

Appendix 11: Lighting Impact Assessment (June 2017) with associated plans and assumptions

Sirius Minerals Plc
Woodsmith Mine Minehead
Basis of Design - External Lighting

REP-P2-EL-002

Rev 6 | 13 July 2017

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.




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1 Introduction

Arup has been appointed by Sirius Minerals Plc to develop the design proposals for the above ground external lighting scheme at the Woodsmith Mine Minehead site to support a Section 73 planning submission.

This document summarises the discussions and briefings undertaken with Sirius Minerals to establish an understanding of the night time operational requirements of the proposed site. These discussions and agreed assumptions are captured within this Basis of Design report. The principles will be adopted in the development of the permanent and construction phase external lighting strategy by the Contractor as part of their temporary and permanent lighting strategy works.

1.1 Design Guide Objectives

The aims of this design guide are to:

- Ensure the lighting design is appropriate for the intended site location
- Ensure that safety issues are addressed in the design of the site layout
- Set out and agree technical design criteria with Sirius Minerals prior to completing the detailed design
- Set out and agree the Basis of Design to governing standards, codes and good practise.

The ecologically sensitive location of the site requires that the visual impact of the lighting scheme should be kept to a minimum. This forms a key priority in development of a sensitive lighting scheme without compromising safety.

2 Site Constraints

The site occupies a prominent elevated position on the B1416 close to Whitby, within the North Yorkshire Moors National Park. As such a planning application will be subject to stringent requirements in relation to lighting performance, light obtrusion, equipment visibility and environmental impact of the proposed installation.

The area is highly sensitive with neighbouring properties looking directly onto the site, and farmland surrounding the Minehead.

2.1 Operational Phase (Post Construction) Statements and Assumptions

The following operational assumptions have been made in the development of the lighting strategy:

2.1.1 General

The Site General Arrangement drawing YP-P2-CX-031 has been used for details of the proposed site layout.

Due to the nature of the local environment it has been assumed that the North Yorkshire County Council does not anticipate any improvements to the public highway in relation to lighting. The proposed main site entrance will remain unlit and lighting will only be installed on the access road approach to the gatehouse. The shaft platform secondary entrance will remain unlit.

Each area containing a task or potential hazard has been considered in turn in relation to the need for lighting. The general position for all areas has been to establish whether the provision of no permanent lighting would represent an unacceptable hazard to the safety of personnel on the site. Therefore, if the area has no requirement for use after dark or the risk of hazard was considered to be low then no lighting has been proposed.

2.1.2 Vehicular Movement

Vehicular movement at night can be generally defined in three primary categories:

- Personnel arriving/departing in accordance with shift patterns.
- Transportation of personnel from the Welfare Facility to place of work.
- Deliveries to site.

2.1.2.1 Arrivals/departures

Vehicle traffic will approach the main gate from the B1416 along the access road. As the B1416 and junction will be unlit, it is unnecessary to light the access road as a whole.

As traffic approaches the main gate, lighting will be required to improve visibility of hazards and ensure safe movement of vehicles, particularly within the vicinity

of the gatehouse, turning circle and security layby. Enhanced lighting levels around the gatehouse will aid security.

Vehicles will enter the site via the main gate and park within the Welfare Facility car park.

The car park will have periods where pedestrians and vehicle traffic will share the car park surface. To ensure the safety of staff during hours of darkness, the car park will require to be lit. The lighting classification has been selected to represent the lowest recommended criteria within the relevant British Standard.

2.1.2.2 Transportation of personnel within the site.

Transportation of personnel across the site will generally be by shuttle bus between designated pick-up points. The majority of these movements at night will be during shift change.

Industrial and management staff beginning shifts will board the site transportation buses undercover within the Welfare Facility. Transport will shuttle the shift change from the Welfare Facility to the minehead complex.

Lighting will be provided above ground in the vicinity of the Welfare Facility and conflict zones where shuttle vehicles and staff vehicles share the same space. This is required to ensure safe movement of staff vehicles and transport shuttles during busy periods.

Within the minehead complex area lighting for vehicles will only be provided within areas where staff and vehicles may share space.

All other routes between the Welfare Facility and work areas will remain unlit. Lighting for safe movement of traffic will be reliant on the use of vehicle headlights only. Consideration should be given to the use of low level retro-reflective bollards and/or “cats eye” studs to denote the edge of traffic routes

Personnel will generally remain in their allocated work area for the duration of the shift. Traffic between the minehead complex and Welfare Facility during shifts will be on an ad hoc basis.

2.1.2.3 Deliveries

Delivery vehicles will enter via the main gate and travel directly to the laydown area.

Vehicles will park at the laydown area therefore lighting will be required to allow for hitching and unhitching of trailers.

The transfer of containers and unhitching/hitching of vehicles within the laydown area represents a potentially hazardous working environment of pedestrians and moving/reversing long vehicles; as such lighting will be required to ensure the safe movement of vehicles and operators.

Containers will not be unpacked or separated within the laydown area. The low level of lighting has been selected to represent the simplicity and duration of the task.

Local task lighting will be mounted on the rear or tractor/lorry cabs to facilitate the detailed hitching/unhitching task.

Generally, all deliveries from stores and for scheduled maintenance will be undertaken during normal daytime working hours (7am until 6pm), pick-up from the laydown area to the processing area as required to meet operational requirements.

2.1.3 Pedestrian Movement

All transportation across the site will be via site vehicles. Due to the size of the site, pedestrian movement between the minehead complex and Welfare Facility will be impractical and will not be encouraged.

2.1.3.1 Arrivals/departures

Personnel arriving by bus will enter the site via the gatehouse and will be dropped off directly outside the Welfare Facility entrance, at the bus layby.

During shift changes there will be a significant amount of pedestrian movement between the car park/bus drop-off and the Welfare Facility. Safely lit routes will be provided at transport drop off points and through the car park to the Welfare Facility entrances.

It is assumed that the walkways around the back perimeter of the Welfare Facility and the south of the car park will not be used during the night; therefore, lighting will not be provided.

2.1.3.2 Minehead Site

During normal operating conditions there will be no anticipated above ground movement between buildings.

Lighting provision will be limited to the following locations only:

- Above ground minehead operator drop-off - safe movement for staff from drop-off to building entrance.
- Emergency lighting to escape exits - low brightness emergency lighting to allow safe egress from the building in event of an evacuation.

2.1.4 Lighting for Maintenance

Scheduled maintenance will generally be undertaken during the day shift (refer to YP-P2-CX-064 Proposed Site Earthworks – Shift Pattern Schematic for times).

Major maintenance will be scheduled. During this time the site will be closed and equipment serviced 24/7. During all other periods, final exit lighting will be provided.

Lighting will be provided to support these tasks during planned maintenance shut down. Supplementary lighting will be provided to support above ground activities during this period within the following locations:

- Area surrounding the winder buildings for the maintenance of winding gear.
- Safety lighting within the transformer pen.

Lighting for activities that require specialist enhanced lighting levels will be provided by mobile/temporary lighting units. The extent of any task lighting is to be identified within any task as required by Sirius Minerals Health and Safety Permit to Work procedures.

All maintenance related lighting will only be on during the planned mine shutdown and then only when required.

2.1.5 Security Requirements

Lighting is not required around the building or site perimeters to aid CCTV coverage. Buildings will be secured with swipe cards and box keys.

Full white lighting is required at the entrance to the site, around the gatehouse to aid CCTV movement monitoring and security checks. Illumination of the perimeter fence is not required. In event of guard patrols of the site boundary, torches will be used.

Any lighting for CCTV coverage will be Infra-Red or Black light illuminated (i.e. non-visible) – specified by others.

2.1.6 Disability Lighting Requirements

The Welfare Facility main entrances will have enhanced lighting levels to comply with BS8300 DDA (Disability Discrimination Act) requirements.

All unaccompanied personnel that travel beyond the Welfare Facility will be fully able bodied without vision impairment; therefore lighting provision to meet these requirements will not be a necessity.

2.1.7 Lighting in Event of Emergency

General lighting to above surface roads will not be required in the event of an emergency. Emergency teams will be able to safely circulate the site and carry out their duties via headlights.

Lighting is not provided for specific detailed tasks, mobile temporary lighting masts may be required as a necessary part of an emergency response strategy (i.e. stand mounted site lamps, head lamps, mobile lighting towers etc.).

When the helipad is required it will be necessary for lighting to be provided to the area to facilitate safe landing. The requirements for illumination levels of the helipad area will be established. The lighting to the helipad will only be illuminated when required.

General lighting above ground does not require emergency generator or battery back-up.

2.1.8 Hours of Operation/Areas of Activity

The site will operate on a 24/7 basis, with mineral extraction being carried out by workers operating within a defined shift pattern.

The following types of personnel roles have been identified as working at the site:

- Industrial staff – Operating in shifts.
- Management – Management and administration staff operating the same shift patterns as Industrial Staff with increased responsibility for shift handover.
- Senior management and technical services – Operating flexible work patterns as required by the mine operations, however typically working normal/extended working hours.
- Administrative staff and technical services – support services work normal day “office” hours.

Administration, senior management and office staff will generally work “normal” day office hours and will arrive at 8am and leave at 5pm.

Industrial staff will typically arrive at the site up to 45min before shift change and leave site up to 45min after end of shift.

Shift management staff will arrive and leave site typically up to 60 minutes either side of the shift change to enable handover between shifts.

During these times there will be increased activity around the Welfare Facility and access road as workers arrive and leave site.

Above ground works will be predominantly limited to hours of daylight/dayshift. Generally night time activity above ground will be limited to:

- Arrival of staff at the site and transport of personnel between the Welfare Facility and mine head at shift change over.
- Movement required as a result of exceptional situation.
 - Emergency.
 - Failure of equipment that may impact safety where spares are not held on site.

There will be no movement above ground around the minehead site beyond movement of staff at shift change.

2.2 Construction Phase Statements and Assumptions

During construction there will be the following principle areas on site:

- Haul roads
- Compound area including:
 - Car park

- Welfare cabins including canteen, changing and shower areas, and first aid facilities
- Site offices
- Storage for equipment
- Lay down areas
- Working platform areas.

The following operational assumptions have been made in the development of the construction phasing lighting strategy:

2.2.1 Vehicular Movement

Vehicular movement at night can be generally defined in 2 primary categories:

- Personnel arriving/departing in accordance with shift patterns.
- Transportation of material from shaft to loose tipping area.

2.2.1.1 Arrivals/departures

During construction the primary entrance to the site will be by the welfare entrance.

All personnel are assumed to arrive to the site by vehicle. Vehicular traffic will approach from the A171/ B1416. The junctions will remain unlit due to the negligible increase in traffic.

The car park will have periods where pedestrians and vehicular traffic share the car park surface. To ensure the safety of staff during the hours of darkness, the car park will be required to be lit. The lighting classification selected represents the lowest recommended criteria within the relevant British Standards.

2.2.1.2 Transportation of material within the site.

Material on site can be defined in two categories:

- Material coming out of the shaft, i.e. spoil.
- Material that is delivered to site to aid the construction of the shaft, i.e. aggregate/concrete/etc.

Extracted material from shafts and tunnel construction will be transported from the shafts and loose tipped onto the bund surfaces throughout the night shift. During the dayshift/daylight hours, this loose material will be compacted and reshaped to form the bunds.

Transportation of spoil across the site will generally be via truck along the temporary haul roads. Lighting is required along the haul roads to provide safe routes for vehicles.

To aid the safe tipping of material onto a section of the bunds at night, lighting will be provided to that section. As the phases progress, the lit area will move.

Deliveries are expected during the day time only; the material will be unloaded and stored for ground works, to take place during daylight hours.

2.2.2 Pedestrian Movement

Pedestrian movement is anticipated between the compound area and minehead buildings. Safely lit routes will be provided from the car park to the entrances of buildings around the site.

During night working hours there will be pedestrian movement between compound buildings therefore lighting provision will be included around perimeters.

2.2.3 Security Requirements

Lighting for security is not required around the buildings or site perimeter.

Any lighting for CCTV coverage will be Infra-Red or black light illumination (i.e. non-visible) – specified by others.

2.2.4 Disability Lighting Requirements

It is assumed, due to the nature of the construction site, all visitors will be fully able bodied without vision impairment; therefore lighting provision to meet these requirements will not be a necessity.

2.2.5 Lighting in Event of Emergency

General lighting to haul roads will already be provided therefore in event of emergency, emergency teams will be able to safely circulate the site and carry out their duties.

Lighting will not be provided for specific tasks. Mobile temporary lighting masts may be required as a necessary part of an emergency response strategy (i.e. stand mounted site lamps, head lamps, mobile lighting towers etc).

2.2.6 Hours of Operation/Areas of Activity

The following types of personnel roles have been identified as working at the site:

- Construction workers – Operating in shifts.
- Site engineers – Management staff operating the same shift patterns as Construction Staff.

Staff will typically arrive at the site up to 1 hour before shift change and leave site up to 1 hour after end of shift, resulting in a two hour shift turn around period.

During these times there will be increased activity around the compound area and access road as workers arrive and leave site.

3 Design Criteria

This section outlines the guiding principles for external lighting scheme. Aspects of the following documents have been used in preparing this guide and ascertaining the appropriate lighting levels around the external site:

- BS EN12464-2:2007 Lighting of Work Places – Part 2: Outdoor work places.
 - BS 5489-1:2013 Code of practice for the design of road lighting, Part 1: Lighting of Roads and Public Amenity Areas.
 - CIBSE Lighting Guide 6– Lighting of outdoor environment.
 - CIBSE Lighting Guide 1 – The Industrial Environment.
 - ILP GN01:2011 Guidance Notes for the Reduction of Obtrusive Light.
 - Design Manual for Roads and Bridges.
 - The Specification for Highway Works (HMSO).
 - Other appropriate standards (referred to in the text).
- ..

4 Proposed Lighting Strategy

4.1 General

The site is set within the North Yorkshire Moors National Park therefore the surroundings will be sensitive to obtrusive light beyond the boundary of the proposed minehead site.

The sites will have general site lighting applied during the phasing works and construction of the shafts. After construction, operation phase lighting will be applied.

4.2 Operational Phase

The proposed lighting strategy will limit the visibility of the lighting installation, reduce the impact to the surrounding area and will be a cost effective solution.

The lighting approach includes the following:

- Light only areas that are deemed critical to the safe operation of the mine at night.
- Target minimum illumination levels on an area-by-area basis.
- Prevent blanket lighting of areas.
- Minimised mounting heights of lighting equipment to not be visible to external observers (i.e. below the level of building ridges and landscape bunds).
- Minimised visibility of bright sources therefore orientation of equipment towards the centre of the site where possible
- Minimised tilt and therefore upward light spill by the use of flat glass lanterns.

A supplementary level of light has been suggested that will only be operational when required for maintenance procedures. Maintenance lighting will have restricted periods of use.

Details of proposed target illumination levels for general and maintenance operation can be found on Arup Lighting Treatment Drawings YP-P2-EL-104 and 105.

Final exits and entrances into the Welfare Facility and minehead buildings have been indicatively shown to be lit. Emergency lighting is provided above final exits to meet British Standard safety requirements.

4.3 Construction Phase

Due to the nature of a construction site, the anticipated tasks on site will require lighting to ensure safe operation.

The proposed temporary lighting for construction phase will aim to have limited visibility from a distance, reduce the impact to the surrounding area and will be a cost effective solution.

The lighting strategy includes the following:

- Provide target minimum illumination levels to the areas that are necessary to the safe operation of the construction site at night.
- Prevent blanket lighting of areas; light only areas which need lighting applied to them.
- Minimise mounting heights of lighting equipment to not be visible to external observers (i.e. below the level of temporary buildings and landscape bunds).
- Minimise visibility of bright sources therefore orientation of equipment towards the centre of the site where possible.
- Minimise tilt and therefore upward light spill by the use of flat glass lanterns.

The lighting strategy will be applied to the following areas:

4.3.1 Roads

The site roads will be lit via column mounted lanterns positioned at the side of the road from the security cabin location to the construction platforms, and no headlights from vehicles would be used. Lighting columns will be 6m tall to allow even distribution of light over the road surface to meet the recommendations set out in the relevant standards. Columns will be mounted on temporary bases to allow movement as the site works progress.

4.3.2 Car Parks

The car parks will be lit to ensure safe movement of pedestrians and vehicle users.

Lighting of the Sirius Minerals car park will include 6-8m columns to ensure good distribution of lighting. Positioning of columns will be carefully considered in relation to parking bays and vehicle tracking.

Illumination will be provided from around the periphery of the car park, with centrally located columns to ensure an even distribution of light. Lighting columns will be mounted on temporary concrete bases.

4.3.3 Shaft Platform

Shaft houses will have an enhanced level of area lighting around them to ensure the safe operation of sinking head gear, cranes and hoists.

Lighting of the perimeter area will include multi-head 10m columns with asymmetrical floodlights to ensure good distribution of lighting. Columns will be mounted on temporary concrete bases to allow movement as the site works progress.

Floodlights will be mounted with cowls and baffles to minimise glare and light spill onto adjacent areas.

Aviation obstruction lighting will be provided on the MTS temporary shaft sinking tower. Aviation lighting will consist of a 2no. 25 candela aircraft obstruction light positioned on a pole 1-2m above the height of the temporary winding towers so as to ensure visible to aircraft from all directions and therefore provides redundancy in the event of single unit failure.

4.3.4 Loose Tipping Area

Areas where loose tipping occurs will require lighting for safe tipping and movement of vehicles.

Tipping gives rise to a series of mounds and valleys, and during the day these are spread and levelled. During the night a technique will be applied to highlight these by creating shadows and bright areas on the low reflectance spoil material.

Lighting will be applied around the perimeter of the area that is to be worked on and as such will be phased as to the daily/weekly work area. Several high power narrow beam floodlights will be illuminated upon each of the 10m columns, mounted on temporary concrete bases.

As the construction phase strategy develops, the Contractor will apply the stated Basis of Design principles for the temporary lighting works.

5 Lighting Technology

5.1 Operational Phase

The lighting design will be developed utilising modern LED technology due to the flexibility and control, compared with traditional sources, will consist of:

- Focused/directional light sources resulting in more effective delivery of light to the task area with reduced upwards light spill.
- Control gear technology allowing the flexibility to dim light output easily with a quick response time.
- Improved environmental characteristics (negligible ultra-violet component).
- Reliability and longevity.

While this solution will increase initial capital expenditure, LED sources have been proposed due to the benefits of long life, reliability and reduced maintenance burdens; in addition to the benefits of increased energy efficiency and low energy consumption.

Lighting for the periodic planned major maintenance will be building mounted.

5.1.1 Lighting Control

Lighting elements for General Operation on site will be controlled via a photocell and time clock to ensure that they only operate during the hours of darkness.

Lighting elements for Maintenance Operation on site will be controlled via manual switch to ensure that they only operate during planned major maintenance/incident operation.

5.2 Construction Phase

The proposed lighting for construction will be established when the site details and operations have been developed further. The principles stated in this Basis of Design will be adopted in developing the external lighting strategy by the Contractor as part of their temporary lighting strategy works.

Haul roads will be lit via flat glass lanterns post top mounted on 6m tall columns, spaced at approximately 21m to achieve the specified lighting level, and mounted upon temporary concrete bases.

Area lighting around the shaft house and tipping areas will be provided via high power floodlights with baffles and glare shields. Floodlights to be mounted on 10m columns upon temporary concrete bases.

5.2.1 Lighting Control

Lighting elements for Construction Phases on site will be controlled via a photocell to ensure dusk until dawn operation.

REPORT

York Potash Mine Operational Lighting Impact Assessment

Section 73 Application (Lighting)

Client: Sirius Minerals Plc

Reference: 40-RHD-WS-83-PA-TN-0001 REV 0

Revision: 00/Final

Date: 30 June 2017

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1 Lighting Impact Assessment

1.1 Introduction

1.1.1 This report re-assesses previously-considered lighting impacts associated with the Woodsmith Mine development. Potential changes are considered in light of amendments defined in the Woodsmith Mine Supplementary Environmental Statement (SES) and the associated amended proposed lighting design. Potential impacts are considered for the operational phase of the development only.

1.2 Approach

1.2.1 The re-assessment of the lighting impact has been approached as follows:

- *Identify physical landscape changes which might give rise to a change in the magnitude and significance of previously reported artificial lighting impacts;*
- *Identify scheme changes likely to be noticeable in terms of the artificial lighting impact, when compared to the previously assessed scheme, and which might give rise to a change in the magnitude and significance of previously reported impacts;*
- *Identify whether the proposed changes in the lighting strategy would affect new receptors and assess impact on these receptors to identify whether significant impacts would arise as a result of the changes.*

1.2.2 The methodology undertaken in this re-assessment was as follows:

- The methodology follows standard practice as described in the Institution of Lighting Professionals Guidance on Undertaking Environmental Lighting Impact Assessments and adopted in the 2014 Environmental Statement;
- Impacts have been identified for Year 1 of the operational phase and do not take into account any potentially beneficial longer term effects of proposed screen planting;
- Reference was made then to the previous Lighting Impact Assessment conducted (York Potash Project Mine, MTS and MHF Environmental Statement: Part 2, Appendix 12.5 Mine Technical Lighting Report);
- Viewpoints No. 1-14 were re-considered with reference to the revised lighting strategy REP-P2-EL-002 (Basis of Design - External Lighting) and construction amendments shown in 2307.MH03 (Woodsmith Mine Restoration Proposals Drawing) and 2307.MH04 (Woodsmith Mine Restoration Proposals-Cross Sections (Sht 1-3) Dwg); and
- Each viewpoint was then assessed to determine any impact in terms of artificial lighting.

1.3 Revised Lighting Strategy (Operational Phase)

1.3.1 With reference to REP-P2-EL-002 (Basis of Design for External Lighting), the revised lighting strategy is as follows:

- Lighting of areas which are deemed critical only, for safe operation of the mine during the night;
- Minimised mounting heights of lighting equipment, to below the level of building ridges and landscape bunds;
- Orientation of light sources towards the centre of the site, where possible; and
- Minimised tilt and use of flat glass lanterns.

1.3.2 Lighting is proposed as shown on YP-P2-CX-511 (Mine head Site: Working Plan Lighting):

- Main entrance from the B146 will not be illuminated;
- Access controlled entrance to site, set back from the B146, will be illuminated utilising 8m lighting columns;
- The Welfare car park will be illuminated utilising lighting columns of 8m mounting height or lower. This is to ensure safe movement of pedestrians;
- Access road between the Welfare building and mine will not be illuminated, with lighting from vehicles being sufficient for safe navigation between these two points; and
- The mine building will be illuminated through a mixture of building mounted bulkhead fittings and 8m lighting columns.

1.4 Operational Phase Changes Requiring Re-Assessment

1.4.1 The following design changes have been identified as requiring re-assessment, on the basis that they have the potential to influence impact significance.

Internal Access

- Access from the Welfare Building to the Mine, now is via surface access road. Vehicular traffic along this route will be limited to 2 hour shift turn period at 10pm and 6am, during normal operation of the mine.
- The access road is at a reduced level, with the surrounding landscape bunds of up to a height of 10m above road level, with broadleaved woodland /scrub screening the site from the north and west of the site.
- Illumination of this access road would be via the use of vehicular head lights.
- As the access road will not be illuminated, and is screened by the landscape bunds, the impact of the affected viewpoints would remain as defined previously (Refer to **Table 1.1**).

1.5 Operational Phase Changes Not Requiring Re-Assessment

Variations to the layout of the buildings at the Mine Head

1.5.1 Proposed variations to the layout of the buildings at Woodsmith Mine, as set out in the SES have been reviewed and are not considered to be materially different, with respect to the lighting impact assessment, when assessed in conjunction with the amended landscape bunds. They are not predicted to result in any change to previously identified impacts.

Bunding

1.5.2 While there will be no significant change to the approved screening bunds (namely A, B, F and G), the non-screening bunds to the south of the drilling platform have been amended but remain within the approved maximum height.

1.5.3 As the site remains well screened, this amendment is not be considered to be sufficiently different, and is not predicted to result in any change to previously identified impacts.

1.6 Updated Assessment of Impacts during Operation

Mine

- 1.6.1 Revised views of the site as shown on 2309.MH04, 2309.MH05 and 2309.MH06, illustrate the operational phase effect of the scheme from the most intervisible landscape character areas to the north and north-east of the site. Overall, the revised scheme would reflect the same degree of scale and contrast in terms of artificial lighting effects as identified for the previous scheme. There will be no change to previously identified operational lighting impacts on visual receptors, with effects being screened by proposed mounds or heavily filtered by intervening mature woodland.
- 1.6.2 As summarised in Table 1.1, all of the viewpoints are assessed to experience a negligible impact effect in terms of light intrusion and luminaire intensity. The impact on viewpoints 5, 6, 11 and 14 is assessed to be minor adverse and viewpoints 8 and 13 is assessed to be negligible to minor adverse, in terms of sky glow. Although mitigation strategies are identified, reflected light and general light spill cannot be completely mitigated and minor adverse impacts would remain in terms sky glow during the operational phase.

Table 1-1: Lighting Effects during Site Operational Phase (after mitigation)

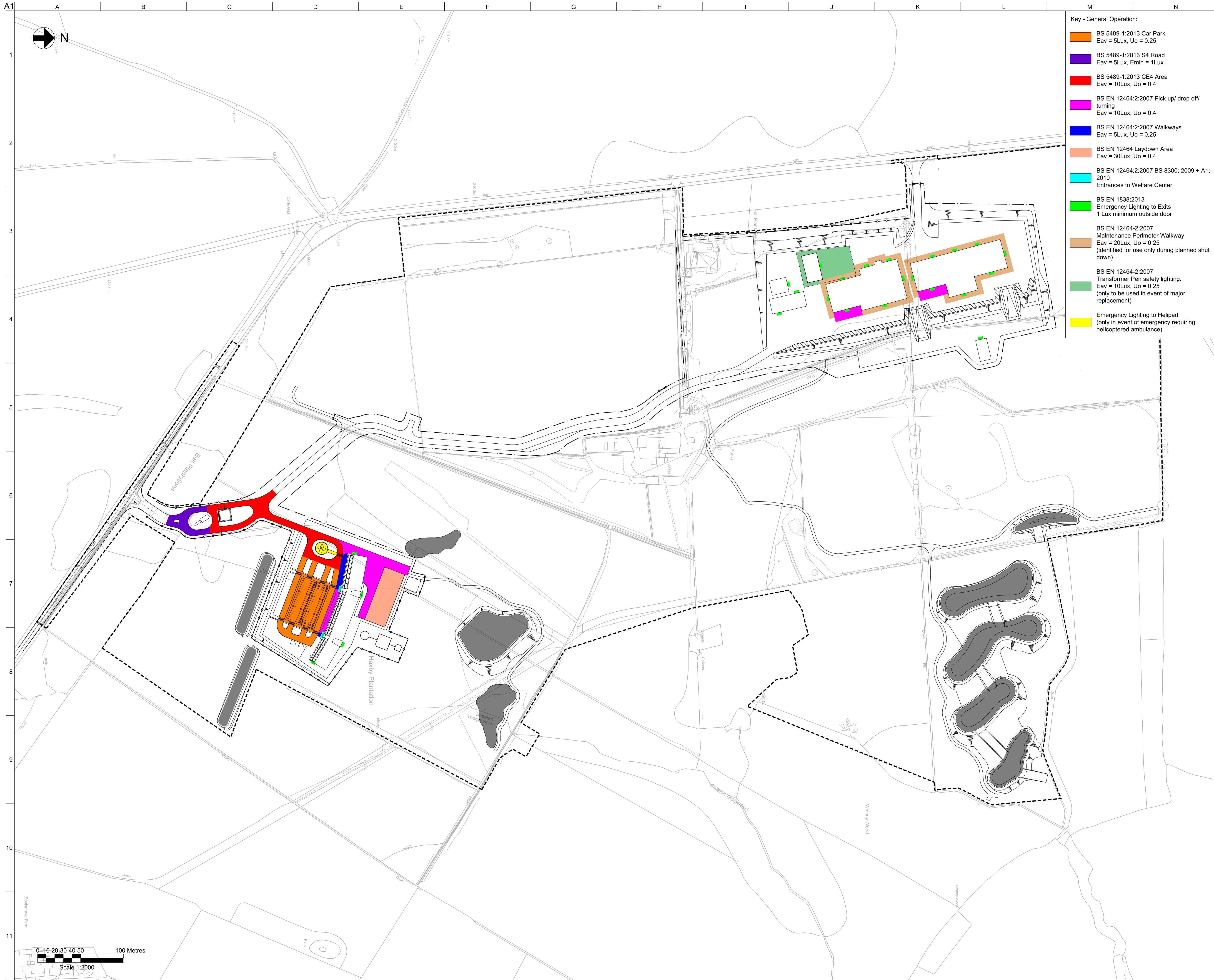
Lighting Effects during Site Operational Phase (After mitigation)			
VP No.	Sky Glow ULR (Upward Light Ratio)	Light Intrusion	Luminaire Intensity
1	Negligible	Negligible	Negligible
2	Negligible	Negligible	Negligible
3	Negligible	Negligible	Negligible
4	Negligible	Negligible	Negligible
5	Minor Adverse	Negligible	Negligible
6	Minor Adverse	Negligible	Negligible
7	Negligible	Negligible	Negligible
8	Negligible to Minor Adverse	Negligible	Negligible
9	Negligible	Negligible	Negligible
10	Negligible	Negligible	Negligible
11	Minor Adverse	Negligible	Negligible
12	Negligible	Negligible	Negligible
13	Negligible to Minor Adverse	Negligible	Negligible
14	Minor Adverse	Negligible	Negligible

- 1.6.3 Noting that the effects on different viewpoints vary, it can be concluded that the significance of the impact of the operational phase lighting would be long term (present for the life of the Mine development) negligible to minor adverse in terms of sky glow, and negligible in terms of light intrusion and luminaire intensity.
- 1.6.4 The revised lighting assessment indicates that the overall artificial lighting effects during the operation of the Mine would be of negligible to minor adverse significance, with the predominant lighting effect being sky glow.

1.7 Summary

- 1.7.1 Revised predicted impacts associated with artificial lighting of the operational phase are summarised in **Table 1.1**.
- 1.7.2 Key mitigation principles embedded in the proposed lighting design are:
- Lighting of areas deemed critical only, for safe operation of the mine during the night;
 - Minimised mounting heights of lighting equipment, to below the level of building ridges and landscape bunds;
 - Orientation of light sources towards the centre of the site, where possible; and
 - Minimised tilt and use of flat glass lanterns.
- 1.7.3 Based on this reassessment it can be concluded that the worst case effects would be of minor adverse significance, with any effect predominantly being due to sky glow¹. Impacts would be of no greater severity than those identified for the currently-consented scheme.

¹ Sky glow - Wide area of night sky scattering direct and indirect upward light back to an observer. Depends on atmospheric conditions and the amount of upward light.



- Key - General Operation:**
- BS 5489-1:2013 Car Park
Eav = 5Lux, U₀ = 0.25
 - BS 5489-1:2013 S4 Road
Eav = 5Lux, E_{min} = 1Lux
 - BS 5489-1:2013 CE4 Area
Eav = 10Lux, U₀ = 0.4
 - BS EN 12464:2:2007 Pick up/ drop off/
turning
Eav = 10Lux, U₀ = 0.4
 - BS EN 12464:2:2007 Walkways
Eav = 5Lux, U₀ = 0.25
 - BS EN 12464 Laydown Area
Eav = 30Lux, U₀ = 0.4
 - BS EN 12464:2:2007 BS 8300: 2009 + A1:
2010
Entrances to Welfare Center
 - BS EN 1838:2013
Emergency Lighting to Exits
1 Lux minimum outside door
 - BS EN 12464:2:2007
Maintenance Perimeter Walkway
Eav = 20Lux, U₀ = 0.25
(identified for use only during planned shut
down)
 - BS EN 12464:2:2007
Transformer Pen safety lighting.
Eav = 10Lux, U₀ = 0.25
(only to be used in event of major
replacement)
 - Emergency Lighting to Helipad
(only in event of emergency requiring
helicoptered ambulance)

- General Operation Notes:**
1. The concept of the external lighting of the site is to keep the lighting to a minimum. The intention is that the levels have been selected on a 3 step basis.
 - Defining if lighting is an absolute requirement (I.e. could other methods be used to limit light and provide a safe working environment).
 - Identification of minimum levels of light required to safely perform anticipated tasks by using British Standard Codes and industry guidance.
 - Effectively deliver light to the surface and prevent unwanted upward light distribution and spill onto the surrounding area.
 2. This operational lighting plan is to be implemented only for planned shut down maintenance where mining operations shut down or in the event of a major incident for major maintenance.
 3. Lighting levels illustrated have been selected following discussions with YPL to understand likely activities above ground during the hours of darkness. Levels have been chosen in accordance with guidance provided within the following documents:
 - BS EN 12464:2 Lighting of work places - Outdoor work places
 - BS EN 5489:1 Lighting of road and public amenity areas.
 - CIBSE Lighting Guide 6 - Lighting of outdoor environment.
 - GN01:2011 Guidance notes from the reduction of obstructive light.
 - BS EN 1838:2013 Lighting Applications Emergency Lighting.
 4. To be read in conjunction with the Arup report REP-P2-EL-002 Basis of Design - External Lighting.
 5. Emergency exit locations and entry/ exit points are subject to chance following the development of the detailed Minehead buildings and MTS design and requirements. Final locations are to be reviewed once known.
 6. Circulation lighting is to be provided to perimeter walkways around the Minehead buildings as shown for access only.
 7. Temporary lighting around winding towers to be provided via towers as required for specific tasks of major maintenance.

1	12/07/17	JB	DL	CW
For planning				
Issue	Date	By	Chkd	Appd

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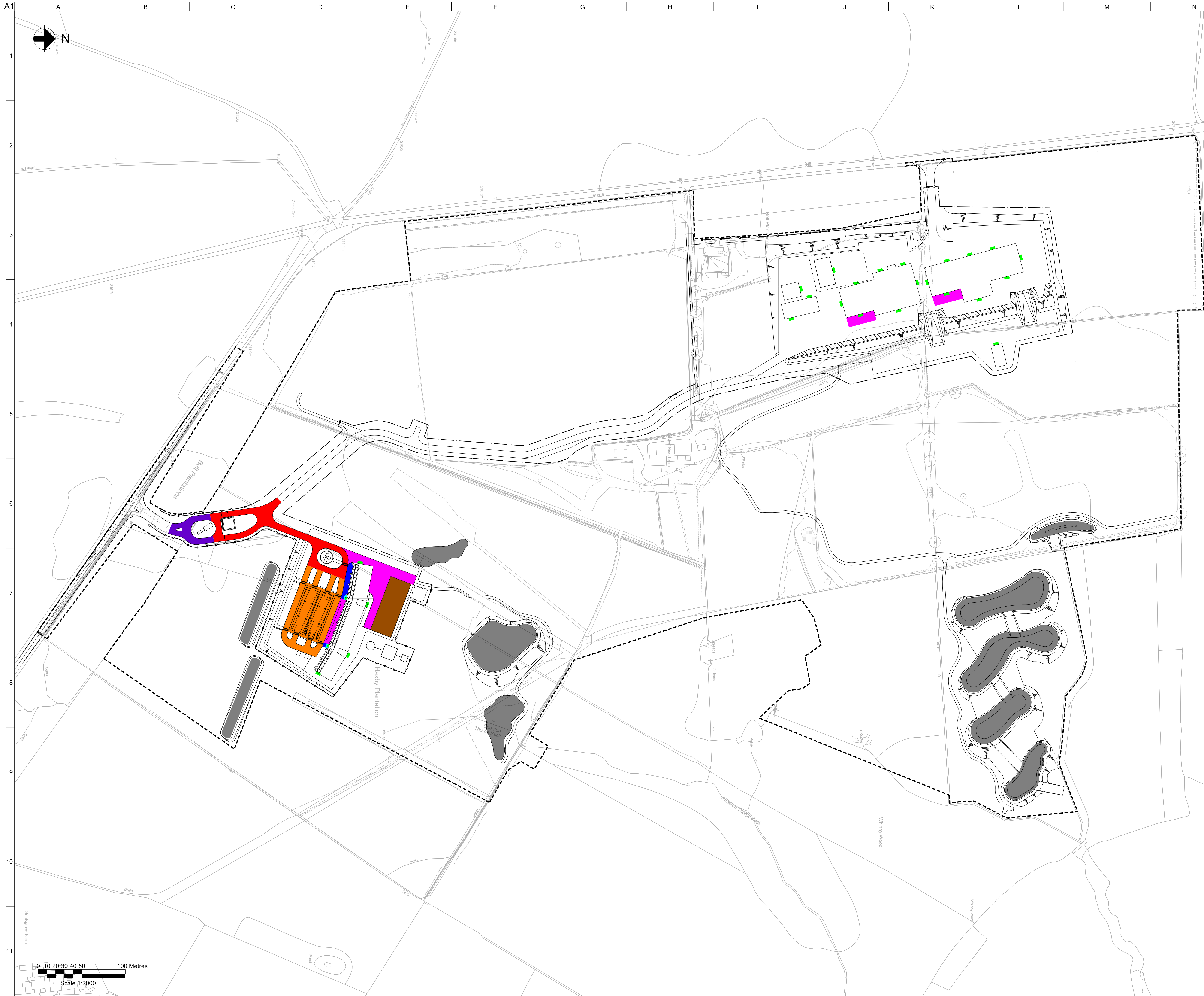
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Client
Sirius Minerals Plc

Job Title
**Woodsmith Mine
Minehead**

**External Lighting Treatment Plan
Planned Shut Down Maintenance /
Major Incident Operation**

Scale at A1 1:2000	
Discipline Lighting	
Job No 253285	Drawing Status For Planning
Drawing No YP-P2-EL-105	Issue 1



- Key - General Operation:**
- BS 5489-1:2013 Car Park
Eav = 5Lux, Uo = 0.25
 - BS 5489-1:2013 S4 Road
Eav = 5Lux, Emin = 1Lux
 - BS 5489-1:2013 CE4 Area
Eav = 10Lux, Uo = 0.4
 - BS EN 12464:2:2007 Pick up/ drop off/ turning
Eav = 10Lux, Uo = 0.4
 - BS EN 12464:2:2007 Walkways
Eav = 5Lux, Uo = 0.25
 - BS EN 12464 Laydown Area
Eav = 10Lux, Uo = 0.4
 - BS EN 12464:2:2007 BS 8300: 2009 + A1: 2010
Entrances to Welfare Center
 - BS EN 1838:2013
Emergency Lighting to Exits
1 Lux minimum outside door

General Operation Notes:

1. The concept of the external lighting of the site is to keep the lighting to a minimum. The intention is that the levels have been selected on a 3 step basis.
 - Defining if lighting is an absolute requirement (i.e. could other methods be used to limit light and provide a safe working environment).
 - Identification of minimum levels of light required to safely perform anticipated tasks by using British Standard Codes and industry guidance.
 - Effectively deliver light to the surface and prevent unwanted upward light distribution and spill onto the surrounding area.
2. Lighting levels illustrated have been selected following discussions with YPL to understand likely activities above ground during the hours of darkness. Levels have been chosen in accordance with guidance provided within the following documents:
 - BS EN 12464:2 Lighting of work places - Outdoor work places
 - BS EN 5489:1 Lighting of road and public amenity areas.
 - CIBSE Lighting Guide 6 - Lighting of outdoor environment.
 - GN01:2011 Guidance notes from the reduction of obstructive light.
 - BS EN 1838:2013 Lighting Applications Emergency Lighting.
3. To be read in conjunction with the Arup report REP-P2-EL-002 Basis of Design - External Lighting.
4. Emergency exit locations and entry/ exit points are subject to chance following the development of the detailed Minehead buildings and MTS design and requirements. Final locations are to be reviewed.
5. General lighting will be on throughout the hours of darkness.

1	12/07/17	JB	DL	CW
For Planning				
Issue	Date	By	Chkd	Appd

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Client
Sirius Minerals Plc

Job Title
Woodsmith Mine Minehead

**External Lighting Treatment Plan
General Operation**

Scale at A1 1:2000

Discipline Lighting

Job No 253285	Drawing Status Planning
Drawing No YP-P2-EL-104	Issue 1

