APPENDIX

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DUNGOWAN DAM AND PIPELINE EIS

Land Use Assessment

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Tremain Ivey Advisory
Agricultural Consultants

Land Use Assessment

Dungowan Dam and pipeline project

Prepared for Water Infrastructure NSW

28 September 2022

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Land Use Assessment

Client

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Contents

Executive summary 5

Acronyms and abbreviations 7

1 Introduction 9
1.1 The project 9
1.2 Project location 9
1.3 Purpose of this report 13

2 Description of the project 15
2.1 Project overview 15

3 Legislation and policy context 18
3.1 Legislation 18

4 Methodology 20
4.1 Land use assessment 20
4.2 Biosecurity 22

5 Existing environment 24
5.1 General description 24
5.2 Land use and zoning 32
5.3 Land and soil capability 35
5.4 Other measures of land capability 37
5.5 Agricultural productivity 40

6 Assessment of construction impacts 43
6.1 Social Impact Assessment Survey 43
6.2 Impacts on land use 43
6.3 Consistency with Zoning Objectives 49
6.4 Stock routes and TSRs 49
6.5 Crown Land 49

7 Assessment of operational impacts 51
7.1 Social Impact Assessment Survey 51
7.2 Impacts on land use 51

8 Assessment of cumulative impacts 55

9 Mitigation measures 56

10 Conclusion 59

11 References 60

Tables

Table 1.1 Relevant matters raised in SEARs 13
Table 2.1 Overview of the project 15
Table 5.1 Summary of rainfall records 25
Table 5.2 Summary of temperature records 26
Table 5.3 Summary of land use in the project area 33
Table 5.4 Summary of land and soil capability 37
Table 5.5 Land use on farms 2015-16 40
Table 5.6 Livestock numbers 40
Table 5.7 Gross value of agricultural production 41
Table 9.1 Mitigation measures – agriculture 56

Figures

Figure 1.1: Regional setting 10
Figure 1.2: Project footprint 12
Figure 2.1: Project overview 17
Figure 4.1: Property owner interviews for the assessment 21
Figure 5.1: Inherent soil fertility 29
Figure 5.2: Land use 34
Figure 5.3: Land and soil capability 39

Attachments

Attachment 1 Statistical Area Map 63

Executive summary

Background

This land use assessment has been prepared to accompany an application and supporting Environmental Impact Statement (EIS) for the Dungowan Dam and pipeline project. 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 32 km 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).

Methodology

The methodology for the land use assessment included the following:

- review of the legislation and policy context for assessing agricultural impacts;
- landowner consultations and property inspections;
- analysis and description of the existing environment based on statistics, spatial data, satellite images, property inspections and consultations;
- assessment of impacts on agriculture (including biosecurity impacts) based on satellite images, property inspections, consultations and professional knowledge of agricultural industries and the project area; and
- provision of mitigation and management measures, based on property inspections, consultations, design information and professional knowledge.

Existing environment

General

The project footprint traverses a landscape of flat to gently sloping terrain, with a surrounding area which includes some steep to very steep land.

Rainfall in the project area has an average annual total of ranging from approximately 740 to 960 millimetres depending mainly on altitude, with a strong summer dominance.

Soils of the project area range from high and moderately high inherent fertility soils on the relatively flat area around Dungowan Creek, to low or moderately low fertility on the surrounding slopes.

Similarly, Land and Soil Capability (LSC) ranges from class 2 (very high capability land) near Dungowan Creek, to class 7 (very low capability land), which dominates the surrounding steep slopes.

Land use & agricultural productivity

Agricultural land uses dominate the project footprint. Livestock grazing and cropping together comprise about 87 per cent of the pipeline footprint with the majority being used for grazing livestock. There is also a significant area of irrigated cropping. The operational footprint of the dam has been purchased by Tamworth Regional Council and is not currently used for agriculture or any other commercial activity. Approximately 63 per cent of the operational footprint was previously used for agriculture.

The total gross value of agricultural production across the Tamworth Region in 2015-16 was equivalent to $387 per hectare. However, this varies from approximately $17,200 per hectare for horticulture production and $1,530 per hectare for hay and silage, to $425 per hectare for

broadacre cropping and $369 per hectare for grazing production. This is indicative of the productivity in the project area.

Impact assessment

In most cases the potential and expected impacts are greater in the construction phase than the operational phase due to greater activity and a larger impact footprint.

Loss of Land Use

The potential impact of any temporary or permanent loss of land use caused by the project would be minor due to the relatively small area removed from production and the limited duration of pipeline construction activities.

The project footprint would cover a small fraction of the productive land in the Tamworth Region, and the impacts of the project on existing land uses would be minimal. Therefore, the project would be consistent with the objects of the *Tamworth Regional Local Environmental Plan 2010.*

It is understood that the land which encompasses the operational footprint of the dam is not currently used for agriculture or any other commercial activity. Therefore, based on the current land use, the impact of the permanent land use loss of the operational footprint of the dam is likely to be negligible.

Biosecurity

The potential spread of weeds by vehicles, machinery, personnel, soil movements or water movements is the highest priority biosecurity risk associated with the construction of the project.

Other potential impacts

Other potential impacts include the crop and pasture damage, temporarily restricted movements, livestock misadventure, disruption to grazing, and fire risks. However, the impacts, if any, are expected to be relatively small and would have minor effect on productivity.

Mitigation and management measures

The mitigation measures for the construction and operation phases of the project are summarised in section 9. Landowner consultation, procedures to minimise disruption and risks, effective rehabilitation, good biosecurity controls and prompt repair of any damage are important aspects of the mitigation measures.

Acronyms and abbreviations

ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
ALC	Agricultural Land Classification system (see Hulme et al 2002)
ANCOLD	Australian National Committee on Large Dams Incorporated
BOM	Bureau of Meteorology.
BSAL	biophysical strategic agricultural land.
Commonwealth	Reference to Commonwealth as an entity such as Commonwealth Government or Commonwealth land.
construction footprint	Those areas used for construction of ancillary facilities and associated clearing and other activities required to build the new dam and pipeline.
DAWE	(Commonwealth) Department of Agriculture, Water and the Environment
downstream	Relative to the dam wall.
DPE	NSW Department of Planning and Environment.
DPI	(NSW) Department of Primary Industries.
DPIE	(NSW) Department of Planning, Industry and Environment (formerly DPE).
EIS	environmental impact statement
EP&A Act	(NSW) *Environmental Planning and Assessment Act 1979*
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
FFDI	Forest fire danger index
FSL	Full supply level for the project. This area would be inundated at full supply.
GL	gigalitre
IAL	important agricultural land.
inundation area	the area defined by the proposed full supply level (FSL) for the project.
LEP	Local environment plan
LGA	Local government area
LLS	Local Land Services – A NSW Government agency.

LSC	Land and Soil Capability Assessment Scheme (see OEH 2012)
LUA	Land use assessment for the project – this report.
ML	megalitre
NSW	New South Wales
OEH	former (NSW) Office of Environment and Heritage.
OJD	ovine Johne's disease
operational footprint	The area retained by permanent infrastructure needed to operate the new dam and pipeline including the dam inundation area.
pipeline easement	A 20 metre wide area surrounding and including the pipeline, which would be a legal 'right of way' and allows for ongoing access and maintenance of the pipeline and would be acquired from landholders.
PMPf	probable maximum precipitation flood
PMF	probable maximum flood
project area	A broader area allowing for assessment of potential indirect impacts. This has been defined as a 10 km area around the project footprint.
project flood extent	An area above the proposed FSL to the level of a probable maximum flood (PMF) event that will be infrequently inundated during operation;
project footprint	Area where direct impacts may be experienced during construction and/or operation.
(the) project	The project is known as 'Dungowan Dam and pipeline'.
RL	Reduced level.
Primary Production SEPP	*State Environmental Planning Policy (Primary Production) 2021*
SEARs	Secretary's environmental assessment requirements
SEPP	State Environmental Planning Policy
stock units	In this assessment, one sheep or goat is equated to one stock unit and cattle are equated to ten stock units each.
Tamworth Region	The part of Tamworth Regional LGA outside the Tamworth city area and surrounds. ABS region code: 110041205.
TIA	Tremain Ivey Advisory.
upstream	Relative to the dam wall.
WTP	water treatment plant.

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 land use assessment 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

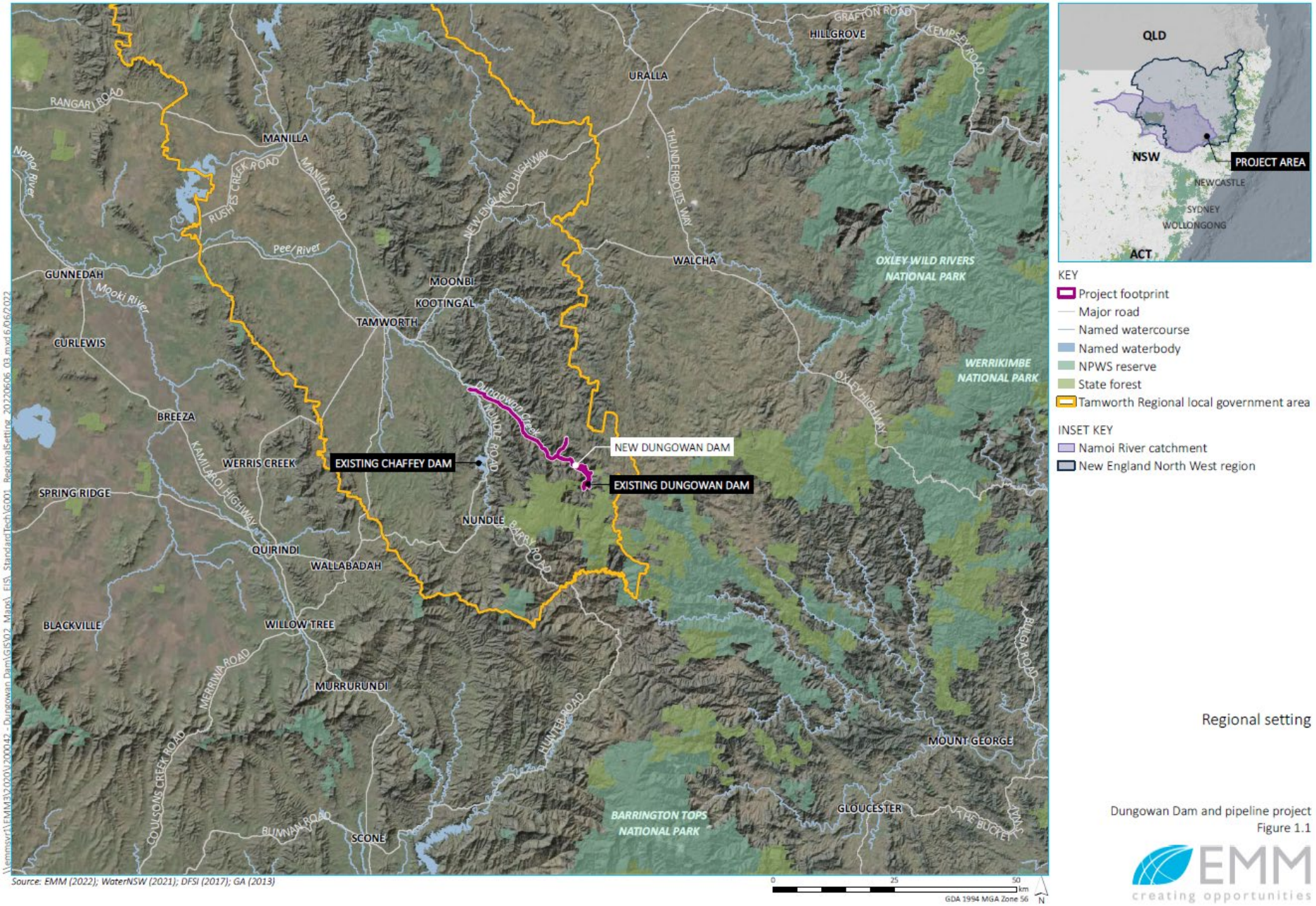
The project is located in the Tamworth Regional local government area (LGA), the New England Tablelands bioregion and part of the New England and North West region of NSW, west of the Great Dividing Range (DPE 2017). The New England and North West region is home to approximately 186,900 people and has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

Figure 1.1: Regional setting



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.

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 2022c) 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.

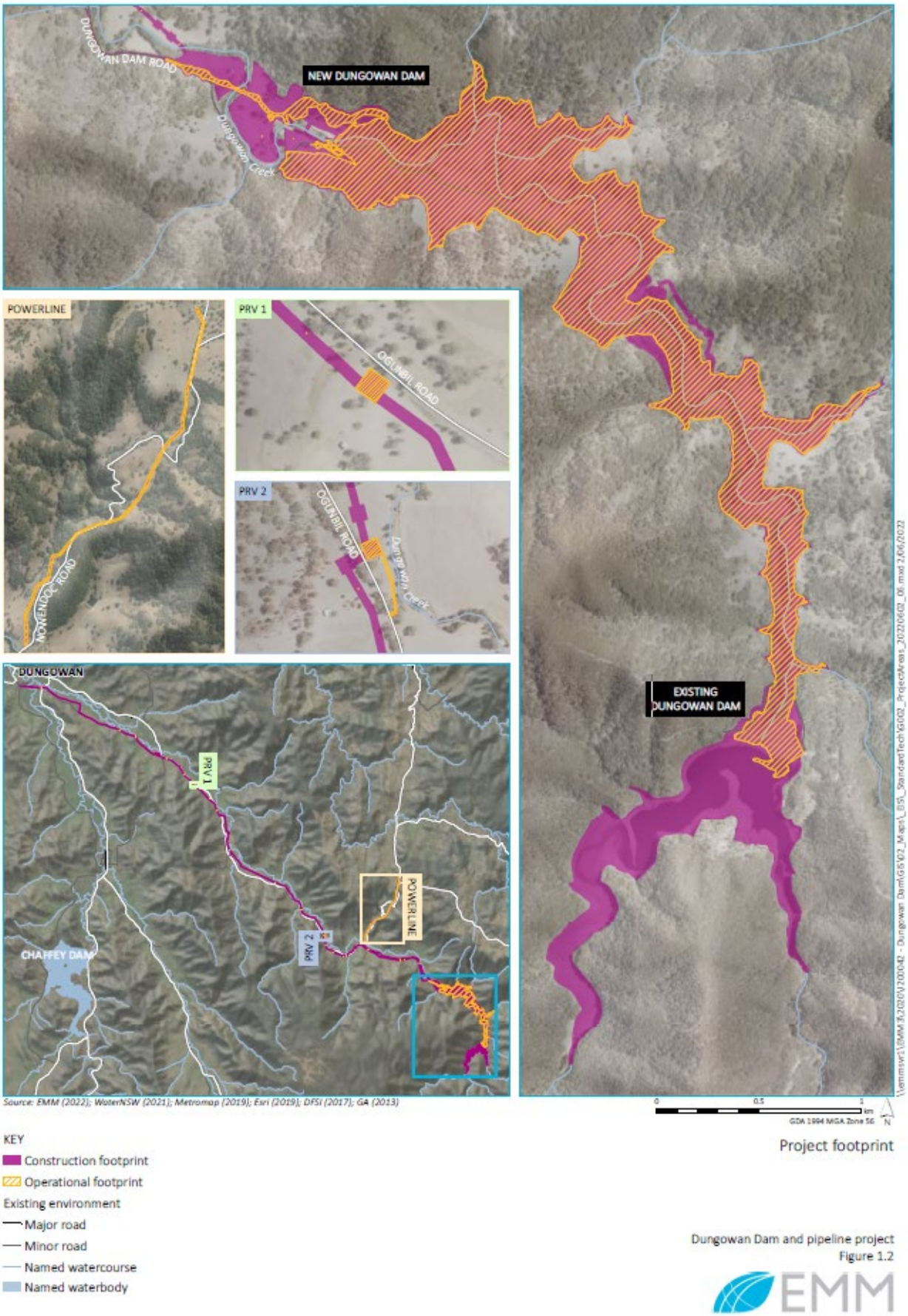
1.2.2 Land use assessment study area

The land use assessment focuses on impacts within the construction and operational footprints. The discussion of impacts presented further divides the construction footprint into the following:

- Pipeline footprint: the portion of the construction footprint associated with the pipeline construction.
- Other construction footprint: all other sections of the construction footprint not associated with pipeline construction.

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

Figure 1.2: Project footprint



1.3 Purpose of this report

This land use assessment supports the EIS for the project. It documents the land use assessment methods and results, identifies and assesses the potential impacts of the project in relation to land use, and describes mitigation and management measures to avoid and minimise these impacts.

The specific objectives of this assessment are to:

- describe the existing land uses within the project area and project footprint;
- describe the existing environment under which the current land uses operate;
- identify and assess the potential direct and indirect impacts of construction and operation of the project on land use; and
- provide mitigation measures to reduce the project impacts wherever possible.

As the dominant land use in the project area and project footprint are agricultural enterprises, the assessment has an emphasis on the impacts on agriculture.

1.3.1 Assessment guidelines and requirements

This land use assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for the Dungowan Dam and pipeline project, as well as relevant government assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

The SEARs must be addressed in the EIS. Table 1.1 lists the matters relevant to this assessment and where they are addressed in this report.

Table 1.1
Relevant matters raised in SEARs

Requirement	Chapter and section addressed
Key Issue: Social 58. Assesses impacts to agricultural businesses in the area during construction and operation of the project, including farmland and farm infrastructure, ancillary business activities (such as farm tourism and direct sales) and road access.	Section 6.2, Section 7.2 and Chapter 8
74. The proponent must assess potential impacts to crown lands and provide evidence of consultation with DPIE Crown Lands	Section 6.5

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.

The SEARs refer to environmental planning instruments, policies, guidelines and plans that may be relevant to the land use assessment. These have been reviewed. In addition, policies

and guidelines at the NSW Planning Portal[1] and the EPBC Act publications and resources site[2] are relevant to this project.

Documents of relevance at these locations are:

- New England North West regional plan 2036 (DPE 2017)
- The land and soil capability assessment scheme (OEH 2012)
- Agricultural land use mapping resources in NSW (Squires 2017).
- Interim protocol for site verification and mapping of biophysical strategic agricultural land (OEH 2013)

The DPI document “A guideline to identifying important agricultural lands in NSW" (DPI 2017) was also referred to in preparing this report.

Some guidelines provided specific guidance in relation to the assessment of agricultural impacts (for example, use of the weed and pest animal management plans in the biosecurity assessment). Where appropriate, these guidelines have been referenced in the relevant sections.

1.3.2 Other relevant reports

This land use assessment has been prepared with reference to other technical reports that were prepared as part of the Dungowan Dam and pipeline project EIS. The other relevant reports referenced in this assessment are listed below.

- Air Quality and Greenhouse Gas Impact Assessment (EMM 2022b) – Appended to the EIS.
- Bushfire Risk Assessment (BlackAsh Bushfire Consulting 2022) – Appended to the EIS.
- Climate Change Risk and Adaptation Report (Edge Environment 2022) – Appended to the EIS.
- Social Impact Assessment (EMM 2022c) – Appended to the EIS.
- Lands, Soils and Erosion Assessment (EMM 2022d) – Appended to the EIS.
- Surface Water Assessment (EMM 2022e) – Appended to the EIS.
- Traffic Impact Assessment (EMM 2022f) – Appended to the EIS.

[1] planningportal.nsw.gov.au/major-projects/assessments/policies-andguidelines.

[2] environment.gov.au/epbc/publications#assessments

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

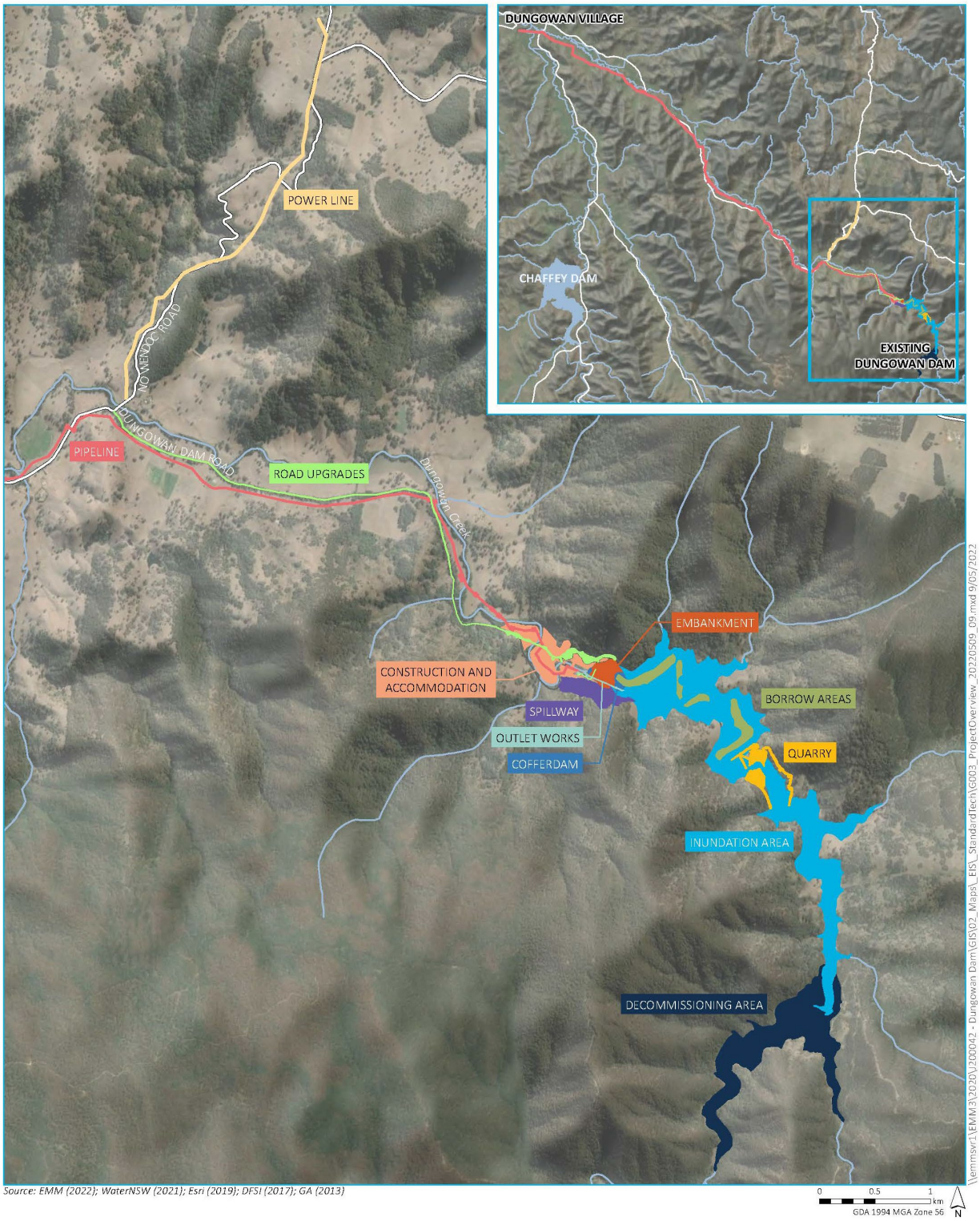
Water Infrastructure NSW proposes to build a new dam at Dungowan (new Dungowan Dam) about 3.5 km downstream of the existing Dungowan Dam and an enlarged delivery pipeline from the new Dungowan Dam outlet to the tie in point to the existing pipeline from Dungowan Showground to the Calala WTP. The existing 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 and 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 approximately 58 m and a dam crest length of approximately 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 per 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 per 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

Project element	Summary of the project
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.
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.

Figure 2.1: Project overview



3 Legislation and policy context

3.1 Legislation

The project is subject to environmental assessment under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Other legislation specific to the land use assessment are the *Biosecurity Act 2015,* the *Soil Conservation Act 1938* and the *State Environmental Planning Policy (Primary Production) 2021* (Primary Production SEPP).

3.1.1 Biosecurity Act

The NSW *Biosecurity Act 2015* (Biosecurity Act) came into effect on 1 July 2017 and complements the Federal *Biosecurity Act 2015*. The primary objective of the Biosecurity Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks. The Biosecurity Act is tenure neutral, that is, it applies to all lands in NSW, both public and private tenure.

The Biosecurity Act *defines key concepts such as biosecurity matter, carrier, biosecurity impact, biosecurity risk and pests and* specifies a wide range of prohibited matter including pests and diseases of plants and animals.

Under the Biosecurity Act, the responsibility for biosecurity risk is shared among the government, industry and the community. Specifically, the Act established *a general biosecurity duty*:

> *General Biosecurity Duty: 'Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.'*

The NSW Department of Primary Industries (DPI) holds the primary responsibility for management of biosecurity under the Act, ensuring the legislative and policy settings support best practice management of biosecurity risks. In addition, DPI works with other jurisdictions to prevent, prepare for, respond to and recover from biosecurity incursions and incidents. DPI works with a range of partners in the management of biosecurity. Significant partners include; Local Land Services (LLS)[1], local government, and industry groups (DPI 2013).

Regional biosecurity strategies developed by DPI and LLS covering the project impact site include the following:

- NSW Invasive Species Plan 2018-2021 (DPI 2018a);
- North West Regional Strategic Weed Management Plan 2017-2022 (North West LLS 2017); and
- North West Regional Strategic Pest Animal Management Plan 2018-2023 (North West LLS 2018).

The above strategies are considered in sections 6.2.6, 6.2.7, 6.2, 7.2.5, and 9 of this report.

3.1.2 Soil Conservation Act 1938

The *Soil Conservation Act 1938* makes provisions for the conservation of soil resources and farm water resources, and for the mitigation of erosion.

[1] lls.nsw.gov.au/

The Act enables the Soil Conservation Commissioner to issue notices to owners or occupiers aimed at preventing soil erosion or land degradation. The notices may require the owners or occupiers to refrain actions such as the clearing of land, or may require the adoption of measures to prevent erosion.

It also enables areas to be designated as "areas of erosion hazard". Landholders in these areas are urged to reach agreements for the completion of prescribed soil conservation measures. Failure to enter into an agreement can result in a notice being issued, similar to above.

3.1.3 State Environmental Planning Policy (Primary Production) 2021

The

State Environmental Planning Policy (Primary Production) 2021 (Primary Production SEPP) include the following relevant aims of the policy:

(a) to facilitate the orderly economic use and development of lands for primary production,

(b) to reduce land use conflict and sterilisation of rural land by balancing primary production, residential development and the protection of native vegetation, biodiversity and water resources,

(c) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,

(d) to encourage sustainable agriculture, including sustainable aquaculture,

Part 2.2 deals with State significant agricultural land within which clause 2.7 states that *"the objects of this Part are as follows—*

(a) to identify State significant agricultural land and to provide for the carrying out of development on that land,

(b) to provide for the protection of agricultural land—

(i) that is of State or regional agricultural significance, and

(ii) that may be subject to demand for uses that are not compatible with agriculture, and

(iii) if the protection will result in a public benefit.

Clause 2.8 states that land is State significant agricultural land if it is listed in schedule 1 of the Primary Production SEPP. However, schedule 1 does not list any State significant agricultural land at present.

4 Methodology

The methodology for this land use assessment has been designed to meet the requirements of the SEARs (section 1.3.1).

4.1 Land use assessment

4.1.1 Landowner consultation and site inspections

Landowner consultation and property inspections occurred on 29 and 30 October 2020. These were undertaken by Peter Tremain of Tremain Ivey Advisory in the company of Samantha Ezzy of EMM Consulting.

No interviews were undertaken in relation to the land owned by Tamworth Regional Council on and around the operational footprint. However, this area was inspected. The focus of the interviews and inspections was on private properties on the pipeline footprint.

Of the privately owned agricultural properties directly affected by the project footprint, face to face interviews were undertaken by Peter Tremain with the owners of six properties, and their properties were inspected. Samantha Ezzy obtained the required information from a seventh owner in a face to face interview. This property was inspected from the roadside. The properties were chosen to give a range of geographical locations, project impacts, and types of agricultural enterprises within the project area. The property locations are shown in Figure 4.1.

Five of the seven properties have river flats, other arable land and steeper non-arable grazing land. Three of these properties undertake irrigation on their river flats producing crops such as lucerne hay, cereal grains, forage and cereal hay. The remaining two properties have no river flats and consist mainly of non-arable grazing land with some arable land.

Dryland cropping on the inspected properties included cereals and lucerne for hay, and winter cereals for fodder and grain. Grazing enterprises are based on both introduced and native pastures, and fodder crops such as wheat and oats. Cattle and/or sheep were run across the inspected properties. Other enterprises included free range egg production, a wedding venue and tourist accommodation.

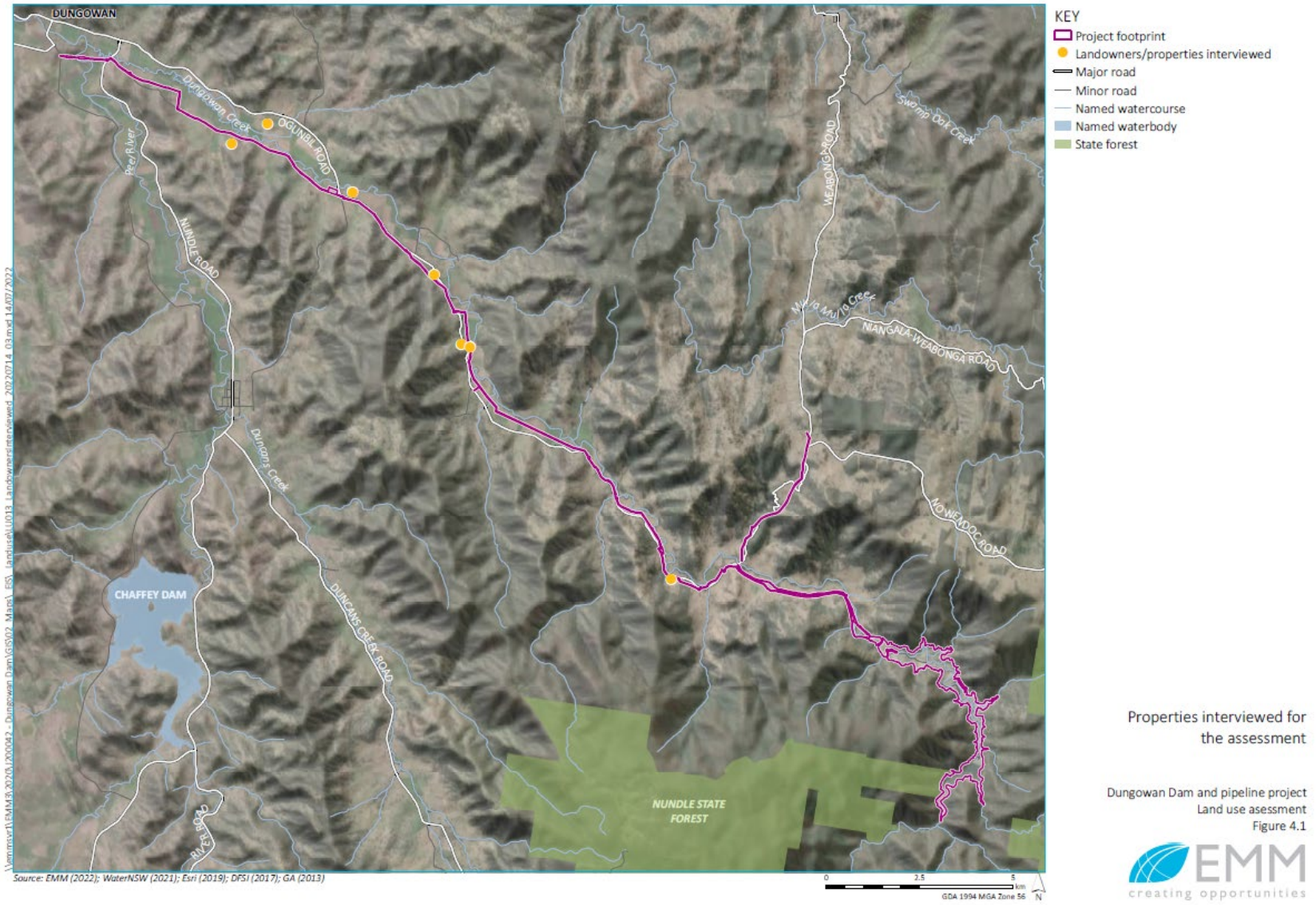
All properties have both the existing pipeline and the footprint of the proposed new pipeline passing through parts of their property. The properties extended from approximately six to 24 kilometres from the proposed dam wall (in a straight line).

Consultations took the form of general discussions on the nature of the agricultural enterprises and specific discussions on perceived impacts of the project with one or more landowners of each property. The consultations also involved an inspection of the affected parts of the landowners' properties.

Some other properties which were not inspected were viewed to some extent from adjacent public roadways and adjacent private property. Further information on these properties such as topography, soil characteristics, vegetation cover, type and locations of crops, and extent of cleared areas was gained through examination of satellite imagery and public GIS datasets.

This information, when combined with information gained from inspections of neighbouring properties and consultations with neighbouring landowners, was adequate to prepare this report.

Figure 4.1: Property owner interviews for the assessment



Properties interviewed for the assessment

Dungowan Dam and pipeline project
Land use assessment
Figure 4.1

EMM
creating opportunities

4.1.2 Stakeholder consultation

Discussions were undertaken by telephone on 3 December 2020 with biosecurity (weeds) officers employed by both North West Local Land Services and Tamworth Regional Council to obtain their opinions on the main biosecurity risks associated with the project and the type of mitigation measures that should be implemented.

4.1.3 Online survey

Two questions relating to land use impacts were included in the online Social Impact Assessment Survey. Stakeholders had the opportunity to respond online to this survey in October 2020. A total of 87 respondents completed the survey, of which 67 (77 per cent) were from the local area (postcodes 2350 and 2352). Eight respondents (9.2 per cent) indicated that they owned or operated "property on which the land use may be affected by the Dungowan Dam and pipeline project".

4.1.4 Land use assessment

The description of the existing environment was primarily a desktop study based on data from various sources as referenced in Chapter 5. However, this information was evaluated by reference to information gathered during property inspections and landowner consultations. The assessment of the existing environment concentrated on:

- geographical factors (such as climate, topography and soils) that have the greatest influence on agriculture in the project area; and
- measures (such as land and soil capability, land use and value of production) which best appraise the nature and productivity of agricultural enterprises in the project area.

The assessment of the impacts on agriculture was based on information from the existing environment assessment, consultations with landowners and other stakeholders, property inspections and professional knowledge.

Mitigation measures are defined as actions, processes or structures, which minimise or eliminate the impacts of the project. The assessment of mitigation and management measures was based on information from the existing environment and impact assessments, consultations with landowners and other stakeholders, property inspections, professional knowledge, and various information sources as referenced in Chapter 9.

4.2 Biosecurity

Relevant information on biosecurity issues for the project site were identified from the following sources:

1. landowner consultations (section 4.1.1);
2. observations during the property inspections (section 4.1.1);
3. consultation with North West Local Land Services and Tamworth Regional Council biosecurity officers (section 4.1.2);
4. reference to the *NSW Biosecurity Act 2015*;
5. reference to the North West Regional Strategic Weed Management Plan 2017-2022; and
6. review of various other documents set out section 6.2.

The methodology for the biosecurity assessment was similar to the land use assessment set out in preceding sections. The description of existing biosecurity issues was primarily a desktop study, but information gathered during property inspections and landowner

consultations was also considered. The assessment of the existing biosecurity issues concentrated on those which were identified as the main risks associated with the project.

The assessment of the potential biosecurity risks was based on information from the existing environment section of this report, consultations with landowners and other stakeholders, property inspections, pest, disease and weed distribution data, professional knowledge, and various legislation and surveys referenced in section 6.2.

The assessment of mitigation and management measures was based on information from the existing environment and impact assessments of this report, consultations with landowners and other stakeholders, property inspections, professional knowledge.

5 Existing environment

5.1 General description

5.1.1 Location

The project footprint is entirely located in the LGA of Tamworth Regional Council, however further to the east a small part of the wider project area lies within the Walcha Council boundary.

The project footprint intersects with approximately 130 land parcels comprising a mix of freehold and crown land. A majority of which are privately owned with a significant proportion owned by Tamworth Regional Council.

5.1.2 Topography

The project footprint generally follows the floodplain of Dungowan Creek. Therefore, it mainly traverses a landscape of flat to gently sloping terrain, with some smaller areas of steeper slopes. The surrounding project area includes some steep to very steep land.

The project ranges from an elevation of approximately 620 metres above Australian Height Datum (mAHD) at the base of the New Dungowan Dam wall to 430 mAHD at the tie in point with the Chaffey Dam pipeline. Parts of the project area east of Niangala rise to more than 1,300 mAHD.

5.1.3 Climate

Climate, especially rainfall and temperature, have a large impact on the productivity of dryland agricultural properties such as those found in the project area. The most relevant Bureau of Meteorology (BOM) rainfall recording stations near the project area with relatively complete records over an extended period are Nundle (Chaffey Dam - 55302), Weabonga (Stoneleigh - 55164) and Niangala (Ashland - 56082). The most relevant BOM temperature recording stations are Tamworth Airport AWS (55325) and Woolbrook (Woolbrook Road – 55136).

The average rainfall ranges from 739 millimetres per annum at Nundle (520 mAHD), to 808 millimetres at Weabonga (690 mAHD) and 959 millimetres at Niangala (1085 mAHD). Rainfall is strongly influenced by altitude (Table 5.1). There is a substantial summer rainfall dominance, with autumn being the driest period, on average.

The rainfall in the project area is relatively reliable with moderately low variability[1] of 53 per cent to 59 per cent according to BOM (2020). Records indicate that one in 10 years records an annual rainfall of less than approximately 69 per cent of the long-term average, one in 10 years also records rainfall of more than 126 per cent of the long-term average. Variability is greater in late summer, autumn and early winter than at other times of the year.

A summary of temperature records for Tamworth Airport and Woolbrook is set out in Table 5.2. The mean maximum monthly temperature reaches a high of 33.1°C at Tamworth (395 m AHD) in January and a low of 16.5°C in July. Maximum temperatures at Woolbrook are 3.6 to 5.3 degrees lower due to its altitude (925 mAHD).

There has been an average of 27.2 days per annum over 35°C at Tamworth, but only 2 days at Woolbrook. The mean minimum monthly temperature falls to a low of 2.3°C at Tamworth in

[1] Defined as the 90th rainfall percentile minus the 10th rainfall percentile divided by the median.

July but is around 17.8°C in January. Minimum temperatures at Woolbrook are 3.4 to 5.0 degrees lower than Tamworth.

Temperatures in the project area will largely be within the range of the Tamworth Airport and Woolbrook stations.

There has been an average of 52.5 days per annum with a minimum temperature under 2°C at Tamworth, which is generally regarded as the approximate temperature at which a frost will occur. Woolbrook averages 115.6 days per annum by the same measure. Nights with a minimum temperature of less than 2°C can be generally expected in Tamworth between May and September in a typical year.

Table 5.1
Summary of rainfall records

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Nundle (Chaffey Dam)													
Station Number: 055302 · Opened: 1977 · Latitude: 31.36°S · Longitude: 151.14°E · Elevation: 520 m													
Mean	85.8	61.8	44.4	34.4	44.9	56.3	58.3	46.3	55.4	58.1	81.8	97.5	739.2
Median	71.6	51.6	36.4	27.8	48.0	46.5	51.2	36.9	52.2	51.5	72.2	95.7	746.8
10th percentile	28.4	15.1	2.8	2.4	7.8	22.0	15.1	6.4	16.0	15.6	19.4	54.6	523.1
90th percentile	178.0	121.4	89.3	72.8	83.0	124.6	108.6	83.3	98.8	108.9	155.0	140.8	941.7
Weabonga (Stoneleigh)													
Station Number: 055164 · Opened: 1913 · Latitude: 31.18°S · Longitude: 151.30°E · Elevation: 690 m													
Mean	100.0	78.6	51.6	38.8	50.5	59.0	59.8	61.9	58.3	74.3	85.3	95.9	808.4
Median	91.2	67.0	42.7	35.6	44.3	45.5	52.3	57.8	55.1	74.0	80.6	91.5	813.9
10th percentile	26.9	14.1	6.5	4.7	7.3	13.8	13.9	11.9	14.9	21.3	26.8	39.0	543.5
90th percentile	169.4	152.8	101.4	82.1	97.6	112.1	106.7	120.7	113.3	124.2	148.7	172.1	1024.8
Niangala (Ashland)													
Station Number: 056082 · Opened: 1952 · Latitude: 31.24°S · Longitude: 151.42°E · Elevation: 1085 m													
Mean	111.8	88.3	60.5	44.2	65.6	70.9	74.0	72.6	68.2	85.7	94.2	101.7	959.1
Median	103.0	67.5	51.8	32.2	53.0	60.2	68.2	62.9	60.2	84.6	93.4	101.8	1005.8
10th percentile	34.2	11.9	7.7	5.0	9.9	20.4	20.1	15.7	22.9	30.6	24.3	36.6	669.6
90th percentile	229.3	195.1	109.6	104.2	149.8	144.2	142.9	145.6	123.4	140.2	143.6	164.9	1205.9

Table 5.2
Summary of temperature records

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tamworth Airport AWS													
Site number: 055325 ▪ Commenced: 1992 ▪ Latitude: 31.07° S ▪ Longitude: 150.84° E ▪ Elevation: 395 m													
Mean maximum temperature (°C)	**33.1**	**31.7**	**29.4**	**25.5**	**20.7**	**17.1**	**16.5**	**18.4**	**22.0**	**25.6**	**28.6**	**30.8**	**25.0**
Decile 1 maximum temperature (°C)	27.8	26.8	25.0	21.0	16.5	13.0	13.0	14.2	17.0	20.0	22.1	25.1	
Decile 9 maximum temperature (°C)	38.0	36.0	33.5	29.0	24.5	20.4	19.9	22.7	27.3	31.1	34.8	36.1	
Mean number of days >= 35°C	11.3	5.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3	2.8	5.4	27.2
Mean minimum temperature (°C)	**17.8**	**17.0**	**14.5**	**10.1**	**6.0**	**3.7**	**2.3**	**2.7**	**5.8**	**9.7**	**13.3**	**15.7**	**9.9**
Decile 1 minimum temperature (°C)	13.0	13.0	10.0	5.0	0.4	-1.2	-2.8	-2.0	1.0	4.8	8.0	11.1	
Decile 9 minimum temperature (°C)	22.0	21.0	19.0	14.8	11.5	9.0	8.0	8.0	11.0	14.6	18.0	19.8	
Mean number of days <= 2°C	0.0	0.0	0.0	0.6	5.9	10.3	15.7	14.4	5.0	0.6	0.0	0.0	52.5
Woolbrook (Woolbrook Road)													
Site number: 055136 ▪ Commenced: 1958 ▪ Latitude: 30.97° S ▪ Longitude: 151.35° E ▪ Elevation: 925 m													
Mean maximum temperature (°C)	**27.8**	**26.8**	**24.9**	**21.3**	**17.0**	**13.5**	**12.8**	**14.4**	**17.9**	**21.2**	**23.7**	**26.4**	**20.6**
Decile 1 maximum temperature (°C)	22.5	22.2	20.8	17.0	12.7	9.2	8.5	9.6	12.6	16.0	18.0	21.0	
Decile 9 maximum temperature (°C)	32.5	31.0	29.0	25.0	20.5	17.0	16.3	18.5	23.0	26.5	29.4	31.5	
Mean number of days >= 35°C	1.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.9
Mean minimum temperature (°C)	**12.8**	**12.6**	**10.1**	**5.7**	**2.0**	**0.2**	**-1.1**	**-0.9**	**2.0**	**5.3**	**8.4**	**10.9**	**5.7**
Decile 1 minimum temperature (°C)	7.7	8.2	4.6	-0.2	-4.2	-6.0	-7.0	-6.2	-3.5	-0.5	2.7	5.4	
Decile 9 minimum temperature (°C)	16.7	16.6	14.6	11.6	9.0	6.5	5.3	5.3	7.9	10.5	13.3	15.4	
Mean number of days <= 2°C	0.1	0.1	1.0	6.3	16.6	19.4	22.4	23.1	16.3	7.3	2.3	0.7	115.6

5.1.4 Climate change

The effect of climate change on the project area is likely to include several distinct impacts.

OEH (2014) reported that the New England - North West Region is projected to continue to warm during the near future (2020–2039) and the far future (2060–2079), compared to recent years (1990–2009). The warming in the vicinity of the project is projected to be on average about 0.7°C in the near future, increasing to approximately 2.3°C in the far future.

The number of days the maximum temperature is above 35°C is projected to increase across the project area, but to a greater degree at lower altitudes. Fewer potential frost risk nights are anticipated, ranging from 10 to 20 days per year in the near future to 20 to 30 days per year in the far future.

Increased temperature is likely to result in higher evapotranspiration, shorter growing seasons, and a greater potential for heat and moisture stress on crops, pasture and animals. The risk of extreme heatwaves, flooding, higher fire frequencies and a longer fire season in the New England - North West Region is also anticipated.

OEH (2014) reported that most of the studied models predict that winter and summer rainfall will decrease in the near future, while autumn rainfall will increase. Evidence for the impact of climate change on spring rainfall is not strong for either the near future or the far future. In the far future, most models predict a decrease in winter rainfall and an increase in summer and autumn rainfall. Total annual rainfall in the far future is predicted to increase in most models.

The average crop and pasture growth is likely to be reduced in spring and summer by higher temperatures, and constrained by lower soil moisture levels. Conversely, plant growth rates may benefit from higher CO_2 levels and warmer average temperatures during autumn and winter. Frost damage risk may reduce.

The New England - North West Region is projected to experience an increase in average daily forest fire danger index (FFDI) and severe fire weather in the near future and the far future. The main impact is predicted to be in spring, with summer affected to a lesser extent. However, there is substantial variation between different fire models and the predicted change is relatively small, up to two more severe fire weather days per year (OEH 2014).

A detailed review of climate change risks has been completed for the project using CSIRO (2016) climate projections (to allow for the life of the asset) and is provided separately in the Climate Change Risk and Adaptation Report (Edge Environment 2022).

5.1.5 Soils

Soils in a narrow strip adjacent to Dungowan Creek generally have high inherent fertility (OEH 2017a). Those soils in the broader relatively flat area around the creek have moderate fertility. There are also some moderately high fertility soils near the junction with the Peel River. On the steeper slopes, soils of low or moderately low fertility prevail.

The project footprint mostly occupies parts of the relatively flat area around Dungowan Creek. Therefore, the project footprint consists mainly of moderately fertile soils, with substantial areas of high and moderately high fertility soils, and relatively small areas of low and moderately low fertility soils. A map of inherent soil fertility across the project area has been included as Figure 5.1.

Across the larger project area, soils of low or moderately low fertility dominate to the north and east of the project footprint, while moderate fertile soils prevail in the south and west.

The dominant soil adjacent to Dungowan Creek are chernozems (Great Soil Group) dark coloured, friable, clay soils of alkaline to neutral pH. They are highly fertile with porous structural units and weak horizon differentiation. The moderately fertile soils near the junction with the Peel River are dominated by euchrozems which are red, alkaline, strongly-structured clay soils with a somewhat lower clay content near the surface (OEH 2017b).

Red-brown earths are the dominant soils in the broader area around Dungowan Creek with non-calcic brown soils on the adjacent slopes. They are both moderately fertile with a grey-brown to red-brown loamy A horizon (topsoil) and an abrupt boundary to a brown to red clay B horizon (subsoil). Non-calcic brown soils are generally shallower than red-brown earths (OEH 2017b).

Lithosols dominate the steeper slopes away from Dungowan Creek. These are low fertility, shallow soils showing minimal profile development and dominated by the presence of weathering rock and rock fragments. Yellow podzolics are also found at higher altitudes away

from Dungowan Creek on less steep slopes. They have a light to medium textured A horizon over a heavier firm to friable B horizon (OEH 2017b).

A detailed review of soil landscapes and soil erosivity potential across the project footprint has been completed for the project and provided separately in the Land, Soils and Erosion Assessment (EMM 2022d).

5.1.6 Surface Water

Surface water for agriculture and domestic use is mainly supplied by the major water courses, earthen dams and associated pipe delivery infrastructure, including the existing Dungowan Dam pipeline.

Surface water is used for stock and domestic use, and for some irrigation along Dungowan Creek and the Peel River. Farm dams capture and store local runoff and are mainly used for livestock purposes.

5.1.7 Groundwater

Groundwater in the project area exists as both alluvial aquifers and fractured rock aquifers.

The alluvial aquifers occur along the Dungowan Creek, Duncans Creek and Peel River valley floors. Three monitoring bores along Dungowan Creek show that the groundwater in the alluvial aquifers is relatively shallow at 3 to 4 metres. The groundwater is closely interconnected with surface water in the creek and will either gain or lose water from each other depending on the location, stream flow and rainfall events (O'Rourke 2011). Water from alluvial aquifers is used for irrigation, domestic and livestock purposes.

Irrigation entitlements in 2010 in the Dungowan Creek Alluvium Management Zone were 5,268 megalitres (O'Rourke 2011).

The fractured rock aquifers form in the valley slopes, the hills and ranges and cover most of the Dungowan Creek, Duncans Creek and Peel River catchments. These aquifers are generally deeper than alluvial aquifers, typically 20 to 50 metres. Water from fractured rock aquifers is used for domestic and livestock purposes.

Groundwater is generally reticulated on grazing properties using a system of pumps, pipes, tanks and troughs for livestock purposes.

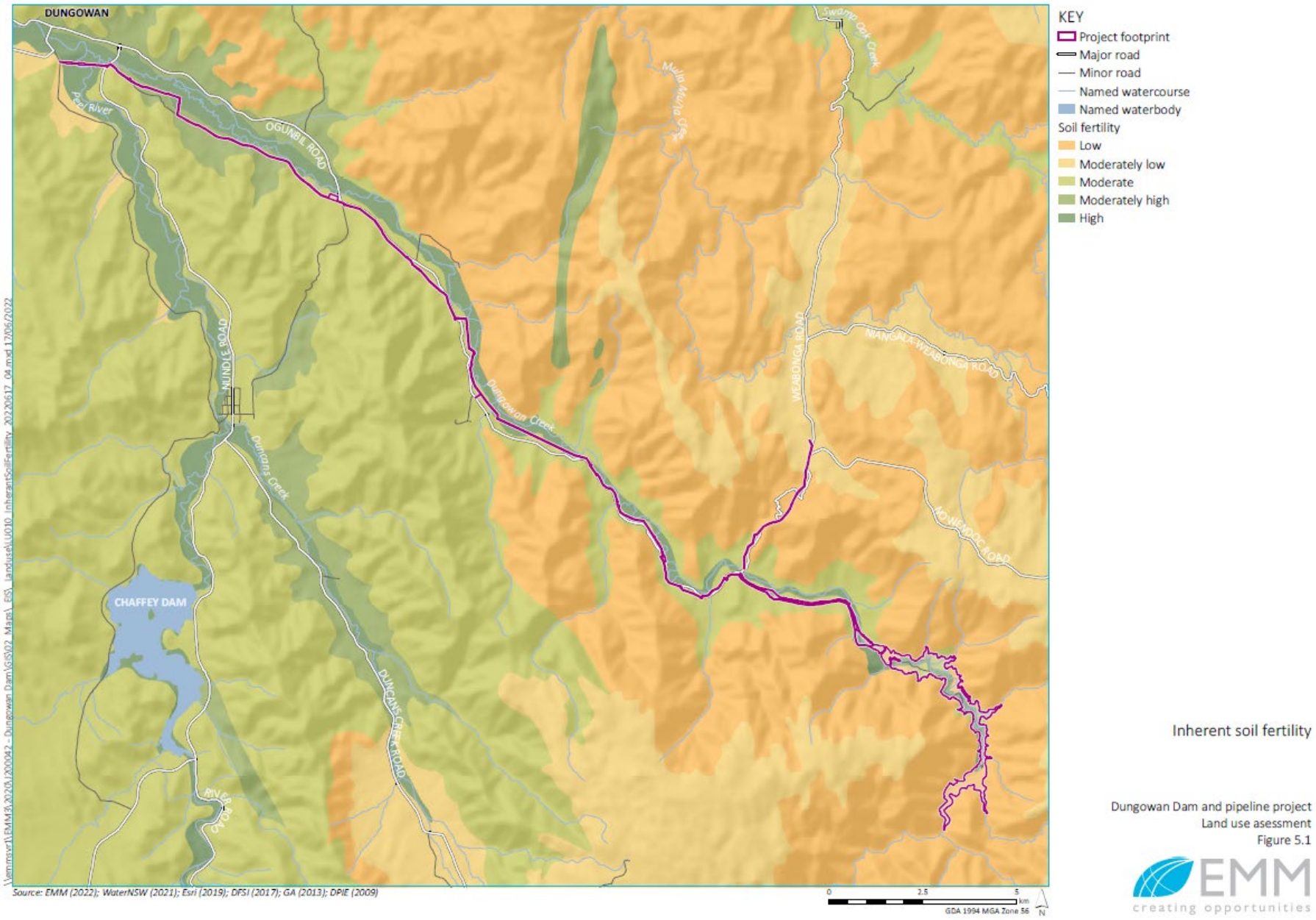


Figure 5.1: Inherent soil fertility

5.1.8 Biosecurity issues

Weeds

The North West Regional Strategic Weed Management Plan 2017 – 2022 (LLS 2017) identifies regional and state priority weeds, some of which may be present in the vicinity of the project area (DPI 2020b; DPI 2020c), as follows:

- Mother of millions (*Bryophyllum delagoense*)
- Athel pine (*Tamarix aphylla*)
- Montpellier broom *(Genista monspessulana)*
- Scotch broom *(Cytisus scoparius)*
- Serrated tussock *(Nassella trichtotoma)*
- African boxthorn *(Lycium ferocissimum)*
- Blackberry *(Rubus fruticosus* spp.)
- Chilean needle grass *(Nassella neesiana)*
- Green cestrum *(Cestrum parqui)*
- Honey locust *(Gleditsia triacanthos)*
- Nodding thistle *(Carduus nutans)*
- St John's wort *(Hypericum perforatum)*
- Sweet briar *(Rosa rubiginosa)*
- Tiger pear *(Opuntia aurantiaca)*
- Madeira vine *(Anredera cordifolia)*
- Opuntia cactuses *(Opuntia* spp.)

Priority weeds recorded by authorised officers during property inspections under the *Biosecurity Act 2015* (DPI 2020b) in the vicinity of the project footprint include African boxthorn, blackberry, Madeira vine, tiger pear and green cestrum. In the wider project area, other priority weeds were recorded as follows: nodding thistle, sweet briar, Chilean needle grass, St. John's wort, and honey locust. Burr ragweed (*Ambrosia confertiflora*) was also recorded.

The Department of Environment, Climate Change and Water NSW (2010) reported that three new weed species had been reported in the Namoi region, namely horsetail *(Equisetum* spp.), parthenium weed (*Parthenium hysterophorus*) and rhizomatous bamboo (*Phyllostachys* spp.). However, the locations were not provided. In addition, 16 emerging weeds were identified including Scotch broom, Montpellier broom, Chilean needle grass and serrated tussock, but the density of emerging weeds in the vicinity of most of the project area is only low to very low. However, there is a very high density of emerging weeds to the east and north east of the existing Dungowan Dam near the headwaters of the Macdonald River.

Other important weeds in the vicinity of the project area include caltrops (*Tribulus terrestris)*, khaki weed (*Alternathera pungens*), various thistles, blue heliotrope (*Heliotropium amplexicaule*), wild turnip (*Brassica* spp.), thornapple (*Datura* spp.), Johnson grass (*Sorghum halepense*) and Bathurst burr (*Xanthium spinosa*). A similar range of weeds were identified by landowners during consultations as problematic weeds present in the district with the potential to become more widespread.

In particular, caltrops are an important weed of crops, pastures, stock yards and roadsides. Khaki weed is often found in irrigation and high traffic areas such as roadways. The burrs can also be a significant problem in irrigation fields and are an important wool contaminant. Under the former *Noxious Weeds Act 1993*, Bathurst burrs were declared noxious in the Tamworth Regional Council Area. All these weeds are easily spread by humans and/or vehicles.

Pest Animals

Feral pigs, foxes, rabbits and kangaroos are present in the vicinity of the project area and are considered to be important pest animals, causing damage to primary production, cultural assets and/or natural environments. Wild dogs, deer, goats and feral cats are also likely to be present (Eco Logical Pty Ltd 2014; Centre for Invasive Species Solutions 2020).

The Department of Environment, Climate Change and Water NSW (2010) identified two emerging animal pests; feral horses (*Equus caballus*) and feral deer (*Dama, Cervus, Axis*

spp.). The density of emerging pest animals in the vicinity of the project area was low to moderate. Reported stock losses to wild dogs were relatively high at 3,548 between 2004 and 2007. The highest losses were to the north and east of the project area around the upper reaches of the Macdonald River.

Consultations with landowners identified a low number of vertebrate pests in the vicinity of the project area with some foxes, goats and deer, and a few pigs.

Some species (such as goats, deer and pigs) pose significant biosecurity, economic and social threats to the region as they can harbour and transmit both endemic and exotic diseases. Common carp is also widespread through river systems in the North West LLS region. Mice and locust species can cause problems in favourable seasons (LLS 2018; Department of Agriculture, Water and the Environment 2020.).

The Department of Environment, Climate Change and Water NSW (2010) identified three emerging freshwater pest species; goldfish (*Carassius auratus*), rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) in the Namoi region. The percentage of all feral fish species in the vicinity of the project area was low to very low (0 to 40 per cent).

Other

The prevalence of sheep footrot in the vicinity of the project area has been low in recent years. DPI (2016) reported no flocks were quarantined for footrot in March 2014 across the North West LLS region, and only two flocks were quarantined in December 2015, out of a total of 998 flocks.

Footrot is a contagious bacterial disease of sheep and goats, caused by the organism *Dichelobacter nodosus (D. nodosus)* in association with several other bacteria. The bacterium *D. nodosus* may persist for many years in the feet of infected sheep and may pass from infected sheep into the soil. Footrot is introduced into a clean flock by the inclusion of infected sheep in the flock, or by exposure to contaminated land under favourable conditions.

Little recent data is available on the prevalence of ovine Johne's disease (OJD) in NSW. However, the project area was in a "low prevalence area" in 2011 with an estimated infected flock proportion of less than 0.8 per cent (DPI 2011). No known OJD infections were reported during landowner consultations. OJD is an incurable infectious disease caused by the bacterium *Mycobacterium paratuberculosis*.

No specific data is available on sheep lice infestations near the project area.

Horticultural enterprises are particularly susceptible to plant diseases and pests, however there are few horticultural operations in the project area.

The project area is located in the Phylloxera Exclusion Zone designed to prevent spread from known infested areas to phylloxera free areas.

All of NSW is in the Potato Biosecurity Zone, which restricts movement of any potato biosecurity matter into the zone. A small part of the project area is in the Northern Tablelands Seed Potato Protected Area, which includes Walcha Council. No potato propagative material, soil, associated packaging and machinery or diagnostic samples can be brought into this area unless certain requirements are met (Subcommittee on Domestic Quarantine and Market Access 2020; DPI 2020e).

5.1.9 Farm size

ABS statistics (ABS 2017a) indicate an average agricultural establishment size of approximately 1,000 hectares for the "Tamworth Region" area[1]. Many of the agricultural properties along the pipeline easement are relatively small as they are based on productive enterprises on river flats along the Dungowan Creek. However, some properties also extend into steeper grazing country surrounding the creek and are relatively large.

5.2 Land use and zoning

5.2.1 Land use

Substantial parts of the pipeline easement are used for grazing of both modified pastures and native vegetation, and for cropping (both dryland and irrigated). Cropping becomes less common at the upper end of the pipeline easement near the new Dungowan Dam wall, on the remaining construction footprint, and on the operational footprint. Grazing native vegetation is predominant in these areas.

The inundation area (which comprises most of the operational footprint) was historically used mainly for grazing native vegetation, with some grazing of modified pastures, but little cropping. These land uses are classified as such in mapping of the NSW Department of Planning, Industry and Environment (DPIE 2020). Grazing of cattle and sheep (for wool and meat) is common.

Additional land uses include intensive poultry, free range egg production, a wedding venue and tourist accommodation.

Most of the project area is classified as grazing native vegetation by DPIE (2020), especially on steeper slopes away from Dungowan Creek. There are also significant areas of minimal use (including residual native cover), production native forests (Nundle and Terrible Billy State Forests) and grazing of modified pasture.

The new 4.2 km powerline would traverse land predominantly used for grazing modified pastures, with substantial other areas of both grazing native pastures and minimal agricultural use. No cropping land use is located on the site of the planned powerline.

There are no current mining activities or active mining leases within the project footprint. However, one exploration licence is active, EL9003, and encompasses the entirety of the western portion of the project footprint (pipeline portion) and surrounding land. One exploration licence application, ELA6120, is located to the west of the project footprint and encompasses a very small portion of the pipeline corridor near the confluence of Dungowan Creek and Peel River. An exploration licence gives the licence holder exclusive rights to explore for specific minerals within a designated area, but it does not permit mining, nor does it guarantee a mining or production lease will be granted.

A map of land use on and around the project footprint has been included as Figure 5.2. Land uses across the construction footprint and operational footprint are summarised in Table 5.3.

5.2.2 Zoning

The entire project footprint is zoned RU1 Primary Production under the *Tamworth Regional Local Environmental Plan 2010*. Across the broader project area, most land is also zoned RU1 Primary Production, with some significant areas of RU3 Forestry. There are also small areas

[1] The part of Tamworth Regional LGA outside the Tamworth city area and surrounds. ABS region code: 110041205.

of RU5 Village (at Dungowan and Woolomin), R5 Large Lot Residential and E3 Environmental Management (near Piallamore).

The objects of the RU1 zone are to:

- Encourage sustainable primary industry production by maintaining and enhancing the natural resource base.
- Encourage diversity in primary industry enterprises and systems appropriate for the area.
- Minimise the fragmentation and alienation of resource lands.
- Minimise conflict between land uses within this zone and land uses within adjoining zones.
- Permit subdivision only where it is considered by the Council to be necessary to maintain or increase agricultural production.
- Restrict the establishment of inappropriate traffic generating uses along main road frontages.
- Ensure sound management of land which has an extractive or mining industry potential and to ensure that development does not adversely affect the extractive industry.
- Permit development for purposes where it can be demonstrated that suitable land or premises are not available elsewhere.

Table 5.3
Summary of land use in the project area

Land Use	Pipeline footprint*		Other construction footprint*		Operational footprint*	
	ha	%	ha	%	ha	%
1.3.0 Residual native & minimal use	2.80	4.0%	26.62	14.0%	19.78	12.7%
2.1.0 Grazing native vegetation	16.73	23.9%	76.66	40.3%	55.59	35.8%
3.2.0 Grazing modified pastures	20.73	29.7%	39.68	20.8%	35.81	23.1%
3.3.0 Cropping	9.61	13.7%	3.80	2.0%	4.02	2.6%
4.3.0 Irrigated cropping	16.02	22.9%			0.08	0.1%
5.4.2 Rural residential with agriculture	0.34	0.5%	2.07	1.1%	1.67	1.1%
5.7.2 Roads	1.72	2.5%	1.10	0.6%	1.15	0.7%
6.2.0 Reservoir/dam			3.14	1.6%	2.52	1.6%
6.3.0 River	1.97	2.8%	37.27	19.6%	34.68	22.3%
Sub Total	**69.92**	**100.0%**	**190.33**	**100.0%**	**155.30**	**100.0%**
6.1.0 Lake			54.70		2.72	
Total	**69.92**		**245.03**		**158.02**	

Notes on Table 5.3:

Source: DPIE (2020)

Individual amounts are approximate and may not sum to the amount of the totals due to rounding.

*The total construction footprint is the sum of the 'pipeline footprint' and the 'other construction footprint'.

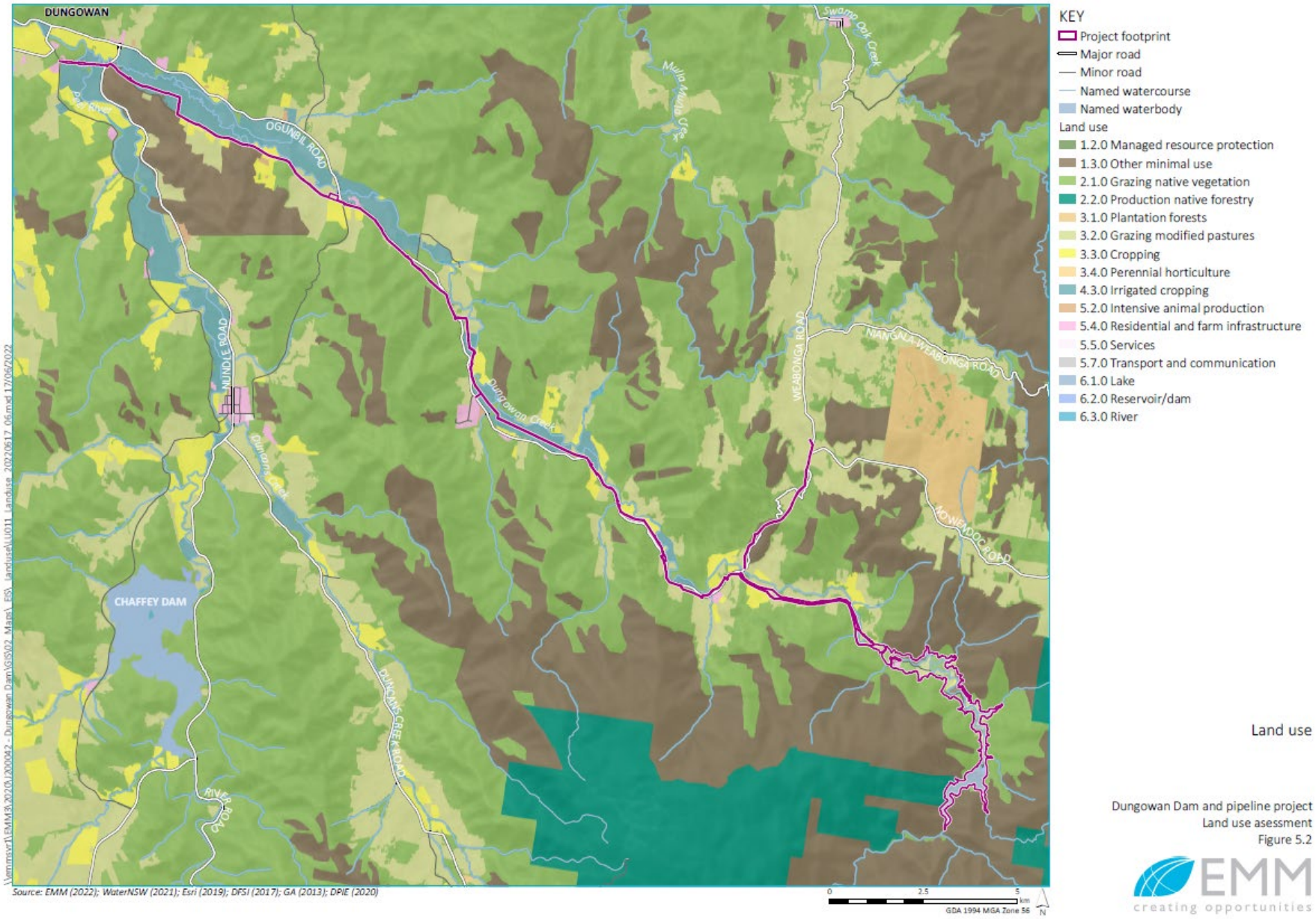


Figure 5.2: Land use

5.3 Land and soil capability

There are a number of measures of land capability relevant to agriculture. This report concentrates on the Land and Soil Capability assessment scheme (OEH 2012). However, other measures are also examined in the following sections.

5.3.1 Background

The Land and Soil Capability (LSC) assessment scheme was published in 2012 by the former Office of Environment & Heritage (OEH 2012), representing a revision of an earlier scheme that was first published by the former Soil Conservation Service of NSW in 1986 (Emery 1986). The LSC system builds on the earlier scheme, but with more emphasis on a broader range of soil and landscape properties.

LSC is based on an assessment of the biophysical characteristics of the land, the extent to which this will limit a particular type of land use, and the current technology that is available for the management of the land. It indicates the broad agricultural land uses most physically suited to an area. That is, it determines the best match between the physical requirements of the use and the physical qualities of the land, and the potential hazards and limitations associated with specific uses over a site. The LSC system can provide guidance on the inputs and management requirements associated with different intensities of agricultural land use (Woodward 1988).

The LSC assessment is based on the premise that using land beyond its capability may have serious consequences for the land and soil resources of the State as well as broader environmental impacts on water, air and biodiversity (Woodward 1988).

The LSC assessment scheme comprises eight land capability classes (1 to 8) with values representing a decreasing capability of the land to sustain intensive agricultural land use. Class 1 represents land capable of sustaining most intensive land uses including those that are often associated with regular soil cultivation, whereas class 8 represents land that can only sustain very low intensity land uses.

The current LSC scheme was initially developed for the NSW property vegetation planning program under the former *Native Vegetation Act 2003* and further upgraded for the NSW Natural Resources Monitoring, Evaluation and Reporting program.

The LSC assessment scheme uses the biophysical features of the land and soil including landform position, slope gradient, drainage, climate, soil type and soil characteristics to derive detailed rating tables for a range of land and soil hazards. These hazards include water erosion, wind erosion, soil structure decline, soil acidification, salinity, waterlogging, shallow soils and mass movement. Each hazard is given a rating between 1 (best, highest capability land) and 8 (worst, lowest capability land). The final LSC class of the land is based on the most limiting hazard.

The LSC class gives an indication of the land management practices that can be applied to a parcel of land without causing degradation to the land and soil at the site and to the off-site environment. As land capability decreases, the management of hazards requires an increase in knowledge, expertise and investment. In lands with lower capability, the hazards cannot be managed effectively for some land uses.

The LSC assessment scheme is most suitable for broad-scale assessment of land capability, particularly for assessment of lower intensity, dryland agricultural land use. It is less applicable for high intensity land use, or for irrigation (Woodward 1988).

EMM (2022) has separately completed an assessment of land and soil capability and determined appropriate mapping across the project footprint. The assessment is provided as (Land, Soils and Erosion Assessment) appended to the EIS.

5.3.2 The project area

A map of LSC across the project footprint has been included as Figure 5.3. The area of each LSC class in the project footprint is summarised in Table 5.4.

The project footprint consists of class 2 land along Dungowan Creek and Peel River, immediately surrounded by mostly class 3 and 5 land in the broader valley areas. Most of the pipeline easement consists of class 5, followed by class 2 and class 3.

Further afield is dominated by class 7 land in the steeper terrain, as is the remainder of the construction footprint, which is located around the new Dungowan Dam wall. There are also some class 4 and class 6 land, in the broader project area, especially west of Peel River, and in the south east.

Most of the new 4.2 km powerline would traverse class 7 land, with some class 4 land at the northern end of the powerline and a small area of class 5 land at the southern end near Ogunbil.

Over 40 per cent of the operational footprint is class 2, with the remainder split relatively evenly between class 5 and 7.

Class 2 land is described as *"Very high capability land: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.*

Class 3 land is described as *"High capability land: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.*

Class 4 land is described as *"moderate capability land: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology"*.

Class 5 land is described as *"moderate–low capability land: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.*

Class 6 land is described as "*low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation"*.

Class 7 land is described as *"Very low capability land: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation".*

The LSC mapping set out in Figure 5.3 broadly concurs with observations made during the property inspections.

Table 5.4
Summary of land and soil capability

LSC Class	Pipeline footprint		Other construction footprint		Operational footprint	
	ha	%	ha	%	ha	%
2 - Very high capability	21.66	31.0%	69.54	28.4%	59.65	37.7%
3 - High capability	13.40	19.2%			0.24	0.2%
4 - Moderate capability			2.02	0.8%	2.02	1.3%
5 - Moderate–low capability	31.74	45.4%	49.02	20.0%	40.77	25.8%
7 - Very low capability	3.12	4.5%	124.45	50.8%	55.34	35.0%
Total	**69.92**	**100.0%**	**245.03**	**100.0%**	**158.02**	**100.0%**

5.4 Other measures of land capability

5.4.1 Agricultural land classification

The Agricultural Land Classification (ALC) system is similar to the LSC assessment scheme. The current Agricultural Land Classification (ALC) system (Hulme, et al 2002) was developed by the former NSW Agriculture (now DPI).

Under the ALC system land is classified by evaluating biophysical, social and economic factors that may constrain the use of land for agriculture. In general terms, the fewer the constraints on the land, the greater its value for agriculture. Each type of agricultural enterprise has a particular set of constraints affecting production.

The ALC system is not considered in detail in this assessment due to its similarity to the LSC assessment scheme, and its limitations. Squires (2017) states that the ALC system has limitations with *"poor quality control of product, limited availability and suitability for digital conversion (available as paper maps only in some areas), does not identify specific industry needs and excludes non-soil based agricultural needs".*

5.4.2 Biophysical strategic agricultural land

Biophysical strategic agricultural land (BSAL) is land with high quality soil and water resources capable of sustaining high levels of productivity. The protocol for determining BSAL is set out in OEH (2013). BSAL have the best quality intrinsic landforms, soil and water resources, which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality (DPE 2013).

Mapping of BSAL was undertaken by the then NSW Department of Planning and Infrastructure in 2012. This mapping indicates that BSAL is found on land of high inherent soil fertility (section 5.1.5) and LSC class 2 land (section 5.3) along Dungowan Creek and Peel River (Department of Planning and Infrastructure 2012). Broadly, the criteria for BSAL requires land to be moderate to high inherent fertility and LSC class 1 to 3.

BSAL makes up a relatively small proportion of the project area, but comprises a substantial proportion of the project footprint.

5.4.3 Important agricultural land

The DPI is undertaking important agricultural land ("IAL") mapping across nine regions in NSW. The IAL mapping program contributes to the DPI's regional planning actions that identify the need to map important agricultural lands in NSW. Knowing where important agricultural land

is situated and understanding its requirements, value and contribution will assist state and local government, organisations and industries with making decisions about current and future agricultural land uses (DPI 2020a).

Important agricultural land ("IAL") is not precisely defined by DPI. The key document on important agricultural land "A guideline to identifying important agricultural lands in NSW" (DPI 2017) states that IAL is defined as *"existing or future location of local or regionally important agricultural industries or resources as mapped"*.

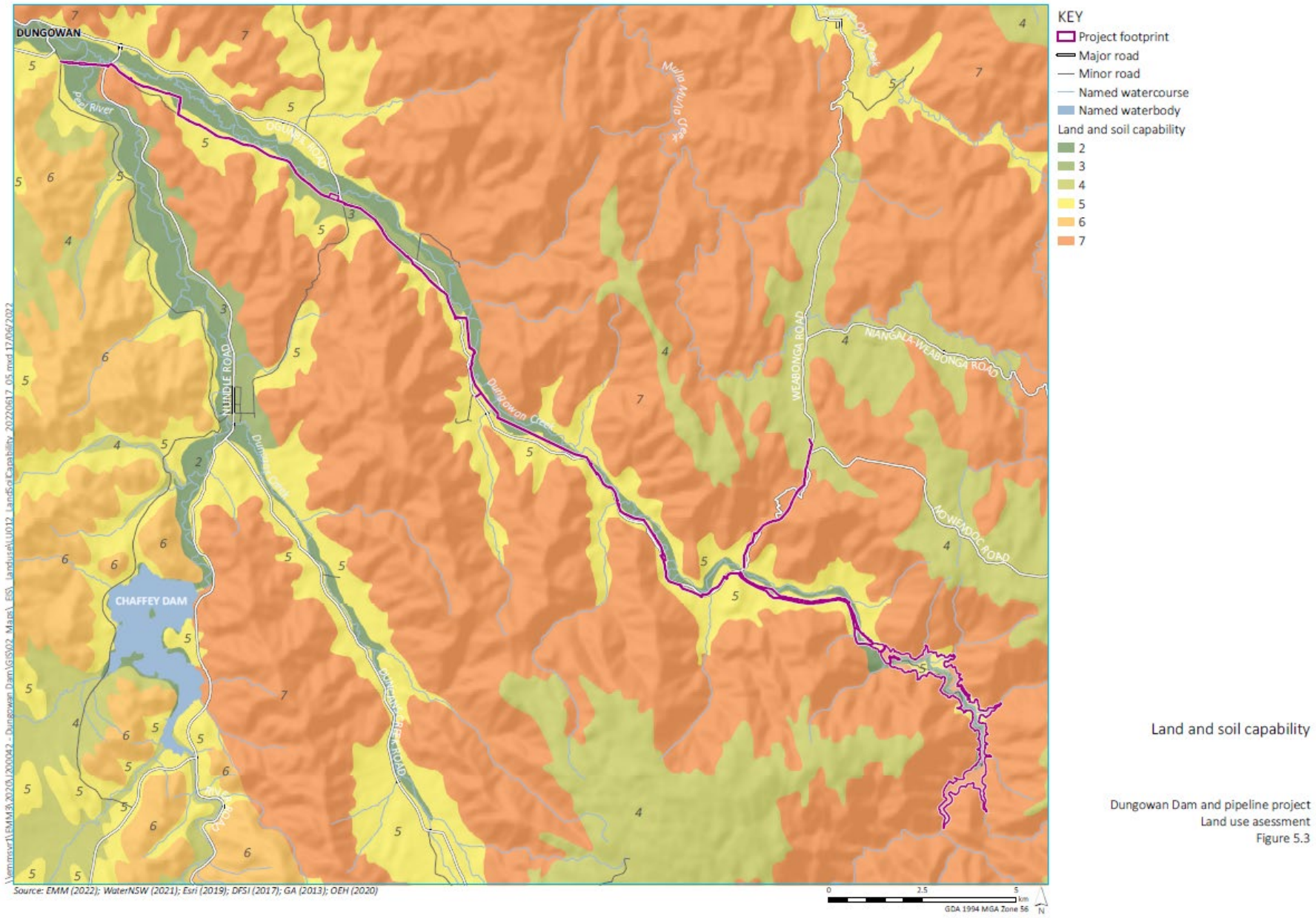
A pilot project in the Central West and Upper Hunter of NSW defined important agricultural industry land as *"land that is highly suitable for specific agricultural industries in accordance with the typical biophysical, marketing and climatic conditions for the locality or region"*.

DPI (2017) sets out the criteria and thresholds used in the mapping of IAL during a study of the Central West and Orana regions of NSW. However, the criteria and thresholds for agricultural industries in a particular study area may vary considerably from those in a different geographic area, and some criteria may not be directly transferable from one region to another.

DPI advise that the IAL project has recently been updated in response to feedback. The IAL project remains a key part of the Government's commitment to implementing Right to Farm Policy and is proposed to be completed in 2020. The revised project will ensure a product is developed which is suitable for inclusion in the planning framework.

The intent of the revised IAL Mapping Project is to identify areas in a region, which are key contributors to that region's agricultural economy; and have the inherent capability of being productive with minimal inputs. These areas will be identified on a basis that they are suitable for consideration when consent authorities are undertaking strategic and statutory planning (DPI 2020d).

It is understood that no IAL mapping has yet been undertaken for the Tamworth Regional LGA.



Land and soil capability

Dungowan Dam and pipeline project
Land use asessment
Figure 5.3

Figure 5.3: Land and soil capability

5.5 Agricultural productivity

5.5.1 Agricultural land use

The area of agricultural holdings in the Tamworth Region (Attachment 1) in 2015-16 was 627,982 hectares. Across 622 holdings, the average size was 1,010 hectares (ABS 2017a)[1]: The same ABS statistics shows the following broad land use in the Tamworth Region.

Table 5.5
Land use on farms 2015-16

	Area (ha)
Wheat for grain	7,225
Other cereal crops for grain	13,011
Other broadacre crops for grain	1,470
Lucerne for hay	3,469
Other hay and silage	3,550
Other non-grain crops	12,648
Horticulture	107
Other - Mostly grazing	586,502
Total area of holdings	**627,982**

Statistics that detail the use of land not used for cropping or horticulture are not available for Tamworth Region, or for 2015-16. However, earlier statistics (2010-11) show that approximately 93 per cent of the area not used for cropping and horticulture in the Tamworth Region was used for grazing, with the balance being for non-agricultural uses. Of the grazing area, only 41 per cent was improved pasture (ABS 2012a).

5.5.2 Livestock carried

Table 5.6 sets out livestock numbers across the Tamworth Region in 2016. Livestock such as poultry and pigs, which are usually associated with intensive production are excluded.

Table 5.6
Livestock numbers

Type	Number
Sheep and lambs	290,339
Meat cattle	169,898
Dairy cattle	5,137
Goats	615
Other livestock	2,259
Total - Stock units	2,065,192
per hectare[2]	3.52

Source: ABS 2017a

[1] Detail agricultural statistics are only produced by the ABS to an LGA level every five years. The most recent LGA data is from 2010-11 and 2015-16.

[2] Excluding cropping and horticultural areas (Table 4.6).

"Stock units" are calculated based on one unit for sheep, lambs, goats and "other livestock" and 10 units each for meat cattle and dairy cattle.

The average stocking rate of 3.52 stock units per hectare in 2016 (Table 5.6) is relatively high. The average stocking rate across all of NSW was 1.68 stock units per grazing hectare, but this includes a large area of lower rainfall pasture area in the west of the state (ABS 2017a).

5.5.3 Value of agricultural production

The gross value of agricultural production in the Tamworth Region in 2015-16 (ABS 2017b) is shown in Table 5.7 at $243 million.

The disposal of cattle and poultry (mostly for meat) are the most valuable agricultural commodities produced in the Tamworth Region. However, the agriculture sector is broadly based with the production of wheat, other broadacre crops, hay, wool, sheep milk and eggs all exceeding a gross value of $5 million.

The total gross value of agricultural production in 2015-16 was equivalent to $391 per hectare over the total area of agricultural holdings in the Tamworth Region (627,982 hectares). However, there is a large difference between the average value of broadacre cropping production (approximately $425 per hectare), hay and silage production (approximately $1,530 per hectare), horticulture (approximately $17,200 per hectare) and grazing production (approximately $369 per hectare).

Table 5.7
Gross value of agricultural production

	2015-16
Broadacre Crops	
Wheat	$5,200,416
Other	$9,396,935
Hay	$10,718,843
Total - Broadacre Crops	$25,316,194
Horticulture	
Cultivated turf	$1,751,781
Other horticulture	$77,122
Total - Horticultural crops	$1,828,903
Livestock Products	
Wool	$10,577,871
Sheep and lambs	$6,774,081
Cattle and calves	$89,767,449
Poultry	$92,067,047
Other livestock	$581,214
Milk	$9,218,161
Eggs	$7,351,726
Total - Livestock Products	$216,337,548
Total – Agriculture	**$243,482,644**

The value of agricultural production is greatly influenced by seasonal and market conditions and can fluctuate widely from year to year. The gross value of agricultural production over the

Tamworth Region in 2010-11 was $208.5 million (ABS 2012b). This was 34 per cent lower than in 2015-16.

On a broader scale, the value of agricultural production in the New England and North West statistical area (SA4) declined by 29 per cent in 2018-19 compared to 2015-16, due mainly to widespread drought conditions (ABS 2020b).

5.5.4 Employment

Agriculture is the largest industry (by number of persons employed) in the Tamworth Region (Attachment 1). In 2019, 14.8 per cent of employed persons in the Tamworth Region were employed in “agriculture, forestry and fishing”. This was equivalent to a total of approximately 1,216 persons (ABS 2020a).

In 2019, there were 1,108 “agriculture, forestry and fishing” businesses in the Tamworth Region (ABS 2020a).

6 Assessment of construction impacts

6.1 Social Impact Assessment Survey

Respondents to the Social Impact Assessment Survey indicated the following main impacts during the construction phase, showing the percentage of "very negative" or "negative" responses:

Disruption of land use	43.0 per cent
Restricted movements	36.0 per cent
Bio-security risks	30.6 per cent

The responses also indicated a lower impact of "fire risks" (20.5 per cent) and "the effect of noise on livestock" (24.4 per cent).

6.2 Impacts on land use

The construction of the project has the potential to result in disruption to land use in several ways as follows:

1. Crop and pasture land temporarily taken out of production.
2. Crop and pasture land permanently taken out of production.
3. Crop and pasture damage by construction activities, including longer term impacts.
4. Disruption to grazing.
5. Misadventure dangers for livestock associated construction activities.
6. Introduction of weeds.
7. Other biosecurity risks.
8. Risk of bushfires.
9. Loss of services.
10. Restricted movements.

Each of these is discussed in the following sections.

6.2.1 Temporary loss of crop and pasture land

Crop and pasture land will be temporarily taken out of production during and after pipeline construction activities. The impacts will be low due to the small areas involved and the relatively short period of time over which production will be lost.

The total area of the pipeline construction footprint is 69.92 hectares (Table 5.3). This represents only 0.01 per cent of the total area of agricultural holdings in the Tamworth Region (627,982 hectares - Table 5.5).

The pipeline footprint, due to its location on and around the Dungowan Creek river flats, is likely to cover a higher percentage of the Tamworth Region's irrigated cropping areas. It is difficult to estimate this percentage due to a lack of information on irrigated crop areas in the Tamworth Region, but it is estimated that it may represent approximately 0.2 per cent of the total irrigated crop area.

On an individual property scale, the pipeline construction will also not affect a large proportion of the grazing or cropping land. The pipeline construction footprint is assumed to be 20 metres wide. Therefore, it is unlikely that the proportion of an individual property's cropping, irrigation or highly productive grazing land (LSC classes 2 and 3) affected by pipeline construction footprint will exceed 10 per cent. Due to extensive areas of lower capability land adjacent to

the river flats, the proportion of these lands affected by the pipeline construction footprint is likely to be much lower than 10 per cent on an individual property basis.

The period of temporary loss due to construction activities will depend on factors such as the speed of construction and type of land use. It is expected that construction in an individual paddock will be completed relatively quickly in most cases, potentially returning the pipeline footprint to its former land use in a short period of time.

In practice, however, the period required to return the pipeline footprint to its former land use will depend on factors such as the degree of impact of construction activities, type of land use, and seasonal conditions. Areas subject to intensive soil disturbance will take longer to recover than peripheral areas, as these will generally need to be rehabilitated to reinstate pastures or crops to former standards. Depending on the time of year and seasonal conditions this may take up to 12 months or more. However, most of the easement, which would not be subject to intensive soil disturbance and rehabilitation will occur much quicker.

The estimated total gross value of agricultural production for the Tamworth Region in 2015-16 averaged $391 per hectare across the total area of agricultural holdings but varied for different enterprises from grazing production (approximately $369 per hectare) to hay and silage production (approximately $1,530 per hectare). We estimate the average gross value across the different land uses on the pipeline construction footprint at approximately $750 per hectare per year.

The average period of temporary loss across the pipeline construction footprint is estimated at three months. This is heavily weighted to the impact on irrigated cropping, dryland cropping and modified pastures, which are the most productive and likely to take the longest to recover.

On this basis, the loss of production due to crop and pasture land taken temporarily out of production during and after pipeline construction activities is estimated at approximately $13,110 per annum (69.92 hectares x $750 per hectare per annum x three months). This represents only 0.005 per cent of the gross value of agricultural production for the Tamworth Region in 2015-16 ($243,482,644, refer to Table 5.7).

It is proposed that a powerline north of Dungowan Creek near Ogunbil would be relocated and 4.2 km of new powerline and some access tracks built. This may cause some temporary disruption to land use in this area, but the impact is likely to be small due to the relatively low land capability; the low intensity grazing and minimal land uses; the short length of relocated powerline and required access tracks; and the relatively low intensity of impacts compared to the pipeline construction.

6.2.2 Land permanently taken out of production

Construction activities around the new Dungowan Dam infrastructure, such as borrow areas, quarry areas, construction facilities and dam works will have a large impact on existing land use in the area. An estimated 245 hectares will be utilised by the construction footprint in addition to the pipeline footprint (Table 5.4). However, the consequences of this impact will be small because it is understood that most of this land is not being productively used for agriculture or any other commercial business. The potential agricultural productivity of this land is relatively low, with 71 per cent being LSC class 7 (very low capacity) or class 5 (moderate-low capacity) as set out in Table 5.4, and with no high value irrigated cropping (Table 5.3).

The construction footprint around the new Dungowan Dam wall overlaps to a substantial degree with the operational footprint in the same area. Consequently, the impact of the permanent loss of land use is addressed in greater detail in section 7.2.1.

6.2.3 Crop and pasture damage

The temporary disruption to cropping and grazing is addressed in section 6.2.1 However, it is possible that impacts may last well beyond the construction period if rehabilitation is ineffective. This could include:

1. Inadequate replacement of affected pasture,
2. Inadequate soil replacement; or
3. Inadequate levelling and consolidation of construction areas.

Ineffective replacement of affected pasture would result in lower pasture and grazing production. Soil inversion and disruption of soil layers due to inadequate soil replacement would leave less fertile soils on the surface of the affected area. Erosion risks due to soil disturbance are covered in the Land, Soils and Erosion Assessment (EMM 2022d).

Problems with an uneven soil surface or unconsolidated soil would cause issues with vehicle trafficability, less efficient irrigation and lower plant production.

This impact would be minor to negligible, due to the small total area of the pipeline and powerline construction footprint (section 6.2.1), the rehabilitation that will be undertaken on affected areas, and the limited area that may be affected by inadequate rehabilitation. The powerline construction should not affect any crops, as no crop land is located within the easement.

Dust deposition arising from construction activities may also temporarily reduce pasture and crop production adjacent to the pipeline, access roads and other construction sites. The Air Quality and Greenhouse Gas Assessment (EMM 2022b) indicates that the dust emission magnitude associated with pipeline earthworks and access tracks is 'medium'.

However, the impact of dust on pasture and crop production would be low due to:

1. The limited area near the pipeline construction activities and access tracks that would be affected by dust deposition. The Land, Soils and Erosion Assessment indicates that dust impacts from soiling are unlikely beyond 500 m from the active trenching area.
2. The moderate level of dust deposition expected. The Land, Soils and Erosion Assessment did not quantify dust deposition from pipeline construction activities and use of access tracks. However, modelling for the dam construction area produced dust deposition levels of less than 0.1 g/m^2/month to a maximum of 0.9 g/m^2/month for receptors located approximately 0.25 to 10 km from the area of highest dust deposition.
3. The relatively short time that pipeline construction would be located in a particular location. The Land, Soils and Erosion Assessment indicates that open trenching and backfilling of material along the proposed pipeline would proceed in sections generally ranging from 50 metres to 200 metres per day.
4. Most of the main public access roads are sealed. Only Dungowan Creek Road and Dungowan Dam Road have gravel surfaces.
5. Much of the land near the dam construction site and Dungowan Dam Road has been purchased by Tamworth Regional Council and is not currently used for agriculture or any other commercial activity.
6. The effect of light levels of dust on pasture and crop growth is not substantial and temporary. Rain will remove dust from plant surfaces while, to a lesser extent, wind will also reduce dust levels.
7. Mitigation measures set out in the separate soils and land capability assessment will reduce impacts on pasture and crop production.

6.2.4 Disruption to grazing

Grazing on and around the pipeline construction footprint and the powerline easement will be disrupted to some extent during the construction phase. This may take the form of disturbance of livestock by noise and the movement of personnel and vehicles. Grazing on affected properties may also be restricted during construction, as it is expected that producers will generally move livestock away from the construction activity.

However, the impacts will be low due to the relatively short period of time disruption may occur, and the grazing flexibility available to most landowners. It is expected that construction activities in an individual paddock will be completed relatively quickly in most cases, enabling grazing to resume in a short period of time. Landowners would also generally have sufficient grazing flexibility to move livestock to alternative paddocks, with little or no decreased production.

Noise created by the movement of construction vehicles and other construction activities may have an impact on livestock, especially during sensitive periods in the reproduction cycle (for example, calving and lambing). Some livestock can be easily panicked, particularly if they are new to the area near the project, such as occurs with relocated, agistment or newly purchased animals. Where such livestock are present, there is a risk of noise disturbance and greater precautions such as relocating the animals will need to be taken.

The impacts of noise on livestock would be diminished by the short duration of construction in each paddock, and the likelihood that livestock in the vicinity of the pipeline construction footprint are accustomed to noise and vehicle movements due to their proximity to Ogunbil Road, Dungowan Creek Road or other roads. Therefore, while noise generated by the project has the potential to impact upon livestock, the effect of noise disruption upon productivity is expected to be negligible.

6.2.5 Livestock misadventure

Construction activities may result in an increased risk of livestock misadventure. This risk could arise from:

1. Hazards such as uneven ground or open excavations produced during the construction process causing injuries to livestock.
2. Livestock being panicked by noise or vehicle movements.
3. Livestock escape resulting from gates being left open or fences not being adequately reinstated during construction activities.
4. Greater movement of traffic along public roads increasing the risk of livestock collisions.

The risk of livestock misadventure is relatively low because rectification works would be promptly made to the land and fencing during pipeline construction. Relocating sensitive animals would reduce the possibility of panic. The risk of a gate being left open is also low. Livestock escape would not necessarily lead to any livestock, crop or property damage. However, damage is possible, and landowner time and resources would be required to resolve any livestock escape.

Greater movement of traffic would increase the risk of collisions with livestock being moved across or along public roads. However, proper procedures for moving including placement of warning signs and movements only in daylight, and adherence of drivers to the road rules, should reduce the risk of collisions.

There is also a small increase in personal risk of vehicle collisions to landowners and other farm workers supervising livestock on public roads.

The Traffic and Transport Assessment Report (EMM 2022f) indicated that existing road safety conditions are generally good along most sections of the primary transport route with good

sight distances at all the major intersections. However, several potential traffic road safety concerns were identified at multiple locations along the route. These concerns have been addressed in the Traffic Impact Assessment (EMM 2022f) mitigation measures including reducing the speed limit for a large section of the project transport route.

6.2.6 Biosecurity risks – weeds

There are risks that weeds could be introduced or spread during the construction phase of the project at the pipeline construction footprint and the powerline easement. A biosecurity breach of this nature is likely to increase costs and decrease income of agricultural properties in the vicinity of the project. Depending on the biosecurity matter, impacts on both costs and income could be short term to longer term (more than five years).

Potential carriers of weed seeds and plant material include vehicles, machinery and personnel (clothing and footwear). Biosecurity matter could also be spread by soil and water movements directly associated with construction works. Soil and water movements generally occur over relatively short distances.

The biosecurity risks are generally highest during the construction phase due to earthworks, and the frequency of vehicle and personnel movements.

Potential impacts of a biosecurity incident on agricultural businesses include increased costs associated with monitoring pests, weeds or diseases and implementing control measures; and reduced income caused by reduced livestock, crop or pasture production and lower produce quality.

Weeds which present the highest potential biosecurity risk of the project are those that:

- may be spread relatively easily by activities associated with the project;
- are well adapted to the environment within the project area; or
- would have a relatively severe economic impact if they were to spread.

Weeds that are present in the region and present a potential biosecurity threat are listed in section 5.1.8. Movements from property to property within the project area have the potential to spread these weeds, as currently they may not be present on all properties.

Vehicles and machinery could also bring in weeds currently not present in the project area from outside the region. The Tamworth Regional Council biosecurity officers advised that weeds such as parthenium weed, fireweed and alligator weed had been introduced into the local government area from elsewhere during previous construction projects. The type of weeds that may be introduced depend on the source of the vehicles, machinery and personnel.

Weeds such as parthenium weed, fireweed, some cactuses, spiny burr grass, khaki weed, giant Parramatta grass and Bathurst burr are readily spread by vehicle, machinery and human activity. Some also have a potential high impact on the income and costs of agricultural enterprises. For example, silver-leaf nightshade is difficult to control in pastures and irrigation areas, while spiny burr grass presents a challenge in pastures and crops. Bathurst burr is an important wool contaminant.

6.2.7 Biosecurity risks – other

The risk of diseases or pests being introduced or spread during the construction phase of the project is very low for the major land uses in the area (grazing and cropping). There is a low chance of biosecurity material associated with pasture or crop pests or diseases being carried by vehicles, machinery or personnel. It is unlikely any activity associated with the project would result in the spread of plant diseases or pests. Therefore, no significant biosecurity risk to grazing and cropping enterprises is expected.

While the biosecurity risk for grazing and cropping enterprises is very low, there are risks for minor land uses. The main possible exceptions are poultry and horticultural enterprises, which generally have a higher susceptibility to pest and/or diseases and have strict biosecurity controls. However, no poultry enterprises are located in the construction footprint, although some are nearby. There are no known horticultural enterprises in the construction footprint.

Sheep lice, ovine Johne's disease (OJD) and ovine footrot are the highest livestock pest and disease risks associated with the project. They are all diseases of sheep, are present in the region, and potentially have significant productivity impacts on sheep enterprises. However, the risk is minimal due to their low prevalence, limited sheep grazing along the pipeline construction footprint and the small risk of spread by vehicles, machinery or personnel.

The impact of the project, if any, on pest animals would be very low as it is unlikely to significantly change the number or movement patterns of vertebrate pests.

6.2.8 Risk of bushfires

Fires could be started by human activities, equipment and vehicles during the construction phase. Fires have the potential to cause significant damage to livestock, agricultural infrastructure (such as dwellings, stock yards, sheds and fences), pasture, shade and shelter trees, and agricultural equipment.

Bushfire risk would be considered as part of construction planning, and a Bushfire Risk Assessment (Blackash 2022) has been prepared. The assessment sets out mitigation and management measures to reduce the risk of ignition potential and fire spread from the project.

6.2.9 Loss of services

It is expected that services such as telephone, electricity and water (domestic, livestock and irrigation) may be temporarily disrupted by the pipeline and powerline construction. Interruptions may be planned as the construction work intersects with known supply lines, but it is possible that some interruptions will be accidental and unplanned.

There is a potential for interruptions to reduce the productivity of agricultural land uses through a break in livestock water supply, communications or irrigation applications. Considerable disruption could occur to livestock and irrigation enterprises if water pipelines were damaged and not promptly repaired during construction. However, the interruptions would be relatively short-lived, and the general flexibility of agricultural operations would result in only a minor impact.

The project area has some locations with poor mobile telephone coverage (including much of the project footprint), and any disruption to fixed line telephone services would potentially have a greater effect on telephone and internet services than in areas of better mobile coverage.

6.2.10 Restricted movements

It is unlikely that the construction of the project would substantially restrict movements of landholders, and their livestock and equipment, within the project area. It is possible that some movement would be affected temporarily due to restricted access to construction areas. However, these restrictions would be of a short duration and in a limited location, and therefore unlikely to markedly affect movements for agricultural purposes.

6.2.11 Ancillary business activities

We are not aware of any direct sale enterprises in the project area, and consequently the project is unlikely to have any impact on this type of business.

There are some tourist accommodation facilities in the project area, and there could be potential impacts with access during the construction period, as discussed above in section 6.2.10.

6.3 Consistency with Zoning Objectives

The project area would cover a small fraction (0.6 percent) of the agricultural land in the Tamworth Region, and the impacts of the project on existing agricultural enterprises would be negligible. In addition, the project does not cause significant fragmentation or alienation of agricultural land, or result in significant disruption to agricultural operations. Therefore, the project would be consistent with the objectives of the RU1 zone under the *Tamworth Regional Local Environmental Plan 2010* (section 5.2.2).

6.4 Stock routes and TSRs

The grazing industry uses public roads for stock routes, plus a network of Crown reserves called travelling stock reserves (TSRs), for moving or grazing stock on foot around NSW. Some of these reserves are linear, providing a route for livestock to move from place to place. Other reserves are blocks of varying sizes providing a place for livestock to be temporarily grazed or held (e.g. for overnight yarding). Livestock can be moved along public roads subject to permit from the LLS.

There are several TSRs near (but not in) the pipeline construction footprint as follows:

- Dungowan TSR (35.67 hectares) Nundle Road, near the intersection with the Duri - Dungowan Road;
- Dungowan Pub (0.29 hectares);
- Dungowan Pub (3.95 hectares);
- Church (3.72 hectares) near Dungowan Hall;
- Dungowan Station (1.84 hectares) Ogunbil Road, near the intersection with the Dungowan Creek Road;
- Memorial (0.29 hectares); near 1990 Ogunbil Road; and
- Ogunbil (28.93 hectares). near 2280 Ogunbil Road.

All are category 3 TSRs, which are defined as “rarely if ever used for travelling stock or emergency management, but are important, valued and used for other reasons, e.g. biodiversity conservation, Aboriginal cultural heritage or recreational purposes” (LLS 2020).

No roads in the project area have been identified by the NSW Government as part of a “livestock highway”. The NSW Department of Industry (2017) defined livestock highways as a key network of livestock routes connecting key agricultural regions within NSW, and with Queensland and Victoria.

The project would not have any significant impact on travelling stock reserves or the movement of livestock along public roads.

6.5 Crown Land

6.5.1 Powerline footprint

There are two Crown reserves partly located within the powerline footprint. They are lots 7002 and 7003 of deposited plan 96290. Together they form ‘Reserve 83214’, which was gazetted on 9 June 1961 for camping, and are managed by Local Land Services.

Reserve 83214 consists of remnant native vegetation located adjacent to the Nowendoc Road, approximately 4.6 km north of Ogunbil in an area which is mainly cleared and semi-cleared grazing land. The reserve does not have any agricultural land use, while camping or other recreation use appears to be minimal. There are no camping or recreational facilities on the land. The significance of the reserve from a natural environment perspective is not within the scope of this report.

The project would not prevent the reserve's use for camping or recreation, and therefore would not have any significant land use impact on this reserve.

6.5.2 Pipeline Footprint

The beds of Dungowan Creek and the Peel River are Crown land. The new pipeline footprint crosses Dungowan Creek five times and the Peel River once. No impact on land use has been identified in relation to these crossings. Other possible impacts are not within the scope of this report.

The new pipeline footprint crosses Crown 'paper' roads in ten locations. Crown roads were originally reserved to provide access to properties. However, they are not currently used as roads, but rather are rented from NSW Department of Planning and Environment by adjacent landowners and generally used for grazing, cropping or farm tracks in conjunction with surrounding freehold land. Therefore, the impact on this Crown land is the same as adjacent freehold land used for the same purpose, and these impacts have been considered elsewhere in this report.

6.5.3 Other

In addition, Tamworth Regional Council is the registered holder of current road enclosure permits numbered 51744, 51744 and 51736 in the vicinity of the project, which cover Crown public roads on or near the existing inundation area. Some of these areas have existing tracks, but most are uncleared native vegetation or semi-cleared former farm land. There is no current agricultural or recreational land use. Current land use appears to be limited to activities associated with management of the existing dam, and light traffic movement on the existing tracks. The Crown roads in and near the existing inundation area will be subject to rehabilitation.

Consequently, the project would not have any significant land use impact on these Crown roads.

7 Assessment of operational impacts

7.1 Social Impact Assessment Survey

Respondents to the Social Impact Assessment Survey rated operational impacts, showing the percentage of “very negative” or “negative” responses, as follows:

- Permanent loss of agricultural land 35.63 per cent
- Disruption of land use 31.39 per cent

7.2 Impacts on land use

7.2.1 Permanent loss of land use

Table 5.3 indicates that the total area of the operational footprint is 158.02 hectares. Most of this (approximately 145 hectares) consists of the land that would be inundated by the reservoir. The remainder would consist of dam and access infrastructure. This land would essentially be permanently lost to its former land use.

It is understood that the land which encompasses the operational footprint is not currently used for agriculture or any other commercial activity. Therefore, based on the current land use, the impact of the permanent land use loss of the operational footprint is likely to be negligible.

All land along the pipeline footprint would be renovated and returned to its former land use, while impacts of the powerline on the grazing land use of its footprint during the operational phase would be negligible.

Despite this, the operational footprint has some land use capacity, as indicated by its past land use and its land and soil capability. Table 5.3 indicates that 61.5 per cent of the operational area had an agricultural land use classification of grazing native vegetation, grazing modified pastures or cropping at the time it was assessed (DPIE 2017). Only 2.6 per cent was irrigated or dryland cropping. The remainder (38.5 per cent) was non-agricultural land, mostly residual native cover and river.

Table 5.4 indicates that 37.7 per cent of the operational footprint has LSC class 2 land (very high capability), with most of the remainder being class 5 or 7 (moderate–low capability and very low capability, respectively).

The total area of the operational footprint (158.02 hectares) represents only 0.025 per cent of the total area of agricultural holdings in the Tamworth Region (627,982 hectares - Table 5.5). However, the operational footprint includes no irrigated land and little area suitable for cropping, and therefore comprises a much lower proportion of the total area of these land use types in the Tamworth Region.

The estimated total gross value of agricultural production for the Tamworth Region in 2015-16 averaged $391 per hectare across the total area of agricultural holdings but varied for different enterprises from grazing production (approximately $369 per hectare) to hay and silage production (approximately $1,530 per hectare). On this basis, average gross value across the different land uses on the operational footprint is estimated at approximately $175 per hectare per year.

Therefore, the potential permanent loss of gross loss of production value due to the loss of crop and pasture land is estimated at approximately $27,654 per annum (158.02 hectares x $175 per hectare per annum). This represents only 0.01 per cent of the gross value of agricultural production for the Tamworth Region in 2015-16 ($243,482,644 - Table 5.7).

The agricultural land in the operational footprint generally consists of small, scattered blocks of modified pasture along Dungowan Creek, and a narrow band of native pasture on both sides of the creek. The difficulties of accessing and managing this land may result in lower productivity in practice than assessed above.

Only a very small area will be permanently taken out of production by the powerline and would be limited to the area occupied by power poles and other transmission line structures. Grazing would continue under the powerline. It is expected that permanent access tracks would not be required for the powerline in the operational phase.

7.2.2 Access to new pipeline

Some landowners in the project area currently have access to water from the existing pipeline. It is understood that this access was based on decisions made many years ago when the first pipeline was constructed. Water from the pipeline is generally used for domestic purposes and as a valuable back up supply of livestock water in these instances.

Water Infrastructure NSW have confirmed that landowners who were connected to the existing pipeline would also be connected to the new pipeline. However, those landowners not connected to the existing pipeline will only get access if the new pipeline traverses their property.

Some landowners were concerned that the future cost of accessing water through the main pipeline may be prohibitive.

7.2.3 Amount of water in Dungowan Creek

Some landowners raised the issue of changes in the amount of water flowing down Dungowan Creek as a result of the operation of the project.

Landowners use the creek for domestic, livestock water and irrigation purposes. Therefore, changes in flows in the creek will change the availability of water for these purposes, both in terms of water quantity and the periods during which water would be accessible from the creek. The amount of water in the creek may also be relevant to the accessibility and extent of water supplies available for firefighting purposes.

The amount of water in the creek is also believed to influence the amount of water in nearby bores, and also the amount of water entering deep soil profiles adjacent to the creek. The deep soil water can be accessed by deep rooted plants, especially lucerne, so that its production can be much greater than if it relied solely on rain-fed soil water.

Records from WaterNSW (2020) indicate that Dungowan Creek had no recorded flow upstream of Dungowan for 39 per cent of days since 1 January 2016. In a further 14 per cent of days, the flow was less than 1 megalitre per day. However, low flows were much less common over the previous 5 years from late 2010 to December 2015. .

The potential for the project to impact water flows and availability has been assessed in detail and is documented in the Surface Water Assessment (EMM 2022e) as part of this EIS. The Surface Water Assessment (EMM 2022e) concluded that, on the majority of days modelled, there would be minimal change in daily flows along Dungowan Creek, as a result of the operation of the project. The flow on a small number of days was found to be higher, which was offset by a similar number of days of predicted lower flow at most locations, so that there is little effect on the flow duration curve.

7.2.4 Cost of irrigation water

Some landowners raised the issue of changes in the cost of irrigation water from the project, compared to existing costs.

A change in water costs would change the expenses of operating an irrigated enterprise. Consequently, it would also potentially change profits generated by that enterprise.

A variation in water costs may also influence irrigation enterprise management decisions such as the viability of the irrigation enterprise, whether to use an irrigation water entitlement, the amount of water to apply to crop or pasture, and the type of irrigation enterprise operated. All of these decisions will influence the gross income and profits of the irrigation enterprise.

Bulk water prices in NSW are set by the Independent Pricing and Regulatory Tribunal (IPART). IPART consider all costs associated with provision of bulk water supplies in making their determination. The project assets will be transferred for nil consideration and deemed contributed assets, with no commercial return charged to the customer.

7.2.5 Biosecurity Risks

The nature of biosecurity risks in the operational phase, especially in relation to weeds, would be similar to those set out in sections 6.2.6 and 6.2.7 for the construction phase. However, the magnitude of the risk will be much lower due to greatly reduced extent of earthworks and soil disturbance, and the decreased frequency of vehicle and personnel movements. Vehicle and personnel movements along the pipeline and powerline easements would generally be limited to those required for inspection, maintenance and repairs.

Consequently, the biosecurity risk in the operational phase would be negligible.

7.2.6 Flood mitigation

A flooding analysis has been prepared and based on a hydrodynamic model for the Dungowan Creek catchment downstream of the new Dungowan Dam location (see Annexure G of Surface Water Assessment).

A comparison of flooding between the current dam and new Dungowan Dam indicates that the new Dungowan Dam will cause no significant increases to flood depths and extents in Dungowan Creek. The biggest impacts are expected to be seen in the upstream sections where the creek is more confined and the influence from the dam is greatest. Impacts diminish downstream as inflows to Dungowan Creek from unregulated catchment areas and tributaries reduced the impact of the dam.

Land use is affected by flooding through damage to crops, pastures, landforms, irrigation equipment, fences, flood gates and other infrastructure. This damage leads to increased expenses for businesses in the Dungowan Creek valley.

The Surface Water Assessment (appended to the EIS) indicates that the impacts of the new Dungowan Dam on downstream landholders will be small, due to the insignificant increase to flood depths and extents. Some upstream areas, where the largest impacts are expected, are not currently used for agricultural enterprises and this will reduce land use impacts in this area. Diminished downstream impacts coincide with areas of more extensive and intensive agricultural land use.

7.2.7 Restricted movement

It is unlikely that the operation of the project would restrict the movements of landholders within the project area.

7.2.8 Disruption to grazing

The impact of noise disturbance on sheep and cattle grazing would be negligible due to a much lower intensity of personnel and vehicle movements than during the construction phase. The potential for gates being left open is also lower than during the construction phase.

7.2.9 Fire risk

Fire risk should also be negligible during the operational phase due to a lower intensity of personnel and vehicle movements.

7.2.10 Aerial agriculture

Aerial agriculture operations are commonly used in inaccessible grazing areas for the application of herbicides and fertiliser. The use of drones for checking livestock and stock water is also becoming more common. It is possible that the some of the powerline easement would be subject to aerial applications in the normal course of farming operations.

Powerlines can interfere with the operation of planes, helicopters and drones. However, the impact is expected to be small due to accessibility of much of the powerline easement to ground vehicles, the relatively short length of the easement, and the expected infrequent use of aerial agriculture.

The impact of the subject power line will also be relatively low compared to tall high voltage lines. The relatively low height of the powerline would enable some aerial activities (especially fertiliser applications) to continue above the lines, while for other applications, the area impacted under and around the lines is much less than for taller high voltage transmission lines.

The closest airstrip recorded on the NSW runway dataset (NSW Spatial Services 2022) is approximately 6 kilometres from the powerline easement at its closest point. Therefore, the project should have no impact on the take-off or landing of planes involved in aerial agriculture.

8 Assessment of cumulative impacts

Cumulative impact assessment means the consideration of the combined impacts of the project with other relevant future projects.

There are two related projects with the potential to contribute to a cumulative impact, as follows:

- Chaffey Dam pipeline. An existing pipeline constructed from the existing Chaffey Dam to a connection point with the existing Dungowan Dam pipeline at Back Woolomin Road in Dungowan. This pipeline commenced operations on 17 June 2020.
- Pipeline from Dungowan Village to Calala WTP. An approved pipeline from the tie in point of the Chaffey Dam to Dungowan pipeline and the new Dungowan Dam pipeline that is the subject of this assessment.

The Chaffey Dam pipeline generally skirts the highly productive irrigated and dryland cropping land along the Peel Valley, following the Back Woolomin Road and the West Bank Road for most of its length. The pipeline has already been constructed and is expected to have negligible ongoing impact on land use during its operational phase.

It is understood that the pipeline from Dungowan Village to Calala WTP is being generally built on dryland grazing and cropping land, largely avoiding higher capacity irrigated and dryland river flats. Impacts from the construction and operation of this pipeline were assessed in a Review of Environmental Factors (EMM 2022a), which concluded that by adopting suitable safeguards it is unlikely that it would result in significant adverse environmental impacts. The impact on land use during construction for this approved pipeline is low due to the relatively small area removed from production and the limited duration of pipeline construction activities. There is negligible ongoing impact on land use during its operational phase.

The cumulative impacts on land use of the project and the two related pipeline projects described above would be small and cover a small fraction of the productive land in the Tamworth region. Impacts would be mostly restricted to a limited period of construction for each project, with minimal ongoing impacts during operations. Therefore, the cumulative impacts of the projects on existing land uses would be minimal.

9 Mitigation measures

The mitigation measures that would be implemented to avoid or manage potential agricultural impacts are listed in Table 9.1.

Table 9.1
Mitigation measures – agriculture

Aspect / impact	Mitigation measure	Applicable location(s)	Timing
Property Acquisition	All property acquisition will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.	All locations	Detailed design Pre-construction
Property Access	The requirement for temporary changes to property access will be minimised during development of the detailed construction methodology. Affected landowners will be consulted when temporary, short-term changes to access to their property will occur. This will include advanced notification of relevant project schedules, construction works and changes to access arrangements.	All locations	Pre-construction Construction
General	A land use management plan would be prepared by the proponent that sets out measures to minimise disruption to nearby agricultural activities and businesses. A pre-construction survey would be undertaken, which would inform the land use management plan. The plan would include but not be limited to: • Process for landholder consultation and input to management plan • Maximising the use of existing roads, tracks and disturbed areas • Avoidance, minimisation and repair of any damage to landholder property caused by construction activities or vehicle access • Measures to minimise conflict between livestock and construction activities including the scheduling of noise intensive works and management of vehicle movement around livestock.	All locations	Construction and Operation
	All gates that are opened will be promptly closed. Fences will be regularly checked and any damage caused by construction will be repaired promptly.	All locations	Construction and Operation
	Mitigation measures to be implemented as set out in the following technical studies:	All locations	Construction and Operation

Aspect / impact	Mitigation measure	Applicable location(s)	Timing
	• Air Quality and Greenhouse Gas Impact Assessment • Bushfire Risk Assessment • Traffic and Transport Assessment Report		
Biosecurity risks	Biosecurity management plans would be developed as part of the Construction Environmental Management Plan. Biosecurity controls will be implemented during construction to minimise the risk of off-site transport or spread of disease, pests or weeds. This will include (but is not limited to): • training and inductions for workers on biosecurity requirements, • inspections and cleaning of vehicles, machinery, and equipment prior to movement into the region, • inspections and cleaning of vehicles, machinery, personnel and equipment prior to movement on and off the construction footprint in a designated decontamination area, • control of unnecessary movements across adjoining farmland, and • implementation of additional measures where localised areas of high biosecurity risk have been identified. The implementation and effectiveness of these controls will be regularly monitored during the project.	All locations	Construction
	Consultation would be undertaken with landowners and biosecurity officers of Tamworth Regional Council to determine local weed risks in the project area.	All locations	Construction
	Consideration would be given to specific biosecurity risks (especially weeds) associated with the source location of vehicles, machinery, personnel and equipment before they are moved into the project area.	All locations	Construction
	Biosecurity controls will be implemented during operation to minimise the risk of on and off-site transport or spread of disease, pests or weeds during maintenance activities.	All locations	Operation
	Where present, weeds will be managed in accordance with the *Biosecurity Act 2015* and industry best practice.	All locations	Operation

Aspect / impact	Mitigation measure	Applicable location(s)	Timing
	Landowners will be consulted regarding farm biosecurity requirements in relation to all plant and equipment that will enter their property. This includes ancillary items such as portaloos.	All locations	Construction and operation

Aspect / impact	Mitigation measure	Applicable location(s)	Timing
Rehabilitation	A rehabilitation plan would be prepared to enable disturbed areas to be stabilised and appropriately rehabilitated as soon as feasible and reasonable following the completion of construction activities. This will be carried out in consultation with the relevant landholders.	All locations	Construction
	Final rehabilitation of lands would be as agreed with landowners and would include a site walkover and handover sign off by the landowner and project representative. Where no specific requirement is agreed, rehabilitation would consider land and soil capability and methods including contour scarification, seed application, fertilizer and protection such as hydromulch and binders.	All locations	Construction
	Measures outlined in the land, soils and erosion assessment should be implemented during construction and rehabilitation to minimise impacts to soil resources.	All locations	Construction

10 Conclusion

Agriculture is the predominant historical and existing land use in the project area. Therefore, land use impacts associated with the project are mainly associated with agriculture.

There are several potential impacts of the project on land use. However, the magnitude of these impacts is constrained by the following factors:

- the relatively small amount of land temporarily and permanently removed from productive land use;
- the limited duration of pipeline and powerline construction activities on individual paddocks;
- lack of current commercial land use near the new Dungowan Dam wall and in the inundation area;
- low pest and disease biosecurity risks associated with the project; and
- effective mitigation measures that would be implemented to reduce the impacts of the project on land use.

The impact of the project on agricultural productivity at a regional scale will be small due to the above factors.

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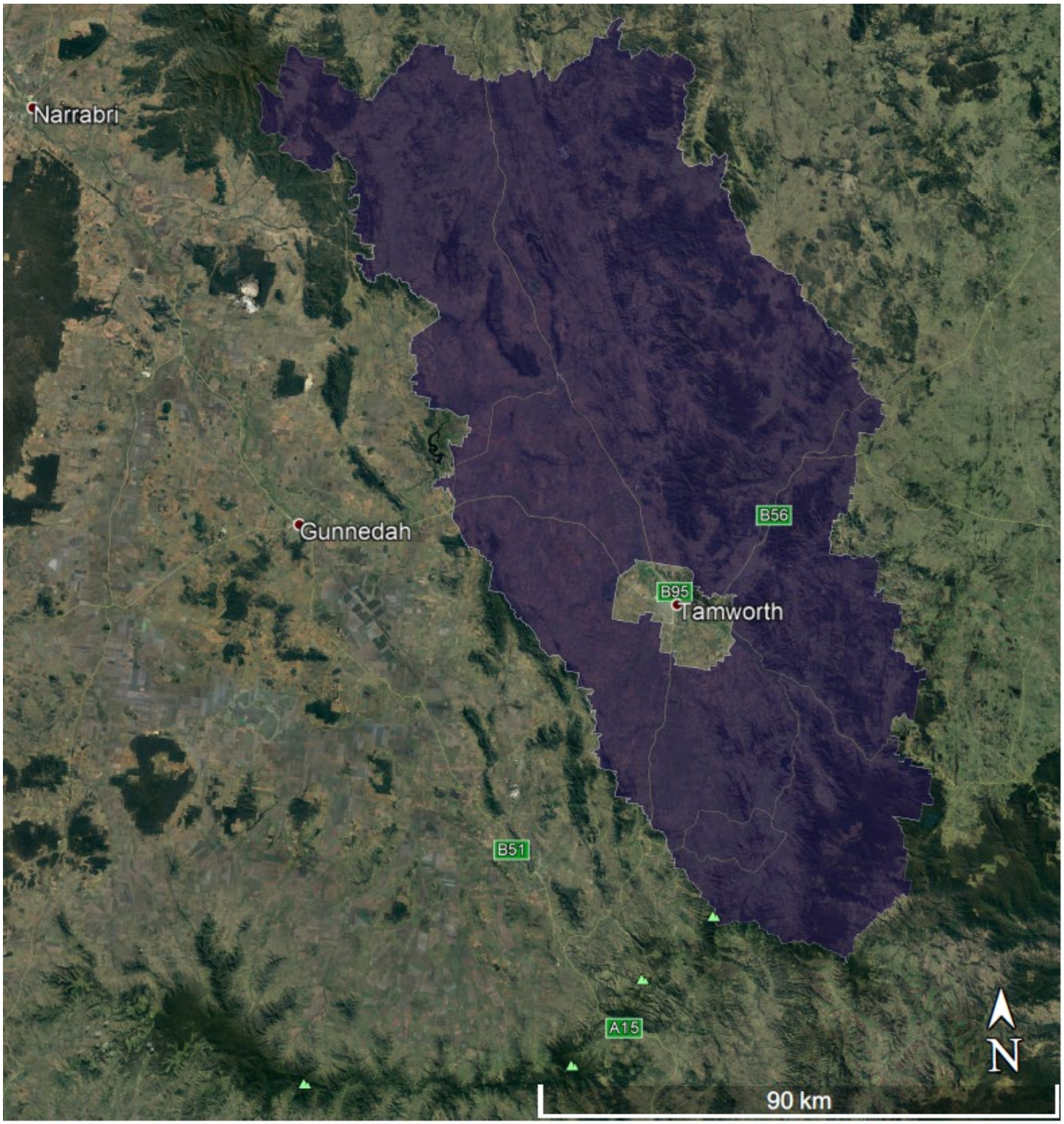
Attachment 1
Statistical Area Map



Tamworth Region (SA2) (ABS 2020a)