pitt&sherry

CopperString 2032

Early Works Package

Hughenden Camp Hub Planning Design Support

Client reference:

CU2-HU00-REP-PAS-100-0002

Prepared for
UGL / CPB JV

Client representative
Emma McCaughey

Date
26 February 2024

Rev 00

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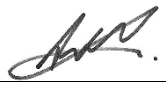
Prepared by: Arthur Bool (RPEQ 10564)		**Date –** 26th February 2024
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Revision History

Rev No.	Description	Prepared by	Reviewed by	Authorised by	Date
00	Initial Issue	A.Bool (RPEQ 10564)	Various	Robert Nicholson	26/02/2024

1. Introduction

1.1 Purpose of Report

The purpose of this report is to document the design inputs, methodologies and outputs created in support of the CopperString 2032 Hughenden Camp Hub planning application and consultation processes.

This report is a supporting document to the planning level design drawings (refer to CU2-HU00-DRG-PAS-100-0900).

1.1.1 Background

The CopperString 2032 Project (the Project) is a 1100km extra high voltage transmission system from Townsville to Mt Isa that will connect the North West Power System (NWPS) near Cloncurry and Mount Isa to the Powerlink network and National Electricity Market (NEM) at Woodstock, that will reduce the cost of power supply and facilitate the large-scale development of the Hughenden wind resource and solar resources within the North Queensland Clean Energy Hub (NQCEH), refer to Figure 1.

The project includes the development of the transmission line, substations, laydown areas, construction camps (Camp Hubs), communication huts, access tracks and equipment storage locations.

The Project requires complex logistics planning and part of this is to have construction accommodation Camp Hub facilities along the extent to allow sufficient space for workforce accommodation and materials storage on large laydown areas.

CPB Contractors and UGL Limited have entered an early contractor involvement (ECI) as a Joint Venture (JV) arrangement to facilitate the delivery of the Project. The JV has engaged pitt&sherry to development application level engineering services associated with the construction accommodation camps to support the project construction activities.

Duration of construction operations is currently estimated to be up to 5 years when considering early works and closeout works.

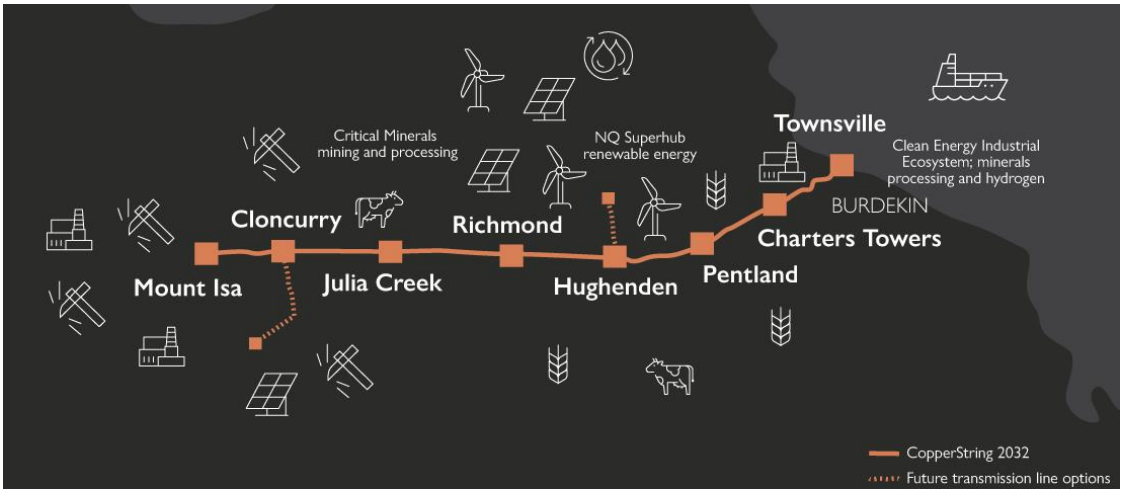

Figure 1: Project Overview (source: [CopperString 2032 | Powerlink])

1.2 Abbreviations, Acronyms and Definitions

Table 1: Abbreviations, Acronyms and Definitions

Term	Definition
Camp Hub	Combined precinct for workforce accommodation, laydown storage maintenance and utilities.
CBR	California Bearing Ratio
ESA	Equivalent Standard Axle
ESC	Erosion and Sediment Control
GIS	Geographic Information System
HU	Hughenden
IECA	International Erosion Control Association
JV	UGL CPB Joint Venture
NEM	National Electricity Market
NQCEH	North Queensland Clean Energy Hub
NWMP	North West Minerals Province
NWPS	North West Power System
RPEQ	Registered Professional Engineer of Queensland
SMP	Stormwater Management Plan
TIA	Traffic Impact Assessment
TMR	Qld Department of Transport and Main Roads
WTP	Water treatment plant
WWTP	Wastewater treatment plant

1.3 Related Packages

The design covered by this report interfaces with the following pitt&sherry design packages:

- Traffic Impact Assessment (TIA) and Road Use Management Plan (RUMP)
- Early works access roads; and
- Dilapidation Surveys of State Controlled Roads and Local Authority Roads.

1.4 Design Inputs

Key design inputs to this document are as follows:

- Design criteria as mentioned in Section 2
- JV Management Plans (noting amendments have occurred since and will be ongoing):
- 0643-JV-PLN-AMP-0019-E Accom Management Plan FINAL
- 0643-JV-PLN-CEM-0003-D CEMP
- 0643-JV-PLN-DMP-0013-F Design Management Plan
- 0643-JV-PLN-TFM-0015-E Temporary Facilities MP FINAL
- CopperString 2032 GIS system
- Queensland Development Code (QDC)
- Meetings held with the relevant local councils and Ergon (all councils except Cloncurry at the time of publishing this report). Minutes are available from the JV and a summary of the issues raised by Councils is noted in Section 3
- CopperString 2032 EIS and associated Coordinator General's report (November 2022)
- Recent approval examples for like facilities in the local region for other Powerlink projects, and best practice standards (for example effluent disposal); and
- Relevant industry standards and guides as listed in the respective areas within this document.

2. Design Basis

2.1 Design Criteria

The Design Criteria for the CopperString 2032 Hughenden Camp Hub is summarised in this matrix which is a high-level summary of key requirements:

Table 2: Design Criteria

Camp Feature	Camp data
Personnel (max)	410
Rooms per 40' unit/module	3 (subject to JV confirmation during detailed design, worst case footprint scenario chosen for this stage of design)
Laydown Yard Area (m^2) - to be min. 45m from Accom	34284
Carpark No.	171
Workshop Area (bunded concrete hardstand)	Workshop sizes are to be confirmed - light vehicle maintenance only
Washdown Bay	1 of (per camp location)
Water Supply	Town water connection may or may not be available, however JV also requires a bore. All camps have been designed with a water supply bore.
Sewer Discharge	Connect to Council system preferably, but retain option for on-site treatment and irrigation
Waste Storage Area (bunded concrete hard stand)	80 x 40m
Cultural Heritage Storage (bunded concrete hard stand)	10m x 10m
Re-Fuelling Bay (bunded concrete hard stand)	2 x 24,500L tanks with storage not to exceed 50,000L per camp hub
Landscaping	by others, but no additional area required other than the area within the existing camp hub footprint
On site Wastewater (i.e. Sewage) Treatment Plant required AND Onsite Water Treatment Plant (connected to purpose drilled bore)	Yes

Camp Feature	Camp data
Fire Fighting Water Volume	10,000L (subject to review with QFES)
Planning Scheme process (e.g DA, MCU…)	TBC
Flood Immunity	1% AEP
Design Vehicle for internal swept paths - laydown yard	B-Double
Design Vehicle for LV camp area	Garbage truck size
Design Vehicle for Carpark circulation	15m rigid bus
Design vehicle - minibus / minivan	~5.2m minivan (Toyota Hiace or similar)
Stabilised trafficked areas	Yes
Reusable products/ timber breakdown Quarry Material (temporary) Environmental supplies (ESC, bunds, tanks, rehab supplies) DG storage	80 x 40m: 2+ x shipping containers, timber waste repurposing area 50 x 50m nominally
Water Quality Class	Class A+
Water Consumption Rates	300L/pp/day
Water Reuse	Dust suppression Washdown bay Toilets and Laundry Motor Vehicle workshop cleaning
Sustainability	Solar panel options to be considered but not mandatory
Sustainability	Rainwater tanks options to be considered but not mandatory
Hours of Operation	24/7 (Workforce to sleep on site as part of a 10 day on, 4 day off, all in/ all out roster). Main operations 5am – 7pm (noisy activities limited to 6.30am - 6.30pm as per conditions of approval)
Light Spill	As per AS4282
Design Life	5 years
Security Hut	Allowance for a "hut" as the base for security guards/ patrols. Could double as the 'front gate office'/ checkpoint.
Communications	Sufficient communications capacity for occupants to remain in contact with their families
Fencing to camp	1.8m chainwire

Camp Feature	Camp data
hub perimeters	
Noise	Varies – see section 8.2

3. Camp Layout Design

3.1 Land Acquisition Areas

The JV provided digital shapefiles from the project GIS system of the allowable land parcels (or parts thereof) to develop within and these are known as the land acquisition areas, developed in consultation between Powerlink and relevant Local Government Authorities.

The land acquisition area is shown on the General Arrangement Plans (Refer to CU2-HU00-DRG-PAS-100-0900 for the Hughenden Camp drawing set). The land acquisition area is deemed to be fixed for the purposes of this assessment; however it is acknowledged that there may be ongoing discussions and negotiations between Powerlink, the State Government and the Local Government authority to amend or confirm the land parcel during the leasing and planning processes.

3.1.1 Camp features and functionality

The Camp Hub overall is a combined space for the accommodation of the construction workforce as well as the storage of construction equipment and construction related operation and maintenance activities.

In general, the accommodation component of the Camp Hub has been designed to be somewhat separate, as much as possible, from the on-site industrial uses such as laydown storage and workshops.

The Camp Hub is intended to be a short-term feature with a design life of up to a maximum of five years to support CopperString 2032 construction activities. The following provides a brief overview of the key components of a typical Camp Hub:

- Camp accommodation quarters (dwelling units, kitchen and dining, laundry, recreation area, gym, office blocks, amenities, covered walkways etc)
    - These include transportable buildings arranged in a living complex to house the construction workforce. Design, layout and features are to be what is expected in a modern construction accommodation facility
    - The camp accommodation area also includes local building services such as water and sewer (plumbing), LV electrical and communications (possible solar options), roof water and potential roof water collection/tanks
- **Sealed access road/driveway**. This provides the vehicular main access for trafficability, durability and safety and is to be in accordance with local and state design guides as appropriate. Bitumen sealing allows for improved trafficability and reduced dust
- **Carpark (Sealed).** The bitumen sealed carpark is provided to ensure that there is a controlled, trafficable and safe parking of vehicles. The construction management team can implement various additional controls including signage, line marking and usage policies
    - Also includes allowance for light vehicles and minivans
    - An allowance can also be made for a bus (coach) drop off and pickup point internally (to facilitate airport transfers)
- **Water and wastewater facilities**. The water and wastewater facilities at each site may vary slightly, depending on the municipal water and wastewater systems available in each Council region. The core water elements are:
    - The fire water storage tank/s and associated reticulation pipelines (also subject to fire authority requirements)
    - The potable water storage tanks and associated reticulation pipelines
    - The on-site water treatment plant for any untreated town water or on-site bore water
    - A water bore for a guaranteed or independent supply option in the event local councils can’t supply water

- Provision for an on-site wastewater treatment plant if local council's either have no available wastewater treatment plant or capacity, or if they do, but they require the wastewater to be treated prior to collection
- Provision for on-site treated wastewater disposal via field irrigation (if required and if approved)
- Provision for associated small (>4 day) turkey's nest style storage dam for treated wastewater for buffer use during wet weather. Options for tank/s in lieu of a turkey's nest dam storages can be assessed at detailed design stage as space allocation is suitable for either option

- **Laydown area hardstand** (equipment storage). The laydown areas are hardstands of compacted subgrade and imported, compacted road base gravel or crushed rock for materials and equipment storage
- **Workshops and maintenance area** (including containerised stores)
  - Workshops include bunded slab on ground with stretched fabric roofs (or similar) for shade and rain cover
  - Bunded slab to include drainage with oil capture system to manage hydrocarbons
  - Light vehicle maintenance only (heavy vehicles and larger trucks to be maintained at regional commercial workshops)
  - Storage areas for tools, parts and equipment (hardstand and shipping containers)
  - The example image supplied below (and all further images shown in this report) is an indicative display of what may be provided. Size, structure, material and colour may differ depending on site needs and availability.

Sample workshop - (source www.ezyigloo.com.au)

- Refuelling facility
  - Containerised self-bunded refuelling tanks (not to exceed 50,000L combined storage per camp hub)
  - Refuelling area to include concrete bunded area for spillage control
  - Sump to be connected to the shared oils/hydrocarbon capture system as with the workshop/s where feasible, or have standalone system

Sample fuel facility - (source www.fuelfix.com.au)

- Vehicle Wash facility
  - Includes a drive in and drive-out system for light vehicles, as well as suitable water supply and water reuse
  - Includes an adjacent concrete pad with gurneys for handheld washdown of muddy light vehicles and rigid vehicles
  - No large trucks/B-doubles to be cleaned on site, these will be cleaned offsite at existing commercial facilities

Sample wash facility - (source www.prwater.com.au)

- **Cultural heritage artefacts storage area**. A designated area on the hardstand where discovered artefacts can be securely kept for safe storage, viewing and processing. To be securely located away from general view to avoid interference.
- **Environmental supplies storage area**. A designated area on the compacted hardstand pavement for ESC spares, tanks, rehabilitation supplies, shipping containers, timber waste repurposing, quarry materials (temporary) and dangerous goods to name a few
- **Waste storage area. Bunded concrete storage area.** Includes area for central storage of waste containers from wheelie to hook bin sized (noting various wheelie and skip bins will be located around sites), waste segregation, truck movements
- **Security entrance hut**. The base for security guards/ patrols. Could double as the front gate office checkpoint
- **Perimeter fencing.** 1.8m chainwire for general level of security, delineation and separation; and
- **Site rehabilitation.** At the end of use the site would be rehabilitated to near pre-existing condition, unless an alternate plan is put forward to retain some or all infrastructure for a future use.

3.2 Architectural aspects

pitt&sherry engaged David Denman and Associates (DDA) architects to assist in laying out the site and assessing the suitability of the proposed temporary Camp facilities on the assigned site. The purpose of the architectural involvement was to complement the infrastructure design plans and the JV's 'Accommodation Management Plan' (0643-JV-PLN-AMP-0019).

The architectural report, in conjunction with the design documentation associated with each Camp, provides evidence of an approvable Camp facilities arrangement against the relevant Planning Schemes, Planning Overlays, Queensland Development Code (QDC), and the National Construction Code (NCC).

The report outlines how the proposed arrangement achieves a considered compliance with the relevant bodies. It should be noted that a further detailed design stage is to be undertaken and assessment of each camp by a building surveyor is required prior to construction.

For further information about the architectural aspects, including building accommodation area drawings, refer to CU2-HU00-REP-PAS-100-0003. Note that industrial building elements such as the workshops have not been part of the architectural design scope.

4. Planning and Environment

Environmental constraints for the camp were determined by reviewing the applicable local planning schemes and having regard to commitments in the EIS to ensure consistency as the project progresses its design. These informed requirements for environmental protection areas, including buffer zones and exclusion zones.

Specific elements of design criteria were also informed by this review, with consideration given to individual council requirements, with reasonable interpretation of these applied. Design criteria considered included visual and noise amenity, waste management, wastewater treatment, car parking allocations, and vehicle access requirements.

The below tables summarise considerations under the relevant planning schemes that have been accounted for, and implemented where reasonable, in the design of the camp.

The CopperString 2032 project has been identified as State Significant pursuant to the *State Development and Public Works Organisation Act 1971*. The project will be subject to local or state based planning approvals process of some form, inclusive of the transmission line, substations, and accommodation hubs. This is managed pursuant to the *Planning Act 2016* and administered by the Department of State Development, Infrastructure, Local Government and Planning (SDILGP). Obtaining primary approvals is the responsibility of Powerlink.

All aspects of design and operation that trigger environmental regulatory approvals have been identified in the project's Regulatory Approvals Plan and will be obtained prior to construction.

4.1 Shire of Flinders Planning Scheme 2017

The use definitions as provided in the *Shire of Flinders Planning Scheme 2017* for each activity proposed to be undertaken at the Hughenden Camp are summarised in Table 3 as well as the relevant assessment benchmarks considered in design.

Table 3: Assessment benchmarks for camp activities in accordance with use definition

Camp Activity	Use definition under Planning Scheme	Assessment Benchmarks
Camp	Non-residential workers accommodation	Planning Scheme
Maintenance Area	Low impact industry	
Carpark and Fuel bay	Transport Depot	
Cable drum storage	Warehouse	
Water treatment	Utility installation	

Assessment benchmarks considered under the Planning Scheme include:

- Part 3 – Strategic Framework themes
  - Growth and Community
  - Economic Development
  - Tourism and the Natural Environment
  - Overlay codes
  - Biodiversity overlay code
  - Flood hazard overlay code
  - Major infrastructure overlay code

- Wetland and waterway corridor overlay code
- Zone Code
  - Special Purpose Zone
- Development works codes
  - Industry and infrastructure activities code; and
  - Residential activities code.

Table 4: Flinders Shire Council Planning Considerations

Aspect	Planning Scheme Considerations	Reference
General	Industrial activities are located away from land uses that are sensitive to, or at risk from, the adverse impacts of industry.	Section 9.2
	Sensitive land uses are separated from uses or areas zoned for activities that have the capacity to generate nuisance noise and missions to the air, including odour	Section 9.2 Section 10.1
	Site cover does not exceed 60% in special purpose zone for industry and infrastructure	CU2-HU00-REP-PAS-100-0003
	Minimum 30% of site is private or communal open space and provides sun and weather protection	CU2-HU00-REP-PAS-100-0003
	Maximum slope for building works is 15%	CU2-HU00-DRG-PAS-100-0900
Biodiversity	Development footprint is outside areas of MSES.	CU2-HU00-DRG-PAS-100-0901
	Development ensures that ecological connectivity is maintained or enhanced.	CU2-HU00-DRG-PAS-100-0901
	Building work, earthworks, physical disturbance of stream bed, construction, clearing of native vegetation does not occur within 25 m from waterways or wetlands	CU2-HU00-DRG-PAS-100-0901
Flood	Minimum floor level for buildings and essential infrastructure is 300 mm above 1 in 100 year ARI.	Section 10.2 CU2-HU00-DRG-PAS-100-0900
	Where development does occur within the 1 in 100 year ARI, the development does not increase the volume, velocity, concentration or flow path alignment of stormwater flow across sites upstream, downstream or in the general vicinity of the subject site	Section 10.2 CU2-HU00-DRG-PAS-100-0900
Earthworks	Erosion and sedimentation protection measures in accordance with *SC6.2 Engineering standards planning scheme policy*.	Section 10.2 CU2-HU00-DRG-PAS-100-0900

Aspect	Planning Scheme Considerations	Reference
Amenity (odour, light, noise, dust etc.)	Development does not adversely impact on the amenity of surrounding land uses or existing residential character	Section 9.2 CU2-HU00-REP-PAS-100-0003
	Air-conditioning equipment and other plant and equipment is to be located behind the front building line and screened to reduce visibility and noise.	CU2-HU00-DRG-PAS-100-0900 CU2-HU00-REP-PAS-100-0003
	Outdoor lighting does not create obtrusive light emissions	Section 14.2
	Outdoor lighting is in accordance with the parameters and requirements of *AS4282-Control of the Obtrusive Effects of Outdoor Lighting*	Section 14.2
Transport, Traffic, and Access	Development accords with the *Queensland Development Code MP4.4 – Building in a transport noise corridor*.	Section 11
	Access onto roads and intersections on roads are designed in accordance with AUSTROADS *Guide to Traffic Management Part 6 Intersections, Interchanges and Crossings*	Section 10.4 Section 11 TIA
	Vehicle manoeuvring and parking areas are sealed with an impervious material	Section 10.6 Section 10.7
	Car parking and access complies with the requirements of the *Industry and infrastructure activities code*	Section 10.4
	Driveways are separated from the building by a 1 m wide landscaping strip	CU2-HU00-DRG-PAS-100-0900 CU2-HU00-REP-PAS-100-0003
	Maximum 1 driveway for access	CU2-HU00-DRG-PAS-100-0900
	Parking and access layout must be designed to be visually unobtrusive from the street	Section 10.4
	Access to development is via constructed and sealed road	Section 10.4
	Maximum 1 vehicle creek crossing	CU2-HU00-DRG-PAS-100-0900
	Major infrastructure overlay – Stock routes Development does not undermine the function and viability of stock routes.	CU2-HU00-DRG-PAS-100-0901
Water and Waste	Development with no reticulated water supply is provided with a single bore capable of delivering a water supply suitable for domestic purposes with a continuous flow rate of 0.25 litres per second.	Section 12.2

Aspect	Planning Scheme Considerations	Reference
	Development with no access to the reticulated sewerage network are serviced by an on-site waste water treatment in accordance with *WSAA Sewerage Code of Australia*.	Section 12.3
	Stormwater drainage is designed and constructed in accordance with *SC6.2 Engineering standards planning scheme policy*	Section 10.2
Landscaping	A densely planted 2 m deep landscape strip is provided along the full width of along all boundaries	CU2-HU00-REP-PAS-100-0003
	A densely planted 3 m deep landscape strip is provided along all boundaries abutting the non-residential activities	CU2-HU00-REP-PAS-100-0003
	Where the main living area is at ground level, private open space is provided that: Is directly accessible from the main living area; and Has a single area of at least 25m^2; and Has with a minimum width of 4 m; and; Has an area with dimensions of at least 3 m by 4 m that is completely covered for sun and weather protection; and Has a maximum gradient of 1 in 10; and Is fenced or screened to protect privacy between adjacent dwellings; and Does not have air-conditioning units or other services located in this space.	CU2-HU00-REP-PAS-100-0003
Building character, screening, and setbacks	Ancillary office, or administration buildings or areas are oriented toward the primary road frontage	CU2-HU00-DRG-PAS-100-0900 CU2-HU00-REP-PAS-100-0003
	Outdoor lighting is in accordance with *AS4282-1997 Control of the Obtrusive Effects of Outdoor Lighting*	Section 14.2
	The office and administration functions comprise an area not greater than 10% of the use area.	CU2-HU00-DRG-PAS-100-0900
	Buildings and structures are set back 6 m from any road frontage and from all side and rear lot boundaries shared with land located in any other zone.	CU2-HU00-DRG-PAS-100-0900 CU2-HU00-REP-PAS-100-0003
	Building dimensions (width and depth) are not greater than 30 m in any one direction	CU2-HU00-REP-PAS-100-0003
	Where windows of habitable rooms in adjoining buildings are located within 9 m: Window sill heights are at least 1.5 m above floor level	CU2-HU00-REP-PAS-100-0003

Aspect	Planning Scheme Considerations	Reference
	Maximum building height is 10 m in the special purpose zone.	CU2-HU00-REP-PAS-100-0003
	Residential activities: Residential density does not exceed one dwelling per 250 m2 Site cover does not exceed 50% Building height does not exceed 8.5 m External walls: Do not exceed 15 m in length Where walls exceed 15 m in length, external treatments such as recesses are provided at least at 7.5 m intervals Building setbacks are 6 m to the road and rear and 2 m to the side	CU2-HU00-REP-PAS-100-0003
	Outdoor storage areas: Not located within any required setback Screened from view from the street, public areas and adjoining premises	CU2-HU00-DRG-PAS-100-0900 CU2-HU00-REP-PAS-100-0003
Emissions and hazardous activities	Refuse container storage areas are: Not located within any required setback or landscaping areas Located in an area free from flood in a 1 in 100-year ari Screened from public view, by a solid fence or wall that is 1.8 m in height, measured from ground level Provided on an imperviously sealed pad that drains to an approved waste disposal system Large enough to accommodate at least one standard industrial refuse bin of a size appropriate to the nature and scale of the refuse generated by the use; and Separated by at least 3m from the common boundary of any adjoining premises containing a sensitive land use.	Section 9.2 Section 10.2 Section 10.6 CU2-HU00-DRG-PAS-100-0900 CU2-HU00-REP-PAS-100-0003

4.2 Comments raised by Flinders Shire Council

A meeting was held with Flinders Shire Council on 29/8/2023. For further details, the meeting minutes are available from the JV.

Council officers raised the following points of note for infrastructure:

- On-site wastewater disposal isn't supported, and municipal wastewater pipelines were shown to be available to the north where connection could be made. Also, some indication of ageing infrastructure that they are reviewing
- Council indicated that the WWTP would have capacity for the camp
- Council indicated that they have adequate nearby piped supply of municipal treated artesian water (for potable uses)
- Council indicated that they did not support municipal potable water being used for construction uses and that a

separate bore (bore #8) nearby could be used with truck cartage for such purposes

- Council indicated a concern with any batch plant located near residential / future residential areas and requested that other locations to the northwest of the township outside the land acquisition area be considered.
- Council also indicated a preference for the full external road to be bitumen sealed from the Highway to Disraeli St; and
- Council raised a concern about the camp staffing impacting the township telecommunications infrastructure capacity.

5. Ecology

An assessment of the impact to ecological values from the camp has been carried out, with the findings summarised below.

Databases searched:

- Vegetation Management Property Report (VMPR) – QLD Department of Resources
- Protected Matters Search Tool (PMST) – Commonwealth Department of Climate Change, Energy, the Environment and Water
- QLD Globe Layers:
  - Biosecurity zones
  - Weed distribution; and
  - MSES.

Ecological values provided for Hughenden camp are based on desktop investigations only and have not been confirmed on site. Pre-clearance surveys have not been completed.

5.1 Ecological Values

Ecological values that may be affected by camp activities are summarised in Table 5.

Table 5: Hughenden Ecology

Value	Result	Status
Regional Ecosystems	Non-remnant	Category X, no status
Biosecurity Zones	Cattle tick infested zone State grape phylloxera risk zone Sugar cane biosecurity zone 3	
Weed Distribution (2 km radius of camp)	• Athel pine • Chinese apple • Mesquite • Mother of millions • Neem tree • Parkinsonia • Parthenium • Prickly acacia; and • Rubber vine.	
MSES	MSES regulated vegetation (defined watercourse)	

5.2 Potential Impacts and Mitigation Measures

Construction of the Hughenden camp hub would require some disturbance to existing ecological habitat. Under the Qld Vegetation Management Framework, the site is mapped as Regional Ecosystem type “Non-remnant” (Category X).

In areas that are mapped as Category X, and where the land tenure is freehold, indigenous land and leasehold land for agriculture and grazing purposes, the clearing of vegetation is considered exempt clearing work and does not require notification or development approval under the vegetation management framework. For all other land tenures, contact the Department of Resources before commencing clearing to ensure that the proposed activity is exempt clearing work.

MSES vegetation is not present within the camp hub.

No pre-clearance surveys have been completed for Hughenden as MSES at Hughenden is limited to the watercourse traversing the site. This is planned to be completed.

The camp hub has been designed to minimise the clearing of vegetation as far as practicable to reduce potential impacts to MSES. Buffers and setbacks outlined in relevant local planning schemes have been taken into consideration during the design process. Where clearing is unavoidable, mitigation measures, including vegetation selection for landscaping, will be implemented to negate potential impacts from clearing as part of the JV’s Construction Environmental Management Plan (CEMP) subject to review and approval two months in advance of construction commencing (i.e. construction commencement includes camp hubs).

The following management plans would be updated and reviewed by the JV to support the project’s CEMP:

- Biodiversity Management Plan
- MNES Threated Species Management Plan (MNES Plan)
- Biosecurity Management Plan; and
- Rehabilitation Management Plan.

A future pre-clearance ecology report for Hughenden camp will be completed and support the preparation of these management plans.

6. Heritage

6.1 Existing Aboriginal and Non-Aboriginal Heritage

Known Aboriginal and non-Aboriginal heritage places in proximity to each camp hub were identified through reviewing the following databases:

- Aboriginal and Torres Strait Islander Cultural Heritage Database (ATSICHD)
- Aboriginal and Torres Strait Islander Cultural Heritage Register (ATSICHR)
- Queensland Heritage Register; and
- Relevant local planning scheme heritage overlays.

The ATSICHD and the ATSICHR also identified relevant Aboriginal heritage stakeholders to the sites.

The results are summarised in Table 6 and Table 7.

Table 6: Known Aboriginal and non-Aboriginal heritage places within 1 km of the camp hub

Camp	Heritage Place (Date Recorded)	Significance	Proximity to Camp
Hughenden	Artefact Scatter (EJ:B35) (24/03/1999)	Aboriginal Place	Within

Table 7: Aboriginal heritage stakeholders and management

Value	Result
Cultural Heritage Party	Yirendali People Core Country Claim (QC2006/020 PRC)
Cultural Heritage Body	Yirendali Aboriginal Corporation (CHB020010)
Cultural Heritage Management Plan	Approved CHMP CopperString power transmission line (CLH020014)

6.2 Potential Impacts and Mitigation Measures

Powerlink have approved Cultural Heritage Management Plans (CHMP) with the following Parties:

- Kalkadoon Native Title Aboriginal Corporation RNTBC
- Mitakoodi People #5
- Wanamarra People Core Country Claim
- Yirendali People Core Country Claim
- Yulluna Aboriginal Corporation RNTBC ICN 7112
- Birriah People; and
- Jangga People #2.

The design and construction of the accommodation facilities will be undertaken by the JV in accordance with the agreed CHMPs. A JV draft Local and Indigenous Employment Engagement and Training Plan will be updated as part of the submission of the project's CEMP through detailed design, following consultation with Aboriginal Parties by Powerlink.

7. Bushfire

7.1 Existing Bushfire Prone Area

Relevant local planning schemes to the camp hubs have been reviewed to identify potential bushfire prone area and potential bushfire impact buffers across the sites. The proposed Hughenden Camp is not located within bushfire prone or impacted land.

7.2 Potential Impacts and Mitigation Measures

Bushfire prone areas are more susceptible to bushfires and pose a higher risk to the environment and safety of onsite personnel. Construction and operation activities can increase fire risk on site through operation of equipment and machinery and storage of hazardous materials.

While the site has not been mapped as bushfire prone, mitigation measures have still been incorporated into the design to further reduce risk. The following design features have been incorporated into the camp hub design to reduce bushfire hazard:

Appropriate buffers and setbacks from identified bushfire prone areas with consideration to relevant local planning scheme bushfire overlay codes.

- AS 3959:2018 Construction of buildings in bushfire-prone areas; and
- Accessibility of water, buildings, site access for emergency response vehicles and personnel.

A JV draft Bushfire Management Plan and Severe Weather Management Plan will be updated and reviewed by a suitably qualified person as part of the submission of the project's CEMP as part of detailed design to confirm bushfire design elements and requirements following Stakeholder consultation will meet community expectations and conditions of approval.

7.3 Bushfire Hazard Assessment

In addition to the general planning level information provided above, a bushfire hazard assessment has been carried out for Hughenden by Greentape Solutions, using a suitably qualified person. The bushfire hazard assessment and its recommendations are provided in document number CU2-HU00-REP-PAS-100-0006.

The outcomes of this hazard assessment can be used to inform ongoing decisions about camp hub site design and bushfire management planning.

8. Air and Noise

8.1 Air

The only emissions to air of concern are dust and odour, although the scale and intensity of these emission sources is sufficiently low such that they can be effectively managed onsite and are not expected to cause any impact on nearby residences or other sensitive receivers.

There will also be minor emissions of combustion products and fine particulates resulting from operation of vehicles and electrical generators on the sites.

Operational management plans for the camp hubs will include control measures, to ensure that dust and odour emissions are not allowed to reach excessive levels. These control measures will be documented in the applicable camp hub environmental management plans. The major control measures and precautions required are described below.

8.1.1 Potential Dust Sources and Dust Control Measures

The camp hub sites include significant areas of unsealed compacted crushed rock hardstand and unsealed internal roads. These surfaces have the potential to generate dust, especially during windy weather or when onsite traffic is frequent.

The following dust control measures will be incorporated into the camp hub designs and management plans, including the development by the JV of an Air Quality (Dust) Management Plan:

- Robust construction materials will be used for unsealed hard stands and on-site access roads, which minimise the potential for dust generation. Where appropriate, heavily trafficked areas will be sealed
- A water truck will be available as required to damp down on-site unsealed roads and heavily trafficked hard stand areas, to reduce vehicle generated dust
- All hardstands, unsealed roads and pavement will be maintained in good condition to minimise the potential for vehicle generated dust
- An on-site speed limit of 20 kph (or less) will be observed to avoid excessive dust generation (as well as for safety)
- A vehicle wash down bay will be provided to enable soiled/muddy vehicles to be cleaned down and reduce the tracking and spread of silt and other fine materials which may dry out and cause dust, or be tracked onto sealed areas
- Granular loads such as sand and aggregate will be covered during transport, to prevent spillage or blown dust generation during transport; and
- Soil disturbance will be avoided, and vegetation maintained on areas of the site that are not being utilised.

8.1.2 Potential Odour Sources and Odour Management Measures

Potential odour sources on site include solid waste / refuse, wastewater treatment plants (and ancillary equipment such as macerators), refuelling areas, wastewater irrigation areas and kitchen exhaust fans and grease trap. All of these activities / facilities have been designed and located to minimise or eliminate the generation of odour and to provide sufficient set back from nearby residences, such that odour is unlikely to be detectable.

The following odour control measures will be incorporated into the camp hub designs and operational management plans:

- All waste will be managed in accordance with the JV's Waste and Refuse Disposal Management Plan (0643-JV-PLN-WRD-0017). This plan has provisions that will ensure that all solid waste generated on site will be handled and disposed of appropriately. Rubbish bins will be located in appropriate designated locations, fitted with lids and collected regularly. No putrescible waste (such as spoilt food) will be kept on site for extended periods
- Wastewater treatment plants will be designed to ensure that excessive odour is not generated. The effluent discharged will be treated to an extent such that negligible odour is generated in the wastewater disposal field. Wastewater treatment and disposal will be undertaken in accordance with regulatory approvals and manufacturer specifications. Note that if possible connection to the existing sewerage system will be used in preference to onsite treatment and disposal of wastewater
- The waste water treatment plants will be operated and maintained in accordance with the designer's instruction so as to avoid generation of excessive odour
- Kitchen rangehoods and exhaust fans will be cleaned regularly in accordance with the manufacturer's recommendations; and
- Enclosed storages for hazardous substances, including self-bunded refuelling containers, shipping containers and generators, etc will be setup, operated and maintained in accordance with manufacturer's specifications to avoid generation of excessive fumes.

8.2 Noise

An assessment of the impact of noise from the camp hub on nearby sensitive receivers has been carried out, and is documented in a separate noise assessment report (document number CU2-HU00-REP-PAS-100-0004). The findings of the noise assessment are summarised below.

8.2.1 Existing Noise Environment

The nearest residences are approximately 210 metres from the proposed site. Traffic volumes on nearby streets are light, especially at night, so existing ambient noise levels are relatively low. The site adjoins the Townsville to Mount Isa railway line, but rail traffic is also quite light.

Ambient noise at the nearest residences to the camp hub, is currently dominated by local traffic during the daytime, declining to lower levels overnight. Other existing noise sources include nearby commercial premises, the railway, residential air-conditioners, insects, birds, dogs, stock and the wind blowing through vegetation.

8.2.2 Description of Noise Sources

Heavy Vehicles

The most significant noise sources are predicted to be trucks moving on the site. Noise relating to movement, loading and unloading of trucks will occur.

Electrical Gen Sets

Allowance has been made for a 125kVa electrical gen set to provide power for the camp hub, although if possible the site will be connected to grid power instead. This allows for emergency back-up generator operation if required, and use of generators to power various activities around the site if required.

Other Noise Sources

Other more minor noise sources include:

- Light vehicles entering and leaving the carpark, refuelling, making deliveries etc.

- External air-conditioning and refrigeration equipment serving accommodation units, communal camp buildings and offices
- Pumps and air compressors associated with water supply, wastewater treatment, vehicle wash, vehicle maintenance and fuel supply; and
- Power tools etc in use in the vehicle maintenance workshop.

8.2.3 Hours of Operation

The hours of operation for construction, maintenance and logistics work related activities on site will be 6.30am to 6.30pm Monday to Sunday. No night time activity will be undertaken other than that relating to the occupancy of the accommodation, excepting circumstances where the project has enacted and sought approval for an out of hours work permit. The period of greatest concern is 6.30am to 7am, when personnel will be departing their accommodation for work site and all other activities may also be in operation. This time period is regarded as night-time from a noise regulation point of view, so night time, sleep disturbance related noise criteria apply.

8.2.4 Provisions for Noise in the Planning Scheme

As detailed in Section 4 above, the planning scheme covering the proposed camp hub has provisions requiring the amenity of nearby sensitive receivers to be protected from adverse noise impacts from new development. The planning scheme does not provide quantitative criteria for evaluation of noise emissions, however it makes reference to the Queensland *Environmental Protection (Noise) Policy 2019* for this purpose. The planning scheme also requires that new developments are located, designed, orientated, and suitable noise mitigation measures implemented, in order to minimise noise impacts on existing sensitive uses.

8.2.5 Queensland Noise Assessment Criteria

The Queensland *Environmental Protection (Noise) Policy 2019* (the EPP) provides a framework for achieving the objectives of the *Environmental Protection Act 1994* relating to protection of the acoustic environment. The legislation aims to strike a balance between protecting the amenity and wellbeing of the community and allowing development to occur in a sustainable, cost-effective manner. Schedule 1 of the EPP specifies various “Acoustic Quality Objectives” which may be used to assess the impact of noise emissions from a proposed activity on the amenity and wellbeing of sensitive receptors such as residences. The objectives are informed by the World Health Organization’s *Guideline for Community Noise 1999.*

Table 8 below shows the Acoustic Quality Objectives relevant to sensitive receptors in the areas surrounding the proposed camp hubs. These include criteria relevant to use of outdoor recreation areas and avoiding sleep disturbance. The noise levels indicated must include adjustments to account for intrusive noise characteristics such as tonality, impulsiveness.

Table 8: EPP Acoustic Quality Objectives

Activity	Time of Day	$L_{Aeq,1hr}$	$L_{A10,1hr}$	$L_{A1,1hr}$
Residences - Outdoor Recreation	Daytime and Evening	50	55	65
Residences - Indoor	Daytime and Evening	35	40	45
Residences – Indoor (Sleep Disturbance)	Night-time	30	35	40
Education Institutions - Indoor	Daytime	35	-	-

If an outdoor to indoor noise reduction for a typical house with open windows, of 7 dB(A) is assumed, the noise limits based on the EPP acoustic quality objectives, measured at the façade of nearby residences are:

- Daytime (7am to 6pm) 42 dB(A)
- Evening (6pm to 10pm) 42 dB(A); and
- Night-time (10pm to 7am) 37 dB(A).

8.2.6 Noise Mitigation Measures

A Noise and Vibration Management Plan would be developed by the JV to mitigate noise impacts from the project and would consider the following measures. These measures are general “good practice” noise mitigation measures which help ensure that excessive noise emissions are not generated:

- All access roads, pavement and hardstand areas on the site will be maintained in good condition, to minimise tyre noise and rattling noise from heavy vehicles
- All plant and equipment will be maintained in good order at all times, especially noise control equipment such as mufflers and exhaust pipes
- Drivers will be encouraged to avoid dropping loads and scraping loader buckets on the ground
- An on-site speed limit of 20 kph (or less) will be observed to avoid excessive noise (as well as for safety); and
- All heavy vehicles will be fitted with “broadband” style reversing beacons.

8.2.7 Noise Assessment Methodology and Results

Noise modelling was carried out using SoundPLAN 8.2 environmental noise modelling software and the ISO 9613-2 noise calculation standard. The modelling has taken into account noise attenuation due to distance, ground absorption, air absorption, topography and shielding by buildings. Sound power levels have been sourced from pitt&sherry’s in-house database of plant noise level measurements, equipment manufacturer’s datasheets and from the SoundPLAN noise source library.

Table 9 below lists the $L_{eq,1hr}$ noise levels predicted by the modelling at sensitive receivers near the camp sites. The noise levels meet the EPP Acoustic Quality Objectives.

Table 9: Noise modelling results at sensitive receivers near the CopperString Camp Hubs - Leq,1hr - dB(A).

Hughenden		
R1	143 Haul Rd	**21.0**
R2	36209 Kennedy Development Rd	**20.0**
R3	Winton Rd	**21.4**
R4	36 Flinders Hwy	**32.1**

Hughenden		
R5	31 Flinders Hwy	**29.9**
R6	46 Disraeli St	**25.7**
R7	39 Disraeli St	**24.8**

8.2.8 Assessment of Rail Noise

Due to the proximity of some of the accommodation units in the southern corner of the proposed camp, to the Mount Isa railway line, railway noise levels have been assessed.

Railway Noise Criteria

The Coordinator General's Report requirements (Appendix 2, Part B) for railway noise at construction camps are as follows:

(i) For all private and communal open space associated with the workers camps, the following external noise criteria must be met:

- < 62 dB(A) Leq, 24hour free field
- < 84 dB(A) single event maximum sound pressure level (Lmax) free field
- < 65 dB(A) Leq, 24hour façade corrected
- < 84 dB(A) single event maximum sound pressure level (Lmax)) façade corrected

(ii) For all residential workforce accommodation not covered by Mandatory Part 4.4 of the Queensland Development Code, the following internal noise criteria must be met:

- < 45 dB(A) single event maximum sound pressure level for all habitable rooms.

Using reference locomotive sound power levels and assuming that six trains pass along the railway line per day, an $L_{Aeq, 24hour}$ of 59.4dB(A) (free-field) or 62.4 at the façade of the accommodation unit, was predicted, and a worst case L_{Amax}, of 79.6dB(A).

Both of these noise levels fall below the required criteria for open space. To meet the L_{max} 45 dB(A) criterium for internal noise levels, a noise reduction (R_w) rating of 35 dB(A) is required for the nearest rooms facing towards the railway line. This is readily achievable by conventional construction materials and windows and doors with effective acoustic seals.

8.2.9 Conclusion

On the basis of the noise assessment, it may be concluded that the level of noise emissions from the proposed camp hub will comply with the Queensland EPP Acoustic Quality Objectives. Noise emissions from the camp hub will not be sufficient to cause loss of amenity or environmental harm at nearby residences, meeting the noise related provisions of the town planning scheme. Noise levels within the accommodation units on the camp hub site, will also meet the Acoustic Quality Objectives for residential amenity and the coordinator general's criteria for rail noise.

If required, the detailed design phase for the camp hubs will include revision and updating of the noise assessment, to ensure that the noise mitigation measures required, are implemented in the final design.

9. Landscape Character and Visual Amenity

9.1 Existing Landscape Character and Visual Amenity

Hughenden camp is located in a rural setting on the outskirts of the township on cleared grazing land. Typical of rural environments, the landscape around Hughenden camp is characterised by agricultural production and associated landforms including dams and stock routes. The land is relatively flat and divided into large land parcels separated by State controlled arterial roads and the local road network, as well as railway to the west. Largely cleared for agricultural land use, vegetation in the rural environment predominantly features grasslands, crops, riparian vegetation along existing watercourses and limited road reserve vegetation. A minor watercourse dissects the site. Hughenden Recreational Lake is about 500 m to the northeast. Flinders Rover is about 1.7 km to the north.

9.1.1 Sensitive Receivers

Hughenden camp is located south of Hughenden township, about 1.3 km south of the town centre. The nearest sensitive receivers to the camp site are several residences about 200 m to the north on Flinders Highway, with many residences beyond 350 m to the north and north-west.

Users of road and rail transport may be considered temporary receivers in transit.

9.2 Potential Impacts and Mitigation Measures

The construction of a camp hub is atypical of the existing landscape character. Therefore, the camp hub has the potential to impact the landscape character of the site and visual amenity for nearby sensitive receivers. To reduce the potential impacts, the design of the camp hub has considered the local planning scheme and would incorporate the following:

- Sufficient shaded fencing or landscaping would be installed to effectively screen obtrusive buildings and structures, such as the waste storage area, from the road and other sensitive land uses
- Road reserve vegetation would be retained where practicable to maintain existing roadside screening
- Appropriate buffers and setbacks from the road would be incorporated to distance buildings and other structures from the road viewpoint
- Landscaping vegetation would be selected based on maximum efficiency for screening purposes; and
- Vegetation clearing would be minimised where practicable to retain existing screening and reduce footprint.

10. Civil Design

10.1 Layout

The Hughenden camp hub includes the following main features:

- Camp accommodation quarters (dwelling units, kitchen, laundry, recreation area, gym, covered walkways etc)
- Offices
- Sealed access road/driveway
- Carpark (Sealed)
- Water and wastewater facilities (tanks, bore, treatment facilities where required and pumps)
- Provision for on-site wastewater disposal (if required)

- Laydown area hardstand (equipment storage)
- Workshops and maintenance area (igloo dome workshops and containerised stores)
- Refuelling facility
- Vehicle Wash facility
- Cultural heritage artefacts and environmental supplies storage area
- Waste storage area
- Security entrance hut; and
- Perimeter fencing.

The layout of the camp as shown drawing set number CU2-HU00-DRG-PAS-100-0900, has been configured such that living quarters are somewhat separate from the industrial site uses such as the workshops as much as practical to improve safety and amenity. Furthermore, where feasible the light vehicle carparking and manoeuvring areas have been kept separate from the heavy vehicle usage areas such as the laydown areas.

10.2 Stormwater drainage and Flooding

A Water Quality Management Plan will be developed to manage impacts to receiving waters from camps and would support the project's CEMP submission through detailed design.

The stormwater drainage philosophy for the camp hub site is aimed at using shallow open channels, bunds and sheet flows as much as possible, with only minimal use of pit and pipe systems. The reason to avoid excessive pit and pipe systems is twofold. Firstly, pit and pipe systems require sufficient slope of land however the site is quite flat so buried pipes could become relatively deep or excessive fill would be required to make pipes viable to discharge to daylight. Secondly, pipe outlets can cause additional scour due to concentrated outflows.

For further information on the stormwater drainage management, refer to the Stormwater Management Plan (refer CU2-HU00-REP-PAS-600-0001).

10.2.1 Flooding

The camp is required to be immune from 1% AEP flood levels. The current layout design relies on publicly available flood data from State and Local Government sources and is subject to confirmation. The JV is in the process of having hydrological and hydraulic assessments carried out to confirm the flood levels across the CopperString 2032 Project including the Hughenden camp site.

A JV draft Severe Weather Management Plan will be updated and reviewed by a suitably qualified person as part of the submission of the project's CEMP through detailed design to confirm severe weather, including flooding, design elements.

10.2.2 Waterway Barrier Works

The site contains a shallow, northeast flowing ephemeral waterway. This is classified as a green (low impact) waterway under the Fisheries Act 1994, for consideration of waterway barrier works.

It is likely that a vehicle crossing would be installed to enable passage between either side of the waterway. This may take the form of either a culvert crossing or a bed level crossing and would be designed to meet the accepted development requirements under the Fisheries Act 1994.

10.3 Erosion and Sediment Control (ESC)

A high-level assessment of the erosion and sediment control management needs of the site during construction of the camp hub has been carried out. For the operational phase of the camp's life once its built and established, the site is intended to be managed by a Stormwater Management Plan (SMP). Refer to CU2-HU00-REP-PAS-600-0001 for the preliminary SMP.

It should be noted that the camp Erosion and Sediment Control Plan (ESCP) will be further developed at detailed design stage using site geotechnical and topographic data, so the advice provided within this report may eventually become superseded. This report however is provided to offer some initial considerations and to assist in the development review process.

Refer to the following the site drawing set (CU2-HU00-DRG-PAS-100-0900) for further details of the nominated erosion and sediment controls.

A Revised Universal Soils Loss Equation (RUSLE) assessment was carried out to gain an understanding of the level of risk and sediment and erosion management techniques likely to be required. The assessment methodology adopted is based on the Best Practice Erosion and Sediment Control Guidelines from the International Erosion Control Association (IECA).

Annual soil loss rate (t/Ha/yr) = A=R.K.LS.C.P

- R = rainfall erosivity factor
- K = soil erodibility factor
- LS = slope length topographic factor
- C = cover and management factor; and
- P = erosion control practice factor.

For Hughenden, the results are as follows:

Table 10: RUSLE table

R	K	LS	C	P	A (t/Ha/yr)
1860	0.05	0.41	1	1.3	49

(refer to the table below for further details on the RUSLE calculations)

Site area	Sub-catchment or Name of Structure						Notes
	Hughenden						
Total catchment area (ha)	6						approx
Disturbed catchment area (ha)	6						approx

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	D						If known. Type D is worst-case.
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							Pg 23 (SCRC) or 3.15 (IECA)
Soil Texture Group	D						Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5						Pg 101 (SCRC) or Pg B.17 (IECA)
Design rainfall depth (percentile)	75						
x-day, y-percentile rainfall event (mm)	20.9						
Rainfall R-factor (if known)							Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	9.05						

RUSLE Factors

Rainfall erosivity (*R*-factor)	1860						Auto-filled from above
Soil erodibility (*K*-factor)	0.05						RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	80						
Slope gradient (%)	2						
Length/gradient (*LS*-factor)	0.41						
Erosion control practice (*P*-factor)	1.3						
Ground cover (*C*-factor)	1						

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Put an X here to use 50% of water zone	x						Fill in one or the other - either an X or nominate the number of months
Storage (soil) zone design (months)							
Cv (Volumetric runoff coefficient)	1			1			Pg 202 (SCRC) or Pg B.18 (IECA)

Calculations and Type D/F Sediment Basin Volumes *

Soil loss (t/ha/yr)	49						
Soil Loss Class	1						Pg 54 (SCRC) or Pg 3.4 (IECA)
Soil loss (m^3/ha/yr)	38						Conversion to cubic metres
Basin storage (soil) volume (m^3)	627						Pg 102 (SCRC) or Pg B.19 (IECA)
Basin settling (water) volume (m^3)	1254						Pg 102 (SCRC) or Pg B.14 (IECA)
Sediment basin total volume (m^3)	1881						Theoretical – to be determined

*Note that sediment basin sizing is nominal only for concept planning purposes. Need for basin to be confirmed following further review of site data including survey and geotechnical reporting.

When the RUSLE equation annual soil loss estimation (A) yields a number larger than 75t/Ha/yr, this triggers the need to consider Type 1 sediment controls which are the most stringent and may require a sediment basin.

When the soil loss rate is less than 75t/Ha/yr, the IECA guidance suggests that Type 3 sediment controls can be used which are the more coarse and most common techniques such as sediment fences, sediment traps, stabilised exits and the like.

As evidenced by the outcomes in the table above, Hughenden camp site is subject to an estimated annual soil loss rate less than 75t/a/yr. As such, Type 3 controls are proposed during construction.

The following table is an extract from IECA Best Practice Guidelines (Book 1), which indicates some of the typical Type 1, 2 and 3 controls.

Table 11: ESC control levels

Type 1	Type 2	Type 3
Sheet flow treatment techniques		
• Buffer Zone capable of infiltrating 100% of stormwater runoff or process water * • Infiltration basin or sand filter bed capable of infiltrating 100% of flow	• Buffer Zone * capable of infiltrating the majority of flows from design storms • Compost/Mulch Berm	• Buffer Zone * • Filter Fence • Modular Sediment Trap • Sediment Fence
Concentrated flow treatment techniques		
• Sediment Basin * (sized in accordance with design standard)	• Block & Aggregate Drop Inlet Protection • Excavated Sediment Trap with Type 2 outlet • Filter Sock • Filter Tube Dam • Mesh & Aggregate Drop Inlet Protection • Rock & Aggregate Drop Inlet Protection • Rock Filter Dam • Sediment Trench * • Sediment Weir	• Coarse Sediment Trap • Excavated Drop Inlet Protection * • Excavated Sediment Trap with Type 3 outlet • Fabric Drop Inlet Protection • Fabric Wrap Field Inlet Sediment Trap • Modular Sediment Trap • Straw Bale Barrier • U-Shaped Sediment Trap
De-watering sediment control techniques (selection not based on soil loss rate)		
• Type F/D Sediment Basin • Stilling Pond	• Filter Bag or Filter Tube • Filter Pond • Filter Tube Dam • Portable Sediment Tank * • Settling Pond * • Sump Pit	• Compost Berm * • Filter Fence * • Grass Filter Bed * • Hydrocyclone * • Portable Sediment Tank * • Sediment Fence
Instream sediment control techniques (selection not based on soil loss rate)		
• Pump sediment-laden water to an off-stream Type F or Type D Sediment Basin or high filtration system	• Filter Tube Barrier • Modular Sediment Barrier* • Rock Filter Dam • Sediment Weir	• Modular Sediment Barrier* • Sediment Filter Cage

At the time of conducting this assessment there were no site-specific geotechnical investigation test results, nor detailed site topographic survey data to rely upon which are key components of consideration for erosion potential. Somewhat conservative assumptions have generally been made for this assessment, however further information including geotechnical data may result in different assessment outcomes. Further assessments will be required once new site data is obtained as part of detailed design to finalise the ESC controls relevant to construction phase.

10.4 Access Road

The entry road and main carpark of the camp hub site are to be bitumen sealed for amenity and aesthetics as well as durability purposes.

The access to site will be for 2-way truck movements, and therefore generally 6-8m minimum width. The driveway intersection configuration to each site is governed by the site-specific road conditions, the traffic analysis and the jurisdictional requirements. The proposed driveway entrance arrangements for each site are as follows:

Hughenden - BAR/BAL in line with TMR requirements since it connects to an unnamed unsealed road, but is in close proximity to an intersection with the Flinders Highway which is a State controlled road

For further analysis, refer to Section 11 Traffic and Transport.

10.4.1 Vehicle wash bay

For the purposes of ensuring vehicles are clean and free dirt and mud to avoid depositing debris onto public roads and contaminating the surrounding environment, and to meet the project's biosecurity requirements, a vehicle wash bay is to be provided at the camp hub site.

The wash bay will be provided near the main access road entrance and exit of camp hubs to allow timely and efficient vehicle cleaning.

10.4.2 Carparking

The car parking requirements of the camp hub site has been informed by the following inputs:

- Personnel numbers as advised by the JV (refer to the design criteria in Section 2.1)
- The JV accommodation management plan (0643-JV-PLN-AMP-0019 Rev E)
- The JV logistics management plan (0643-JV-PLN-LMP-0016 Rev G)
- The relevant local government planning scheme parking code requirements and rationalising discrepancies between them as described in the sections below; and
- The Australian Standard for off-street parking (AS2890.1 Parking facilities - Off-street Car Parking).

Given the remote locations of the camp hub site relative to the limited available local workforces in each region, it is expected that most individual workers will not arrive to camp hub sites individually in personal vehicles. Rather they are likely to arrive via JV managed buses, minivans and pool vehicles connecting to regional airports and cities including Townsville, Mount Isa and others along the transmission line project alignment. For this reason, it is not expected, nor feasible to require parking spaces at the rate of one parking bay per person. Furthermore, when deploying to work sites along the transmission corridor, workers will commute between the camp hub sites and the work fronts in mini-vans or car-pooling methods, not all in individual vehicles.

Parking code requirements vary across each of the local government planning schemes that span the CopperString 2032 project area. To allow a sensible approach that considers common logistics arrangements and common industrial relations issues across the camps hub sites, the designs include a standard approach to calculate reasonable parking provisions across all camps, rather than adopting the differing requirements of each town planning scheme which could see vastly different parking outcomes between sites. This approach has assumed the following:

A minimum consideration of one car space for every three beds (1:3 ratio), with each of these car spaces servicing one worker, noting that at least one local government planning scheme required one carpark per bed, while another required one carpark per five beds for a temporary workforce accommodation land use. At a 1:3 ratio, the following is the minimum numbers of parking bays:

- Hughenden – 410/3 = 137
- However, regardless of the minimum adopted ratio of one parking space per three beds, the JV has resolved to provide at least 170 at Hughenden; and
- In addition,12-seater minibuses / minivans which are anticipated to be in the order of 5.2m in length (Toyota HiAce or similar) will provide transport for the remaining workforce, and so additional provision is made for minibus parking at the camp hub.

Additional ancillary unsealed parking spaces can be provided adjacent to associated facilities (storage area, laydown yard etc). These could typically be used by supervisors and key equipment operators/maintainers on an as needs basis.

10.4.3 Carpark layout

The camp hub has one main bitumen sealed carpark for light vehicles and mini vans which caters for the majority of the parking needs.

The main carpark layout was developed in general accordance with AS2890.1 Parking facilities - Off-street Car Parking, to ensure general compliance with requisite standards for parking bay sizes, aisles widths and lengths, while considering that most small vehicles are likely to be 4x4s and SUVs. The ultimate carpark layout may be reconfigured at detailed design stage, but the same core parameters used here are expected to apply and there is adequate room within the land acquisition area to reconfigure the carparking arrangements if required. The carpark dimensional parameters are as follows:

- The adopted typical carpark bay is 5.4m long and 2.7m wide
- The adopted aisle width is 5.8m minimum
- Mini vans are nominally 5.2m long and so are expected to be able to use a standard carpark bay
- There is however room to adjust these dimensions at detailed design stage if required; and
- No allowance has been shown on the layout plans for disabled bay parking facilities, however this can be further considered at detailed design stage with relevant authorities and camp managers to understand the site policies and needs. There is adequate space to make such provision if required.

Refer to drawing CU2-HU00-DRG-PAS-100-0020 for the main car park arrangement including swept path of a 15m bus (50 seat coach for airport transfers):

10.5 Laydown areas

The laydown area will be a hardstand of compacted subgrade and imported, compacted road base gravel or crushed rock. They are used to store construction equipment such as conductor cable drums, steel components, reinforcement, and various other construction related items and activities that need to be securely stored in a trafficable area in a way that is accessible and cost effective.

The sizes of the laydown areas have been nominated by the JV based on their expected construction needs (refer to Section 2.1). The laydown areas are critical components of the CopperString 2032 construction management process and give the JV flexibility in the logistics process in terms of how and where to manage and store construction equipment along the project corridor at convenient locations. Being a simple asset mainly involving compacted natural ground and imported compacted gravel pavements for a durable storage surface, they can be locally varied in size and shape on site to suit the available land and the evolving needs of the project.

The nominal minimum sizes of the laydown areas is 34,200m2 which may be fully on-site if there is no need for wastewater irrigation or alternative additional land elsewhere in Hughenden may be required. Sizes may be slightly altered at detailed design stage based on logistics assessments, site needs and constraints:

10.6 Pavements and surface finishes

The overall camp hub site will be stripped of topsoil (only where necessary) and levelled as required during early bulk earthworks operations to provide a functional surface. To provide a durable, aesthetically acceptable and operationally manageable surface finish to the various facilities, the following pavements and surface finishes are proposed:

Table 12: Surface finishes

Camp Hub location	Surface finish or pavement
Overall Camp Hub site where disturbance is required	To be surfaced with imported, well compacted road base gravel / crushed rock to provide a construction surface and seal in the underlying natural soils to protect from rainfall and wind erosion during and after construction. Thicknesses and gravel types to be based on geotechnical data and an assessment of available materials
Camp accommodation quarters	Compacted road base gravel, with landscape features, including covered concrete walkways, hardy plants, rock mulch. (Landscape architect design by others)
Site entry road	2 coat bituminous spray seal over compacted road base gravel.
Carparking (Sealed)	2 coat bituminous spray seal over compacted road base gravel.
Additional and ancillary carparking (unsealed) other than the main carpark	Compacted road base gravel / crushed rock.
Water and wastewater facilities (tanks, bore, treatment plant, reservoir, and pumps area)	Compacted road base gravel / crushed rock. Optional concrete slabs as per supplier recommendations if required.
Refuelling facility	Concrete slab on compacted road base gravel / crushed rock, Slab to be bunded as required for spill containment.
Vehicle Wash facility	2 coat bituminous spray seal over compacted road base gravel to its entry and exit.
Cultural heritage artefacts and environmental supplies storage area	Concrete bunded area over compacted road base gravel.
Waste storage area	Concrete bunded area over compacted road base gravel.
Workshops and maintenance area (igloo dome workshops and containerised stores)	Compacted road base gravel to parking and storage areas adjacent to workshops. Concrete slab to workshop floors with bunding if required for spill containment.
Laydown area (equipment storage)	Compacted road base gravel / crushed rock
Provision for on-site wastewater disposal / irrigation (if required)	Natural or existing intact land, and possible supplementation with mulch.

Camp Hub location	Surface finish or pavement
Electrical facilities (diesel areas or kiosk substations)	Compacted road base gravel, with rock mulch to help contain spills and offer step and touch protection if required. Optional concrete slabs as per supplier recommendations
Stormwater drainage channels	Suitable linings to suit flow velocities and climate. Geofabrics, rock, concrete, (grass / vegetation subject to soils, landscape architect and climate tolerance assessment).
Other bare earth areas including batters	Options such as topsoil and grass, mulch, hydro mulch, rock mulch, regular polymer sprays (grass / vegetation subject to landscape architect and climate tolerance assessment).
Landscape areas	Landscape as per landscape architect specifications
Parts of the camp hub lots where no disturbance is proposed or required	Preferably leave the natural state of the land intact and undisturbed

10.7 Pavement design and material assessments

At the time of compiling this report, there were no site-specific geotechnical investigation datasets available, and the JV was still in the process of obtaining this information. However, based on the mapped regional geology and engineering judgement, the following in-situ subgrade CBR values may be considered representative:

Table 13: Indicative CBR values

Camp	Unit	CBR (%)
Hughenden	Sedimentary rocks	3

Based on Section 11 – Traffic and Transport, the adopted construction and operations traffic loads for the main access entries / roads (expressed as ESA - equivalent standard axles) is as follows and is subject to review at detailed design stage:

- For a 300-400 person camp - 4.59×10^5 (Hughenden).

Using The Austroads empirical design method for granular pavements with thin bituminous surfacing (Austroads Guide to Pavement Technology Part 2, Figure 8.4), the following maximum pavement thicknesses may be expected for the most heavily trafficked areas such as the main access roads and entrances:

- Hughenden – Subgrade CBR 3, 480mm thick.

Figure 8.4: Design chart for granular pavements with thin bituminous surfacing

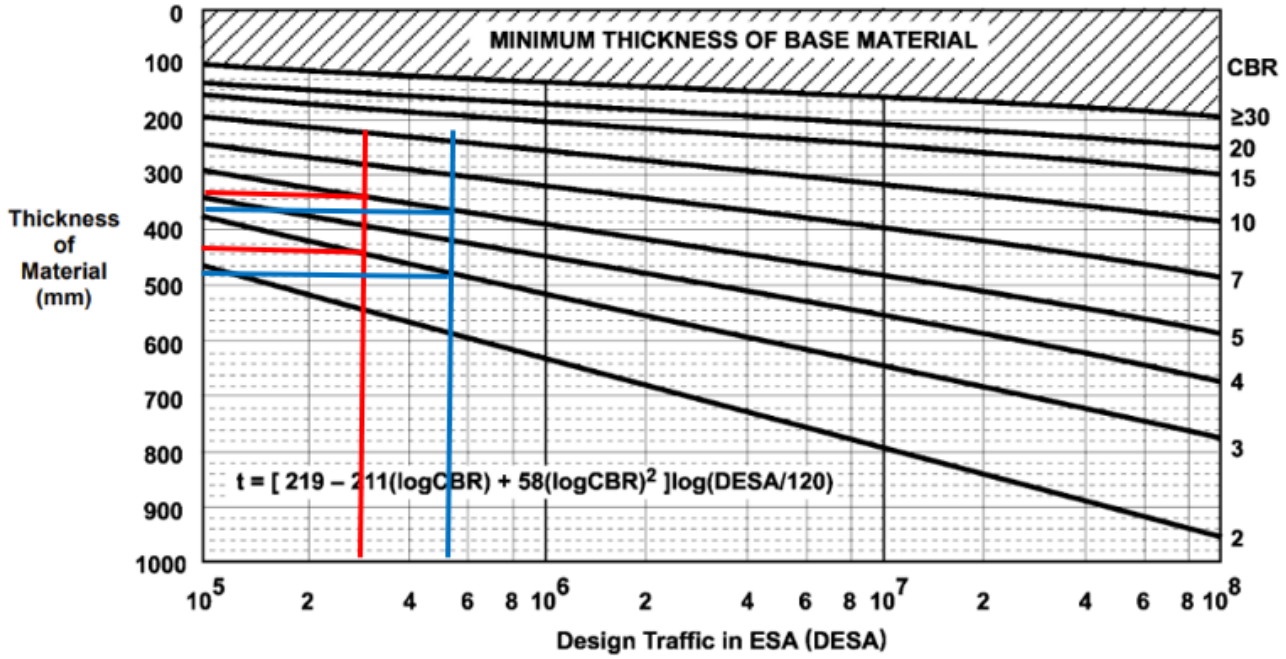

Figure 2: Pavement design chart

However, these pavement designs may be reduced based on the following considerations which should be further assessed at detailed design stage:

- Confirmation of camp design life. The current design life is <1year construction and maximum of 5 years of operation, however the actual operational period may be less than 5 years and it may have a ramp up and a ramp down in vehicle numbers
- A potential acceptance of more maintenance requirements for what is a short-term private road (i.e. lower cost road with more site maintenance and operational cost required)
- An assessment of the traffic distribution on the sites. (for example, the main light vehicle parking will see much less heavy traffic than the main access, so its pavement thicknesses can be less than other areas); and
- Confirmation of subgrade CBR's.

Using engineering judgement and nominal pro-rata assessments from the maximum thickness main access road pavement findings, the following pavement thicknesses have been adopted for preliminary design:

- Access roads and main entrances – as listed above
- Camp living quarters area pavement – 150mm thick unsealed compacted road base / crushed rock
- Laydown and industrial use pavement – 250mm thick unsealed compacted road base / crushed rock; and
- Main carpark – 200mm thick bitumen sealed and compacted road base / crushed rock.

11. Traffic and Transport

A Traffic Impact Assessment (TIA) report addressing the direct impacts of the Hughenden Camp Hub on the local road network, as required by the Guide to Traffic Impact Assessments, has been prepared.

The findings presented in this TIA may be summarised as follows:

- The Public Access Road to the camp will need to be widened to a width of 8m as discussed in CopperString 2032 Traffic Impact Assessment Report – FSC
- The modelled intersections are expected to continue to operate well in the peak operational phase of the camp with minimal queues and delays experienced on all approaches
- The LOS for the Public Access Road to the camp is expected to remain at free flow conditions (i.e. LOS A) during the peak operational phase
- The increased pedestrian and vehicular traffic movements generated by the proposed camp hub is not expected to increase the frequency or severity of crashes in the vicinity of the camp hub
- A swept path assessment shows that the site accesses can accommodate the 26m B-double truck including at locations where there are opposing vehicles passing one another along the site access
- The sight distances at the camp hub access to vehicles travelling in both directions the requirements of the Australian Standard
- As a BAR and BAL turn lane is proposed to be installed along Public Access Road at the camp hub access, the site access will comply with relevant guidelines
- There is sufficient storage capacity space to accommodate queuing of both light vehicles and heavy vehicles at both the wash bay and refuelling facility; and
- The car parking provision exceeds the car parking requirements specified within the Shire of Flinders Planning Scheme 2017 and is anticipated to be sufficient to more than sufficiently accommodate parking demand generated by the site.

The following upgrades are required on the adjacent road network to ensure safe and efficient operation of the camp hub:

- Widen the Public Access Road to the camp hub to 8m as discussed in the CopperString 2032 Traffic Impact Assessment Report – FSC; and
- Provide a BAR and BAL turn lane along the Public Access Road at the site access.

For detailed information, please refer to the Hughenden Camp Hub TIA (CU2-HU00-REP-PAS-100-0001).

A JV draft Traffic Management Plan will be prepared by a suitably qualified person as part of the submission of the project's CEMP through detailed design to address design elements and mitigation measures for traffic generation impacts associated with the project.

12. Water and Wastewater

12.1 Planned requirements

The overall volumes for water and wastewater anticipated at Hughenden Camp site are shown below:

Table 14: Water and Wastewater volumes

Camp	population	water supply (kL/day)	WW volume (kL/day)
Hughenden camp	410	168	141

These requirements are taken from the following assumptions.

Water use by personnel:

- Full occupancy of on-site accommodation
- Usage of 300L per person/day (twice that nominally allowed for in domestic usage per AS1547)
- Additional allowance for a transient population (drivers, designers, engineers, maintenance crew etc) equivalent to 50% of the full occupancy numbers
- Usage of 90L per person/day for transient staff (twice the office usage in AS1547); and
- All water from personnel usage to be combined in one single wastewater treatment system.

Water for dust suppression:

- Currently assessed at 20kL per day.

Water for truck washing:

- Vehicle numbers are taken from the Accommodation Management Plan provided by the JV
- 30% of vehicles are anticipated to require a wash when passing through the site
- Vehicles are envisaged to undergo 2 stages of wash; first being automated deluge wash primarily focussed on wheels and undersides and the second being a manual high-pressure wash (if required further to the first stage of wash)
- Water consumption for each stage of wash is based as follows:
    - Deluge Wash: A standard 3.4-meter-wide system with ramp length of 4 meters. Total pumped capacity of 1000 LPM approximately with an average wash time of 20 seconds per vehicle
    - Manual Wash: Total pumped capacity of 7.5 LPM with an average wash time of 5 minutes
- The deluge wash system is equipped with a reservoir to supply for the wash cycles; and
- It is assumed that majority of the pumped water will flow back to the reservoir resulting in very low water consumption per wash which has been estimated to be 125 litres per wash.

12.2 Water supply

Supply for the site is to be from three possible sources:

- Municipal supply if available
- Bore water from either nearby bores (trucked in) or an on-site bore (new); and
- Recycled water from on-site uses treated to class A and used for dust suppression.

The table below presents the water supply sources identified for Hughenden Camp and summaries of discussions with Councils regarding infrastructure is shown in Section 4 of this report:

Table 15: Water supply sources

Site	Municipal	Bore	Recycle
Hughenden camp	Council discussions indicate acceptable connections are available. Balance tank is provided on site.	Site design allows for bore and water treatment plant to meet drinking water quality	Site design allows for holding tank following tertiary treatment of wastewater

Details can be found in the water and wastewater plan drawing in document CU2-HU00-DRG-PAS-100-0900.

12.2.1 Treatment details

Municipal

Municipal supplies are potable water, no further treatment is required. A balance tank is provided to smooth demand on the council systems. Pressure pumps provide site reticulation from the balance tank. For any concerns over water taste/odour by the workforce, additional treatment may be undertaken by the JV at its discretion.

Bore

The use of groundwater has been investigated for two purposes:

1. Drinking water. This option has been assessed for the purpose of maintaining independence from local council water mains and will require its own treatment facilities

2. Construction water (raw), including dust suppression. This option also assists in minimising the demand on local council water mains. It is noted however that construction water will be from various sources along the easement in addition to camp hub to facilitate timely water supply during the schedule of works.

Drinking water treatment

Groundwater from a bore is expected to require treatment to meet water quality requirements as specified in Australian Water Drinking Guidelines 6 (ADWG):2011.

The most common method of post-extraction treatment of groundwater is reverse osmosis (RO), media filtration and chemical dosing. This is a conservative assumption and groundwater may require simpler treatment – pending groundwater testing. Any water treatment that exceeds threshold of 10ML per day will be licenced accordingly. All brine wastes will be stored in tanks for disposal.

Reverse Osmosis is a process that achieves this separation of dissolved salts and impurities from a water solution by means of pressure exerted on a semi-permeable membrane. The passage of dissolved materials through the membrane is resisted, but the chemical structure of the membrane material itself allows pure water to permeate through relatively easily. The salts and other impurities that build up on the feed side of the membrane are continuously flushed away as a concentrated solution (i.e. brine or reject), while the purified water (the permeate) is drawn off for use, as shown in **Figure 3** below.

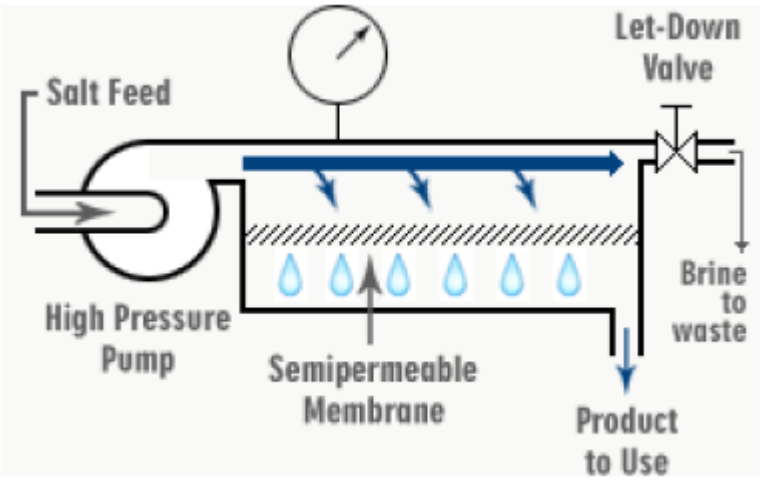

Figure 3: Sketch of reverse osmosis

Media filtration is the physical process of removing suspended solids by passage of water through a porous fine media bed of well graded sand/glass/Turbidex. The filtration process results in a gradual accumulation of entrapped solids within the granular media, which requires intermittent removal by means of a backwash cycle which is achieved by reversing the flow of water through the filter bed to remove suspended solids that are trapped within the bed.

It is common for these RO plants to be supplied in modular sea containers. A 100kL per day module has been allowed for in this design (footprint approx. 30m by 30m). Figure 4 below shows some examples of modular RO plants that are installed inside transport-ready sea containers.

Figure 4: Examples of modular RO plants

Brine reject water from RO plant

It is assumed that any brine produced as a reject stream from the RO plant (in the absence of any site testing details) will be diluted to be suitable for either construction water or stored in a tank for disposal offsite.

Construction water

The bore water may also be used for construction operations, including dust suppression via water carts. In this case, vehicles and water carts will be fed from a single raw water tank with a dedicated standpipe and pump. To save on treatment costs, the groundwater for construction water may not be treated depending on the quality. The JV is separately undertaking a construction water assessment.

Infrastructure Requirements

The minimum major infrastructure required for this groundwater bore, treatment, and storage facility listed below have been designed for in this initial assessment:

- One (1) DN100 bore with PVC casing and submersible bore pump (3 L/s, 300 kPa)
  - Three (3) raw water tanks; 50 kL HDPE tanks (4.6m dia., 3.2m high):
  - Two (2) for RO plant raw water feed
- One (1) for dust suppression standpipe feed
- One (1) 100 kL/day RO plant with chlorine dosing module, including air-conditioning and switchboard
- Two (2) treated water tanks; 50 kL HDPE tanks (4.6m dia., 3.2m high)
- One (1) potable water pump with accumulator; (5 L/s, 300 kPa) for camp utilities
- One (1) standpipe & standpipe pump; (50 L/s, 200 kPa) for water cart filling; and
- Approximately 100 metres of small bore HDPE piping (<DN100) and associated valves and fittings.

Refer to water and wastewater drawings in Document CU2-HU00-DRG-PAS-100-0900 for approximate layout details:

- CU2-HU00-DRG-PAS-100-0012 (Hughenden).

Development Approval & Building Requirements

The Table below summarises the regulations required to construct and operate a groundwater bore as defined by the Department of Regional Development, Manufacturing and Water, Queensland.

Table 16: Groundwater requirements per camp

Camp	Water Plan Area (Water Act 2000)	Development Approval Requirements	Requirements to build & operate
Hughenden camp	Water Plan (Gulf) 2007 Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017	Development Approval (Planning Act 2016) is required for all new sub-artesian and artesian bores	Must be constructed by a suitably licensed bore driller to supervise or carry out the activity and all bores must comply with the QLD standards: https://www.business.qld.gov.au/industries/mining-energy-water/water/bores-and-groundwater/construction-standards Prior to the construction of a bore, access to land and permission to construct the bore must be obtained from the relevant landowners. The testing of all proposed groundwater supplies is recommended to determine the suitability of the water for the purposes of domestic use.

Recycled Water

Recycled water will supplement non-potable water consumption in the camp. Two streams of recycled water have been identified as follows:

1. Recycled water from sewage treatment plant treated to class A+ (only relevant for camps requiring on-site wastewater treatment and disposal); and
2. Recycled water from process (e.g. vehicle wash, contaminated stormwater etc).

The treatment system for each of the streams is described in the following sections.

12.3 Wastewater

Wastewater treatment/disposal for the site is to be achieved in two possible manners:

- Municipal connection if available
- Tertiary treatment on-site
    - On-site disposal to an irrigation field
    - Use directly for dust suppression; and/or
    - Dual reticulation to supply laundries, motor vehicle workshop and washdown bay.

Wastewater treatment and disposal options for Hughenden Camp has been identified in the table below.

Table 17: Wastewater options

Site	Municipal	On site disposal	Recycle
Hughenden camp	Council discussions indicate acceptable connections points are available (and preferred over on-site disposal). Requires an extension of the council system to be negotiated.	Site design allows for a wastewater treatment plant and irrigation area sized according to anticipated local soil conditions.	Site design allows for holding tank following tertiary treatment for reuse opportunities (with standpipe or connected to internal plumbing).

Details can be found in the plan drawings. The on-site irrigation option has been sized based on the full load of anticipated wastewater (not relying on recycling), the anticipated site conditions, and may be affected by actual site soil mapping when this is conducted.

Wet weather storage of 800kL is provided as a small dam at the entrance to the disposal field. The irrigation site has monthly evaporation which significantly exceeds rainfall, however Queensland Technical Guidelines require provision of 3-4 days of storage for brief wet weather periods. The provided 800kL wet weather storage allows just over 5 days' storage for Hughenden site. At a minimum this allows for 4 days storage plus 4 days direct rain on the dam at the highest daily rainfall recorded in the region.

12.3.1 Treatment details

Municipal

If municipal disposal is to an established treatment plant, then no further treatment is required. A balance tank can be provided to smooth demand on the council systems, depending on the limitations of each individual site connection and each council's treatment facility limitations, particularly during peak uses.

Recycled

As mentioned in the preceding section, two major wastewater streams have been identified as follows.

1. Advanced Wastewater Treatment System (AWTS) - Tertiary treatment for all sewage (grey and blackwater) generated in the camps to class A+; and

2. Process Wastewater Treatment System - Settling pond for process wastewater with neutralization, flocculation and filtration as required. The settling pond is an in ground fenced but accessible tank (for removing solids) installed at slightly below ground level. Calculations indicate a footprint of approximately 6x3m subject to detailed design.

The following are sources of non-treated construction water noted in the site waste management plan (WMP) and the management process associated with the source:

- Onsite
  - Stormwater management - for treatment see stormwater management plan.
  - Vehicle washdown – will be treated using solids settlement and reuse of water.
- Offsite (not reporting to camps)
  - Drilling fluids – Treat offsite and dispose (per WMP)
  - Slurry from non-destructive drilling (contaminated) - Treat offsite and dispose (per WMP); and
  - Dewatering excavations/other - Treat offsite and dispose (per WMP).

Other on-site water treatment of note includes the provision of a fat, oil and grease (FOG) separator on the washdown bay outlet and/or any on site vehicle workshops. This is prior to recycle and settlement of solids. These are relatively small devices which do not appear separately on the site plans as they are normally incorporated within the wash equipment scope, but they will create a small amount of the captured FOG that will be removed by a commercial waste (local vacuum truck) company as per the WMP.

Advanced Wastewater Treatment System (AWTS) for sewage

Should an on-site sewage treatment be required for Hughenden Camp, the following technology is recommended. The following table summarizes the quantity of sewage generated at the camp based on equivalent population and design hydraulic flowrates.

Table 18: Sewage estimates

Camp	Equivalent Population (EP)	Design hydraulic flow rates (L/person.day)	Sewage generation kL/day	Organic material loading design rates (g BOD/person.day)	Total Biological Oxygen Demand (BOD) (kg BOD/day)
HUGHENDEN	472	300	142.00	60	28.32

The equivalent population (EP) accounts for total residents of the camp and daytime transient (50% of the total residents) applied to a relevance factor of 0.3.

The expected wastewater parameters are summarised in the table below.

Table 19: Expected Wastewater Parameter

Parameter	Typical Influent Characteristics	Expected Regulatory Effluent Limits	Design Effluent Target Class A(+) Standards
Biological Oxygen Demand, BOD5	<350 mg/L	20 mg/L	<10 mg/L
Total Suspended Solids, TSS	<450 mg/L	30 mg/L	<10 mg/L
Total Nitrogen, TN	<80 mg/L		<10 mg/L
Total Phosphorous, TP	<20 mg/L		<3 mg/L
E. Coli		1000cfu / 100mL	< 1 cfu / 100mL

The treatment system is required to treat the sewage to Class A+ effluent.

Owing to the temporary nature of the installation, a modular containerized system is recommended. Membrane Biological Reactor (MBR) has been proposed as the most suitable technology based on the high quality of effluent water and low footprint requirements. The basic MBR system will include following processes:

1. Primary screening
2. Secondary treatment involving anoxic and aerobic treatment
3. Tertiary treatment involving flat sheet membrane filtration with air scouring and CIP system; and
4. Effluent disinfection involving UV sterilization or Chlorine dosing.

The following process flow diagram shows a standard MBR system and its components.

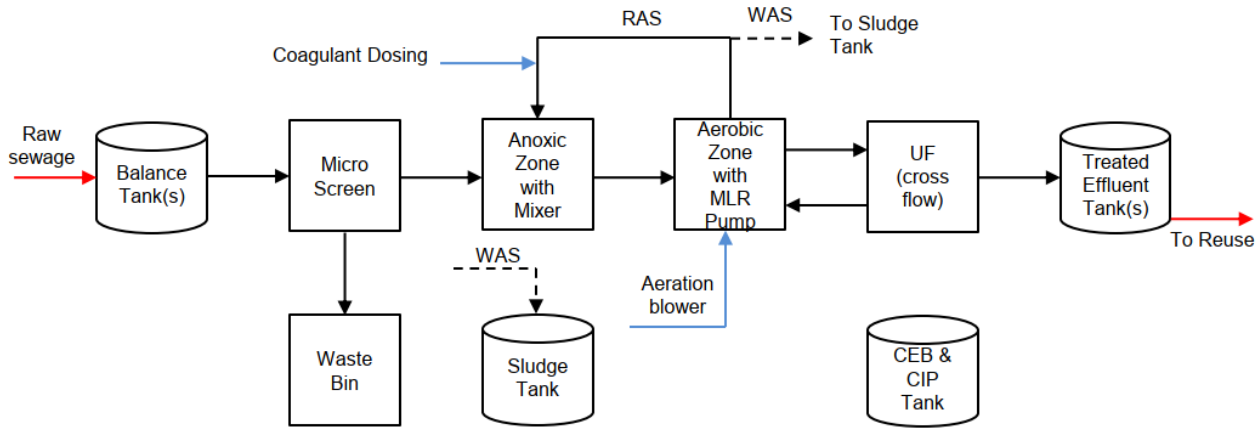

Figure 5: Process flow diagram for MBR system

Raw sewage from different locations within the camp will be fed to the balancing/equalization tank which allows for controlled flow for subsequent treatment. The sewage is pumped to anoxic zone via a mechanical screening unit where coarse particles are separated from the remaining treatment processes. The anoxic zone, where nitrogen removal takes place, will be equipped with a mixing pump (or a stirrer) to maintain the homogeneity of the sewage. An influent feed pump will discharge the influent to the aerobic treatment chamber at required rate. The aerobic zone will be aerated with the help of a submersible aerator or a blower. Depending upon the level of nitrogen removal, a mixed liquor recirculation

(MLR) pump will pump the influent back to the anoxic zone to undergo further anoxic reaction. The sedimented activated sludge will be pumped to the previous processes as required or to a sludge tank for disposal off-site. After aerobic treatment, the sewage will pass through cross flow ultrafiltration MBR unit to remove bio-solids. The treated effluent will undergo disinfection (UV or Chlorine dosing) and collected in a treated effluent tank for reuse or land application.

The activated sludge might have beneficial reuse if trucked and spread as fertilizer. Or the collected sludge can be collected in a regular manner and disposed of at the municipal disposal site. The coarse solid waste collected from the mechanical screening needs to be disposed off-site at regular intervals (note the site will have potential macerators that will limit the need for screening).

Based upon the total sewage generation, the required size of the AWTS and land application area (LAA) have been estimated as shown in the following table. Early stakeholder consultation has indicated that there's a possibility to connect the sewer from the camp to the municipal sewer line, which is preferred disposal option. However, estimated sizes of AWTS and LAA are included in the following table as a precautionary approach to sewage treatment.

Land application area is based on AS1547:2012 application rates for Category 4 or 5 soils, This is a conservative estimate of the soil type expected from a mix of soil types taken from the Queensland Globe database for nearby soil sites in the absence of actual site soil typing. The area is calculated for either spray irrigation or surface drip irrigation. Spray irrigation can be used to minimise ground disturbance. Drip irrigation to minimise any risk of aerosol formation although it may additionally require a covering of 150mm mulch in the absence of persistent sterilisation.

The current design allows for chlorination which is a persistent form of sterilisation and adequate for either form of irrigation – to be chosen in detailed design phase.

Exact soil typing across the site can be variable. If for any site-specific reason the irrigation option is not feasible then, due to the dominance of evaporation over rainfall in the region, the same land area can accommodate an adequate evapotranspiration bed with appropriate grassland plantings.

The irrigation area will require signage, will be non-trafficable, and will need offsets to buildings, boundaries and waterways and these are included in the drawings as per the requirements of AS1547:2012.

Table 20: Land Application Areas

CAMP	Sewage generation kL/day	AWTS capacity kL/day	AWTS Footprint (L x W) m x m	Approximate Required land application area m^2
HUGHENDEN	141	160	20x25	47,200 (if required)

It should be noted that if recycled the effluent will have different end uses (vehicle washdown, dust suppression etc) which reduces the effluent flowing to LAA. The provided LAA is therefore considered conservative.

Treatment System for Process Wastewater

Process wastewater generated onsite in the camp has been identified to originate from the following sources:

- Agitator washout
- Truck washing/slump stand
- Yard washdown; and
- Contaminated stormwater.

Contaminated stormwater is dealt with under the WMP.

All these wastewaters generated in the camp will be channelled to an on-site settling tank or pond. The settling tank or pond should be lined with impervious material. The settled water can be used directly in dust suppression or yard washdown.

The settled solids are inorganic in nature and hence inert, they will be removed in a slurry form, pumped out of the tank or pond and trucked to a licensed disposal site.

Process wastewater is expected to be reused. The majority of this water is generated by the activities of agitator washout, vehicle washdown and stormwater. Stormwater will be dealt with as per the section on Civil design. Wastewater from agitator washout will have high pH and TSS, however, it's production will be very insignificant when there are lesser activities of concrete trucks. Any remaining light vehicle washdown during these periods is expected to be very small, will not have the high pH, and will be of similar nature to stormwater runoff from carparks. It will join the civil stormwater stream.

Correspondingly we are not expecting and have not allowed for alternative disposal of high pH process wastewater that would need to be treated prior to joining the stormwater runoff into the stormwater drain. For this it would require neutralization, flocculation, and filtration to bring down the pH value to 6.5-8.5 and TSS to below 50mg/L.

13. Waste

13.1 Planning Considerations

A Waste and Refuse Disposal Management Plan (WRFDMP) was developed for the EIS in 2022 and includes detailed waste camp assessment and controls.

Within the camp hub a designated waste storage area has been included in the design. These waste storage areas have been designed with best practice waste management in mind and with consideration to relevant local planning schemes. Features of the design include:

- Impervious flooring and bunding in case of loss of containment
- Appropriate screening to mitigate visual amenity impacts
- Categorised waste disposal containers
- Appropriately buffered from road frontages and sensitive land uses; and
- Accessibility for efficient waste collection.

13.2 Operation

Table 21outlines the estimated operational waste expected from each site.

Table 21: Operational waste

Waste Stream	Waste Category	Estimated Quantity	Waste Hierarchy	End Use	Assumptions
Hughenden (410 pax)					
Putrescible / general waste	Non-regulated waste	1,025,000 kg	Dispose	Landfill	- 5 kg/personnel/day - based on 10/4 roster (250 days) - peak for 2 years
Comingled recycling	Non-regulated waste	512,500 kg	Recycle	Recycling - Townsville facility.	2.5 kg/personnel/day (50% of general waste estimate based on 1/3 recyclable)
Cardboard	Non-	2,496 m^3	Recycle	- Bailed	- 4 x 3 m^3 skips

Waste Stream	Waste Category	Estimated Quantity	Waste Hierarchy	End Use	Assumptions
	regulated waste			- End use as per waste service provider recycling contract"	- twice weekly collection
Timber Pallets	Non-regulated waste	2,080 pallets	Dispose	- Landfill - Return to Supplier if possible - Auction/Beneficial reuse	- 20 pallets - twice weekly delivery
Grease	Regulated waste	93,600 kg	Recycle	Composting	- 150 kg grease trap/camp/week

A Waste Management Plan (WMP) has been developed by the JV in August 2023 to effectively manage predicted waste streams resulting from the Project. The WMP adopts the waste and resource management hierarchy underpinning the State's waste management strategy: 'Waste Management and Resource Recovery Strategy for Queensland' (the Strategy). The waste hierarchy focuses on waste reduction and recycling as more preferable to waste disposal.

The initial waste assessment undertaken for the WMP determined that waste facilities at Townsville and Mt Isa provide higher order waste hierarchal solutions. Therefore, waste generated at each location of the Project would be diverted to the closest facility at Townsville or Mt Isa, including reliance on the operation of the Material Recovery Facility (MRF) at Mt Isa to divert/stay recyclable waste in the west, as well as, diverting waste to the east in Townsville.

Details of the full implementation approach can be found in the WMP.

14. Electrical and Lighting

14.1 General

14.1.1 Electrical Services

Where practical UGL CPB JV has advised that their preference is to connect the camp to an Ergon Energy supply rather than operate the camp from diesel generators. To this extent a desktop survey was undertaken and enquires lodged with Ergon Energy to discuss the feasibility of providing a new point of supply for the camp. An early engagement meeting was held with Ergon Energy Networks Connection team members on 16/08/2023, minutes of which are provided in document number CU2-HU00-REP-PAS-100-0005**.** Early advice is that a power supply will be able to be established at the site. Details of the connection capability for the site is outlined below. A summary of the expected supply availability and maximum demand estimate is also provided in CU2-HU00-REP-PAS-100-0005.

If a power supply is unable to be provided in full or in part, the camp will operate using a series of generators. As part of developing the camp layout, a preliminary maximum demand estimate for a 256-person campsite was sourced from a typical Camp Supplier. The estimate advised that three (3) x generator skids, each with three (3) x 125kVA generators are required, refer CU2-HU00-REP-PAS-100-0005. The electrical load (or demand) is expected to be split evenly to ensure duty and standby generator operation and redundancy of the supply. This should mean that only two (2) of three (3) generators per skid will be in-use at any one time. Based on the Camp Supplier information, three (3) x generator skids have been included on the preliminary camp layout. However, it is likely that if a mains supply can be provided by Ergon, that only one (1) generator skid will be installed as a back-up power supply for the kitchen (refrigerators), dining and common areas of the camp. The final configuration and generator requirements will be confirmed during detailed design.

It is anticipated that a main switchboard will be installed near the incoming supply from Ergon Energy, with supplies to each group of accommodation blocks and building units to be provided from centrally located distribution boards. It is expected that the supplies to the accommodation units and common buildings will be installed via a combination of underground and overhead (insulated aerial bundled cables), as required.

14.1.2 Maximum Demand Estimate

As outlined above a preliminary maximum demand estimate for a 256-person campsite was sourced from a typical Camp Supplier. The estimate advised that the maximum demand for a typical camp of this size is approximately 1,056 Amps, which is equivalent to a main supply transformer of 750kVA.

To assess this estimate against the known requirements of the camp, a further preliminary maximum demand estimate has been developed. The estimate developed is based on the Energy Demand Method for Non-Domestic Installations, using the average VA/m^2 energy demand outlined in Table C3 of AS/NZS 3000 (refer Figure 6 below). This method allows for an estimate based on building use (type of occupancy) and area.

TABLE C3
MAXIMUM DEMAND—ENERGY DEMAND METHOD FOR NON-DOMESTIC INSTALLATIONS

Type of occupancy		Energy demand	
		Range, VA/m²	Average, VA/m²
Offices	Light and power	40–60	50
	Airconditioning:		
	— Cooling	30–40	35
	— Reverse cycle	20–30	25
	— Zonal reheat	40–60	50
	— Variable volume	20	20
* Carparks	Open air	0–10	5
	EV charging	5–15	10
	Basement	10–20	15
	EV charging	10–30	20
Retail shops	Light and power	40–100	70
	Airconditioning	20–40	30
Warehouses	Light and power	5–15	10
	Ventilation	5	5
	Special equipment	(use load details)	
Light industrial	Light and power	10–20	15
	Ventilation	10–20	15
	Airconditioning	30–50	40
	Special equipment	(use load details)	
Taverns, licensed clubs	Total	60–100	80
Theatres	Total	80–120	100

NOTE: EV charging relates to charging equipment associated with electric vehicles and should be considered in addition to all other energy demands.

Figure 6: Energy Demand (extract from AS/NZS 3000:2018)

The maximum demand estimate calculations are provided in document CU2-HU00-REP-PAS-100-0005 , with a summary provided in Table 22 below:

Table 22: Camp Electrical Demand (Estimate)

Camp	Hughenden
Site No.	4
Personnel (max)	410
Maximum Demand (Amps - Supplier estimate)	1,600
Estimated Transformer size (kVA)	1,000
Maximum Demand (Camps - VA/m^2)	786
Maximum Demand (Ancillaries - VA/m^2)	125
Sub-total (using VA/m^2)	**912**
Total inc. 20% Contingency	1,094
Estimated Transformer size (kVA)	1,000
Ergon Energy Estimate (2kVA per person) (3)	820
Maximum Demand Equivalent (Amps)	1,184
Estimated Transformer size (kVA)	1,000

The calculated estimate for the Hughenden camp supports the preliminary Camp Supplier information received. The estimate also includes a provision for the Ancillary plant and equipment associated with the camp, which includes the,

Water Treatment plant, workshops and car-park lighting. A conservative approach has been used with a 20% contingency (margin) applied to the calculations to allow for design variations and changes as the requirements for the camp are finalised.

In early discussions with Ergon Energy, it is their advice, based on experience with other camp installations, is that the maximum demand is likely to equate to approximately 2kVA per person. This is substantially less than the preliminary Camp Supplier and the calculated maximum demand estimate. It is thought that the Ergon Energy estimate may not include an allowance for the ancillary plant and equipment associated with the camp. It is expected that Ergon Energy will review the supply requirements and provide further advice regarding this as the design progresses. Further information on the site and early engagement with Ergon Energy is provided below.

14.1.3 Applicable Electrical Standards

The following electrical standards have been considered, in the development of the preliminary design of the camps:

Table 23: Applicable Electrical Standards.

Document	Revision
AS/NZS 3000 Electrical Installations – Wiring Rules	2018
AS/NZS 3000 Electrical Installations – Generating Sets	2017
AS/NZS 1158.3.1 Lighting for roads and public spaces (Category P)	2020
AS/NZS 4282 Control of the obtrusive effects of outdoor lighting	2019
Queensland Electricity Connection Manual (QECM)	16 Jul 2020
Queensland Electricity Metering Manual (QEMM)	12 Aug 2020

14.2 Lighting Design

14.2.1 Street Lighting

Given that the construction camp is to be temporary, an assessment of the existing street lighting has not been undertaken. It is expected that night-time vehicle movements would be considered ‘low’ and that there will be limited (or ‘low’) mix of vehicle and pedestrian activity in the street adjoining the camp. It is therefore considered that ‘residential’ level street lighting will be adequate. It is expected that the lighting of the camp car park and accommodation area will contribute to the level of lighting available on adjoining roads and access ways.

14.2.2 Car-park Lighting

It is anticipated that lighting for the car park at each of the camps be provided to ensure safe vehicle and pedestrian movement and for site security. It is recommended that the lighting for the car parks be designed in accordance with AS/NZS 1158.3.1 sub-category PC3. The selection of sub-category PC3 is based on an assessment of a “Low” mix of night time vehicle and/or pedestrian movements and a “Low” perceived fear of crime. The requirements of the sub-category PC3 are summarized in the table below:

Table 24: AS/NZS 1158.3.1 Sub-category PC3 light technical parameters.

Lighting Subcategory	Average Horizontal Illuminance ($\bar{E}_h$)	Point Horizontal Illuminance (E_{Ph})	Illuminance (horizontal) uniformity (U_{E2})	Point Vertical Illuminance (E_{Pv})
PC3	3.5 lux	0.7 lux	8	N/A

Based on the proposed arrangement for the car park, it expected that up to eight (8) light poles will be required at each site to meet the requirements of sub-category PC3. This estimate is based on the use of 6m light poles, with 72W luminaires (light fittings), at an estimated spacing of 30 to 35m. It is expected that the light poles will be able to be accommodated within the traffic islands used to delineate the car-parking spaces from other trafficable areas of the site.

14.2.3 Camp Lighting

The general area lighting within the construction camp is expected to be provided from lighting mounted to each of the portable accommodation buildings and common room areas. Supplementary lighting is expected where required for walkways and common spaces within the camp. The general lighting shall be in accordance with the minimum requirements of the applicable standards to minimise the risk of slips, trips and falls, and to provide a comfortable level of security within the camp.

14.2.4 Obtrusive / Spill lighting assessment

An assessment of the potential for the spillage of light from the new lighting onto the adjacent properties in accordance with AS/NZS 4282 is expected to be carried out during detailed design. The assessment shall be undertaken using appropriate lighting design software, such as Lighting Analysts Agi-32, to calculate the obtrusive effects of the new lighting at the adjacent property boundaries. With reference to AS/NZS 4282 Table 3.1 it is expected that the applicable environmental zone for the camp would be considered as “A2”, or Low district brightness. Examples of A2 environmental zones include sparsely inhabited rural and semi-rural areas. With reference to AS/NZS 4282 Table 3.2, the maximum value for the vertical illuminance (lighting) level for curfew hours (night-time) is 1-lux.

Light spillage can be further assessed at the detailed design stage. It is expected that any spill lighting from the camp and carpark will be minimal that that it will be below the levels considered to be obtrusive. Further assessment can be carried out during detailed design to manage the balance of lighting requirements for the site and impacts on adjacent properties.

14.3 Supply Considerations

A desktop assessment of the site indicates that a power supply is likely to be available from an existing 33kV power line to the west of the site. It is proposed that a new connection point is established where the supply meets the northern access road off Flinders Highway. It is expected that the supply may be provided by extending this line to the other side of the access road to provide a new connection point at the proposed construction camp property boundary.

The maximum demand for the site has been estimated at 912kVA or 1094kVA, including a 20% contingency margin. Typically, a 1,000kVA pad mounted (or kiosk style) transformer would be provided to meet this demand. However, Ergon have advised that the transmission network in the Hughenden area is 33kV and that kiosk style sub-stations at this voltage are not available. Therefore, it is understood that two (2) x 500kVA pole mounted transformers will need to be installed to meet the required demand of the camp. Further information on the Ergon Energy requirements to install two transformers at this location are to be advised during detailed design.

It is noted that there is an existing 33kV high voltage transmission line on the site, which runs North-South along the western property boundary. An easement has been deemed to exist either side of the transmission line and as such, the camp hub layout has been designed to avoid this line and an associated stay wire support, that exists where the line changes direction.

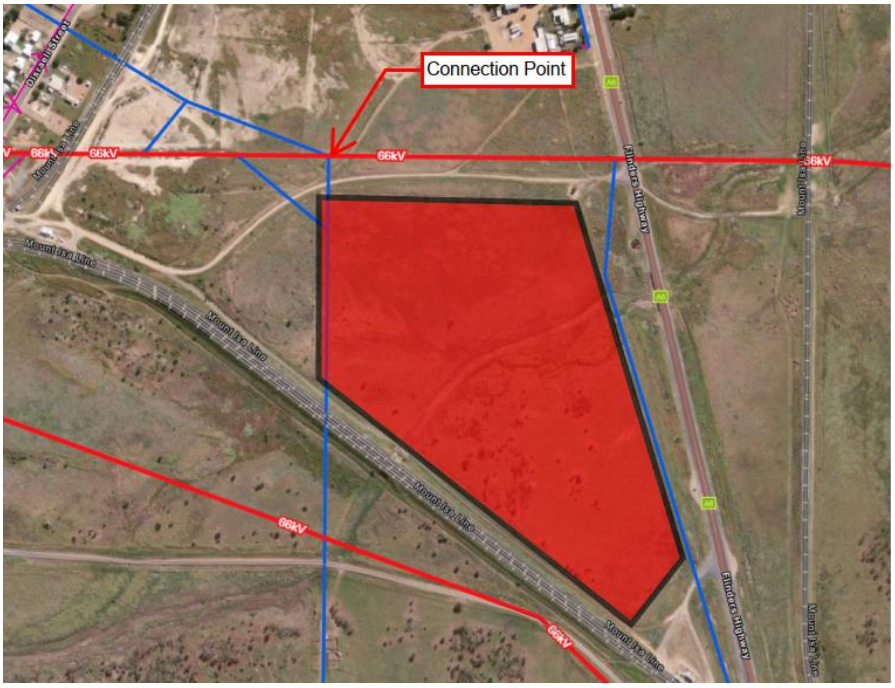

Figure 7: Hughenden Area Map - Ergon Energy

15. Conclusion

The purpose of this report is to document the design inputs, methodologies and outputs created in support of the CopperString 2032 Hughenden Camp Hub planning application and consultation processes.

The report may be referred to or parts of it may be extracted to be used to support approvals submissions and the contents may also be used to inform broader management plans associated with the CopperString 2032 Project.

The reporting has involved the following:

- Review of the relevant Council town planning scheme and an assessment of the project's response to it
- Consultation with council and Ergon Energy regarding their infrastructure capabilities and/or deficiencies
- Review of infrastructure requirements for:
    - Camp hub site layout
    - Water and wastewater
    - Environment and heritage
    - Ecology
    - Air and Noise
    - Visual amenity
    - Waste
    - Traffic and Transport
    - Civil and stormwater drainage
    - Lighting and electrical; and
    - Architecture and buildings.

The outcome is that based on the information available, the proposed Hughenden Camp Hub can feasibly be implemented as planned. Further details can and are expected to be worked on during a thorough detailed design stage, to be completed by the JV, where any local or state approval authority outcome development conditions and further detailed site investigation outcomes (e.g., geotechnical studies) can be considered.

Important information about your report

In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. The Report may only be used and relied on by the Client for the purpose set out in the Report. Any use which a third party makes of this document, or any reliance on or decisions to be made based on it, is the responsibility of the Client or such third parties.

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CopperString 2032 Early Works Package

Hughenden Camp Hub Planning Design Support

Client reference: CU2-HU00-REP-PAS-100-0002