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North Yorkshire Polyhalite Project

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PHASE 5 NOISE AND VIBRATION MANAGEMENT PLAN

NYMNPA
25/05/2018

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REPORT

Phase 5 - Woodsmith Mine Noise and Vibration Management Plan

Woodsmith Mine Phase 5 - NVMP

Client: Sirius Minerals plc

Reference: 40-RHD-WS-70-EN-PL-0027 REV 2

Revision: 0.4/Final

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Document Sign-Off

This document forms the Noise and Vibration Management Plan (NVMP) to address construction works associated with the Phase 5 Works at Woodsmith Mine. The NVMP was produced to address the requirements of Planning Condition NYMNPA-18.

The Contractor(s) commit(s) to comply with all noise and vibration management approaches and procedures detailed herein.

.....
(Contractor) (Date)

The remainder of this document contains technical information to support the NVMP and address the requirements of the Planning Condition. The document may be revised and updated as the project progresses.

1 INTRODUCTION

1.1 Purpose of this Report

- 1.1.1 In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to North York Moors National Park Authority (NYMNPAA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning permission was subsequently granted in 2015 subject to conditions, as varied in February 2018 by NYM/2017/0505/MEIA.
- 1.1.2 This document has been prepared on behalf of Sirius Minerals plc (Sirius Minerals) and details the requirements with respect to noise and vibration management for the Phase 5 Works (see Paragraph 1.1.4 below) at Woodsmith Mine. This document is required to partially satisfy the requirements of Condition 18 of the NYMNPAA planning permission. It has been prepared in accordance with current good practice. This planning condition states that:

Table 1-1: Condition NYMNPAA 18 Noise and Vibration Management Plan

NYMNPAA 18	Compliance with Condition NYMNPAA-18
Prior to the commencement of the development at Dove's Nest Farm or Lady Cross Plantation, a Noise and Vibration Management Plan (NVMP) for the control, mitigation and monitoring of noise and vibration for both construction and operational phases at the two sites shall be submitted to and approved in writing by the MPA in consultation with the SBC EHO. The scheme shall set out the following:	This document addresses Phase 5 Works at Woodsmith Mine. Works at Lady Cross Plantation are deferred and are therefore not addressed in this Plan.
Noise-sensitive receptors for which predictions shall be made and at which the noise and vibration limits shall apply and which shall include recreational receptors.	Section 3.1
Predicted noise levels at the noise-sensitive receptors from noise and vibration generated at the DNF and LCP sites for the key construction phases during the forthcoming year including any periods in which the higher daytime limit of 70 dB L _{Aeq} shall apply (permitted 56 days for temporary works to create noise-reducing bunds and/or barriers as per Conditions 16 and 18).	Section 3, and Appendix C
The best practicable means which will be used to control noise and vibration levels on site including such measures proposed in the Environmental Statement and Supplementary Environmental Information. Such measures shall include, but are not limited to: the use of the quietest available plant, equipment and techniques; the regular maintenance and inspection of such plant and equipment; the use of cladding, attenuators and barriers to reduce noise levels from noisy plant and operations; the specification of appropriate reversing alarms to minimise annoyance; and, measures to reduce vibration and air overpressure during blasting.	Section 5
Details of the noise and vibration monitoring system to be installed around the DNF and LCP sites to continuously log noise levels during construction and operation. The system shall include at least six noise monitors installed around the boundary of the Dove's Nest site and at least four monitors at key residential receptors near the Dove's Nest site and at least four noise monitors around the Lady Cross Plantation Site and at least three monitors at key residential receptors near the Lady Cross Plantation site.	Section 4
The precise number and location of noise monitors shall be set out in the NVMP. The developer shall use reasonable endeavours to obtain access to the residential receptor properties for the installation of noise monitors and only if access cannot be obtained the number or location of noise	Section 3, Section 4 and Figure B.1

NYMNPA 18	Compliance with Condition NYMNPA-18
monitors may be reduced. The MPA and the SBC EHO and/or their advisers shall be granted access to inspect the noise and vibration data whenever required, records of the data should be kept for a reasonable period and these records should be accessible by the public.	
Details of the procedure to be followed in the event that the noise predictions detailed in the NVMP or the noise limits detailed in conditions 16 to 19 are exceeded. Such procedures shall require the investigation of the reasons for the breach of the limits and the cessation of the activity causing the breach until such a time as additional mitigation can be provided.	Section 5.4
Details of how the residents will be informed and consulted about the site operations and progress, particularly in regard to blasting and especially noisy operations including details of complaints logging and management procedures and a 24-hour telephone incident hotline. Details of the procedure for investigating complaints and informing complainants of the results of such investigations and of any actions resulting from them.	Section 5.4
The NVMP shall be adhered to at all times unless agreed previously in writing by the MPA.	A document sign off section has been included within this report requiring the Contractor to commit to compliance with the NVMP
The NVMP shall be updated and agreed whenever appropriate to reflect changes in the programme during construction and operation and at intervals not less than 6 months after the initial start on site and thereafter annually.	Section 1

1.1.3 This NVMP relates to the Phase 5 Works at Woodsmith Mine and does not include any activities at Lady Cross Plantation, as these works have been deferred. The NYMNPA has confirmed that it supports this approach.

1.1.4 Activities identified in previous NVMPs will continue past the start date of Phase 5. This NVMP therefore supersedes those upon the commencement of Phase 5 and considers processes and controls with respect to all activities on site throughout Phase 5. Activities required for Phase 5 comprise the following:

- Construction of Service Shaft foreshaft chamber to a depth of 168.7m AOD;
- Construction of Service Shaft permanent winder foundations to a depth of 197.17m AOD;
- Construction of Service Shaft permanent winder basement to a depth of 194.17m AOD;
- Construction of Service Shaft permanent building foundations to 202.2m AOD;
- Dewatering of Service Shaft foreshaft and platform to facilitate excavations;
- Excavation and construction of a working platform area on the western edge of the Production Shaft platform, with an AOD of 203.7m; and
- Stockpiling of extractive material for re-use.

Planning Conditions

1.1.5 In addition to Condition NYMNPA 18, two further conditions NYMNPA 20 and NYMNPA 21 establish noise limits relating to the Woodsmith Mine site (see **Section 2.2**).

1.1.6 In this document, the term 'construction' includes all physical and related engineering and construction activities associated with the Phase 5 Works, as described above. Updates to this plan will be prepared and submitted to the NYMNPA for approval in advance of subsequent construction phases and following any material design or method change.

2 GUIDANCE

2.1 Legislation and British Standards

2.1.1 As a minimum, the Contractor will adhere to the following standards:

- BS 7445:2003 – Description and measurement of environmental noise; and
- BS 5228:2009+A1:2014 – Code of Practice for noise and vibration control on construction and open sites.

2.2 Construction Noise Limits

2.2.1 Established construction noise limits (as measured at the identified receptors) remain as:

- 55dB $L_{Aeq,1hr}$ for daytime (07:00 – 19:00);
- 65dB $L_{Aeq,1hr}$ for the demolition of buildings and erection of new structures;
- Up to 70dB $L_{Aeq,1hr}$ for temporary noisy operations to provide noise-reducing earth bunds and / or barriers; and
- 42dB $L_{Aeq,1hr}$ for evening and night-time (19:00 – 07:00).

2.3 Construction Method

2.3.1 Contractors associated with the Phase 5 Works (see Construction Environmental Management Plan (CEMP; reference 40-CAR-WS-8300-PA-MS-00001)) have provided details of the construction masterplan, number and type of plant items to be used and location/duration of construction activities within the site. The Construction Method Statement for the Phase 5 Works (reference 40-CAR-WS-1000-PA-MS-00001) outlines the proposed approach.

2.3.2 **Appendix C** details the plant items used within the model, their sound power level and location on site. Predictions of noise levels based upon these details are assessed within this NVMP.

2.3.3 For the purposes of this NVMP the works have been considered as the following sub-phases:

- Phase 5.1 – Excavation to -3m
- Phase 5.2 – Capping beam;
- Phase 5.3 and 5.4 – Backfilling and excavation to -6.1m;
- Phase 5.5 and 5.6 – Excavation to -9m, uplift anchors;
- Phase 5.7 – Capping beam, uplift anchors;
- Phase 5.8 – Winder foundations and walls cast, continuing excavation; and
- Phase 5.9 to 5.13 – Backfill and continuing excavation.

3 PREDICTED CONSTRUCTION NOISE AND VIBRATION LEVELS

3.1 Baseline Receptor Locations

3.1.1 Residential and recreational receptors for this NVMP remain as identified in the Environmental Statement (ES) which accompanied the planning application, in previous iterations of the NVMP (e.g. Phase 4 NVMP; document reference 40-RHD-WS-70-EN-PL-0017), and as shown in **Figure B1 (Appendix B)**.

3.2 Predicted Noise Levels

- 3.2.1 Noise modelling was undertaken to provide predictions of noise levels throughout the Phase. **Tables C.1 to C.6** in **Appendix C** outline the construction noise assessment predictions for the Phase 5 Works.
- 3.2.2 Noise levels due to construction activities in the Phase 5 Works were not predicted to exceed the agreed construction noise limits at any of the identified noise-sensitive receptors during the daytime, evening or night-time following the application of suitable measures, including phasing and physical mitigation.

3.3 Vibration

- 3.3.1 Ground borne vibration was considered according to the conservative approach outlined in previous NVMP (e.g. Phase 4 document reference 40-RHD-WS-70-EN-PL-0017; see Table C.7, Appendix C for minimum set-back distances for vibration levels of reportable significance).
- 3.3.2 All identified sensitive receptors are at least 180m from the nearest site boundary, and the minimum distance between the primary haul route and any of the surrounding receptors is over 400m. Therefore ground-borne vibration levels will be below levels considered to be 'just about perceptible in residential environments'¹.

4 NOISE AND VIBRATION MONITORING PROGRAMME

4.1 Vibration Monitoring

- 4.1.1 As construction activities during Phase 5 will not give rise to significant levels of vibration at sensitive receptors, vibration monitoring is not proposed during this phase.

4.2 Noise Monitoring

- 4.2.1 Continuous noise monitoring, as required by condition NYMNPA 18, is being undertaken during construction at three key residential receptor locations and seven boundary locations as described in previous NVMP (e.g. Phase 4 document reference 40-RHD-WS-70-EN-PL-0017) and shown in **Appendix B, Figure B1**.
- 4.2.2 Monitoring commenced at each location on 4 April 2017 and continues to operate in compliance with relevant guidance as outlined in previous NVMP (e.g. Phase 4 document reference 40-RHD-WS-70-EN-PL-0025). The Sound Level Meters (SLMs) record L_{Aeq} , L_{Amax} , L_{A90} , and L_{A10} data with a 'fast' time constant and A-weighting (see **Appendix A** for descriptions of these terms). Weather condition monitoring is carried out simultaneously.
- 4.2.3 A system of real time alerts allows remote monitoring of noise levels. Alerts are managed by the Contractors, who respond to any potential breaches appropriately. Reports are produced monthly for submission to SBC and NYMNPA, confirming the measured noise data at each location and cross-referencing to corresponding weather data and Works Contractor Site Activity Logs. The full dataset is presented in graphical format.

¹ Planning Policy Guidance Note 24 (PPG24, 1994), Department for Communities and Local Government

5 MITIGATION AND PROCEDURES

5.1 Purpose of the Section

- 5.1.1 This section outlines measures to be taken by the Contractors to limit, and manage the impact of, noise. This section also outlines the Best Practicable Means and specific mitigation actions to be adopted.

5.2 Best Practice Measures

- 5.2.1 The Control of Pollution Act (1974) and BS 5228:2009+A1:2014 define working methods and mitigation measures referred to as Best Practicable Means (BPM). Appropriate BPM, set out in previous NVMPs (e.g. Phase 4, reference 40-RHD-WS-70-EN-PL-0017), will continue to be applied to the Phase 5 Works.

Management Structure and Responsibilities

- 5.2.2 While overall responsibility for compliance with environmental and approvals requirements will remain with Sirius Minerals, all Contractors working on site are accountable for undertaking the construction activities in line with the requirements of this NVMP.
- 5.2.3 The CEMP (reference 40-CAR-WS-8300-PA-MS-00001) provides details of the lines of responsibility for environmental management (including relating to robust implementation of noise management and mitigation measures) during the Phase 5 Works.

Maintenance

- 5.2.4 Maintenance of plant will be carried out routinely and in accordance with the manufacturers' guidance. Daily inspections will be undertaken as described in previous NVMPs (e.g. Phase 4, reference 40-RHD-WS-70-EN-PL-0017).

Training

- 5.2.5 The site induction programme and site rules will include good working practice instructions for site staff, managers, visitors and contractors to help minimise noise, as set out in previous NVMPs (e.g. Phase 4, reference 40-RHD-WS-70-EN-PL-0017).

5.3 Specific Mitigation

Bunds

- 5.3.1 The bunds to the north and north--east of the platform area currently have an access gap between them. This gap will be closed to form a continuous bund by extending the north-eastern bund (which is 7m above ground level).

Activity timing, barriers, screens and enclosures

- 5.3.2 Temporary screens of 3m in height will be placed behind the diaphragm walling cutters (screens are demountable, to enable positioning at the side of the cutters facing receptor NM1). Screens will also be placed around the upper parts of the bentonite plant, thereby enclosing the vibrating screens.
- 5.3.3 Excavator-mounted rock breakers will be fitted with proprietary muffling devices to achieve a reduction in noise level of at least 10dB(A).
- 5.3.4 A continuous barrier of 5m in height (comprising shipping containers with an absorptive treatment to the inner face) will be erected to the north, east and south (at a distance of approximately 6m from the boundary of the Service Shaft) before rock breakers are utilised.
- 5.3.5 Excavation during Phases 5.1 to 5.3 (i.e. close to current platform level) will be undertaken using standard excavator buckets.
- 5.3.6 Throughout Phase 5, when shaft excavation is underway, no other surface works (cranes, dump truck filling etc.) associated with those works described in Section 1.1.4 will be undertaken during the evening and night.

5.4 Communications

Procedure for complaints or breach of limits

- 5.4.1 The procedures to be followed in the event of a complaint or a breach of permitted noise limits will remain as set out in previous NVMPs (e.g. Phase 4, reference 40-RHD-WS-70-EN-PL-0017).

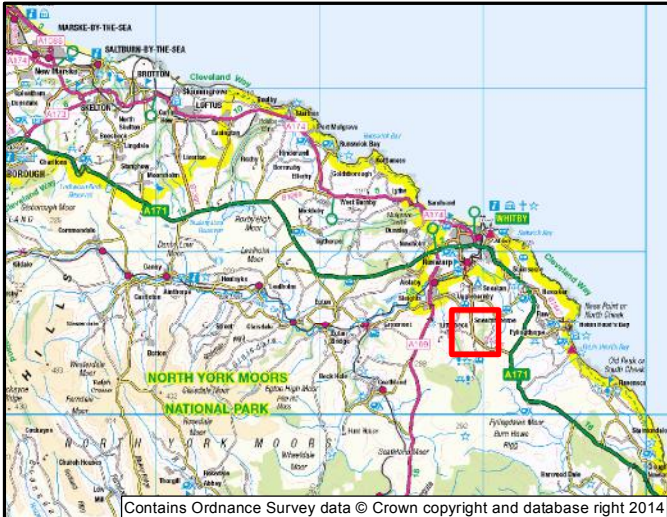
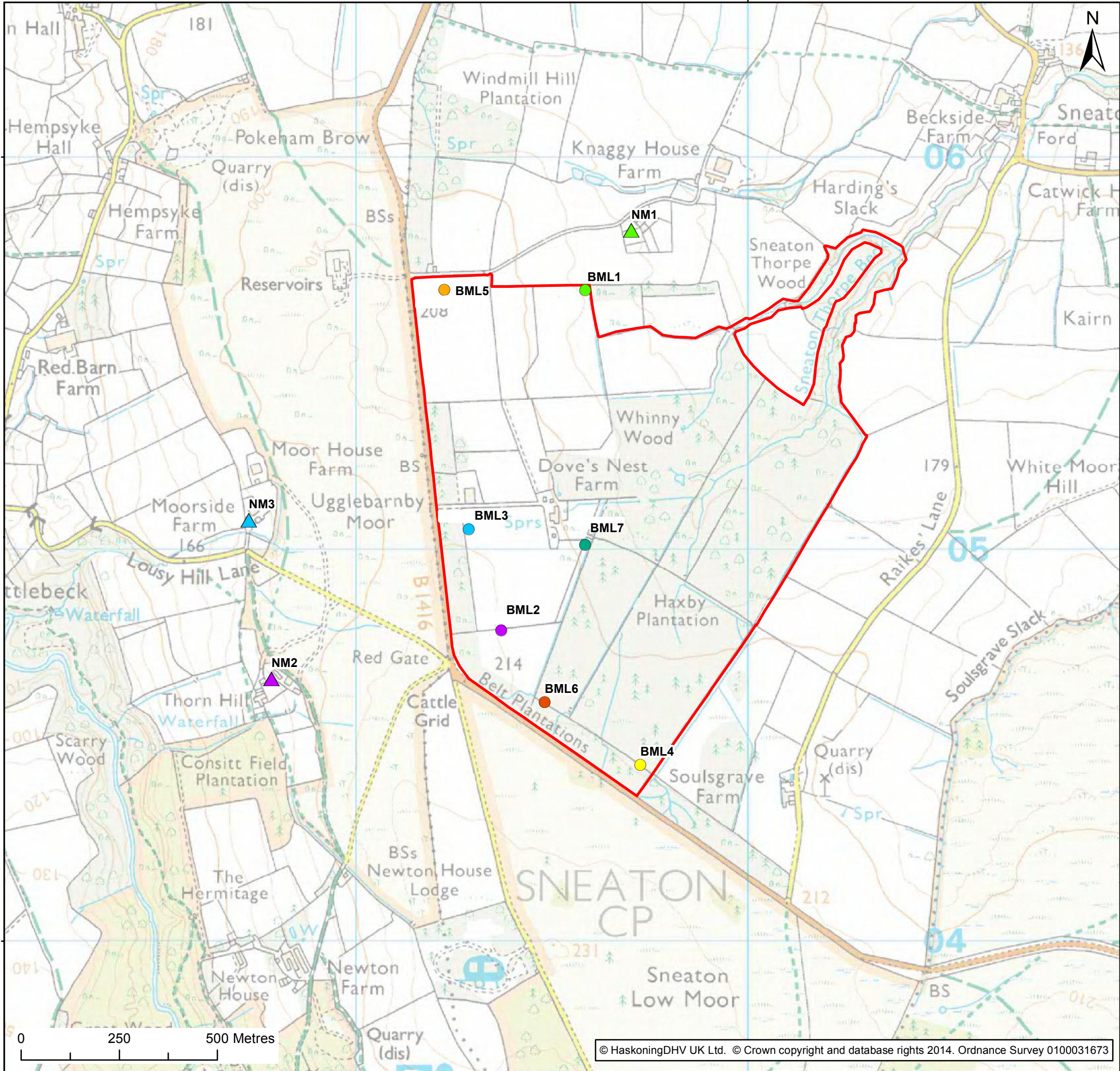
Public relations

- 5.4.2 Good public relations with local residents in nearby noise-sensitive receptors will be maintained.
- 5.4.3 A Community and Stakeholder Engagement Plan is provided in Appendix 4 to the Phase 3 CEMP (40-RHD-WS-70-EN-PL-0014). It remains valid for Phase 5 Works, and details actions to be taken by Sirius Minerals plc and the Contractors.

Appendix A Acoustic Terminology

Term	Definition
Noise sensitive receptors	People, property or designated sites for nature conservation that may be at risk from exposure to noise and vibration that could potentially arise as a result of the proposed development/project
Noise and Vibration study area	The area assessed for noise and vibration impacts during this assessment
Baseline scenario	Scenarios with the proposed development/project not in operation
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μ Pa, the threshold of normal hearing is 0dB, and 140dB is the threshold of pain. A change of 1dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3dB(A) is the smallest perceptible change.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142:2014 it is used to define the 'background' noise level.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
'A' weighting	A frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Fast time constant	Sound level meters have two conventional time weightings, F = Fast and S = Slow with time constants of 125 ms and 1000 ms respectively. Fast time constant relates to the response time of the meter which allows rapid variations in noise level to be registered.

Appendix B Figures



- Legend:
- Land Ownership Boundary
 - Receptor Monitoring Locations**
 - ▲ NM1 - Parkdown Bungalow
 - ▲ NM2 - Thornhill
 - ▲ NM3 - Moorside Farm
 - Site Boundary Monitoring Locations**
 - BML1 - Parkdown Bungalow
 - BML2 - Thornhill
 - BML3 - Moorside Farm
 - BML4 - Soulsgrave Farm/Wainwright Coast to Coast Walk
 - BML5 - Lound House
 - BML6 - Sneaton Foss/Falling Foss
 - BML7 - Between shaft sinking area and BML4

Client:	Project:
Sirius Minerals plc	Sirius North Yorkshire Polyhalite Project

Title: Proposed Residential Receptor and Boundary Noise Monitoring Locations

Appendix: A	Figure: A.1	Drawing No: 40-RHD-WS-70-EN-PL-0016-F001			
Rev: 0	Date: 08/09/2017	Drawn: DC	Checked: AB	Size: A3	Scale: 1:10,000

Co-ordinate system: British National Grid

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Enhancing Society Together

Appendix C Predicted Construction and Demolition Noise and Vibration Levels

The predicted noise levels detailed within the tables below are considered to represent the most conservative scenario.

Table C.1 Calculated highest noise levels during Phase 5 – Daytime

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum Predicted $L_{Aeq,1hr}$ dB
Parkdown Bungalow	55	50.9
Moor House Farm	55	49.3
Moorside Farm	55	48.1
Thornhill	55	46.6
Soulsgrave	55	45.9
Wainwright Coast to Coast Path	55	44.7
Sneaton Foss Caravan Park	55	44.5
Falling Foss Tearooms	55	31.5
Lound House Caravan Park	55	44.5

Table C.2 Calculated highest noise levels during Phase 5 – Evening and night time

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum Predicted $L_{Aeq,1hr}$ dB
Parkdown Bungalow	42	41.6
Moor House Farm	42	41.2
Moorside Farm	42	39.6
Thornhill	42	40.6
Soulsgrave	42	41.1
Wainwright Coast to Coast Path	42	39.8
Sneaton Foss Caravan Park	42	40.7
Falling Foss Tearooms	42	23.6
Lound House Caravan Park	42	37.0

During the past year, visits have been made to the various receptors for equipment maintenance and monitoring purposes. At those receptors to the south and west of the site (particularly Moorside, Thornhill and the Wainwright Coast to Coast Path) it was observed, over a number of visits, that site noise is generally inaudible at these locations. The predicted noise levels in the tables above can, therefore, be considered a very conservative worst case.

Modelling Assumptions

The following equipment and associated sound power levels were used within the SoundPLAN noise models:

Dewatering

1no. flush circulation pump (Selwood H80 Super Silent), 96dB(A), 100% ontime daytime
 1no. flush suction pump (Selwood S150 Super Silent), 92dB(A), 100% ontime
 Compressor, 97dB(A), , 100% ontime daytime

Platform Extension

2 x Excavators 20T - 103dB(A) CAT 320, daytime only
 2 x Dozers D6 - 109dB(A) daytime only

2 x Wheeled dumpers 9T Volvo A30D - 109dB(A) daytime only
2 x Single-drum Rollers 30T - 108dB(A) daytime only
Delivery lorries 20T / 28T - 108dB(A) daytime only

Diaphragm Walling

1no. MC128 Diaphragm Walling Rig, measured 110dB(A), 100% ontime
2no. MC96 Diaphragm Walling Rigs, measured 108.1dB(A) 100% ontime (Production Shaft)
Crawler crane, 1no. 90t Kobelco CKE900G or similar, 110dB(A) daytime only
Crawler crane, 1no. 160t Liebherr LR1160 or similar, 105dB(A) daytime only
Mobile crane, 110t Liebherr LTM 1100 or similar, 110dB(A) daytime only

Vertical Shaft Sinking

1x Vertical Shaft Sinking Machine (surface equipment including hydraulic winches) – 101dB(A)
1 x 1MW Generator – 108.1dB(A) (on standby)
1 x Desander – 108.1dB(A)
Mobile crane, 110t Liebherr LTM 1100 or similar, 110dB(A)
1x front end loader – 109dB(A) CAT 966M or similar

Excavation of foreshaft

2x 22t Excavator mounted muffled rock breakers (buckets during Phase 5.1), 111dB(A) (99dB(A))
1x 35t Excavator moving rubble, 114dB(A)
4x ATD, 109dB(A)
4x Tower Lights, 85dB(A)
1x Crawler Crane, 110dB(A)
1x Mobile Crane, 110dB(A)
60kVA Generator, 86dB(A)
1x Concrete Truck discharging, 111.6dB(A)
2x Drill rigs, 114dB(A)
2x Poker Vibrators, 112dB(A)
Dump truck being loaded, 115dB(A)
Bulk skip filling, 114dB(A)

Other

Lime Plant – 107dB(A)
Crusher – 109dB(A)

Mobile equipment was modelled as a moving point line source with speeds of between 5 and 20kph.
Stationary plant was modelled as a point source.

Noise propagation was calculated using the BS5228:2009+A1:2014 methodology.