire
Chesterfield
S41 7SL
UK

T: +44 (1246) 209221
aecom.com

Table of Contents

Tables

1. Introduction

1.1 Overview of the project

The Department for Environment, Food and Rural Affairs (Defra) set up the “Water and Abandoned Metal Mines” (WAMM) Programme in 2010 to begin to tackle pollution from the hundreds of metal mines across the country. The programme is being delivered as a partnership between Defra, the Coal Authority and the Environment Agency.

Inputs of metals into the River Nent cause average concentrations of cadmium, lead, and zinc to exceed Environmental Quality Standards, so the River Nent fails to achieve good status for fish and invertebrates. The Northumbria River Basin Management Plan (RBMP), published in 2015, includes steps for addressing pollution from abandoned mines and managing the impacts to 2027. The WAMM programme has ranked the River Nent as the lowest quality in the Northumbria RBMP, and one of the lowest quality rivers in England, with respect to mine water related pollution. The pollution from the River Nent contributes to pollution in the River South Tyne up to 40km downstream. Due to these impacts, the Nent Catchment has been a priority for investigation, assessment and targeted improvement measures.

AECOM has been appointed by the Coal Authority to undertake the feasibility and outline design for a mine water treatment scheme (MWTS) at the Caplecleugh Level Adit, which is one of the point source contributors to the failure of the River Nent under the RBMP. The aim is to reduce the metal loading (principally lead, zinc and cadmium) within the mine water discharge from the Caplecleugh Adit by between 70% and 90%, providing betterment to the River Nent, whilst adhering to the conditions required for any consents, licences and permits. The construction of the MWTS is planned for completion by 2019.

1.2 Proposed Development

The proposed development would divert mine water flowing from the Caplecleugh Level Adit, near the Nenthead Mines car park, to a mine water treatment scheme at Site 101 (Figure 1). The treatment scheme would remove heavy metals from the water before discharging the treated water in to the River Nent. At the location of the adit, works would be carried out to construct a collection chamber and transfer pipework.

1.3 Scope of the Report

This report relates to an area of land referred to as Site 101 (the site), which is located near Nenthead, Alston, Cumbria. The surveys that have been undertaken were commissioned to inform of any ecological constraints to development of a mine water treatment scheme at the site.

This report presents a preliminary ecological assessment (PEA), pond assessment for use by amphibians, analysis of water samples taken from the waterbodies for presence of great crested newt DNA, an upland bird survey, a water vole survey of the ditches and a more detailed vegetation survey of the grassland and heath areas. It also identifies any other sensitive ecological features that could be affected by any proposed development.

In order to deliver the PEA element, a desk study and an extended Phase 1 Habitat survey were undertaken by an appropriately experienced ecologist to identify ecological features within the site. Additional details are provided in Section 3: Methodology.

The aim of this report is to provide baseline ecological information, such as the habitats present on site and the potential for these habitats to support protected and/or otherwise notable species that could be adversely affected by any proposed works. In addition, the report gives the detail of upland wader use of the site. This information will allow for an evaluation of the ecological significance of the site along with the requirement for any further surveys to inform the detailed design.

1.4 Site Description

The site is located southeast of Nenthead (site central grid reference: NY 787 433) and comprises acid grassland, heathland, open and vegetated mine spoil heaps, wetland and ditches. There is a small reservoir

adjacent to the site and several ponds with 20m of the proposed site footprint. The wider landscape includes further moorland habitat, the River Nent and mine workings.

2. Legislation and Planning

2.1 Wildlife Legislation

The following legislation relates to species and habitats that could potentially occur within the site:

- The Conservation of Habitats and Species Regulations 2017
- The Wildlife and Countryside Act 1981 (as amended)
- The Countryside and Rights of Way (CRoW) Act 2000
- Natural Environment and Rural Communities (NERC) Act 2006
- The Protection of Badgers Act 1992
- Wild Mammals (Protection) Act 1996
- The Hedgerow Regulations 1997

2.2 Planning

Consideration has also been given to relevant national, regional and local planning policy and strategy documents. These are listed below:

- National Planning Policy Framework (NPPF)
- Eden District Council Core Strategy (adopted March 2010)

A summary of relevant policy is provided below.

An updated and revised National Planning Policy Framework (NPPF) was published on 24th July 2018 and it sets out the Government's planning policies for England and how these are expected to be applied.

Promoting a strong theme of sustainable development, the Framework aims to strengthen local decision making and reinforce the importance of up-to-date plans. Core aims of the NPPF include:

- The Presumption in favour of Sustainable Development;
- Delivering Sustainable Development – Building a strong competitive economy and ensuring the vitality of town centres;
- Promoting sustainable transport;
- Meeting the challenge of climate change, flooding and coastal change;
- Conserving and enhancing the natural environment; and
- Conserving and enhancing the historic environment.

The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity. It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this it to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

The Eden District Council Core Strategy (2010) contains relevant environmental policies, and 'CS16 Principles for the Natural Environment' is particularly relevant to the proposed development. CS16 states that:

- *"The relationship between the development and the natural environment will be managed to minimise the risk of environmental damage.*
- *"Encouragement will be given to the creation of opportunities for species to spread out and create niches elsewhere in order to reduce any negative impacts of development and to allow species to migrate as a result of climate change.*
- *The re-creation and restoration of traditional habitats will be encouraged and existing wildlife and habitats such as hedges, ponds, woodlands, ancient woodlands, wetlands and species rich grasslands will be protected and enhanced.*
- *Where possible, developments will be expected to include suitable measures to contribute positively to overall biodiversity in the District or to mitigate harm caused by the development.*
- *Promote improvements in accessibility to the natural environment for all people regardless of disability, age, gender or ethnicity.*
- *Development should reflect and where possible enhance local landscape character."*

2.3 Biodiversity

The NERC Act 2006 Section 41 (S41) lists habitats and species which are of principal importance for the conservation of biodiversity in England. The habitats and species included on the S41 list are identified as conservation priorities under the UK Post-2010 Biodiversity Framework, which replaced the UK Biodiversity Action Plan (UK BAP).

The Cumbria Biodiversity Action Plan (BAP) was published in 2001, by the Cumbria Biodiversity Partnership and aims to raise public awareness and understanding of the natural environment and hopes to encourage local people and politicians to take a closer look interest in biodiversity to take action to help vulnerable wildlife and threatened habitats.

Twenty-one species and 18 habitats have been identified in the Cumbria BAP for priority action and targets set for recovery, and include bats, water vole *Arvicola amphibius*, song thrush *Turdus philomelos*, hay meadows and blanket bogs.

The above legislation has been considered when undertaking this PEA using the methods described in Section 3, when identifying potential constraints to the proposed developments and when making recommendations for further survey, design options and mitigation, as outlined in Section 5. Compliance with legislation may require the attainment of relevant protected species licences prior to the implementation of the proposed developments.

3. Methodology

3.1 Desk-Study

A stratified approach is usually taken when defining the desk study area, based on the likely zone of influence of the proposed developments on different ecological receptors and on an understanding of the maximum distances typically considered by statutory consultees (2km for statutory site designations and 1km for local, non-statutory designations together with protected and notable habitats and species).

A desk study was undertaken as part of The Coal Authority's mine water treatment scheme proposed works local to Nenthead and was carried out in January 2017. This considered a 3km search area from a location close to the site (centre point NY782435) and the data collected is considered to be relevant to this project, as it is only a year and a half old and covers more than adequately a 1km radius around the site for non-statutory sites and protected/notable species. In addition, an updated check has been carried out in June 2018 for statutory designated sites within a 2.5km radius from centre point NY787434.

The desk study was carried out using the data sources detailed in Table 1. Protected and otherwise notable habitats and species include those listed under Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended); Schedules 2 and 5 of the Habitats Regulations, species and habitats of principal importance for nature conservation in England listed under section 41 (s41) of the NERC Act and other species that are Nationally Rare, Nationally Scarce or listed in national or local Red Data Lists and Biodiversity Action Plans.

Table 1: Desk study data sources

Data source	Accessed	Data Obtained
Multi-Agency Geographic Information for the Countryside (MAGIC) website.	8th June 2018	• International statutory designations within 2 km. • Other statutory designations within 2 km. • Ancient woodlands and notable habitats within 2 km. • Information on habitats and habitat connections (based on aerial photography) relevant to interpretation of planning policy and assessment of potential protected and notable species constraints.
Cumbria Biodiversity Data Centre.	19th January 2017	• Non-statutory designations within 1km. • Protected and notable species records within 1km.

3.2 Existing Survey Information

Previous survey work has been carried out as part of the wider scoping for other related projects in the area. Whilst not directly relevant to this site, there are completed surveys that were carried out in the general locality, which have been utilised as part of this assessment.

3.3 Extended Phase 1 Habitat Survey

An extended Phase 1 Habitat Survey of the site was completed on 7th June 2018.

The aim of the survey was to identify the type and extent of habitats present within and adjacent to the site and to identify the potential for these habitats to support protected or otherwise notable species. The survey was conducted according to the standard Phase 1 habitat survey methodology (Joint Nature Conservation Committee 2010[1]) and with adherence to standard guidelines[2] and was extended to include targeted searches for signs of protected species such as bats, amphibians, reptiles, and badger (*Meles meles*). The survey also included a search for invasive species listed under schedule 9 of the Wildlife and Countryside Act, such as Japanese knotweed (*Fallopia japonica*) and giant hogweed (*Heracleum mantegazzianum*).

Target notes (TN) were made to provide supplementary information on species composition, features of interest, topography, location of habitats and evidence of management. Botanical nomenclature follows Stace (2010[3]).

3.4 Pond assessment for amphibians

Given that four ponds and the reservoir were recorded on/near to the site, a Habitat Suitability Assessment and analysis of water samples for presence of great crested newt DNA of the ponds and reservoir were completed to inform the PEA.

3.4.1 Habitat Suitability Index

Habitat suitability is determined by using the Habitat Suitability Index (HSI), which is calculated using ten habitat variables ('suitability indices') which are known to affect the survival of great crested newt. These are:

- Geographical location (i.e. with respect to the range of great crested newt);
- Pond area;
- Permanence of water (estimated number of years a waterbody is likely to dry out in spring, per decade);
- Water quality;
- Percentage shade of waterbody margin;
- Presence of waterfowl;

[1] Joint Nature Conservation Committee, (2010), Handbook for Phase 1 Habitat survey – a technique for environmental audit, ISBN 0 86139 636 7.
[2] Chartered Institute of Ecology and Environmental Management (April 2013) *Guidelines for Preliminary Ecological Appraisal* (GPEA) Professional Guidance Series (CIEEM: http://www.cieem.net/)
[3] Stace, C.A. (2010) The New Flora of the British Isles. Cambridge University Press.

- Occurrence of fish;
- Pond density;
- Connectivity and quantity of suitable terrestrial habitat; and
- Macrophyte (aquatic plant) coverage.

Each habitat variable is assessed by experienced surveyors in the field. The ten suitability indices are combined to derive the final HSI score for the pond. The HSI, expressed as a value between 0.01 and 1.0, is then categorised as shown in Table 2.

Table 2 HSI score and suitability of the aquatic habitat for great crested newt[4]

HSI Score	Suitability of the aquatic habitat for Great Crested Newt
0.01 – 0.49	'Poor'
0.50 – 0.59	'Below average'
0.60 - 0.69	'Average'
0.70 – 0.79	'Good'
0.80 – 1.00	'Excellent'

It is generally considered unsuitable to apply the HSI tool when assessing ditches. Ditches can form long networks, thus determining the area of a ditch is not always possible. Some sections of a ditch may be more suitable for great crested newts than other sections (which for example may be dry). Ditches within 500 metres of the Proposed Scheme that were accessible during the survey period were visually assessed for their potential to support great crested newts by experienced AECOM ecologists and professional judgement was used to determine whether further survey to determine great crested newt presence/absence was required.

3.4.2 Presence/Absence Surveys – eDNA Survey Techniques

Environmental DNA that has been released from an organism in the form of faeces, saliva, urine, skin cells or carcasses is found within the environment. In aquatic environments (e.g. lake, pond& ditch), the eDNA is diluted and distributed in the water where it can persist for 7-21 days, depending on environmental conditions. The procedure for sampling a waterbody involves collecting 20 water samples from a pond or ditch, combining these samples into a single composite sample which is then sent to an approved laboratory for analysis according to Biggs *et a*l. (2014[5]). Water samples must be collected between mid-April and end-June to capture the peak breeding season.

Results are returned as either positive (great crested newt present), negative (great crested newt not detected) or inconclusive.

If a positive result for great crested newt is returned through eDNA surveys, six further survey visits, using traditional survey methods, would be subsequently carried out to provide an estimation of the population size class (see below). Population size class estimates are used to inform a great crested mitigation licence and help determine the levels of mitigation required.

On 26th June 2018, water samples were collected from Ponds 2, 3, 4 and 5 (reservoir), shown on Figure 2, and sent to an approved laboratory (SureScreen Scientifics) for testing.

For each pond/ditch, a total of 20 water samples were taken from different areas which were considered suitable to support for great crested newts, using sterile kits provided by SureScreen Scientifics, and taking care to not collect sediment from the bottom. All sampling was carried out from the banks and the water was not entered, as this may risk DNA from elsewhere being transferred between waterbodies (e.g. from the ecologist's boots). All water samples were transferred into a whirl pack and mixed thoroughly. Once mixed a pipette was used to transfer 15ml of the water sample into a tube of ethanol to preserve the eDNA, filling the tube up to 50ml. The

[4] Taken from: Oldman, R. S., Keeble, J., Swan, M. J. S., and Jeffcote, M. (2000). *Evaluating the Suitability of Habitat for the Great crested newt (*Triturus cristatus*)* Herpetological Journal 10 (4), 143-155.
[5] Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Defra Project WC1067. Freshwater Habitats Trust: Oxford

tube was fastened, labelled and shaken. This process was completed until six tubes had been prepared for each waterbody. Following the survey all the tubes were safely packed and sent to the laboratory for testing.

In the laboratory, the six sample tubes from each waterbody are pooled together, and then tested 12 times to ensure an accurate result is obtained. For great crested newt presence to be confirmed, one or more of the 12 tests is required to be returned positive. If all results are returned negative, then it can be concluded that great crested newts have not used the waterbody in the preceding two week period. The accuracy of this method compares favourably with surveys undertaken using standard methods.

3.5 Upland Wader Survey

Breeding bird surveys were conducted on three occasions in June and July 2017. The primary aim of the surveys was to determine the distribution and abundance of breeding waders within and adjacent to the site and so the primary method of survey was based upon Brown & Shepherd (1993)[6].

During each visit, all bird observations were recorded on maps using standard British Trust for Ornithology (BTO) notation for species, behaviour and evidence of breeding. The surveys involved walking across the entire site on a transect route, ensuring that all areas within the site were approached to within 100 metres. The survey conditions are present in Table 3 below.

Birds were classified as **Non-breeding, Possible, Probable and Confirmed** breeding depending on activity recorded. A summary of each breeding type is provided in Table 4 as described in Gibbons et al. (1993).

In addition to breeding waders, birds of notable conservation concern were noted in the below species lists:

- Annex 1 of the EC Birds Directive
- Schedule 1 of the Wildlife and Countryside Act 1981
- Red-listed birds of Conservation Concern[7]

Table 3: Breeding Bird Survey Conditions

Date	Start time	Weather Conditions	Visibility
07th June 2017	08.40	No cloud cover, dry, sunny 16°C, slight breeze	Excellent
26th June 2017	08.30	No cloud cover, dry, sunny 20°C, no wind	Excellent
20th July 2017	08.30	95% cloud cover, dry, 14°C, slight breeze	Good

All surveys were undertaken in suitable weather conditions. Surveys were completed at a slightly earlier time of day than those suggested by Brown & Shepherd (1993) to account for other notable species such as short-eared owl and black grouse.

Table 4: Breeding Classification Descriptions[8]

Breeding Classification	Activity Recorded
Non-breeding	Passage flight only
	Non-breeding males
Possible breeding	Singing male
	Bird in suitable nesting habitat

[6] A. F. Brown & K. B. Shepherd (1993) A method for censusing upland breeding waders, Bird Study, 40:3, 189-195, DOI: 10.1080/00063659309477182
[7] M. A. Aebischer et al. (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708-746
[8] Table 2 adapted from Breeding Status Codes: Gibbons et al. (1993) the new atlas of breeding birds in Britain and Ireland: 1988-1991. T. & A. D. Poyser

Breeding Classification	Activity Recorded
Probable breeding	Pair in suitable nesting habitat
	Permanent territory behaviour
	Visiting probable nest site
	Agitated behaviour
	Nest building or excavating nest hole
Confirmed breeding	Distraction display or injury feigning
	Used nest or eggshells found from this season
	Recently fledged or downy young
	Adult carrying faecal sac or food for young
	Nest containing eggs
	Nest with young seen or heard

3.6 Water Vole Survey

A specific water vole survey was undertaken along the main ditch on site and 50 metres upstream and downstream beyond the site boundary on 20th July 2017. These surveys were completed in accordance with the standard methodology[9][10][11].

The survey involved walking along the watercourse and looking at the potential for use and evidence of presence of water voles. Evidence of water voles includes the species themselves, bankside burrows, latrines, feeding signs and footprints.

No limitations to the survey were encountered and the full length of the watercourse that was planned to be surveyed was able to be surveyed. Weather conditions were good.

3.7 Detailed Vegetation Survey

The survey was undertaken on 6th September 2018 by an experienced AECOM surveyor. The vegetation was surveyed to National Vegetation Classification (NVC) methodology. Homogenous vegetation stands were classified according to the NVC as given in the relevant original NVC volumes[12]. Reference was also made to the NVC review and other guidance[13],[14] in which some additional vegetation types not covered by the original NVC volumes are described. Sample quadrat data were taken as necessary using standard methods set out in the NVC volumes (2x2m quadrats were used in the vegetation encountered). Vegetation was assigned to a sub-community where possible. Since NVC communities often occur in patches too small to map amongst more extensive communities, or in complexes which cannot be feasibly mapped within reasonable timescales, NVC polygons were described as mosaics as necessary.

Within each quadrat all species were recorded with an estimate of percentage cover/abundance using the Domin scale (1 = few individuals; 2 = some individuals; 3 = many individuals; 4 = 4% - 10%; 5 = 11% - 25%; 6 = 26% - 33%; 7 = 34% - 50%; 8 = 51% -75%; 9 = 76% - 90%; 10 = 91% - 100%). Subsequent areas of the same vegetation within a site do not require five additional quadrats but should be sampled for consistency and at least one quadrat recorded and, based on size, possibly more at the discretion of the surveyor.

[9] Dean et al. (2016). The Water Vole Mitigation Handbook (Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. Mammal Society London.
[10] Strachan, R. et al. (2011). Water Vole Conservation Handbook; 3rd Edition. Wildlife Conservation Research Unit, Abingdon.
[11] Common Standards Monitoring Guidance for Mammals; JNCC; August 2004.
[12] Rodwell, J.S. (Ed.) (1991). *British Plant Communities. Volume 2 – Mires and heaths*. Cambridge University Press, Cambridge.
Rodwell, J.S. (Ed.) (1992). *British Plant Communities. Volume 3 – Grasslands and montane communities*. Cambridge University Press, Cambridge.
[13] Averis, A., Averis, A.B.G., Birks, J., Horsfield, D., Thompson, D. & Yeo, M. (2004). *An Illustrated Guide to British Upland Vegetation.* Joint Nature Conservation Committee, Peterborough.
[14] Rodwell, J.S., Dring, J.C., Averis, A.B.G., Proctor, M.C.F., Malloch, A.J.C., Schaminée, J.N.J., & Dargie, T.C.D. (2000). *Review of coverage of the National Vegetation Classification*. JNCC Report No. 302, Joint Nature Conservation Committee, Peterborough.

The quadrat data was analysed initially using TWINSPAN (Two Way INdicator SPecies ANalyis) Hill (1979)[15]. The version utilised was that in the Community Analysis Package Version 2.13 (2002) Pisces Conservation Ltd, Lymington.

TWINSPAN is designed to produce ordered two-way tables by identifying differential species. In TWINSPAN, the samples are classified and then the species are classified using the sample classification as a starting point. The starting point of TWINSPAN is to firstly produce a crude dichotomy of the samples by ordination of the data and dividing the ordination in the middle. Differential species (i.e. ones that are preferential to one side or other of the ordination) are identified and then the ordination is improved. Finally, a third ordination is undertaken based on the most highly differential species. The dichotomy is produced from the results of the second ordination but the third ordination allows a further succinct characterisation if required.

The identified groups of quadrats from the TWINSPAN analysis were then tabulated and a constancy value for each species calculated for each defined group of quadrats, as follows:

- Scale: I = 1% - 20%. II = 21% - 40%. III = 41% - 60%. IV = 61% - 80%. V = 81% -100.

The tables produced were then used to assign the vegetation types to one of the published plant community types through use of the keys provided in the published volumes and by visual comparison of the collected data with the published data. In addition, use was made of TABLEFIT (Hill 2015[16]), which assesses the similarity between single vegetation samples or sets of samples and the species constancy tables which characterise the NVC communities and sub-communities.

The location of each quadrat was recorded by taking a GPS coordinate and then mapped (see Figure 4).

Botanical nomenclature follows the third edition of Stace 2010[17].

3.8 Limitations and Assumptions

Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. The absence of records for a particular species does not therefore necessarily mean that such species does not occur in the study area.

The upland wader survey missed a May survey, due to timing of the job commission, and this is not ideal in terms of breeding; however, given the cold spring and late season in 2018, it is not considered that this is a significant limitation and it is likely that any breeding taking place on site would have been captured.

The more detailed vegetation survey was carried out in September, which is not considered an issue for the upland communities; however, Calaminarian communities are best surveyed in the spring and due to timing of the commission the best period for doing a more detailed survey of this community had passed. This is not considered a significant issue as the areas and extent of this habitat was identified during the initial survey, although the detailed boundaries of the community within the site have not been mapped at this point.

It should be noted that the Phase 1 Habitat map and detailed botanical survey map (Figure 2 and Figure 4) are indicative habitat boundaries and these have not been surveyed-in accurately in terms of GIS, particularly given the mosaic nature of the site where actual boundaries are difficult to delineate.

4. Results

4.1 Desk Study

The results for the wider search carried in June 2018 and January 2017 for statutory and non-statutory sites are included in Appendix A. The desk study results for protected and notable species received from Cumbria Biodiversity Data Centre were too numerous to include as raw data therefore only the relevant species have been identified and considered within the body of the report (a full record set can be issued on request).

[15] Hill, M.O. (1979) TWINSPAN - A FORTRAN Programme for Arranging Multivariate Data in an Ordered Two-Way Table by Classification of the Individuals and Attributes. Ecology and Systematics. Cornell University, Ithaca, New York 14850, U.S.A.
[16] Hill, M.O. (2015). TABLEFIT version 2.0 for identification of vegetation types. Wallingford: Centre for Ecology and Hydrology.
[17] Stace, C. (2010). *New Flora of the British Isles*. Cambridge University Press, Cambridge.

4.1.1 Statutory Designations

The Tyne and Nent Special Area of Conservation (SAC) is within 1.2 km to the southwest. The North Pennine Moors Special Area of Conservation (SAC) and Special Protection Area (SPA) is approximately 1.2 km to the north-northwest of the site. Haggs Bank SSSI is approximately 2.7 km northwest of the site. Allendale Moors SSSI is approximately 1.4 km to the northwest of the site. Small Cleugh Mine SSSI is adjacent to the south of the site and Whitesike Mine and Flinty Fell SSSI is around 1.2 km to the southwest of the site.

4.1.2 Non-statutory Designations

Table 5 details the non-statutory nature conservations identified by the desk study, based on the method given in Section 3.1 of this report. The designations are listed in order of increasing distance from the Site boundary. Table 5 includes Candidate and Potential/Historic sites. Candidate Local Wildlife Sites (LWS) are those which have clear evidence that they meet the LWS criteria but have not been formerly designated. Potential/Historic LWS are former parish, county and district-level sites but have not been recently surveyed to check status. It should be noted that the Site is part of Nenthead Mine Local Geological Site.

Table 5 Sites with non-statutory designations for nature conservation

Designation	Reason(s) for Designation	Relationship to the Site boundary
Flinty Fell County Wildlife Site	Notable habitat (Blanket Bog, Calaminarian grassland)	1.1 km to the southwest of the site
River Nent County Wildlife Site	Notable habitat (Riverine/riparian)	1.2 km to the northwest of the site.
Special Roadside Verge (C1Y (1)).	Notable habitat (road verge).	1.2 km to the northwest of the site.
Special Roadside Verge (C17 (2)).	Notable habitat (road verge).	1.6 km to the northwest of the site.

4.1.3 Protected and Otherwise Notable Species

Table 6 provides a summary of potentially relevant species identified through the desk study. The table summarises the conservation status of each species and provides commentary on the likelihood of presence.

Where species are identified in Table 6 as likely or possible within the site or immediate wider area, depending on the potential for effects from the proposed development, they could be material to determination of a planning application and could represent a legal constraint. Where they are flagged as a potential constraint, further surveys are likely to be required to determine presence/ population size so the impacts from the proposed development can be assessed to the satisfaction of the Planning Authority. Requirements for further surveys are identified in Section 5 of this report.

Table 6 Protected and notable species relevant or potentially relevant to the proposed development

Species	Legally Protected Species	Species of Principal Importance	Other Notable Species	Present on Site	Present/Potentially Present in Wider Zone of Influence	Supporting Comments
Bats	✓	✓	-	?	?	The desk study returned 21 bat records within 1 km of the site. Species included Pipistrelle species (*Pipistrellus*), Daubenton's (*Myotis daubentonii*), natterer's (*Myotis nattereri*) and whiskered/brandt's (*Myotis mystacinus/brandtii*). Roosts are known in Nenthead itself, at Capleclough adit (0.6 km west of the site at adit - NY78104347) & Rampgill Burn adit (0.1 km north - NY787435).
Breeding birds	✓	✓	-	?	?	The desk study revealed the presence of, amongst others, Oystercatcher (*Haematopus ostralegus*), Lapwing (*Vanellus vanellus*) and ringed plover (*Charadrius hiaticula*) within 1km of the site.
Sand Martin (*Riparia riparia*)	✓	X	-	✓	?	This species was not recorded within the desk study itself, but colony of sand martins is known to utilise the river bank local to the west of the site for nesting.
Red Squirrel (*Sciurus vulgaris*)	✓	✓	-	?	?	The desk study revealed various records of this species within 1 km of the site boundary. The nearest was in the woodland to the northwest (NY78144357)
Water Vole (*Arvicola amphibius*)	✓	✓	-	?	?	The desk study revealed various records of this species within 1 km of the site boundary. This included Galligill Burn and Hardedge. There were no records for water vole on or near the site.
Alpine pennycress (*Noccaea caerulescens*)	-	✓	-	✓	✓	The desk study noted that this species is local to the site recorded south of Capleclough adit (Nenthead Mine car park – NY780435).

Key to symbols: ✓ = yes, X = no, ? = possibly, see Supporting Comments for further rationale.

Species present on site are those for which recent direct observation or field signs confirmed presence. Species which are possibly present are those for which there is potentially suitable habitat based on the results of the desk study records.

Legally protected species are those listed under Schedules 1,5 and 8 of the Wildlife and Countryside Act 1981 (as amended) and Schedules 2 and 4 of the Conservation of Habitat & Species Regulations 2010 (as amended).

Species of Primary Importance are those listed under Section 41 of the NERC Act. Planning Authorities have a legal duty under Section 40 of the same Act to consider such species when determining planning applications.

Other notable species include native species of conservation concern listed in the LBAP (except species that are also of Principal Importance), those that are Nationally Rare, Scarce or Red Data List and non-native controlled weed species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

4.2 Extended Phase 1 Habitat Survey

In summary, the site comprises acid grassland, heathland, wet flushes, mine spoil mounds (both vegetated and un-vegetated) and wet ditches. The location of the site is shown in Figure 1. The Phase 1 Habitat Map is shown in Figure 2. Details of target notes (TN) are found in Appendix B and site photographs are found in Appendix C.

4.2.1 Acid Grassland

There were various areas across the site that had acid grassland present (e.g. see TN1 and TN2 and see Photographs 1 and 2), which were interspersed with the other habitats found. There was a large mound to the southeast (TN1), which then graded into further grassland areas across the site. Species recorded in the grassland areas included sheep's fescue *Festuca ovina*, red fescue *Festuca rubra*, common bent *Agrostis capillaris*, wavy hair grass *Deschampsia flexuosa*, purple moor grass *Molinia caerulea*, heath bedstraw *Galium saxatile*, heath milkwort *Polygola serpyllifolia* , heath woodrush *Luzula multiflora* and the moss *Polytrichum* sp. (forms large tufts is some areas – see Photograph 3).

4.2.2 Calaminarian community

The main area showing a heavy metal influence and therefore providing habitat for the Calaminarian community type was to the north-northwest of the site (see TN3 and Photograph 4), although there were some open areas and representative species on the mound to the southeast (TN1 and Photograph 1). Species recorded in these areas included spring sandwort *Minuartia verna*, alpine pennycress *Noccaea caerulescens*, bird's foot trefoil *Lotus corniculatus*, sheep's fescue, mouse-ear hawkweed *Pilosella officinarum* agg. and a rich moss and lichen flora.

4.2.3 Wet grassland/mire

There were areas of damper communities, which varied in terms of species and community type. In some areas it was grassland with species such as heath rush *Juncus squarrosus*, common sedge *Carex nigra*, marsh thistle *Cirsium palustre*, a horsetail *Equisetum* sp. alongside species such as red fescue, sweet vernal grass *Anthoxanthum odoratum*, wavy hair grass, heath milkwort and heath woodrush (TN4 and Photograph 5); other areas with marshy species present included along the ditches to the centre and south of the site (TN5 and Photographs 6 and 7) with species such as marsh thistle, sedges *Carex* spp., bog stitchwort *Stellaria uliginosa*, soft rush *Juncus effusus*, purple moor grass, floating sweet grass *Glyceria fluitans*, a willowherb *Epilobium* sp., and tufts of *Polytrichum* sp. present; in addition there was a more dominant area of soft rush to the southeast (TN6 and Photograph 8) and further there were other areas that had bog mosses *Sphagnum* spp. present to the north and centre west (TN7 and Photograph 9) alongside species such as ling *Calluna vulgaris* and cotton grass *Eriophorum* sp.

4.2.4 Heathland

There were various areas of heathland dominated communities (e.g. TN8 and Photograph 10) with ling being the dominant species with occasional cross-leaved heath *Erica tetralix* and other species such as heath rush, heath bedstraw, bilberry *Vaccinium myrtillus*, wavy hair grass, sheep's fescue, heath woodrush and patches of lichen.

4.2.5 Bare ground/sparse vegetation

Given the nature of the area there were various sections with bare ground or just a sparse vegetation present (TN9 and Photograph 11).

4.2.6 Ponds

There were four ponds recorded on or local to the site (see Figure 2). Three of the ponds (1, 2 and 4) had aquatic vegetation present such as horsetails, rushes *Juncus* spp. and broadleaved pondweed *Potamogeton natans* present (see Photographs 12-14). Pond 3 was devoid of vegetation (see Photograph 15). In addition, there was a disused reservoir (recorded as Pond 5 for the purposes of the report) adjacent to the west and south of the study area, which had some occasional aquatic species but little marginal vegetation except near the outfall where there was a gradation into a marsh community to the southern end with species such as soft rush, cuckoo flower *Cardamine pratensis* and horsetail present.

4.2.7 Running water

There were four main ditches on the site, with one running from the east into the reservoir (see TN5 and Photograph 7), which had dense vegetation within it and along its length with species such as marsh thistle and floating sweet grass present (see above also). There were two at the northern end of the reservoir, one running north and the other running southeast from the reservoir. The ditch running southeast had quite rocky substrate and grassland edges with again species such as soft rush found along with New Zealand willowherb *Epilobium brunnescens* and a pearlwort *Sagina* sp. found on some of the stony edges (see Photograph 16). The ditch coming to the reservoir from the north was not open but was covered in places, although a line of rush was noted in places. There was also a ditch leaving the reservoir to the south, which again was covered in places but also had rush species present.

There were other shallow strips, which formed seemingly wet ground again falling towards the reservoir from the eastern field, were damp grassland and potentially would hold water as drains during wet periods but no obvious ditch was present.

4.2.8 Riparian Mammals

The River Nent is approximately 100m from the southern part of the site, which has potential for use by otters and water vole. In addition, there are ditches on site that may offer habitat to water voles.

The main ditch on site runs from east to west running into the reservoir, which contained shallow water in some sections and was dry in others. The ditch was very narrow and contained a lot of vegetation. No evidence of water vole was seen during the survey and the ditch was considered to have low potential to support water vole.

The ditch that exits the reservoir to the north and runs southwest (towards the River Nent) had a combination of a rocky substrate, and shallow bank with grassy vegetation and indicated a low suitability for water voles in the area surveyed. No evidence of water vole was seen during the survey and the ditch was considered to have low potential to support water vole.

Other ditches checked on site were very shallow and full of vegetation and were not considered suitable for water vole. Whilst no signs were seen on the day of the survey, the watercourses were subsequently surveyed specifically for riparian mammals on the 20th July 2018. In terms of otter, there was no potential for the presence of an otter holt on or local to the site. There are records for both otter and water vole in the wider landscape, although none in the vicinity of the works.

No evidence of water vole was recorded during the survey.

4.2.9 Amphibians

There were five waterbodies on or within 50m of the site. There were opportunities for areas such as rocky substrate, dry stone walls, shrubs and rough grassland that would offer refuge or hibernation features for amphibians, although the site in general was very open. There are no desk study records for great crested newts in the locality.

Habitat Suitability Index

A habitat suitability index assessment was completed for the waterbodies recorded on the survey as follows (see Appendix D for the table of full results):

- Pond 1 was poor
- Pond 2 was below average
- Pond 3 was below average
- Pond 4 was average
- Pond 5 (reservoir) was poor

Presence/Absence Surveys – eDNA Survey

Water samples were taken from Ponds 2-5 (Pond 1 was dry) and sent to an accredited laboratory (SureScreen Scientifics) for analysis for the presence of great crested newt DNA. The results showed probable absence of great crested newts in the ponds sampled (see Appendix E for results).

4.2.10 Reptiles

The heathland and upland grassland habitats are suitable for reptiles such as adders *Vipera berus* to be present, although there were no records for the species in the local or wider area. In addition, the watercourses and wetland (ponds) areas, could offer habitat for grass snake *Natrix helvetica*. The mine workings and spoil heaps would also offer basking potential and there were some small rocky outcrops that could be also used by reptiles for basking. There is dry stone walling that could also be suitable for common lizard *Zootoca vivipara* for basking and cover.

4.2.11 Badger

No evidence of badger activity or setts was observed within or adjacent to the site. There is potential for the site to support foraging activity but no signs were found.

4.2.12 Bats

There were no trees or buildings offering bat roost potential within the site.

There was a tunnel/culvert leaving to the north of the reservoir, which may offer bat roost potential; however, this was quite short in length and exposed which would reduce its potential for use as roosting, particularly for hibernation due to temperature fluctuations and winter weather conditions.

Most of the land within the site comprises grassland and heathland, habitats which are not typically associated with high levels of bat activity where there is no shelter afforded by woodland or hedgerows and generally low value for foraging. However, the reservoir and local watercourses provide foraging areas and commuting routes and bat activity may occur in these areas. However, given the open nature of the wider area, only low levels of activity would be expected and bats that may be roosting in Nenthead are more likely to use the sheltered habitats along the Nent corridor in the valley.

4.2.13 Red Squirrel

There are records for red squirrel local to and near the site. However, there was no red squirrel habitat on or adjacent to the site but they could be present in the conifer plantation to the southwest and they may utilise other areas of woodland in the wider landscape.

4.2.14 Other Fauna

There is potential that hedgehog *Erinaceus europaeus* and brown hare *Lepus lepus* would be found local to the site as there was suitable habitat.

The site itself could support a notable invertebrate fauna, given the heathland and open/bare ground habitat both on and local to the site. In addition, areas of wetland habitat offer further potential for invertebrate diversity.

4.3 Breeding Birds (Upland Wader Survey)

4.3.1 Overview

The site had relatively good numbers of ground nesting waders encountered over the three visits. There was evidence of probable breeding behaviour from two pairs of curlew and one common sandpiper. Both of these species were close to, but not on the site, (see Figure 3 for locations of territories). Other birds likely to be nesting in the vicinity included grey wagtail' likely outside the site boundary and red grouse and meadow pipit within the site boundary.

4.3.2 Curlew

On Visit 1, curlews were heard singing in the west field and also alarm calling. One curlew was seen flying over the site towards the west field. Curlews were present in good numbers in the vicinity and there was abundant suitable habitat present for the birds in the wider area. There was evidence of breeding behaviour from the frequency of the alarm calling which lasted throughout the duration of the survey. No further curlew were seen or heard during Visits 2 and 3.

The survey suggests a category of probable breeding.

4.3.3 Lapwing

One lapwing was observed flying over the site during Visit 2. This bird was neither calling nor displaying agitated behaviour. There was no evidence of nesting within the site. No lapwings were observed within the site or adjacent to the site during any of the visits.

4.3.4 Oystercatcher

An oystercatcher was feeding along the margin of the reservoir during Visit 1. This bird did not alarm call. During Visit 2 there was two oystercatchers alarm calling in the west field outside the site boundary. No further birds were seen or heard during the final visit. A total of three birds were encountered across all three visits. Oystercatcher is known to be an early breeding species and may have been unaffected by the suggested late start to the breeding season. This may account for the low numbers of birds, particularly since this habitat is highly suitable for this species

The surveys suggest probable breeding for oystercatcher in the site.

4.3.5 Snipe

No evidence of breeding. There were no sightings of snipe *Gallinago gallinago* within or adjacent to the site across the three visits.

4.3.6 Redshank

No evidence of breeding. There were no sightings of redshank *Tringa tetanus* within or adjacent to the site across the three visits.

4.3.7 Common Sandpiper

During Visit 1, a common sandpiper was observed feeding along the margin of the reservoir and within the rock formed bank of the reservoir. There was no agitated behaviour during this visit. During Visit 2 a common sandpiper was noted in the same location, however during this visit there was continuous and distinct agitated calling ongoing until the survey ended.

The surveys suggest probable breeding for common sandpiper in the site.

4.3.8 Notable Observations

During Visits 1 and 2, a grey wagtail was observed feeding in the margin of the reservoir which then flew across the River Nent. There is suitable nesting habitat for grey wagtail in the area which may suggest breeding, albeit outside of the site boundary. Skylarks were heard within the vicinity during Visit 1. Meadow pipits were heard during all visits and during Visit 3, a bird was observed carrying food, indicating young nearby. During all three visits red grouse were observed; three birds were disturbed when carrying out the survey during Visit 1, two during Visit 2 and seven during Visit 3. The birds disturbed during the final visit were in two groups and included juveniles, indicating that breeding took place on site. Sand martins which are known to nest nearby were observed during all visits; the greatest count was seven birds during Visit 2. A little grebe was observed feeding on the reservoir during Visit 3.

There were black headed gulls present during all visits. During Visit 1 there were two black headed gulls on the reservoir and two flying over the site towards the west. On Visit 2 there were five black headed gulls, including one juvenile and two herring gulls on the reservoir. An adult and a juvenile black headed gull were noted flying over the site to the west. During Visit 3, seven juveniles and one adult black headed gull were found dead scattered around the perimeter of the reservoir. There were no other gulls observed during this visit.

Notable flyovers during the surveys include merlin *Falco columbarius*, kestrel *Falco tinnunculus*, Buzzard *(Buteo buteo)*.

Table 7 below provides a summary of the surveys.

Table 7: Summary of Sighting and Activity at each Survey Visit

Common Name & BTO Code	Conservation status	Observations			Nesting Pairs
		7th June 2018	26th June 2018	20th July 2018	
Curlew (CU)	Species of Principal Importance (SPI) & Red List[18]	Individuals heard within area east of the reservoir, but not within site boundary – constant alarm calling once field entered Flyover from single bird	Individuals heard within east area but not within site boundary	None	x2 possible
Lapwing (L.)	SPI & Red List	None	Flyover from single bird	None	None
Oystercatcher (OC)	Amber List	Single bird feeding along the margin of the reservoir. No breeding behaviour.	Two birds calling from the west of the site.	None	None
Snipe (SN)	Amber List	None	None	None	None
Redshank (RK)	Amber List	None	None	None	None
Common Sandpiper (CS)	Amber List	Single bird feeding along the margin of the reservoir. No breeding behaviour.	Single bird in the same location as Visit 1 displaying agitated behaviour.	None	x1 possible

4.4 Detailed Vegetation Survey

The Phase 1 Habitat Survey (above) identified several habitats on site, which included a Calaminarian community and acid grassland. The key habitats identified for further survey were the areas of acid grassland, heathland and mire. Other habitats on site such as the stands of soft rush, the ponds/reservoir and areas of running water were not surveyed, as it was considered that further work was not needed. The Calaminarian community was not surveyed; the best time to survey this community is in May, as several of the key and notable species of this community are spring annuals that flower and set seed early and so are not visible later in the year. However, it was considered that enough data was collected during the Phase 1 Survey to confirm this as a calaminarian community and a further assessment is made below.

Figure 4 shows an indicative map of the habitats surveyed and the location of the quadrats taken. Appendix F is a table of the results for each quadrat recorded. Appendix G gives the Twinspan group results and the best fit NVC communities.

Stands of acid grassland, areas of heathland (*Calluna vulgaris* dominated) and areas of mire (more obvious areas with Sphagnum moss) were noted across the Site and 2x2m quadrats were taken where it was considered the vegetation was homogenous. Five quadrats were taken in the grassland and areas with more dominant heather and three quadrats were taken in areas where Sphagnum was more obvious. Only three were taken in the areas that were clearly Sphagnum dominated as it appeared the 'mire' community was degrading and was transitional to the more acid grassland/heath communities (see below); other quadrats did contain Sphagnum. The quadrats were taken in the northwest, north and central areas of the site. Whilst the southern areas were walked, no further quadrats were taken as the vegetation appeared to be the same as previously surveyed areas.

[18] Aebischer, M. A. et al. (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708-746

4.4.1 Twinspan data analysis and TABLEFIT assessment

Three groups were identified from the TWINSPAN analysis of the data collected as follows. These were tabulated and run through TABLEFIT (percentage 'fit' given below to best fit community type) and were then checked with the community descriptions and tables.

Group 1

Appendix G summarises the data from Group 1 (Quadrats 1, 2, 6 & 7) showing the quadrat number, species and their constancy.

The quadrats forming Group 1 had a 60% fit to the U5 acid grassland (*Nardus stricta-Galium saxatile* grassland) with the U5b sub-community being the best fit.

Group 2

Appendix G summarises the data from Group 2 (Quadrats 3, 4, 5, 8, 11 & 13) showing the quadrat number, species and their constancy.

Group 2 was not a good fit with any NVC community type, although TABLEFIT suggested U5b (55% (poor) fit), U6c (*Juncus squarrosus-Festuca ovina* grassland) (53% (poor) fit) and/or M18c (*Erica tetralix-Sphagnum papillosum* raised and blanket mire) (52% (poor) fit). The analysis again suggests an acid grassland community, with the possibility of a mire community, as the group includes sphagnum species, *Polytrichum commune*, *Calluna vulgaris*, *Eriophorum vaginatum*, *Vaccinium myrtillus* and *Empetrum nigrum*.

Group 3

Appendix G summarises the data from Group 3 (Quadrats (9, 10 & 12) showing the quadrat number, species and their constancy.

Group 3 was identified using TABLEFIT as having a 78% fit to the acid grassland U5b sub-community. In addition, the U4d (*Festuca ovina-Agrostis capillaris* grassland) acid grassland sub-community had a 67% fit.

4.4.2 NVC Community Assessment

The Phase 1 Habitat Survey identified the potential for acid grassland, heathland and mire to be present in the areas subject to more detailed vegetation assessment. It appears from the analysis that the site has an affinity to the U5 acid grassland NVC type with potential for M18 mire, but no specific heathland communities were identified. The following is an assessment of the vegetation types originally identified, given both the analysis along with consideration of the keys and community descriptions in the relevant NVC volumes.

Acid Grassland

The acid grassland had a mix of grasses with *Festuca rubra*, *Nardus stricta*, *Festuca ovina* and *Anthoxanthum odoratum* being the constant species and *Nardus stricta* and *Festuca rubra* having the highest cover of these grasses; these are accompanied by other typical acid grassland grasses and herbs (including *Deschampsia flexuosa*, *Galium saxatile* and *Potentilla erecta*). In addition, species typical of acid conditions such as *Juncus squarrosus* and *Calluna vulgaris*, which are constant species in Groups 1 and 2.

The frequency and cover of *Nardus stricta* suggests a community around U5 type with other frequent species of *Festuca ovina*, *Galium saxatile*, *Vaccinium myrtillus* and *Juncus squarrosus* alongside occasional *Calluna vulgaris* for example. However, the ubiquity of *Juncus squarrosus* in the sward suggests the U6 community type. This separation has been noted as a problematic issue in terms of diagnostics and it is sometimes hard to distinguish between the U5 and U6 communities[19]. In addition, over grazing can contribute to increased levels of *Juncus squarrosus* within a U5 community.

In terms of the U5 community, the species composition suggests most affinity with U5b or U5c, with the presence of *Juncus squarrosus* frequent alongside *Rhytidiadelphus squarrosus* and *Luzula multiflora*. The presence of

[19] Rodwell, J.S. (Ed.) (1992). *British Plant Communities. Volume 3 – Grasslands and montane communities*. Cambridge University Press, Cambridge.

Cirsium palustre and the moss *Calliergonella cuspidatum* suggest U5c although a clear sub-community is not apparent.

As mentioned *Festuca rubra* is a constant in the grassland surveyed; often with high relative cover values, which conforms less to the U5/U6 communities. It is not a species considered part of the U6 community and whilst present in U5 communities, it is never considered to be dominant with a low constancy and low cover (I and 1-4 respectively). It is more commonly associated with U4 sub-communities or as a sign of transition into other communities. This may be due to under-recording or a reflection of the mosaic nature of the site; in fact, some of the areas were likely to be transitional towards the calaminarian areas given the presence of *Linum catharticum, Euphrasia officinalis* agg. and *Thymus praecox*. Although *Thymus praecox* and *Euphrasia officinalis* agg. are species found in low abundance in U4 communities also..

Overall, it is considered that U5 (U5b most likely) was the predominant grassland type across the site although this is likely to be transitional with other community types such as U6, U4 and potentially OV37 (*Festuca ovina-Minuartia verna* community and see below).

Heathland

The areas identified as heather dominated, whilst seemingly obvious given the constancy and cover of *Calluna vulgaris* (heather) were quite patchy across the site and tended to be in a mosaic with the grassland communities and given the constancy again of *Juncus squarrosus*, alongside *Nardus stricta* tends to suggest the U5/U6 acid grassland community, in either transition to heathland (reduction in grazing) or from heathland (increase in grazing). This is reflected in the fact that TABLEFIT did not identify a heathland community.

However, the presence of *Vaccinium myrtillus*, *Deschampsia flexuosa*, *Cladonia impexa* and *Festuca ovina* suggests that these vegetation patches retain affinity to heathland communities such as H12 (*Calluna vulgaris-Vaccinium myrtillus* heath) that can include *Juncus squarrosus* and *Nardus stricta* in varying degrees within the different sub-communities. In addition, H10 (*Calluna vulgaris-Erica cinerea* heath) and specifically the H10b sub-community can contain species such as *Racomitrum lanuginosum* alongside *Juncus squarrosus* and *Vaccinium myrtillus* as seen on the site.

Whilst clearly heather dominated, the range and type of species recorded make these areas difficult to assign a clear community type and forms part of a transitional mosaic of acid grassland/heath communities.

Mire

The areas of sphagnum noted were relatively small and only three quadrats were taken in obvious stands of sphagnum, although sphagnum was present in other heath/grass quadrats. The species of note are *Sphagnum magellanicum* and *Eriophorum vaginatum* as peat forming species; however, the areas were relatively dry and some of the Sphagnum was degrading.

It is likely that the areas of sphagnum on site are transitional to grassland/heath communities and given their restricted size and the limited data collected, it is difficult to place them within a specific mire community. Whilst sphagnum was quite common in patches across the wider site, it is unlikely that it would be mire but rather acid grassland with patches of Sphagnum. Whilst the data is limited, given the presence of *Sphagnum magellanicum* alongside *Eriophorum vaginatum* along with *Calluna vulgaris* and *Rytidiadelphus squarrosus*, it suggests that the small areas identified have affinities to M17 (*Scirpus cespitosus-Eriophorum vaginatum* blanket mire), M18 (as suggested by TABLEFIT) or M19 (*Calluna vulgaris-Eriophorum vaginatum* blanket mire).

Quadrats 4 and 5 (in Group 2) also contained *Sphagnum magellanicum* but these areas had the appearance of heath/grass and on mineral soil, suggesting that the communities here are more aligned with a grassland/heath mosaic containing patches of Sphagnum.

Calaminarian Community

The areas of Calaminarian grassland were not subject to further detailed assessment but sufficient data was collected previously to identify the habitat. These are essentially open-structured plant communities, which are composed of ruderal/metallophyte species of lichens, bryophytes and vascular plants, such as *Minuartia verna* and *Noccaea caerulescens*.

In terms of NVC, the community is generally regarded as OV37. The more open areas, which did grade into damper areas and into the acid grassland, contained both *Minuartia verna* and *Noccaea caerulescens* along with

Festuca ovina, *Linum catharticum*, *Pilosella officinarum* agg. and *Lotus corniculatus*, all of which are part of the OV37 community.

4.4.3 Summary

Overall the grassland, mire and heath communities tend to form intergrades and mosaics with no discernible boundaries in most cases. This has made separation into distinct community types difficult, as many species are present across areas that appear homogeneous.

Based on the habitat plan and the data collected it should be considered that the vegetation on the Site is acid grassland in mosaic with patches of varying degrees of heather dominance and Sphagnum presence. The best fit community type for the Site appears to be U5b as the dominant community, but with possible small patches in mosaic of M18, H10b communities.

All the above communities are generally common in the uplands and in the case of U5 almost ubiquitous where grazing has reduced and eliminated heather cover. The small areas of mire with *Eriophorum vaginatum* and *Sphagnum magellanicum* is a very small example of the blanket bog community that covers large expanses of the Pennines.

In terms of mapping the site is recorded as acid grassland with a mosaic of heathland and mire represented in patches across the site which is shown on Figure 4.

5. Summary of potential constraints

5.1 Designated Sites

5.1.1 Tyne and Nent Special Area of Conservation (SAC)

The site is around 1.2 km to the northeast of the Tyne and Nent SAC (at Whitesike and Flinty Fell SSSI Unit 4, although the watercourses associated with this area flow into the River Nent so no impact is foreseen) and 5.2 km to the southeast and downstream of Tyne and Nent SAC (at Blagill SSSI), which are designated for calaminarian (heavy metal tolerant) grassland. This grassland type relies on periodic inundation with sediments containing high concentrations of metals such as lead, cadmium and zinc to allow the metallophyte flora to out-compete other species. Since these metallophytes rely on metal rich sediments being deposited, it is unclear whether mine water treatment (which only removes dissolved rather than particulate metals) will affect this habitat.

An Appropriate Assessment (Habitats Directive) was completed by the Environment Agency in 2014[20] to assess the potential impacts of several schemes proposed to remediate the severe metal pollution of rivers in the South Tyne catchment. This assessment concluded that "*with the planned mitigation package, including the perturbation of the substrate*", the proposed schemes to decrease metals entering the rivers "*will not adversely affect the integrity of the Tyne & Nent SAC and/or the Tyne & Allen River Gravels SAC*". Furthermore, the HRA stated:

"Natural England's (NE) advice is that the potential impacts of reduced heavy metal concentrations can be mitigated by perturbation of the substrate to bring soils still rich in heavy metals to the surface. Although previous discussions have revolved around different types of management e.g. turf stripping, scrub clearance and addition of metal rich spoil from elsewhere NE has advised that perturbation of substrate would not form part of the ordinary management planned for the sites and can directly address the potential impacts of mine water remediation. To that extent perturbation is legitimate mitigation for the purposes of the Habitats Directive."

5.1.2 North Pennine Special Protection Area

The North Pennine Moors Special Protection Area (SPA) is approximately 1.2 km to the north of the development area. However, no impacts are foreseen on the SPA itself and no works within the SPA are proposed.

5.1.3 Haggs Bank SSSI

Haggs Bank SSSI is approximately 2.7 km northwest of the site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed. In addition, in the optioneering study by the Rivers Trust Natural England commented that no impact was foreseen on this site.

5.1.4 Small Cleugh Mine SSSI

Small Cleugh Mine SSSI is adjacent to the south of the site. However, the SSSI itself is designated for geological reasons, which is out of the scope of this report.

5.1.5 Allendale Moors SSSI

Allendale Moors SSSI is approximately 1.4 km to the northeast of the site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed.

5.1.6 Whitesike Mine and Flinty Fell SSSI

Whitesike Mine and Flinty Fell SSSI is around 1.2 km to the southwest of the site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed (see 5.1.1 above also).

5.2 Habitats

The site was, in general, a mosaic of heath and acid grassland, which also graded into mire to the north and southwest and open/ephemeral metalliferous communities above the reservoir in the north and west; Figure 2 shows indicative habitat boundaries and Figure 4 indicates habitat types under the NVC. Figure 5 shows an indicative development area, although this is outline at the present time.

5.2.1 Acid Grassland

The acid grassland areas appeared to be good quality acid grassland with various indicator species such as heath bedstraw and heath woodrush with acid grass species such as wavy hair grass. The grassland grades into heath, open communities and mire across the site and is considered that the grassland best fits the U5b community.

The current design shows that much of the grassland would be lost to the development but with some areas mapped outside the development footprint. The U5 grassland type in itself is not a Habitat of Principal Importance (under S41 of the NERC Act); however, whilst not the defining grassland type, it is included within the habitat definition of the Annex 1(Habitats Directive 1992; The Conservation of Habitats and Species Regulations 2017) Habitat 6230 Species-rich Nardus grassland, on siliceous substrates in mountain areas (and sub-mountain areas in continental Europe).

Whilst the grassland on site does contain several of the species associated with this community type it is unlikely the habitat on site would be designated as an Annex 1 grassland, particularly given the defining grassland communities within the habitat type CG10 (*Festuca ovina–Agrostis capillaris–Thymus praecox* grassland) and CG11 (*Festuca ovina–Agrostis capillaris–Alchemilla alpina* grassland) were not considered to be present. In addition, there are extensive areas of similar habitat in the wider landscape and with habitat management or creation as part of a mitigation package any loss of this grassland is not considered to be a significant constraint.

5.2.2 Heath

The heath community was, like the acid grassland, found across the central part of the site to the east of the reservoir, with patches amongst grassland and mire in the north and west. In general, these areas appeared to be good quality heathland dominated by heather along with species such as bilberry. However, the more detailed assessment has shown that the heathland vegetation is more transitional towards the U5 acid grassland type.

These areas will in general be lost to the development, however, similar to the grassland, it is unlikely that the heathland areas would be considered priority habitat and there are extensive areas of similar habitat in the wider landscape and any loss of heather/acid grassland on site is not considered to be a significant constraint.

5.2.3 Mire

There were several small areas of mire community across the site with an area with *Sphagnum* hummocks in the north and in particular to the east of the reservoir towards the south of the main development area. There were also patches of rush dominated ground to the north and south and along ditches across the site. However, some of the *Sphagnum* areas appeared to be drying and may become replaced by acid grass/heath in the future. The closest community type was M18, which is a Habitat of Principal Importance type but the very limited extent and transitional nature of the community suggests that it is not of sufficient quality to be considered priority habitat.

These areas will be impacted by the development, however, similar to the heath and grassland and as discussed above these areas would not be considered a significant constraint given the limited extent and extensive areas of similar habitat in the wider landscape

5.2.4 Calaminarian community

The main areas showing a calaminarian influence were to the north of the reservoir and towards the old mine workings, although there were some small patches on an old spoil mound to the south of the site (east of the reservoir). These were more of an open ephemeral nature rather than a closed grassland community and will be highly influenced by the heavy metal content of the spoil form the old mine workings. This is a rare plant community (OV347; Annex 1 Habitat 6130 Calaminarian grasslands of the *Violetalia calaminariae*) and is in part the reason for designation of several of the nature conservation sites local to the development area; whilst the development may impact on the community to a certain extent, most of this habitat lies outside the current footprint and it is recommended that this community along with acid grassland should be the focus of habitat creation/management as part of the scheme.

5.2.5 Ponds

There were four ponds on or local to the site; none of these will be impacted or lost to the development.

5.2.6 Watercourses

There were four ditches across the site either running to or from the reservoir. There was some botanical interest in these but this is considered to be of only of local interest. Any impact on these appears likely to only be minimal, with the habitat being maintained during and beyond the development.

5.3 Species

5.3.1 Breeding birds

The upland wader survey recorded possible breeding of curlew and common sandpiper on site. However, the loss of the areas of the generally small areas of heath, acid grassland and mire to the proposed development within what is a landscape comprising extensive similar habitat, is unlikely to affect the local population of these species; curlew was noted on the main central eastern area of heath and grassland and the sandpiper was recorded local to the reservoir but within the current location for the proposed development.

However, all birds receive protection whilst nesting or attempting to nest under the Wildlife & Countryside Act 1981 (as amended) and so vegetation clearance and soil stripping should, wherever possible, be undertaken between 1st October and end February, i.e. outside of the main bird nesting season.

If works are required to be carried out within the bird nesting season, a nesting bird check of the site will be required prior to works starting. If a nesting bird is recorded within the development footprint, then works will not be able to proceed until the young have fledged.

5.3.2 Riparian Mammals

Evidence of water voles and otters has been recorded within 1.5km of the site (site search and previous surveys of the River Nent). No evidence of water voles was seen during the survey, and it appeared that the substrate would be generally unsuitable and it is unlikely water voles are present in the site.

Otters will use the River Nent for movement and may utilise the ditches and reservoir in the site. However, there was no potential for laying up areas or a holt in the locality of the site and no impact of the use of the area by

otter is foreseen; works would be undertaken during the day and otters would be moving along the river at night. Standard measures should be taken to avoid leaving open excavations overnight or provide a means of egress.

5.3.3 White clawed crayfish

There are no records along this stretch of the Nent and surveys undertaken downstream have not recorded the species and no constraints are foreseen for this species.

5.3.4 Bats

There are no trees or buildings within or immediately adjacent to the site. The tunnel/culvert recorded on the northern section of the reservoir may have some potential for bat use and there is a record of a bat roost local to the site near the adit. However, it has been assessed that the tunnel has negligible potential for bats being short, open both ends and hence very exposed. The tunnel will not be directly affected and currently any works are more than 10 m from the tunnel, so no impact on bats, if present, are foreseen.

5.3.5 Reptiles

Given the range of habitats such as heathland and open communities, there is potential that reptiles such as adder and common lizard could be present on site, although there are no local records for these species. All common species receive protection from deliberate harm under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) and the proposals would result in loss of potential reptile habitat.

Whilst reptiles could be present, most of the site has sub-optimal habitat for these species and is surrounded by extensive areas of similar open aspect upland habitat with high suitability for reptiles and as such significant populations would not be expected within the Site. This being the case, it is considered that a survey for reptiles is not necessary but that their presence can be assumed and appropriate measures included as a method statement to avoid harm.

Appropriate measures would comprise habitat manipulation prior to soil stripping/construction works. It is a standard method to persuade reptiles to move out of an area and is used regularly on development as well as by conservation bodies as part of management of reserves etc. to avoid harming reptiles from management operations. There is no reason to suspect that this method would not be as successful here as elsewhere.

Three or four weeks prior to vegetation clearance, the vegetation would be cut to around 10cm in height and raked off and left for 4 days during suitable weather (warm, dry and little wind). On Day 5, the vegetation would be cut to 5cm and again left for four days. An ecologist suitably experienced in identifying and handling reptiles would supervise all the cutting works. The area cut would be larger than that required to be stripped/developed to provide a sterile buffer to dissuade any reptiles from moving back into the cleared area. This is assessed to be proportionate effort to check for reptile presence and to persuade them to move out of the area prior to soil stripping.

5.3.6 Amphibians

The ponds local to the site may hold breeding populations of amphibians and the walls and disturbed ground offer refuge and hibernating areas. However, the results from the water samples taken from the ponds and analysed for the presence of great crested newt DNA were negative and no constraints for this species are foreseen. Common species such as frog and toad are likely to be present but the ponds are not affected by the works and further wetland areas (a reedbed) will be created as part of the development.

5.3.7 Other fauna

Red squirrels are known locally, but there is no habitat suitable for them in or adjacent to the site and it is unlikely this species would be affected by the scheme.

No evidence of badgers was seen on the site and it is unlikely this species will be impacted by the works.

5.4 Summary

It is assessed that there is potential for the development to have an impact on several ecological receptors, most notably the heathland, acid grassland and mire communities recorded on site. To reduce the potential impacts of the scheme the following recommendations are made:

- In terms of reptiles being present on site it is recommended that measures are taken to make the habitat unsuitable for reptiles prior to any development occurring under the supervision of an ecologist as detailed above (see section 5.3.5).
- It is recommended that a habitat management plan for the site is developed to ensure the better quality and higher conservation value communities are maintained on and around the site to mitigate any loss of the plant communities. This should focus on the Calaminarian and acid grasslands found on and local to the site.
- Any works carried out in the bird nesting season should not be carried out until a check for nests has been undertaken by a suitably experienced ecologist. If a nest was found, then a buffer zone would be required around the nest site and works in that area would not be able to proceed until the young have fledged.

Figure 1 Site Location map

Figure 2 Phase 1 Habitat Map

Figure 3 Upland Wader Survey

Figure 4 Botanical Survey Map

Figure 5 Indicative Development Outline Drawing

Appendix A Desk Study: Statutory and Non-Statutory sites

Appendix B Target Notes

1. Mound to the south of the site with remnant calaminarian community present, which graded into acid grassland.
2. Areas of acid grassland across large areas of the site
3. Calaminarian community to the north of the site
4. Areas of marshy grassland/mire
5. Watercourse/wetland flush
6. Area dominated by soft rush
7. Areas of mire with Sphagnum moss present
8. Areas of heathland dominated by ling
9. Areas of bare ground/sparse vegetation

Appendix C Photographs

Plate 1. Mound to south of site (TN1) with acid grassland and remnant calaminarian community.

Plate 2. Acid grassland (TN2) found across the site interspersed with heath and mire.

Plate 3. Tufts of Polytrichum moss to the south of the site.

Plate 4. Calaminarian influence to north of site (TN3).

Plate 5. Marshy/mire grassland (TN4).

Plate 6. Ditch/flush habitats (TN5).

Plate 7. Ditch/flush habitats (TN5).

Plate 8. Area dominated by soft rush (TN6).

Plate 9. Areas of Sphagnum moss (and Polytrichum) in the north and central areas of the site (TN7).

Plate 10. Areas of Heathland (TN8).

Plate 11. Areas of rocky substrate/bare ground (TN9).

Plate 12. Pond 1.

Plate 13. Pond 2.

Plate 14. Pond 4.

Plate 15. Pond 3.

Plate 16. Ditch running southeast from the north of the reservoir.

Appendix D Habitat Suitability Index results

		Pond 1	
		Results	**Scores**
SI_1	**Location**	B	0.50
SI_2	**Pond area**	35m²	0.07
SI_3	**Pond drying**	Annually	0.10
SI_4	**Water quality**	Moderate	0.67
SI_5	**Shoreline shade**	0%	1.00
SI_6	**Fowl**	Minor	0.67
SI_7	**Fish**	Absent	1.00
SI_8	**Pound count**	6	0.80
SI_9	**Terrestrial habitat**	Moderate	0.67
SI_{10}	**Macrophytes**	60%	0.90
HSI			**0.49**
Pond suitability			**Poor**

		Pond 2	
		Results	**Scores**
SI_1	**Location**	B	0.50
SI_2	**Pond area**	30m²	0.06
SI_3	**Pond drying**	Sometimes	0.50
SI_4	**Water quality**	Moderate	0.67
SI_5	**Shoreline shade**	0%	1.00
SI_6	**Fowl**	Minor	0.67
SI_7	**Fish**	Possible	0.67
SI_8	**Pound count**	6	0.80
SI_9	**Terrestrial habitat**	Moderate	0.67
SI_{10}	**Macrophytes**	80%	1.00
HSI			**0.55**
Pond suitability			**Below Average**

		Pond 3	
		Results	**Scores**
SI_1	**Location**	B	0.50
SI_2	**Pond area**	70m²	0.14
SI_3	**Pond drying**	Sometimes	0.50
SI_4	**Water quality**	Poor	0.33
SI_5	**Shoreline shade**	0%	1.00
SI_6	**Fowl**	Minor	0.67
SI_7	**Fish**	Absent	1.00
SI_8	**Pound count**	6	0.80
SI_9	**Terrestrial habitat**	Moderate	0.67
SI_{10}	**Macrophytes**	0%	0.30
HSI			**0.51**
Pond suitability			**Below Average**

		Pond 4	
		Results	**Scores**
SI_1	**Location**	B	0.50
SI_2	**Pond area**	100m²	0.20
SI_3	**Pond drying**	Sometimes	0.50
SI_4	**Water quality**	Moderate	0.67
SI_5	**Shoreline shade**	0%	1.00
SI_6	**Fowl**	Minor	0.67
SI_7	**Fish**	Possible	0.67
SI_8	**Pound count**	6	0.80
SI_9	**Terrestrial habitat**	Moderate	0.67
SI_{10}	**Macrophytes**	60%	0.90
HSI			**0.61**
Pond suitability			**Average**

		Pond 5	
		Results	**Scores**
SI_1	**Location**	B	0.50
SI_2	**Pond area**	7000m²	0.03
SI_3	**Pond drying**	Never	0.90
SI_4	**Water quality**	Moderate	0.67
SI_5	**Shoreline shade**	0%	1.00
SI_6	**Fowl**	Minor	0.67
SI_7	**Fish**	Possible	0.67
SI_8	**Pound count**	6	0.80
SI_9	**Terrestrial habitat**	Moderate	0.67
SI_{10}	**Macrophytes**	10%	0.40
HSI			**0.50**
Pond suitability			**Poor**

Appendix E eDNA Results

Appendix F Botanical Survey Results Table

	Q1[20]	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Juncus squarrosus	4[21]	5	5	5	4	6	5	3	4	3	4	4	3
Calliergonella cuspidatum	5	5	4	4	4		4	3	4	7	5	7	6
Nardus stricta	5	7	5	3	4	6	6	4	4			4	5
Festuca rubra	6	5	3	3	3	4	3		5	4		5	3
Calluna vulgaris	3	4	7	6	7	3	6	6			8		8
Hypnum cupressiforme	8	7	4	7	4	5	6	2	5				7
Festuca ovina	4	4	3			4	4		4			4	3
Polytrichum commune				3	2		6	5	6	6		5	
Rhytidiadelphus squarrosus		4		2		4			4	5		5	
Vaccinium myrtillus		2	4	3		4					4		5
Deschampsia flexuosa			2				2	2	4	6		7	
Anthoxanthum odoratum	3	4				3	4					3	
Pleurozium schreberii	6	5	4		2		4						
Polygala serpylifolia		3	2	2		3	3						
Eriophorum angustifolium	5	3			3		4						
Luzula multiflora	2	2				4						4	
Racomitrum lanuginosum			3		7			2			4		
Cladonia impexa			3	3	4			2					
Sphagnum magellanicum				4	3			6	4				
Galium saxatile	2									6		6	
Cirsium palustre	3					2							
Linum catharticum	3	2											
Holcus lanatus	4	4											
Taraxacum officinale agg.	2	2											
Potentilla erecta		2				2							
Peltigera canina agg.	2	2											
Agrostis canina						4			5				
Empetrum nigrum							4	4					
Eriophorum vaginatum								3	5				
Sphagnum angustifolium								6	5				
Carex viridula	2												
Euphrasia officinalis	2												
Thymus polytrichus	2												
Scapania undulatum	3												
Huperzia solago	2												
Lepidoza reptans					4								
Cynosurus cristatus						2							
Lophoclea bidentata						4							
Festuca pratensis										3			

[20] Quadrat number – these were 2x2m quadrats in each community identified

[21] Within each quadrat all species were recorded with an estimate of percentage cover/abundance using the Domin scale (1 = few individuals; 2 = some individuals; 3 = many individuals; 4 = 4% - 10%; 5 = 11% - 25%; 6 = 26% - 33%; 7 = 34% - 50%; 8 = 51% -75%; 9 = 76% - 90%; 10 = 91% - 100%). Subsequent areas of the same vegetation within a site do not require five additional quadrats but should be sampled for consistency and at least one quadrat recorded and, based on size, possibly more at the discretion of the surveyor.

Appendix G Twinspan Group Results

Group 1 identified by Twinspan analysis

Species	Quadrat				Constancy
	Q1	Q2	Q6	Q7	
Juncus squarrosus	4	5	6	5	V
Nardus stricta	5	7	6	6	V
Festuca rubra	6	5	4	3	V
Calluna vulgaris	3	4	3	6	V
Hypnum cupressiforme	8	7	5	6	V
Festuca ovina	4	4	4	4	V
Anthoxanthum odoratum	3	4	3	4	V
Calliergonella cuspidatum	5	5		4	IV
Polygala serpylifolia		3	3	3	IV
Pleurozium schreberii	6	5		4	IV
Eriophorum angustifolium	5	3		4	IV
Luzula multiflora	2	2	4		IV
Rhytidiadelphus squarrosus		4	4		III
Vaccinium myrtillus		2	4		III
Cirsium palustre	3		2		III
Linum catharticum	3	2			III
Holcus lanatus	4	4			III
Taraxacum officinale agg.	2	2			III
Potentilla erecta		2	2		III
Peltigera canina agg.	2	2			III
Polytrichum commune				6	II
Deschampsia flexuosa				2	II
Galium saxatile	2				II
Agrostis canina			4		II
Empetrum nigrum				4	II
Carex viridula	2				II
Euphrasia officinalis	2				II
Thymus polytrichus	2				II
Scapania undulatum	3				II
Huperzia solago	2				II
Cynosurus cristatus			2		II
Lophoclea bidentata			4		II

TABLEFIT NVC communities identified: Fair U5b 60%; U5 56%

Group 2 identified by Twinspan analysis

Species	Quadrat						Constancy
	Q5	Q3	Q4	Q11	Q13	Q8	
Calliergonella cuspidatum	4	4	4	5	6	3	V
Juncus squarrosus	4	5	5	4	3	3	V
Calluna vulgaris	7	7	6	8	8	6	V
Nardus stricta	4	5	3		5	4	V
Hypnum cupressiforme	4	4	7		7	2	V
Racomitrum lanuginosum	7	3		4		2	IV
Cladonia impexa	4	3	3			2	IV
Festuca rubra	3	3	3		3		IV
Vaccinium myrtillus		4	3	4	5		IV
Polytrichum commune	2		3			5	III
Sphagnum magellanicum	3		4			6	III
Deschampsia flexuosa		2				2	II
Festuca ovina		3			3		II
Polygala serpylifolia		2	2				II
Pleurozium schreberii	2	4					II
Eriophorum vaginatum						3	I
Sphagnum angustifolium						6	I
Lepidoza reptans	4						I
Rhytidiadelphus squarrosus			2				I
Empetrum nigrum						4	I
Eriophorum angustifolium	3						I

TABLEFIT NVC Communities identified: Poor U5e 55%; U6c 53%; M18c 52%

Group 3 identified by Twinspan analysis

Species	Quadrat			Constancy
	Q9	Q10	Q12	
Calliergonella cuspidatum	4	7	7	V
Polytrichum commune	6	6	5	V
Deschampsia flexuosa	4	6	7	V
Rhytidiadelphus squarrosus	4	5	5	V
Juncus squarrosus	4	3	4	V
Festuca rubra	5	4	5	V
Galium saxatile		6	6	IV
Nardus stricta	4		4	IV
Festuca ovina	4		4	IV
Festuca pratensis		3		II
Sphagnum magellanicum	4			II
Eriophorum vaginatum	5			II
Sphagnum angustifolium	5			II
Agrostis canina	5			II
Hypnum cupressiforme	5			II
Luzula multiflora			4	II
Anthoxanthum odoratum			3	II

TABLEFIT NVC communities identified: Good fit U5b 78%; U5 78%; U4d 67%

AECOM Infrastructure & Environment UK Limited
Royal Court
Basil Close
Derbyshire
Chesterfield
S41 7SL
UK

T: +44 (1246) 209221
aecom.com

Appendix B – Preliminary Ecological Appraisal Report, Nenthead Car Park

Nenthead Carpark Embankment Stabilisation Works

Preliminary Ecology Assessment

The Coal Authority

Project Number: 60571450

April 2018

Quality information

Prepared by	Checked by	Approved by
Mark Hampton Principal Ecologist	Paul Benyon Associate	Tim Benson

Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	3rd April 2018	Minor comments from client		Paul Benyon	Associate Ecologist

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

The Coal Authority
200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

Prepared by:

AECOM Infrastructure & Environment UK Limited
Royal Court
Basil Close
Derbyshire
Chesterfield
S41 7SL
UK

T: +44 (1246) 209221
aecom.com

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1. Introduction

1.1 Overview of the project

AECOM has been appointed by the Coal Authority to undertake a Preliminary Ecological Assessment (PEA) of an area of land in Nenthead, Cumbria.

The Site (NY781 436) includes the River Nent confluence with the Dowgang Burn, which has an extensive area of eroding river embankment that extends for a length of approximately 65m and has a maximum height of approximately 6m. The stratification of sediments at the site mean that contaminated sediment enters the river by either direct erosion of the embankment or by disturbance of unconsolidated rocky sediments on the base of the riverbank.

1.2 Proposed Development

The proposed development is to install a line of gabion baskets and re-angle the slope of the existing eastern embankment of the River Nent to create a physical barrier and prevent contaminants entering the river.

1.3 Scope of the Report

AECOM was instructed to undertake an ecological study of the Site, including the banks of the River Nent.

This report presents the preliminary ecological assessment (PEA). It also identifies any other sensitive ecological features that could be affected by the proposed development.

In order to deliver the PEA element, a desk study and an extended Phase 1 Habitat survey were undertaken by an appropriately experienced ecologist to identify ecological features within the site. Additional details are provided in Section 3: Methodology.

The aim of this report is to provide baseline ecological information, such as the habitats present on site and the potential for these habitats to support protected and/or otherwise notable species that could be adversely affected by any proposed works. This information will allow for an evaluation of the ecological significance of the site along with the requirement for any further surveys to inform the detailed design.

1.4 Site Description

The Site is situated in Nenthead just off the A689 to the south (site central grid reference: NY 7807 4359). The site comprised a car park area, grassland, scrub and trees and the River Nent and Dowgang Burn watercourses. Surrounding the site are buildings to the southeast and west of the Site, and there is a mosaic of woodland and grassland to the north, south and east of the Site.

2. Legislation and Planning

2.1 Wildlife Legislation

The following legislation relates to species and habitats that could potentially occur within the site:

- The Conservation of Habitats and Species Regulations 2017
- The Wildlife and Countryside Act 1981 (as amended)
- The Countryside and Rights of Way (CRoW) Act 2000
- Natural Environment and Rural Communities (NERC) Act 2006
- The Protection of Badgers Act 1992
- Wild Mammals (Protection) Act 1996

- The Hedgerow Regulations 1997

2.2 Planning

Consideration has also been given to relevant national, regional and local planning policy and strategy documents. These are listed below:

- National Planning Policy Framework (NPPF)
- Eden District Council Core Strategy (adopted March 2010)
- Cumbria Biodiversity Action Plan (BAP)

A summary of relevant policy is provided below.

The NPPF guides Local Planning Authorities (LPA) in developing their planning policies and when considering planning applications affecting protected habitats, sites and species. Guidance on biodiversity and related matters is provided Paragraph 109, Section 11 which states that '*the planning system should contribute and enhance the natural and local environment by:*

- *Protecting and enhancing valued landscapes, geological conservation interests and soils;*
- *Recognising the wider benefits of ecosystem services;* and
- *Minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures…'*

The NPPF references Circular 06/2005, which provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.

The Eden District Council Core Strategy (2010) contains relevant environmental policies, and 'CS16 Principles for the Natural Environment' is particularly relevant to the proposed development. CS16 states that:

- *"The relationship between the development and the natural environment will be managed to minimise the risk of environmental damage.*
- *"Encouragement will be given to the creation of opportunities for species to spread out and create niches elsewhere in order to reduce any negative impacts of development and to allow species to migrate as a result of climate change.*
- *The re-creation and restoration of traditional habitats will be encouraged and existing wildlife and habitats such as hedges, ponds, woodlands, ancient woodlands, wetlands and species rich grasslands will be protected and enhanced.*
- *Where possible, developments will be expected to include suitable measures to contribute positively to overall biodiversity in the District or to mitigate harm caused by the development.*
- *Promote improvements in accessibility to the natural environment for all people regardless of disability, age, gender or ethnicity.*
- *Development should reflect and where possible enhance local landscape character."*

The Cumbria BAP was published in 2001, by the Cumbria Biodiversity Partnership and aims to raise public awareness and understanding of the natural environment and hopes to encourage local people and politicians to take a closer look interest in biodiversity in order to take action to help vulnerable wildlife and threatened habitats.

Twenty-one species and 18 habitats have been identified in the Cumbria BAP for priority action and targets set for recovery, and include bats, water vole *Arvicola amphibius*, song thrush *Turdus philomelos*, hay meadows and blanket bogs.

The above legislation has been considered when undertaking this PEA using the methods described in Section 3, when identifying potential constraints to the proposed developments and when making recommendations for further survey, design options and mitigation, as outlined in Section 5. Compliance with legislation may require the attainment of relevant protected species licences prior to the implementation of the proposed developments.

3. Methodology

3.1 Desk-Study

A stratified approach is usually taken when defining the desk study area, based on the likely zone of influence of the proposed developments on different ecological receptors and on an understanding of the maximum distances typically considered by statutory consultees (2km for statutory site designations and 1km for local, non-statutory designations together with protected and notable habitats and species).

A desk study was undertaken as part of The Coal Authority's mine water treatment scheme proposed works local to Nenthead and was carried out in January 2017. This considered a 3km search area from a location close to the Site (centre point NY782435) and whilst this is a different scheme, the data is considered to be relevant to this project, as it is only a year old and covers more than adequately a 1km radius around the site for non-statutory sites and protected/notable species.. In addition, an updated check has been carried out in March 2018 for statutory designated sites within a 2.5km radius from centre point NY781436.

The desk study was carried out using the data sources detailed in Table 1. Protected and otherwise notable habitats and species include those listed under Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended); Schedules 2 and 5 of the Habitats Regulations, species and habitats of principal importance for nature conservation in England listed under section 41 (s41) of the NERC Act and other species that are Nationally Rare, Nationally Scarce or listed in national or local Red Data Lists and Biodiversity Action Plans.

Table 1: Desk study data sources

Data source	Accessed	Data Obtained
Multi-Agency Geographic Information for the Countryside (MAGIC) website.	5th March 2018	• International statutory designations within 2 km. • Other statutory designations within 2 km. • Ancient woodlands and notable habitats within 2 km. • Information on habitats and habitat connections (based on aerial photography) relevant to interpretation of planning policy and assessment of potential protected and notable species constraints.
Cumbria Biodiversity Data Centre.	19th January 2017	• Non-statutory designations within 1km. • Protected and notable species records within 1km.

3.2 Existing Survey Information

Previous survey work has been carried out as part of the wider scoping for other related projects in the area. Whilst not directly relevant to this Site, there are completed surveys that were carried out in the general locality, which have been utilised as part of this assessment.

In addition, a previous optioneering study carried out by the Tyne Rivers Trust for this site and the proposed works (Tyne Rivers Trust, 2017[1]) is utilised as background and information as part of this assessment.

3.3 Extended Phase 1 Habitat Survey

An extended Phase 1 Habitat Survey of the Site was completed on 12th March 2018.

The aim of the survey was to identify the type and extent of habitats present within the site and to identify the potential for these habitats to support protected or otherwise notable species. The survey was conducted according to the standard Phase 1 habitat survey methodology (Joint Nature Conservation Committee 2010[2]) and with adherence to standard guidelines[3] and was extended to include targeted searches for signs of protected

[1] Tyne Rivers Trust (2017). River Tyne Diffuse Metals – Optioneering of Strategies to Reduce Contamination of Watercourses in the North Pennines.
[2] Joint Nature Conservation Committee, (2010), Handbook for Phase 1 Habitat survey – a technique for environmental audit, ISBN 0 86139 636 7.
[3] Chartered Institute of Ecology and Environmental Management (April 2013) *Guidelines for Preliminary Ecological Appraisal* (GPEA) Professional Guidance Series (CIEEM: http://www.cieem.net/)

species such as bats, amphibians, reptiles, and badger (*Meles meles*). The survey included a search for invasive species listed under schedule 9 of the Wildlife and Countryside Act, such as Japanese knotweed (*Fallopia japonica*) and giant hogweed (*Heracleum mantegazzianum*).

Target notes (TN) were made to provide supplementary information on species composition, features of interest, topography, location of habitats and evidence of management. Botanical nomenclature follows Stace (2010[4]).

3.4 Limitations and Assumptions

Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. The absence of records for a particular species does not therefore necessarily mean that such species does not occur in the study area.

The survey was carried out in March 2018, which is outside the optimal time suggested for Phase 1 Habitat Surveys (the accepted survey period is mid- April to mid-October**Error! Bookmark not defined.**). In addition, there had been heavy snowfall in the week preceding the survey and there was still a lot of snow covering in particular the grassland areas, which restricts the level of recording carried out, so the value of the habitat may not be fully realised. However, the overall habitat type can be identified and give indications as to whether further survey is required at a more suitable time of year.

4. Results

4.1 Desk Study

The results for the wider search carried in March 2018 and January 2017 for statutory and non-statutory sites are included in Appendix A. The desk study results for protected and notable species received from Cumbria Biodiversity Data Centre were too numerous to include as raw data therefore only the relevant species have been identified and considered within the body of the report (a full record set can be issued on request).

4.1.1 Statutory Designations

The Tyne and Nent Special Area of Conservation (SAC) is within 0.8 km to the southwest and around 2 km to the northwest. The North Pennine Moors Special Protection Area (SPA) is approximately 1.6 km to the north of the site. Haggs Bank SSSI is approximately 2 km northwest of the site. Allendale Moors SSSI is approximately 1.6 km to the northeast of the site. Small Cleugh Mine SSSI is 0.7 km to the southeast of the site and Whitesike Mine and Flinty Fell SSSI is around 0.8 km to the southwest of the site.

4.1.2 Non-statutory Designations

Table 2 details the non-statutory nature conservations identified by the desk study, based on the method given in Section 3.1 of this report. The designations are listed in order of increasing distance from the Site boundary. Table 2 includes Candidate and Potential/Historic sites. Candidate Local Wildlife Sites (LWS) are those which have clear evidence that they meet the LWS criteria but have not been formerly designated. Potential/Historic LWS are former parish, county and district-level sites but have not been recently surveyed to check status. It should be noted that the Site is part of Nenthead Mine Local Geological Site.

Table 2 Sites with non-statutory designations for nature conservation

Designation	Reason(s) for Designation	Relationship to the Site boundary
River Nent County Wildlife Site	Notable habitat (Riverine/riparian)	0.4 km to the northwest of the site.
Special Roadside Verge (C1Y (1)).	Notable habitat (road verge).	0.7 km north of site.

[4] Stace, C.A. (2010) The New Flora of the British Isles. Cambridge University Press.

Designation	Reason(s) for Designation	Relationship to the Site boundary
Special Roadside Verge (C17 (2)).	Notable habitat (road verge).	1 km to the northwest of the site.
Flinty Fell County Wildlife Site	Notable habitat (Blanket Bog, Calaminarian grassland)	1.2 km to the south of the site

4.1.3 Protected and Otherwise Notable Species

Table 3 provides a summary of potentially relevant species identified through the desk study. The table summarises the conservation status of each species and provides commentary on the likelihood of presence.

Where species are identified in Table 3 as likely or possible within the site or immediate wider area, depending on the potential for effects from the proposed development, they could be material to determination of a planning application and could represent a legal constraint. Where they are flagged as a potential constraint, further surveys are likely to be required to determine presence/ population size so the impacts from the proposed development can be assessed to the satisfaction of the Planning Authority. Requirements for further surveys are identified in Section 5 of this report.

Table 3 Protected and notable species relevant or potentially relevant to the proposed development

Species	Legally Protected Species	Species of Principal Importance	Other Notable Species	Present on Site	Present/Potentially Present in Wider Zone of Influence	Supporting Comments
Bats	✓	✓	-	?	?	The desk study returned 21 bat records within 1 km of the site. Species included Pipistrelle species (*Pipistrellus*), daubentons (*Myotis daubentonii*), natterers (*Myotis nattereri*) and whiskered/brandts (*Myotis mystacinus/brandtii*). Roosts are known at in Nenthead itself, at Capleclough adit (just south of the site at adit - NY78104347), Rampgill Burn adit (0.7km east - NY787435).
Breeding birds	✓	✓	-	?	?	The desk study revealed the presence of, amongst others, Lapwing (*Vanellus vanellus*) and ringed plover (*Charadrius hiaticula*) within 1km of the site.
Sand Martin (*Riparia riparia*)	✓	X	-	✓	?	This species was not recorded within the desk study itself but a known colony of sand martins utilise the river bank on site for nesting as noted in the Tyne Rivers Trust Report (2017). The species is legally protected when nesting.
Red Squirrel (*Sciurus vulgaris*)	✓	✓	-	?	?	The desk study revealed various records of this species within 1 km of the site boundary. The nearest was in the woodland to the north and just outside the red line (NY78144357)
Water Vole (*Arvicola amphibius*)	✓	✓	-	?	?	The desk study revealed various records of this species within 1 km of the site boundary. This included Galligill Burn and Hardedge. There were no records for water vole on or near the site.
Alpine pennycress (*Noccaea caerulescens*)	-	✓	-	?	?	The desk study noted that this species is local to the site recorded south of Capleclough adit (Nenthead Mine car park – NY780435)

Key to symbols: ✓ = yes, X = no, ? = possibly, see Supporting Comments for further rationale.

Species present on site are those for which recent direct observation or field signs confirmed presence. Species which are possibly present are those for which there is potentially suitable habitat based on the results of the desk study records.

Legally protected species are those listed under Schedules 1,5 and 8 of the Wildlife and Countryside Act 1981 (as amended) and Schedules 2 and 4 of the Conservation of Habitat & Species Regulations 2010 (as amended).

Species of Primary Importance are those listed under Section 41 of the NERC Act. Planning Authorities have a legal duty under Section 40 of the same Act to consider such species when determining planning applications.

Other notable species include native species of conservation concern listed in the LBAP (except species that are also of Principal Importance), those that are Nationally Rare, Scarce or Red Data List and non-native controlled weed species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

4.1.4 Previous relevant survey data and findings

In 2015, a Phase 1 Habitat Survey[5] was carried out by AECOM of a field and a stretch of the River Nent northwest of the Horse and Wagon Caravan Park (2 km northwest of the Site), adjacent to the A689. Potential constraints were listed as breeding birds, otter *Lutra lutra*, water vole *Arvicola amphibius* and white clawed crayfish *Austropotamobius pallipes*.

In 2015, a white clawed crayfish and water vole survey[6] was carried out along a stretch of the River Nent between Nenthall Bridge and to the northwest of the Horse and Wagon Caravan Park (2 km northwest). No evidence of water vole or white clawed crayfish was found on this stretch of the Nent.

In 2016, a further aquatic survey[7] was carried out along a similar stretch of the River Nent to the white clawed crayfish survey in 2015. The surveys involved River Corridor Surveys (RCS), aquatic macroinvertebrate, otter and water vole surveys, throughout a 1 km stretch of the river between National Grid Reference (NGR) NY 76375 45074 and NGR NY 75880 45767. The results suggested a moderate-to-good quality throughout the stretch surveyed and the conservation value was recorded as moderate to high. No evidence of water vole was seen. Evidence of otter was recorded along the stretch with fresh otter spraints being found and possible refuge locations recorded.

The optioneering study carried out by the Tyne Rivers Trust for this site (see above) described the area as follows: The local mining "*land-use has given rise to highly contaminated sediments and distinct stratification of metal-contaminated soils in the area of interest. As such, loosely bound cobbles and coarse gravels are at the base of the river cliff, supporting finer gravels and sandy particles. At the top of the river cliff very fine sands, silts and clays form a dense layer of contaminated sediments*".

In addition the study detailing the proposed works sought the opinion of both Natural England and the biodiversity officer of the Area of Outstanding Natural Beauty. The main constraint foreseen was the use of the Site by sand martins *Riparia riparia* and recommendations were given to mitigate for the loss of this habitat.

4.2 Extended Phase 1 Habitat Survey

In summary, the Site comprises the River Nent and the Dowgang Burn, a car park, plantation woodland and grassland. The location of the site is shown in Figure 1. Details of target notes (TN) are found in Appendix B and site photographs are found in Appendix C.

4.2.1 Semi-improved Grassland

The bank above the car park to the east was dominated by moss species and grasses such as Yorkshire fog *Holcus lanatus* (see Photograph 1). To the west and on the banks of the River Nent was grassland (see Photograph 2), which again had a good moss flora along with species such as sheep's fescue *Festuca ovina*, red fescue *Festuca rubra*, cocksfoot *Dactylis glomerata*, common bent *Agrostis capillaris*, tufted hair grass *Deschampsia cespitosa*, rosebay willowherb *Chamerion angustifolium*, selfheal *Prunella vulgaris*, heather *Calluna vulgaris*, daisy *Bellis perennis*, soft rush *Juncus effusus* and common mouse ear *Cerastium fontanum*.

[5] AECOM (2015), 47072599. Nentberry Haggs Phase 1 Habitat Survey. Coal Authority.
[6] AECOM (2015), 47072599. Nentsberry Haggs White clawed crayfish and water vole survey. Coal Authority.
[7] AECOM (2016), 47072599. Nentsberry Haggs, Cumbria: Check Weirs Ecology Survey. Coal Authority.

4.2.2 Mixed Plantation Woodland

There was a band of planted trees above the River Nent and to the west of the car park area (see Photograph 3). Trees included pines and spruce, larch *Larix decidua*, silver birch *Betula pendula*, alder *Alnus glutinosa* and poplar species *Populus* sp. There was grass and moss in the ground flora. They appeared quite young (10-15 years) although there was a lot of lichen on the trees (see Photograph 4).

To the east of the car park on the top of the bank was predominantly broadleaved species including birch and oak *Quercus* sp, beyond which and to the south became more mixed plantation again.

4.2.3 Coniferous Plantation

To the southwest of the site and outside the redline boundary was a large area of coniferous plantation woodland.

4.2.4 Running water

The River Nent ran through the west-central section of the Site (see Photograph 5). This was fast flowing and did not appear to have much aquatic flora present; there was some marginal species such as soft rush. In addition the Dowgang Burn joined the Nent at a confluence to the north of the site (see Photograph 6). There was also a drain that ran north to south with the grassy bank to the east of the car park (see Photograph 7).

The River ran through a culvert at the northern boundary of the Site, which was brick lined (TN1 and see Photograph 8). In addition, the River Nent had sheer cliffs in the eastern bank, which had holes that is a known nesting site for sand martin (TN2 and see Photograph 9).

A Phase 1 habitat map of the Site is presented in Figure 2.

4.2.5 Breeding Birds

The woodland areas offer breeding habitat for birds and it is likely that birds will nest in these areas (including the plantation woodland on site. It is unlikely that there are ground nesting species such as skylark *Alauda arvensis* on the site.

There is a known colony of sand martins in the cliffs above the River Nent (TN2), which will be lost to the scheme. No sand martins were seen on the day of the survey and it is unlikely they have arrived to start nesting yet.

4.2.6 Riparian Mammals

The River and Burn have potential for use by otters and water vole. No signs were seen on the day of the survey, but the watercourses were not surveyed specifically for riparian mammals. There are records for water vole in the wider landscape, although none in the vicinity of the works. The eroding bank was considered unlikely to have water voles present.

4.2.7 Amphibians

There were no waterbodies on Site, although there were two local to the site and within 100m. There were opportunities for areas such as walls and woodland that would offer refuge or hibernation features for amphibians. There are no desk study records for great crested newts in the locality and whilst it is unlikely they would be found in the vicinity of the proposed works, this is unknown at the present time.

4.2.8 Reptiles

It is unlikely that the Site as whole would have significant use by reptiles. The Site was very open and is likely to have significant human activity, which would reduce the potential use of the area by reptiles.

There is suitable habitat in the wider area for reptiles and the watercourses and wider grassland and woodland may be utilised by grass snake.

However, there were no records of reptiles recorded in the local area.

4.2.9 White Clawed Crayfish

The desk study revealed no records of white clawed crayfish within the 1km or 3km study radius and in a previous survey (2015) of an area of the river to the north to the site no crayfish were recorded. Whilst, the River and Burn do offer habitat potential for white clawed crayfish, the previous survey suggests none are present in the River Nent in the Nenthead area. Therefore it is considered unlikely they are present in the locality of the site.

4.2.10 Badger

No evidence of badger activity or setts was observed within or adjacent to the site. There is potential for the site to support foraging activity but no signs were found. There were signs of rabbit activity on site.

4.2.11 Bats

Trees - All trees found on the Site itself were young and had been planted relatively recently meaning they had no Bat Roost Potential (BRP). Trees in the local landscape were older but again did not appear to have bat roost potential due to age.

Culvert – the culvert for the River Nent (TN1) appeared to have a potential for bat use. Access to examine the brick culvert was not possible on the day of the survey.

4.2.12 Red Squirrel

There are records locally for red squirrel local to and near the site. There were no obvious signs of red squirrel on the plantation woodland on Site and no dreys were seen. It is likely that they are present in the conifer plantation to the southwest and they may utilise other areas of woodland in the wider landscape.

4.2.13 Other Fauna

There is potential that hedgehog *Erinaceus europaeus* would be found local to the site as there was suitable habitat.

It is unlikely that the actual Site would support a notable invertebrate fauna, although the River Nent may have aquatic fauna present.

5. Summary of potential constraints

5.1 Habitat

5.1.1 Tyne and Nent Special Area of Conservation (SAC)

The Site is around 0.8 km to the southwest and 2 km to the northeast of the Tyne and Nent SAC, which is designated for calaminarian (heavy metal tolerant) grassland.

The project is designed to reduce heavy metals from entering the Nent, which could impact the SAC due to the lowering of the heavy metal deposition received by the areas of calaminarian grassland. This grassland type relies on the periodic inundation and heavy metal deposition to supress colonisation of other species and therefore the reduction of heavy metals in the inundation water could lead to loss of the species and communities for which the SAC is designated.

An Appropriate Assessment (Habitats Directive) was completed by the Environment Agency in 2014/15[8] to assess the impacts of a reduction in the heavy metal load into the river on the SAC from several proposed schemes, which was informed via discussion with Natural England. Whilst it was concluded that the schemes collectively would most likely negatively impact the calaminarian grassland communities, mitigation was proposed such that there would not be a significantly adverse effect in the short to medium term. The mitigation proposed was as follows:

[8] Proforma HR02 for Stage 3 for New Permissions under the Habitats Directive. Tyne & Nent SAC, Tyne & Allen River Gravels SAC. Land Drainage Consent for Mine Remediation Schemes. Environment Agency 2014

"NE advice is that perturbation of substrate will rework soil profiles bringing metal rich material to the surface horizons. This will increase its availability to metallophyte species."

In the optioneering report for this site, Natural England were asked to comment and the response was that Natural England considered that the measures previously recommended to maintain calaminarian grassland at Haggs Bank (perturbation of substrate to bring metal-rich soils to the surface) would cover the works discussed here.

5.1.2 North Pennine Special Protection Area

The North Pennine Moors Special Protection Area (SPA) is approximately 1.6 km to the north of the development area. However, no impacts are foreseen on the SPA itself and no works within the SPA are proposed.

5.1.3 Haggs Bank SSSI

Haggs Bank SSSI is approximately 2 km northwest of the Site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed. In addition, in the optioneering study by the Rivers Trust Natural England commented that no impact was foreseen on this site.

5.1.4 Allendale Moors SSSI

Allendale Moors SSSI is approximately 1.6 km to the northeast of the Site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed.

5.1.5 Small Cleugh Mine SSSI

Small Cleugh Mine SSSI is 0.7 km to the southeast of the site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed.

5.1.6 Whitesike Mine and Flinty Fell SSSI

Whitesike Mine and Flinty Fell SSSI is around 0.8 km to the southwest of the site. However, no impacts are foreseen on the SSSI itself and no works within the SSSI are proposed.

5.1.7 Grassland

The grassland areas appeared to be semi-improved and relatively rough grassland with in places a luxuriant moss flora, indicating damp conditions. On the river bank there appeared to be more diversity and there were indications of acid grassland with occasional stands of heather. There are records for alpine pennycress *Noccaea caerulescens* in the local area and this species may be present on or local to the site. However, the areas of what appeared to be more interesting grassland are unlikely to be impacted by the scheme. As far as it is understood, the only grassland to be impacted would be a thin strip (1 m – 2 m width) that lies above the River Nent between the top of the bank and the plantation woodland. Based on this, any loss of this area of grassland is not considered to be a significant constraint.

5.1.8 Woodland and trees

The mixed plantation woodland, which is likely to be lost (in part) to the scheme was young and in itself had low nature conservation value and would not present a significant constraint to the scheme. However, the lichen flora on the trees appeared to be diverse (although not uncommon in the area as most trees had lichen) and as such it is recommended that felling is restricted to only essential areas for the works.

Other trees and woodland areas will not be impacted by the scheme and no constraints from these areas are foreseen.

5.1.9 Watercourses

It is likely there will be some in-river works and there is potential for disturbance of the in-river habitat. There was little aquatic flora present in the area where the key works would occur. It is not considered that these temporary works would have a significant impact on the river itself given the limited length affected and recolonization from

upstream would occur. In addition, once the works are completed the ecological value of the river would most likely be improved.

5.2 Species

5.2.1 Breeding birds

It is likely that there are nesting birds that would utilise the plantation woodland to the east of the car park on Site. In addition, there is a sand martin nesting site in the cliffs above the River Nent. Both of these habitats could be impacted by the works and if undertaken during the nesting season, there is the potential for an offence as all birds receive protection from harm whilst nesting or attempting to nest under the Wildlife & Countryside Act 1981 (as amended) and so removal of trees and shrubs and disturbance to grassland should, wherever possible, be undertaken between 1st October and end February, i.e. outside of the main bird nesting season. The works have been planned to be undertaken outside of the nesting season and so the potential does not arise.

Whilst there is sufficient alternative habitat in the local area for birds utilising trees and shrubs that may be affected by the proposals and no significant impact is foreseen, the section of cliff utilised by sand martins will be lost completely. A check locally was made for suitable alternative cliff habitat that could be utilised by sand martin and none was seen; although this was limited to areas in the immediate and very local (20-30m) vicinity of the proposed works due to potential access issues.

Whilst it is not a legal requirement, it is recommended that replacement habitat for the sand martins be provided as part of the works. This could be construction of a sand martin structure into the river bank above the new retaining structures along the river, or in an area near the car park and above the river to the south of the plantation woodland set aside to create a sand martin bank/wall. This will need landowner permission (Cumbria County Council) and any plans would need to be agreed with them. Options for mitigation, such as the design and location of sand martin nesting habitat were also suggested by the AONB in the optioneering study. These include a wooden structure that could be built as bespoke for a given scheme and ideally as part of this project would be placed above the new gabions as part of the bank stabilisation scheme. See RSPB website https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/advice/conservation-land-management-advice/sand-martin-nest-sites/ for details and design.

If however works have to be rescheduled or there are delays into the bird nesting season, a nesting bird check of the site will be required prior to works starting. If a nesting bird is recorded within the development footprint, then a buffer zone should be established around the nest and works will not be able to proceed in that area until the young have fledged.

5.2.2 Riparian Mammals

Evidence of water voles and otters has been recorded within 1.5km of the site (site search and previous surveys of the River Nent) and no evidence of water voles was seen on the day of the survey but a specific survey of the watercourse along the northern boundary was not carried out. The substrate along the section to be stabilised appeared generally unsuitable and it is unlikely there are burrows in the areas to be affected (see Plate 9). However, it is recommended that a survey of the watercourse for water vole is carried to confirm absence.

It is likely that otters use the River Nent for movement and they may utilise the area to be affected. However, there was no potential for laying up areas or holt in the locality of the Site and no impact of the use of the area by otter is foreseen; works would be undertaken during the day and otters would be moving along the river at night. Standard measures should be taken to avoid leaving open excavations overnight or provide a means of egress.

5.2.3 White clawed crayfish

There are no records along this stretch of the Nent and surveys undertaken downstream have not recorded the species and no constraints are foreseen for this species.

5.2.4 Bats

No trees were observed to contain features with potential to support bat roosts and no buildings will be impacted by the works. The culvert recorded on the northern section of the river may have potential for bat use and there is a record of a bat roost very local to the Site. However, it is understood there will be no impact on the culvert itself

and works would not come within 5-10 m of the culvert (the area immediately south of the culvert is already retained with gabion baskets and concrete wall – see TN1), so no impact on bats, if present, is foreseen.

5.2.5 Other fauna

Reptiles such as common lizard and grass snake may be present locally but it is unlikely that individuals or the population status of reptiles in the local area would be impacted by development of this site. Measures could be incorporated into the design to minimise any effects; in particular a method statement could be implemented that could include an ecologist checking the area prior to works starting to ensure no fauna that could be impacted by the scheme is present.

The walls and woodland areas offer refuge and hibernating areas for amphibians that may breed in the two ponds nearby. It is unknown whether great crested newts utilise these ponds and there are no records from within at least 1km of the site but to ensure appropriate mitigation, if required, is provided, it is recommended that water samples are taken of the two ponds local to the works and sent for eDNA analysis. In the unlikely event that one or both ponds return a positive result, based on the limited area of working, it is probable that a method statement approach could be employed to reduce any potential impact on great crested newts but this can only be confirmed once the results are known.

Red squirrels are known locally, but no signs of red squirrel were seen and whilst potential habitat is being impacted (felling of semi-mature trees) on the Site it is unlikely this species would be affected by the scheme.

No evidence of badgers was seen on the site and it is unlikely this species will be impacted by the works.

5.3 Summary

It is assessed that there is potential for the development to have an impact on several ecological receptors, most notably sand martins; although there is little notable habitat that will be impacted by the works. However, the works once complete are likely to have a beneficial effect on the riverine habitat in this locality and further downstream. To reduce the potential impacts of the scheme the following recommendations are made:

- A water vole survey is recommended, specifically in the area that would be impacted and extend upstream and downstream 10m from the area of impact;
- It is understood that the works are planned to be undertaken outside of the nesting bird season but if it has to be rescheduled or there are delay that take the works into the start of the nesting season, then checks for nesting birds will be required prior to commencement and measures taken to avoid any nesting birds if found;
- It is also recommended that if possible replacement nesting habitat for sand martins is created to ensure nesting habitat is available to sand martins in the future. This could be a sand martin structure built into the river bank above the new retaining structures along the river, or on a local area of riverbank e.g. beyond the car park to the south of the plantation woodland. This will need landowner permission (Cumbria County Council) and any plans should be agreed with them.
- Whilst it is considered unlikely that great crested newts are present in the two nearby ponds and there are no records within at least 1km, it is recommended that water samples are taken from the two ponds and sent for eDNA analysis to confirm whether great crested newts are present/absent.
- Whilst it is not considered likely that there would be a significant adverse impact on any habitats or species, production of a Construction Environmental Management Plan (CEMP) statement is recommended to ensure there are measures in place to minimise any impacts on biodiversity from the works.

Figure 1 Site Location map

200 0 200 400 600 800 1,000 Metres

N

Nenthead Car Park

Cottage
Pry House
Dykeheads
Moffat Cottage
Black Hill
Quarries
Grassfield
Foulardrigg
River Nent
Cemetery
Strellas Cottage
Wellgill Cottages
Moorlands
Cob End
Foulard Cottage
Wellgill
Woodbrae Farm
Wellgill Farm
The Beeches
Old Workings
Whitehall
PW
Chapel Row
Spring House
Chapel House Cottages
Donks Hall
Holmsfoot
Hillerston Terrace
Vicarage Terrace
CHURCH LANE
Gillgill Burn
Area of Disused
Levels
Greengill Hush
Nenthead Primary School
Nenthead Bridge
The Row
PO
PW
Fairhill Farm
Fairhill
Gillgill Bridge
Works
Nenthead
Overwater
Nenthead House
Fiddlers Cottage
Bevan Terrace
Scaleburn Bridge
Fiddler Street
Levels
Hilltop Cottages
Firestone Bridge
Mus
Reservoir (dis)
Dowgang Burn
River Nent
Mill Cottage
Rampgill Burn
Mill (dis)
Levels
Reservoir (disused)
Course of Old Flue
Fairview
Dowgang Hush
Dowgang Burn
Area of
Chimney
Levels
Nunnery Hill
Shaw Side
Long Cl

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

Survey area

Purpose of Issue: DRAFT

Client: THE COAL AUTHORITY

Project Title: NENTHEAD CAR PARK

Drawing Title: LOCATION PLAN

Drawn	Checked	Approved	Date
CAA	-	-	16/03/2018

AECOM Internal Project No.: 60543055

Scale @ A3: 1:8,000

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NG9 6RZ
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Drawing Number: FIGURE 1

Rev: .

File Name:Y:\Claudia Ardrey\Projects 2018\Nenthead Mine Car Park\GIS\project_files\Nenthead_car_park_20180301.mxd

Figure 2 Phase 1 Habitat Map

N

Legend

- Survey area
- Coniferous plantation
- Mixed plantation
- Scattered broad-leaved trees
- Semi-improved acid grassland (SI)
- Poor semi-imporved grassland (SI)
- Running water
- Steep bank to sheer cliff
- Building
- Bare ground
- Hard standing
- Wet ditch
- Target note

TN1

TN2

River Nent

10 0 10 20 30 40 50 Meters

Project Title/Drawing Title

THE COAL AUTHORITY
NENTHEAD CAR PARK
PHASE 1 HABITAT MAP

AECOM Internal Project Number
60543055

Drawn	Checked	Approved
CAA	-	-
Date	Scale @ A3	Purpose of issue
16/03/2018	1:500	DRAFT
Drawing Number		Rev
Figure 2		0

AECOM
Royal Court
Basil Close, Chesterfield
Derbyshire. S41 7SL
+44 (0) 1246 209221
+44 (0) 1246 209229
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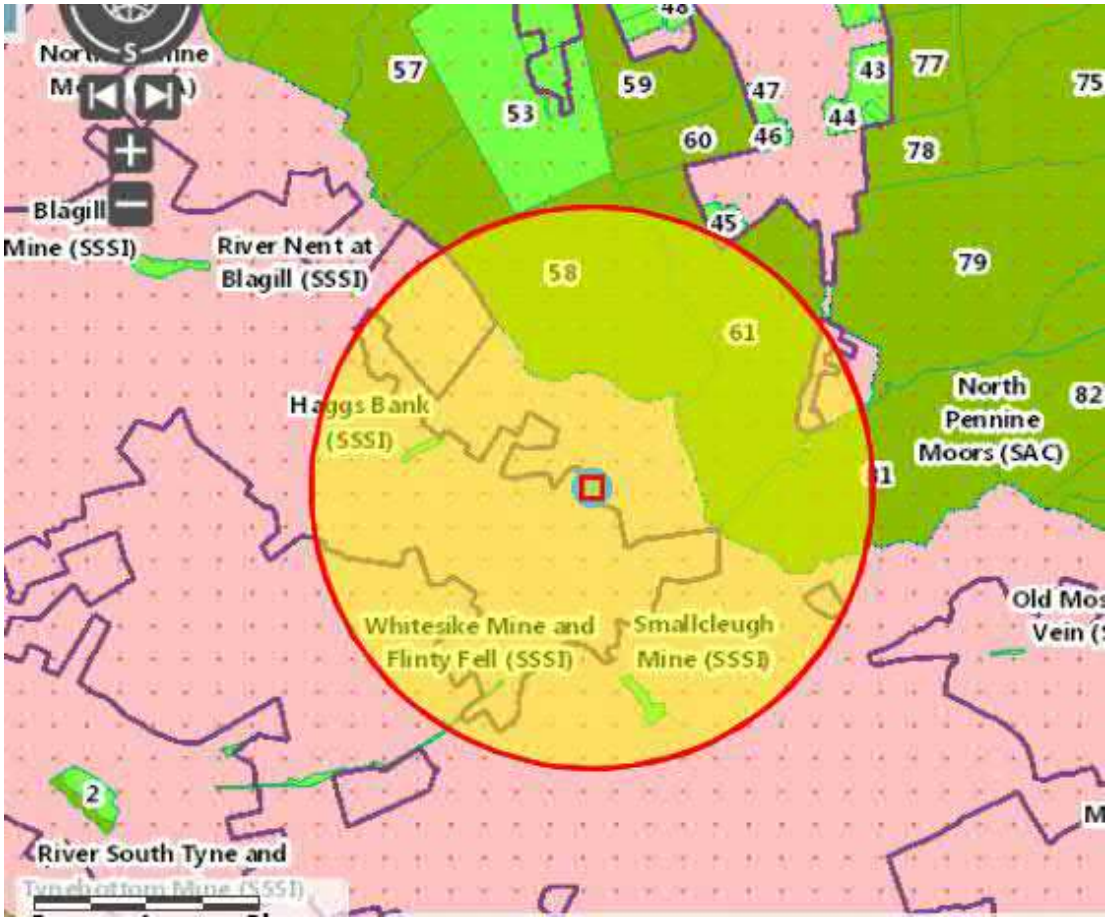
Appendix A Desk Study: Statutory and Non-Statutory sites

Multi-Agency Geographic Information for the Countryside (MAGIC) 2.5km search radius for Statutory Site Designations from point NY783448 – for sites 24 and 43 Nenthead Mine Water Treatment Scheme.



Site Check Report Report generated on Mon Oct 09 2017
You selected the location: Centroid Grid Ref: NY782447
The following features have been found in your search area:

Areas of Outstanding Natural Beauty (England)

Reference	25
Name	North Pennines
Date Designated	Jun-88
Hyperlink	http://www.landscapesforlife.org.uk/north-pennines-aonb.html
Statutory Area in Sq.km	1985.16

Moorland Line (England)

Name	MS
Hectares	179058.5681

Sites of Special Scientific Interest Units (England) - points

Name	ALLENDALE MOORS
Reference	1060858
Site Unit Condition	UNFAVOURABLE RECOVERING
Citation	1020263
Hectares	351.71
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020263

Name	ALLENDALE MOORS
Reference	1060862
Site Unit Condition	UNFAVOURABLE RECOVERING
Citation	1020714
Hectares	289.63
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020714

Name	SMALLCLEUGH MINE
Reference	1059223
Site Unit Condition	FAVOURABLE
Citation	1010595
Hectares	5.01
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1010595

Name	WHITESIKE MINE AND FLINTY FELL
Reference	1059601
Site Unit Condition	FAVOURABLE
Citation	1027650
Hectares	1.56
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1027650

Name	HAGGS BANK
Reference	1059597
Site Unit Condition	FAVOURABLE
Citation	1027663
Hectares	2.13
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1027663

Sites of Special Scientific Interest Units (England)

Name	ALLENDALE MOORS
Reference	1060858
Site Unit Condition	UNFAVOURABLE RECOVERING
Citation	1020263
Hectares	351.71
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020263

Name	ALLENDALE MOORS
Reference	1060844
Site Unit Condition	FAVOURABLE
Citation	1020765
Hectares	9.79
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020765

Name	ALLENDALE MOORS
Reference	1060884
Site Unit Condition	UNFAVOURABLE RECOVERING
Citation	1020724
Hectares	257.47
Hyperlink	http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020724

Name	ALLENDALE MOORS

Reference 1060862
Site Unit Condition UNFAVOURABLE RECOVERING
Citation 1020714
Hectares 289.63
Hyperlink http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020714

Name ALLENDALE MOORS
Reference 1060881
Site Unit Condition UNFAVOURABLE RECOVERING
Citation 1020722
Hectares 366.77
Hyperlink http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1020722

Name SMALLCLEUGH MINE
Reference 1059223
Site Unit Condition FAVOURABLE
Citation 1010595
Hectares 5.01
Hyperlink http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1010595

Name WHITESIKE MINE AND FLINTY FELL
Reference 1059601
Site Unit Condition FAVOURABLE
Citation 1027650
Hectares 1.56
Hyperlink http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1027650

Name HAGGS BANK
Reference 1059597
Site Unit Condition FAVOURABLE
Citation 1027663
Hectares 2.13
Hyperlink http://designatedsites.naturalengland.org.uk/UnitDetail.aspx?UnitId=1027663

Sites of Special Scientific Interest (England) - points

Name Haggs Bank SSSI
Reference 1007359
Natural England Contact SIMON STAINER
Natural England Phone Number 0845 600 3078
Hectares 2.13
Citation 2000418
Hyperlink http://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s2000418

Name Smallcleugh Mine SSSI
Reference 1004064
Natural England Contact SIMON STAINER
Natural England Phone Number 0845 600 3078
Hectares 5.01
Citation 1005631
Hyperlink http://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1005631

Sites of Special Scientific Interest (England)

Name Haggs Bank SSSI
Reference 1007359
Natural England Contact SIMON STAINER
Natural England Phone Number 0845 600 3078
Hectares 2.13
Citation 2000418
Hyperlink http://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s2000418

Name Whitesike Mine and Flinty Fell SSSI
Reference 1007360
Natural England Contact SIMON STAINER
Natural England Phone Number 0845 600 3078
Hectares 8.15
Citation 2000420
Hyperlink http://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s2000420

Name Allendale Moors SSSI
Reference 1006745
Natural England Contact CLAIRE FURNESS
Natural England Phone Number 0845 600 3078
Hectares 5289.1
Citation 2000292
Hyperlink http://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s2000292

Name	Smallcleugh Mine SSSI
Reference	1004064
Natural England Contact	SIMON STAINER
Natural England Phone Number	0845 600 3078
Hectares	5.01
Citation	1005631
Hyperlink	http://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=s1005631

SSSI Impact Risk Zones - to assess planning applications for likely impacts on SSSIs/SACs/SPAs & Ramsar sites (England)

1. DOES PLANNING PROPOSAL FALL INTO ONE OR MORE OF THE CATEGORIES BELOW?	2. IF YES, CHECK THE CORRESPONDING DESCRIPTION(S) BELOW. LPA SHOULD CONSULT NATURAL ENGLAND ON LIKELY RISKS FROM THE FOLLOWING:
All Planning Applications	ALL PLANNING APPLICATIONS - EXCEPT HOUSEHOLDER APPLICATIONS.
Infrastructure	
Wind & Solar Energy	
Minerals, Oil & Gas	
Rural Non Residential	
Residential	
Rural Residential	
Air Pollution	
Combustion	
Waste	
Composting	
Discharges	
Water Supply	
Notes	
GUIDANCE – How to use the Impact Risk Zones	/Metadata_for_magic/SSSI IRZ User Guidance MAGIC.pdf

1. DOES PLANNING PROPOSAL FALL INTO ONE OR MORE OF THE CATEGORIES BELOW?	2. IF YES, CHECK THE CORRESPONDING DESCRIPTION(S) BELOW. LPA SHOULD CONSULT NATURAL ENGLAND ON LIKELY RISKS FROM THE FOLLOWING:
All Planning Applications	ALL PLANNING APPLICATIONS - EXCEPT HOUSEHOLDER APPLICATIONS.
Infrastructure	
Wind & Solar Energy	
Minerals, Oil & Gas	
Rural Non Residential	
Residential	
Rural Residential	
Air Pollution	
Combustion	
Waste	
Composting	
Discharges	
Water Supply	
Notes	
GUIDANCE – How to use the Impact Risk Zones	/Metadata_for_magic/SSSI IRZ User Guidance MAGIC.pdf

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All Planning Applications	ALL PLANNING APPLICATIONS - EXCEPT HOUSEHOLDER APPLICATIONS.
Infrastructure	
Wind & Solar Energy	
Minerals, Oil & Gas	
Rural Non Residential	
Residential	
Rural Residential	
Air Pollution	
Combustion	
Waste	
Composting	
Discharges	
Water Supply	
Notes	
GUIDANCE – How to use the Impact Risk Zones	/Metadata_for_magic/SSSI IRZ User Guidance MAGIC.pdf

1. DOES PLANNING PROPOSAL FALL INTO ONE OR MORE OF THE CATEGORIES BELOW?	2. IF YES, CHECK THE CORRESPONDING DESCRIPTION(S) BELOW. LPA SHOULD CONSULT NATURAL ENGLAND ON LIKELY RISKS FROM THE FOLLOWING:
All Planning Applications	ALL PLANNING APPLICATIONS - EXCEPT HOUSEHOLDER APPLICATIONS.
Infrastructure	
Wind & Solar Energy	
Minerals, Oil & Gas	
Rural Non Residential	
Residential	
Rural Residential	
Air Pollution	
Combustion	
Waste	
Composting	
Discharges	
Water Supply	
Notes	

Composting	Any composting proposal. Incl: open windrow composting, in-vessel composting, anaerobic digestion, other waste management.
Discharges	
Water Supply	Large infrastructure such as warehousing / industry where net additional gross internal floorspace is > 1,000m² or any development needing its own water supply .
Notes	
GUIDANCE – How to use the Impact Risk Zones	/Metadata_for_magic/SSSI IRZ User Guidance MAGIC.pdf

1. DOES PLANNING PROPOSAL FALL INTO ONE OR MORE OF THE CATEGORIES BELOW?	2. IF YES, CHECK THE CORRESPONDING DESCRIPTION(S) BELOW. LPA SHOULD CONSULT NATURAL ENGLAND ON LIKELY RISKS FROM THE FOLLOWING:
All Planning Applications	All planning applications outside or extending outside existing settlements/urban areas affecting greenspace, farmland, semi natural habitats or landscape features such as trees, hedges, streams, rural buildings/structures.
Infrastructure	Pipelines, pylons and overhead cables. Any transport proposal including road, rail and by water (excluding routine maintenance). Airports, helipads and other aviation proposals.
Wind & Solar Energy	Solar schemes with footprint > 0.5ha, all wind turbines.
Minerals, Oil & Gas	Planning applications for quarries, including: new proposals, Review of Minerals Permissions (ROMP), extensions, variations to conditions etc. Oil & gas exploration/extraction.
Rural Non Residential	Large non residential developments outside existing settlements/urban areas where net additional gross internal floorspace is > 1,000m² or footprint exceeds 0.2ha.
Residential	Residential development of 50 units or more.
Rural Residential	Any residential developments outside of existing settlements/urban areas with a total net gain in residential units.
Air Pollution	Any development that could cause AIR POLLUTION (incl: industrial/commercial processes, pig & poultry units, slurry lagoons/manure stores).
Combustion	All general combustion processes. Incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion.
Waste	Mechanical and biological waste treatment, inert landfill, non-hazardous landfill, hazardous landfill, household civic amenity recycling facilities construction, demolition and excavation waste, other waste management.
Composting	Any composting proposal. Incl: open windrow composting, in-vessel composting, anaerobic digestion, other waste management.
Discharges	Any discharge of water or liquid waste of more than 20m³/day to ground (ie to seep away) or to surface water, such as a beck or stream (NB This does not include discharges to mains sewer which are unlikely to pose a risk at this location).
Water Supply	Large infrastructure such as warehousing / industry where net additional gross internal floorspace is > 1,000m² or any development needing its own water supply .
Notes	
GUIDANCE – How to use the Impact Risk Zones	/Metadata_for_magic/SSSI IRZ User Guidance MAGIC.pdf

1. DOES PLANNING PROPOSAL FALL INTO ONE OR MORE OF THE CATEGORIES BELOW?	2. IF YES, CHECK THE CORRESPONDING DESCRIPTION(S) BELOW. LPA SHOULD CONSULT NATURAL ENGLAND ON LIKELY RISKS FROM THE FOLLOWING:
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Infrastructure	Pipelines, pylons and overhead cables. Any transport proposal including road, rail and by water (excluding routine maintenance). Airports, helipads and other aviation proposals.
Wind & Solar Energy	Solar schemes with footprint > 0.5ha, all wind turbines.
Minerals, Oil & Gas	Planning applications for quarries, including: new proposals, Review of Minerals Permissions (ROMP), extensions, variations to conditions etc. Oil & gas exploration/extraction.
Rural Non Residential	Large non residential developments outside existing settlements/urban areas where net additional gross internal floorspace is > 1,000m² or footprint exceeds 0.2ha.
Residential	Residential development of 10 units or more.
Rural Residential	Any residential developments outside of existing settlements/urban areas with a total net gain in residential units.
Air Pollution	Any development that could cause AIR POLLUTION or DUST either in its construction or operation (incl: industrial/commercial processes, pig & poultry units, slurry lagoons/manure stores).
Combustion	All general combustion processes. Incl: energy from waste incineration, other incineration, landfill gas generation plant, pyrolysis/gasification, anaerobic digestion, sewage treatment works, other incineration/ combustion.
Waste	Mechanical and biological waste treatment, inert landfill, non-hazardous landfill, hazardous landfill, household civic amenity recycling facilities construction, demolition and excavation waste, other waste management.
Composting	Any composting proposal. Incl: open windrow composting, in-vessel composting, anaerobic digestion, other waste management.
Discharges	Any discharge of water or liquid waste that is discharged to ground (ie to seep away) or to surface water, such as a beck or stream (NB this does not include discharges to mains sewer which are unlikely to pose a risk at this location).
Water Supply	Large infrastructure such as warehousing / industry where net additional gross internal floorspace is > 1,000m² or any development needing its own water supply .
Notes	
GUIDANCE – How to use the Impact Risk Zones	/Metadata_for_magic/SSSI IRZ User Guidance MAGIC.pdf

Special Areas of Conservation (England)

Name	TYNE & NENT
Reference	UK0030293
Hectares	36.73
Hyperlink	http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?eucode=UK0030293
Name	NORTH PENNINE MOORS
Reference	UK0030033
Hectares	103130.38
Hyperlink	http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?eucode=UK0030033

Special Protection Areas (England)

Name	NORTH PENNINE MOORS
Reference	UK9006272
Hectares	147277.49

Less Favoured Areas (England)

Reference	S
Hectares	6.3465
Type	Severely Disadvantaged
Reference	M
Hectares	179058.5681
Type	Severely Disadvantaged
Reference	S
Hectares	219937.8172
Type	Severely Disadvantaged
Reference	S
Hectares	16.7787
Type	Severely Disadvantaged

Objective 2 Areas (England)

Reference	A06
Name	OBJECTIVE 2
NUTS1	NE
Hectares	698814.457
Reference	B06
Name	OBJECTIVE 2
NUTS1	NW
Hectares	687917.606

Arable Assemblage Farmland Birds (England)

Number of Species Present	3

Grassland Assemblage Farmland Birds (England)

Number of Species Present	2
Data Collation Period	2005-2009 (plus any 2010 data available
Number of Species Present	2
Data Collation Period	2005-2009 (plus any 2010 data available
Number of Species Present	3
Data Collation Period	2005-2009 (plus any 2010 data available
Number of Species Present	4
Data Collation Period	2005-2009 (plus any 2010 data available

Black Grouse (England)

Species	Black Grouse
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Black Grouse
Data Collation Period	2005-2009 (plus any 2010 data available)

Curlew (England)

Species	Curlew
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Curlew
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Curlew
Data Collation Period	2005-2009 (plus any 2010 data available)
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Species	Curlew
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Curlew
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Curlew
Data Collation Period	2005-2009 (plus any 2010 data available)

Grey Partridge (England)

Species	Grey Partridge
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Grey Partridge
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Grey Partridge
Data Collation Period	2005-2009 (plus any 2010 data available)
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Species	Grey Partridge
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Grey Partridge
Data Collation Period	2005-2009 (plus any 2010 data available)

Lapwing (England)

Species	Lapwing
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Lapwing
Data Collation Period	2005-2009 (plus any 2010 data available)
Species	Lapwing
Data Collation Period	2005-2009 (plus any 2010 data available)
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Species	Lapwing

Data Collation Period 2005-2009 (plus any 2010 data available)

Species Lapwing
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Lapwing
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Lapwing
Data Collation Period 2005-2009 (plus any 2010 data available)

Redshank (England)

Species Redshank
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Redshank
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Redshank
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Redshank
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Redshank
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Redshank
Data Collation Period 2005-2009 (plus any 2010 data available)

Snipe (England)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Species Snipe
Data Collation Period 2005-2009 (plus any 2010 data available)

Tree Sparrow (England)

Species Tree Sparrow
Data Collation Period 2005-2009 (plus any 2010 data available)

Twite (England)

Species Twite
Data Collation Period 2005-2009 (plus any 2010 data available)

Important Bird Areas (GB)

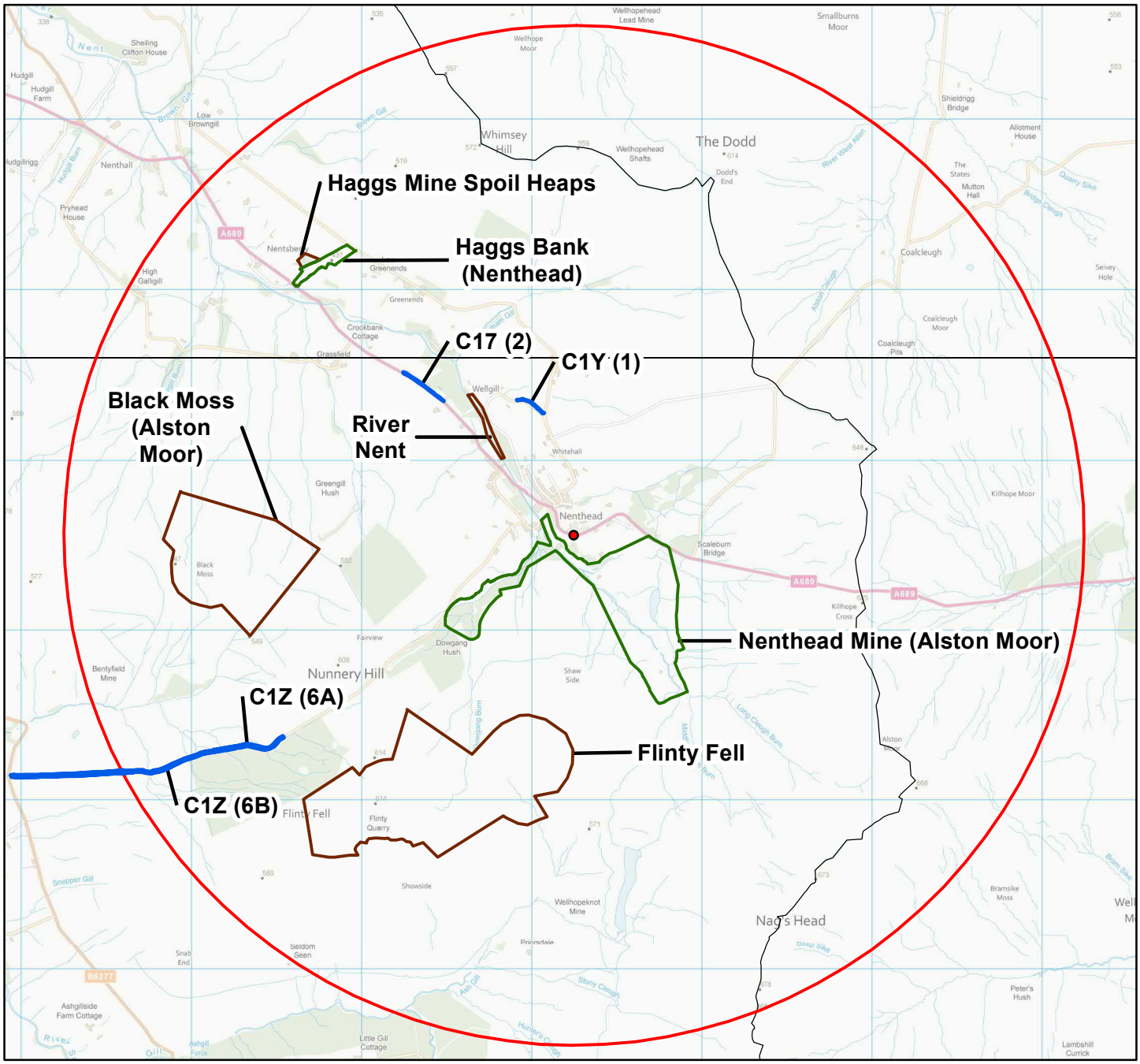
Name NORTH PENNINE MOORS
Site reference UK048
Description First identified in 1989; in 1992, combined 4 sites. Overlap with Yorkshire Dales to be amended in future reviews.
Hectares 1473030754.971051

Cumbria Biodiversity Data Centre (CBDC): Non-Statutory Sites Search

For: Paul Benyon at AECOM Infrastructure & Environment UK Ltd

Centroid: NY 782435
Site Name: Nenthead discharge points
Search Buffer: 3km
Search Date: 13/01/2017

N.B. Sites are displayed only if they exist within the search area



Key

- County Wildlife Sites
- Local Geological Sites
- Special Roadside Verges

0 375 750 1,500 Meters

Any queries in the first instance contact:
Dr Moustafa Eweda
Biological Data Officer
Cumbria Biodiversity Data Centre (CBDC)

T. 01228 618770
E. dataofficer@cbdc.org.uk

Appendix B Target Notes

1. NY 7805 4363. Culvert at north end of site on the River Nent.
2. NY 7806 4360. Cliff above River Nent with sand martin colony.

Appendix C Photographs

Plate 1. Semi-improved mossy grassland on bank above car park to the east of the site.

Plate 2. Grassland areas on the embankment of the River Nent.

Plate 3. Mixed plantation woodland and grass strip above the River Nent.

Plate 4. Lichen on the trees in the mixed plantation above the River Nent.

Plate 5. River Nent.

Plate 6. Dowgang Burn.

Plate 7. Ditch/drain in grassland to the east of the car park.

Plate 8. Culvert of the River Nent (TN1).

Plate 9. Sand Martin cliff on bank above the River Nent.

Appendix C – Calaminarian Grassland HRA Monitoring Strategy

Nent Haggs Mine Water Treatment Scheme

Environmental Statement
Volume 3-Technical Appendices

November 2017

Calaminarian Grassland HRA Monitoring Strategy

Calaminarian Grassland HRA Mitigation on the South Tyne and Nent

Dr Janet Simkin MCIEEM

8th February 2016

1. Introduction

Some of the alluvial gravels of the rivers Nent and South Tyne are contaminated with lead, zinc and cadmium derived from historic metal mining upstream in the North Pennine orefield. They support small areas of calaminarian grassland, a plant community that includes species of vascular plants, bryophytes and lichens that are particularly associated with nutrient-poor metalliferous substrates. Many of these species are obligate or facultative metallophytes, and some are nationally scarce, nationally rare, or are otherwise of conservation importance (Simkin, 2007 and 2011).

The works to be carried out at Nenthead, Nentsberry Haggs and other sites on the Nent are intended to reduce heavy metal levels in the river water and sediments, and this will inevitably reduce the occasional input of metals to the alluvial gravels that in the past helped to maintain calaminarian grassland as a plagioclimax community. Succession to mossy grassland and then scrub is already reducing the extent of this habitat downstream, with associated soil development and the loss of metallophyte plants and lichens, and the rate of this succession is expected to be increased by the water quality improvements.

As mitigation for this suitable sites were sought on which the succession could be restarted by stripping off the developing soil to expose the contaminated sediments beneath. The development of calaminarian grassland could then be encouraged by the reintroduction of spring sandwort *Minuartia verna*, a plant with an important ecological role in stabilising the surface and providing sheltered microniches in which other plants, bryophytes and lichens could become established.

The potential of this approach to habitat creation has been demonstrated by a long term field trial carried out on three sites since 2002 (Simkin 2007, 2012). Larger scale trials are now being set up as part of the Plantlife/Northumberland Wildlife Trust (NWT) SOMM project, with small areas stripped of soil at Burnfoot, Williamston and Partridge Nest, all on the South Tyne.

2. Site selection

2.1 Criteria

Calaminarian grassland habitat creation stands the greatest chance of success on stony sediments with high levels of lead, zinc and cadmium, low nutrient levels (especially phosphorus and nitrogen), a low organic content, and with high quality calaminarian grassland close by to act as a seed source. Gravel bars that are vulnerable to being covered by relatively uncontaminated river sediments during floods are unsuitable, but bars that are scoured by floods or are above all but the highest floods are more suitable.

Thus the criteria for site selection are:

- Alluvial gravel of historic mining age, with highly contaminated fine sediment trapped within the matrix of cobbles and boulders
- Thin soil and vegetation which can be removed by digger
- A suitable site nearby where the soil and vegetation can be dumped without environmental impact

- High quality calaminarian grassland nearby
- Open situation not shaded by trees, to minimise shade and flood water impedance

Many sites met these criteria, but most were then excluded by constraints imposed by the HRA:

- Work could only be done on SSSIs (biological or geological) on the Nent and South Tyne downstream of Nenthead or Nentsberry Haggs mines, excluding Nenthead itself. This excluded Alston and Tynebottom SSSIs on the South Tyne as they are upstream of the Nent confluence, and Ninebanks SSSI and the other sites on the East and West Allens. It also ruled out sites that have not been designated SSSI, such as Kirkhaugh, Featherstone, Coanwood, Haltwhistle, Partridge Nest, and most of the gravel bars on the Tyne below the North Tyne confluence.
- Natural England (NE) support is essential as SSSI consents will be required.
- Landowner support is also a prerequisite, and this ruled out Lambley, Wharmley and Beltingham SSSIs (Beltingham is managed as a nature reserve by NWT but with restrictions on tree felling that have prevented any work on the area of calaminarian grassland for which it was originally designated.
- Close House SSSI on the Tyne is rather different in origin and profile to the other sites and is unsuitable for this sort of intervention.
- The work must not already be planned to be done by NWT or the landowners as part of their site management plan or the SOMM project. This planned work included soil stripping at Williamston SSSI and part of Burnfoot SSSI.
- The work was to be restricted to habitat creation, i.e. surface stripping to create new habitat, preparatory work such as scrub and grass clearance, and the reintroduction of locally provenanced calaminarian grassland plants such as spring sandwort *Minuartia verna* and mountain pansy *Viola lutea*. Interventions to maintain or improve existing habitats are excluded.

As we were restricted to considering sites that had been designated for their calaminarian grassland, any habitat creation was necessarily the re-creation of habitat that had been present but had recently been lost.

2.2 Sites selected

Four sites have been selected for mitigation:

Blagill – a small area of one of the older terraces that is less vulnerable to erosion and river channel movements than the rest of this braided river site. Being close to the mines at Nenthead and Nentsberry this site is highly contaminated, with unusually high levels of zinc. The calaminarian grassland is extensive and of the highest quality, with large populations of metallophytes and vigorous lichen communities that include many rare species, so there are only small areas that are suitable for intervention that wouldn't do more harm than good. Further information on this important site, including the justification for the area selected for intervention, is included as Appendix 1.

Williamston – this is a small site with calaminarian grassland that is being replace by a mossy species-poor grassland despite annual management by NWT. The only area suitable for surface stripping is already being done as part of the SOMM project, but there is scope to introduce *Minuartia verna* seedlings to the cleared area as part of this mitigation.

Burnfoot – this large site has lost almost all its calaminarian grassland to gorse scrub and woodland in the last 20-30 years. One area is being stripped as part of the SOMM project, but there are others

that could be done as part of this mitigation to create a mosaic of habitats in an area close to a remnant of calaminarian grassland on an older terrace.

Wydon – this large site has lost much of its calaminarian to uncontaminated flood deposits and mossy grassland over the last 10 years, but scrub clearance by the National Trust has helped to speed up flood water flow and deposition was greatly reduced in the recent floods. The area to be stripped is adjacent to the long term field trial where calaminarian species are well established, and it is above the level of all but the highest floods.

The suitability of these sites was further reviewed after the extensive flooding caused by Storm Desmond on 5th December 2015 (Simkin 2015). No changes were needed.

3. Proposed interventions

3.1 Soil and vegetation stripping

Soil and vegetation are removed down to the level of the top of the gravel bar, to expose the contaminated fine sediments trapped between the clasts. At Burnfoot and Wydon this will be carried out by NWT, using a Bobcat mini-digger and by hand if necessary for small areas to ensure no damage to existing habitat. At Blagill it will be done by Mr Graham.

The areas to be cleared are shown below.

Blagill

Two areas on the older (higher) terrace on the north side of the river in the middle of the site, marked in red below. They will be marked out on site before the work is done. Damage to the rest of the terrace where there are important populations of metallophyte plants must be avoided.

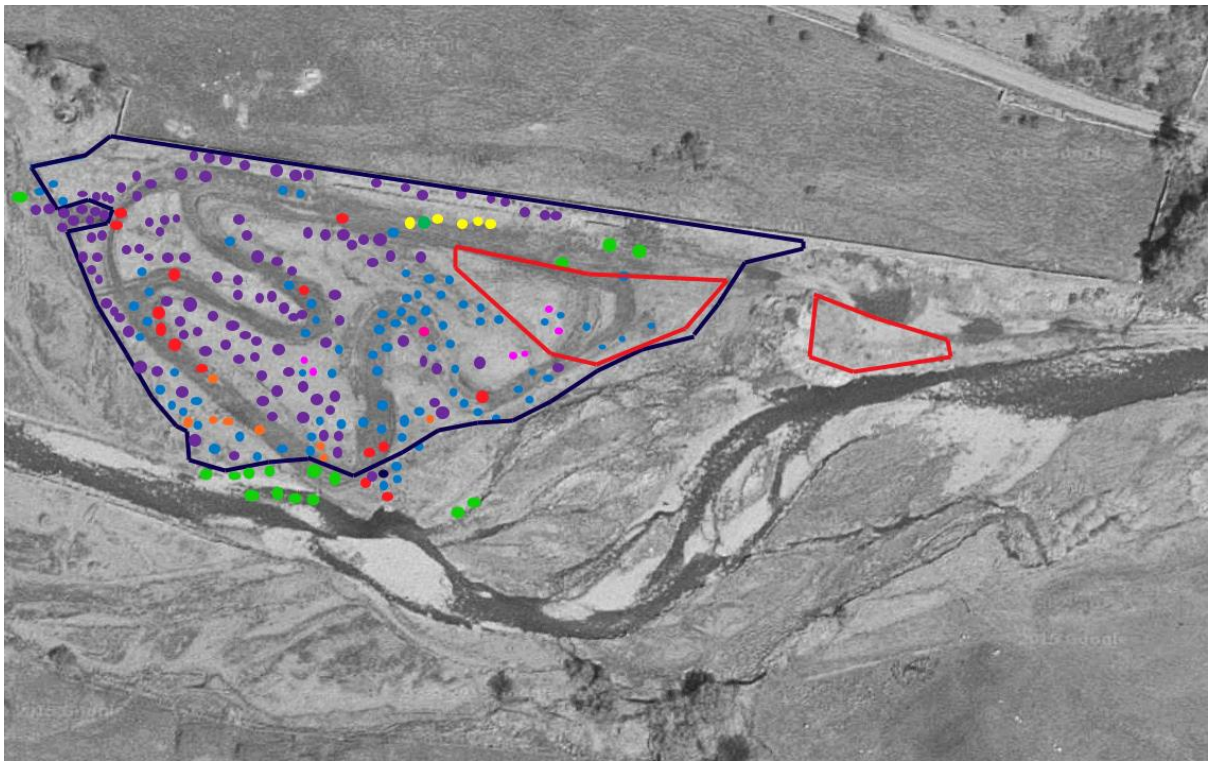


Fig. 1. Aerial photograph of the central part of the Blagill site, showing the river channels (there have been channel movements since this was taken), and the terrace. The current edge of the terrace is outlined in black, and the two possible areas for intervention are outlined in red. The dots indicate

species of interest: red – *Bryum pallens*, green - *Cochlearia pyrenaica*, purple – *Minuartia verna*, pink – *Noccaea caerulescens*, yellow – *Parnassia palustris*, purple – *Viola lutea*, orange – lichen communities.

Burnfoot

The proposed work here was considered in the interim report for the development phase of the NWT SOMM project (Simkin, 2013) but was excluded from the scope of that work due to its extent. The total area to be stripped, including that already done for the SOMM project is outlined in red below, with the two areas to be done as part of this mitigation towards the western edge. These three areas will form a mosaic of habitats in an area recently cleared of gorse and birch scrub, with small pockets of calaminarian grassland nearby to act as a seed source.

Fig. 2. Aerial photo of the Burnfoot site, with the area now cleared of gorse and birch outlined in red. This includes the two patches to be stripped of soil as part of this project.

Wydon

The proposed work here was considered in the interim report for the development phase of the NWT SOMM project (Simkin, 2013) but was then excluded for reasons of access, which have since been reconsidered. Detailed review of flood sedimentation and the distribution of metallophyte plant and lichen communities has narrowed the area to be stripped down to the eastern area outlined in red below.

The western area will be kept under review and a small part may also be stripped if conditions allow this to be done without damage to existing calaminarian grassland patches. The field trial plots are immediately to the east of the area to be cleared, and the two areas outlined in blue are subject to regular scrub control to keep them open and avoid flood water impedance.

Fig. 3. Aerial photo of the Wydon site, showing the two areas considered for soil stripping in red and areas needing regular scrub control in blue. The trees in the eastern areas have now all been removed.

3.2 Plant reintroductions

Williamston

Metallophyte plant species will be reintroduced to the stripped area at Williamston as plug plants, to promote soil stability and the development of calaminarian grassland. These plants, mainly spring sandwort *Minuartia verna* and mountain pansy *Viola lutea*, will be grown on from seed harvested in 2015 from calaminarian sites along the South Tyne to ensure local provenance.

At Williamston this will be done by NWT, who manage the site as a nature reserve. The area to be planted is the more northerly of areas outlined in red below.

Next year similar introductions could be made to the cleared plots at Burnfoot and Wydon, if we have sufficient stock of plants to do so. Direct seeding into the ground is less productive as, although the germination rate is generally high, many of the seedlings can be expected to be lost to disturbance by rabbits and surface water ponding during rain, but it may be worth trying on these two sites if we can harvest enough seed in 2016. This was not possible in 2015 due to heavy rain in summer which caused the ripe seed to be shed before it could be collected. Any seed collection must be restricted to no more than 10% of the seed produced in each small area to avoid a negative impact on regeneration at the source location. Seed collection and propagation will be shared by NWT and myself, depending on who is available when needed.

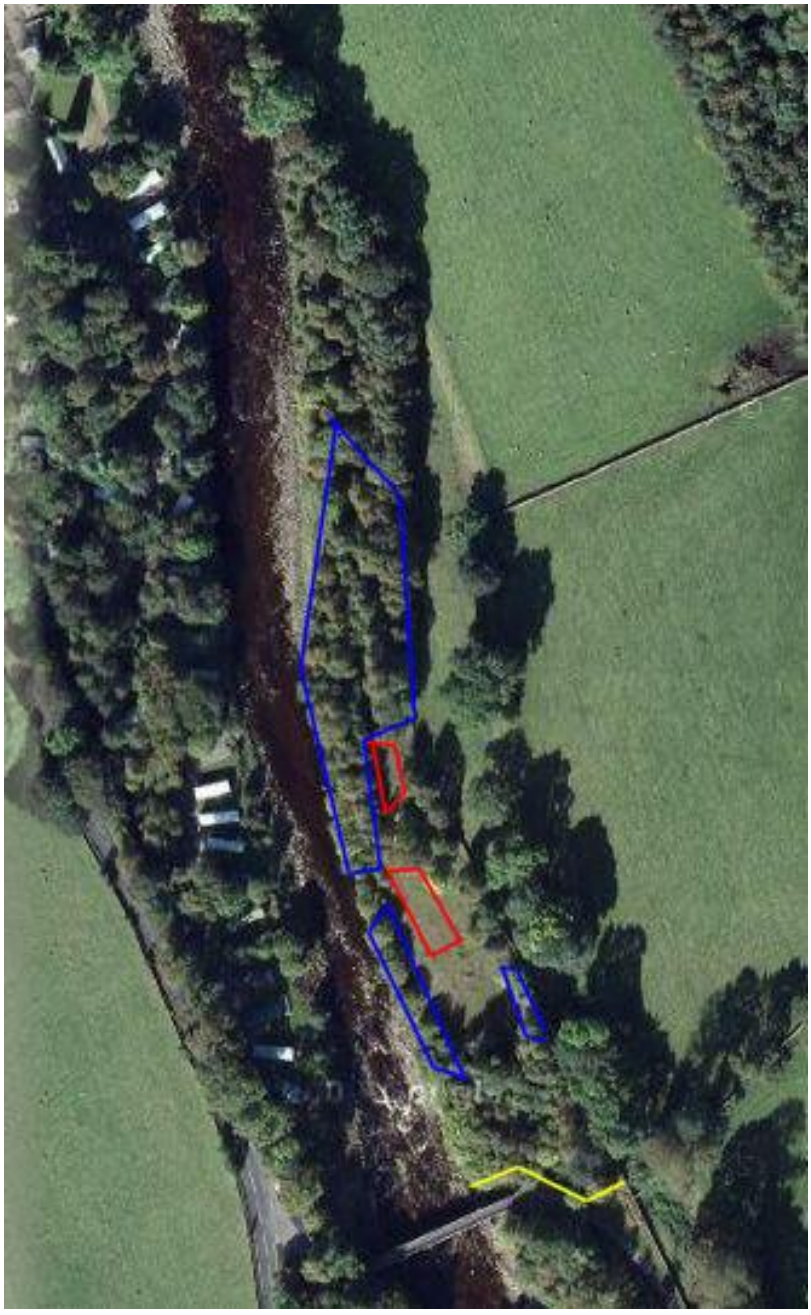


Fig. 4. Aerial photo of Williamston Reserve, with the area that has been stripped as part of the SOMM project being the smaller patch outlined in red. The other has not been done due to the potential for damaging existing calaminarian grassland. The areas outlined in blue are subject to scrub clearance but also support the dune helleborine, *Epipactis dunensis*.

3.3 Monitoring

Immediately after clearance there will be no vegetation in the cleared areas and it may be several years before there is any significant colonisation. That initial colonisation may not be indicative of longer term trends, as has been demonstrated by the field trial (Simkin, 2012), so long-term monitoring will be required to assess the success of these interventions. To assist in the interpretation of the results this should follow a similar method to that used in the field trial.

At least three fixed 1 x 1 m quadrats will be established in each of the cleared areas at Blagill, Burnfoot, Wydon and Williamston. This should be done in late summer, and the corners will be

located by reference to large boulders that are unlikely to move and to fixed points in the adjacent grassland, with sketch maps and photographs to ensure that they can be relocated. Quadrat markers rarely persist in this habitat and can encourage dog and rabbit activity that is deleterious to the experiment, so they will not be used.

The total number of quadrats to be set up will be between 15 and 24, to be finalised once the soil and vegetation stripping has been completed:

Blagill	2 or 3 x 3 quadrats
Williamston	1 x 3 quadrats
Burnfoot	1 or 2 x 3 quadrats
Wydon	1 or 2 x 3 quadrats

The percentage cover of all species of vascular plants, bryophytes and lichens should be recorded in mid-summer each year for the next 10-15 years, and a vertical photograph of each quadrat should be taken from above to provide a visual record.

Soil samples should be taken from the cleared areas in the first year after soil stripping, and again every 3 - 5 years. One sample is needed for each, bulked up from 5 sampling points and sieved to remove any stones >2mm diameter. This should be analysed for pH, organic content (LOI), total and available metals (Pb, Zn and Cd, using nitric and acetic acid digests respectively), and nutrients (N, P and K). I will collect and sieve the samples, but will EA then perform the analyses?

Analysis of this data may include univariate statistics on summary measures such as species richness, and multivariate analysis of the species data to show trends of plant community change. The fit to NVC communities OV37a and OV37b should also be calculated as this is a useful summary measure of the development of calaminarian grassland rather than non-metallophyte communities.

At milestone points, perhaps every 3-5 years to correspond to the soil sampling years, additional time should be allowed for analysis and reporting so that a summary report can be produced to inform future interventions on these and other similar sites.

3.5 Repeat vegetation and soil monitoring at Blagill

Blagill River Gravels is a nationally important calaminarian grassland site, but the river at this point is dynamic and still braided and it has been observed that several gravel bars supporting rare species have been lost or are threatened by recent floods. There has also been a recent change to site management with sheep now grazing the shingle bars.

A detailed baseline survey was carried out in 2000-2005 (Simkin, 2007) but has not been repeated since, so a full survey of the remaining plant, bryophyte and lichen populations is needed to inform site management and to set the habitat creation works into context. This should follow the same methodology as before. A full species list of the vascular plants, bryophytes and lichens in each calaminarian grassland compartment will be compiled, with estimates of abundance using the DAFOR scale, and the compartment extents will be mapped in the field as a sketch map on an aerial photo. The other plant communities on the site, including rough grassland, wetlands and the river, will not be surveyed.

Surface soil samples from each compartment (the terrace and each vegetated gravel bars) should be collected and processed in the same way as the stripped plot samples, for comparison with the samples taken during the baseline survey. This will provide quantitative measures of the rate of soil development and of any increase or decrease in heavy metal levels as a result of flooding and leaching. One sample is needed for each compartment, bulked up from 5 sampling points and sieved to remove any stones >2mm diameter. This should be analysed for pH, organic content (LOI), total and available metals (Pb, Zn and Cd, using nitric and acetic acid digests respectively), and nutrients

(N, P and K). I will collect and sieve the samples at the same time as doing the vegetation monitoring, but will EA then perform the analyses?

Further opportunities for mitigation works may be identified as a result of this monitoring.

4. References

Simkin, J.M. (2007) *The Vegetation and Management of Calaminarian Grassland in the North Pennines*. PhD thesis, Newcastle University

Simkin, J.M. (2011) *Calaminarian grassland*. Report for the North Pennines AONB Partnership.

Simkin, J.M. (2012) *Research Project on Management Methods for Calaminarian Grassland, report on 2012 monitoring*. Report for Tyne Rivers Trust

Simkin, J.M. (2015) Assessment of the proposed calaminarian grassland mitigation site at Blagill. Unpublished report for the Environment Agency.

Simkin, J.M. (2015) Notes on the condition of the South Tyne and Nent River Shingles after flooding in December 2015. Unpublished report.

Appendix 1 Assessment of proposed calaminarian grassland mitigation site at Blagill

1. Introduction

The Blagill river gravels (River Nent at Blagill SSSI, part of the Tyne and Nent SAC) support nationally important calaminarian grassland habitat with large populations of metallophyte plants and lichens. They are also an important geomorphological site, and one of the few reaches on the Nent-South Tyne catchment that is still active as a braided river, and include recently exposed archaeological features associated with the Foreshield Shaft on the Nent Force Level.

The large terrace in the middle of the reach, on the north side of the River Nent, is being considered as a possible site for surface soil and vegetation clearance to expose contaminated river gravels and restart the process of succession to species-rich calaminarian grassland. To be suitable for this the site must:

a) have significant areas without existing populations of species of conservation importance

b) have these species growing nearby, to act as a source of seed or fragments to recolonise the cleared ground

c) have a stable deposit within 25cm of the surface that will resist erosion by heavy rain and river floods once exposed, preferably an imbricated gravel with large clasts and with contaminated fines trapped in the spaces between them

d) the fines to be exposed must be sufficiently contaminated with Pb, Zn and/or Cd to support calaminarian grassland and resist colonisation by other plant species.

The terrace is unusual on the north Pennine river gravels in being largely comprised of fine flood sediments rather than gravel, and yet supporting plants typical of calaminarian grassland.

2. Methods

This investigation was carried out on site on 20th August 2015 to assess the site and to identify and map suitable areas for surface clearance. Only the terrace and the disturbed ground adjoining it was assessed because of the presence of breeding waders on the gravel bars, but information on the wider distribution of plants and lichens has been taken from a previous survey (Simkin, 2007).

3. Vegetation assessment

3.1 Habitat condition

The calaminarian grassland on the terrace is in excellent condition, and is one of the best of the remaining examples of this closed sward form of calaminarian grassland on the Nent-South Tyne river system. The damage caused by vehicles some years ago can still be seen on the ground but the tracks are now vegetating over and are being colonised by spring sandwort *Minuartia verna* and the distinctive red moss *Bryum pallens*.

The recent reintroduction of sheep has reduced sward height on the terrace, and the metallophytes, particularly the mountain pansies *Viola lutea*, appear to have responded quickly to the reduction in competition. While light grazing has clearly been beneficial to the terrace vegetation, care must be taken to ensure that sheep numbers are kept very low and that any supplementary feeding takes place away from the calaminarian grassland, for instance on the disturbed ground where the access track comes onto the terrace at the eastern end.

The effect of sheep and human trampling on the important terriciolous lichen populations south of the main river channel is also a concern. These were surveyed in detail 10-15 years ago (Simkin, 2007) so we have baseline data for comparison, and they should now be reassessed now to inform the future management of the site.

Some erosion of the southern edge has taken place over the last few years, as can be seen from the current terrace edge outlined on the aerial photograph taken some years ago (Figure 1).

2.2 Botanical interest

The terrace is dominated by sheep's fescue *Festuca ovina* with some common bent *Agrostis capillaris* and small areas of other grasses. Common mouse-ear *Cerastium fontanum*, sorrel *Rumex acetosa* and fairy flax *Linum catharticum* are scattered throughout, with smaller amounts of meadow buttercup *Ranunculus acris* and harebell *Campanula rotundifolia.* There are also populations of vascular plants, lichens and bryophytes of interest, and their distribution within the terrace is shown in Fig. 2.

a) **Spring sandwort *Minuartia verna*** is a metallophyte able to tolerate extremely high level of lead. On the terrace it has colonised the old bike tracks and is scattered throughout where there is not too much completion from grasses. It is frequent on stable gravel bars elsewhere on the site.

b) **Mountain pansy *Viola lutea*** is abundant throughout the western half of the terrace, less common elsewhere and scarce on the rest of the site. From the number of young plants on the terrace it appears to be spreading. Most of the flowers are of the purple form with some yellow marking that is most common on the Nent-South Tyne river gravels. The white and yellow forms used to be present but were not seen on this visit.

c) **Alpine penny-cress *Noccaea caerulescens*** is present as a few scattered plants in the eastern and southern parts of the terrace, and is scarce elsewhere on the site. Populations of this zinc hyper-accumulator have recently declined on most of the river gravels on the Nent-South Tyne river system, probably as a result of the reduced input of zinc and other heavy metals from floods.

d) **Pyrenean Scurvy-grass *Cochleria pyrenaica*** is a lead-tolerant metallophyte of damp lead contaminated ground, and here is found in the damp ground in the NE corner of the terrace and on the active gravels below where the river floods frequently. Elsewhere on the site it is a useful indicator of contamination levels of thee active gravel bars, being abundant on those with significant levels of lead or zinc but absent from those that do not. There is a good example of this immediately to the south of the terrace.

e) ***Bryum pallens*** is an ecologically important moss of calaminarian grassland, being an early coloniser of lead and zinc contaminated sediments and playing a role in stabilising the surface and sheltering germinating metallophyte seedlings. It has a distinctive deep red colour. On the terrace it is still present on the old bike tracks, but is decreasing as they grass over, and there may be a similar decrease elsewhere on the site.

f) **Grass of Parnassus *Parnassia palustris*** is found on several lead mines and river gravels in the North Pennines and appears to have some tolerance of lead. Here there is a small population on damp, previously disturbed, ground along the northern edge of the terrace.

g) **Terricolous lichens** are present in small areas near the terrace edge where the ground has escaped disturbance. Much larger and more diverse lichen populations used to be present on the gravel bars to the south and west of the terrace, but a repeat survey is now needed to assess their condition and extent.

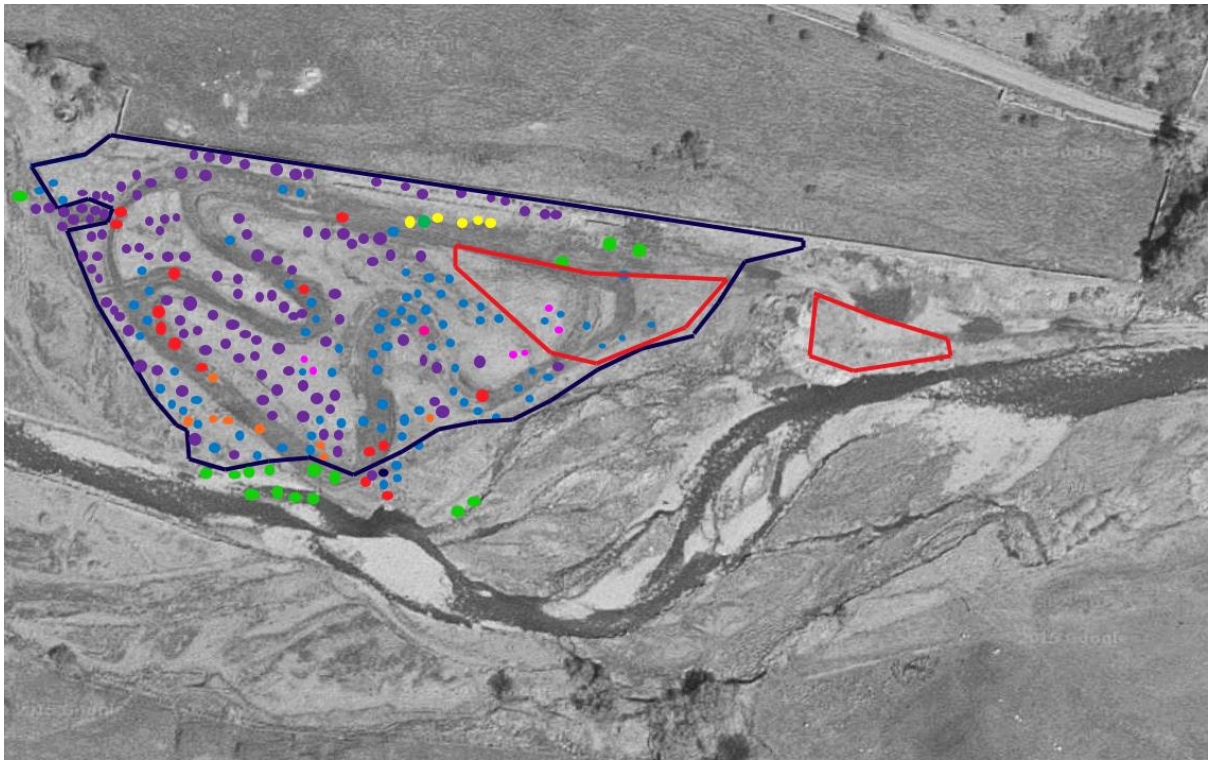


Fig. 1. Aerial photograph of the central part of the site, showing the river channels (now out of date as there have been channel movements since this was taken), and the terrace. The current edge of the terrace is outlined in black, and the two possible areas for intervention are outlined in red. The dots indicate species of interest: red – *Bryum pallens*, green - *Cochlearia pyrenaica*, purple – *Minuartia verna*, pink – *Noccaea caerulescens*, yellow – *Parnassia palustris*, purple – *Viola lutea*, orange – lichen communities.

The abundance of metallophytes across much of the terrace rules those areas out of any mitigation scheme, but there may be two areas from which the surface could be stripped without significant impact - the NE corner of the terrace itself, and the already disturbed ground to the east (Fig. 2, outlined in red). Both areas would be limited in extent by the need to maintain access for vehicles, and any plants of *Noccaea caerulescens* should be translocated to another suitable location on the terrace before any work is done.

In both cases, however, the vegetation and the lack of metallophytes suggests that heavy metal concentrations at the surface are currently below phytotoxic levels. Soil pits should be dug to determine the nature of the substrate at this point, and in particular the depth of fines above the gravel, and soil samples should be analysed for heavy metals from 10cm, 20cm and 30cm depth to determine whether the substrate is suitable.

3. Substrate assessment

3.1 Geomorphological history

The terrace is noticeably higher than the gravel bars that support lichen-rich calaminarian grassland immediately to the south and west, and as the rivers in this area are undergoing a phase of incision it can be assumed that it is older. It also has a rather different composition, with a considerable depth of fine sediments and no exposed stone at the surface (other than archaeological features.

The geomorphological history of the Blagill river gravels was first studied by Mark Macklin (Macklin, 1986). Dating gravels bars is difficult, but some evidence can be derived from analysis of old maps and by lichenometry (using the known growth rate of a lichen that is an early coloniser of sandstone boulders, *Porpidia tuberculosa*), but the lack of exposed stone on this higher terrace makes it impossible to date by that method.

Macklin's interpretation of the evidence is shown in Figure 4. The lichenometry dates have since been reworked as part of an ecological study (Simkin, 2007), but the overall interpretation of change from the single channel river form shown on the 1775 and 1820 maps to an actively braided river by 1861, and gradual reversion to the single channel from the eastern end since 1980, remains unchanged. The terrace appears to have been in place throughout this time, but with erosion along the southern edge as the river channels moved.

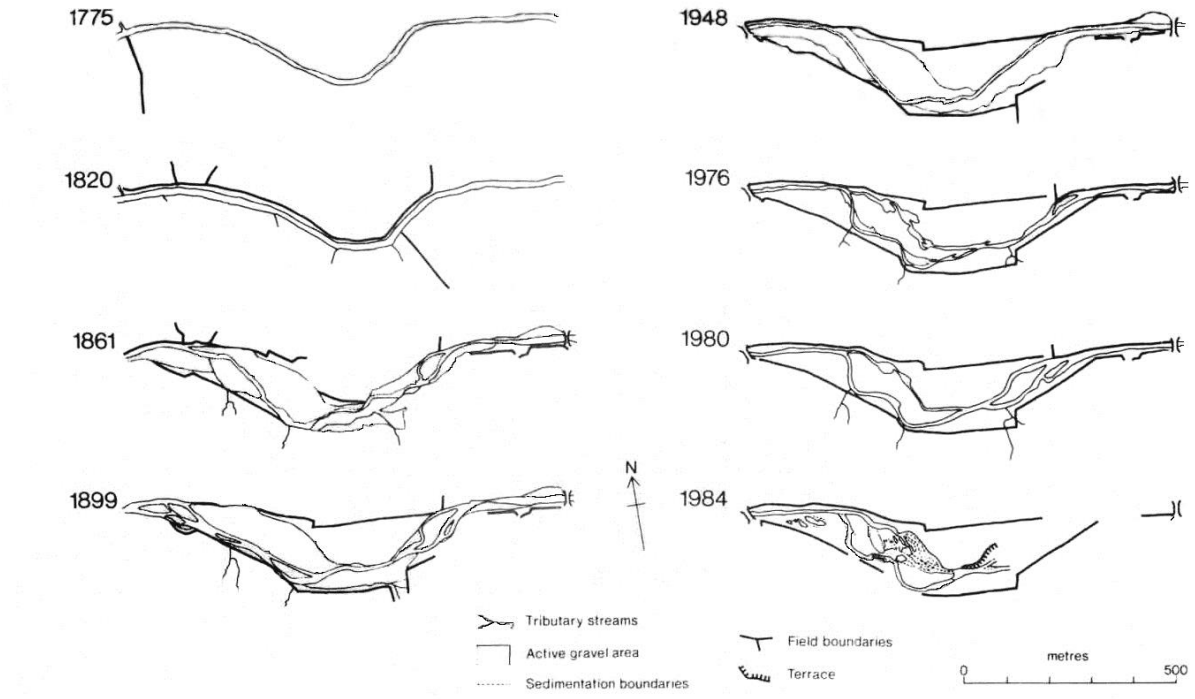


Fig. 2. Changes in river channels and gravel bars in the Blagill-Foreshield reach of the River Nent (from Macklin, 1986).

3.2 Substrate

The photographs of recently exposed sections through the terrace (Figs. 3 and 4) show at least 1 m depth of fine sediments, with a thin layer of scattered stones and gravel at approximately 30 cm depth.

The remains of a drystone wall are now exposed in the eroding edge, and from its position and angle this appears to part of the length shown on the southern tip of the terrace in the 1861 map. This must be the remains of the wall that originally followed the north bank of the river in 1820 but is not shown on the 1775 map. It is now buried in sediment with only the top of the wall showing (Fig. 5).

The nearby lower gravel bars have been dated to 1908-1951, but these dates relate to when the gravel bars became sufficiently stable for lichens to establish on the larger stones so the dates when they were created would have been rather earlier. This suggests that the terrace accumulated this depth of fine sediment between 1820 and about 1900, the period that coincides with the most intense mining and smelting activity at Nenthead a few miles upstream and during which there were many river floods on the South Tyne, Allens, and presumably also on the Nent although there are

few records to support this. The obvious layers in the sediment, with dark lines that appear to be soil layers, are consistent with this high frequency of floods, with periods of stability between when the terrace began to revegetate. At least one flood, towards the end of this time, left pebbles and stone fragments strewn across the surface. Major floods on the South Tyne or Allens were recorded in this period in 1824, 1829, 1842, 1856, 1868, 1877, 1881, 1883, 1900 and 1903 (Archer 1992), with the 1900 flood being the greatest on the Allens since the Great Flood of 1771.

On this basis the fine sediments in the terrace, at least to the depth of the old wall, can be taken to be of mining age, and given the proximity to the mines and smeltmill at Nenthead they are likely to be highly contaminated with lead, zinc, cadmium and other heavy metals throughout. This should be confirmed by soil analysis prior to any intervention.

Fig. 3. Section through the terrace, showing the line of scattered stones at approximately 30 cm depth. The ruler is 1 m length, and the depth of the deposit at this point at least 110 cm.

Fig. 4. Another section through the terrace, recently cut as the river channel moved north. The ruler is 1m length, and the depth of the deposit at this point at least 120cm, and there is no stony layer exposed at this point.

Fig. 5. Section through the terrace, showing a buried wall of unknown age buried by the flood sediments. The wall is running at a shallow angle to the section so about 1 m of its length can be seen. Only the top stones now shows on the ground.

4. Recommendations

Before any decisions are taken on intervention on this site, further investigation is needed:

a) Soil profiles and substrate analysis for heavy metal concentrations, in the two areas identified for possible intervention. As this is a geomorphological SSSI, NE permission will be required for digging the pits.

b) Once the depth of material to be removed is known, an assessment of the impact on flood water flows, channel movements and erosion.

c) Botanical, lichen and bryophyte survey of the gravel bars in the rest of the site to assess changes since the baseline surveys 10-15 years ago, and the impact on the lichen-rich calaminarian grassland communities of the reintroduction of sheep grazing.

d) Surface soil sampling and analysis from the terrace and gravel bars for comparison with baseline data, to assess changes in substrate contamination levels over the last 10 years. This is needed to support the interpretation of any changes in the vegetation.

5. References

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