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| Attention: | Campbell Robertson |
| Company: | Bathhurst Coal |
| Date: | 11 March 2019 |
| From: | Rhys Girvan (Registered Landscape Architect)  |
| Message Ref: | Night Time Lighting Assessment  |
| Project No: | C18155 Canterbury Coal |

Dear Campbell,

This memorandum sets out an assessment of night time lighting effects associated with the proposed development at the Canterbury Coal Mine site (“**The Site**”). Specifically, this memo responds to Selwyn District Council’s request to undertake a night-time lighting assessment considering visibility of the existing mine during the current night-time operation.

This memo is supported by a graphic supplement which includes night-time photography of the existing mine in operation (**“Graphic Supplement**”). Viewpoints include a range of representative locations drawn from those previously included in the Landscape and Visual Effects scoping report, dated 15 October 2018 (the “**Scoping Report**”). These have been supplemented with views obtained from the vicinity of Coalgate and Malvern Hills and the nearest residential property, located at 295 Malvern Hills Road (the Deans’ Residence).

**Night Visual Survey**

To assess the visual effects of lighting in this rural landscape context, a Site visit was undertaken by Rhys Girvan, landscape architect and Corey Murray, visualisation specialist. During the site visit, the broader surroundings was also observed to understand the typical existing visible night environment. The Site visit was undertaken on the evening of 28th of February 2019. During the Site visit, the following was noted:

* Night time mining activity and associated lighting (excluding the Coal Process Plant) was operational during the Site visit.
* The Site visit, and photography, was undertaken on a clear night before moon rise and therefore represents a ‘worst-case scenario’ in terms of degree of natural illumination to the area.
* Photography of the Site, for night time photography occurred during the hours of 10:00 pm and 1:30 am, and these conditions have informed my assessment.
* Whilst the night time survey was undertaken during relatively clear conditions, it is appreciated that ephemeral changes in temperature and weather conditions will change the extent to which the potential for lighting may be apparent.

Representative views were obtained to show the nature of visible lighting from a range of identified viewpoints. While photographs illustrate a two-dimensional view from a particular viewpoint, they are not a three-dimensional image or ’real life view’ as seen in the landscape with the human eye. Notwithstanding this, night time perspective views are useful tools to assist in the assessment and decision-making process. Location and camera parameters used to obtain night time photography has been included with each image to ensure this method is accurate and replicable as set out in the more detailed methodology included in **Appendix 1** of the Graphic Supplement.

**Receiving Environment**

The receiving environment remains consistent with the description as previously set out in the Scoping Report. That is, that the Site forms part of a rolling hilltop within the Malvern Hills area, which extends along the foothills of the larger Southern Alps to the north of Glentunnel. The surrounding landscape is sparsely settled supporting agriculture and more extensive areas of forestry within Coalgate Forest.

Lighting within the receiving environment is limited and typically includes dispersed lighting associated with rural dwellings and related farming activity. Street lighting within Coalgate, Glentunnel and Malvern Hills (Whitecliffs) also limits the extent to which lighting within the Site can be observed and introduces an observable amber sky glow to the south and west of the Site. Lighting is typically absent along surrounding rural roads. Photography was taken between 10:00 pm and 1:30 am and is therefore representative of the middle of the night during a typical week day in late summer.

The Operative Selwyn District Plan identifies that any activity which involves lighting shall be a permitted activity provided that the activity has a maximum light spill not exceeding 3-lux spill on to any part of any other adjoining property or any road reserve.

**Existing and Proposed Light Sources within the Site**

The location of existing light sources considered during this assessment are illustrated on **Figure 1** of the Graphic Supplement. This is representative of ongoing proposed lighting, whilst noting that the location of mobile towers will remain dynamic and change through the development of the mine.

Fixed lighting comprises seven lights associated with external buildings and fixed operational areas which reach between 4.5 and 6 metres in height. It is understood that each light produces 26,000 lumens and is rotated down at ~35° from horizontal. Fixed lighting occurs in the following key areas:

* 3 light towers on the workshop
* 2 lights luminating the office car parks
* 2 lights luminating the coal process plant (not operational during the Site visit)

Mobile light sources comprise of up to seven mobile towers with five typically in operation at any one time. Given the dynamic nature of the mine, the location of mobile light plants will vary according to the areas undergoing operation and the current stage of mining / rehabilitation. Mobile light towers are typically located and orientated to illuminate two dig areas, an overburden disposal area and the main intersections within the mine. The following seven mobile light towers are used:

* 4 x 9 metre light towers each with 4 LED lights (26,000 lumens per light)
* 3 x 9 metre light towers each with 4 halogen lights (60,000 lumens per light)

In addition, during the Site visit, several pieces of mining equipment were operational in the mine fitted with headlights and safety lights. A light utility vehicle with an operational safety light was also parked on the highest point of the Site (the Crow’s Nest) to assist with identifying potential visibility from surrounding areas. It is understood that lighting on night shift typically occurs from Monday to Friday year-round, although night shift is not usually worked through winter (May-July).

**Zone of Theoretical Visibility and Potential Night Time Viewing Audience**

The Zone of Theoretical Visibility (ZTV) map (refer **Figure 2)** shows the current theoretical visibility of the existing direct sources of light within the Site. Potential views of mobile lights are shown in yellow, permanent lights are shown in blue and both mobile and permeant light sources are shown in green. The ZTV analysis was generated by creating a landform model of the existing Site and its context by using contour data and light source information supplied by Canterbury Coal. No existing vegetation or above ground features such as buildings or vegetation have been included in the ZTV analysis and therefore the analysis represents a worst-case scenario in terms of visibility.

The ZTV map demonstrates that the extent to which direct light sources are visible is limited from the wider night landscape. No potential direct light sources from the Site were visible from the townships of Coalgate, Glentunnel and Malvern Hills. There are however, potential views of light sources from within the Site from the vicinity of Malvern Hills Road to the east and over longer distances to the east of Coalgate. Here, the light sources appear small along a localised area of vegetated backdrop. Based on the ZTV analysis, a range of viewpoints were identified to obtain representative night-time views. These were based on viewpoints identified in the Scoping Report and inlcuded additional viewpoints obtained from nearby settlements. During the night-time Site visit, representative photographs were obtained from:

VP 1: View from Malvern Hills Road

VP 3: View from Wairiri Road (SH77)

VP 4: View from Yeomans Road

VP 6: View from Malvern Hills Road to the north-east

VP 7: View from the vicinity of Coalgate

VP 8: View from the vicinity of Whitecliffs

VP 9: View from Deans’ Residence

**Assessment of Effects**

The night-time lighting analysis indicates that the greatest potential visual effects will occur from a small section of Malvern Hills Road to the east seen over a distance of approximately 2 kilometres from the Site (as illustrated in **VPs 1 and 9**). From here, direct views of existing light sources are limited to mobile lights observed through gaps between intervening vegetation and seen in association with a localised area of sky glow which forms a silhouette of intervening trees along the skyline in the immediate context of the Site.

Where visible from the Deans Residence (**VP 9**) and areas along Malvern Hills Road (**VPs 1** and **6**), visible light spill does not substantially diminish ambient levels of darkness. Whilst actual lux levels would need to be verified by a lighting engineer, it is considered that these would fall well below the anticipated limits of the District Plan. Impacts on the adjoining night sky are limited to mobile light sources which would be temporary and reversible and localised in extent. Whilst such lighting is clearly apparent when contrasted against a darkened area of landform or sky, it is not unusual or unexpected in a working rural environment with any potential for more substantial adverse effects reduced by ensuring mobile directional lighting is located and angled to minimise sky glow and limits the direct observation of sources of light. Accordingly, any adverse effects will be very low.

Beyond viewpoints observed along Malvern Hills Road, any effect of light spill is limited, including negligible levels of sky glow observed from the settlements of Coalgate (**VP7**), Glentunnel or Malvern Hills (**VP 8**). From these nearby settlements, any lighting within the Site is very difficult to detect and would typically remain unnoticed without careful scrutiny. Further to the west, a localised area of sky glow is apparent from State Highway 77 when approaching Glentunnel from the west. However, this appears similar in extent to an area of amber sky glow generated by Glentunnel, as seen in the right-hand side of **VP 3** and does not substantially detract from the broad expanse of darkened night sky which remains apparent.

Over long distances, points of light are visible from the Canterbury Plains to the south-east of Coalgate beyond approximately 6 kilometres (**VP 4**). From this area, a localised area of sky glow is visible together with small direct points of mobile light along a localised area which occur below the more distant Southern Alps skyline. Beyond the immediate local context of the Site observed, there is no perceptible impact on the overall expansive darkness of the night sky.

**Conclusion**

Overall, the night-time lighting visual analysis identifies that night-time effects will result in very low level and localised adverse visual effects which are primarily limited to an adjoining rural dwelling approximately 2 kilometres from the Site along Malvern Hills Road. Such effects would remain within the context of a working rural environment and do not substantially diminish ambient levels of darkness or appreciation of the larger night sky. Any direct views of mobile light sources are reversible and can be effectively reduced by ensuring lights are directed down towards work areas and light sources are located to minimise visibility from beyond the Site.

Yours sincerely

**BOFFA MISKELL LTD**

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