# Appendix 3-D

## Outdoor Lighting Evaluation Baseline Report

DILLON CONSULTING

75 YEARS

## NWP COAL CANADA LTD

# Outdoor Lighting Evaluation Baseline Report

### Crown Mountain Coking Coal Project

April 2021 - 12-6231

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# Acronyms and Abbreviations

| | |
|---|---|
| AIR | Application Information Requirements |
| BC | British Columbia |
| BC EAO | British Columbia Environmental Assessment Office |
| BC MOF | British Columbia Ministry of Forests |
| BMP | Best Management Practices |
| CEAA | Canadian Environmental Assessment Act |
| CDEM | Canadian Digital Elevation Model |
| CHPP | Coal Handling Process Plant |
| e.g. | For example |
| ESRI | Environmental Systems Research Institute |
| ERDZ | Enhanced Resource Development Zone |
| FLNRO | Ministry of Forest, Lands and Natural Resource Operations |
| GIS | Geographic information system |
| i.e. | That is |
| km | Kilometres |
| LSA | Local Study Area |
| LED | Light Emitting Diode |
| Lux | One Lumen per Square Meter |
| m | Metres |
| mASL | Metres above sea level |
| ROM | Run of the Mine Dump Trucks and Loaders |
| RSA | Regional Study Area |
| Teck | Teck Coal Limited |
| TEM | Terrestrial Ecosystem Mapping |
| VLI | Visual Landscape Inventory |
| VQO | Visual Quality Objective |
| VSU | Visual Sensitivity Unit |

# Definitions

**Adaptive Controls** Devices such as motion sensors, timers and dimmers used in concert with outdoor lighting equipment to vary the intensity or duration of operation of lighting.

**Ambient Light** The general overall level of lighting in an area.

**Background** Greater than 5 km up to 10 km viewing distance from the Project footprint.

**Baseline** Represents current or existing conditions (or a temporal period specifically defined to represent baseline [e.g., the year 2010]) and serves as a reference point to which future conditions can be compared. Unless otherwise noted, baseline refers to a surveyed or measured condition, rather than one predicted through the use of models.

**Baseline Viewpoints** Viewpoints selected from inventoried viewpoints which are determined to be most representative of the range of viewing opportunities and used for baseline assessment and reporting.

**Biophysical Rating** A measure of the degree to which the biophysical characteristics of a Visual Sensitivity Unit (VSU) create visual interest and draws people's attention.

**Brightness** The strength of the sensation that results from viewing surfaces from which the light comes to the eye.

**Bulb or Lamp** Source of electric light. To be distinguished from the whole assembly. Lamp often is used to denote the bulb and its housing.

**Cumulative Effects** The effects of a development in combination with the effects of other past, present or reasonably foreseeable future developments.

**Cut-off Angle, of a Luminaire** The angle, measured up from the nadir (i.e., straight down), between the vertical axis and the first line of sight at which the bare source (the bulb or lamp) is not visible.

**Cut-off Fixture** An Illuminating Engineering Society (IES) definition "Intensity at or above 90° (horizontal) no more than 2.5% of lamp lumens, and no more than 10% of lamp lumens at or above 80°".

**Digital Elevation Model** A three-dimensional grid representing the height of a landscape above a given datum.

**Existing Visual Condition** A measure of the present level of landscape alteration caused by human activities and contributes to the baseline from which additional landscape alterations would be measured.

**Fixture** The assembly that holds the lamp in a lighting system. It includes the elements designed to give light output control, such as a reflector (mirror) or refractor (lens), the ballast, housing, and the attachment parts.

**Fixture Lumens** A light fixture's light output after processing of emitted light by optics in that fixture.

**Footprint** The proposed development area that directly affects the soil and vegetation components of the landscape.

**Foreground** Less than 1 km viewing distance from the Project footprint.

**Fully Shielded fixture** A fixture that allows no emission above a horizontal plane through the fixture.

**Glare** Intense and blinding light that reduces visibility. A light within the field of vision that is brighter than the brightness to which the eyes are adapted.

**Illuminance** Density of luminous flux incident on a surface. Unit is footcandle or lux.

**Intensity** The degree or amount of energy or light.

**Geographic Information System** Computer software designed to develop, manage, analyze and display spatially referenced data.

**Key Viewpoints** One or a series of points on a travel route or at a use area or a potential use area, where the view of the Project would be most revealing.

**Land Cover** The surface cover on the ground, whether vegetation, urban infrastructure, water, bare soil or other.

**LED** Light emitting diode.

**Light Pollution** Any adverse effect of artificial light.

**Light Spill** Unwanted spillage of light onto adjacent areas that may affect sensitive receptors, particularly residential properties and ecological sites.

**Light Trespass** Light falling where it is not wanted or needed. Spill light. Obtrusive light.

**Lumen** Unit of luminous flux; the flux emitted within a unit solid angle by a point source with a uniform luminous intensity of one candela.

**Luminance** At a point and in a given direction, the luminous intensity in the given direction produced by an element of the surface surrounding the point divided by the area of the projection of the element on a plane perpendicular to the given direction. Units: candelas per unit area.

**Lux** One lumen per square meter. Unit of illuminance.

**Middle ground** A 1 km to 5 km viewing distance from the Project footprint.

**Mounting Height** The height of the fixture or lamp above the ground.

**Polygon** The spatial area delineated on a map to define one feature unit (e.g., one type of ecosite phase).

**Regional Study Area** Represents the geographic study area for the assessment of cumulative (combined) effects of the Project and other past, existing, planned or reasonably foreseeable developments.

**Scenic Quality Evaluation** A measure of the visual appeal of a landscape based on rating criteria for the scenic landscape elements of landform, vegetation, water, colour, adjacent scenery, scarcity and cultural modifications.

**Scenic Quality Ratings** The range of maximum to minimum values for rating criteria for scenic landscape elements based on characterization of visual patterns.

**Scenic Value** Evaluation of scenic quality in relationship to the natural landscape and combined with a measure of public concern for scenic quality.

**Sensitivity Level Evaluation** A measure of viewer's sensitivity to visual change by analyzing various indicators of public concern for scenic quality including dimensions of patterns of use and adjacent land use or management context.

**Sensitive Receptors** Potential locations where there may be viewers with visibility of the Project.

**Semi-cutoff Fixture** An IES definition; "Intensity at or above 90° (horizontal) no more than 5% of lamp lumens and no more than 20% at or above 80°".

**Shielding** An opaque material that blocks the transmission of light.

**Skyglow** Diffuse, scattered sky light attributable to scattered light from sources on the ground.

**Spotlight** A fixture designed to light only a small, well-defined area.

**Stray Light** Emitted light that falls away from the area where it is needed or wanted. Light trespass.

**Viewer Rating** A measure of the number of people likely to view the Visual Sensitivity Unit (VSU) and the preferences, expectations or concerns they have about how they would like the VSU to look.

**Viewshed** The area of the landscape that can be seen from one or more source points. Therefore, according to the model, a person standing at any area identified in the viewshed would be able to see at least one of the source points.

**Visibility Modelling** Visibility modelling identifies areas across a landscape that can be seen from one or more observation points, often called a 'viewshed'.

**Visual Aesthetic Resources** Natural and cultural features of the landscape that can be seen and that contribute to the public's appreciative enjoyment of the environment.

**Visual Aesthetics** The study of the psychological responses to appearances.

**Visual Character** Distinguishing visual physical aspects of a landscape.

**Visual Quality** The visual aesthetic characteristics and value of a landscape.

**Visual Resource Inventory** The identification, classification and recording of visual resource related values and their geographic location.

**Visual Sensitivity Class** A measure of the sensitivity of the visual sensitivity unit to visual alteration.

**Visual Sensitivity Unit** A distinct topographical unit as viewed from one or more viewpoints and is delineated based on the homogeneity of the landform and of biophysical elements.

**Wall Mount** A luminaire, typically affixed to the side of a structure, used for area lighting.

# Executive Summary

NWP Coal Canada Ltd (NWP) is proposing to develop the Crown Mountain Coking Coal Project (the Project), an open pit metallurgical coal mine in the East Kootenay region of southeastern British Columbia (BC). The Project is expected to produce approximately 10,150 tonnes per day and up to 4.0 million run-of-mine tonnes per year for 15 years. The Project is located in the Front Ranges Rocky Mountains of BC, an area of steep terrain, and is accessed by several local roads. The Project is in the Alexander and Grave Creek Watersheds, and is located within the asserted traditional territory of the Ktunaxa Nation.

To fulfill the 2015 Environmental Impact Statement (EIS) guidelines set out by the Canadian Environmental Assessment Agency, Dillon Consulting Limited (Dillon) conducted an outdoor lighting evaluation baseline study for the proposed Project site. The lighting evaluation will be included in the environmental assessment process to determine the potential effects of the proposed Project.

This report builds on the *Visual Aesthetics Baseline Report* (Dillon, 2021) and the inventory of resources in the Project study areas. The scope of work for the outdoor lighting evaluation involved building on regulatory context for visual resource management and used the analysis from the baseline visual impact assessment as a starting point to identify key locations predicted to have potential night time outdoor lighting effects from the Project area.

A review of existing relevant BC Visual Landscape Inventory (VLI; Province of BC, 2020), resource management guidelines and strategic planning documents was conducted to understand the policy context for visual aesthetic management within the LSA. These management guidelines do not address the evaluation of potential lighting effects from night time operations; however, excessive artificial light can pollute the visual environment and have negative environmental consequences for humans and wildlife. The VLI database rating identifies that the Project footprint is in a zone that is 'not visually sensitive' (Province of BC, 2020), and does not include defined Visual Quality Ratings (VQR) or Visual Quality Objectives (VQO). This is to be expected because the Project and a significant part of the LSA is in the Coal Enhanced Resource Development Zone (ERDZ) that recognizes that coal exploration, development and production activities can be anticipated on these lands (Kootenay Inter-Agency Management Committee, 1997). However, it is also expected that the Project's outdoor lighting impacts can be minimized during the operation of the Project and be successfully mitigated once the site has been rehabilitated.

The visibility mapping for outdoor lighting demonstrates that the Project is screened from view and on-site lighting consisting of light fixtures (flood lights, spot lights, and area lights) on poles or light fixtures mounted on the processing plant buildings or conveyors will not be visible. This is consistent with the findings in the *Visual Aesthetics Baseline Report* and is a consequence of the location of the Project which is situated between the Mount Erickson Ridge and the Great Divide range along the BC-Alberta

border. Crown Mountain's peak is approximately 2,200 mASL and the processing plant is situated approximately 1,910 mASL. The peak of the Mount Erickson Ridge is 2,500 mASL and the Great Divide is 2,700 mASL. These ridges screen the Project and the effects of its outdoor illumination from the west and east. The likelihood of having discernible views from the north and south are also very low because of the dense evergreen forests in the valleys and the relatively low profile of Crown Mountain. The clean coal haul road is unlit, and the visibility mapping demonstrates that the outdoor illumination at the rail loadout area would not be visible due to nearby forest cover and the local landscape screening. The Sedgman *Crown Mountain CHPP Light Plan - Crown Mountain Coking Coal Project (2020)* identified a number of measures that would be implemented to address potential skyglow, including full cut-off fixtures and shields to avoid light above a horizontal plane and using adaptive controls to reduce ambient light where it was not needed.

Based on the visibility mapping, the landforms associated with surrounding ridges and the evergreen forests effectively block views to the Project in locations where there are sensitive receptors that include residences, institutions and recreational properties. Because the rail loadout is the closest facility to Sparwood, the outdoor lighting for night time operation of the loading facility, should implement full cut off fixtures to ensure that the light sources are dark sky compliant and do not contribute to skyglow. The use of dark sky compliant luminaires extends to all outdoor illumination for the processing plant, the operations yard and portable floodlights in the extraction areas.

The reclamation plan, prepared by Keefer Ecological Services Ltd, is based on progressive ecological treatment based on the process of assisting the natural recovery of ecosystems that have been damaged, using surrounding areas to guide the recovery. The plan involves the removal of the mining infrastructure including all outdoor lighting. This will eliminate the potential for outdoor lighting impacts once the reclamation plan is complete.

There will be insignificant outdoor lighting effects during mining operations from luminaires that have full cut-off fixtures and are fully shielded. As a result, the Project effects will not contribute to the cumulative effects.

# 1.0 Introduction

## 1.1 Project Overview

NWP Coal Canada Ltd (NWP) is proposing to develop the Crown Mountain Coking Coal Project (the Project), which is intended as an open pit metallurgical coal mine located within the Elk Valley coal field in the East Kootenay Region of southeastern British Columbia (BC; **Figure 1**). NWP is a subsidiary of Jameson Resources Limited and Bathurst Resources Limited (Canada). The Project comprises ten coal licences, covering a total area of approximately 5,630 hectares (ha).

The Project is located between several existing metallurgical coal mines in the Elk Valley and Crowsnest coal fields, the nearest being Teck Coal Limited's (Teck) Elkview Operations (8 kilometres [km] to the southwest) and Line Creek Operations (12 km to the north). The Elk Valley and Crowsnest coal fields are home to 4 of Canada's 8 producing coking coal mines. The coal mines in the area produce over 21 million tonnes per annum of export quality metallurgical and thermal coal and represent over 70% of Canada's total coal exports annually, making the Elk Valley coal field the most productive in the country. Exploration activities have indicated that the coal at the Project site is typical of coking coals produced from existing mines in the Elk Valley. The Project is expected to produce approximately 10,150 tonnes per day (tpd) and up to 4.0 million run-of-mine tonnes per year for 15 years. The metallurgical coal would be transported via railway to coastal BC, where it would be shipped overseas to be used in steelmaking.

The centre of the Project property (i.e., coal licences) is located approximately 12 km northeast of the District Municipality of Sparwood, British Columbia at 114°43.6'W and 49°48.4'N. By road, the Project is situated approximately 30 km from Sparwood. The Project is accessed by several local roads, including Grave Creek Road in the northwest and Alexander Creek Road from the south.

Key components of the proposed Project include, but are not limited to:

- Surface extraction areas (3 pits – north pit, east pit, and south pit) lit with moveable, temporary, high mast flood lights to illuminate night time mining operations;
- Raw coal stockpile (unlit);
- Coal Handling Preparation Plant (CHPP) and surround including raw coal conveyor, sizing station, plant feed conveyor, coal processing plant and infrastructure facilities (lit with outdoor wall mounted and pole mounted floodlights);
- Waste rock management areas (unlit);
- Clean coal transportation route (lit overland conveyor and truck loading bin);
- Haul road (unlit);
- Rail loadout facility and rail siding (lit with outdoor pole mounted flood lighting);
- Power supply (unlit);

- Natural gas supply (unlit);
- Explosives storage (lit);
- Fuel storage (lit);
- Sewage treatment (unlit); and
- Water supply (unlit).

The Project is subject to both the *Canadian Environmental Assessment Act* (CEAA) 2012 and the *British Columbia Environmental Assessment* Act (BC EAA) 2002. Under the federal Environmental Impact Statement Guidelines (EIS Guidelines; CEAA, 2015), ambient light levels at the Project site, specifically night time illumination levels need to be described and characterized. The purpose of the baseline outdoor lighting evaluation study is to describe the existing conditions within the Project study area and to identify the potential effects of outdoor lighting on the visual environment.

## 1.2 Purpose, Scope and Applicable Standards

The purpose of this lighting evaluation report is to address the effects of outdoor lighting. The *Visual Aesthetic Baseline Report* describes the existing visual aesthetics resources in the Project area. The light evaluation study builds on the visual aesthetics analysis and evaluates specific impacts from site lighting infrastructure (light poles, luminaires), to determine if there is light trespass involving unwanted spillage of light. The visibility mapping tool developed for the baseline visual aesthetic study has been modified to include the location and height of night lighting luminaires to determine if the light sources are visible and describe if and how the visible landscape may be altered. The visibility of the Project can have differing effects depending on the physical and social setting, as well as the proximity to the Project footprint. The visual baseline study inventoried and classified the physical conditions of the contextual landscape and sensitivities of viewers (receptors) to visible changes in the landscape. This outdoor lighting evaluation is based on the same visual aesthetic regulatory requirements, relevant policies and engagement with regulators, stakeholders and community members.

The outdoor lighting evaluation report is organized into the following sections:

- **Section 2.0** describes the study areas and the existing setting of the Project;
- **Section 3.0** provides a summary of relevant background information and methodology; and
- **Section 4.0** presents the results of the outdoor lighting baseline evaluation.

# 2.0 Study Areas

The study area for the outdoor lighting evaluation baseline report is consistent with the spatial limits for the visual aesthetic study. The overall study area is defined as the Project footprint, Local Study Area (LSA) and Regional Study Area (RSA).

The RSA includes all areas within 20 km of the Project and is shown on **Figure 1**. This includes foreground, middle-ground and background viewing distances of the Project (BC Ministry of Forests [MOF], 1997). From foreground (less than 1 km from the Project), middle-ground (1 km up to 5 km) and background (5 km to 10 km) from the Project, viewers can observe a discernable level of detail, texture and contrast in the landscape that diminishes as the distance increases. From background viewing distances that are more than 10 km to 20 km, viewers have the potential for distant views towards the Project that include a larger contextual landscape but have little or no discernable detail of the Project. The LSA includes receptor sites in the District of Sparwood, as well as recreation sites and transportation corridors that also have potential views of other existing coal mines in the Elk River Valley, including the Elkview and Line Creek Operations.

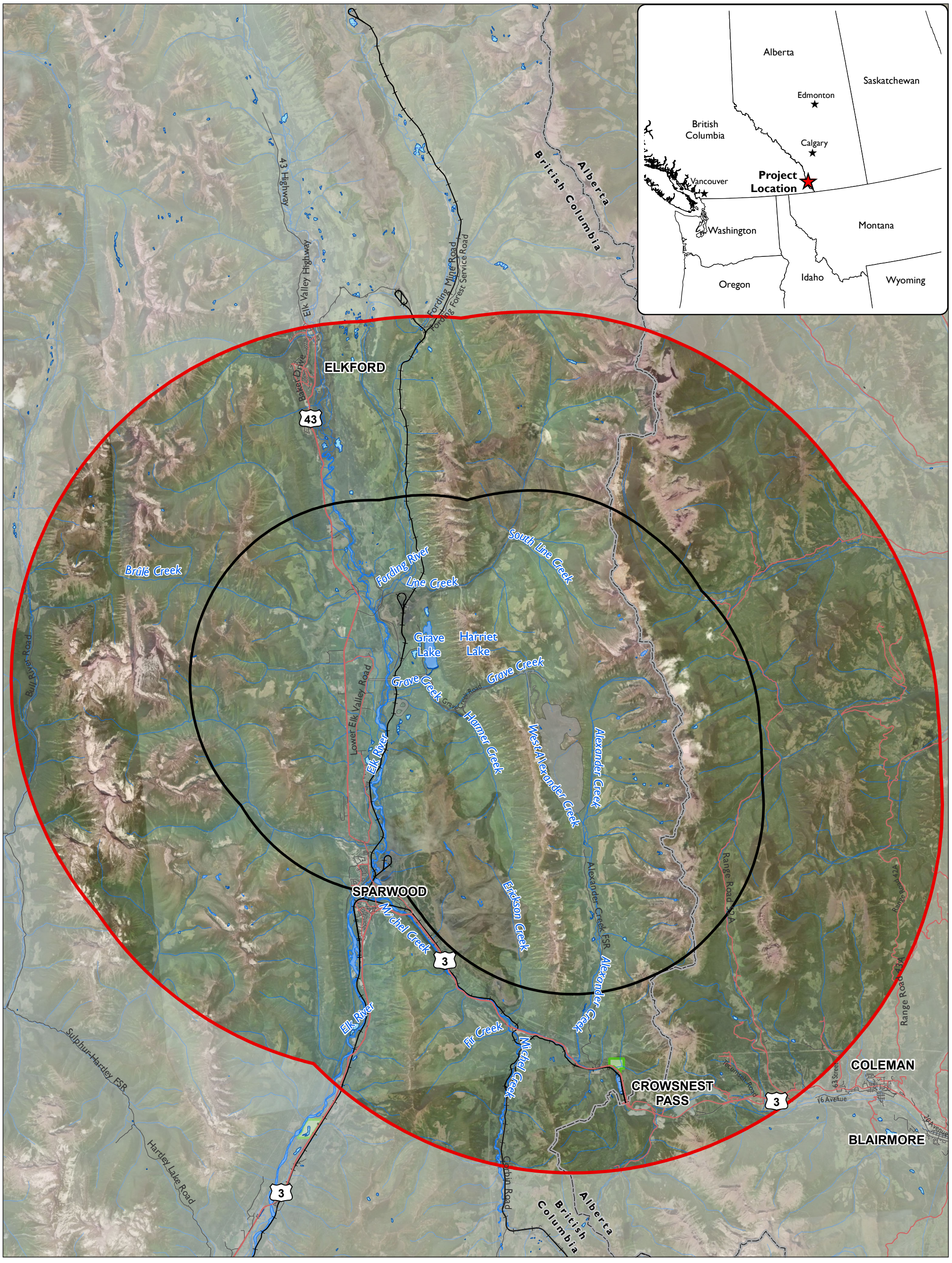
## 2.1 Project Footprint

The Project footprint covers approximately 1,300 ha and is positioned approximately 12 km northeast of the Sparwood and approximately 5 km west of the provincial boundary between BC and Alberta (**Figure 1**). By road, the Project is situated approximately 30 km from Sparwood. The Project site is visually contained by two high mountain ridges that shield the mine, the Mount Erikson Ridge to the west (elevation approximately 2,500 mASL) and the 'Great Divide' to the east along the BC-Alberta boundary (elevation approximately 2,700 mASL).

The Project footprint consists of the mine site, coal processing plant, the haul road corridor, and the rail loadout facility. The mine site, including the extraction zone (top elevation approximately 2,200 mASL) and plant area (elevation approximately 1,910 mASL), includes the raw coal stockpile area and processing plant and ancillary facilities (i.e., water supply, power supply, natural gas supply, water and waste water treatment, fuel storage and explosives storage).

## 2.2 Local Study Area

The LSA includes the Project footprint and the surrounding landscape area where potential impacts associated with Project activities could directly be affected by visual aesthetic conditions. The LSA covers an area of approximately 690 km², which encompasses the Project footprint and extends in a 10 km radius from the Project footprint.




Crown Mountain Coking Coal Project

FIGURE 1
Visual Aesthetics Baseline Study Areas

**LEGEND**

- Visual Aesthetics Local Study Area
- Visual Aesthetics Regional Study Area
- Project Footprint
- Highways
- Arterial Roads
- Local/Resource Roads
- Railway (Canadian Pacific)
- Watercourse
- Waterbody
- Wetland
- Provincial Park
- BC/Alberta Border

0 1 2 3 4 Kilometers

SCALE 1:200,000

Map Drawing Information: Data Provided by Province of British Columbia, NWP Coal Canada Ltd., Dillon Consulting Limited

Map Created By: JFC/LMM
Map Checked By: EMN
Map Projection: NAD 1983 UTM Zone 11N

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PROJECT: 12-6231
STATUS: FINAL
DATE: 2021-04-30

File Location: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\Light\Baseline\126231_VA_StudyArea.mxd

## 2.3 Regional Study Area

The RSA comprises the area where environmental conditions could potentially be indirectly impacted by the Project. The RSA generally encompasses the Elk River watershed and Alexander Creek watershed that drains the majority of the Project site. The RSA extends in a 20 km radius from the Project footprint and covers a total geographic area of approximately 1,960 km².

# 3.0 Relevant Background Information and Methodology

## 3.1 Data Compilation and Review of Background Information

Existing information for use in the background review was compiled from a wide range of sources including, but not limited to:

- Sedgman Canada Ltd. (2020). *Crown Mountain CHPP Light Plan - Crown Mountain Coking Coal Project;*
- Dillon Consulting (2021). *Visual Aesthetic Baseline Report – Crown Mountain Coking Coal Project*;
- Keefer Ecological Services Ltd. (2021). *Mine Closure and Ecological Restoration Plan* – Crown Mountain Coking Coal Project;
- Province of British Columbia, GeoBC Open Data. (2020a). *Baseline Thematic Mapping Present Land Use Version 1*;
- Province of British Columbia, GeoBC Open Data. (2020b). *Vegetation Resources Inventory - Forest Vegetation Composite Rank 1 Layer (R1)*;
- Province of British Columbia, GeoBC Open Data. (2020c). *Visual Landscape Inventory – Ministry of Forests, Lands, Natural Resource Operations and Rural Development*; and
- Kootenay Inter-Agency Management Committee. (1997). *Kootenay/Boundary Land Use Plan Implementation Strategy*.

## 3.2 Delineate/Verify Visual Study Area

The outdoor lighting evaluation identifies potential negative effects that could include glare, skyglow and light trespass effects and is supported by mapping to characterize the existing conditions and post-construction impacts. The Project is located in a remote area that is not easily accessed by the public or in view of local municipalities; however, the site and surrounding area is currently used by recreationists (e.g., snowmobiling, hiking, camping, all-terrain vehicles [ATVs]), as well as hunters. Although the RSA extends 20 km from the Project footprint, the visibility of the Project and the assessment for light impacts extend to 10 km, the distance Dillon selected to serve as the basis for this evaluation. The impact of visual changes is dependent on proximity, with the greatest impact to sensitive receptors that are in the foreground (0-1 km) and mid-ground (1-5 km) and to a lesser degree in the background (5-10 km) from which changes to the visual landscape as the context for outdoor lighting impacts such as skyglow may be observed. The baseline inventory of visual resources is illustrated in **Figure 2**.

The Project is located within the Elk Valley, east of the Mount Erickson Range, and northeast of the community of Sparwood, BC. The RSA is characterized as the southeast Rocky Mountain physiography of rocky peaks, parallel trending ridges and valleys containing meandering rivers and streams. The Project

encompasses a complex of high ridges and contains Crown Mountain and Alexander Creek (west and east tributaries). The Elk River valley is west of the Project footprint but within the LSA. It is a large, meandering watercourse and wide valley that contains the rail loadout facility and rail siding. The clean coal transportation route is located within the Grave Creek valley.

In the LSA, land cover comprises Montane spruce forests in the valleys, and Engelmann spruce and subalpine fir at higher elevations. Cultivated field crops and pasture lands are also evident near the rail loadout facility and along Highway #43 (**Figure 2**). Industrial uses northeast of Sparwood include several open-pit coal mines that have visibly modified the Elk Valley landscape. Previous logging activity is also visible on both sides of the Elk River. Vegetation regeneration is established at various stages in these areas, producing a landscape with a variation of textures and patterns reflecting past and current timber harvesting and coal extraction activities. Recreational uses in the RSA include year-round outdoor activities, such as golfing, wildlife viewing, camping, hiking, hunting, fishing, ATV trails, snowmobiling and skiing.

## 3.3 Integration of Consultation Input

A primary data collection program was conducted in 2020 to support the socio-economic and land use baseline studies and effects assessments and is summarized in the *Socio-Economic Baseline Report* (Dillon, 2021). Though the primary data program, current land uses within the Project footprint were identified that include ATV and hiking trails on Crown Mountain that are used by the Elkford ATV Club, the Crowsnest Pass Quad Squad, the Alberta Off-Highway Vehicle Association and the Great Divide Trail Association and others. Sensitive receptor locations were identified through the primary data collection program and through consultation with the Ktunaxa Nation and from open source data available from the Province of BC (**Figure 3**). These sensitive receptors include residential, commercial, recreational and institutional uses. The closer the use to the Project, the more significant the potential disturbance to visual aesthetics. Visual changes in the foreground (within 1 km), are the most disruptive. The impact diminishes with distance and the complexity of the surrounding landscape.

Crown Mountain Coking Coal Project

FIGURE 2
Land Use Map

**LEGEND**

- Visual Aesthetics Local Study Area
- Project Footprint
- Highways
- Arterial Roads
- Local/Resource Roads
- Railway (Canadian Pacific)
- Watercourse
- BC/Alberta Border
- Agriculture
- Alpine; Sub alpine Avalanche Chutes; Permanent Ice and Snow
- Barren Surfaces; Exposed Soil
- Closed Upland Shrub; Open Upland Shrub; Fescue Grassland; Range Lands; Wetlands
- Closed Aspen/Balsam Poplar/Birch; Open Engelmann/White Spruce; Closed Undifferentiated Coniferous; Old Forest; Young Forest
- Residential Agriculture Mixtures
- Recently Burned; Undifferentiated Burn; Recently Logged; Selectively Logged
- Urban; Urban and Industrial; Mining
- Water
- Wetland
- No Data

0 1 2 3 4 Kilometers

SCALE 1:120,000

N W E S

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd.,
Dillon Consulting Limited, Province of British Columbia,
Government of Alberta.

Map Created By: JFC/LMM
Map Checked By: EMN
Map Projection: NAD 1983 UTM Zone 11N

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File Location: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\Light\Baseline\126231_VA_Landuse.mxd

Crown Mountain Coking Coal Project

FIGURE 3
Consultation Input/Sensitive Receptor Map

**LEGEND**

- Visual Aesthetics Local Study Area
- Project Footprint
- Highways
- Arterial Roads
- Local/Resource Roads
- Railway (Canadian Pacific)
- Watercourse
- Waterbody
- Wetland
- BC/Alberta Border
- Receptors from Background Data
- Receptors from Consultation
- Recreation Trails from Consultation
- Great Divide Trail

0 1 2 3 4 Kilometers

SCALE 1:120,000

N W E S

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd., Dillon Consulting Limited, Province of British Columbia, Government of Alberta.

Receptor data from Province of British Columbia, GeoBC Open Data, Dillon Consulting Limited, Consultations

Map Created By: JFC/LMM
Map Checked By: EMN
Map Projection: NAD 1983 UTM Zone 11N

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## 3.4 Visual Resource Management Context

A review of existing relevant BC Visual Landscape Inventory (VLI; Province of BC, 2020), resource management guidelines and strategic planning documents was conducted to understand the policy context for visual aesthetic management within the LSA. These management guidelines do not address the evaluation of potential effects from night time operations; however, excessive artificial light can pollute the visual environment and have negative environmental consequences for humans and wildlife.

The VLI database rating identifies that the Project footprint is in a zone that is 'not visually sensitive' (Province of BC, 2020), and does not include defined visual quality ratings or Visual Quality Objectives (VQOs). This is to be expected because the Project and a significant part of the LSA is in the Coal Enhanced Resource Development Zone (ERDZ) that recognizes that coal exploration, development and production activities can be anticipated on these lands (Kootenay Inter-Agency Management Committee, 1997). It is also expected that the Project's outdoor lighting impacts can be minimized with the application of dark sky compliant fixtures during the operation of the Project and successfully mitigated with the removal of all outdoor lighting infrastructure once the site has been rehabilitated.

## 3.5 Assemble GIS Data to Prepare Visibility Map/Model

To prepare the visibility mapping for the outdoor lighting evaluation, ESRI ArcGIS Pro software was used to create a surface that represented the Project infrastructure, including: surface extraction areas; raw coal stockpile; coal handling process plant (CHPP) including raw coal conveyor, sizing station, plant feed conveyor, coal processing plant and infrastructure facilities; mine rock management areas; clean coal transportation facilities; and rail loadout and rail siding.

The location of outdoor lighting equipment from the Sedgman (2020) *Crown Mountain CHPP Light* Plan (**Appendix A**) was added to the model. The elevation (height) above ground of the luminaires was also included to identify which sources of light might be viewed from sensitive receptor locations.

A surface offset of 1.5 m was used to represent the viewing height of a person. Once the model was generated, 'areas with visibility' results were further refined to exclude unlikely observation areas such as tree tops or roof tops.

### 3.5.1 Topographic Surface – Digital Elevation Model (DEM)

The base surface for the visibility mapping was a bare earth Airborne LiDAR 5m resolution DEM dataset, covering 97% of the visual aesthetic study LSA. The remaining base surface incorporated the 20 m Canadian Digital Elevation Model (CDEM). The resulting surface was used as the reference for the process environment; resolution of 5 m, coordinate system of NAD 1983 UTM Zone 11, and an extent of the 10 km for the LSA (**Figure 4**).

Crown Mountain Coking Coal Project

FIGURE 4
Digital Elevation Map

**LEGEND**

- Visual Aesthetics Local Study Area
- Project Footprint
- Highways
- Arterial Roads
- Local/Resource Roads
- Railway (Canadian Pacific)
- Watercourse
- Waterbody
- BC/Alberta Border

**Elevation**

- High : 2834m
- Low : 1074m

0 1 2 3 4 Kilometers

SCALE 1:120,000

N W E S

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd., Dillon Consulting Limited, Province of British Columbia, Airborne Imaging Inc. Digital Terrain Model, Government of Canada Natural Resources Canada. Canadian Digital Elevation Model

Map Created By: JFC/LMM
Map Checked By: EMN
Map Projection: NAD 1983 UTM Zone 11N

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File Location: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\Light\Baseline\126231_VA_DEM.mxd

### 3.5.2 Surface Compilation - Digital Surface Model (DSM)

To accurately depict the natural and built features that depicted existing land use, forest cover/vegetation, cut blocks, buildings, and linear infrastructure areas, the heights were incorporated into the surface. Land use and vegetation datasets were layered onto the bare earth DEM to create the DSM. The land use dataset was obtained from the GeoBC Open Data online catalogue and Keefer Ecological Services Ltd. *Mine Closure and Ecological Restoration Plan* (2021), including estimated heights for each category of vegetation, specifically for data that was not available from GeoBC Open Data. Estimated vegetation heights was further supplemented with Dillon field observations. Outdoor luminaire locations and heights were added based on the Sedgman (2020) *Crown Mountain CHPP Light Plan.*

Local residential and commercial buildings and linear infrastructure (hydro corridors) were added to the DSM. Data for the buildings, roads, trails, railway and water features were sourced from BC Open Street Map (OSM). The OSM buildings dataset did not have heights so these were generalized to be 1 to 3 stories based on dimensions of the building footprint and open source digital mapping.

### 3.5.3 Exclusion Areas

Once the digital surface model was compiled, the analysis was checked to confirm that local vegetation or buildings did not obscure the viewer. Linear infrastructure (roads, railway and trails) were not considered exclusion areas if they transected the vegetation.

### 3.5.4 View/Observation Points to the Project

The DSM for the Project footprint depicts the site cleared of vegetation with all of the supporting infrastructure and buildings in place. The extraction/mine site is depicted with pre-extraction elevations. Each source of light was assigned a height based on data from the Sedgman *Crown Mountain CHPP Light* Plan (2020) and using coal handling process plant drawing files to further refine locations and heights.

# 4.0 Results of the Outdoor Lighting Baseline Assessment

Visibility mapping (**Figure 5**) depicts the visibility of night time outdoor lighting from the entire Project footprint. The 'pink' zones indicate locations that will have a view (observation point) of the Project and the 'green' zones indicate locations that do not have views (observation points) of the Project because views are blocked by topography, vegetation or other structures.

Based on the visibility mapping, the Project is screened from view with few exceptions. The Project footprint is situated between the Mount Erickson Ridge and the Great Divide range along the BC-Alberta border. Crown Mountain's peak is approximately 2,200 mASL and the plant is situated at approximately 1,910 mASL. The peak of the Mount Erickson Ridge is 2,500 mASL and the Great Divide is 2,700 mASL. These ridges screen the Project footprint from the west and east.

The likelihood of having discernible views from the RSA is very low because of the dense evergreen forest and complex landscape (high visual absorption capacity) that is comprised of steep ridges and the relatively low profile of Crown Mountain.

The conclusion, based on the visibility model, is that the landforms associated with surrounding ridges and the dense evergreen forest effectively block views to outdoor lighting of the Project in locations where there are sensitive receptors are located (e.g., residences, public roads, institutions and recreational properties). The clean coal haul road is unlit and the visibility mapping demonstrates that the outdoor illumination at the rail loadout area would not be visible due to nearby forest cover and the local landscape screening. Because the rail loadout is the closest facility to Sparwood, the outdoor lighting for night time operation of the loading facility, should implement full cut off fixtures to ensure that the light sources are dark sky compliant and do not contribute to skyglow. The use of dark sky compliant luminaires extends to all outdoor illumination for the processing plant, the operations yard and portable floodlights in the extraction areas.

There are impacts to recreational trails that are currently within the Project footprint. Mitigation involving reclamation and closure and post-closure reclamation of the mine site and the potential relocation, where appropriate and practicable, of recreational trails is addressed in **Section 5.0**.

Crown Mountain Coking Coal Project

FIGURE 5
Light Visibility Mapping

**LEGEND**

- Visual Aesthetics Local Study Area
- Project Footprint
- Highways
- Arterial Roads
- Local/Resource Roads
- Railway (Canadian Pacific)
- Watercourse
- Waterbody
- Wetland
- BC/Alberta Border
- Receptors from Background Data
- Receptors from Consultation
- Recreation Trails from Consultation
- Great Divide Trail

**Visibility**

- Not Visible
- Visible
- Light Visibility Processing Point Coverage

0 1 2 3 4 Kilometers

SCALE 1:120,000

N W E S

Map Drawing Information:
Data Provided By NWP Coal Canada Ltd., Dillon Consulting Limited, Keefer Ecological Services Ltd., Province of British Columbia, Airborne Imaging Inc. Digital Terrain Model Government of Canada Natural Resources Canada. Canadian Digital Elevation Model

Receptor data from Province of British Columbia, GeoBC Open Data, Dillon Consulting Limited, Consultations

Map Created By: JFC/LMM
Map Checked By: EMN
Map Projection: NAD 1983 UTM Zone 11N

DILLON CONSULTING

PROJECT: 12-6231
STATUS: FINAL
DATE: 2021-04-30

File Location: \\42dillon\CAD\GIS\2012 and Prior\126231 Crown Mountain\Light\Baseline\126231_VA_LightVisibilityMapping.mxd

# 5.0 Approach to Mitigation

A mine closure and ecological restoration plan (MCERP) for the Project (**Figure** 6) has been developed by Keefer Ecological Services Ltd. (2021). The restoration process will be ongoing during mining operations with the objective of progressively phasing in restoration as the site evolves. The ecological treatment approach is based on reinstating ecotypes that are consistent with the adjacent, undisturbed landforms and species found on the site prior to mining. This approach is consistent with the Class 3 Management Guidelines for the Front Country Visual Management Area in the *Kootenay/Boundary Land Use Plan Implementation Strategy* (Kootenay Inter-Agency Management Committee, 1997). The approach to reclamation includes removing all infrastructure (including outdoor lighting) and reclaiming and repurposing salvaged soil for enhancing natural habitats to pre-mining conditions, and progressively reclaiming exhausted areas of the mine.

The post mine ecological treatment will include three biogeoclimatic units that were present in the mine site, rail loadout and haul roads prior to disturbance. The mine site reclamation will support fifteen reclamation treatment units that correspond to the full range of ecotypes found in the pre-mine site. The approach to reclamation includes the creation of key habitats:

- Deciduous-leading forest with lodgepole pine and spruce;
- Warm aspect wildlife forage habitat (e.g., grasslands);
- Cooler aspect shrub land to forest;
- Wetlands;
- Riparian habitats;
- Footwall escape terrain for ungulates (e.g., bighorn sheep and mountain goat).

The restoration plan uses natural processes to steer long term restoration, using all native plants in the ecological associations that occur in the region. The goal is to have a vegetated post-mine environment that minimizes post-mining effects and reduces the impact to visual aesthetics. The plan involves the removal of the mining infrastructure including outdoor lighting. This will eliminate the potential for outdoor lighting impacts once the reclamation is complete.

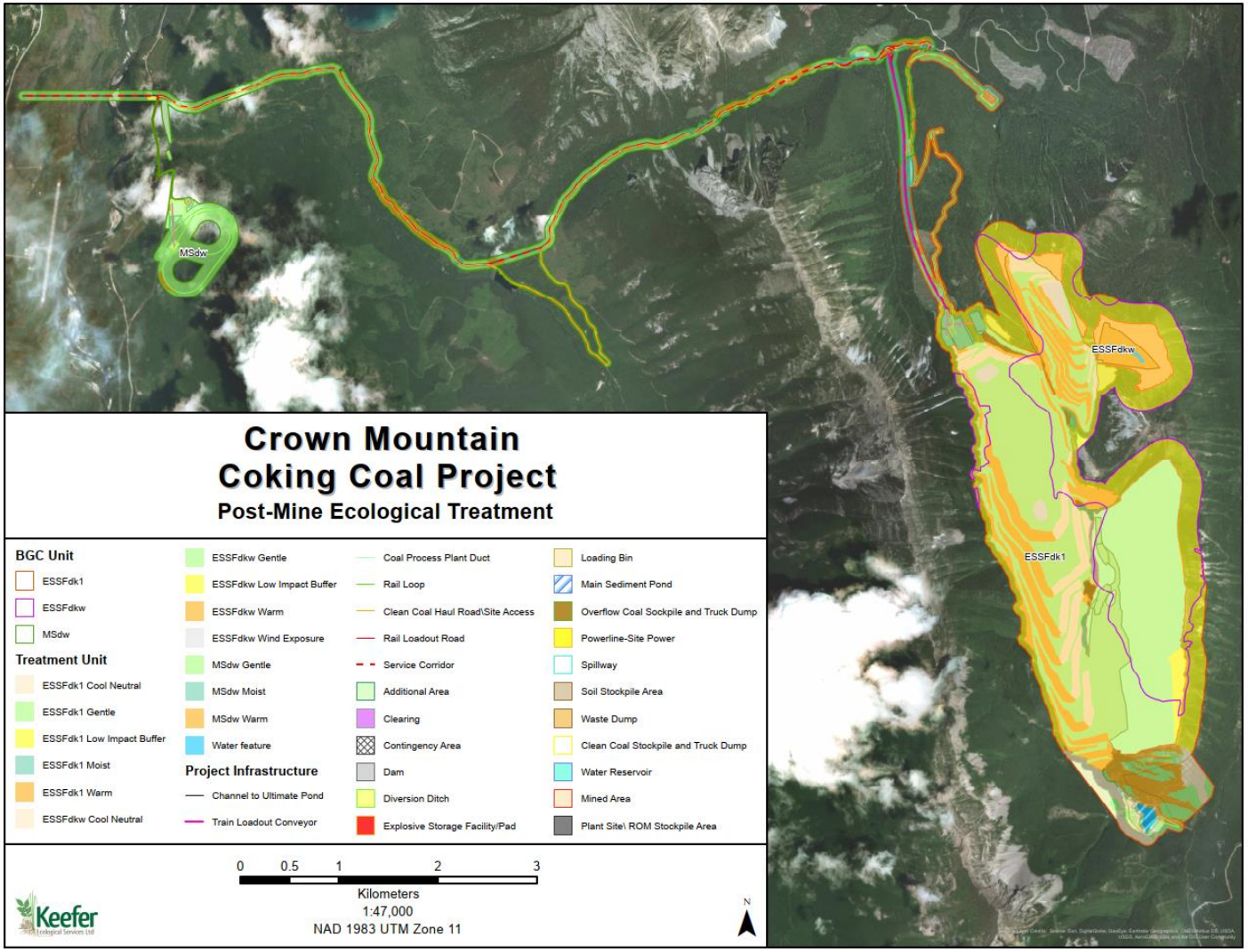


**Figure 6: Remediation Plan - Ecological Treatment**

The selection of dark sky compliant luminaires, the use of shielding to reduce glare and unwanted light trespass and the implementation of adaptive controls (motion activated) that reduce the intensity and duration of lighting will result in no adverse outdoor lighting effects during operations and will not contribute to the cumulative effects.

The *Kootenay/Boundary Land Use Implementation Plan Strategy* (Kootenay Inter-Agency Management Committee, 1997) provides guidance for areas where extraction activities interfere with recreational trails. The guidelines suggest that where substantial disruption to hiking and motorized recreational trails is unavoidable, licensees should relocate/re-establish trails to avoid mineral extraction sites. Through consultation, new trail alignments that avoid the mine site should, where appropriate and practicable, be established.

Monitoring is one of the tools to assess the degree to which mitigation strategies are effective in successfully achieving reclamation and cumulative effects. Monitoring is one of the primary adaptive management tools and should be used to indicate adjustments in mitigation strategies used for the Project.

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# Appendix A

## *Crown Mountain CHPP Light Plan*

SEDGMAN

# Memorandum

**To:** Mike Allen
**From:** Luke Page
**CC:** Mark Wilkin
**Date:** 28 October 2020
**Our Ref:** A355-D04-02054-MM-0001
**Subject:** **Crown Mountain CHPP Light Plan**

The purpose of this technical memo is to provide NWP Coal Canada Ltd.'s EA consultant Dhillon Consulting with information from the recently completed Crown Mountain Feasibility Study (FS) Coal Handling and Preparation Plant (CHPP) design. In using this completed design we have updated the FS design to include lighting layouts using referenced information from our previously completed plant designs to convey the design basis for Dhillon Consulting to complete a lighting assessment of the facilities.

This memo provides the following summary information:

- Section 1- An outline of the CHPP lighting key design criteria including descriptions of the light fittings and the area lux levels
- Section 2 - CHPP facility exterior lighting plans including key reference co-ordinates, locations, heights and light types on marked-up images of the plant 3D model
- Section 3 - A brief description of the CHPP's 24 hours operation and mobile lighting required for the operation and maintenance of the CHPP
- Section 4 - Light mitigation design strategies, i.e. angling of fittings, cut-offs, etc.

## Section 1 – Lighting Design Criteria

CHPP lighting and associated equipment shall comply with the latest relevant Canadian Standards and industry codes and standards.

The following section sets out the minimum requirements for the design, equipment selection and installation of plant lighting.

**Power supply**

Lighting shall typically be suitable for operation at LV single phase. Luminaires shall operate continuously with a voltage variation of ±10%, transient voltage dips of up to 20%, and a supply frequency variation of ±5Hz.

All luminaires shall be of the high power factor type to ensure a power factor of not less than 0.95 lagging.

The LV lighting power supply specifications are provided in the table below.

| Description | Details | Units and Quality |
|---|---|---|
| **Voltage** | 208V/120V (Alternative is 240V/120V) | Vac (-10%; +10%) |
| **Frequency** | 60 | Hz (-5%; +5%) |
| **Number of phases** | Three Phase , 4 wire (panel board) | |

| Description | Details | Units and Quality |
|---|---|---|
| **3 Phase symmetrical fault level** | 10 | kA for 1 seconds (design) |
| **Cable Insulation** | 0.6 | kVac |
| **Grounding method** | Solid | |

## Lighting Design

### *Key Design Criteria*

The lighting system shall be designed in accordance with CEC, subject to the following criteria:

1. The contribution of daylight shall be excluded from any illuminance calculations.
2. Unless specified otherwise, the “uniformity of illuminance” shall be not less than 0.5 with a target of 0.7.
3. The “light output from a luminaire” (luminaire light loss factor) after 6 months shall be not more than 80% (6 month cleaning cycle).
4. The minimum levels shall not be reached until after 16,000 hours of lighting operation.
5. The lamp’s deteriorating light output with age shall be taken into consideration by the use of a minimum lumen maintenance factor of 75%.
6. The value of reflectance for all surfaces shall be considered zero for the purpose of any illuminance calculations.

### *Minimum Illuminance Levels*

The average illumination levels for the different areas of the CHPP shall be as outlined in the table below.

| Area | Average Maintenance Illuminance (Lux) | Maximum Working Plane (m) |
|---|---|---|
| **Electrical rooms and control rooms** | 500 | 0.75 |
| **MCC control panels** | 300 | 0.75 |
| **Feeders** | 200 | On Pan |
| **Compressors and pumps** | 200 | On Drive |
| **Screens** | 200 | On Deck |
| **Magnetic separators** | 200 | On Drive |
| **Remaining CHPP drive heads (where not specified above)** | 200 | On Drive |
| **Hydraulic power packs** | 200 | On Drive |
| **Transfer chutes** | 200 | 0.75 |
| **Intermittent inspection area/tasks** | 200 | 0.75 |
| **CHPP Bunkers and Pits** | 200 | 0.75 |
| **Internal stairs (within plant buildings)** | 100 | 0 |
| **Internal walkways (within plant buildings)** | 100 | 0 |
| **Platforms** | 100 | 0 |
| **Conveyors, gantries and tunnels** | 50 | 0 |

| Area | Average Maintenance Illuminance (Lux) | Maximum Working Plane (m) |
|---|---|---|
| **External stairs and catwalks** | 50 | 0 |
| **Building access** | 50 | 0 |
| **Access roadways** | 10 | 0 |
| **Substations** | 50 | 0 |
| **Building surrounds (External)** | 10 | 0 |

The remaining CHPP drive heads, transfer chutes, CHPP Bunkers and Pits, external stairs and catwalks, building access, substations and building surrounds lux levels will be most applicable for the lighting model.

Control panel lighting shall be provided with electronic dimmers.

Control Room lighting shall be designed such that light images or reflections will be minimised on computer monitors.

The lighting design shall ensure that the change in contrast on entry of building drive throughs shall not cause the blinding of drivers.

***Lighting Equipment***

The lighting system design intent is to provide adequate illuminance levels around mechanical and electrical equipment (including drive units) to permit safe and efficient operation and maintenance at night.

Luminaires shall be selected for their intended environment, which includes high levels of vibration, water, snow, dust, and corrosive atmosphere.

Luminaires shall be constructed of stainless steel or epoxy coated cast alloy and fitted with stainless steel screws and hinges.

The number of different types of luminaires, lamps and control gear shall be kept to a minimum in order to reduce spares holding.

Luminaires shall be selected and in general utilized as outlined in the following table.

| Area | Fitting Type | Remarks |
|---|---|---|
| **Conveyor and process plant walkways, general access areas** | Bulkhead | 2100-2400 mm mounting height (typ.). NEMA 3R minimum. |
| **Task areas** | Floodlight | Miniature style, 2100-2400 mm mounting height (typ.) NEMA 3R minimum. |
| **External areas, general** | Floodlight | Lumen output and mounting height to suit working area. NEMA 3R minimum. |
| **Plant areas – roof mounted** | High bay floodlight or similar | High vibration tolerance required |

**Note:** LED fittings are preferred to conventional light fittings such as fluorescent, HID or HPS. The drawing mark-ups in section 2 indicate High Pressure Sodium (HPS) lamp light fittings, however these can be interchanged with an equivalent lumen output LED lamp. The colour rendering will be different between the two different lamp technologies, however the resulting lux levels will remain the same.

All externally mounted luminaires and their associated lamps shall be designed to meet the requirements and recommendations of CEC, and any additional requirements imposed by local authority regulations or environmental design constraints (dark sky compliance). In particular, cut-off angles shall be such as to minimise the effect of the lighting system on nearby residents.

Transmitting surfaces and diffusers shall be made of a suitable material that will not become opaque or discoloured from age or prolonged heat. In addition, they shall be able to withstanding sudden changes in temperature from high pressure water hose down without cracking or otherwise affecting their properties in any way.

Luminaires shall be designed to accommodate two separate cable entries without drilling or affecting NEMA ingress ratings in any way. Sufficient space shall be provided for termination of incoming and outgoing cables. Unused cable entries shall be fitted with blanking plugs protected to not less than NEMA 3R.

The cable directly connected to the light fitting shall be flexible and thermally rated for the temperature rise of the light fitting when operated at an ambient temperature of 40 °C.

Where luminaires require additional mechanical protection, they shall be fitted with suitable proprietary guarding.

***Luminaires – Electrical Rooms and Control Rooms***

Indoor lighting for electrical rooms and control rooms shall use either conventional or LED light fittings, protected to not less than NEMA 12.

***HID Luminaires***

Unless specified otherwise all 70/110W lamps shall be fitted with internal igniters.

When HID lighting is used the standard lamp sizes to be used on site shall be 70/110W, 150/250W, 360/400W, and 940/1000W.

The 70/110W lamps shall have an average life of not less than 16,000 hours and be of the sintered electrode type. The 150/250W, 360/400W and 940/1000W lamps shall have an average life of not less than 24,000 hours.

Lamps of the specified type, size and manufacture shall be installed in the luminaires.

***LED Luminaires***

LED luminaires exposed to material build up (e.g. plant areas, highly dusty areas) shall not incorporate cooling fins or similar structure whose performance or longevity may be impeded by material build-up (loss of cooling efficiency) or corrosion (retention of wet material).

Emergency LED luminaires shall be a variant of the standard bulkhead style fitting, i.e. a standard bulkhead fitting with an emergency battery and control circuit added in the manufacturer’s standard fashion.

## Section 2 - CHPP Facility Exterior Lighting Plan

The exterior lighting plans for each CHPP plant area are outlined below, which are at a feasibility level of completion, at this stage no lux level calculations have been performed by Sedgman and use source completed projects design information..

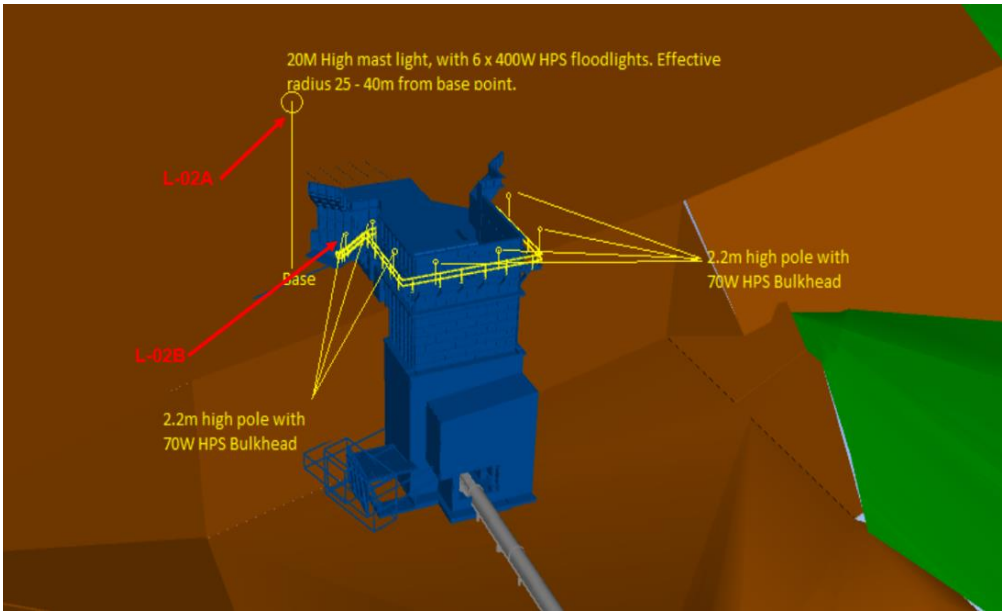
Co-ordinates for reference lights have been provided on the 3D model snapshots to assist the light modeller with locating the lights.

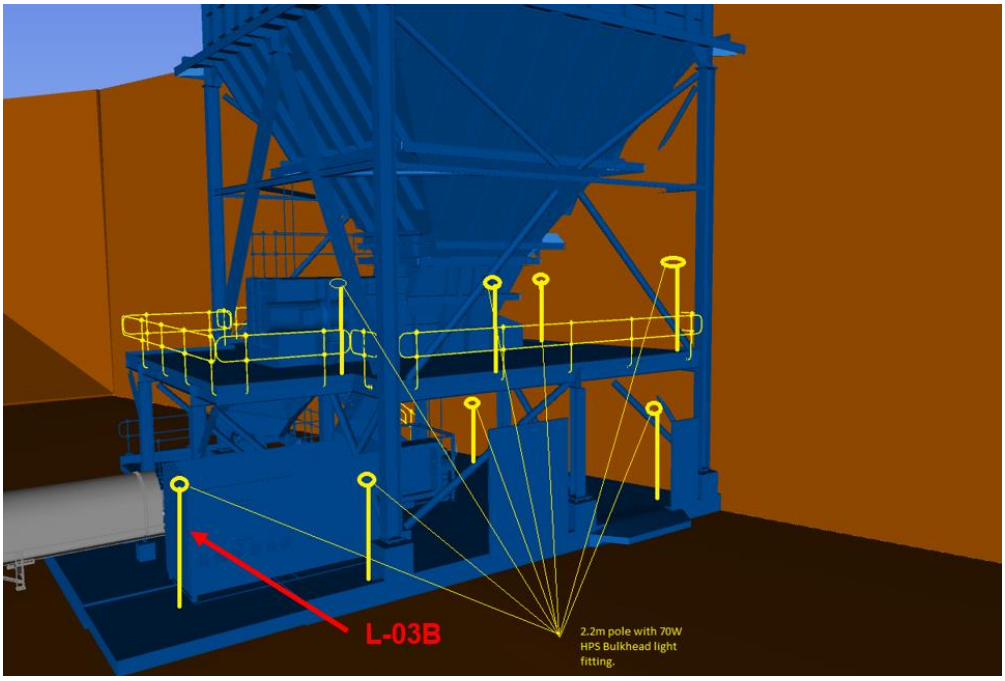
***ROM Pad and Bin (BN-101)***

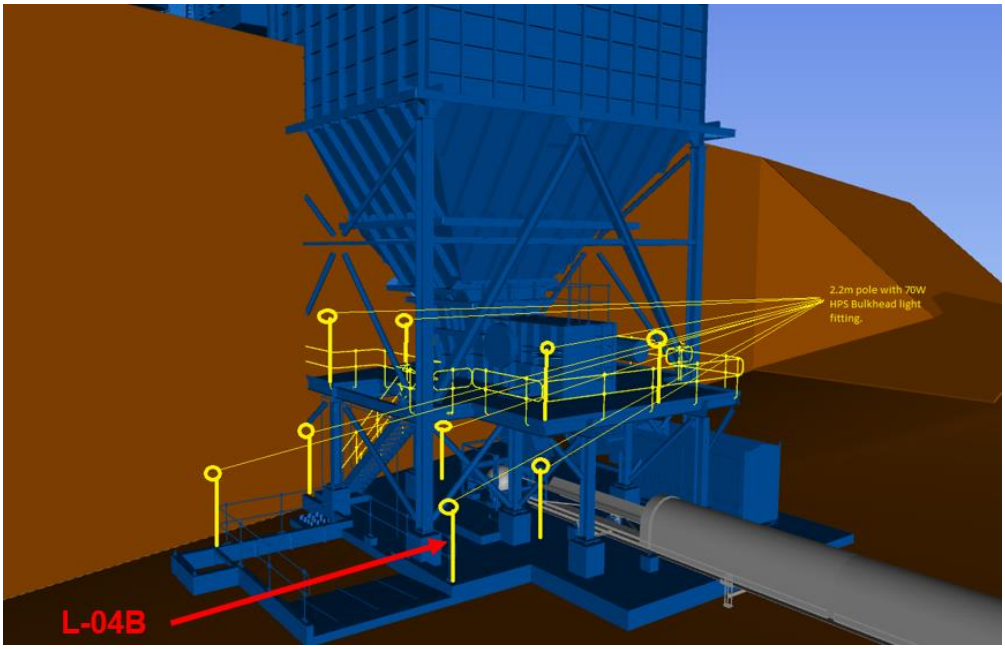
The lighting plan for the ROM pad and bin is shown in the figures below, with co-ordinates for labelled lights, i.e. L-02A, etc, tabled.

A ROM Pad 20m high mast light is required to provide lighting for the Run of Mine (ROM) coal dump trucks and raw coal stockpile Front End Loader (FEL) night-time operation.

**Note:** The base of the ROM bin will be an open uncladded structure (as shown in the 3D model snapshots of the bottom of the bin). The bin underside will not be cladded as shown in the first figure.



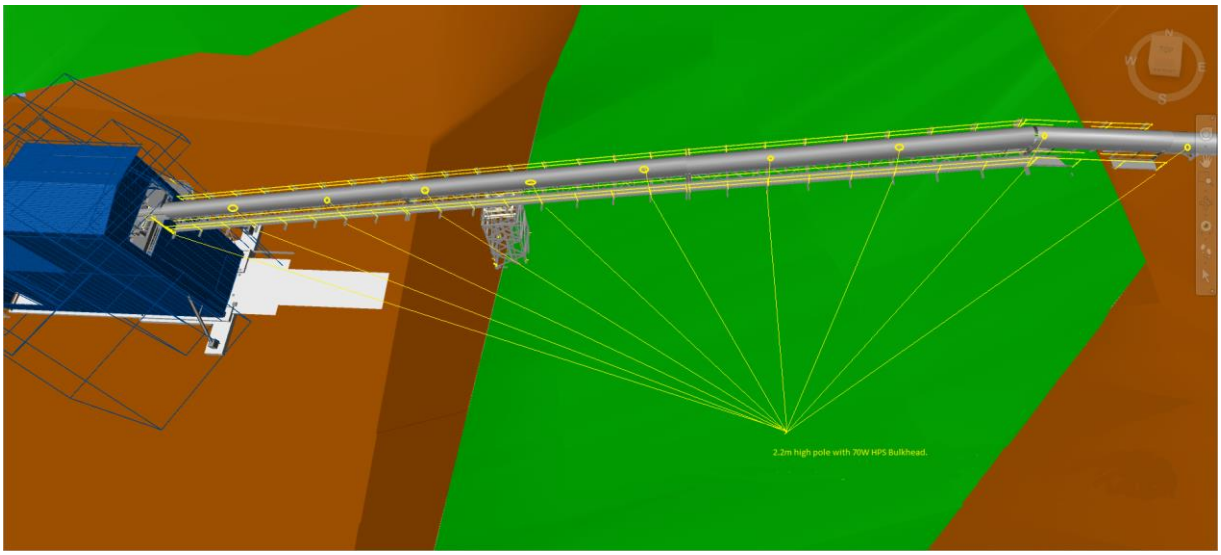



| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-02A** | 70W HPS | 661870 | 5521639 | 2200 |
| **L-02B** | 6X400W High Mast | 661892 | 5521644 | 20000 |
| **L-03A** | 70W HPS | 661853 | 5521630 | 2200 |
| **L-04A** | 70W HPS | 661853 | 5521635 | 2200 |

***Raw Coal Conveyor (CV-101)***

The lighting plan for the raw coal conveyor is shown in the figure below. The conveyor is an open style gantry conveyor with a single sided walkway with lights spaced 9m apart.

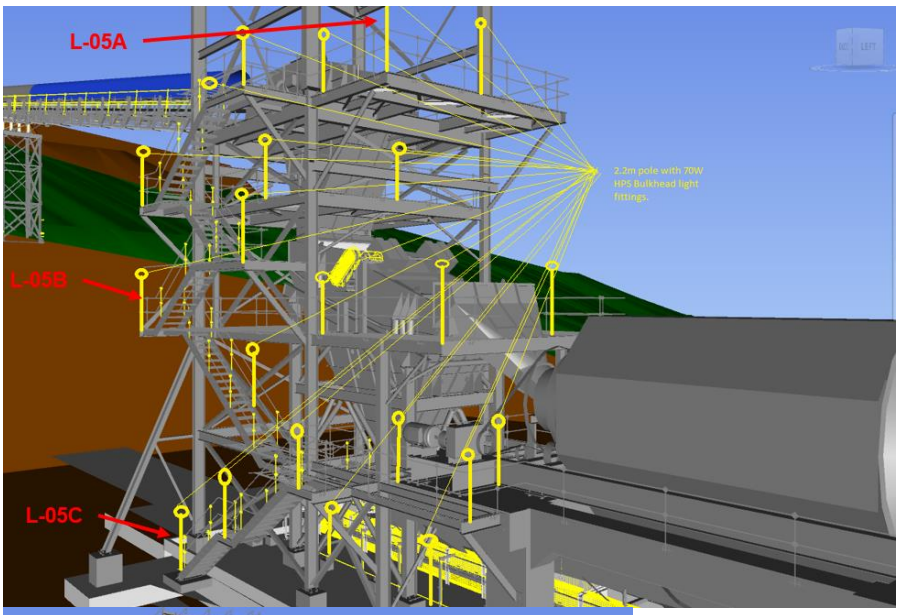
**Note:** The sizing station (ST-102) is shown cladded in the 3D model snapshot below, however this structure will not be cladded as shown in the detailed lighting plan snapshots.

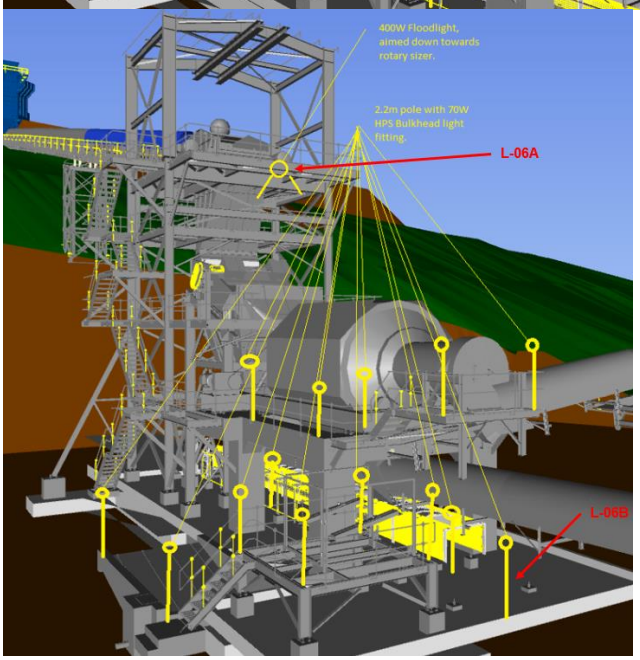


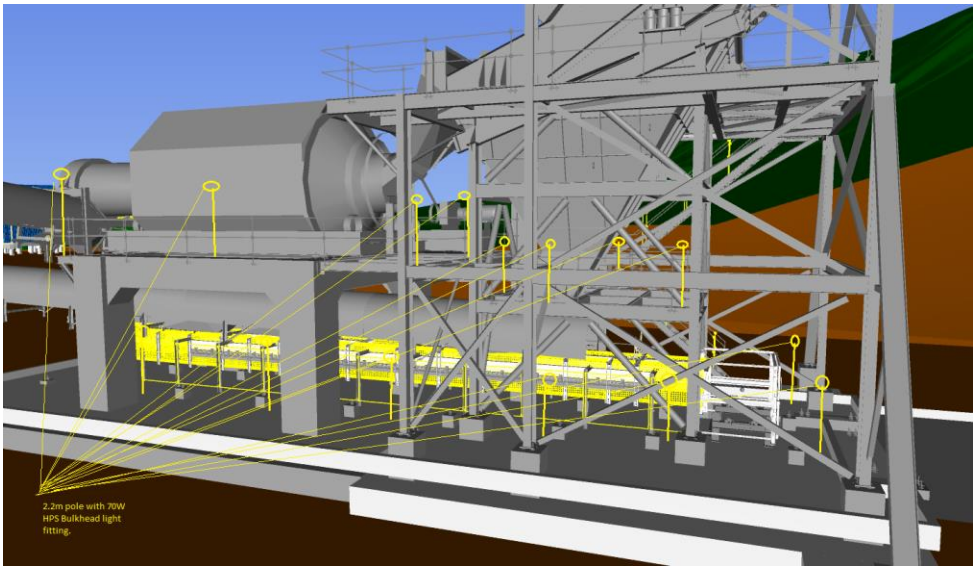
***Sizing Station (ST-102)***

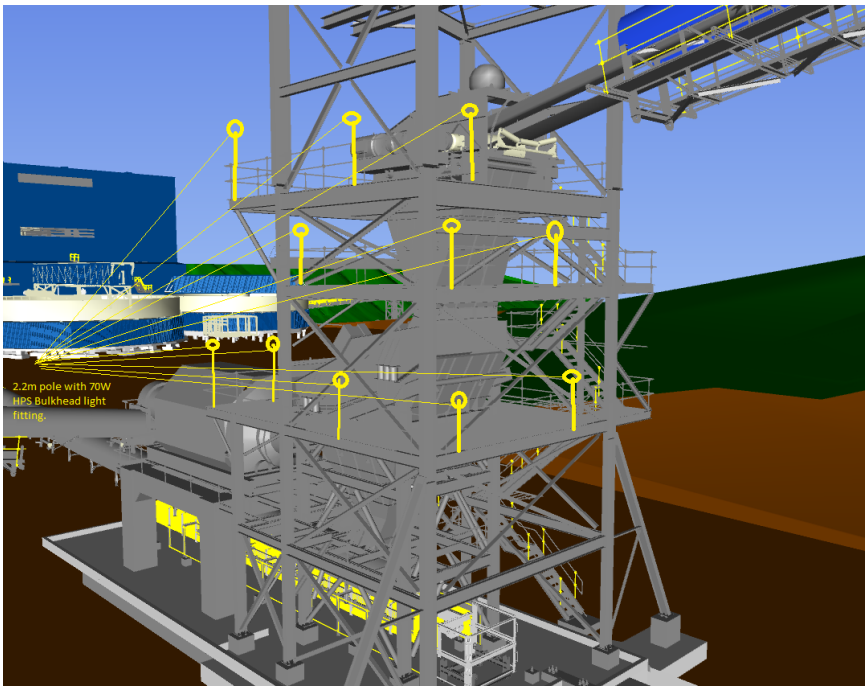
The lighting plan for the sizing station is shown in the figures below, with co-ordinates for labelled lights tabled.

The sizing station is an open style structure with a basic style skillion roof to provide overhead weather and snow cover protection. The structure will not be enclosed/cladded.





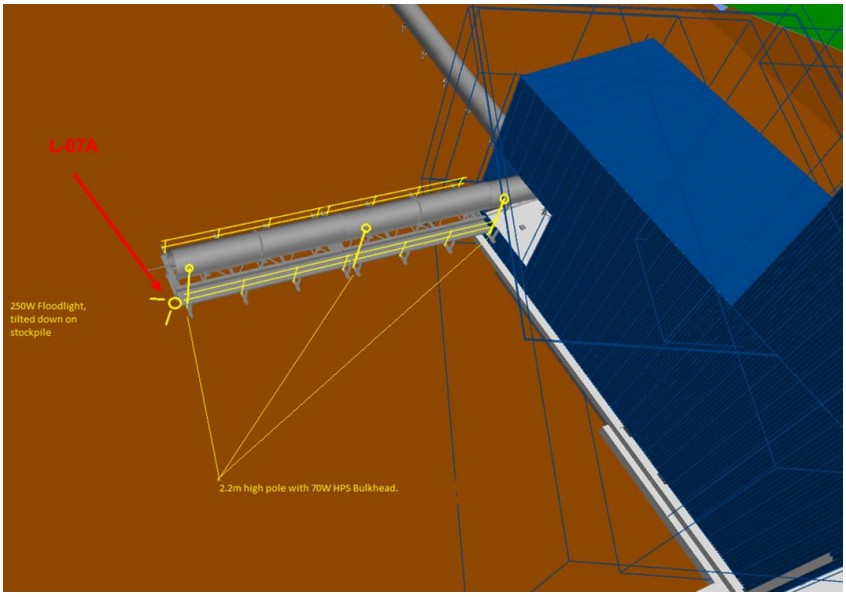

| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-05A** | 70W HPS | 661742 | 5521631 | 2200 |
| **L-05B** | 70W HPS | 661753 | 5521632 | 2200 |
| **L-05C** | 70W HPS | 661752 | 5521632 | 2200 |
| **L-06A** | 400W Flood Light | 661742 | 5521625 | |
| **L-06B** | 70W HPS | 661727 | 5521621 | 2200 |

***Breaker Rejects Conveyor (CV-103)***

The lighting plan for the breaker rejects conveyor is shown in the figure below, with co-ordinates for labelled lights tabled. The conveyor is an open style gantry conveyor with a single sided walkway with lights spaced 9m apart.

A floodlight is positioned at the head end of the conveyor to provide light for the breaker rejects stockpile.

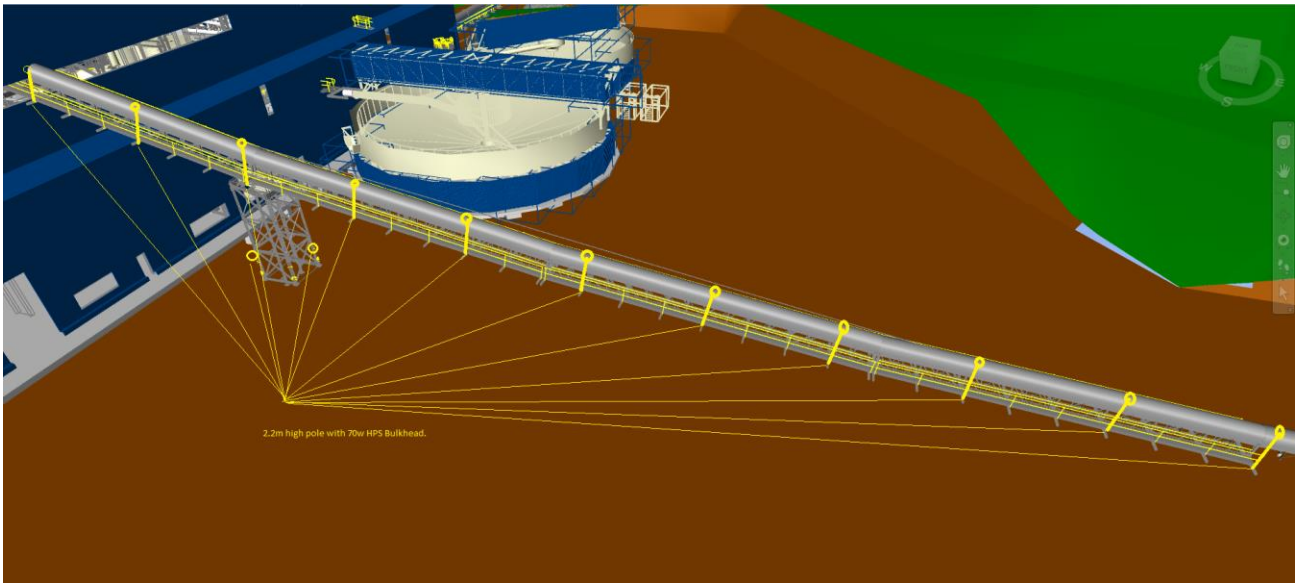
**Note:** The sizing station (ST-102) is shown cladded in the 3D model snapshot below, however this structure will not be cladded as shown in the detailed lighting plan snapshots.




| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-07A** | 250W Flood Light | 661732 | 5521599 | 2200 |

***Plant Feed Conveyor (CV-102)***

The lighting plan for the plant feed conveyor is shown in the figure below. The conveyor is a open style gantry conveyor with a single sided walkway with lights spaced 9m apart.

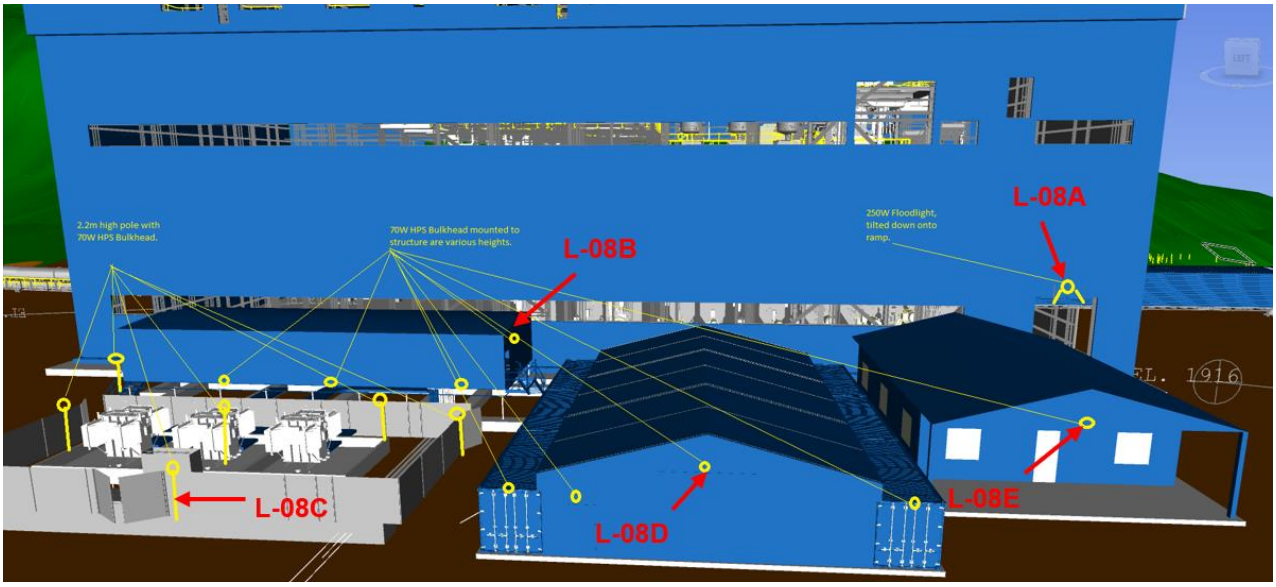


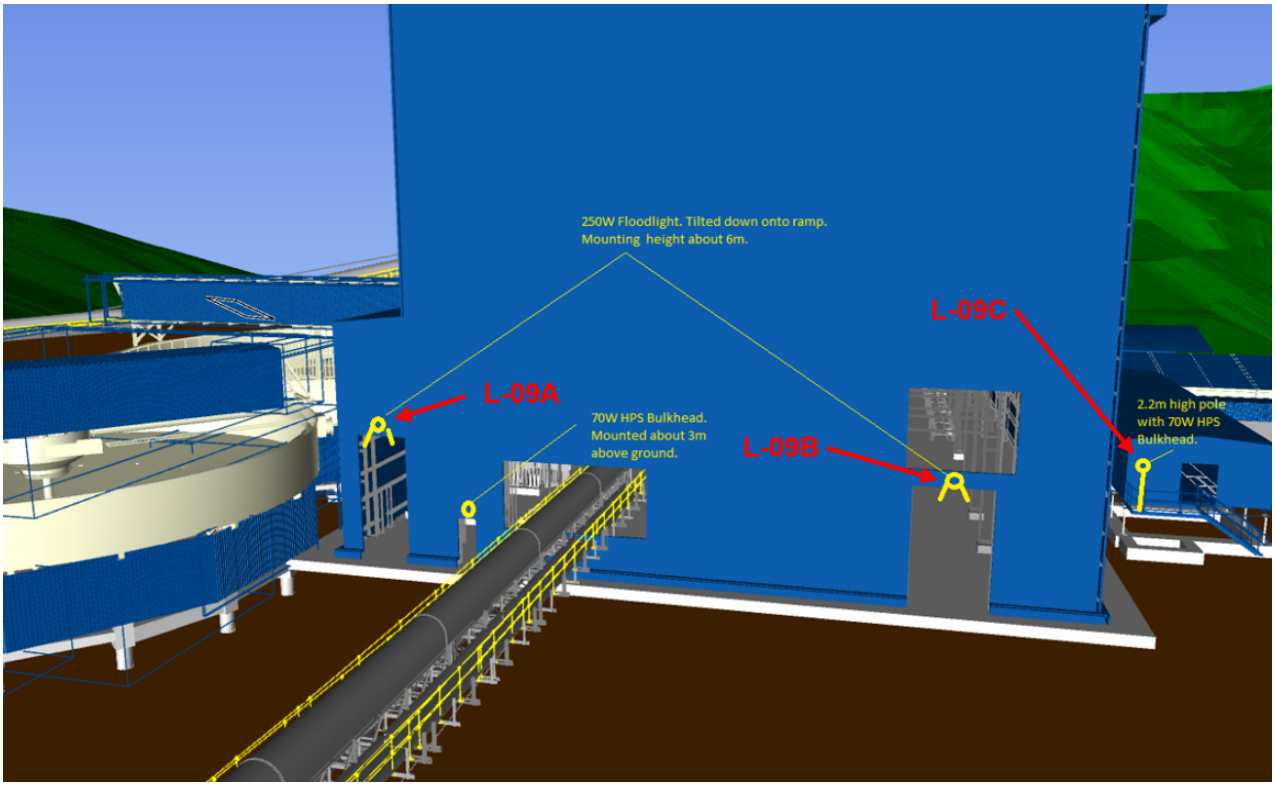

***CPP Building (ST-401) and Infrastructure Facilities***

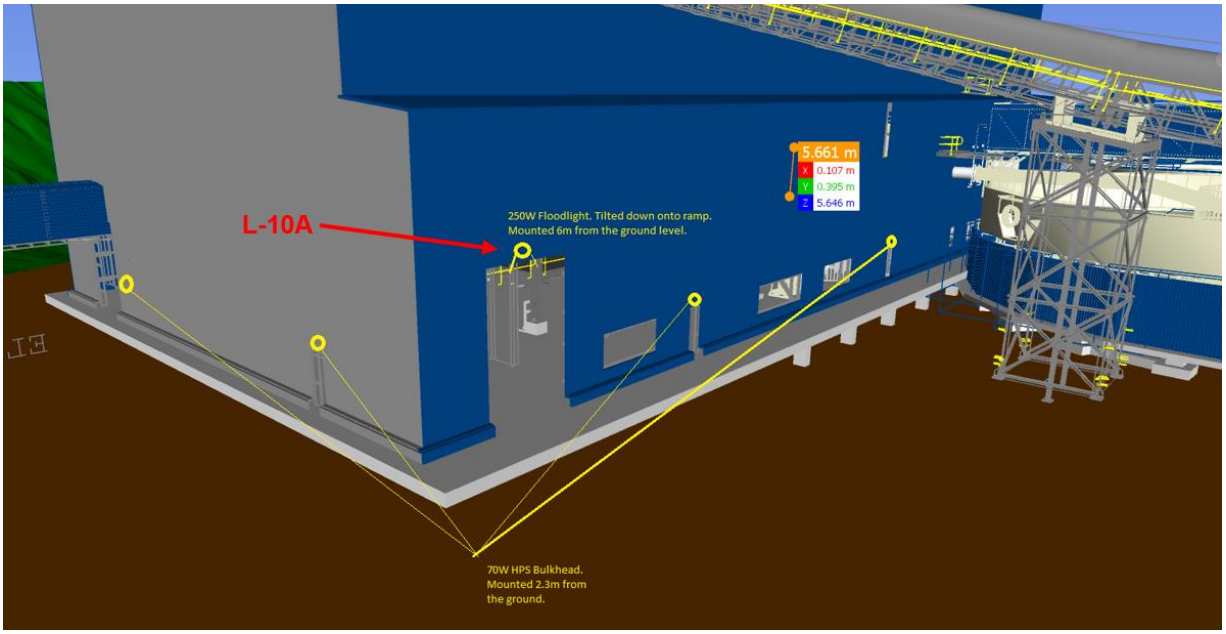
The exterior lighting plan for the CPP and associated infrastructure is shown in the figures below, with co-ordinates for labelled lights tabled.

Vehicle door entrances will have a 250W floodlight tilted onto the entry ramps and 70W lights will be used above mandoor entrances.

**Note:** The CPP building will be a completely enclosed and cladded building. Apart from the marked door and conveyor entry points, all other windows/openings currently showing in the 3D model snapshot should be ignored for light modelling purposes.





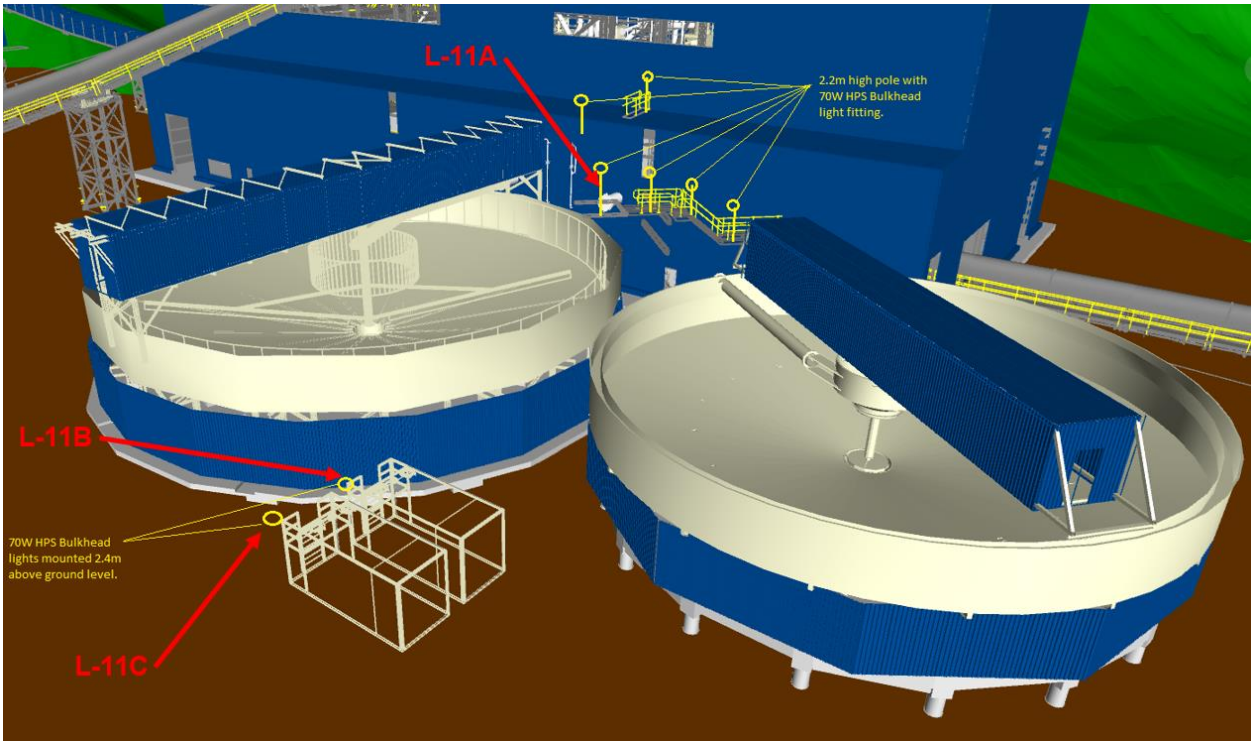

| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-08A** | 250W Flood Light | 661585 | 5521606 | 7866 |
| **L-08B** | 70W HPS | 661578 | 5521644 | 2668 |
| **L-08C** | 70W HPS | 661568 | 5521650 | 1906 |
| **L-08D** | 70W HPS | 661569 | 5521627 | ~3000 |

| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-08E** | 70W HPS | 661574 | 5521609 | ~3000 |
| **L-09A** | 250W Flood Light | 661613 | 5521678 | 6000 |
| **L-09B** | 250W Flood Light | 661587 | 5521677 | 6000 |
| **L-09C** | 70W HPS | 661577 | 5521658 | 2200 |
| **L-10A** | 250W Flood Light | 661620 | 5521610 | 6000 |

***Coal/Tails Thickeners (TH-601/TH-701) and Reagent Tanks (TK-960/961)***

The exterior lighting plan for the thickeners and reagent tanks is shown in the figure below, with co-ordinates for labelled lights tabled.

The thickener bridge structure and underside are fully enclosed and cladded, therefore they do not contribute to the exterior lighting.



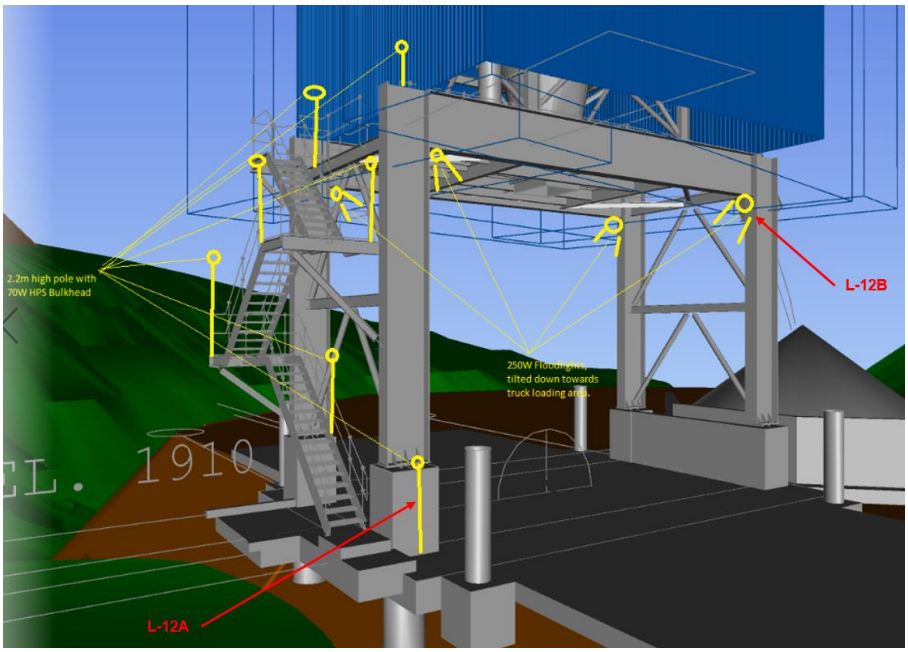

| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-11A** | 70W HPS | 661625 | 5521655 | 2200 |
| **L-11B** | 70W HPS | 661652 | 5521652 | 2400 |
| **L-11C** | 70W HPS | 661661 | 5521652 | 2400 |

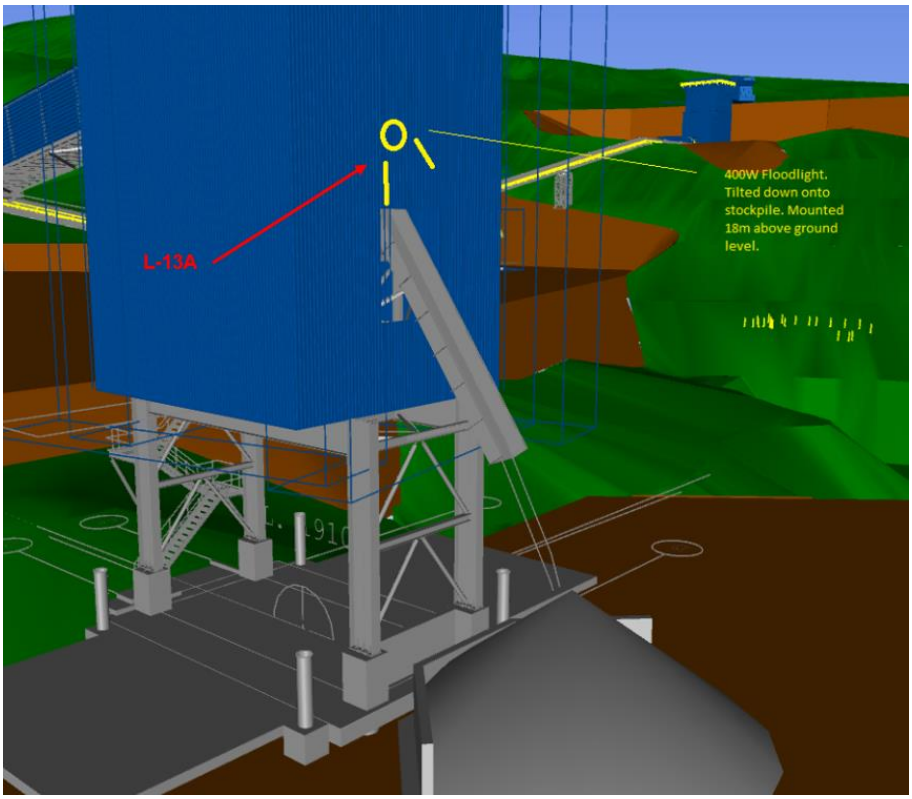
***Reject Conveyor (CV-701) and Reject Bin (BN-701)***

The exterior lighting plan for the underside of the rejects bin is shown in the figures below, with co-ordinates for labelled lights tabled.

Four floodlights, one at each corner of the bin underside structure, will be tilted downwards to the bin ground centre to provide lighting for night-time reject truck loading. A floodlight located above the bin overflow chute will provide lighting to the rejects overflow bunker/stockpile.

The rejects conveyor and the top of the rejects bin are completely enclosed and cladded, therefore these areas do not contribute to the exterior lighting.



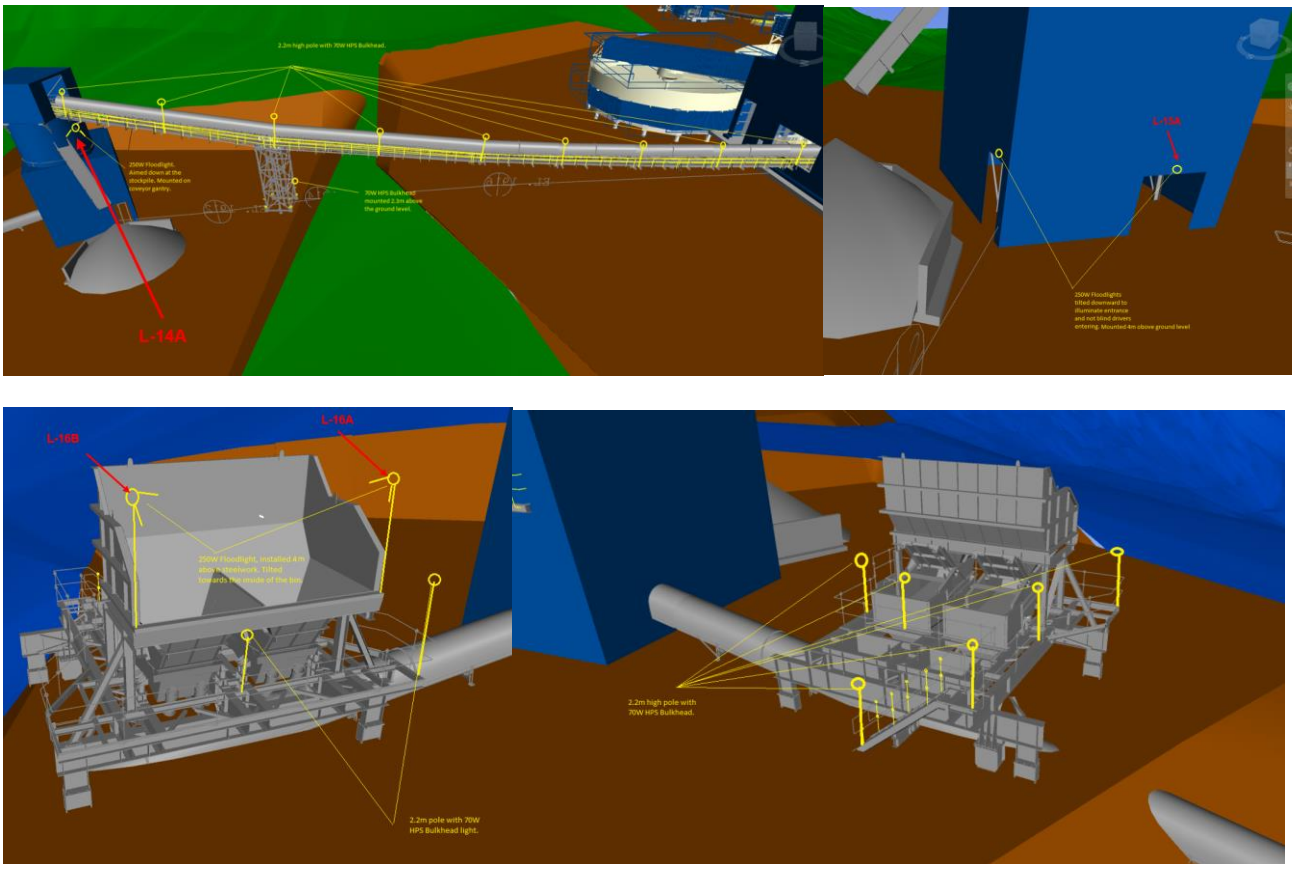
| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-12A** | 70W HPS | 661604 | 5521765 | 2200 |
| **L-12B** | 250W Flood Light | 661598 | 5521765 | 11000 |
| **L-13A** | 400W Flood Light | 661598 | 5521758 | 18000 |

***CPP Product Conveyor (CV-801) and OLC Feed Bin (BN-801)***

The exterior lighting plan for the CPP product conveyor and Overland Conveyor (OLC) feed bin is shown in the figures below, with co-ordinates for labelled lights tabled.

The CPP product conveyor is an open gallery style conveyor with a single sided walkway, with lights spaced 9m apart. A floodlight is located above the bin overflow chute to provide lighting for the product coal overflow bunker/stockpile. The top and underside of the OLC loading bin will be fully enclosed/cladded, therefore these areas will not contribute to the exterior lighting. The vehicle access door will have a floodlight.

The product reclaim hopper is an open structure with two floodlights tilted inwards to provide lighting for unplanned product reclaim night-time operation.




| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-14A** | 250W Flood Light | 661601 | 5521758 | ~9000 |
| **L-15A** | 250W Flood Light | 661603 | 5521759 | 4000 |
| **L-16A** | 250W Flood Light | 661604 | 5521759 | 4000 |

| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-16B** | 250W Flood Light | 661603 | 5521765 | 4000 |

***Product Overland Conveyor (OLC) (CV-802) and Truck Loading Bin (BN-802)***

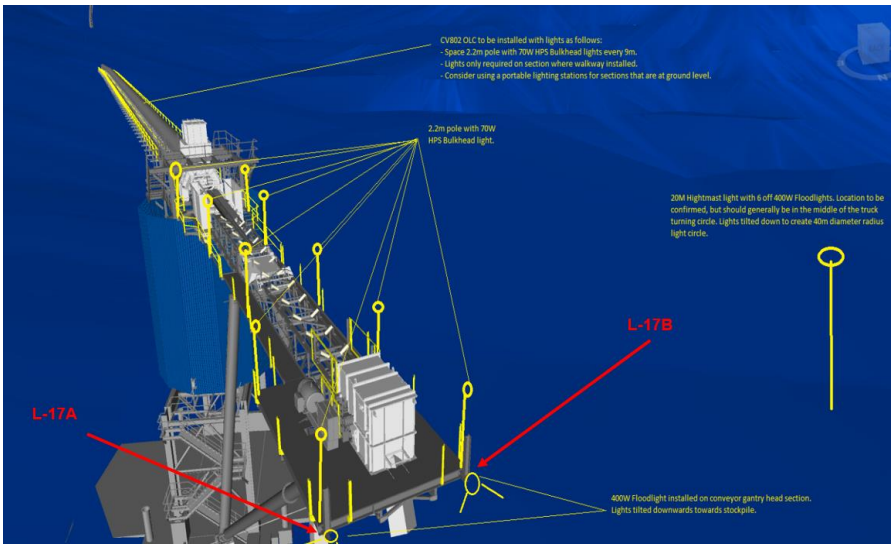
The exterior lighting plan for the OLC and product truck loading bin is shown in the figures below, with co-ordinates for labelled lights tabled.

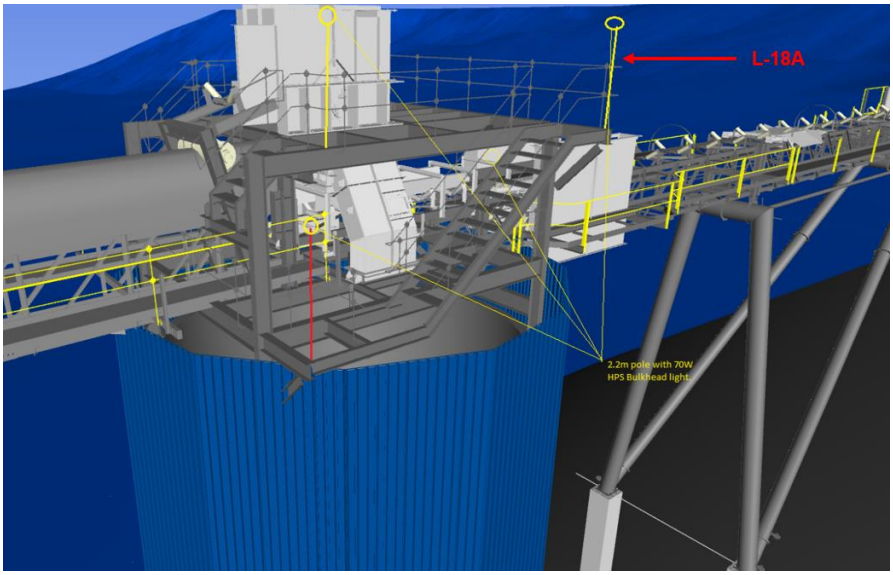
The OLC conveyor is predominantly a ground mounted module conveyor with no structural walkway. The last section of the conveyor, which elevates up to the top of the truck loading bin, will be an open style gallery conveyor with a single sided walkway. The OLC will not be lit along the length of the ground mounted modules. The elevated section lifting to the bin would be illuminated, with lights spaced 9m apart. Mobile lighting will be used for any OLC unlit section unplanned maintenance or operational activities.

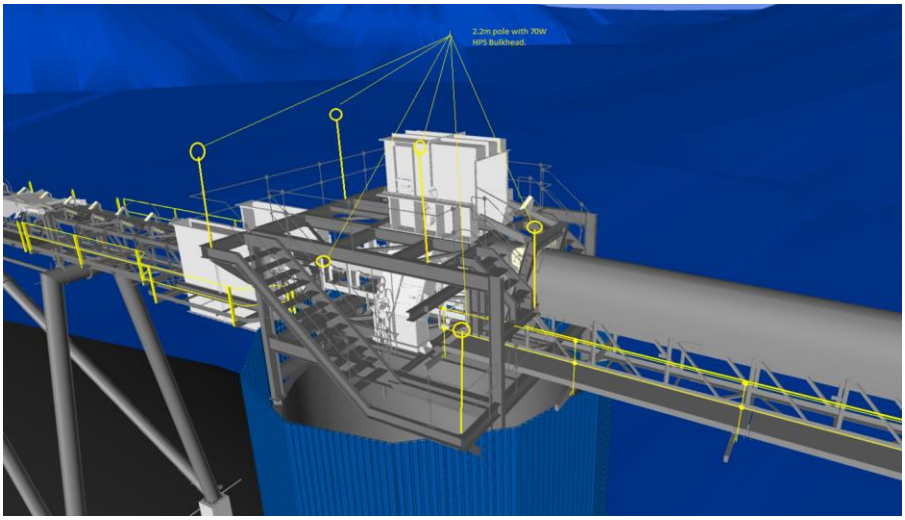
The top of the truck loading bin will be an open style structure. The lighting plan for the underside of the truck loading bin is identical to that of the rejects bin.

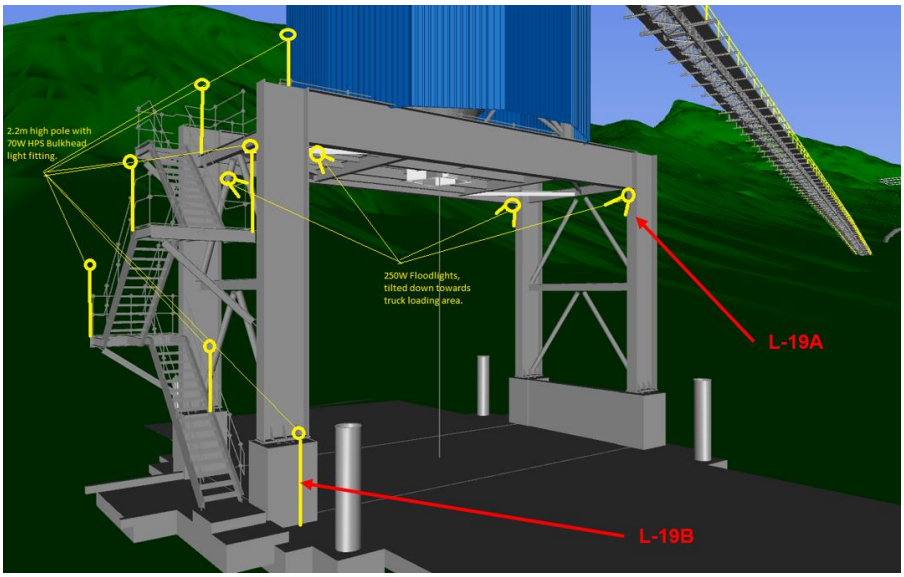
Floodlights will be located at the end of the emergency stockpile conveyor to provide night-time lighting for the emergency product stockpile.

A 20m high mast light will be located in the middle of the truck turning circule to provide lighting for the safe night-time coal haul truck operation.




L-18A
2.2m pole with 70W
HPS Bulkhead light.


2.2m pole with 70W
HPS Bulkhead.


2.2m high pole with
70W HPS Bulkhead
light fitting.
250W Floodlights,
tilted down towards
truck loading area.
L-19A
L-19B

| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-17A** | 400W Flood Light | 661615 | 5521751 | |
| **L-17B** | 400W Flood Light | 661611 | 5521748 | |
| **L-18A** | 70W HPS | 661607 | 5521761 | 2200 |
| **L-19A** | 250W Flood Light | 661604 | 5521765 | ~4000 |
| **L-19B** | 70W HPS | 661604 | 5521759 | 2200 |

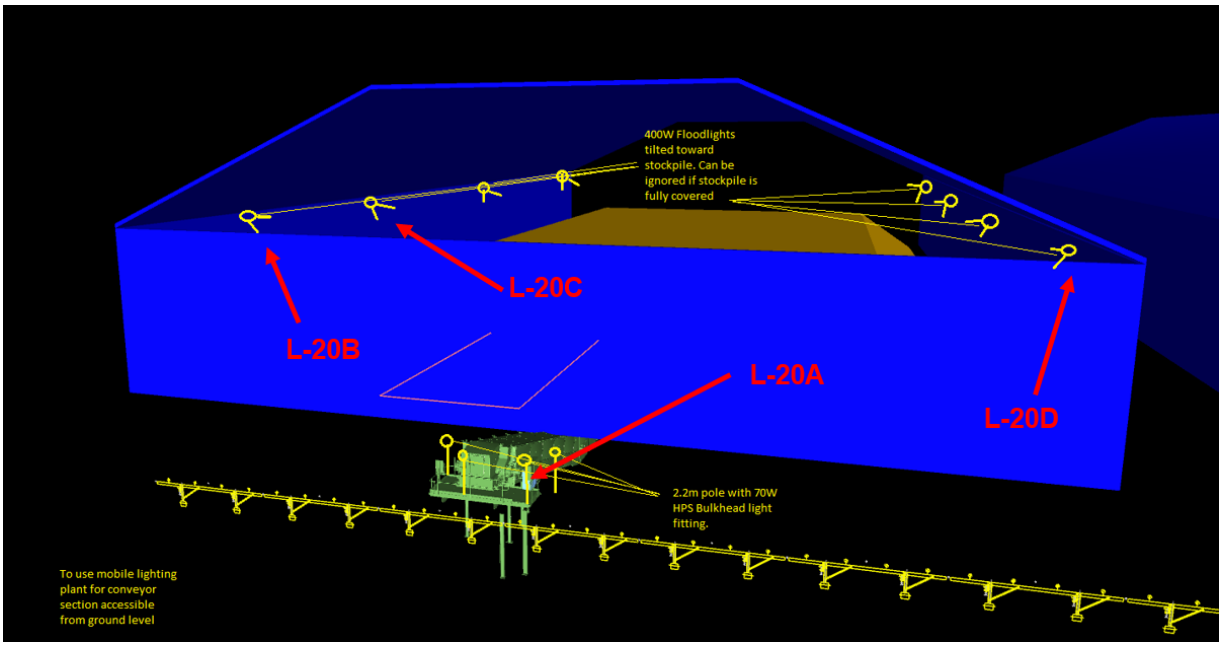
***Product Stockpiles (ST-803)***

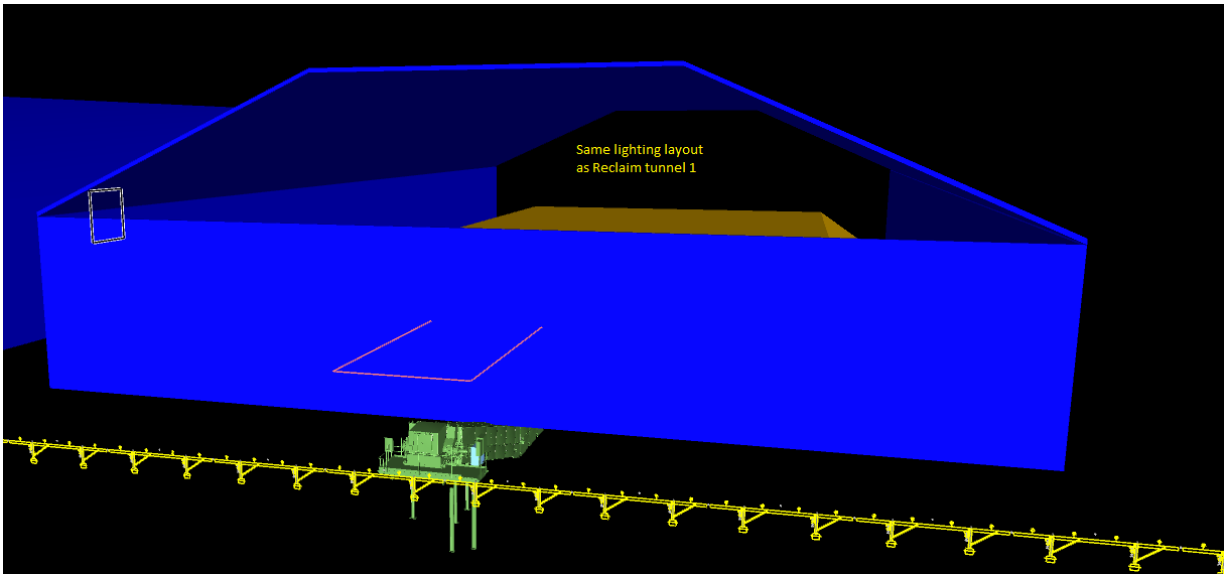
The lighting plan for the product coal stockpiles is shown in the figures below, with co-ordinates for labelled lights tabled.

Product haul trucks transport and dump product coal to one of two product stockpiles, with the product coal then pushed by a dozer onto the stockpiles. Each product stockpile will be covered by a fabric cover structure which will be fully enclosed, apart from the truck receival end which will be fully open. Floodlights will be positioned and tilted down inside the fabric structures to provide stockpile lighting.

The lighting will be the same for each product stockpile and reclaimer arrangement.

**Note:** The fabric stockpile cover end (nearest shown) will be completely enclosed and not partially enclosed as shown in the 3D model snapshot.






| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground (mm) |
|---|---|---|---|---|
| **L-20A** | 70W HPS Bulkhead | 647765 | 5522797 | 2200 |
| **L-20B** | 400W Flood Light | 647790 | 5522870 | 10000 |
| **L-20C** | 400W Flood Light | 647814 | 5522871 | 10000 |
| **L-20D** | 400W Flood Light | 647801 | 5522733 | 10000 |

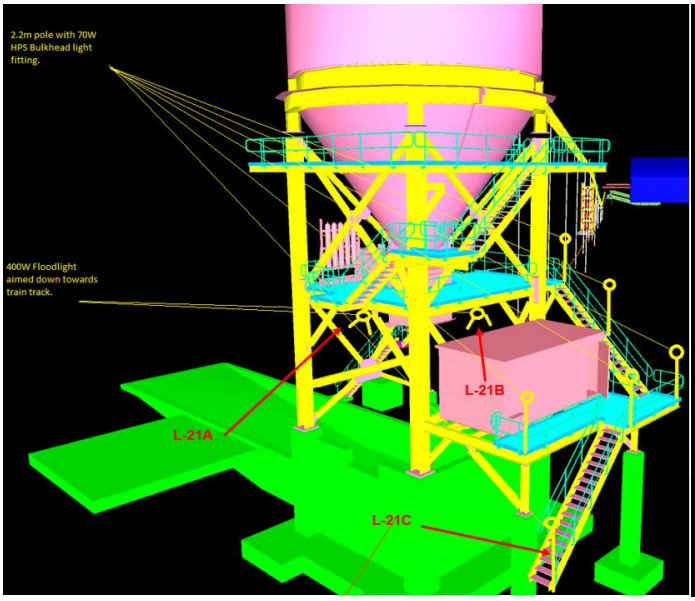
***TLO Bin (BN-803) and TLO Bin Feed Conveyor (CV-805)***

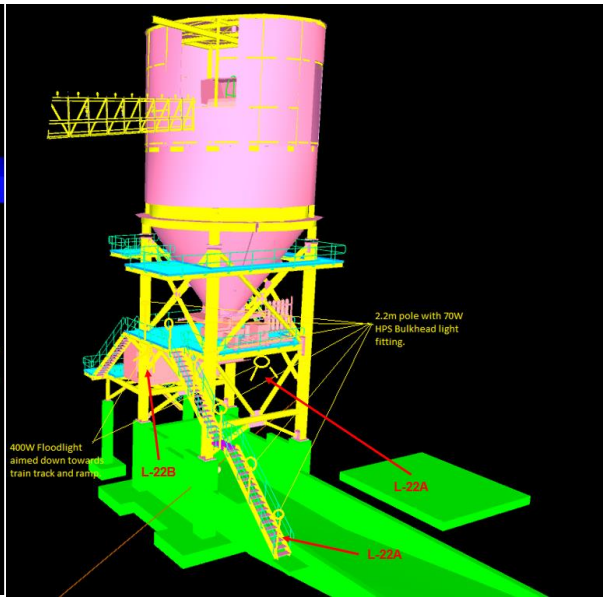
The lighting plan for the TLO bin and feed conveyor is shown in the figures below, with co-ordinates for labelled lights tabled.

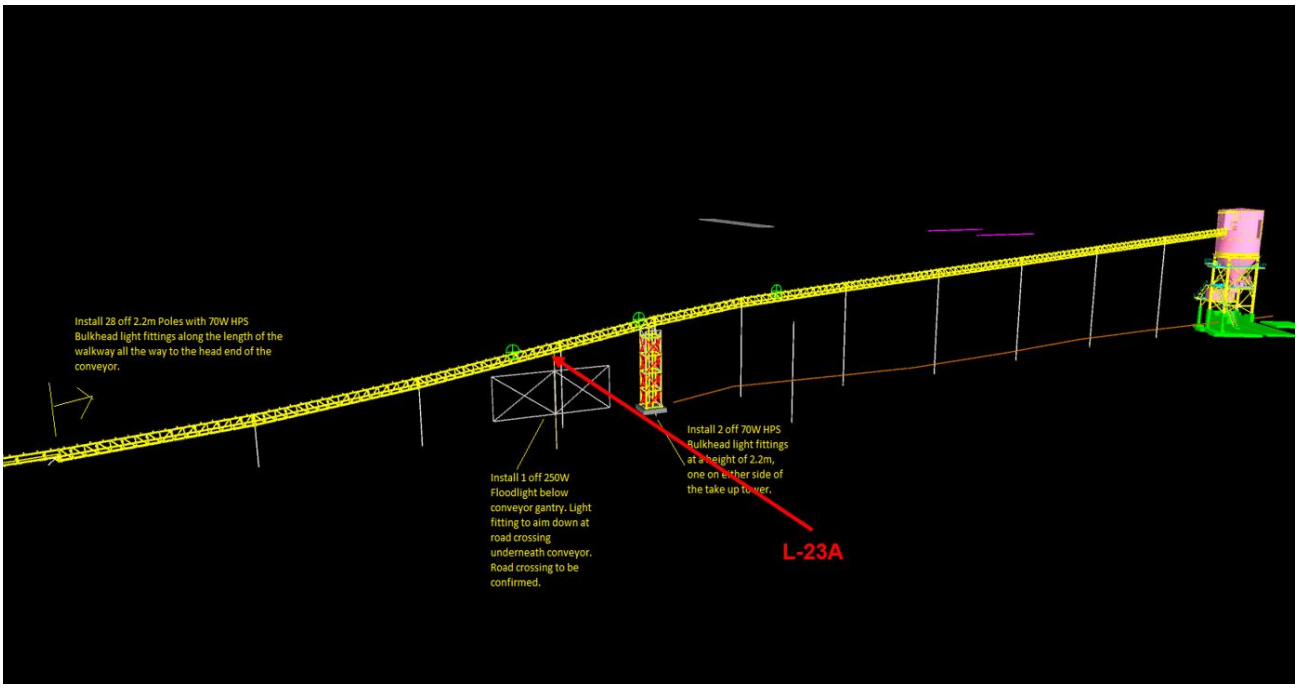
Four floodlights, one in the centre of each side of the bin underside structure (bin gate floor), will be tilted downwards to the centre to provide lighting for night-time train rail car loading.

Like the OLC, the ground mounted sections of the TLO feed bin conveyor are not lit. The elevated sections of the TLO feed conveyor are open style conveyor galleries with a double-sided walkway. Lights will be located on each walkway approximately 9m apart.

**Note:** The TLO Bin structure will be fully enclosed/cladded from the gate floor up to and including the TLO feed conveyor head end section. The lighting plan in the 3D model snapshots has been marked up to reflect this.




| Fixture ID | Luminaire Description | Easting Co-ordinate | Northing Co-ordinate | Height Above Walkway/Ground |
|---|---|---|---|---|
| **L-21A** | 400W Flood Light | 647786 | 5522413 | 13200 |
| **L-21B** | 400W Flood Light | 647785 | 5522419 | 13200 |
| **L-21C** | 70W HPS Bulkhead | 647789 | 5522406 | 2200 |
| **L-22A** | 70W HPS Bulkhead | 647776 | 5522425 | 2200 |
| **L-22B** | 400W Flood Light | 647779 | 5522417 | 13200 |
| **L-22C** | 400W Flood Light | 647788 | 5522417 | 13200 |
| **L-23A** | 250W Flood Light | 647776 | 5522551 | 9800 |

# Section 3 – CHPP Operation and Mobile Lighting

**24 Hour Operation**

The plant will operate on a 24-hour basis and the CHPP lighting will be designed so feeding the plant, removal of breaker and plant rejects, OLC operation, product coal trucking, stockpile dozer management and train loading can be sustained for night-time operation.

The CHPP mobile equipment required for plant operation includes:

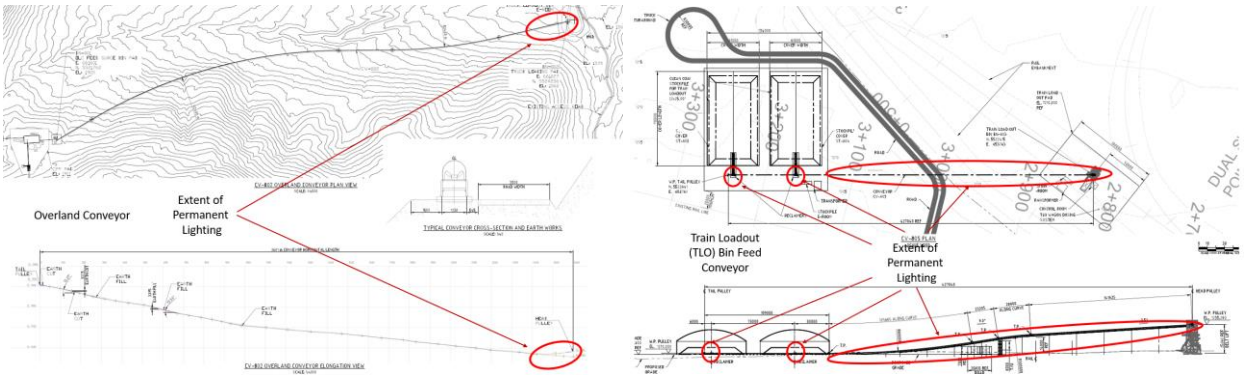
- ROM dump trucks/FEL at ROM Bin
- FEL and Rejects Trucks at Sizing Station rejects stockpile (periodically, day time operation preferred)
- Rejects Trucks at plant rejects bin
- Product trucks for hauling product coal from truck loading bin to product stockpiles
- Dozers for product stockpile management and train loading

**CHPP Mobile Lighting**

The following CHPP locations will not have permanent lighting fixtures:

- OLC ground mounted sections. Only the elevated section of the OLC will have permanent lighting.
- TLO bin feed conveyor ground mounted sections. Only the elevated sections of the conveyor will have permanent lighting.

The elevated sections which will be lit for these conveyors are outlined below.




Mobile light towers will be used on unlit sections of conveyors for unplanned breakdown maintenance only.

Mobile lighting towers will also be used by the mining group on the ROM pad to provide lighting on the raw coal stockpiles and to ensure safe dump truck and FEL operation.

# Section 4 – Light Mitigation Strategies

In addition to the light mitigation strategies identified in section 1, the following light mitigation strategies will be adopted.

Directional luminaires to light up specific task areas will be used and lighting designs will be focussed on reducing glare. Tilting type light fittings are to be used and installed such that they only illuminate on the horizontal plane. Certain newer technology LED light fittings have special lamp lenses to assist with correct light spread for various applications.

Light fitting orientation should be such that it shines away from areas where light pollution is unwanted.

High mast light heights should be kept to a minimum and be designed such that the flood lights are not tilted above the horizon. Light fittings with cut-offs/shields can also be used to ensure dark sky compliance, which is believed to be required within the project region.