APPENDIX

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DUNGOWAN DAM AND PIPELINE EIS

Visual Impact Assessment

NSW GOVERNMENT | EMM creating opportunities

Dungowan Dam and pipeline project

Visual Impact Assessment

Prepared for Water Infrastructure NSW

September 2022

Dungowan Dam and pipeline project

Visual Impact Assessment

Water Infrastructure NSW

J200042 DUN-EMM-EN-RPT-0021

September 2022

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Executive Summary

The Dungowan Dam and pipeline project is classified as Critical State Significant Infrastructure (CSSI) under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As CSSI, the project is subject to Division 5.2 of the EP&A Act, which requires the preparation of an environmental impact statement (EIS) and the approval of the NSW Minister for Planning. The EIS has been prepared for the planning approval application for the project.

The Visual Impact Assessment has been prepared to support the EIS. The assessment has been prepared with reference to the *Guidelines for Landscape and Visual Impact Assessment* (3rd edition), prepared by the UK Landscape Institute and the Institute of Environmental Management and Assessment (2013). Key sensitive receptors were identified through consideration of the project's social context, landscape context and heritage items, a modelled area of theoretical visibility, and site appreciation and photography.

This Visual Impact Assessment has assessed the visual impacts to the key sensitive receptors and concluded that the project would have moderate–low, low and negligible impacts on nearby receptors. The main visual impacts of the project are associated with the (temporary) construction of the pipeline, road upgrades and the permanent installation of powerlines and their impacts on views from rural residences and minor roads. The dam infrastructure and reservoir would not be visible from any nearby residences and the main (transient) views would be from minor roads and forestry land.

Overall, the visual impacts of the project are considered acceptable and can be suitably managed with standard construction management measures. Some additional measures have been recommended to further minimise residual visual impacts of the project, which could be implemented during detailed design and construction.

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1 Introduction

1.1 The project

The Peel River, part of the Namoi River catchment, provides water for irrigation as well as being the primary water supply for the city of Tamworth. Prompted by the millennium drought, investigations into the future water supply and demand for bulk water were undertaken for the regional city of Tamworth and the Peel Valley water users. The Dungowan Dam and pipeline project (the project) is a critical project to improving long-term water security for the region. The project includes a new dam at Dungowan (new Dungowan Dam) approximately 3.5 km downstream of the existing Dungowan Dam and a new section of pipeline about 32km long between the proposed Dam outlet and the tie in point to an existing pipeline from Dungowan Showground to the Calala Water Treatment Plant (WTP).

In September 2022, the Minister for Planning and Homes declared the project to be Critical State Significant Infrastructure (CSSI) as it is a development that is essential for the State for economic and social reasons. This requires Schedule 5 of the *State Environmental Planning Policy (Planning Systems) 2021* to be updated to reflect the CSSI status of the project. As CSSI, the project is subject to Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), which requires the preparation of an environmental impact statement (EIS) and the approval of the NSW Minister for Planning and Homes.

The EIS has been prepared for the planning approval application for the project. This Visual Impact Assessment (VIA) has been prepared to support the EIS.

In addition to requiring approval from the NSW Minister for Planning and Homes, the project has been deemed a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and requires approval from the Commonwealth Minister for the Environment and Water. The Minister for the Environment and Water has accredited the NSW planning process for the assessment of the project. Therefore, a single EIS has been prepared to address the requirements set out by the NSW Department of Planning and Environment (DPE) and the Commonwealth Department of Climate Change, Energy, the Environment and Water.

1.2 Project location

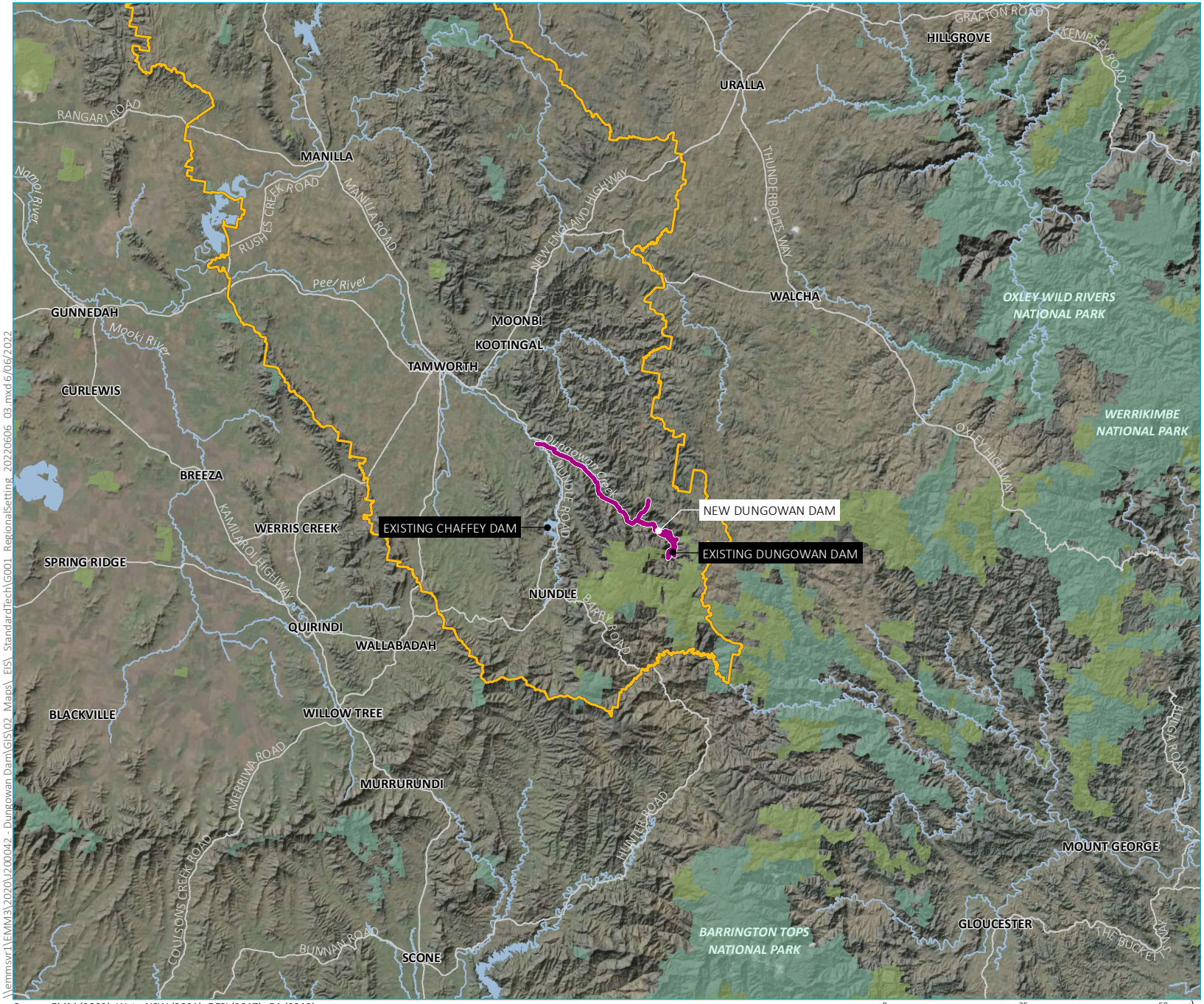
The project is located in the Tamworth Regional local government area (LGA), the New England Tablelands bioregion and part of the New England and North West region of NSW, west of the Great Dividing Range (DPE 2017). The New England and North West region is home to approximately 186,900 people and has a total area of around 99,100 km^2 (ABS 2018).

The city of Tamworth is the nearest (and largest) town to the project with over 40,000 residents. Other nearby regional towns include Quirindi (70 km west), Manilla (90 km north-west), Gloucester (90 km south-east), Armidale (100 km north) and Gunnedah (110 km west of the project).

The existing Dungowan Dam is in the Namoi River catchment approximately 50 km south-east of Tamworth in NSW. The Namoi catchment covers 4,700 km^2 and borders the Gwydir and Castlereagh catchments and is bounded by the Great Dividing Range in the east, the Liverpool Ranges and Warrumbungle Ranges in the south, and the Nandewar Ranges and Mount Kaputar to the north.

The existing Dungowan Dam is on Dungowan Creek, which is a tributary of the Peel River. Dungowan Creek is confined by the existing Dungowan Dam, while the Peel River system is regulated by Chaffey Dam, located in the upper catchment near the town of Woolomin, approximately 45 km from Tamworth.

The project's regional setting is shown in Figure 1.1.



\\emmsvr1\EMM3\2020\200042 - Dungowan Dam\GIS\02 Maps\ EIS\ StandardTech\G001 RegionalSetting 20220606 03.mxd 6/06/2022

Source: EMM (2022); WaterNSW (2021); DFSI (2017); GA (2013)

Regional setting

Dungowan Dam and pipeline project
Figure 1.1

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1.2.1 Project impact areas

In outlining the project, a project footprint has been defined to facilitate the assessment of direct impacts from the project:

- Project footprint: all areas where direct impacts may be experienced during construction and/or operation.

The project footprint has an area of 315 ha and is comprised of the construction and operational footprints, of which there is some overlap:

- Construction footprint: areas where vegetation clearing and/or ground disturbance is required for construction of the dam, pipeline and ancillary facilities, including the area needed to decommission and rehabilitate the existing dam.

- Operational footprint: areas where there will be permanent operational elements or easements, including infrastructure needed to operate the new Dungowan Dam and pipeline. The operation footprint includes the inundation area, being the area defined by the proposed full supply level (FSL) for the project.

The construction and operational footprints are shown in Figure 1.2. Additional areas outside the project footprint have also been considered where relevant to the assessment of project impacts and include:

- Upstream flood extent: An area above the FSL to the level of a probable maximum flood (PMF) event that would be inundated for relatively short periods during operation associated with extreme rainfall events.

- Project area: A 10 km buffer around the project footprint defined to allow for assessment of potential indirect impacts.

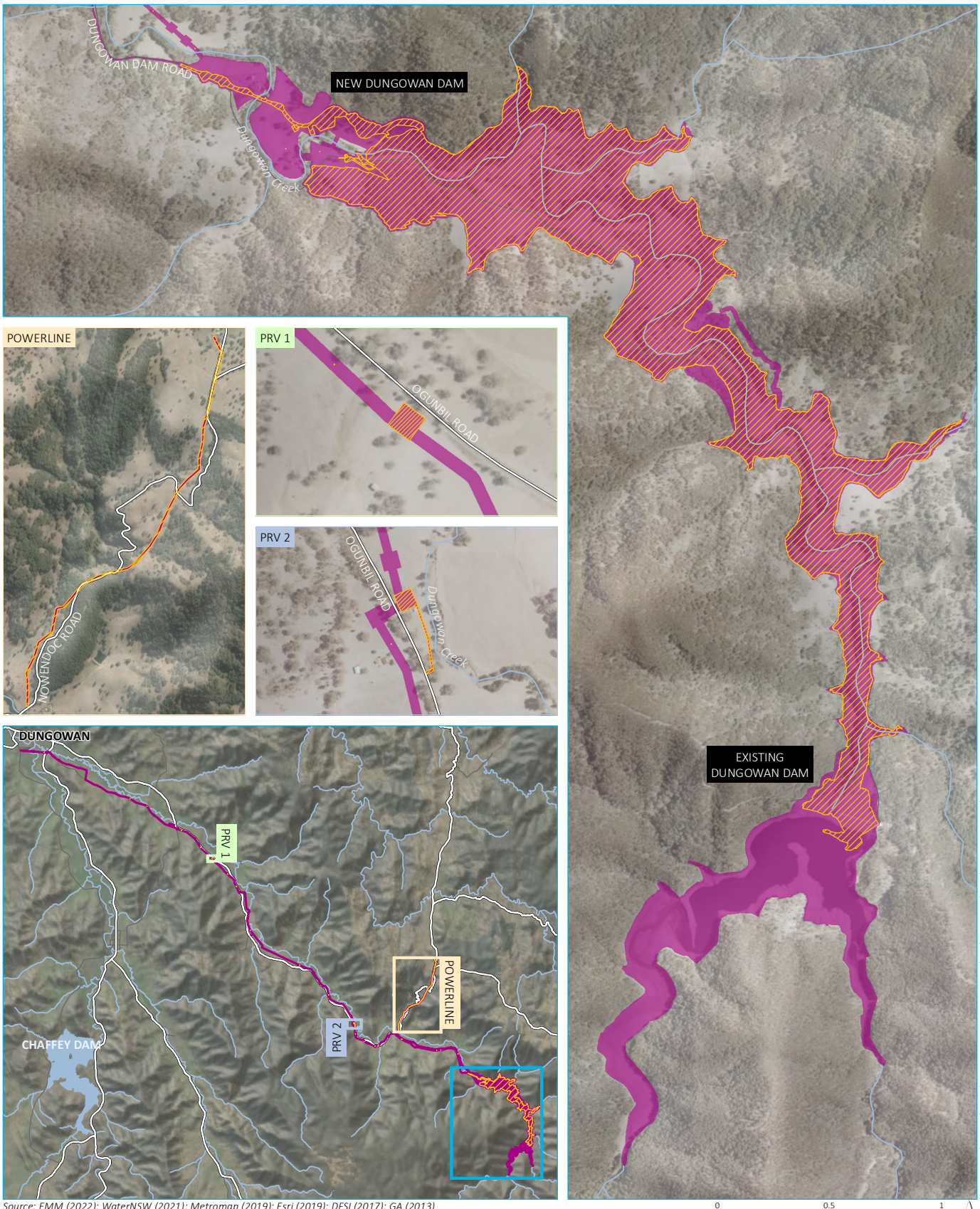
- Downstream impact area: the area where hydrological changes may occur due to the project. This area is discussed in detail in the Surface Water Assessment (EMM 2022a) as well as other technical reports subject to changed flow regimes as a result of the new Dungowan Dam operation. The downstream impact area includes Dungowan Creek and also the Peel River downstream of Chaffey Dam.

The project construction and operational footprints are shown in Figure 1.2.

1.2.2 Visual impact assessment study area

The study area for the VIA is generally encompassing of the project area however is informed by modelling an area of theoretical visibility. The area of theoretical visibility is based on the area within which significant effects of the project are likely to register with receptors.

It is noted that for a complex project such as this, with components that have vastly different visual reach (such as the dam and reservoir, and the pipeline and roads), one single area of theoretical visibility is impractical. This VIA therefore uses different areas of theoretical visibility for different project elements. The area of theoretical visibility for the project is discussed in detail and defined in Section 5.1 of this report.



Source: EMM (2022); WaterNSW (2021); Metromap (2019); Esri (2019); DFSI (2017); GA (2013)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Construction footprint
- Operational footprint

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody

Project footprint

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Dungowan Dam and pipeline project

Figure 1.2

EMM creating opportunities

1.3 Purpose of this report

This Visual Impact Assessment supports the EIS for the project. It documents:

- the existing environment surrounding of the study area;
- the social values attached to the landscape;
- the visual effect of the project;
- the visual sensitivity to the project;
- the consideration of visual effect and visual sensitivity findings;
- the overall visual impact; and
- the consideration of feasible mitigation measures.

1.3.1 Assessment guidelines and requirements

This VIA has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for the Dungowan Dam and pipeline project. The assessment also follows the *Guidelines for Landscape and Visual Impact Assessment* (3rd edition), prepared by the UK Landscape Institute and the Institute of Environmental Management and Assessment (2013) (GLVIA).

Table 1.1 lists the matters raised in the SEARs relevant to this assessment and where they are addressed in this report.

Table 1.1 Relevant matters raised in SEARs

Requirement	Chapter/Section addressed
59. Considers the Dark Sky Planning Guideline for any proposed development within 200 kilometres from the Siding Spring Observatory	Chapter 8
60. An assessment of the visual impact of the project and any ancillary infrastructure during construction and operation on: a) views. b) key sites and buildings. c) the existing dam. d) heritage items including Aboriginal places and non-Aboriginal heritage. e) the local community.	Key receptors and/or views are identified in Chapter 4 and Chapter 5. Visual impact assessment, including visualisations, is provided in Section 7.1.
61. Artist impressions, perspective drawings and view analysis of the project to illustrate how the project has minimised adverse visual impacts through design and landscaping	Visual impact assessment, including visualisations, is provided in Section 7.1.

To inform preparation of the SEARs, the DPE invited relevant government agencies to advise on matters to be addressed in the EIS. These matters were taken into account by the Secretary for DPE when preparing the SEARs.

1.3.2 Other relevant reports

This VIA has been prepared with reference to other technical reports that were compiled as part of the EIS. The other relevant reports referenced in this VIA are listed below.

- Aboriginal Cultural Heritage Assessment (EMM 2022b) – Appended to the EIS;
- Statement of Heritage Impact (EMM 2022c) – Appended to the EIS;
- Land use and Property Assessment (Tremain Ivey 2022) – Appended to the EIS;
- Social Impact Assessment – (EMM 2022d) – Appended to the EIS; and
- Traffic Impact Assessment (EMM 2022e) – Appended to the EIS.

2 Description of the project

This chapter provides a summary of the Dungowan Dam and pipeline project. It outlines the permanent infrastructure required to operate the project, as well as the key construction elements and activities required to construct the project. A comprehensive and detailed description of the project is provided as Appendix B1 of the EIS, which has been relied upon for the basis of this technical assessment.

2.1 Project overview

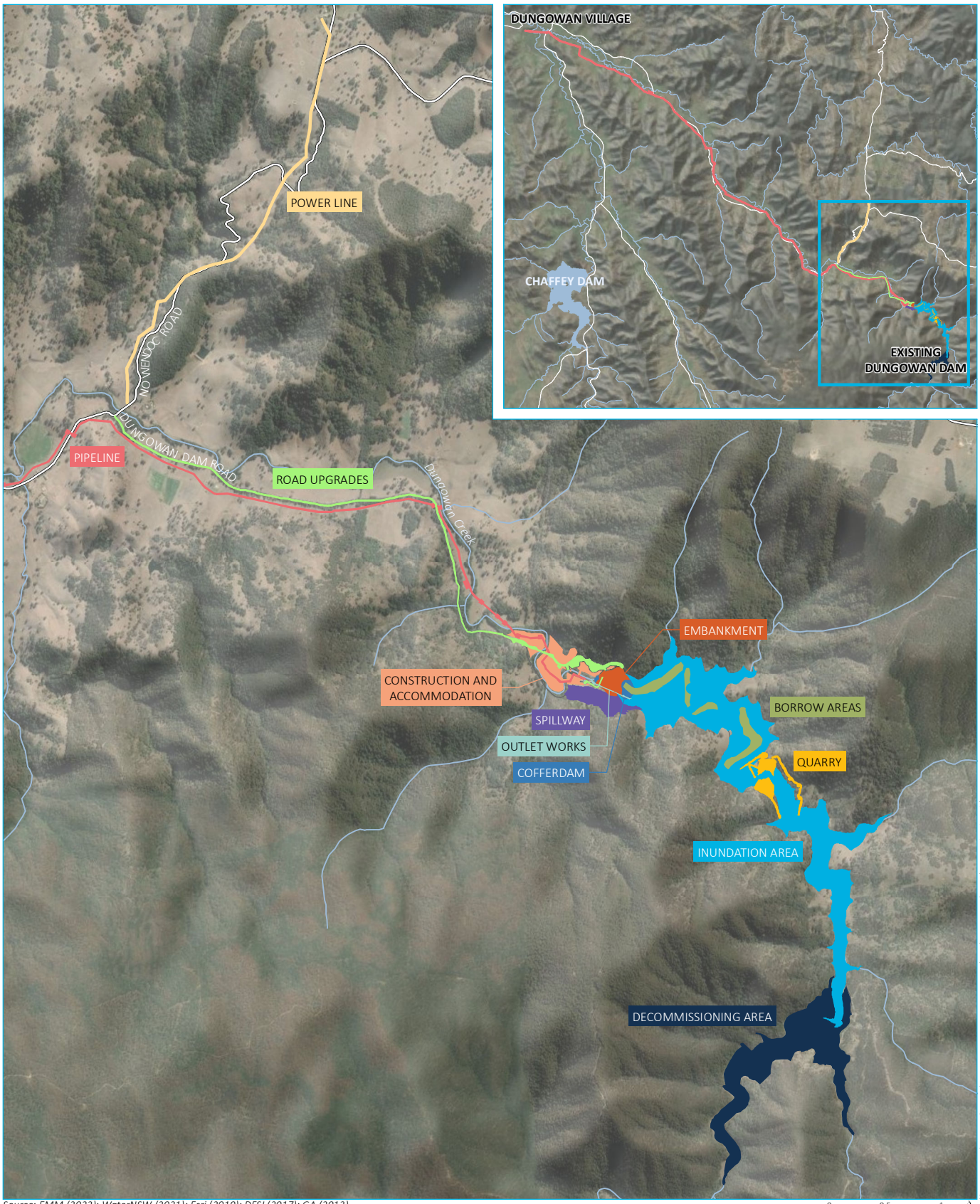
Water Infrastructure NSW proposes to build a new dam at Dungowan (new Dungowan Dam) about 3.5 km downstream of the existing Dungowan Dam and an enlarged delivery pipeline from the new Dungowan Dam outlet to the tie in point to the existing pipeline from Dungowan Showground to the Calala WTP. The existing pipeline from Dungowan Showground to the Calala WTP is not part of the Dungowan Dam and pipeline project. A summary of project elements is provided in Table 2.1. An overview of the project is provided in Figure 2.1.

Table 2.1 Overview of the project

Project element	Summary of the project
New Dungowan Dam infrastructure	Earth and rockfill embankment dam with height of ~58 m and a dam crest length of ~270 m.
	Storage capacity of 22.5 GL at full supply level (FSL) of RL 660.2 m AHD.
	The new Dungowan Dam on Dungowan Creek has a catchment size of 175 km^2 and is part of the Peel Valley and Namoi River catchment.
	Inundation extent (to FSL) of 130 ha (1.3 km^2)
	Spillway to the south of the dam wall including an approach channel, uncontrolled concrete ogee crest, chute and stilling basin. Free standing multiple-level intake tower connected with a bridge to the embankment, diversion tunnel with outlet conduit, valve house and associated pipework and valves.
	A permanent access road over the Dam crest to the valve house for operation and maintenance.
	Water diversion works including a diversion tunnel and temporary pipeline and upstream and downstream cofferdams to facilitate construction of the dam wall embankment.
Pipeline infrastructure	31.6 km of buried high density polyethylene (HDPE) pipe between 710 mm to 900 mm nominal diameter.
	Maximum 71 ML/day from the proposed dam to the junction with the pipeline from Chaffey Dam to the Calala Water Treatment Plant, to replace the existing 22 ML/day pipeline. The pipeline would connect to the valve house on the left abutment of the embankment. Valve infrastructure would include control valves installed in two above ground buildings along the pipeline.
	10 m wide easement for the 31.6 km length of the pipeline. The replacement pipeline extends from the new Dungowan Dam to a connection point with the existing pipeline between Dungowan Showground and Calala WTP.
Ancillary infrastructure and works	Road works to improve existing roads to provide construction access, temporary establishment and use of a construction compound, an accommodation camp, two upstream quarries and four borrow areas within the inundation area.
	A new 4.2 km long 11 kV overhead powerline (including a new easement and access track) connecting to an existing overhead line approximately 6 km north west of the dam. The existing overhead line that extends approximately 13.2 km to the Niangala area would also require minor upgrades, including re-stringing of new overhead wiring and replacement of some poles.

Table 2.1 Overview of the project

Project element	Summary of the project
Decommissioning of existing Dungowan Dam	Dewatering of existing dam, removal of existing Dungowan Dam infrastructure and full height breach of the existing Dungowan Dam wall. Rehabilitation of inundation area of the existing Dungowan Dam.
Disturbance	Areas of disturbance have been identified based on the direct impacts of the project. There is some overlap in the areas disturbed during construction and operation, with a resulting total disturbance area proposed for the project of 315 ha (project footprint). Disturbance would occur in a staged manner, with construction requiring disturbance of approximately 315 ha (construction footprint). Following construction and once rehabilitation is completed, there would be a permanent disturbance of approximately 158 ha comprising the inundation area and permanent infrastructure (operational footprint).
Construction	Construction duration of approximately 6 years.
	Construction workforce of approximately 125 workers at construction peak.
Operation	WaterNSW will be responsible for management, operation and general maintenance of the new dam. Tamworth Regional Council will be responsible for the management, operation and general maintenance of the pipeline. Public use and access to the dam would not be permitted and there would be no public facilities available during operation.
	One to two new full time workers plus part time work for existing WaterNSW operations team. Due to the new Dungowan Dam being prioritised over Chaffey Dam for Tamworth's future water supply, the water reserved for town water in Chaffey Dam would increase from 14.3 GL to 30 GL to ensure that water is set aside to meet Tamworth's town water supply water demand in years when rainfall is low.
Design life	100 years for zoned earthen embankment, structural concrete elements of the dam and the pipeline. 15 to 50 years for other non-structural project elements and pavements.
Assessment period (operational)	The assessment end point is when the water system performance reaches a level when an additional water supply option or change to the Water Sharing Plan is required. This has been estimated to be when the mean average annual water demand from Tamworth increases to 11 GL/year.



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Source: EMM (2022); WaterNSW (2021); Esri (2019); DFSI (2017); GA (2013)

0 0.5 1 km

GDA 1994 MGA Zone 56

N

KEY

- Inundation area
- Borrow areas
- Construction and accommodation camp
- Outlet works
- Cofferdams
- Embankment
- Quarries
- Spillway
- Road upgrade
- Decommissioning area
- Power line footprint
- Pipeline construction footprint

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody

Project overview

Dungowan Dam and pipeline project

Figure 2.1

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3 Approach and methodology

3.1 Purpose

Assessment of potential changes to visual impacts caused by infrastructure projects are important because landscapes provide:

- a setting for the day-to-day lives of local communities and residents;
- a backdrop to the experiences of visitors or people transiting the area;
- a sense of place and character; and
- opportunities for aesthetic enjoyment.

A visually interesting or attractive landscape can also provide economic benefits through recreation and tourism, plus indirect benefits to health and wellbeing.

Projects are also important to communities and local economies, and there is generally some visual effect arising from development because it typically generates a new element or change in the landscape. Not all development has a negative visual impact and not all impacts are unacceptable. There is a need to consider the extent to which the proposed development integrates or contrasts with the local landscape, and the extent to which sensitive receptors in the vicinity will be affected by the proposed development.

The purpose of this VIA is to understand the likely interactions between the project elements, including the new dam, powerline and pipeline and associated infrastructure and visual receptors in the vicinity.

3.2 Study method

The study method adopted for this assessment follows the GLVIA (2013).

The VIA needs to establish the existing nature of the landscape and visual environment. This includes the range of authorised uses which have modified the environment, such as roads, resource extraction, infrastructure etc, as well as the natural environment.

Importantly, the assessment seeks to assess only the project activities, not legacy issues or the impact of historical practices. All existing infrastructure, including roads and pipelines, form part of the base case.

The stages of the assessment are:

- describe the existing environment surrounding the project area and establish a visual catchment or study area;
- identify and evaluate the visual effect of the project considering the nature and scale of proposed development;
- identify and evaluate the visual sensitivity of the existing environment, which may be affected by the project, including identifying visual receptors that may be directly or indirectly impacted;
- integrate the consideration of visual effect and visual sensitivity findings to understand the likely visual impact; and
- consider feasible mitigation measures.

When assessing the visual impacts of a proposed project, there are two high-level variables to be considered:

- the visual effect; and
- the sensitivity of the receptors to the visual effect.

Visual effect is concerned with the development or activities and the extent to which they will contrast to or integrate with the existing landscape. It considers the size or scale of the change, the duration of the change, and reversibility of the change. It also considers design elements such as form, shape, texture and line relative to the host landscape.

Visual sensitivity is concerned with the people or locations likely to have visibility of the development. It considers the nature of the receptors and considers factors such as the planar distance between the receptor and the proposed development, relative elevations, the relationship of the receptor to the development, and any intervening or mitigating factors such as vegetation. When combined, those two variables determine the significance of the overall visual impact.

In order to retain a level of objectivity, the method includes a series of tables which allow the impact of the development to be assessed against key factors. These are presented in Table 3.1 below.

3.2.1 Establishing the visual catchment and identifying receptors

A visual catchment for the project is determined following a desktop study of the surrounding environment and modelling an area of theoretical visibility.

The desktop study and area of theoretical visibility provides the basis for identifying sensitive receptors and possible principal viewpoints. This is then ground-truthed during a field survey, which confirms the extent of visibility and confirms representative viewpoints for the assessment. The desktop study also provides the primary context for the landscape or visual sensitivity of a view or receptor, to inform further assessment.

The area of theoretical visibility is based on the area within which significant effects of the project are likely to register with receptors, informed by the height and scale of the project. As a rule of thumb, the larger the disturbance or change created by the project, the greater the radial or linear distance set for examination – simply because bigger things can be seen from further away.

From the visual catchment, assessment locations are then selected to provide a representative sample of the likely visual landscape changes on the different users of the areas surrounding the project and their visual exposure to various project elements. Assessment locations that are considered to have potential exposure to various project elements or areas available to public access, such as roads, and private viewpoints from residential properties surrounding the project, have been identified through GIS mapping, fieldwork, and desktop analysis.

The baseline review and site context is provided in Chapter 4, area of theoretical visibility is shown in Annexure A, with the findings of the review and model presented in Chapter 5.

3.2.2 Evaluating visual effect

Three factors are considered when evaluating the visual effect:

- contrast;
- integration; and
- the magnitude of the change.

A development which occupies a significant portion of a primary view, but which has high integration and low contrast within the landscape, may nevertheless have a low visual effect. On the other hand, a development occupying only a minor proportion of a primary view but which exhibits high contrast and low integration may have a higher visual effect.

Contrast and integration are the 'visual properties' of the project. The effect of the two visual properties can, however, only be known once we establish how much of the landscape is occupied by the project, the duration and reversibility of the change. The measurement of magnitude is concerned with the size and scale of the development relative to other landscape elements, and whether there will be a complete loss of a particular characteristic of the landscape or simply a minor change.

Consideration of the contrast, integration and magnitude are assessed against the criteria outlined in the GLVIA and provided in Table 3.1 below. When considering these criteria, the following should be noted:

- A high contrast is less favourable than a low contrast.
- A high level of integration is more favourable than a low level of integration.
- Once we understand the visual properties, the next step is to consider the size and sale of the project. A low level of magnitude is more favourable than a high level of magnitude.

Table 3.1 Visual effect criteria

Category	Meaning		
	Contrast	**Integration**	**Magnitude**
High	The scale, form, line, colour or texture of the proposed development do not reflect, borrow from or complement the existing visual landscape	The existing visual landscape remains the dominant visual character because the design, siting, screening or filtering of the development makes it the recessive element.	A substantial change due to total loss of elements, features or characteristics of the host landscape; and represents a generally permanent and irreversible change. Size and scale are strongly inconsistent with other landscape elements.
Moderate	The scale, form, line, colour or texture of the proposed development include some key elements which reflect, borrow from or complement the existing visual landscape	The existing visual landscape remains the dominant visual character, but the design, siting, screening or filtering of the development only achieves partial integration.	A discernible change due to partial loss of elements, features or characteristics of the host landscape; and represents a generally medium-term change (less than 10 years) and landscape recovery is expected. Size and scale are moderately inconsistent with other landscape elements.
Low	The scale, form, line, colour or texture of the proposed development extensively reflect, borrow from or complement the existing visual landscape	The existing visual landscape is dominated by the development.	An insubstantial change due to alteration of elements, features or characteristics of the host landscape; and represents a generally medium-term change (less than 10 years) and landscape integrity is broadly retained. Size and scale are consistent with other landscape elements.

It is necessary to consider the two visual properties – contrast and integration – plus the magnitude of the landscape change, in order to rank the overall visual effect. Table 3.2 provides a simple matrix to consider the interplay between those factors. The grey boxes contain the visual effect classifications.

Table 3.2 Visual effect matrix

Visual properties		Magnitude		
Contrast	**Integration**	High	Moderate	Low
High	Low	High Effect	High-Moderate Effect	Moderate Effect
High	Moderate	High Effect	Moderate Effect	Moderate-Low Effect
High	High	High Effect	Moderate Effect	Low Effect
Moderate	Low	High Effect	Moderate Effect	Moderate Effect
Moderate	Moderate	Moderate Effect	Moderate Effect	Moderate-Low Effect
Moderate	High	Moderate Effect	Moderate Effect	Low Effect
Low	Low	High Effect	Moderate Effect	Low Effect
Low	Moderate	High-Moderate Effect	Moderate Effect	Low Effect
Low	High	Moderate Effect	Moderate-Low Effect	Low Effect

Note that the visual effect is not the same as the visual impact. In order to understand the impact, we not only need to understand the visual effects associated with the project, but also the visual sensitivity of local receptors to a landscape change as described by the visual effects. In short, visual effects describe the characteristics of the source and visual sensitivity describes the characteristics of the receivers.

3.2.3 Evaluating visual sensitivity

The ranking of visual sensitivity depends on how critically changes to the landscape are likely to impact observers at the viewpoint. Not all places where a view is possible will have residents or visitors. Those locations that do have residents or visitors also are not equal in terms of the likely duration of the view (for example from a moving vehicle vs from a living room), the number of people experiencing the view, or the importance of the amenity or view integrity to the viewpoint. In this respect, the primary view from a residential dwelling or a tourist lookout will have a higher sensitivity than a remote agricultural or forestry location.

A primary view is defined as being an arc created by sight lines from a standing human radiating out vertically and horizontally at angles of 30 degrees around the centreline of the line of sight towards the project. It is recognised that views do exist beyond the 30-degree arc but this is, by convention, considered the most important part of a view. Generally, the closer to the development, the more of the view that is occupied by the project.

The table used to rank the relevant local sensitivities relevant to project elements is provided in Table 3.3.

Table 3.3 Visual sensitivity criteria

Land use	Less than 1 km from the development	Between 1 km and 5 km from the development	Between 5 km and 10 km from the development	More than 10 km from the development	
Residential dwelling	High	High / Moderate		Moderate	Low
Community facility or commercial accommodation	High	High / Moderate		Moderate	Low

Table 3.3 Visual sensitivity criteria

Land use	Less than 1 km from the development	Between 1 km and 5 km from the development	Between 5 km and 10 km from the development	More than 10 km from the development	
Designated lookout, picnic site or recreational destination	High	Moderate		Low	Low
Designated tourist road or scenic route	High	Moderate		Low	Low
Main (State) road or rail line	Moderate	Low		Low	Low
Minor road	Moderate	Low		Low	Low
Broadacre rural land	Low	Low		Low	Low
Forestry land	Low	Low		Low	Low
Heritage	Moderate	Low		Low	Low

3.2.4 Determining visual impact

Visual impact is an aggregation of visual effect (Section 3.2.1) and visual sensitivity (Section 3.2.3), with the broad categorisation outlined in the GLVIA and provided in Table 3.4.

The ranking of visual impact can often be across a hybrid of two categories, such as Moderate/Low or High/Moderate. It should be recognised that the categorisation of impact narrows the expected impact range, and that impact range should then be further explored to identify a single category of impact, being low, moderate or high. This is achieved by consideration of situational factors for each sensitive receptor group. It may be, for example, that forestry workers or recreational hunters may find a line of sight from forestry lands, but the frequency of visits to the relevant vantage points are extremely rare. This factor when considered, may lead to a lesser ranking in terms of impact. Similarly, a normally remote spot attracting frequent bushwalkers may be ranked higher than the location would normally suggest.

Visualisations have been prepared to inform the visual impact assessment.

If a receptor has no feasible line of sight or a line of sight, which is sufficiently distant or obscured to be trivial or inconsequential, then the visual impact is said to be 'nil'. This can occur where, for example, the area of theoretical visibility – based on natural topography alone – includes a receptor point, but that receptor point has a view line obscured by an artificial structure such as an earthen mound, local infrastructure or a nearby building.

Table 3.4 Visual impact matrix

Visual effect	Visual sensitivity		
	High	Moderate	Low
High	High Visual Impact	High/Moderate Visual Impact	Moderate/Low Visual Impact
Moderate	High/Moderate Visual Impact	Moderate Visual Impact	Moderate/Low Visual Impact

Table 3.4 Visual impact matrix

Visual effect	Visual sensitivity		
	High	Moderate	Low
Low	Moderate/Low Visual Impact	Moderate/Low Visual Impact	Low Visual Impact

3.2.5 Recommending mitigation and management measures

Mitigation and management measures include those built into the project as part of the iterative design and environmental assessment process, as well as those secondary measures recommended to treat residual impacts. Measures are recommended in Chapter 9 to respond to the identified impacts at sensitive receptors or the changed landscape.

3.2.6 Photomontages/artist impressions

Visualisations of the new Dungowan Dam infrastructure and inundation area were prepared to support the assessment of visual impacts. Sensitive receptors within the area of theoretical visibility for the dam infrastructure and reservoir were identified and a site visit was completed to inspect the viewpoints. Photographs were taken at the viewpoints to form the basis for visualisations of the new Dungowan Dam infrastructure and reservoir. Composite images were then prepared that combined an artist's impression of the dam infrastructure and reservoir with the photographs taken at the sensitive receptors. The resulting imagery illustrates the potential visual impacts of the dam infrastructure and reservoir on the sensitive receptors. The visualisations are provided in Chapter 7 for the sensitive receptors with potential views of the new Dungowan Dam infrastructure and reservoir.

4 Site context and existing environment

4.1 Introduction

This chapter provides a description of the site context and existing environment relevant to the Visual Impact Assessment. The chapter provides background information on the social context, landscape context and heritage values of the study area.

The project is in the Tamworth Regional Council Local Government Area (LGA). The region is home to approximately 186,900 people and has a total area of around 99,100 km^2 (ABS 2018). Other nearby regional towns include Quirindi approximately 60 km south-west of the site and Walcha approximately 50 km north-east of the site.

Smaller towns in the region include Nundle, Woolomin, Dungowan. There are also villages and localities such as Niangala, Ogunbil, Piallamore and Bowling Alley Point.

4.2 Social context

A detailed review of the surrounding area of the project has been completed as part of the Social Impact Assessment (EMM 2022d) appended to the EIS. However, an overview of relevant social aspects that contribute to the landscape and visual setting of the project is provided in this section.

4.2.1 Census data

The project is located in Dungowan within the Tamworth Regional Council LGA. The Australian Bureau of Statistics (ABS) does not provide data specifically for the Dungowan district but statistics for the Tamworth LGA are available[1].

The largest number of businesses in the LGA are classified as “agriculture, forestry and fishing”, which accounts for approximately 50% of all businesses. This was marginally also the largest sector for employment, accounting for 15% of all persons employed in the LGA. Other key employment industries were “health care and social assistance”, “education and training” and “retail trade”.

The average household size is 2.5 persons. The majority of households are families (73%). Single person households account for 25% and group households 2%. Dwelling types are predominantly separate houses (96%). The population density is approximately six people per square kilometre.

4.2.2 Community Strategic Plan

- The Blueprint 100 Our Community Plan 2023-2033 (TRC 2022) is Tamworth Regional Council’s community strategic plan, and is the principal means of articulating the vision and values of the community. The vision states “Our region will be thriving, modern and prosperous, with compassion for our people, reverence for our culture, and respect for nature.”. The key focus areas for the LGA are:
- water security;
- a liveable built environment;
- prosperity and innovation;

[1] Australian Bureau of Statistics Regional Summary for Tamworth (SA2) 2016

- resilient and diverse communities;
- connect our region and its citizens;
- working with and protecting our environment;
- celebrate our cultures and heritage;
- a strong and vibrant identity; and
- open and collaborative leadership.

It is noted that the focus area of 'water security' includes strategies to establish appropriate water and drought contingency measures in collaboration with the state government and investigate and develop practical ways to secure water supply.

4.2.3 Towns and localities

There are no major urban centres within a 20 km radius of the new Dungowan Dam and pipeline however several small villages and rural localities are within proximity and are noted below. Population statistics cited below are derived from Australian Bureau of Statistics 2016 Census Quickstats[2]. Villages in the region which fall within the study area include:

- Dungowan village, which is a scattered collection of residences and community facilities near the junction of Nundle Road and Ogunbil Road, approximately 25 km north-west of the new Dungowan Dam and approximately 500 m north of the pipeline alignment. Dungowan has a recorded population of 398 people. The village includes the Dungowan Hotel and Dungowan Public School.
- Ogunbil, which is a small village at the junction of Ogunbil Road and Allawah Road approximately 12 km north-west of the new Dungowan Dam infrastructure and abutting the pipeline alignment. It has a recorded population of 148 people.
- Woolomin: Woolomin is a small village on Nundle Road, 5 km north of Chaffey Dam and approximately 18 km north-west of the new Dungowan Dam. It has a population of 279 people.

4.2.4 Local community facilities

Local community facilities have been considered as potential receptors and are located within the towns and localities described in the previous section, and include:

- Dungowan Public School is on Ogunbil Road, Dungowan. It caters for 20 students from Kindergarten to Year 6.
- Woolomin Public School is located on Frederick Street and also provides education from Kindergarten to Year 6. The most recent enrolment figure is 32 students.
- The Dungowan Hotel, on Nundle Road, Dungowan, includes a public bar, accommodation and restaurant.
- Dungowan Hall on Ogunbil Road, Dungowan, is a local community centre.

[2] Source: Australian Bureau of Statistics Census 2016

4.2.5 Rural residences

In addition to the dwellings identified within the local towns and localities, there are scattered rural residences throughout the area within a 20 km radius of the new Dungowan Dam. Not all of these rural residences will have a line of sight to the project. All of the historical rural residences and properties situated within the footprint of the new Dungowan Dam and the reservoir have been acquired by Tamworth Regional Council.

4.2.6 Tourist sites

There are no identified tourist lookout destinations within the area of theoretical visibility. The nearest tourist lookout destination is Hanging Rock Lookout which is approximately 6 km east of Nundle. There is no line of sight between the lookout and the new dam, pipeline or powerline.

4.2.7 Roads and transport

Relevant road infrastructure includes transport routes as well as local roads connecting properties to rural towns and to other regional centres. They include:

- The New England Highway (A15) is the nearest State road and is not within the area of theoretical visibility. It runs in a north-south direction approximately 43 km to the west of the study area. All other local roads, including those described below, are Council-owned. Traffic volumes are low, comprising mostly access for the small local population or operational traffic associated with the existing Dungowan Dam.

- Thunderbolts Way is a sealed regional road approximately 17 km to the east of the new Dungowan Dam. It is a popular tourist route. The main vantage point along the route – Pioneer Lookout – is approximately 50 km to the south-east and does not provide views to the new dam, pipeline or powerline.

- Nundle Road is a sealed two-lane road connecting Tamworth and Nundle via Woolomin and Chaffey Dam. It generally follows the Peel River and is part of Tourist Route 23.

- Ogunbil Road is a sealed road generally continuing east of the junction of the Peel River and Dungowan Creek, where Nundle Road takes a southern direction. This road is on the northern side of Dungowan Creek until the junction with Dungowan Creek Road and Woolomin Gap Road, after which the road travels to the south of Dungowan Creek.

- Dungowan Creek Road is an unsealed road on the southern side of Dungowan Creek.

- Dungowan Dam Road extends south-east from the junction of Ogunbil Road and Nowendoc Road, along the southern and western side of Dungowan Creek, to the existing Dungowan Dam.

- Duri-Dungowan Road is a mostly sealed road which connects with Nundle Road at a point adjacent to the Dungowan Hotel, through to the localities of Loomberah and Duri, and connecting eventually with the New England Highway at Timbumburi approximately 16 km south of Tamworth.

- Nowendoc Road / Topdale Road is situated, at its closest points, approximately 3 km to the north and north-west of the new dam. It joins with Ogunbil Road and Thunderbolts Way to link between the Nowendoc area and Nundle/Tamworth.

4.3 Landscape context

The study area is in the New England Tablelands region. Valley flats in the study area have generally been the subject of clearing for agricultural purposes, notably livestock grazing and pastureland. There are scattered paddock trees, occasional remnant stands of mature trees, and more heavily vegetated areas along riparian zones. The landscape is sparsely populated but the pipeline infrastructure route follows the valley floor through some residential areas, agricultural premises and localities such as Dungowan and Ogunbil.

4.3.1 Landscape character units

There are two main landscape character units (LCUs):

- Landscape Character Unit 1 (LCU 1): Valley floor, comprising the relatively cleared and modified landscape along the valley floor; and
- Landscape Character Unit 2 (LCU 2): Peaks and ridges, comprising the more heavily timbered peaks and State forest areas.

i LCU 1 - Valley floor

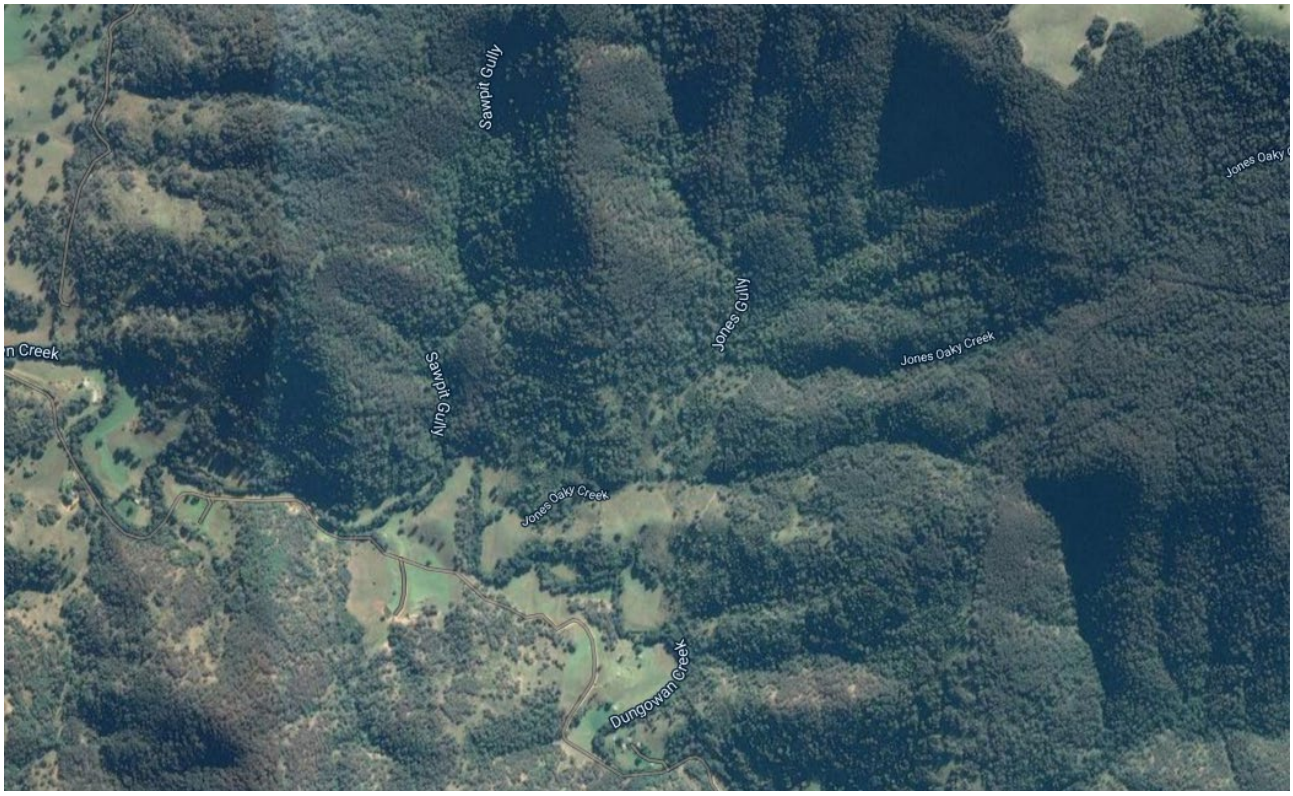
The valley floor contains small village areas, some community facilities, and predominantly clear agricultural or pastoral land. The patchwork of fields contains sparse structures such as sheds, water storage or farm dams, fencing, powerlines and sheds. The Valley Floor LCU dominates in the area generally north-west of the village of Dungowan. Refer to Figure 4.1 for an example of the landscape type, which is dominated by a Valley Floor character.

Figure 4.1 Typical Valley Floor Landscape Character

Source: Google Earth

ii LCU 2 - Peaks and ridges

The vegetated peaks and ridges are the backdrop to the populated ribbon of land along the valleys of the Peel River and Dungowan Creek. There is less available suitable terrain for agriculture to the south-east of Ogunbil, including the area proposed for the new Dungowan Dam and the area of impounded water, and hence the Peaks and Ridges LCU dominates in the section of the study area. Refer to Figure 4.2 for an example of the landscape type which is dominated by a Peaks and Ridges character.



Source: Google Earth

Figure 4.2 Typical Peaks and Ridges Landscape Character

4.3.2 Land use

The land use zoning for the study area under the *Tamworth Regional Local Environmental Plan 2010* is predominantly RU1 Primary Production with a land use zone of RU5 Village applied to the village of Dungowan. A land-use zone of E3 Environmental Management zonings applies to the State forest areas to the south of the project footprint. Closer to the Tamworth suburb of Calala, there is a zoning of RU4 Primary Production Small Lots and also R5 Large Lot Residential consistent with the growth of the Tamworth urban area on the city perimeter.

The dominant land use in the region is broadacre grazing and cropping. The rural agricultural uses tend to be on the flat land between rocky outcrops. Rural infrastructure, such as dams, fences, sheds and unsealed access tracks, are scattered sparsely throughout the rural lands.

The land to be occupied by the dam infrastructure, reservoir, pipeline and powerline is all zoned RU1 Primary Production.

4.3.3 Landform and topographic features

The new Dungowan Dam, pipeline and powerline sit within the Peel Valley, east of Tamworth, which is a valley surrounded by low peaked hills with a north-westerly alignment, generally undulating to steep terrain, and more elevated towards the eastern end of the project site. The significant topographic features for this locality are:

Peaks in topography generally rising in height to the east and south of the study area:

- Round Hill 612 m AHD;
- Flagstaff Mountain 831 m AHD;
- Goat Mountain 950 m AHD;
- Glendower Mountain 1,054 m AHD;
- Weabonga Sugarloaf 1,115 m AHD;
- Isle of Skye Mountain 1,176 m AHD;
- Bakers Downfall Hill 1,352 m AHD; and
- Baldy Knob 1,354 m AHD within Hanging Rock State Forest.

The Peel River is the main watercourse in the area, and Dungowan Creek is a tributary to the Peel River. The Peel River rises in the northern slopes of the Liverpool Range and flows in a generally north-west direction through the centre of Tamworth. The Peel River has a more southerly alignment from its junction with Dungowan Creek, near the town of Dungowan. The Peel River has a confluence with the Namoi River approximately 40 km downstream of Tamworth. Chaffey Dam is situated on the Peel River upstream from Dungowan Creek.

Dungowan Creek is a major tributary to the Peel River and Namoi River catchment. Dungowan Creek sits within a relatively steep and narrow valley. The creek is channelised in sections, and elsewhere is characterised by a series of pool and riffle habitats within a meandering natural channel. There is an existing dam, constructed in 1958, on Dungowan Creek approximately 3.5 km upstream from the new Dungowan Dam.

Several gullies and smaller creeks connect with the Peel River and Dungowan Creek, including:

- Hodgkiss Creek;
- Sawpit Gully Creek;
- Paradise Creek;
- Fox Hole Creek;
- Oaky Creek;
- Big Oaky Creek;
- Jones Oaky Creek;
- Johnston Oaky Creek;
- Hellhole Gully Creek;
- Cooee Creek; and

- Terrible Billy Creek.

Photograph 4.1 View of the Dungowan Creek valley and surrounding topography

Photograph 4.2 View of Dungowan Creek near the new Dungowan Dam

4.3.4 Protected areas

Local areas of vegetated land, and potentially including visitor destinations, include protected areas such as national parks and nature reserves. There are no protected areas within the area of theoretical visibility. The nearest protected areas include Nowendoc National Park and Ben Halls Gap National Park, but none are projected to incur any visual impact.

4.3.5 State forests

- State forests in this region are popular for hunting and camping, and include:
- Nundle State Forest, which covers an area of approximately 13,000 hectares to the south of the study area.
- Hanging Rock State Forest, which is a 7,000 hectare radiata pine plantation adjacent to Nundle State Forest, 7 km south of the study area.
- Terrible Billy State Forest, which covers an area of approximately 790 hectares, 2.5 km east of the study area.

4.3.6 Recreational areas

There are several recreational areas within 20 km of the new Dungowan Dam and pipeline alignment. These include:

- Bowling Alley Point Recreational Reserve at Chaffey Dam;
- Woolomin Reserve Campground, on the banks of the Peel River;
- Swamp Creek Reserve;
- Sheba Dam is on Barrys Road;
- Ponderosa Park Campground; and
- Fossickers Way which is a self-drive tourist route in the New England region linking Nundle, Tamworth, Glen Innes and Warialda. The route passes through Woolomin, Dungowan and Nemingha.

4.4 Heritage items, values or views

4.4.1 Historic heritage

The study area is in a landscape that retains evidence of the earliest colonial period to the present day. Some of these values have been recognised in the *Tamworth Regional Local Environmental Plan 2010* (Tamworth Regional LEP) while others were documented during the investigation for the Statement of Heritage Impact (SOHI) (EMM 2022).

In summary, within approximately 1km of the project footprint there are:

- no heritage items on the National Heritage List;
- no heritage items on the Commonwealth Heritage List;
- no heritage items on the State Heritage Register;
- one heritage item on the NSW Department of Education s170 register; and
- 11 items on the Tamworth Regional LEP.

Table 4.1 identifies the listed that occur within approximately 1 km of the project footprint. Some 37 unlisted items with potential for heritage significance were identified within and adjacent to the project footprint (as part of the investigation for the SOHI). Sites with potential for higher significance are related to Dungowan Station, a squatting run that was established in 1847. The original headstation belonging to the run is in proximity to the northern extent of the pipeline but well clear of the project footprint.

Table 4.1 Listed heritage items in proximity of the project footprint

Item	Address	Register	Item ID	Approximate distance from project footprint
Ogunbil Brick Shearing Shed and Silo	Ogunbil Road, Ogunbil. Lots 158 and 234, DP 755350; Lot 1, DP 807846	Tamworth Regional LEP	I283 (DH09)	Pipeline partially within the footprint.
Port Stephens Cutting	Nowendoc Road.	Tamworth Regional LEP	I264 (DH08)	Item is within the footprint of the new overhead powerline. 0.130 km north-east of pipeline. On the north side of Dungowan Creek.

Table 4.1 Listed heritage items in proximity of the project footprint

Item	Address	Register	Item ID	Approximate distance from project footprint
Dungowan Store and Bakery	Nundle Road, Dungowan. Part Portion 22, DP 755337; Lot 1, DP 254341	Tamworth Regional LEP	I106	0.559 km north of pipeline and north of Nundle Road.
Former Butchery	Nundle Road, Dungowan. Lot 1, DP 375009	Tamworth Regional LEP	I108	0.768 km north of pipeline; north of Peel River.
Former Manvell's Bakery	Nundle Road, Dungowan. Lot 1, DP 307297	Tamworth Regional LEP	I109	0.640 km north of pipeline and north of Ogunbil Road.
Roman Catholic Church, former Catholic Convent, former Catholic School Site	Nundle Road, Dungowan. Lot 2, DP 24002; Lot 1, DP 950284	Tamworth Regional LEP	I110	0.568 km north of pipeline and north of Ogunbil Road.
Dungowan Cemetery	Ogunbil Road, Dungowan. Lot 139, DP 755337	Tamworth Regional LEP	I111	1.035 km north of pipeline and north of Ogunbil Road.
Dungowan Memorial Hall	Ogunbil Road, Dungowan. Lot 35, DP 755337	Tamworth Regional LEP	I112	0.260 km north of pipeline and south of Ogunbil Road.
St Thomas' Anglican Church	Ogunbil Road, Dungowan. Lot 143, DP 755337	Tamworth Regional LEP	I113	0.485 km north of pipeline and south of Ogunbil Road.
Dungowan Public School	137 Ogunbil Road, Dungowan. Lots 1 and 38, DP 755337	Tamworth Regional LEP	I114	0.550 km north of pipeline and north of Ogunbil Road.
Dungowan Public School – Building B00A	As above	s170 Register (Department of Education)	-	As above.
Old Piallamore School Building	Nundle Road, Dungowan. Lot 183, DP 733065	Tamworth Regional LEP	I285	0.782 km north of pipeline and north of Ogunbil Road.

4.4.2 Aboriginal heritage

The project footprint is defined by two distinct environments:

i) the new Dungowan Dam, inundation area and the powerline are within a narrow, steep V-shaped valleys; and
ii) the pipeline alignment is situated on the wider alluvial floodplains of Dungowan Creek.

These environments would have contained a variety of resources that would have been attractive to Aboriginal people in the past, but also will have influenced the potential cultural materials that may have been deposits and survived. Specifically, the alluvial terraces and lower slopes adjacent waterways would have been conducive to surface and/or shallowly buried stone and shell cultural materials, while more rugged country has some potential for grinding grooves, engravings, rockshelter and associated features.

The geology of the region includes a range of raw materials, including jasper, chert and serpentine, that were used by Aboriginal people in the past for producing stone artefacts. Other sources are known at nearby Mt Pleasant, Hanging Rock and near to Chaffey Dam.

A detailed field investigation of the soil profiles was undertaken focussing on the new Dungowan Dam and inundation footprint. These found two main soil profiles, both of which exhibit shallow topsoil units, within which cultural material is commonly found and unlikely to extend >80 cm below current ground surface. Although some geotechnical evidence references deeper alluvium may be present in some locales, and which may be of archaeological interest depending on the age of formation.

The project footprint contains a wide variety of flora and fauna that would have been used by Aboriginal people in the past for food, medicinal, totemic and cultural purposes. An extensive description of flora and fauna of importance to the contemporary Aboriginal participants was documented as part of a cultural mapping study. These include both native and introduced species, the latter demonstrating the high adaptability of past and contemporary Aboriginal people to integrate useful resources into their established food, medicinal and cultural practises.

The study area has been subject to both natural and anthropogenic disturbance that will affect the survivability of cultural materials if present. These include agricultural, pastoral and vegetation clearance across most of the project footprint that will have resulted in disruption of the upper soil profile and any associated cultural materials. More extensive disturbance includes the establishment of the current Dungowan Dam in the 1950s at the southern end of the project footprint, and which is considered to have resulted in the loss of cultural materials in these areas.

4.4.3 Travelling Stock Reserves

Several Travelling Stock Reserves (TSRs) are within or adjacent to the study area. Those TSRs are:

- Ogunbil – 28.93 hectares - Category 3;
- Memorial – 6.75 hectares - Category 3;
- Dungowan Station – 1.84 hectares - Category 3;
- Church – 3.72 hectares - Category 3;
- Dungowan – 35.67 hectares - Category 3; and
- Dungowan Pub – 3.95 hectares - Category 3.

Category 3 TSRs are reserves that are rarely if ever used for travelling stock or emergency management, but are important, valued and used for other reasons, eg biodiversity conservation, Aboriginal cultural heritage or recreational purposes. None of the TSRs have a line of sight to the new Dungowan Dam, however two (Ogunbil and Memorial TSRs) will be intersected by the pipeline alignment.

5 Visual catchment and receptors

This chapter describes the area of theoretical visibility and key sensitive receptors identified with potential to be impacted by the visual effects of the project.

5.1 Area of theoretical visibility

The area of theoretical visibility represents the area within which the majority of potential views of the project components or elements may be located. Each project component has its own area of theoretical visibility and these areas are based on different distance settings, which reflect the likely range at which each component can be distinguished and identified as a discrete landscape feature. A large reservoir, for example, will be seen from a greater distance than a line of timber power poles.

Consideration of the views within the area of theoretical visibility are the focus of the Visual Impact Assessment. It is acknowledged that there may be other viewpoints, at some significant distance, outside the area of theoretical visibility but the likelihood of any material impact at those locations is negligible and are therefore not investigated as part of this assessment.

When dealing with unobstructed sight lines and adequate lighting, human-scale objects are resolvable as objects via unaided vision to a maximum distance of approximately 3 km. This is generally the conventional limit for 'distance' views. Some additional allowance has been made with respect to the project due to the size of the disturbance footprint and the scale of the change, particularly in relation to the new Dungowan Dam.

The different project components need to be considered both separately and cumulatively, because they create very different visual impacts in terms of scale, duration and location. The area of theoretical visibility calculated for each of the project elements is provided in Annexure A. The area of theoretical visibility considers topography however does not factor any screening provided by vegetation, therefore providing a conservative assessment.

5.2 Key sensitive receptors

This section identifies sensitive receptors with potential to be impacted by the visual effects of the project. It does not mean that project elements will be visible from all sensitive receptor locations. Key sensitive receptors were identified based on the areas of theoretical visibility described in Section 5.1 above and are subject to the sensitivity and Visual Impact Assessment provided in Chapter 7.

5.2.1 Residential dwellings and rural properties

Rural residential dwellings are located throughout the study area with some falling within the zone of theoretical visibility.

- There are 94 rural residences within the 350 m distance of the pipeline infrastructure. Many of these properties host sheds and farm buildings associated with the properties predominantly agricultural land use. Residences further afield tend to have the benefit of intervening vegetation, which obscures views to the pipeline infrastructure and road.

- There are nine rural residential dwellings within the area of theoretical visibility (350 m distance) for the road upgrade works, being those premises closest to Dungowan Dam Road between the new Dungowan Dam works area and Nowendoc Road.

- There are three rural residences within the area of theoretical visibility for the new powerline, two of which are also within the area of theoretical visibility for the pipeline and road.

- There is one rural residential dwelling within the area of theoretical visibility of the new Dungowan Dam and reservoir. The property also contains several farm buildings.

Dwellings are usually considered to be sensitive receptors but where existing dwellings would remain unoccupied for the purpose of the project, the dwellings are not considered to be sensitive receptors in this VIA. Due to the scale of the study area, not all dwellings were ground-truthed and were conservatively identified using recent aerial imagery.

5.2.2 Community facilities and commercial accommodation

The nearest community facilities and commercial accommodation (including farm stay facilities) are in or near the villages of Ogunbil and Dungowan. Neither of these locations falls within the area of theoretical visibility of the dam.

Churches, community halls, commercial accommodation/hotel, and schools in Dungowan and Ogunbil are approximately 500 m or more from the pipeline and powerline alignments and not considered to be within the area of theoretical visibility of the project infrastructure.

5.2.3 Designated lookout, picnic site or recreational destination

There are no existing designated lookouts, picnic sites or recreational destinations within the area of theoretical visibility of any of the project elements.

5.2.4 Designated tourist road or scenic route

There are no existing designated tourist roads or scenic routes within the area of theoretical visibility.

Nundle Road is part of Tourist Route 23. It has a very small section (approximately 150 m) where pipeline construction works will intersect with the road. This is considered to be a low visual impact given the route covers Tamworth to Willow Tree via Quirindi.

5.2.5 Main road or rail line

There is no main road or rail line within the area of theoretical visibility.

5.2.6 Minor road

Two minor roads have sections on which there is a line of theoretical visibility to the new Dungowan Dam infrastructure and reservoir.

- Terrible Billy Fire Trail; and
- Dungowan Dam Road.

Three minor roads have sections on which there is a line of theoretical visibility to the pipeline infrastructure.

- Ogunbil Road;
- Nundle Road; and
- Dungowan Dam Road.

Visibility of the pipeline construction is unavoidable for motorists on these roads as the pipeline is generally, but not exclusively, co-aligned with the roads. The proximity is close but unavoidable and the sections of the pipeline alignment subject to disturbance will be minimal relative to the overall road length. Once construction is complete, the pipeline will be buried and not visible with the exception of at or above ground valves.

Three minor roads have sections on which there is a line of theoretical visibility to the new powerline.

- Dungowan Dam Road;
- Weabonga Road; and
- Nowendoc Road.

These are very low volume traffic roads. Where some sections will be co-aligned with powerlines. Powerlines are an extremely common roadside item.

5.2.7 Forestry land

Sections of Terrible Billy State Forest fall within the area of theoretical visibility but these are heavily vegetated and there are no known vantage points, which attract visitation for a view-related purpose. There is little known visitation to the forestry areas of Terrible Billy.

An extremely small section of Nundle State Forest (north-east) falls within the area of theoretical visibility but these are heavily vegetated and there are no known vantage points, which attract visitation for a view-related purpose.

There are no forestry lands within the area of theoretical visibility of the pipeline or powerline.

5.2.8 Broadacre rural land

The visual character unit that dominates the area of theoretical visibility for the dam is the Peaks and Ridges LCU. This landscape character is heavily wooded and there are no specific vantage points, which might attract visitation or use.

Broadacre rural land surrounds much of the pipeline alignment. The level of activity in broadacre rural lands is very limited and the sensitivity is similarly low. The distance varies greatly given the size of landholdings adjoining the proposed pipeline works area.

The powerline traverses through both Peaks and Ridges and broadacre rural lands.

5.2.9 Heritage items and sites

There are several travelling stock reserves (TSRs) and (listed and unlisted) heritage items within the area of theoretical visibility for the pipeline infrastructure, and which are detailed and assessed as part of the SOHI prepared for the project (EMM 2022c).

The TSRs are all adjacent to local roads and the heritage items are similarly within 350 m of the road or pipeline alignment.

The listed heritage items within the area of theoretical visibility are:

- Dungowan Memorial Hall (I112);
- Ogunbil Brick Shearing Shed and Silo (I283); and
- Port Stephens Cutting (I264).

Dungowan Station is located along the pipeline infrastructure route and while it is not a listed heritage item, it has been identified in the SOHI (EMM 2022c) for its potential State heritage significance. Several other unlisted items of lesser significance are located along the pipeline and have been assessed separately in the SOHI. Potential and existing heritage sites contribute to a cultural landscape of cleared fields, fences and stockyards, archaeological sites and roads, and the landscape impacts are assessed in this VIA.

5.3 Visual impact assessment locations

Based on the area of theoretical visibility and sensitive receptors discussed in Section 5.2, receptors with potential to experience adverse visual impacts were confirmed. These are detailed in Table 5.1, and shown in Figure 5.1 and Figure 5.2.

Table 5.1 Sensitive receptors and observer locations

ID	Receptors	Receptor type	Potentially visible project elements
1*	Rural residence: 309 Dungowan Dam Road (Lot 1 DP 749796)	Permanent - Residential	Construction stage: Construction camp and compounds, Pipeline, Roads Operational stage: Dam infrastructure, Roads
2	Rural residences (various) on Dungowan Dam Road, Ogunbil Road, Dungowan Creek Road and Nundle Road west of new dam	Permanent - Residential	Construction stage: Pipeline, Roads Operational stage: Roads
3	Rural residences (3) on Nowendoc Road and Weabonga Road	Permanent - Residential	Construction stage: Pipeline, Roads Operational stage: Electricity powerlines, Roads
4	Minor road: Dungowan Dam Road	Transient – Roads	Construction stage: Pipeline, Borrow pits and quarries, Construction camp and compounds Operational stage: Dam infrastructure, Reservoir, Roads
5	Minor roads: Ogunbil Road, Dungowan Creek Road and Nundle Road	Transient – Roads	Construction stage: Pipeline
6	Minor roads: Weabonga Road, Nowendoc Road, including local heritage item Port Stephens Cutting	Transient – Roads; Permanent – Heritage	Operational stage: Electricity powerlines
7	Minor roads: Pearsons Trail	Transient – Roads	Construction stage: Decommissioning works (existing dam)
8*	Minor roads: Terrible Billy Fire Trail	Transient – Recreational and silviculture operations	Operational stage: Reservoir
9	Forestry land	Transient – Recreational and silviculture operations	Construction stage: Borrow pits and quarries, Construction camp and compounds, Decommissioning works (existing dam) Operational stage: Dam infrastructure, Reservoir
10	Broadacre rural land	Transient – Agricultural operations	Construction stage: Pipeline, Roads Operational stage: Electricity powerlines, Roads
11	Dungowan Memorial Hall	Permanent – Heritage	Construction stage: Pipeline
12	Ogunbil Brick Shearing Shed and Silo	Transient – Heritage	Construction stage: Pipeline
13	Dungowan Station Homestead (also referred to as Cadell's Dungowan Station)	Permanent – Heritage	Construction stage: Pipeline
14	Travelling Stock Reserves	Transient – Heritage	Construction stage: Pipeline

* indicates a visualisation has been prepared to assess changes to view

KEY

Project footprint

Receptor ID #

- 1 | Rural residence: 309 Dungowan Dam Road
- 3 | Rural residences on Nowendoc Road and Weabonga Road
- 4 | Minor road: Dungowan Dam Road
- 5 | Minor roads: Ogunbil Road, Dungowan Creek Road and Nundle Road
- 6 | Minor roads: Weabonga Road and Nowendoc Road
- 7 | Minor roads: Dungowan Dam Road and Pearsons Trail
- 8 | Minor roads: Terrible Billy Fire Trail
- 9 | Forestry land
- 11 | Ogunbil Brick Shearing Shed and Silo
- 12 | Dungowan Station Homestead
- 13 | Travelling Stock routes/camps
- 14 | Dungowan Memorial Hall

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody
- State forest

Source: EMM (2022); WaterNSW (2021); Esri (2019); DFSI (2017); GA (2013)

0 2.5 5 km

GDA 1994 MGA Zone 56

N

Visual impact assessment locations

Dungowan Dam and pipeline project
Visual impact assessment
Figure 5.1

EMM
creating opportunities

KEY

- Project footprint

Receptor ID #

- 2 | Rural residences on Dungowan Dam Road, Ogunbil Road, Dungowan Creek Road and Nundle Road

Existing environment

- Major road
- Minor road
- Named watercourse
- Named waterbody
- State forest

Source: EMM (2022); WaterNSW (2021); Esri (2019); DFSI (2017); GA (2013)

0 2.5 5 km

GDA 1994 MGA Zone 56

N

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Visual impact assessment locations - receptor ID #2

Dungowan Dam and pipeline project
Visual impact assessment
Figure 5.2

EMM
creating opportunities

6 Analysis of visual effects

The visual effect of the components or elements of the project are discussed below, noting that the visual effect is not the same as the visual impact. The visual impact is identified only after considering the sensitivity of the various receivers to the visual effect of the project components.

6.1 Reservoir

The reservoir is a body of water covering an area about 130 ha at full supply level. The visual effect of the reservoir is described in Table 6.1.

Table 6.1 Visual effect - Reservoir

Criteria	Description	Rating
Contrast	The introduction of a reservoir, although large, represents a form, line and texture which borrows from the host environment. There is already a watercourse in the form of Dungowan Creek, and there is an existing (smaller) Dungowan Dam upstream from the project site. The presence of water as a landscape feature is therefore established but the scale clearly changes. The reservoir is also a natural element rather than a foreign element not normally found in a rural setting. The reservoir is also a dynamic feature which will change with seasons, precipitation events and water consumption. The contrast rating for the reservoir is therefore moderate.	Moderate
Integration	The integration is considered to be low as the reservoir, while creating a low contrast to the host environment, is not recessive. This element of the project will dominate the local landscape. The reservoir will be identifiable as a major characteristic in the landscape.	Low
Magnitude	The magnitude of the visual effect is considered high as the permanence of the change and the difference in size and scale compared to other landscape features. To some extent, the reservoir will also cause the loss of the otherwise visible vegetated landscape in the valley floor.	High
Overall effect	The combined variables of contrast, integration and magnitude result in an overall high visual effect.	High

6.2 Dam infrastructure

The embankment dam will be a height of ~58 m and a dam crest length of ~270 m and comprise earthen and concrete infrastructure. The visual effect of the dam infrastructure is described in Table 6.2.

Table 6.2 Visual effect – Dam infrastructure

Criteria	Description	Rating
Contrast	The introduction of the new Dungowan Dam infrastructure, including the dam wall and spillway, will contrast strongly with the otherwise rural and low-development character of the study area. While there is an existing Dungowan Dam, the existing dam does not share the same area of theoretical visibility as the new Dungowan Dam and the existing dam cannot be considered part of the immediate landscape for the purposes of ranking the visual contrast. The 'backdrop' for the new Dungowan Dam infrastructure is broadly a natural landscape with few elements suggesting engineering intervention. The ranking for contrast is therefore high.	High
Integration	The integration of the new Dungowan Dam infrastructure is considered to be low, as the dam infrastructure will not be a recessive element in the landscape. The dam infrastructure will not fully dominate the landscape but this is only due to the larger and more dominant feature of the reservoir behind the dam wall. The dam infrastructure is not able to be screened, redesigned or sited in alternative locations to materially reduce the magnitude.	Low

Table 6.2 Visual effect – Dam infrastructure

Criteria	Description	Rating
Magnitude	The magnitude of the visual effect is considered high, as the permanence of the change and the difference in size and scale compared to other landscape features.	High
Overall effect	The combined variables of contrast, integration and magnitude result in an overall high visual effect.	High

6.3 Pipeline

Pipeline infrastructure will primarily be buried underground along the alignment. However, a series of valves are needed to control flows, pressure and facilitate maintenance. This includes two control valves of approximately 8.1 m x 6.4 m x 3.5 m high Colourbond sheds, surrounded by security fencing. An example is shown in Photograph 6.1.

Photograph 6.1 Example of control valve structure

All other valves would be required to be exposed and accessed during operation and therefore would have either an element of above ground or ground level infrastructure, including pits, exposed valve arrangements and safety/protection bollards. The visual effect of the pipeline is described in Table 6.3.

Table 6.3 Visual effect - Pipeline

Criteria	Description	Rating
Contrast	The pipeline, when operational, will be predominantly all underground. The only elements above ground, when operational, will be valve control infrastructure. These valve controls are either the two control valves or sub-surface pits with a sealed access and protective bollards (or similar low profile assets). The visual effect of these is considered low as the infrastructure is consistent with existing farm sheds and access pits along roadways. The underground pipeline at operational stage is considered to have a nil visual effect. The key visual contrast arises during construction, as the alignment of the pipeline and the associated construction works generally follows a formed road and associated roadside structures and activity.	Low
Integration	The integration of the pipeline infrastructure will be high once complete. During construction, the integration is also high because the staged approach and scale of construction works will ensure that the construction works do not dominate the host landscape. Integration is considered to be high.	High
Magnitude	The magnitude of the visual effect is considered to be low. There is a low to nil visual magnitude for the pipeline when operational. The duration of the visual intrusions during construction are of a modest scale and will occupy a viewshed only temporarily. This represents a low level of magnitude.	Low
Overall effect	The combined variables of contrast, integration and magnitude result in an overall low visual effect.	Low

6.4 Powerline

Most academic and project-based analysis of the visual impact of powerlines tends to consider high voltage powerlines, which have a very different structure to the local powerline proposed as part of the project (see for example Slusser (2012)3 or Priestley & Evans (1996)4). The single ('monopole') structure proposed will not have the same bulk and scale as a lattice structure, which is typical of pylon construction for high-voltage overhead powerlines.

Research does suggest however that casual observers (such as drivers and passengers in cars) perceive transmission lines in vastly different ways. Some casual observers barely notice them, even if they are large, lattice structure objects, while others acknowledge the presence (Slusser 2012 p 67). As noted by López-Rodríguez & Rafael Escribano-Bombín (2013)5 physical proximity and visibility make the public more aware of the presence of high-voltage powerlines, but also that there is an important difference between visibility and visual significance for a powerline. Similarly, Boyer et al (1978)6 found that the nearest residents were the most sensitive to powerline construction and that the attitude persisted over years, not just due to the initial construction phase. These concerns however are linked to perceptions and concerns about undesirable impacts to health and safety, which are generally limited to high-voltage installations. Priestley & Evan (1996) found that landscaping can provide a compensating amenity, which can positively affect the perception of residents.

3 Slusser, Andrea M. 2012. *Transmission lines in wildland landscapes: Gauging visual impact among casual observers* Thesis submitted in partial fulfilment of the requirements for the degree of Master of Landscape Architecture, University of Washington.

4 Priestley T & Evans GW. 1996. Resident perceptions of a nearby electric transmission line. *J Environ Psychol*. 16(1):65 – 74.

5 Alicia López-Rodríguez & Rafael Escribano-Bombín. 2013. Visual significance as a factor influencing perceived risks: cost-effectiveness analysis for overhead high-voltage power-line redesign, *Impact Assessment and Project Appraisal*, 31:4, 291-304, DOI: 10.1080/14615517.2013.842299.

6 Boyer JC, Mitchel B, Fenton S. 1978. *The socio-economic impacts of electric transmission corridors: a comparative analysis*. Waterloo: University of Waterloo, Royal Commission on Electric Power Planning.

Power poles and the electricity wires are a distinctly non-natural landscape element, but they are thin and relatively difficult to discern where a textured background, such as a stand of trees, provides a visually absorptive backdrop. This is particularly so when the monopole comprises a timber pole. Photograph 6.2 shows an existing timber monopole adjacent to Nowendoc Road.

Source: EMM Consulting

Photograph 6.2 Power pole in landscape setting, Nowendoc Road, Ogunbil

There are already powerlines and other infrastructure, such as fences, in properties where the new powerline is proposed (refer to Source: EMM Consulting

Photograph 6.3). Power poles and associated access tracks are a common sight across regional and rural landscapes generally, as the rural residences, workshops and sheds located off the main network service powerlines along local roads require private lines across properties.

Source: EMM Consulting

Photograph 6.3 Existing powerlines on private property, Weabonga Road, Ogunbil

The visual effect of the powerline is described in Table 6.4.

Table 6.4 Visual effect – Powerline

Criteria	Description	Rating
Contrast	The electricity powerline will have a moderate contrast. There are existing elements in the landscape, which have vertical elements, and the scale and texture of the poles will be not inconsistent with the background. The poles are timber construction. The removal of trees within the clearing zone (ie a 20 m ribbon of land aligned with the conductor lines) and establishment of access to the powerline will have a low contrast in landscape zones generally cleared and partly cleared. The loss of trees within vegetated landscape zones (peaks and ridges) will represent a greater contrast with that existing landscape however has limited visibility from receptors. Access (public and private) roads are common within the landscape and associated access for the powerline will be consistent with the form of these existing roads.	Moderate
Integration	The integration of the proposed powerlines will be moderate because the existing visual landscape remains dominant, and there are already power poles and wires and access tracks along part of the route (notably near dwellings and long road corridors) but the structures will nevertheless not fully integrate with the landscape in all viewsheds. The removal of trees within the clearing zone will not create an unvegetated pocket, which dominates the landscape, and the effect is considered to be moderate integration.	Moderate

Table 6.4 Visual effect – Powerline

Criteria	Description	Rating
Magnitude	The magnitude of the visual effect is considered to be low. The installation of poles and wires and an access track is an insubstantial change relative to the elements, features or characteristics of the host landscape and landscape integrity is broadly retained. The new powerlines will extend for approximately 4 km from the junction of Dungowan Dam Road and Nowendoc Road, generally following the direction of Nowendoc Road north to the junction of Nowendoc Road and Weabonga Road. The magnitude of the removal of trees within the clearing zone is also low magnitude, noting that the proposed alignment is likely to generally require the loss of isolated trees and not the wholescale clearing of otherwise unmodified landscape.	Low
Overall effect	The combined variables of contrast, integration and magnitude result in an overall low visual effect.	Low

6.5 Road Upgrades

Dungowan Dam Road requires widening and upgrade to facilitate construction and these upgrades will be retained permanently. The visual effect of the road upgrades described in Table 6.5.

Table 6.5 Visual effect – Road upgrades

Criteria	Description	Rating
Contrast	The contrast created by the road upgrade is more dependent on the sealing of the road rather than the widening of the road surface. If road sealing is required, the change from an unsealed gravel road to a sealed road would include key elements, which are already in the landscape but colour and texture of the surface would create a moderate contrast.	Moderate
Integration	The integration is high because the road widening and upgrade will not subvert the existing dominant features in the landscape and it is to be generally aligned with an existing road. The view to the road will, in many sections, be filtered through roadside vegetation (refer to Source: SMEC Photograph 6.4).	High
Magnitude	The increased road width is an insubstantial change at landscape scale and the integrity of the host landscape is not compromised. The change in width is from the current width of generally 5.5 m to 6.5 m to a new cross-sectional width of 7.5 m to 8.0 m. The ranking is therefore low magnitude.	Low
Overall effect	The combined variables of contrast, integration and magnitude result in an overall low visual effect.	Low

Source: SMEC

Photograph 6.4 Typical section of existing Dungowan Dam Road

6.6 Borrow and quarry areas

Borrow and quarry areas are temporary project elements required during construction. The areas not within the FSL will be rehabilitated. The visual effect of the borrow and quarry areas are described in Table 6.6.

Table 6.6 Visual effect –Borrow and quarry areas

Criteria	Description	Rating
Contrast	In considering the contrast attributable to the proposed borrow and quarry areas, there is some consideration that the materials, and indeed associated clearing, are identifiable as elements elsewhere in the local landscape setting. The dominant landscape is, however, is LCU 1 – valley floor terrain. There are no substantial buildings proposed in the borrow and quarry areas, and the contrast is therefore attributable to the loss of vegetation and the presence of stockpiled material and minor structures during construction. The colour, texture and naturalness are altered but not replaced by significant build form. Nevertheless, there is little which can be said to complement or borrow from the main existing visual landscape. The contrast therefore is considered high during the construction period, noting that the areas will be inundated when the dam is full.	High
Integration	Integration is moderate due to the benefit of surrounding vegetation as a filtering element. The steep surrounding topography also obscures views.	Moderate
Magnitude	The 19-hectare area of disturbance likely to be associated with these areas – being approximately 11.7 hectares for borrow pits and 7.3 hectares for the quarries – is considered a moderate magnitude predominantly because the duration of the works in these areas is relatively short-lived (approximately two years).	Moderate
Overall effect	The combined variables of contrast, integration and magnitude result in an overall moderate visual effect.	Moderate

6.7 Construction camp and compounds

During construction, temporary accommodation camp and compounds will be established. They will be removed and the landscape rehabilitated prior to project operation. The visual effect of the construction camp and compounds are described in Table 6.7.

Table 6.7 Visual effect –Construction camp and compounds

Criteria	Description	Rating
Contrast	The installation of a construction camp and works compounds will have a high contrast. The buildings and infrastructure to be installed include items such as a concrete batching plant. These structures will not reflect, borrow from, or complement the existing visual landscape.	High
Integration	The integration of the construction camp and works compounds will be moderate. The siting of the construction camp and compounds has the benefit of surrounding vegetation as a filtering element. It is situated adjacent to the Dungowan Creek and at the foot of relatively steep hills to the north-east and south-west which rise approximately 300 m above the height of the proposed construction camp.	Moderate
Magnitude	The magnitude of the proposed construction camp and compounds is limited by the temporary existence of the facilities. The construction period is estimated to be 4 years. The accommodation facilities and other related infrastructure will be decommissioned at the end of the construction period. The footprint of the accommodation camp, works compounds and related enclosures is approximately 15 hectares. The magnitude is therefore ranked as moderate.	Moderate
Overall effect	The combined variables of contrast, integration and magnitude result in an overall moderate visual effect.	Moderate

6.8 Decommissioning works

The embankment and former inundation area of the existing Dungowan Dam to be decommissioned will be rehabilitated as part of the construction phase. The visual effect of the decommissioning works are described in Table 6.8.

Table 6.8 Visual effect –Decommissioning works

Criteria	Description	Rating
Contrast	The modification and overall reduction in the existing Dungowan Dam is unlikely to create a contrast noting that the decommissioning is to occur in an area already modified by the existing dam. The former inundation zone would be temporarily exposed following release of the water, displaying an unvegetated and eroded landscape that would contrast with the vegetated surroundings. A low level of contrast is anticipated as they reflect, borrow from or complement the existing visual landscape.	Moderate
Integration	Once the former dam has been rehabilitated, the integration of the decommissioning works will be high due to the placement of spoil to give effect to rehabilitation of the upstream and downstream areas, and will restore a level of naturalness in the riparian area. The site is situated at the foot of a relatively steep vegetated slope.	High
Magnitude	The magnitude of the proposed decommissioning works is unusual in that the area disturbed as part of the decommissioning is less than 5 hectares within an already modified site. The impounded water (Dungowan Creek and Lever Creek) is removed and the area rehabilitated and returned to a natural setting. The change while substantial in area, is of a scale consistent with surrounding landscape elements and also retains landscape integrity. The magnitude is therefore ranked as low.	Low
Overall effect	The combined variables of contrast, integration and magnitude result in an overall low visual effect.	Low

7 Sensitivity and impact assessment

7.1 Visual impact assessment

This section provides an assessment of the visual impact of the project during construction and operation on sensitive receptors (as shown in Figure 5.1 and Figure 5.2) including consideration of views, key sites and buildings, heritage and the local community.

7.1.1 Receptor 1 - Rural residence: 309 Dungowan Dam Rd

The rural residential dwelling at 309 Dungowan Dam Road, Ogunbil (Lot 1, DP 749796), approximately 1.5 km north-west of the main dam construction site. The site is a rural residence with associated structures across the property. The landscape is a rural setting and within LCU 1 – Valley floor. The receptors are the occupants of the rural residence.

An assessment of visual impact to this receptor is provided in Table 7.1. A visualisation showing the predicted view from the receptor towards new Dungowan Dam infrastructure is provided in Photograph 7.1.

i Construction

The residential dwelling is some 250 m from the construction of the pipeline and upgrade works of Dungowan Dam Road. The view towards the construction of these elements is largely obscured by trees along Dungowan Creek.

This residential dwelling is nominally within the area of theoretical visibility for the construction camp. It has a potential view line towards the construction camp obscured by a small hill and mature vegetation. There is a marginal element of the viewshed which benefits from mature vegetation as an obscuring feature, and this is not expected to change over the duration of the construction period. The area of theoretical visibility only considers topography and not other features such as vegetation. Refer to Photograph 7.1, note that the red line indicates the position of the dam infrastructure (obscured). The elevation of the construction camp is less than that of the dam infrastructure and as such it is inferred that the viewshed from the dwelling does not provide a line of sight to the construction camp, and the overall visual impact is nil.

The extent of obscuring by the hill and vegetation is marginal and the visual impact for this location should be re-assessed if there is any design change to the proposed construction camp infrastructure, which results in a more elevated position for the proposed camp assets.

ii Operation

This assessment location has the potential view line towards the new Dungowan Dam and associated infrastructure. The viewshed from the dwelling does not however provide a line of sight to the dam (refer to Photograph 7.1). Despite the similarly high visual effect of the dam infrastructure, the absence of any line of sight from the dwelling means that the overall visual impact is nil.

Table 7.1 Visual impact assessment – Rural residence: 309 Dungowan Dam Rd

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Moderate	High/moderate	Nil
Operation	Moderate	High/moderate	Nil

Image: EMM / Robert Bird Group

Note: Red line identifies the new dam assets (obscured)

Photograph 7.1 Visualisation – Rural residence, Dungowan Dam Road, Ogunbil, looking south-east

7.1.2 Receptor 2 - Rural residences (various) along Dungowan Dam Road, Ogunbil Road, Nundle Road and Dungowan Creek Road

There are two activities likely to impact rural residences along Dungowan Dam Road, Ogunbil Road, Dungowan Creek Road and Nundle Road.

Dungowan Dam Road will be the site of works associated with both the pipeline and the road upgrade. This section of road is generally between the junction of Dungowan Dam Road with Nowendoc Road and Ogunbil Road, continuing east to the construction site.

Ogunbil Road, Dungowan Creek Road and Nundle Road will be the site of works associated with the pipeline alignment. Nundle Road is only impacted for approximately 100 m. Ogunbil Road is impacted only in the section between the junction with Dungowan Creek Road, and the junction with Dungowan Dam Road.

There are 94 rural residences within the 350 m distance of the pipeline alignment. Along the alignment, the vast majority of rural residences are found within the nominated 350 m distance. Residences further afield tend to have the benefit of intervening vegetation, which obscures views to the pipeline and road and are not considered to be within the area of theoretical visibility for the pipeline infrastructure.

There are nine rural residences identified to be within 350 m of the pipeline and road upgrade locations along the alignment of Dungowan Dam Road. These residences are situated in LCU 1 – Valley floor. The receptors are occupants of the rural residences.

An assessment of visual impact to this receptor is provided below and summarised in Table 7.2.

i Construction

a Pipeline

Rural residences within the 350 m typically have landscaping between the residence and the road, which is also generally the pipeline alignment. The proximity to the pipeline construction area can be as close as 10 m to 15 m in a small number of cases, but generally the distance between the works area and residences will be 30 m or more. An example of a house with landscaping and screening (30 m distance from pipeline) is shown at Photograph 7.2. An example of an unscreened residence (25 m distance from pipeline) is shown at Photograph 7.3 and a screened rural residence at 100 m is shown at Photograph 7.4. One of the closest residences to the pipeline alignment is shown at Photograph 7.5.

The sensitivity of the houses will vary but generally ranks between high and moderate, depending on distance from the pipeline works area. The overall visual effect of the construction works is low, noting that the visual intrusion in viewsheds for residences will be temporary.

The overall visual impact of the pipeline on residences is therefore moderate to low, depending on distance and screening between the residence and the construction works.

b Road upgrades

For the nine residences proximate to the section of Dungowan Dam Road to be upgraded, there is also a moderate degree of filtering by vegetation, although this varies between dwelling locations.

The sensitivity of the houses will vary but generally ranks between high and moderate, depending on distance from the road works area. The overall visual effect of the construction works is low, noting that the visual intrusion in viewsheds for residences will be temporary.

The overall visual impact of the road upgrades on residences is therefore moderate to low, depending on distance and screening between the residence and the construction works.

ii Operation

a Pipeline

During operation the pipeline will be buried and will not be visible except for at or above ground valve structures. Two control vales are located along the pipeline route with one control valve is located approximately 290 m to the north east of a rural residence at 2 Thorntons Road, Ogunbil, and the other located approximately 100 m to the north of a rural residence on Lot 34/DP755338. In both locations the residences are surrounded by or screened by vegetation and separated by Ogunbil Road. Current views includes Ogunbil Road and screening vegetation, as well as farm buildings and paddocks. Motorists using Ogunbil Road are the only other receptors with views to the control valves. These views are transient due to the speed and movement of motorists passing by, the visibility of the structures would integrate into the surrounding landscape.

The sensitivity of the residences is high, due to the close proximity and permanence of the receptor and views. The overall visual effect however is low, noting that the infrastructure is consistent with current buildings and structures in the existing view and impacts will be largely mitigated by existing screening vegetation.

b Road upgrades

The alignment of the current (unsealed) Dungowan Dam Road will not vary greatly when upgraded and the changes to the width or surface are at grade, meaning that there will be little visual prominence in the changes.

The sensitivity of the houses will vary but generally ranks as high-moderate, depending on distance from the road works area. The overall visual effect of the upgraded roads is low. It is also noted that the impact is mitigated in most cases by the presence of screening vegetation.

The overall visual impact of the operational roads on residences is therefore moderate to low, depending on distance and screening between the residence and the construction works.

Table 7.2 Visual impact assessment – Rural residences (various) along Dungowan Dam Road, Ogunbil Road, Nundle Road and Dungowan Creek Road

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Moderate	Moderate – High	Moderate – Low
Operation	Low	Moderate - High	Moderate – Low

Image: Google Street View

Photograph 7.2 Dungowan Creek Road, rural residential dwelling ~30 m to pipeline alignment (screened)

Image: Google Street View

Photograph 7.3 **Dungowan Creek Road, rural residential dwelling ~25 m to pipeline alignment (unscreened)**

Image: Google Street View

Photograph 7.4 **Dungowan Creek Road, rural residential dwelling ~100 m to pipeline alignment (screened)**

Image: Google Street View

Photograph 7.5 Nundle Road, rural residential dwelling ~11 m to pipeline alignment (unscreened)

7.1.3 Receptor 3 - Rural residences (3) on Nowendoc Road and Weabonga Road

There are three residential dwellings within the area of theoretical visibility for the electricity powerline. Two premises are on Nowendoc Road, approximately 300 m north of the junction between Ogunbil Road and Nowendoc Road. The third premises is situated on Weabonga Road, immediately north of the junction with Nowendoc Road, and approximately 5 km north of the Ogunbil Road and Nowendoc Road junction.

These rural residences are situated on the cusp of LCU 1 and LCU 2, meaning that the context is a mix of cleared agricultural land and vegetated ridges. The receptors are the occupants of the residential premises. In all three cases, the proximity to residential receptors is less than 200 m and therefore sensitivity is high.

An assessment of visual impact to this receptor is provided in Table 7.3.

i Construction

The construction phase for the installation of powerlines will not require works compounds or significant stockpiling areas near the residences however an access track is required that may be retained permanently. The brief use of plant to erect power poles is not considered to be materially different from the use of agricultural machinery in the landscape. The construction phase is therefore negligible in visual effect and impact.

ii Operation

There will, however, be a low-moderate impact overall for these three residential receptors during operation. In considering the overall impact, it is also recognised that the installation of the electricity powerline and access track will not require substantial vegetation removal in the areas close to the residences (although some clearing may be required, depending on alignment, in areas away from the residences). Powerlines and associated poles and access tracks are a common feature in the rural landscape and is not considered that the new powerline would represent a substantial change to this setting. The ranking is therefore considered to bias towards low impact, within the low-moderate spectrum.

Table 7.3 Visual impact assessment – Rural residences on Nowendoc Road and Weabonga Road

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Nil	Nil	Nil
Operation	Low	High	Low – Moderate

7.1.4 Receptor 4 - Minor road - Dungowan Dam Road

Self-evidently, upgrades to Dungowan Dam Road will create a visual effect on motorists utilising that minor road but it is noted that this road carries very little traffic. The upgraded section of road is approximately 4.7 km in length.

The pipeline alignment will also broadly align with Dungowan Dam Road albeit offset to one side or the other, and varying from coincidence with the formed road to 150 m away from the formed road. For significant sections of Dungowan Dam Road, the line of sight from the formed road to the construction area for the pipeline will be filtered by roadside vegetation.

The receptors will be drivers and passengers in vehicles. The visual experience will be transitory. An assessment of visual impact to this receptor is provided in Table 7.4.

i Construction

While the construction works will temporarily introduce plant, materials and machinery along the road corridor, and the completed component will render the road to be slightly wider, regraded and potentially sealed, these are not considered materially detrimental to the viewing experience of drivers and passengers. Roadworks and the presence of workers and plant, are a regular experience for anyone travelling via vehicle.

ii Operation

Gravel roads, back roads and remote trails are sometimes promoted as destinations for 4WD enthusiasts. There are discussion threads on some off-road websites, which mention the route from Thunderbolts Way to Nundle or Tamworth along Topdale Road, Nowendoc Road and Ogunbil Road. There is no formal promotion of these roads as a scenic route. The proposed road upgrades do not materially impact the visual experience of anyone seeking the ‘back road’ experience. The impact for motorists on these roads is considered low.

Table 7.4 Visual impact assessment – Dungowan Dam Road

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Low	Low

Table 7.4 Visual impact assessment – Dungowan Dam Road

Project phase	Visual effect	Visual sensitivity	Visual impact
Operation	Low	High	Low

7.1.5 Receptor 5 - Minor roads – Ogunbil Road, Dungowan Creek Road and Nundle Road

These roads all share some proximity to the pipeline alignment and the visual impact will be associated with the construction stage for the pipeline infrastructure. The distance from the pipeline alignment ranges from nil to approximately 900 m.

Nundle Road experiences the least interaction with the pipeline, being only approximately 100 m.

In the western sections of the pipeline, the alignment closely follows Dungowan Creek Road although it can vary from nil distance to approximately 400 m away.

From the junction of Ogunbil Road, Dungowan Creek Road and Woolomin Gap Road, the eastern section of the pipeline between this point and the new Dungowan Dam, the pipeline alignment generally follows the Ogunbil Road alignment but predominantly a short distance away from the formed road, in the range of 10 m to 300 m.

These are all roads that service low levels of traffic. Nundle Road may carry slightly greater volumes and is considered a tourist drive, but the visual intrusion is minimal on this road. The roads are all within LCU 1 – modified lands. Refer to Photograph 7.6.

Noting that the pipeline alignment is frequently not coincidental with the formed road, and often behind screening vegetation, the impact on motorists and passengers is considered low during both construction and operation.

Table 7.5 Visual impact assessment – Ogunbil Road, Dungowan Creek Road and Nundle Road

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Low	Low
Operation	Low	High	Low

Image: Google Street View

Photograph 7.6 Nundle Road

7.1.6 Receptor 6 - Minor roads - Weabonga Road and Nowendoc Road

The installation of electricity powerlines will be visible from Weabonga Road and Nowendoc Road.

A powerline will be installed in proximity to Nowendoc Road, from the junction with Ogunbil Road and extending north for approximately 3.5 km to the junction with Weabonga Road. There is only approximately 400 m of Weabonga Road immediately adjacent to the proposed powerline.

Traffic volumes are likely to be low and roadside powerlines are a common feature of other local roads. There is only a distance of approximately 700 m where the powerline will be situated immediately alongside Nowendoc Road. Generally, the powerline will be set back behind roadside vegetation and therefore viewsheds will be filtered or obscured.

Part of Nowendoc Road adjacent to the powerline is a local heritage item (I264 'Port Stephens Cutting'), recognised for its transport innovation and evidence of convict construction. No heritage sight lines or views are associated with the item. The construction and operation of the powerline will not physically impact the heritage item, and views of the cutting would not be impeded. Visual impacts to the heritage item are low to negligible.

The receptors will be drivers and passengers in vehicles. The visual experience will be transitory.

i Construction

While the construction works will temporarily introduce plant, materials and machinery along the road corridor, and the completed component will render the road to be slightly wider, regraded and potentially sealed, these are not considered materially detrimental to the viewing experience of drivers and passengers. Roadworks and the presence of workers and plant, are a regular experience for anyone travelling via vehicle.

ii Operation

Gravel roads, back roads and remote trails are sometimes promoted as destinations for 4WD enthusiasts. There are discussion threads on some off-road websites which mention the route from Thunderbolts Way to Nundle or Tamworth along Topdale Road, Nowendoc Road and Ogunbil Road. There is no formal promotion of these roads as a scenic route. The proposed road upgrades do not materially impact the visual experience of anyone seeking the 'back road' experience.

The impact for motorists on these roads is considered low.

Table 7.6 Visual impact assessment – Weabonga Road and Nowendoc Road

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Low	Low
Operation	Low	Low	Low

7.1.7 Receptor 7 – Minor road - Pearsons Trail

Pearsons Trail is a forestry access road extending several kilometres from the central region of Nundle State Forest through to the existing Dungowan Dam. At this north-eastern extremity of the forest area, the traffic volume is extremely low. The receptors may include forestry operations staff and hunters, noting that hunting is permitted within the State forest.

One minor road, being Dungowan Dam Road, is (in part) adjacent to the proposed decommissioning works but this road essentially services only the existing dam and Pearsons Trail, and has extremely low traffic volume. While the two trails connect to provide Pearsons Trail a through road option to Dungowan Dam Road, this would be removed once the project is operational and the new Dungowan Dam reaches full supply level, inundating the existing Dungowan Dam Road.

The structural components of the existing dam (to be decommissioned) are shown in Photograph 7.13.

For this section of Pearsons Trail, LCU2 is dominant and there is unlikely to be any significant viewing opportunities due to dense vegetation.

The overall sensitivity of the minor roads is moderate to low (depending on distance) and the visual effect is also ranked low, hence the visual impact is also expected to be low.

The operational stage will be similar to the construction stage impacts.

Table 7.7 Visual impact assessment – Pearsons Trail

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Low	Low
Operation	Low	Low	Low

7.1.8 Receptor 8 - Minor road - Terrible Billy Fire Trail

Terrible Billy Fire Trail is an unsealed access road within Terrible Billy State Forest.

The trail is predominantly situated within LCU2 – Peaks and ridges. It is heavily vegetated but at one point towards the western extent of the fire trail the terrain opens up at a bluff with visibility to the reservoir area and dam infrastructure.

Receptors are forestry workers or occasional recreational users (hunting). Terrible Billy State Forest allows hunting on weekends only.

i Construction

The cleared bluff at Terrible Billy Fire Trail may provide a line of sight to the borrow pits and construction camp, at a distance of approximately 2.0 km and 3.8 km respectively.

The excavated areas for borrow pits and quarries will have a low or moderate effect in an area of low sensitivity. These areas will be below ground level and therefore usually partly obscured by surrounding vegetation. The overall visual impact will be low.

There will be a line of sight from Terrible Billy State Forest to the construction camp but at a distance of approximately 3.5 km, the effect and sensitivity are both low, and hence the visual impact is low.

ii Operation

From the cleared area at an elevation of approximately 965 mAHD at the western extent to Terrible Billy Fire Trail there is visibility to the area of impounded water in the reservoir (at an elevation of approximately 660 mAHD). This is the location at which the most visibility of the proposed body of impounded water can be achieved from a publicly accessible viewpoint.

The images below show the current view to the west from a clearing at the western extent of Terrible Billy Fire Trail (refer to Photograph 7.7) and then an image depicting the same view with the dam at full capacity (refer to Photograph 7.8), and the dam at half capacity (refer to Photograph 7.9).

Additional images below show the current view to the north-west from a clearing at the western extent of Terrible Billy Fire Trail (refer to Photograph 7.10)and then an image depicting the same view with the dam at full capacity and the new Dungowan Dam wall (refer to Photograph 7.11) and the dam at half capacity (refer to Photograph 7.12).

Terrible Billy Fire Trail is, at its closest point, approximately 1 km from the inundated area. This suggests a ranking of moderate/low sensitivity.

The impounded water in the reservoir has a high visual effect and therefore the viewpoint at Terrible Billy Fire Trail (being one point in the overall length of the road) has a high/moderate overall visual impact.

The expected traffic on the southern terminus of Terrible Billy Fire Trail is extremely low and hence the high level of visibility is not seen as a significant visual impact.

Table 7.8 Visual impact assessment – Terrible Billy Fire Trail

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	High	Moderate/Low	Low
Operation	High	Moderate/Low	Low

Image: EMM Consulting

Photograph 7.7 Terrible Billy Fire Trail, looking west, current view

Image: EMM / Robert Bird Group

Photograph 7.8 Terrible Billy Fire Trail, looking west, future view at full dam capacity

Image: EMM / Robert Bird Group

Photograph 7.9 Terrible Billy Fire Trail, looking west, future view at half dam capacity

Image: EMM Consulting

Photograph 7.10 Terrible Billy Fire Trail, looking north-west, current view

Image: EMM / Robert Bird Group

Photograph 7.11 Terrible Billy Fire Trail, looking north-west, future view at full dam capacity

Image: EMM / Robert Bird Group

Photograph 7.12 Terrible Billy Fire Trail, looking north-west, future view at half dam capacity

7.1.9 Receptor 9 - Forestry land

Nundle State Forest covers an area of approximately 13,000 hectares but only a small eastern section of the land is within the area of theoretical visibility. The land is comprised entirely of LCU 2, being heavily vegetated ridges and hilltops.

Terrible Billy State Forest covers an area of approximately 790 hectares, and borders Nundle State Forest.

The receptors are potentially forestry workers or recreational hunters. For Terrible Billy State Forest, hunting permits are restricted to weekends only.

i Construction

Terrible Billy State Forest may have occasional glimpses to construction areas such as the borrow pits and quarries. Again, noting the very low level of visitation and the generally heavily vegetated nature of State forests, the prospect of meaningful view lines, other than from the open bluff on the Terrible Billy Fire Trail (detailed at section 7.1.8), is very limited. The visual impact is rated as low.

ii Operation

For the Terrible Billy State Forest, viewsheds at operational stage will include occasional filtered views to the reservoir and dam infrastructure.

Terrible Billy State Forest has a low level of visitation and the generally heavily vegetated nature of State forests, the prospect of meaningful view lines, other than from the open bluff on the Terrible Billy Fire Trail (detailed at section 7.1.8), is very limited. The visual impact is rated as low.

For consideration of the Nundle State Forest as a receptor, it is noted that the retention of the existing dam at a reduced scale and storage capacity diminishes the size of the upstream reservoir and represents a smaller scale footprint.

This is a low visitation area and heavily vegetated meaning that opportunities to form a view to the existing dam are extremely constrained. The visual impact is low.

Table 7.9 Visual impact assessment – Forestry land

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Moderate.	Low	Low
Operation	Low	Low	Low

Image: EMM Consulting

Photograph 7.13 Existing Dungowan Dam (Nundle State Forest in background)

7.1.10 Receptor 10 - Broadacre rural land

The area of theoretical visibility for both the construction stage and operational stage is predominantly described as LCU2, being heavily vegetated ridges and slopes. There is a relatively small area of LCU1 being the modified valley floor more typically associated with broadacre agricultural production.

The receptors for broadacre rural land would typically be agricultural workers or land owners undertaking activities associated with farming. A typical aspect for broadacre rural land is shown in Photograph 7.14.

i Construction

The construction footprint of the dam itself comprises mostly existing broadacre agricultural land but this land is to be acquired and is therefore not assessed. The main broadacre agricultural land with visibility to the construction sites is to the immediate north-west of the construction area, generally in the vicinity of Dungowan Dam Road.

The construction of the pipeline has a more direct impact on broadacre rural land because most land adjacent to the pipeline alignment is almost exclusively LCU1.

ii Operation

At the operational stage, the dam infrastructure and reservoir have less broadacre rural land within the area of theoretical visibility than was the case during construction. There will be permanent changes to the physical, visual and landscape setting however there is an absence of visual receptors.

Table 7.10 Visual impact assessment – Broadacre rural land

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Low	Low
Operation	Low	Low	Low

Source: Google Street View

Photograph 7.14 Broadacre rural land, Duri-Dungowan Road

7.1.11 Receptor 11 - Dungowan Memorial Hall

Dungowan Memorial Hall is situated adjacent to Ogunbil Road approximately 1.2 km east of the junction with Nundle Road.

The location is within LCU1, being highly modified land in the Dungowan Village precinct.

The building itself is approximately 480 m north of the pipeline (Photograph 7.15) but the local heritage listing of the property refers to the landholding on which it is built, and that parcel of land extends to a point approximately 260 m north of the pipeline alignment.

Visitation to the heritage site would predominately be associated with the hall rather than the land within the lot to the south. The lot supports remnant vegetation in a partly cleared landscape. This means that the receptors associated with the heritage item would mostly be local residents who attend the hall for community functions. Given the distance from the hall to the pipeline (480 m) and the intervening mature trees, the visual impact for hall users would be nil.

In the event that a visitor to the site walked to the southern extent of the heritage land (likely to be a rare occurrence, if at all), the view lines to the pipeline infrastructure would still be filtered by the riparian vegetation along Dungowan Creek, which form the southern perimeter.

Table 7.11 Visual impact assessment – Dungowan Memorial Hall

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Low	Low. At the nearest point of the lot on which the hall is situated, the distance to the pipeline construction alignment is over 250 m. The most likely point at which receptors would be present is the hall and immediate curtilage itself, some 480 m away, negating any visual impact.
Operation	**Nil**	**Nil**	Nil

Source: Google Street View

Photograph 7.15 Dungowan Memorial Hall

7.1.12 Receptor 12 - Ogunbil Brick Shearing Shed and Silo

The Ogunbil Brick Shearing Shed and Silo (Photograph 7.16) are located adjacent to Ogunbil Road, approximately 3.9 km east of the village of Ogunbil (Allawah Road junction).

The setting is characterised as LCU1, being in the cleared paddock of a farm. It is very close (approximately 10 m) to Ogunbil Road and pipeline alignment (15-20 m).

The local heritage item is not, however, known as a destination for visitors, and the most frequent receptors likely to be associated with the heritage item are the owners or workers associated with the farm. It is conceivable that passing motorists may take an interest in the scenic value of the shearing shed and silo in its rural setting, or indeed that a heritage professional may seek to view the item for academic inquiry, but these occurrences are expected to be occasional, at most.

The visual setting for the local heritage item is already a modified landscape and the works associated with the pipeline are not expected to diminish the heritage context. This is generally due to the temporary nature of the construction works and the proposed undergrounding of the pipeline at operational stage. Any valves required along the section of pipeline through the property are proposed at or below ground level and would not detract from the heritage sites landscape setting. As no permanent above-ground elements are proposed to be constructed in the curtilage of the shearing shed and silo, the visual impacts on heritage values will be low.

Table 7.12 Visual impact assessment – Ogunbil Brick Shearing Shed and Silo

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Moderate	Low	Low. The distance to the pipeline construction alignment is close but the temporary nature of the construction, and considering the already modified landscape setting, suggest that the impact will be low.
Operation	**Nil**	**Nil**	Nil

Photograph 7.16 The shearing shed and silo. View north. Source: EMM.

7.1.13 Receptor 13 - Dungowan Station Homestead

Dungowan Station Homestead (ie the dwelling) is located approximately 180 m north of Ogunbil Road, near the junction of Ogunbil Road and Woolomin Gap Road.

The homestead sits within LCU1 and is an established premises with outbuildings and mature landscape plantings on the southern side (ie Ogunbil Road side) of the dwelling. These trees and outbuildings will assist in filtering view lines between the dwelling and the road alignment where the pipeline will be constructed.

The veranda outlook and orientation of the homestead is towards Dungowan Creek, to the north. Refer to Photograph 7.17 and Photograph 7.18. This suggests that the intended outlook for the dwelling was to the north, rather than towards Ogunbil Road where the pipeline infrastructure is proposed.

It is noted that the site may attract visitors for functions and that the woolshed may be converted to a micro-brewery and/or restaurant, both of which suggest periodic visitors to the site. News articles (Northern Daily Leader, 26 February 2019) indicate that if the restaurant or micro-brewery operates at the site, then the viewshed for visitors is, like the homestead, northwards across the lucerne fields and towards Dungowan Creek. This is the direction away from Ogunbil Road. The current events area is also stated to be held “down by the creek” – approximately 300 m north of the pipeline alignment. The construction works for the pipeline will have a temporary disruptive effect on visitors to the heritage building or associated facilities. The sensitivity of restaurant

patrons or other visitors is ameliorated by the arrangement of the site layout to orientate view opportunities northwards.

The Dungowan Station property is not a listed heritage site but has been identified as of potential State significance (EMM 2022c) however only physical impacts to the curtilage of the property are expected. The impact on the heritage setting of the homestead is considered to be low. The curtilage of the homestead is surrounded by specimen trees and there are several operational outbuildings between the homestead and the location of pipeline construction works on Ogunbil Road.

Table 7.13 Visual impact assessment – Dungowan Station Homestead

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Low	Moderate	Low. Although visitors to a venue such as Dungowan Station are considered moderately sensitive to visual effects caused by the construction of a pipeline, the distance (180 m), the intentional orientation of view opportunities away from the pipeline alignment, and the screening by trees and outbuildings, all serve to result in a low impact.
Operation	Nil	Nil	Nil

Source: realestate.com.au

Photograph 7.17 Dungowan Station Homestead, western facade

Source: realestate.com.au

Photograph 7.18 Dungowan Station Homestead, northern facade

7.1.14 Receptor 14 - Travelling Stock Routes / camps

Travelling Stock Reserves (TSRs) within the area of theoretical visibility are all adjacent to the roadways in the area (such as Ogunbil Road and Nundle Road) and therefore tend to be part of LCU 1. For example, Photograph 7.19 shows 'Church' TSR, Photograph 7.20 shows 'Dungowan Station' TSR and Photograph 7.21 shows 'Dungowan' TSR.

Travelling Stock Reserves, being adjacent to the road, will be impacted by the construction of the pipeline which generally follows a similar alignment.

The NSW Travelling Stock Reserves Classification Map indicates that all local TSRs are in Category 3. As stated in the Local Land Services *Travelling Stock Reserves: State-wide Plan of Management* Category 3 TSRs "are rarely if ever used for travelling stock or emergency management".

Further, the Local Land Services *NSW Travelling Stock Reserves State Planning Framework 2016-21* (TSR Planning Framework) states that the management outcome for TSRs with a historic heritage value is to "retain access for travelling stock and recognise historic use". This suggests that receptors will use these as occasional and transient grazing or camping areas. The active uses of TSRs includes movement of stock between properties and markets, short term grazing, apiaries and emergency refugia for livestock. The receptor characterisation is therefore similar to broadacre rural land. The TSR Planning Framework also notes that non-agricultural uses of TSRs include road works stockpiling.

On this basis it is considered that the sensitivity and impact of the TSRs are low.

Table 7.14 Visual impact assessment – Travelling Stock Reserves

Project phase	Visual effect	Visual sensitivity	Visual impact
Construction	Moderate	Low	Low
Operation	Nil	Nil	Nil

Source: Google Street View

Photograph 7.19 Church TSR, Ogunbil Road

Source: Google Street View

Photograph 7.20 'Dungowan Station' TSR, Ogunbil Road

Source: Google Street View

Photograph 7.21 'Dungowan' TSR, Nundle Road

7.2 Cumulative impacts

7.2.1 Local development

A search of the NSW Planning Portal and the Development Application Tracker on the Tamworth Regional Council website – searched for the quarter of April to June 2022 - indicate that there are numerous minor developments proposed (modifications to consents, residential developments, additions and alterations, sheds, etc), but none were identified as being contributors to the visual impact in the localities of the project. The majority of applications are within the Tamworth urban area and surrounds (roughly within a 20 km radius). No applications were identified within the influence of the project footprint.

7.2.2 Regional development

There are no larger scale projects under consideration or recently determined (within 2022 to date) by the Northern Regional Planning Panel. Several determined projects, such as a solar farm and quarry, are generally west of the Tamworth urban area and would not contribute to the cumulative visual impact of the project.

There are not regionally significant developments in the vicinity of the project.

7.2.3 State significant development

State significant projects currently proposed within the Tamworth LGA include the Tamworth Battery Energy Storage System (located near Tamworth, some 25 km north west of the Dungowan Dam project) and the Hills of Gold Wind Farm (located at Hanging Rock, some 18 km south west of the Dungowan Dam project). Due to the distance from the project, cumulative visual impacts are not expected.

7.2.4 Overall cumulative impact

The cumulative visual impact of the project is not materially different to the proposed development itself.

There is negligible development identified as likely to occur in or near the area of the project. Any significant contributors to regional visual impact are generally found in the urban area of Tamworth or to the west of the city.

7.3 Summary of visual impacts

The overall visual impact is classified, according to each project component, in Table 7.15 below. This considers the overall visual effect of the component, the receptors within the area of theoretical visibility, and the impact on those receptors, if any.

Table 7.15 Sensitive receptors and observer locations

Receptors	Receptor type	Potentially visible project elements	Visual impact
Rural residence: 309 Dungowan Dam Road (Lot 1 DP 749796)	Permanent - Residential	Construction stage: Construction camp and compounds, Roads, Pipeline Operational stage: Dam infrastructure, Roads	Nil
Rural residences (various) on Dungowan Dam Road, Ogunbil Road, Dungowan Creek Road and Nundle Road west of the new Dungowan Dam	Permanent - Residential	Construction stage: Pipeline, Roads Operational stage: Roads	Moderate–Low
Rural residences (3) on Nowendoc Road and Weabonga Road	Permanent - Residential	Construction stage: Pipeline, Roads Operational stage: Electricity powerlines, Roads	Construction: Nil Operation: Low–Moderate
Minor road: Dungowan Dam Road	Transient – Roads	Construction stage: Pipeline, Borrow pits and quarries, Construction camp and compounds Operational stage: Dam infrastructure, Reservoir, Roads	Low
Minor roads: Ogunbil Road, Dungowan Creek Road and Nundle Road	Transient – Roads	Construction stage: Pipeline	Low
Minor roads: Weabonga Road, Nowendoc Road Including local heritage item Port Stephens Cutting	Transient – Roads	Operational stage: Electricity powerlines	Low
Minor roads: Pearsons Trail	Transient – Roads	Construction stage: Decommissioning works (existing dam)	Low
Minor roads: Terrible Billy Fire Trail	Transient – Recreational and silviculture operations	Operational stage: Reservoir	Low
Forestry land	Transient – Recreational and silviculture operations	Construction stage: Borrow pits and quarries, Construction camp and compounds, Decommissioning works (existing dam) Operational stage: Dam infrastructure, Reservoir	Low

Table 7.15 Sensitive receptors and observer locations

Receptors	Receptor type	Potentially visible project elements	Visual impact
Broadacre rural land	Transient – Agricultural operations	Construction stage: Pipeline, Roads Operational stage: Electricity powerlines, Roads	Low
Dungowan Memorial Hall	Permanent – heritage	Construction stage: Pipeline	Construction: Low Operation: Nil
Ogunbil Brick Shearing Shed and Silo	Transient – heritage	Construction stage: Pipeline	Construction: Low Operation: Nil
Dungowan Station Homestead (also referred to as Cadell's Dungowan Station)	Permanent – heritage	Construction stage: Pipeline	Construction: Low Operation: Nil
Travelling Stock Reserves	Transient – heritage	Construction stage: Pipeline	Construction: Low Operation: Nil

8 Dark sky considerations

This section provides consideration to the Dark Sky Planning Guideline for the project.

8.1 AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting

AS 4282 was originally written to control the impact of sports lighting on the amenity of surrounding residents but has a much wider scope of application. It was republished in 2019 and includes restrictions for intrinsically dark areas and light emissions to the sky. The standard is not referenced in legislation but is commonly relied upon when formulating conditions of consent and is considered to be a benchmark for reasonable lighting effects.

AS/NZS 4282 standard specifies limits for the vertical illuminance surrounding the project footprint, the upward light and the glare from the luminaires. Although primarily written to limit the impact of light on people, the standard also includes limits relating to astronomy and the environment and, as such, is applicable to the project.

8.2 Designated observatories

The Astronomical Society of Australia publishes a list of designated observatories[7]. These are identified in AS/NZS4248:2019 as observatories that have to be taken into account as part of an assessment. AS/NZS4282:2019 does not recommend additional parameters or limits that should be applied, but simply raises awareness of the observatories.

The nearest major observatories on the list are itemised in Table 8.1 below.

Table 8.1 Major astronomical observatories considered in this assessment

Observatory	Distance from site
Siding Spring Observatory, Coonabarabran	192 km
Mount Stromlo Observatory, Canberra	500 km
Paul Wild Observatory, Narrabri	178 km

There are private and amateur observatories elsewhere in NSW, with the closest facilities being in Bathurst (280 km to the south-west), Ilford (224 km to the south-west), Bucketty (197 km to the south) and Armidale (96 km to the north-east).

8.3 Dark Sky Planning Guideline

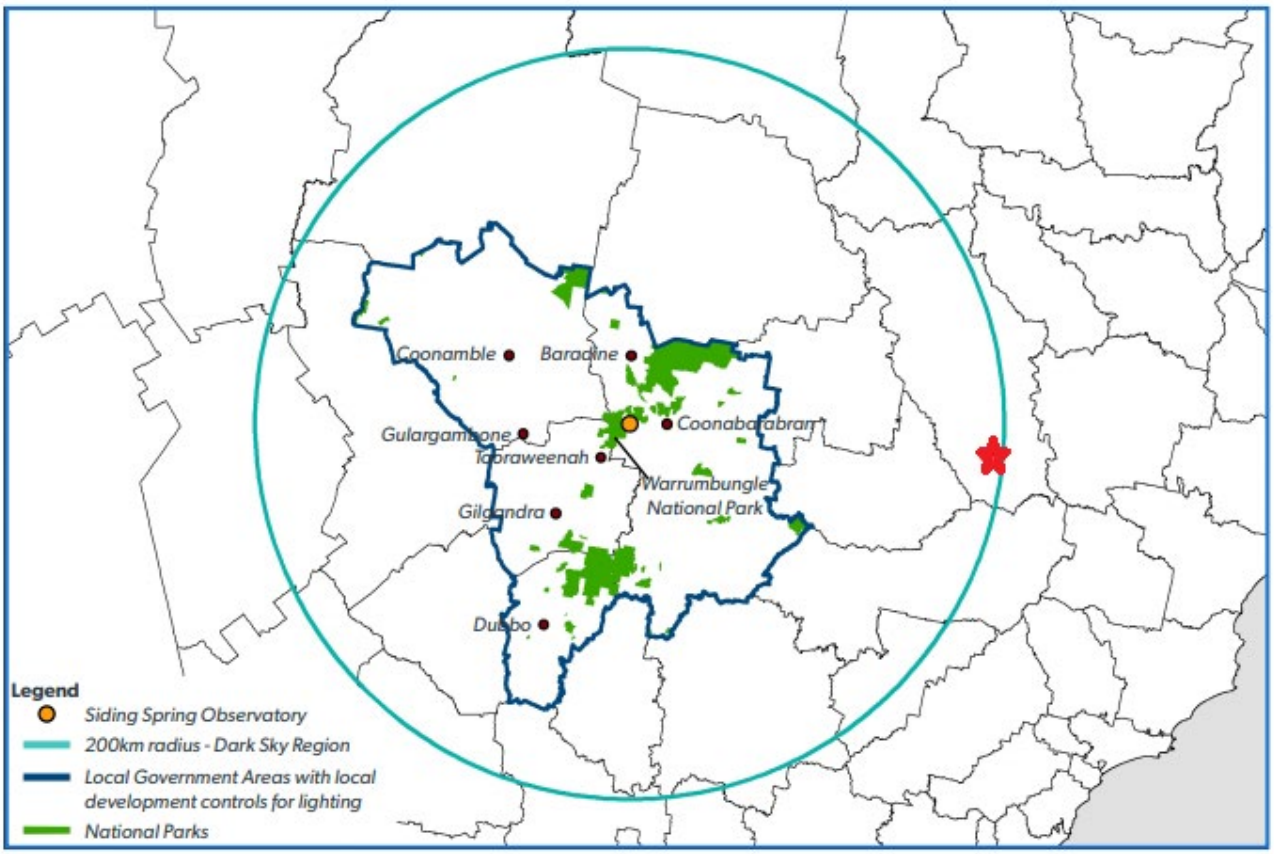
The Dark Sky Planning Guideline (2016) was published by the (then) Department of Planning and Environment as a handbook to inform the assessment of significant development within a 200 km radius of the Siding Spring Observatory (SSO) and to provide technical information on appropriate lighting design.

The project will create linear infrastructure including approximately 33 km of pipeline, running generally in a north-westerly direction from the new Dungowan Dam to a locality known as Dungowan Park.

The north-western extent of the pipeline is 192 km from SSO. There is therefore up to approximately 11 km of the 33 km pipeline within the area subject to the Dark Sky Planning Guideline. The new Dungowan Dam, being approximately 216 km from SSO, is not within the Dark Sky Planning Guideline area.

The approximate location of the pipeline infrastructure area is indicated in Figure 8.1.

[7] The Astronomical Society of Australia *Current List of Designated Observatories*. http://asa.astronomy.org.au/observatories.php



Source: DPIE Dark Sky Planning Guideline (2016) – adapted (red star indicates approximate pipeline infrastructure location)

Figure 8.1 Pipeline location within the dark sky planning area

The angle nominated for the assessment of sky glow is 30 degrees of elevation. The Dungowan pipeline is, at its nearest point, 192 km from the SSO, and at 30 degrees above elevation, this equates to a rise of 1.09 km. Hence the refence point for light effects of the project is 1.09 km above the project site at its nearest point, immediately east of Tamworth.

Assuming the same viewing angle (30 degrees) for the only other major astronomical facility in the Dark Sky area – the Paul Wild Observatory, near Narrabri – the reference point is 1.02 km above the pipeline infrastructure area. The Paul Wild Observatory is 178 km from the nearest point of the pipeline alignment.

8.4 Dark Sky Impact Assessment

Factors which have the potential to impact viewing conditions at astronomical observatories are lighting arrangements and dust generation.

8.4.1 Lighting

Construction will occur generally in accordance with standard construction hours, with extended construction hours as required (such as during spillway concreting which would be undertaken 24 hours a day, seven days a week). Where these standard or extended construction hours occur in darker evening or night-time periods, there will be a need for task lighting. The lighting direction will be towards the ground below the horizontal plane. This will mitigate upward light spill, which can contribute to artificial skyglow.

It is also noted that the urban areas of Tamworth are approximately 20 km to the north-east of the pipeline infrastructure area and the lighting associated with the construction of the pipeline would be absorbed in the glow of normal urban lighting emanating from towns such as Tamworth.

During operation, minimal to negligible lighting is expected as the majority of the pipeline infrastructure is buried and at or above ground infrastructure is not expected to require lighting except for safety lighting during maintenance activities.

8.4.2 Dust

There is negligible opportunity for the construction period to generate dust emissions, which will cause an increase in atmospheric dust. Dust is not generated by the operation of the project. Should the upgrade to Dungowan Dam Road result in sealing the surface, this would minimise the potential for dust generation resulting from operational traffic (though operational traffic volumes are negligible).

Dust mitigation measures during construction will be employed and the activity likely to generate dust is limited to movement of vehicles over unsealed haulage roads, earthworks for the dam, quarry and decommissioning areas and trenching of the pipeline alignment. There may be low level risk of ground level dust dispersion but negligible opportunity for dust to be raised to a height which will influence light scatter or impact observing conditions for any of the designated observatories.

Refer to the Air Quality Impact Assessment (Appended to the EIS) for details of dust generation and management.

9 Management and mitigation

Mitigation and management measures recommended to minimise the visual impacts of the project are provided in Table 9.1 below.

Table 9.1 Environmental management measures for visual impacts

Impact	Ref #	Environmental management measures	Timing
Visual impacts from pipeline and road construction	VIS01	The siting of works compounds for the storage of materials and plant should consider avoiding any location immediately adjacent to residential dwellings, particularly if those premises do not have the advantage of existing screening by landscaping etc.	Construction
Powerline introduced into landscape and views from residences and transient receptors	VIS02	The final alignment of the proposed electricity powerline should be selected to avoid or minimise vegetation clearance.	Construction
Removal of screening and views of borrow pits and quarry areas	VIS03	Retain mature vegetation, as far as operationally feasible, around the perimeter of the excavation areas.	Construction
Light spill from extended construction hours	VIS04	Where extended construction hours occur in darker evening or night-time periods, the task lighting direction will be towards the ground below the horizontal plane.	Construction

10 Conclusion

This VIA has assessed the visual impacts of the new Dungowan Dam and pipeline project and determined that the project would have moderate–low, low and negligible impacts on nearby receptors. The main visual impacts of the project are associated with the temporary construction activities for the pipeline infrastructure and road upgrades, the construction and permanent installation of the powerlines and their impacts on views from rural residences and minor roads. The new Dungowan Dam infrastructure and reservoir would not be visible from any nearby residences and the main views would be from minor roads and forestry land.

Overall, the visual impacts of the project are considered acceptable and can be suitably managed with standard construction management measures. Some additional mitigation measures have been recommended (refer Chapter 9) to further minimise the visual impacts of the project, which could be implemented during detailed design and construction.

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Glossary

Table G.1 Glossary of acoustic terms and abbreviations

Abbreviation or term	Definition
CEMP	Construction environment management plan
Concept design	The design prepared through the project planning phase on which the EIS is based.
Detailed design	The design that would be prepared for construction based upon the concept design.
Downstream	Downstream of the dam wall
DPE	NSW Department of Planning and Environment
Embankment or dam wall	The permanent dam infrastructure that impounds the water.
EMM	EMM Consulting Pty Limited
Full Supply Level (FSL)	The water level when the water storage is at maximum operating level when not affected by flood.
Intake	A structure that provides the controlled intake of water from the reservoir for release downstream.
Left and right abutments	The sides of the valley abutting the dam wall embankment when looking in the downstream direction.
Minimum operating level (MOL)	The minimum water level from which water can be released downstream
Reservoir	The waterbody impounded by the dam wall.
SEARs	Secretary's environmental assessment requirements
Spillway	A structure used to provide the controlled release of surplus flows when the reservoir is full.
Upstream	Upstream of the dam wall

Annexure A

Areas of theoretical visibility

EMM
creating opportunities

A.1 Area of theoretical visibility - Dam infrastructure and reservoir

The conventional limit to 'distant' views is 3 km but having regard to the scale of the proposed infrastructure and reservoir, the approach for the project has been to constrain the overall limit for setting the area of theoretical visibility at a radius of 20 km from the new Dungowan Dam and the reservoir. Three kilometres remains the extent of the area from which the effect of the development could conceivably be evident in any detail[8] but the overall mass of the water body would generally be identifiable as a landscape feature for up to 20 km.

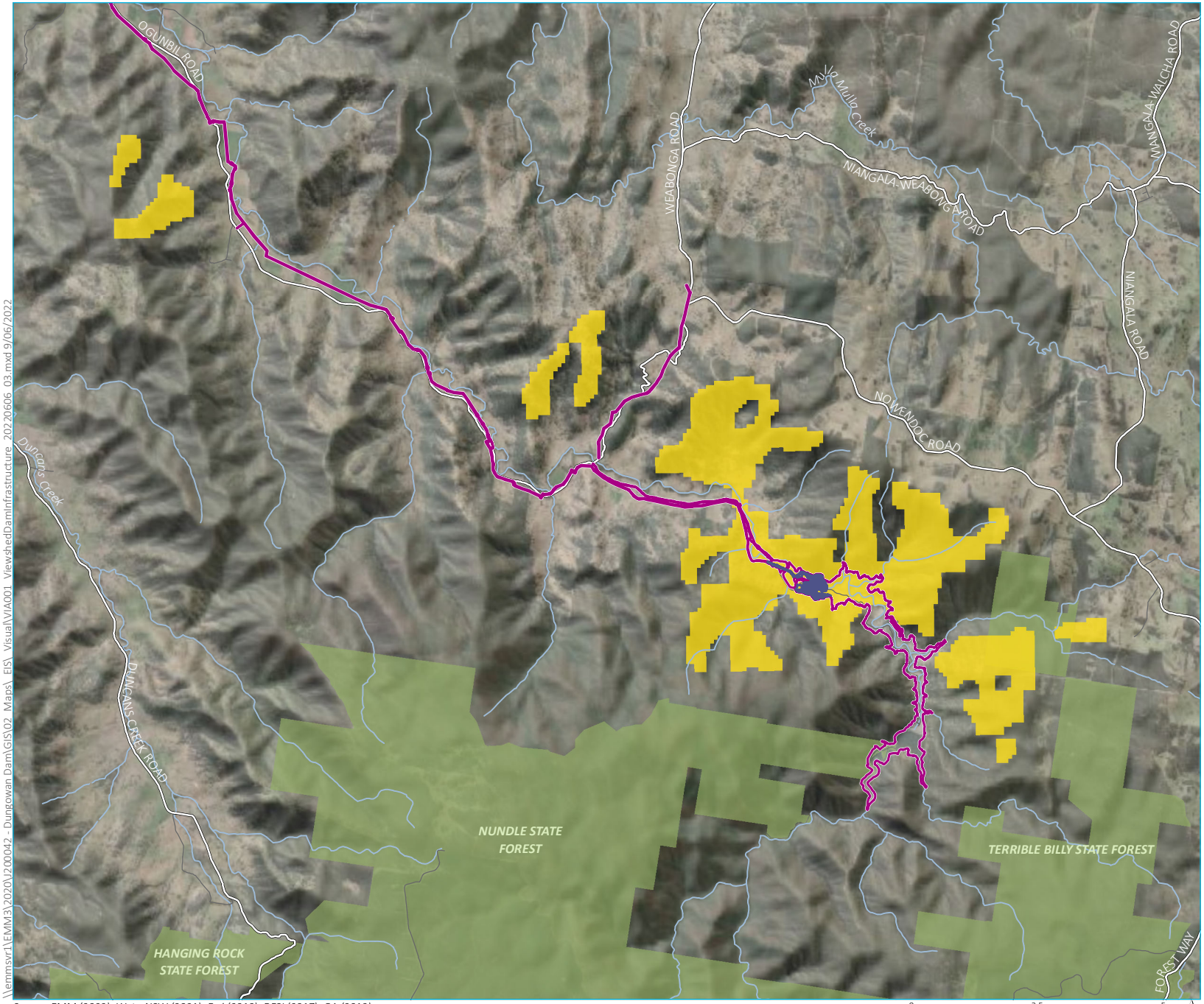
The area of theoretical visibility sets the overall envelope for visual impact consideration. Within the area of theoretical visibility, not all areas will have a line of sight to the project.

The areas of theoretical visibility[9] for the dam infrastructure and the reservoir are provided in Figure A.1 and Figure A.2. The area of theoretical visibility is based on the elevation of the project components – principally the new Dungowan Dam infrastructure and reservoir – and the extent to which topography, such as ridges and hills, limit the locations from which a line of sight to those development features might be possible. Please note that the area of theoretical visibility does not take into account any vegetation or structures such as sheds or water tanks, which might also prevent or limit a line of sight. Those additional factors are considered only after topography has been considered as a feature, which will obscure a line of sight.

Despite the conservative 20 km radius for the area of theoretical visibility, the viewshed remains tightly constrained due to the elevation of the ridges immediately surrounding the new Dungowan Dam. The area of theoretical visibility indicates that the maximum distance for theoretical line of sight is approximately 6 km. These longest view lines are to the north-west and to the south.

[8] Tomko, M, Trautwein, F & Perves, R S (2009) Identification of practically visible spatial objects in natural environments, DOI: 10.1007/978-3-642-00318-9_1 · Source: DBLP

[9] Theoretical visibility figures are based only on topography. They do not consider any other natural or built features, such as trees or buildings, which can influence the actual line of sight. Potential receptor locations which are not within the area of theoretical visibility are not assessed further in the VIA.



KEY

- Project footprint
- Dam infrastructure
- Viewshed dam infrastructure

Existing environment

- Major road
- Minor road
- Named watercourse
- State forest

\\emmsvr1\EMM3\2020\P00042 - Dungowan Dam\GIS\02 Maps\ EIS\ Visual\VIA001 ViewshedDamInfrastructure 20220606 03.mxd 9/06/2022

Source: EMM (2022); WaterNSW (2021); Esri (2019); DFSI (2017); GA (2013)

0 2.5 5 km

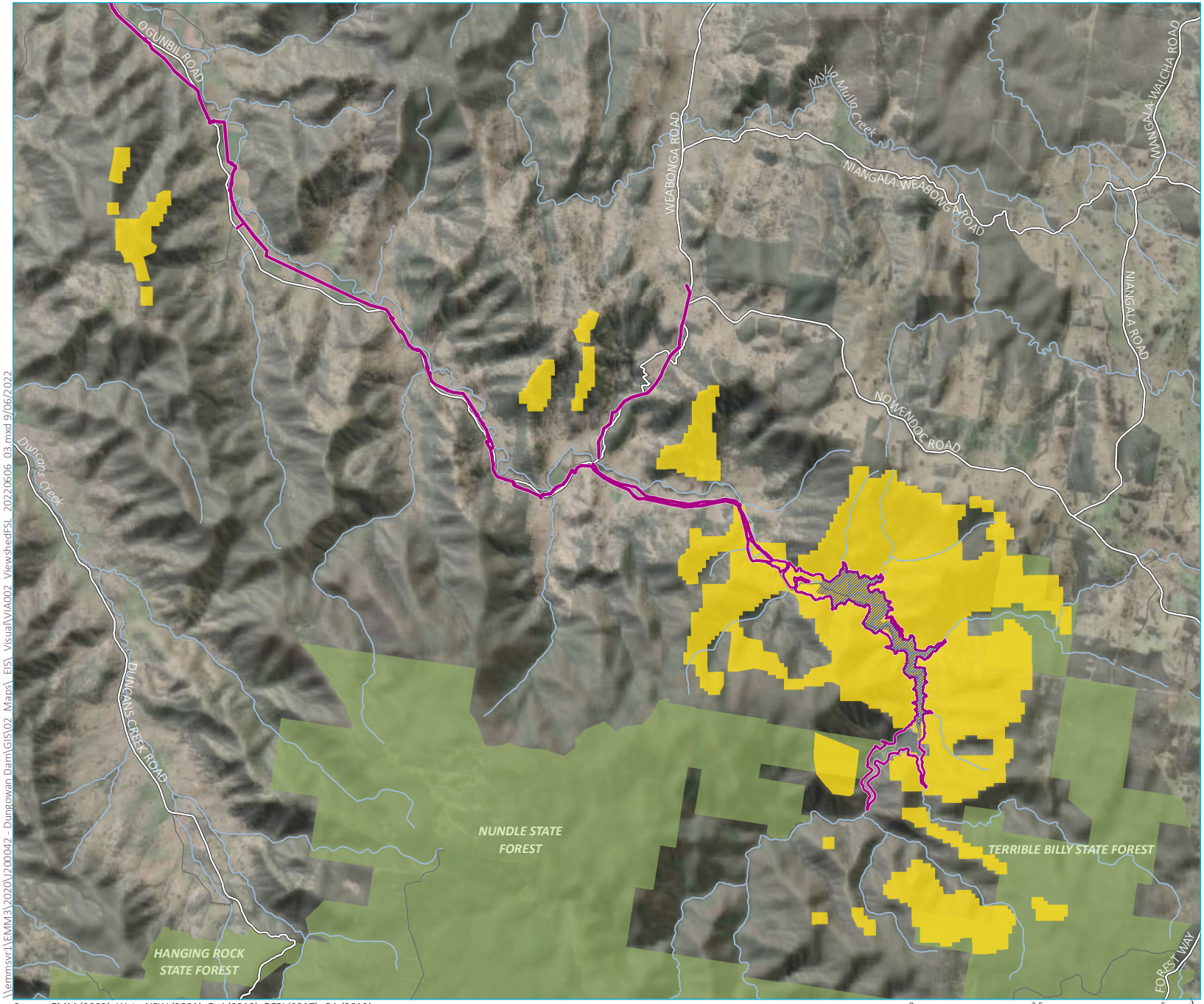
GDA 1994 MGA Zone 56

N

Area of theoretical visibility
- dam infrastructure

Dungowan Dam and pipeline project
Visual impact assessment
Figure A.1

EMM
creating opportunities



\\emmsvr1\EMM3\2020\J200042 - Dungowan Dam\GIS\02 Maps\ EIS\ Visual\VIA002 ViewshedFSL 20220606 03.mxd 9/06/2022

Source: EMM (2022); WaterNSW (2021); Esri (2019); DFSI (2017); GA (2013)

Area of theoretical visibility
- reservoir

Dungowan Dam and pipeline project
Visual impact assessment
Figure A.2

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A.2 Area of theoretical visibility - Linear infrastructure

A.2.1 Pipeline

The pipeline infrastructure is to be installed underground and therefore the visual impacts of the pipeline are largely limited to the construction phase when there will be materials, plant and equipment in place temporarily. Some above-ground valve infrastructure will be required for operation however these are small, discrete structures with the exception of two PRVs comprising a valve housed within a shed-type structure.

The linear nature of the pipeline does not lend itself to a radially defined catchment. Rather, the viewshed for the pipeline is defined as being a ribbon of land within 350 m either side of the pipeline alignment. The selection of 350 m in defining the area of theoretical visibility was based on the pattern of local rural residential development which, as a rule of thumb, is typically within this distance of the road and pipeline alignment or, if more distant, is often visually separated by intervening vegetation.

On this basis, 94 rural residences are within the area of theoretical visibility of the pipeline infrastructure.

A.2.2 Road upgrades

The road upgrades include the widening of Dungowan Dam Road from Ogunbil Road to the new Dungowan Dam access road to facilitate the safe use by construction vehicles and local residents. The road upgrade would involve widening to 8 m where practical, or alternatively the construction of pullout areas to allow vehicles to pull over and give way. The road may also be re-sheeted to minimise dust and damage to the road.

These changes are 'at grade' and the likely range of visibility is limited to 350 m either side of the Dungowan Dam Road. The choice of 350 m as an area of theoretical visibility was made for reasons the same as the pipeline infrastructure assessment.

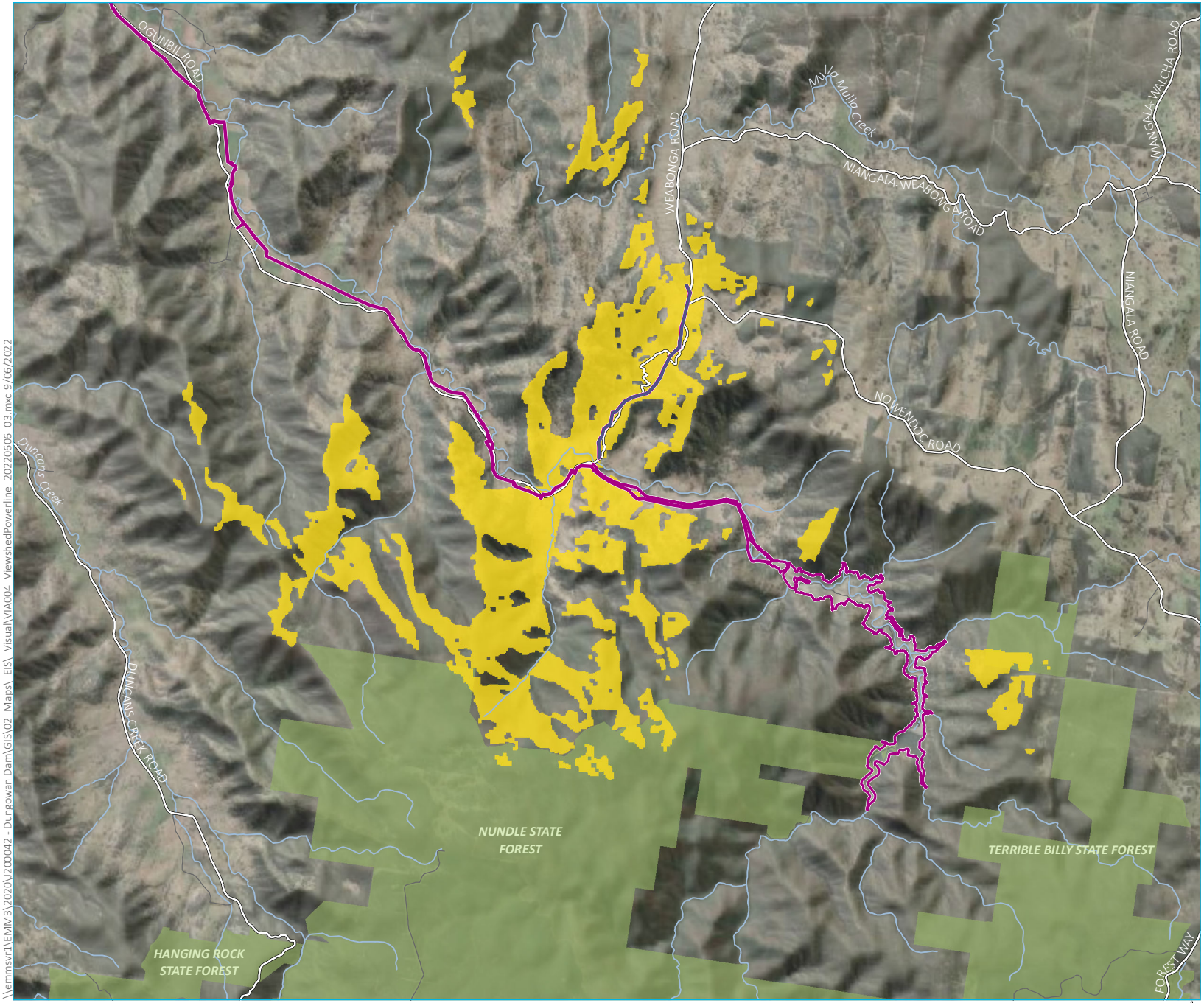
A.2.3 Electricity powerline

In setting the area of theoretical visibility for the powerlines, there are two visual sub-components to consider – the structural features (poles, wires) and the clearing zone required to achieve the vegetation control requirements.

For the purposes of visual assessment it is assumed that the poles will be timber monopoles and that the clearing zone will be up to 20 m (generally 10 m either side of the conductor lines). It is noted that the clearing zone can vary depending on a range of factors, including the voltage, the length of the span, the section of the span, and whether the land is bush fire prone. As a conservative measure, it is assumed that trees will be removed from the 20 m corridor.

The modelled area of theoretical visibility is shown on Figure A.3. However, the site inspection confirms vegetation will likely obscure views to a substantial portion of the powerline and as such the modelled area is considered highly conservative. Given this, it is appropriate to adopt a more reasonable viewshed for assessment. Therefore, a nominal distance set for the area of theoretical visibility is 500 m.

The rational for the selection of this distance is that although the clearing zone is assumed to be a 20 m strip aligned with the conductor lines, the landscape through which the lines are proposed to be established is predominantly cleared and partly cleared, including road corridors. The clearing of trees, where required, would retain the existing landscape character and any discernible difference would be limited to close range viewing. The main visual component is therefore the poles and wires, for which a 500 m area of theoretical visibility is considered appropriate and which allows key receptors to be considered.



KEY

- Project footprint
- Powerline
- Viewshed powerline

Existing environment

- Major road
- Minor road
- Named watercourse
- State forest

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Source: EMM (2022); WaterNSW (2021); Esri (2019); DFSI (2017); GA (2013)

0 2.5 5 km

GDA 1994 MGA Zone 56

N

Area of theoretical visibility
- powerline

Dungowan Dam and pipeline project
Visual impact assessment
Figure A.3

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A.3 Area of theoretical visibility - Borrow and quarry areas

The proposed construction of the new Dungowan Dam is likely to require the establishment of up to four borrow areas for low permeability material such as silt and clay. This would be excavated and stockpiled before transporting to the site of the new Dungowan Dam embankment. There are also two quarries proposed to source rock aggregate. The quarries include haul roads which mostly utilise existing access roads.

The sites are likely to be active for a period of approximately two years and all sites are within the area proposed for future inundation. The 19-hectare area of disturbance likely to be associated with these areas – being approximately 11.7 hectares for borrow pits and 7.3 hectares for the quarries – warrants an application of a standard 3 km area of theoretical visibility.

A.4 Area of theoretical visibility - Construction camp and compounds

For the construction camp and compounds this VIA will use the conventional standard of a 3 km radius to establish the area of theoretical visibility. This combined area is approximately 12.5 hectares.

A.5 Area of theoretical visibility - Decommissioning works

The existing Dungowan Dam is proposed to be decommissioned and would involve a full height breach through the existing embankment. The visual considerations in setting the study area are therefore the removal of the embankment and impounded water and rehabilitation of the former inundation area including a profiled spoil emplacement area.

An area of 1 km radius from the existing dam is therefore set as the area of theoretical visibility.

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