

Dungowan Dam Project

Scoping Report



Dungowan Dam Project

Scoping Report

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Executive Summary

ES1 Overview

New South Wales (NSW) is currently facing critical water supply issues and the government response is to fast track a portfolio of drought relief and water security projects. This includes the proposed new Dungowan Dam in the Peel Valley region of NSW (the project).

The NSW *Water Supply (Critical Needs) Act 2019* has declared the new Dungowan Dam project to be Critical State Significant Infrastructure (CSSI) under Division 5.2 of Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The CSSI declaration acknowledges that the project is critical to NSW for environmental, economic or social reasons.

Critical State Significant Infrastructure projects require approval from the NSW Minister for Planning and Public Spaces. Applications for CSSI must be accompanied by an environmental impact statement (EIS). The purpose of this Scoping Report is to inform the content of the environmental assessment requirements issued by the Secretary of the NSW Department of Planning, Industry and Environment. The Secretary's environmental assessment requirements will specify what needs to be addressed within the EIS.

WaterNSW is responsible for dam operations, water security and managing water stored in 42 water storages across the State. WaterNSW is the proponent for the project.

ES2 What is the project?

The project would increase storage on Dungowan Creek to 22.5 gigalitres and increase estimated yield by 6 gigalitres per annum. The project would contribute to a step improvement in water security, drought security and flood management capacity.

Key project components include:

- building a new embankment dam with an expected capacity of 22.5 gigalitres, 3.5 kilometres downstream of the existing dam;
- incorporating a spillway to provide controlled release of water;
- provision of a multi-level offtake tower to mitigate downstream water quality impacts from releases;
- installing appropriate fish passage (at the dam site and/or on downstream structures);
- decommissioning (or partial decommissioning) the existing dam and rehabilitating the storage area of the dam, while retaining/repurposing infrastructure where possible;
- constructing a new augmented delivery pipeline (nominally 45 megalitres per day) from the proposed dam to the junction with the pipeline that runs from Chaffey Dam to the Calala Water Treatment Plant;
- establishing construction compounds and supporting facilities;
- obtaining construction materials, including the potential use of a quarry during construction;
- use of coffer dams, dewatering and material management during construction; and

- construction and use of operational infrastructure such as offices, communications and utilities, workshops and service facilities.

While the key components of the project are largely fixed, the final design and operation will be based on an iterative design and assessment process that will be carried out during the development of the EIS.

ES3 Why is the project needed?

The principle objective of the project is to secure the long-term water supply security for the regional city of Tamworth. Drought security and flood management have been dual challenges for the Peel Valley and for Tamworth. Tamworth's bulk water supplies are currently critically low due to the severe drought. These same bulk water supplies also became critical during the previous drought between 2003 and 2008. The region was also impacted by the severe flood events that occurred across NSW in 2010 and 2011. The inability of the regulated water system to mitigate these weather events impacts the agricultural and mining industries in this region, as well as the local town water supplies.

Providing water security and balancing growth for Tamworth town water supply has historically been a challenge in the Peel Valley. The population of Tamworth is growing and so is the need for secure long-term water supply. The need to maintain current water security and reliability, coupled with the risk of increasing likelihood of droughts and floods and the lengthy time to develop the scale of infrastructure response required, means that work to deliver solutions needs to be commenced.

The project is aligned with the NSW Government's 20-year infrastructure investment plan set out in the *State Infrastructure Strategy 2018-2038*, and WaterNSW's *20-year Infrastructure Options Study 2012*. Following investigations into options for the Peel Valley, it was concluded that the development of a new Dungowan Dam is required to improve water availability and security.

ES4 What are the key issues?

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for the project and the required level of assessment. This process was guided by government, community and stakeholder views obtained during previous consultation for the project and informed by desktop assessment and some limited field survey in areas potentially impacted.

Key issues to be assessed within the proposed EIS would include:

- Water – the project is likely to impact on surface water hydrology, water quality, cold water pollution and flooding. Consequently, consideration of water users (which includes surface and ground water), downstream infrastructure and properties adjacent to the downstream watercourse will be required.
- Biodiversity – the project would impact native vegetation, including threatened species habitat and waterways due to the need to clear vegetation during construction and from the inundation of the environment upstream of the dam. Indirect impacts are also possible to the downstream aquatic habitat and species due to changes to the flow regime.
- Heritage – the project has the potential to impact an area predicted to contain Aboriginal objects and sites due to inundation and/or from construction work. The project area was used for pastoralism and a range of associated historic features may also be present.
- Land – the project is likely to impact on existing land uses, including partial or complete inundation of agricultural land. The construction of the proposed pipeline through agricultural land may impact the productivity of some land holdings.

- Social and economic – the project would improve water security for the town of Tamworth and its associate industries. Additionally, employment opportunities within the Tamworth local government area would increase during the construction of the proposed dam and pipeline and decommissioning the existing dam.
- Hazard and risk – dam safety management is paramount to protect life, property and the environment from dam failure. A detailed assessment of the design against dam safety requirements would be undertaken.

ES5 How will the project be assessed?

The project is subject to Division 5.2 of Part 5 of the EP&A Act that requires preparation of an EIS and approval from the NSW Minister for Planning and Public Spaces.

With respect to the provisions of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act), further detailed survey work is needed to determine potential impacts of the project on matters of national environmental significance and the environment generally. Therefore, WaterNSW will submit a referral under the EPBC Act nominating that the project would potentially result in a significant impact. The Commonwealth Minister for the Environment will need to consider whether the project is likely to be a controlled action under the EPBC Act and require Commonwealth approval.

WaterNSW will seek an accredited process, where the Commonwealth accredits the NSW assessment process under Division 5.2 of the EP&A Act and enable the NSW Department of Planning, Industry and Environment to manage the assessment process, including the identification of environmental assessment requirements and the assessment of the EIS.

Accordingly, the EIS will consider the requirements of both State and Commonwealth agencies. The EIS will be supported by comprehensive technical reports appended to the main report and prepared in accordance with relevant NSW and Commonwealth legislation and guidelines.

The community and stakeholders will have the opportunity to review the EIS and provide a submission. WaterNSW will continue to engage with government agencies, Tamworth Regional Council, key stakeholder groups and the community throughout the development of the project.

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1 Introduction

1.1 Critical water infrastructure

New South Wales (NSW) is currently facing critical water supply issues and the government response is to fast track a portfolio of drought relief and water security projects. A fundamental part of the solution is the planning and development of three new or augmented dams in NSW. This includes the development of a new dam at Dungowan and augmented delivery pipeline from the proposed dam to the junction with the pipeline from Chaffey Dam to the Calala Water Treatment Plant in the Peel Valley region of NSW (the project) as shown in Figure 1.1.

The project is situated on Dungowan Creek approximately 3.5 km downstream of the existing dam (Figure 1.2a). Dungowan Creek is one of the major tributaries of the Peel River and part of the Namoi River catchment. The Peel River is a major regulated tributary with stream flows regulated by Chaffey Dam (located approximately 20 kilometres (km) west of the project) and services dryland and irrigated agricultural production as well as Tamworth's town water supply.

The project would provide improved drought security for Tamworth and secure the city's long-term water supply by providing an increase in local water utility supply, enabling Tamworth to grow while maintaining a level of future agricultural water diversions. Additionally, the project would deliver increased flood security and dam safety, relative to the existing dam infrastructure.

Key benefits of the project include:

- increased storage on Dungowan Creek to 22.5 gigalitres (GL);
- increased estimated additional yield of 6 GL per annum; and
- improved water availability and security.

The NSW *Water Supply (Critical Needs) Act 2019* (WSCN Act) declared the project to be critical State significant infrastructure (CSSI) under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). A CSSI declaration acknowledges that the dam is critical to NSW for environmental, economic or social reasons.

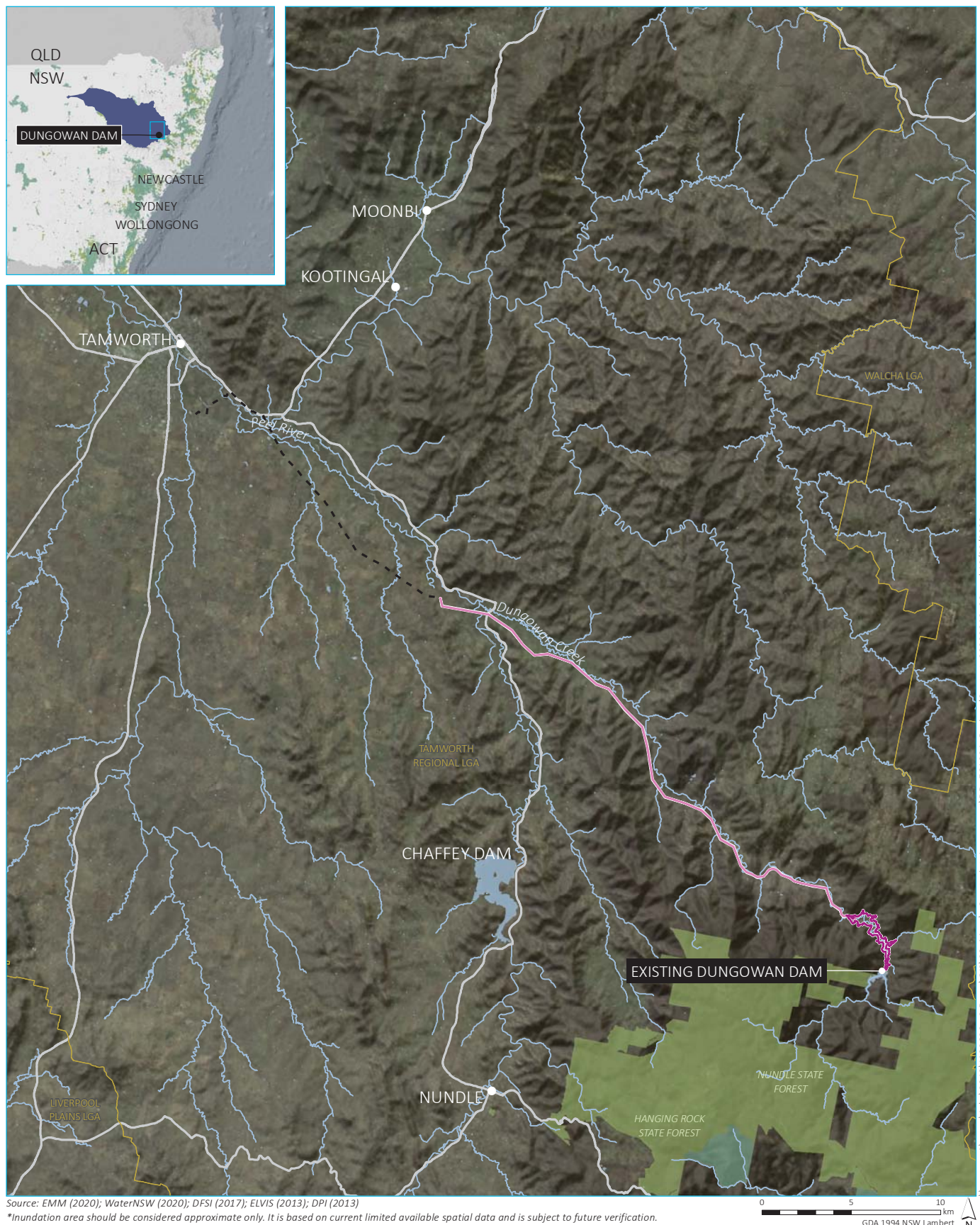
As CSSI, the project is subject to Division 5.2 of Part 5 of the EP&A Act, which requires the preparation of an environmental impact statement (EIS) and the approval of the NSW Minister for Planning and Public Spaces.

1.2 Purpose of this scoping report

This scoping report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of WaterNSW (the proponent) to provide an overview of the project, to consider the potential environmental issues associated with its construction and operation and to identify likely impacts for further investigation and assessment.

The report accompanies the application of the project to the Planning Secretary under section 5.15 of the EP&A Act to carry out State significant infrastructure.

An EIS for State significant infrastructure must be prepared in accordance with the Secretary's environmental assessment requirements (SEARs). The Scoping Report is to inform the content of the SEARs for the project. The SEARs will specify the requirements for the EIS that will be prepared to accompany the application for the project.



KEY

- Project footprint
- Indicative alignment for pipeline (project)
- - Pipeline to Calala WTP proposed under separate approval
- Major road
- Named watercourse
- Waterbody
- Local government area
- NPWS reserve
- State forest
- Namoi River catchment (inset)

Regional context

Dungowan Dam Project
 Scoping report
 Figure 1.1



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- | | |
|---|--|
| Project footprint | Waterbody |
| Indicative alignment for pipeline (project) | State forest |
| Dam wall | |
| Local road | |
| Track | |
| Watercourse | |

Local context - dam

Dungowan Dam Project
Scoping report
Figure 1.2a



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- Project footprint
- Indicative alignment for pipeline (project)
- Inundation area*

- Main road
- Local road
- Track
- Watercourse (strahler >3rd order)
- Waterbody
- State forest

Local context - pipeline

Dungowan Dam Project
Scoping report
Figure 1.2b

2 The project

2.1 Overview

The project is in the Namoi River catchment approximately 50 km south east of Tamworth in NSW and includes three components:

- a new dam approximately 3.5 km downstream of the existing Dungowan Dam, with an expected capacity of 22.5 GL;
- decommissioning (or partial decommissioning) the existing Dungowan Dam and rehabilitation of the storage area of the dam; and
- a new 45 megalitre per day (ML/d) augmented delivery pipeline from the proposed dam to the junction with the pipeline from Chaffey Dam to the Calala Water Treatment Plant.

The catchment area for the proposed dam is approximately 50 per cent larger than that of the existing dam, resulting in an estimated additional yield of just over 6 GL per annum – 9 GL per annum total. The forecast yield increase would improve water security for Tamworth and water reliability of general security water users. The proposed dam would also provide improved flood security benefits.

An outline of the key phases of the project has been developed with the key milestones and indicative timing as shown in Figure 2.1.

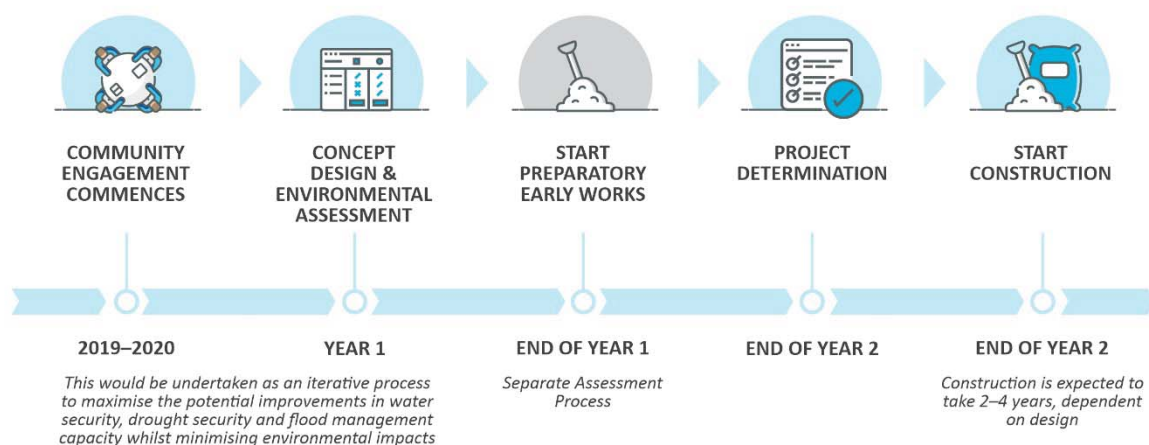


Figure 2.1 Indicative project timing

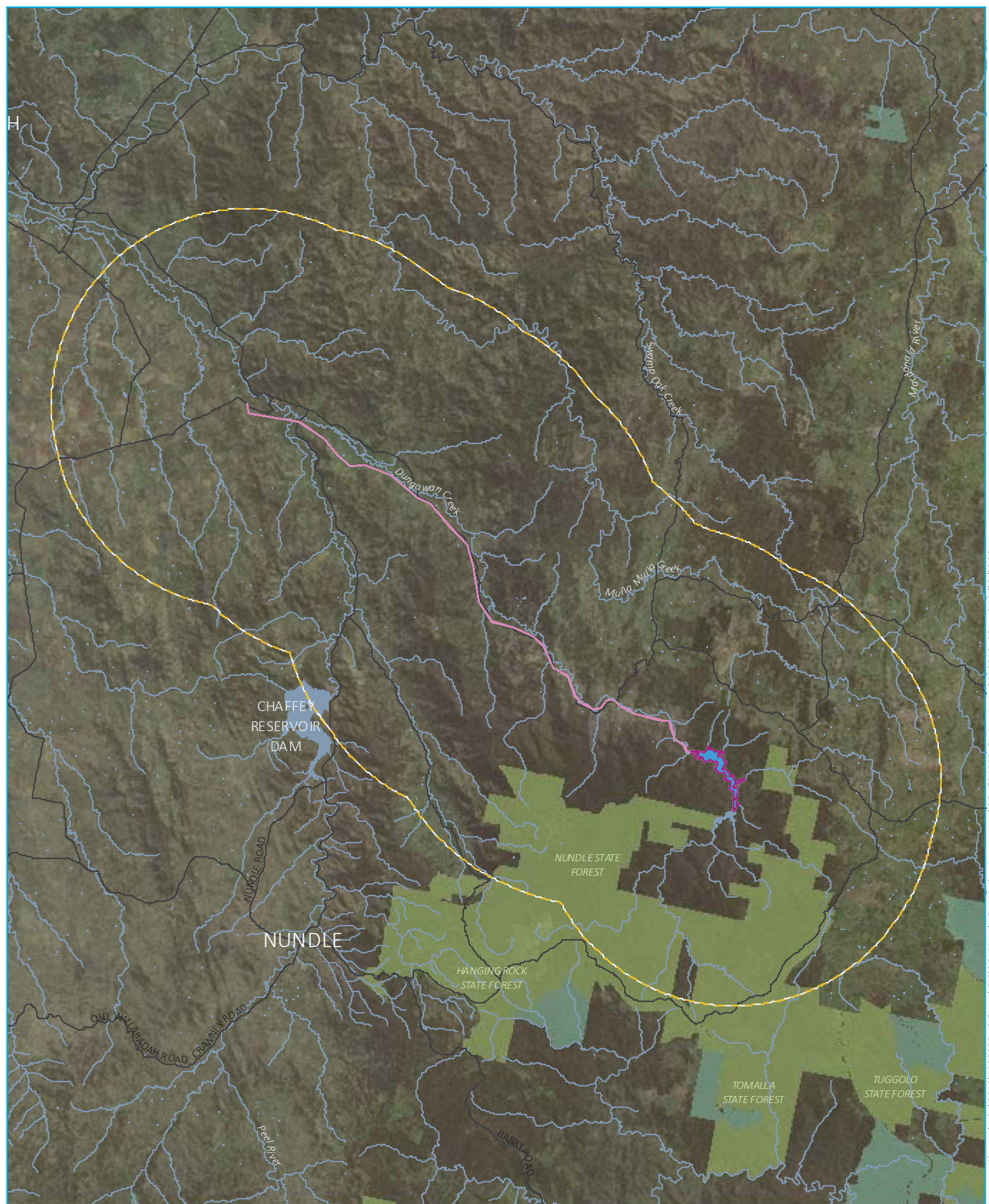
2.2 Project areas

In outlining the project, three key areas have been described to facilitate the assessment of both direct and indirect impacts during construction and operation. The project areas to be considered include:

- **Inundation area:** which relates to the proposed full supply level (FSL) for the project. This area would be inundated at the proposed FSL and as such forms the key area of impact during operation of the project.
- **Project footprint:** is an area in addition to the area of inundation, as direct impacts may be experienced within the footprint of both construction and operational areas; and

- Project area: is a broader area that has also been defined to allow for assessment of potential indirect impacts. This has been defined as a 10 km area around the project footprint.

Figure 2.2 shows the key project areas, including the inundation area, project footprint and project area.



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- Project footprint
- Indicative alignment for pipeline (project)
- Project area
- Inundation area*

- Main road
- Named watercourse
- Waterbody
- NPWS reserve
- State forest

Project areas

Dungowan Dam Project
Scoping report
Figure 2.2

2.3 Key components of the project

The project design provided in this section is an indicative preliminary design. The project design will be further developed to take into consideration environmental and technical investigations.

While the key components of the project are largely fixed, the final design solution and operation will be based on:

- the outcomes of further community and stakeholder engagement;
- results of geotechnical and other structural analysis and design investigations;
- flood and dam break modelling;
- ability for the design to meet dam safety requirements; and
- outcomes of environmental impact studies to ensure the design balances water storage benefits with potential social and environmental impacts.

2.3.1 Key components of the project

Table 2.1 provides a summary of the key components of the project identified by the preliminary design. An indicative layout for the project is shown in Figure 2.3.

Table 2.1 Summary of key components of project

| Component | Description |
|---------------------|---|
| Existing dam | <p>The existing dam may only require partial decommissioning, though at a minimum, the gates on the existing dam would be removed. Further design investigations will be needed to determine the approach to decommissioning. There are several considerations to decommissioning the existing dam, including:</p> <ul style="list-style-type: none">• implications for flood storage and safety of the proposed dam (in a flood event both the existing and proposed dams would likely fill. If the existing dam failed it would rapidly add a significant volume of water to the proposed dam storage);• ongoing need to inspect and maintain the existing dam, (unless completely removed), as well as public liability risks relating to the remaining dam;• environmental rehabilitation of the existing reservoir area following opening of the outlets to fill the proposed dam; and• the foundations of the existing dam would be saturated from downstream by the FSL of the proposed dam. Depending upon the materials in the foundations, and the potential for rapid drawdown of the downstream reservoir levels, this could affect the stability of the existing dam. |
| Dam wall embankment | <p>Preliminary investigations indicate several types of dam are suitable for the dam, including concrete-faced rockfill, concrete mass gravity and clay core earthfill dams. The type of dam to be constructed would be determined following detailed site investigations, including determining the availability of construction materials. For the <i>Dungowan and Peel River Feasibility Study – Dam and Pipeline Feasibility Design</i> (feasibility design – GHD 2017b) a clay core earthfill dam was adopted. The indicative embankment has been set with a straight crest, since the topography favours this alignment. To protect against wave erosion the upstream slope of the embankment would need a thick layer of rip rap, overlying a layer graded filter. The lower portion of the downstream embankment would also need protection against erosion. The embankment geometry is to be confirmed once construction material properties are known and suitable construction material sources have been identified.</p> |

Table 2.1 **Summary of key components of project**

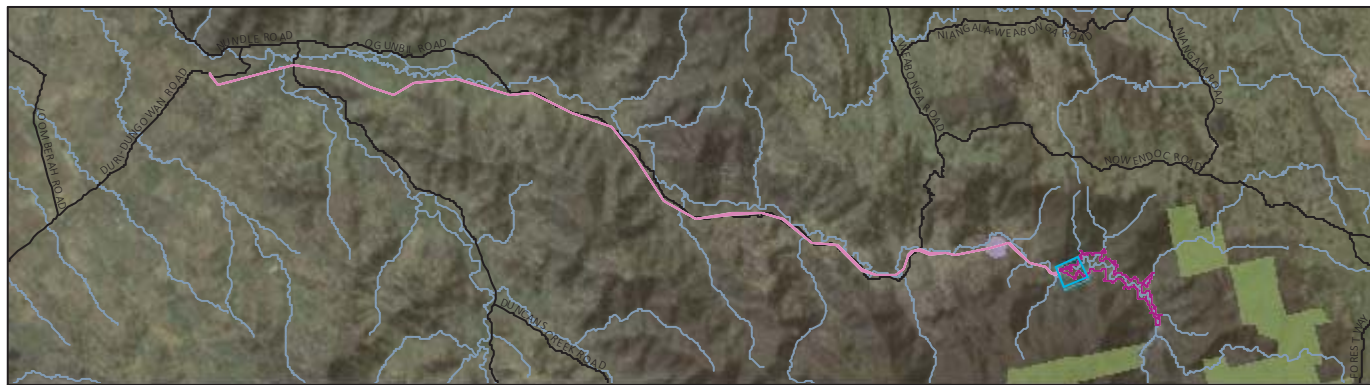
| Component | Description |
|-------------------------------|---|
| Spillway | <p>Subject to detailed design it is presumed a spillway channel would be excavated through the left abutment of the embankment, as this side of the valley is less steep than the right side and would therefore result in less excavation. Excavation needs to be deep enough to expose rock of acceptable quality to support the spillway, with the excavated material potentially used in construction of the embankment shoulders. A lined spillway channel, including concrete side walls is an assumed requirement. Higher walls are likely to be required in the vicinity of the spillway sill. This would need to be confirmed during the detailed design stage.</p> <p>At the downstream end of the spillway chute, a flip bucket is suggested to direct the water into a plunge pool, where energy would be dissipated. If employed as part of the final design the dimensions of the plunge pool would be confirmed during detail design by a physical model or computational fluid dynamics modelling. A low ogee spillway section is suggested for the upstream side of the lined spillway chute. Spillway sizing will need to be designed to pass the probable maximum flood (PMF).</p> |
| Grout curtain and core trench | <p>For the purpose of the feasibility design, a single row grout curtain is proposed in the core trench, with the need for consolidation grouting in the bottom of the core trench to be evaluated once the geological conditions have been investigated in more detail. Fissures and sharp irregularities in the core trench would be given special treatment in order to provide an acceptable contact zone between the foundation and the core. Shotcreting of parts of the foundation is also likely to be required.</p> |
| Outlet conduit | <p>The feasibility design proposes an oversized square outlet conduit on the right creekbank, for diverting the creek during construction, as well as to accommodate the outlet pipework and provide access to the intake tower during dam operation. To protect the dam core against piping along the outlet, the conduit would have sloping sides that facilitate compaction of earthfill against the conduit.</p> <p>While the conduit in the feasibility design follows the bends in the river, the provision of a straighter conduit set further into the right abutment should be evaluated during detailed design. A diversion tunnel could also be considered in detailed design, in lieu of a conduit.</p> |
| Upstream coffer dam | <p>Following construction of the outlet conduit an upstream coffer dam would be constructed, itself requiring low, temporary coffer dams to maintain dry conditions for foundation preparation and construction. The height of the coffer dam would be confirmed once the design floods have been computed. The feasibility design proposes using the upstream coffer dam to form part of the main embankment.</p> |
| Downstream coffer dam | <p>A downstream coffer dam is proposed to prevent water flowing back into the footprint of the main embankment dam. Detailed design will require backwater calculations and a risk analysis to confirm an appropriate height for the downstream coffer dam.</p> |
| Intake tower | <p>A dry intake tower with access to the tower through the outlet conduit is being considered. A man-lift would provide access to the top of the tower, where a service crane would facilitate the maintenance of valves, cleaning of screens, placement of bulkhead gates, etc. The intake would be located directly above the outlet conduit. The final location of the intake would need to be confirmed during the detailed design stage. To minimise potential cold-water pollution and dissolved oxygen impacts a multi-level off-take would be included, with final offtake intervals to be confirmed during detailed design. During the detailed design stage, bridge access to the intake tower would be evaluated as an alternative to access through the outlet conduit.</p> |
| Outlet valve house | <p>At the downstream end of the outlet conduit is a proposed valve house where the pipe from the outlet tower would bifurcate, with one side linking to the Calala Water Treatment Plant and the other going to the river outlet valve. The need for more than one size of outlet valve to provide varying releases would need to be considered at detail design stage. In addition, the environmental requirements will be evaluated in more detail to ensure that appropriate environmental release facilities are provided.</p> |
| Fish passage | <p>Fish passage design and location will be investigated and confirmed during preparation of the EIS.</p> |

Table 2.1 **Summary of key components of project**

| Component | Description |
|------------------------|--|
| Pipeline | The project involves construction of a new 33 km pipeline (nominally 45 ML/d to deliver water from the proposed dam to the Calala Water Treatment Plant by connecting in with the pipeline from Chaffey Dam. The pipeline route will need to be confirmed during detailed design. Depending on the route the pipeline may require pumping stations and/or water tanks to control flow. |
| Access roads | Road access to the outlet valve house and dam crest would be necessary for maintenance and operations. A low-level culvert crossing would be provided across the Dungowan River downstream of the dam. Maintenance access to the bottom of the intake tower would be limited by the size of the outlet conduit. To provide access, particularly when transporting heavy goods, within the outlet conduit, a small vehicle may be provided within the outlet conduit to the bottom of the intake tower. Some adjacent gravel roads would likely need to be upgraded to facilitate access. |
| Construction compounds | The project is likely to require the establishment of one or more construction compounds to facilitate construction of the proposed dam. Smaller construction laydown areas may also be required to allow for construction of specific elements of the project, including the pipeline. Site selection of the construction compounds would be determined during detailed design, based on siting criteria provided in Section 2.5.1. |
| Construction camp | A construction camp may also need to be established to provide accommodation and associated services during the construction phase of the project. The need for and location of such a camp would be considered during preparation of the EIS. |

2.3.2 Design integration and assessment approach

The preliminary design considered in this scoping report was developed in accordance with WaterNSW's objective to improve water security for Tamworth. Further design work is underway to develop the concept design to inform the environmental assessment and feed into the detailed design. The process of design development during the EIS will involve an iterative design integration and assessment process where findings of environmental investigation of the concept will input to ongoing design refinement and solutions. This process will allow the design to avoid or minimise environmental and social impacts where possible without compromising dam safety requirements.



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- | | | |
|---|---------------------------|-------------------------|
| Project footprint | Watercourse | Embankment dam |
| Indicative alignment for pipeline (project) | Waterbody | Pipeline (20 m buffer) |
| Local road | Indicative infrastructure | Spillway |
| Track | Cofferdam | Spillway stilling basin |
| | Diversion culvert | |

Indicative project layout

Dungowan Dam Project
Scoping report
Figure 2.3

2.4 Construction

Construction activities for the project would be undertaken within the project footprint (Figure 2.2). Key construction activities include:

- Establishment of construction compound(s) and associated infrastructure, including construction camp (if needed).
- Construction of key components, including:
 - main dam embankment;
 - spillway; and
 - pipeline.
- Commissioning, filling and operation: Following completion of construction work, the dam would undergo a period of commissioning and filling before commencing routine operation. This stage of the project would be guided by development and implementation of an operational strategy. The Dungowan Dam operating strategy would be developed with consideration of existing water users, environmental outcomes and flood mitigation.
- Decommission/partially decommission the existing dam.
- Decommissioning temporary construction facilities, including construction compounds, laydown areas, construction camp, and site rehabilitation as required.

2.5 Alternatives being considered

Several options for improving Tamworth's long-term water security were identified, including further enlarging Chaffey Dam's storage, construction of new off-channel water storages, construction of new dams at Swamp Oak Creek Dam and Mulla Creek Dam, inter-basin transfer from Aspley River Scheme and Bernard River Scheme and groundwater options including the Peel alluvium aquifer, Peel fractured rock aquifer and the Mooki Valley aquifer.

WaterNSW developed and assessed several bulk water augmentation options. The shortlist of options considered included:

- raising the dam wall on the existing Dungowan Dam to enlarge its capacity;
- provision of a new Dungowan Dam located downstream from the existing dam, with possible storage capacities of 22.5 GL, 40 GL and 60 GL, combined with a new Dungowan pipeline; and
- new Chaffey pipeline delivering 45 ML/day for water supply to Tamworth. This was considered together with each of the above options.

The construction of a new 22.5 GL Dungowan Dam and replacement of the pipeline was identified as the preferred option. This option was selected because there were less construction and operational complexities, as well as safety management issues associated with augmenting the existing dam. The preliminary design is based on the construction of a clay core earthfill embankment dam to provide 22.5 GL of storage and improve yields by 6 GL/annum. While raising the existing dam to achieve the same storage capacity was considered, this option only provided half the estimated increase in yields; 3 GL/annum.

As well as the superior yields offered, constructing a new dam was estimated to have a similar or lower construction cost than enlarging the existing. Relative to the larger dam options the proposed 22.5 GL dam provided a superior cost/benefit ratio, meaning the added expense of the larger dam options had relatively reduced benefits and was not justified.

An iterative process of environmental investigation, impact assessment and concept design will be undertaken to refine the preliminary design. The design will be optimised to maximise the potential improvements in water security, drought security and flood management capacity whilst minimising environmental impacts.

Some key considerations during development of the concept design include:

- Decommissioning the existing dam: The decommissioning program for the existing dam needs to be rationalised with ongoing site management and operational concerns for the proposed dam.
- Geotechnical: Detailed field investigations are required to inform selection and design of key infrastructure elements, including the dam wall and spillway.
- Construction materials: The type, availability and cost of construction materials will inform the type of dam wall that can be constructed. Construction material investigations are required to determine the type of dam that will be constructed, as well as other logistics associated with dam construction.
- Dam wall and spillway design: The feasibility design was for a clay core earthfill dam and a spillway on the left abutment, noting this was dependent on geotechnical and construction material investigations. Refinement of these design elements is a key consideration for development of the concept design.
- Flood risks during construction and operation: The presence of the existing dam is a key consideration for managing flood risks during both construction and operation of the proposed dam, with the risk of the existing dam failing/routing flood flows needing to be managed. Both the design and construction methodology need refinement to manage the risk of flooding impacts on the proposed dam and downstream.
- Pipeline route: Optimisation of the pipeline route and concept design need to consider opportunities to avoid and minimise impacts to environmental features, linking with the newly constructed Chaffey Dam pipeline and minimising potential operating costs from water pumping.

2.5.1 Criteria for determination of construction compound site locality

Potential locations for construction compounds will be identified during detailed design and EIS preparation. As the iterative process of concept design and environmental assessment progresses, preferred locations for construction compounds will be identified. The following provides a summary of key criteria that would be considered when selecting a preferred location:

- land ownership / lease arrangements;
- site topography, drainage and soil conditions: The preference should be a large open area with a reasonably flat site. A slight slope is permissible for stormwater runoff;
- proximity to the construction site of the dam wall – preferably downstream of the dam to be constructed;
- a site that avoids or minimises potential impacts to threatened vegetation and Aboriginal cultural heritage;
- a site that avoids or minimises potential impacts on sensitive receivers including noise and air quality impacts;

- a site that has large enough area to accommodate key facilities, including concrete batch plants, heavy construction machinery, construction site offices, storage and laydown areas;
- access and availability of potable water and electricity;
- access and availability of communications;
- accessibility by emergency services;
- accessibility by road for delivery of construction materials and removal of waste;
- potential impact from flooding; and
- safety and security – inner and outer perimeter security including safety for pedestrian and vehicular movements.

3 Strategic context

3.1 Water security for the future

WaterNSW is responsible for dam operations, water security and managing water stored in all its 42 water storages. Each valley has different water storage and supply issues. In the coming decades, the most important environmental change with significant implications for infrastructure is a reduction in water availability.

3.1.1 Drought and climate trends

Natural rainfall variability in NSW is large and the State has a history of drought and flooding events. The most severe drought events include the Federation Drought (1896 to 1902) and the more recent Millennium Drought (1996 to mid-2010). Severe flooding events across NSW followed during 2010 and 2011, which provided the wettest two-year period on record and broke the long-term drought across the State (BoM 2012).

While natural variability is expected to provide rainfall during cooler months and in the short-medium term, in the longer term, large year to year rainfall variability is expected against a background state which is expected to further change through time. Longer, drier periods and less frequent but more intense rainfall events are expected.

NSW is currently experiencing one of the most severe droughts on record, with the Central West, Far West and North West regions the worst affected to date. WaterNSW is already delivering a range of emergency drought relief projects to extend water supplies for critical human needs in towns and valleys where rainfall, inflows and storage levels are low. The current experience further highlights the critical need for planning for future droughts and ensuring water security during these periods.

3.1.2 Government support, plans and policy

The State Infrastructure Strategy (SIS) was first delivered in October 2012 and is a 20-year infrastructure investment plan for the NSW Government that places strategic fit and economic merit at the centre of investment decisions. The strategy assesses infrastructure problems and solutions, and provides recommendations to best grow the State's economy, enhance productivity and improve living standards for NSW community. The SIS was reviewed in 2014 and updated in 2018 to the current *Building Momentum State Infrastructure Strategy 2018-2038*.

In support of the SIS:

- WaterNSW developed a 20 year Infrastructure Options Study (2018). This Options Study details the state's existing rural bulk water supply systems and provides a strategic level assessment of infrastructure solutions to mitigate or improve long-term level of service issues in the regulated valleys. A new Dungowan Dam was one of many options considered to improve water availability in the Peel Valley;
- WaterNSW commissioned a feasibility study for Dungowan Dam and Peel Valley. The study identified a number of water security options. A select number of these options were carried forward for further analysis and the new 22.5 GL Dungowan Dam to be built downstream of the existing dam was determined to be the preferred option; and
- a regional water security and supply fund was committed to by the NSW and Commonwealth governments.

The \$1 billion water infrastructure package for rural and regional communities in NSW was announced in October 2019 by the NSW Premier and Commonwealth governments. Part of this funding is committed to the planning and development of the project.

3.2 Peel Valley catchment

In NSW, 82.5 per cent of the land area and 11.6 per cent of the population is located west of the Great Dividing Range. The main water demands in this area are agriculture, mining and supporting regional towns.

The Peel Valley provides water for irrigation as well as supplementing water supply for the city of Tamworth. Irrigated pastures and fodder crops (ie lucerne) comprise the largest proportion of irrigated land use in the Peel Valley. Town bulk water supplied from Chaffey Dam releases down the Peel River in addition to Dungowan Dam and pipeline. Dungowan Dam supplies water directly through the transfer pipeline to Calala water treatment plant for potable supply distribution.

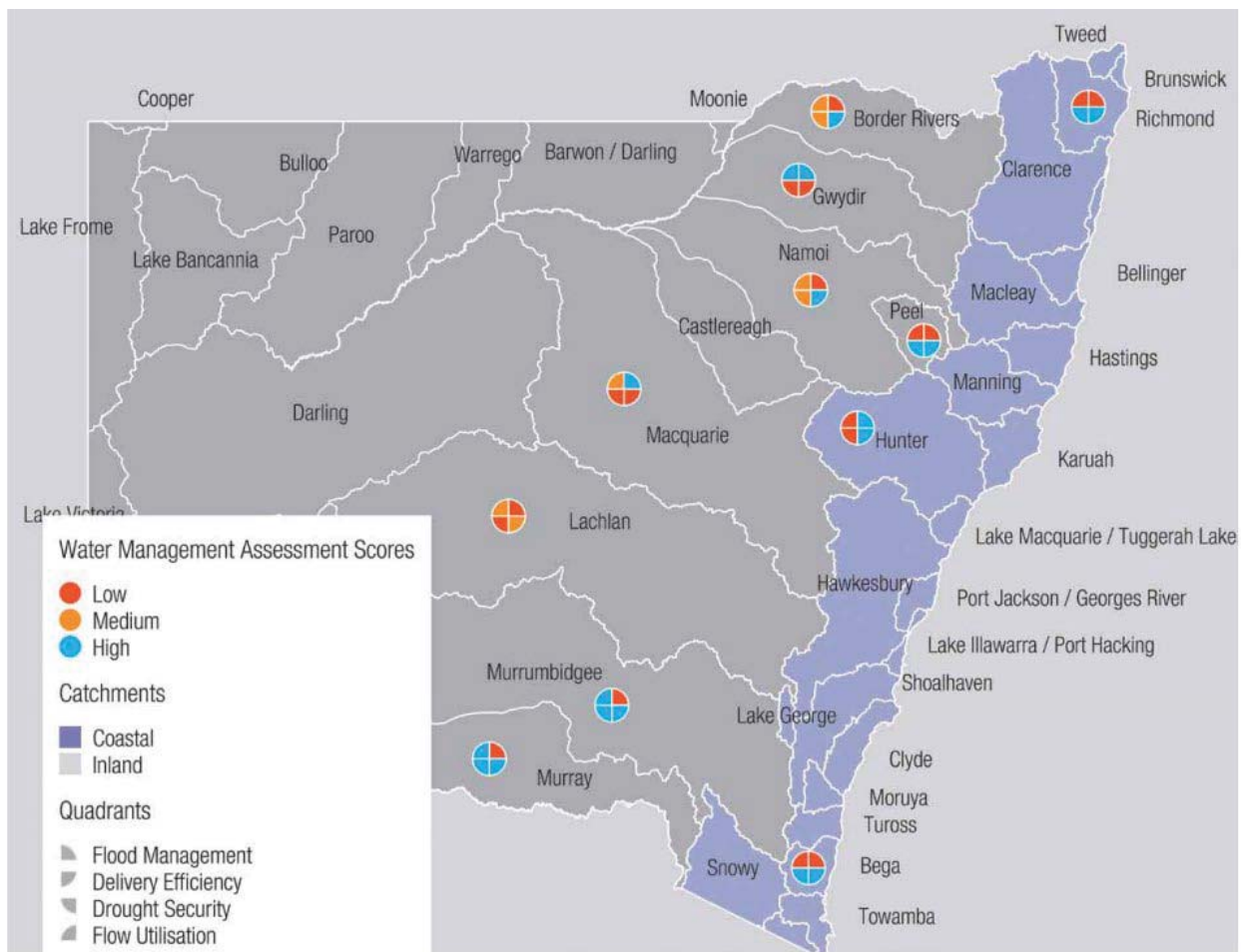
3.2.1 Current challenges and opportunities

The population of Tamworth is growing and so is the need for secure long-term water supply. Tamworth's bulk water supplies became critical during the previous drought conditions experienced between 2003 to 2008.

While dam safety upgrades and augmentation of Chaffey Dam (increasing storage capacity from 62 GL to 102 GL), which was completed in May 2016, has eased the short-to medium term pressures facing Tamworth, concerns remain around its long-term water security. This is evidenced by the current low supply levels (as at 9 March 2020 the dam level is 14.2 per cent of capacity) with water supply currently critical as NSW again faces extreme drought conditions.

The relative capability of the Peel Valley's water system is reflected in the SIS Review, which rated regional valleys according to four attributes (as shown in Figure 3.1). The Peel Valley had low scores across two of the four key areas: flood management and flow utilisation.

The current dam, which has an ungated spillway, is operated as a water supply storage and is not operated for the purposes of flood management and mitigation. A secondary benefit of a new dam downstream is that flood security and water storage benefits may accrue as the dam would improve the ability to store a greater volume of inflows, including from two tributaries downstream of the existing Dungowan Dam. The temporary storage of flood inflows facilitated by the larger dam would contribute to the reduction in flood impacts to the downstream community, particularly during less frequent though larger flood events.



Source: Infrastructure NSW (2014)

Figure 3.1 Water management assessment scores for NSW catchments

3.2.2 Natural and built features of the catchment

The proposed dam is on Dungowan Creek, within a relatively steep, albeit shallow, narrow valley. Much of the land within the inundation area is owned by Tamworth Regional Council and is uninhabited. The landscape within the proposed inundation area is varied, with the riparian corridor of the Dungowan Creek degraded, channelised and eroded in places, while other areas are more natural. Key features identified within the catchment that could be impacted by the project include substantial biodiversity values, Aboriginal cultural and historical heritage values. These features and further consideration on how they may be impacted by the project is described in Chapter 6.

3.3 Critical need for the project

The principle objective of the Dungowan Dam project is to secure the long-term water supply security for the regional city of Tamworth and Peel Valley water users. Prompted by the millennium drought a series of investigations into the future supply and demand for bulk water were undertaken. The recent augmentation of Chaffey Dam completed in May 2016, has eased the short- to medium-term pressures facing Tamworth, although there remain concerns around its long-term water security and that of other regulated water users in the valley. Based on the existing supplies, future Tamworth demand could exceed available supply between 2035 and 2040 under an average growth scenario or between 2025 and 2030 under a high growth scenario.

The need to maintain current water security and reliability for general security licence holders is an important issue in the Peel Valley. As Tamworth City grows, this will result in reductions in irrigation water reliability and average annual use. The reduced availability for irrigation would negatively impact economic productivity and water affordability in the Peel Valley. This may act as a capacity constraint on the growth of Tamworth City - a leading regional centre in the north-east of NSW.

It is necessary, therefore, to explore infrastructure solutions that secure both the long-term water supply for Tamworth and maintain or improve the existing level of reliability for general security users. In addition, there is the need to improve flood security and address the dam safety risks of the current Dungowan Dam.

The need to deliver the project is critical to the State's drought recovery process. The project would be constructed rapidly to create security for Tamworth's town water supplies and associated industries reliant to the delivery of water for viability. The project is wholly consistent with the State's infrastructure priorities of improving water security for regional communities.

4 Statutory context

4.1 Critical State significant infrastructure

Section 5.12 of the EP&A Act provides for the declaration of SSI, and section 5.13 enables the NSW Minister for Planning and Public Spaces to declare SSI to be CSSI if 'it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental or social reasons'.

On 21 November 2019, the *NSW Water Supply (Critical Needs) Act 2019* (WSCN Act) was enacted. The object of the act is to facilitate the delivery of water supplies to certain towns and localities to meet critical human water needs, and to declare certain activities to be CSSI for the purposes of the Part 5 of the EP&A Act.

Schedule 3 of the WSCN Act provides that certain activities described in the schedule is taken to be CSSI. It currently includes four activities, including the project.

Accordingly, the project is declared to be SSI and CSSI. As such, the project requires assessment and approval from the NSW Minister for Planning and Public Spaces under Division 5.2 of Part 5 of the EP&A Act.

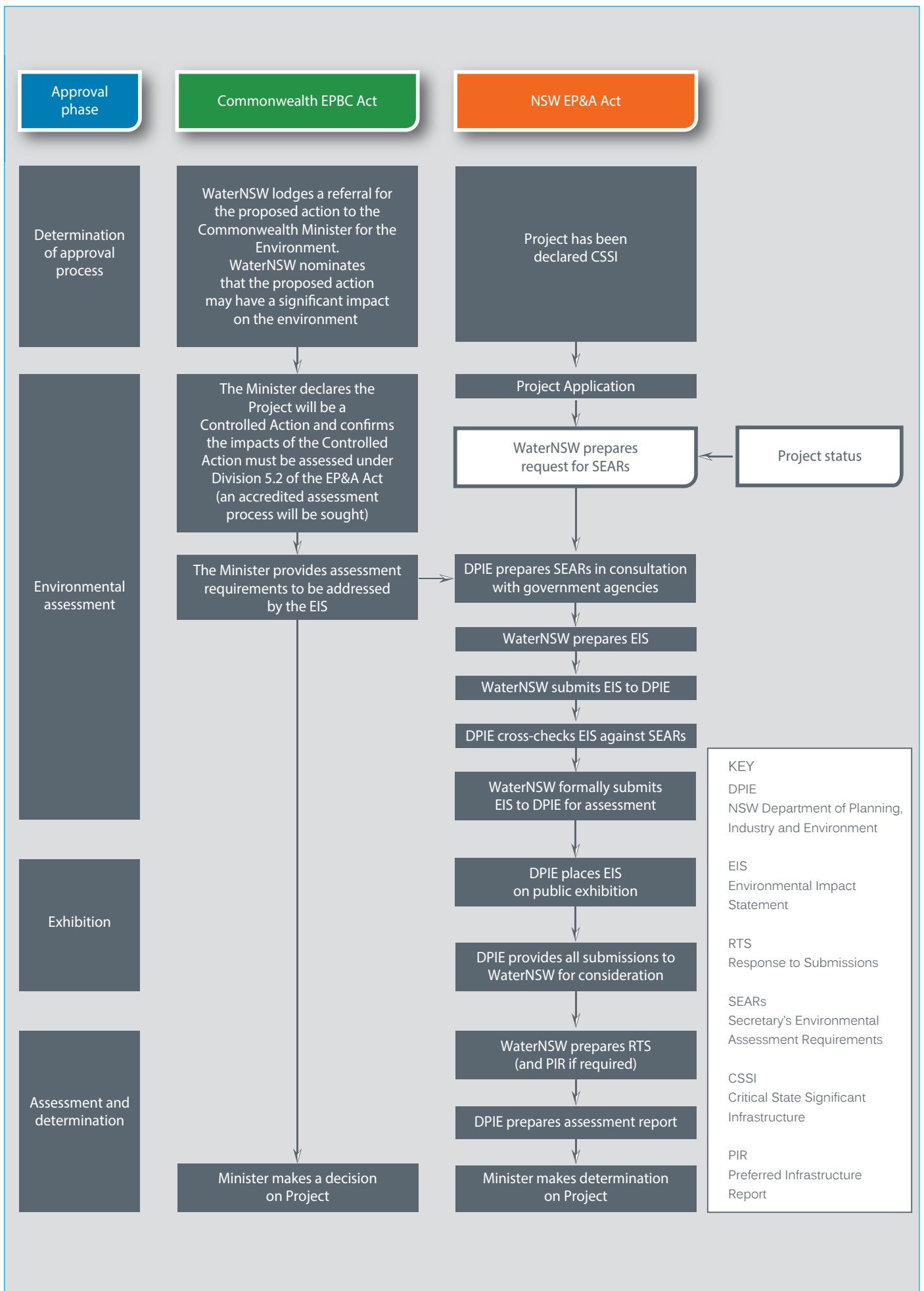
4.2 Planning and assessment process

Division 5.2 of Part 5 of the EP&A Act sets out the assessment and approval framework for SSI and CSSI. This process is shown in Figure 4.1.

As previously stated, applications for SSI and CSSI must be accompanied by an EIS. The requirements of an EIS are stipulated in Schedule 2 of the EP&A Regulation 2000. This states, among other things, that an EIS must address the Secretary of DPIE's environmental assessment requirements (SEARs) and include:

- (a) a summary of the EIS,
- (b) a statement of the objectives of the development, activity or infrastructure,
- (c) an analysis of feasible alternatives to the carrying out the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,
- (d) an analysis of the development, activity or infrastructure, including:
 - (i) a full description of the development, activity or infrastructure, and
 - (ii) a general description of the environment likely to be affected by the development, activity or infrastructure, and
 - (iii) the likely impact on the environment of the development, activity or infrastructure, and
 - (iv) a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure, and
 - (v) a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,
- (e) a compilation (in a single section of the EIS) of the measures referred to in item (d)(iv),
- (f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development.

The EIS for the project would be undertaken to address the SEARs and include the above requirements.



4.2.1 Application of other provisions of EP&A Act

By virtue of section 5.22 of the EP&A Act, a number of parts and divisions of parts of the EP&A Act do not apply to SSI and CSSI. This includes local environmental plans (LEPs) and state environmental planning policies (SEPPs) (except where they apply to the declaration of infrastructure as SSI and CSSI) and Part 4 of the EP&A Act.

4.2.2 Other State approvals and licences

Under sections 5.23 and 5.24 of the EP&A Act, certain separate environmental approvals under other NSW legislation would not be required for the project or would be required to be issued consistent with an approval (if granted) for the project. Each of these separate environmental approvals is considered in Table 4.1.

Further environmental and other approvals may be required in addition to those referred to under section 5.23 and 5.24 of the EP&A Act, and these would be considered and outlined where relevant to the assessment of the project as part of the EIS.

Table 4.1 Other State approvals and licenses

| Approval | Relevance to project | Comment |
|---|---------------------------|---|
| Approvals not required under section 5.23 | | |
| A permit under section 201, 205 or 219 of the NSW <i>Fisheries Management Act 1994</i> (FM Act) | Relevant but not required | Consistent with clause 5.23 of the EP&A Act, these approvals are not required for SSI and CSSI or any investigative or other activities that are required to be carried out for the purpose of complying with any environmental assessment requirements in connection with an application for approval. |
| An approval under Part 4 or an excavation permit under section 139 of the NSW <i>Heritage Act 1977</i> | Relevant but not required | |
| An Aboriginal heritage impact permit under section 90 of the NSW <i>National Parks and Wildlife Act 1974</i> | Relevant but not required | |
| A bushfire safety authority under section 100B of the NSW <i>Rural Fires Act 1997</i> | Relevant but not required | |
| A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than a groundwater interference approval) under section 91 of the NSW <i>Water Management Act 2000</i> (WM Act) | Relevant but not required | |
| Approvals required to be issued consistently under section 5.24 | | |
| An aquaculture permit under section 114 of the FM Act | No | The project does not involve aquaculture. |
| Approval under section 15 of the NSW <i>Mine Subsidence Compensation Act 1961</i> | No | The project is not within a mine subsidence district. |
| A mining lease under the NSW <i>Mining Act 1992</i> | No | The project does not involve mining. |
| A production lease under the NSW <i>Petroleum (Onshore) Act 1991</i> | No | The project does not involve petroleum production. |

Table 4.1 Other State approvals and licenses

| Approval | Relevance to project | Comment |
|---|----------------------|--|
| An environment protection licence (EPL) under Chapter 3 of the NSW <i>Protection of the Environment Operations Act 1997</i> | Yes | It is likely that an EPL would be required for the applicable scheduled activities. Under section 5.24(1) of the EP&A Act, an EPL cannot be refused if it is necessary for carrying out approved SSI and CSSI and is to be substantially consistent with the EP&A Act approval. |
| A consent under section 138 of the NSW <i>Roads Act 1993</i> (Roads Act) | Yes | The project involves interaction and works within public road reserves. Under section 5.24(1) of the EP&A Act, consent under section 130 of the Roads Act cannot be refused if it is necessary for carrying out approved SSI and CSSI and is to be substantially consistent with the EP&A Act approval. |
| A licence under the NSW <i>Pipelines Act 1967</i> (Pipelines Act) | Yes | The project involves the construction and operation of water pipelines. Under section 5.24(1) of the EP&A Act, a licence under the Pipelines Act cannot be refused if it is necessary for carrying out approved SSI and CSSI and is to be substantially consistent with the EP&A Act approval. |

4.3 Commonwealth approval framework

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect matters of national environmental significance (MNES) including:

- world heritage properties;
- national heritage places;
- Ramsar wetlands of international importance;
- nationally threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development.

If an action will, or is likely to, have a significant impact on any MNES, it is deemed to be a 'controlled action' and requires approval from the Commonwealth Minister for the Environment or the Minister's delegate. To determine whether a proposed action will or is likely to be a controlled action, a Referral of Proposed Action is submitted to the Commonwealth Department of the Agriculture, Water and the Environment (DAWE) for assessment.

As stated in 6.2.1, regional vegetation mapping and preliminary field surveys identified that some of the native vegetation within the study area is likely to be part threatened ecological community, commonly known as Box Gum Woodland which is listed as critically endangered under the EPBC Act. This community is also known to provide habitat for threatened flora and fauna species listed under the EPBC Act.

Accordingly, WaterNSW, on a precautionary basis, will refer the project to DAWE and nominate that it has the potential to have a significant impact on MNES. This will allow potential impacts to relevant MNES to be considered in the EIS being prepared for the project.

The approval process under the EPBC Act will be determined with DAWE. A proposed Action can be assessed using one of the following assessment approaches:

- accredited assessment (where there is no bilateral agreement in place the Commonwealth Minister for the Environment can accredit use of state legislation, such as the EP&A Act, for the assessment);
- assessment on referral information;
- assessment on preliminary documentation;
- assessment by EIS or public environment report; or
- assessment by public inquiry.

It is WaterNSW's preference that the project be assessed using an accredited process under section 87(4) of the EPBC Act, where the Commonwealth accredits the assessment process under Division 5.2 of Part 5 of the EP&A Act.

The approval process under the EPBC Act using an accredited process can be seen in Figure 4.1.

The use of an accredited assessment process does not alleviate the approval requirements of the Commonwealth Minister for the Environment under the EPBC Act. While the NSW Minister for Planning and Public Spaces is the determining authority for the project under the EP&A Act, the Commonwealth Minister for the Environment remains the person who must decide whether to approve the controlled action under the EPBC Act.

5 Considerations during scoping

5.1 Engagement with community and stakeholders

The project is one of the first major dam projects in NSW in four decades and comes in response to the effects of a severe drought, which has highlighted the importance and priority of water security for communities and users of river systems and water storages.

WaterNSW commenced introductory discussions for the project in late 2019 and early 2020 with Tamworth Regional Council and key stakeholder groups. These preliminary meetings provided initial views on issues and concerns, perceived benefits and preferred methods of interaction and communication and discussed the principles and practices around WaterNSW future engagement.

The primary concerns highlighted by this consultation were:

- ownership of the assets (and perceived control of operation and benefits) once constructed, noting the current Dungowan Dam is owned by Tamworth Regional Council;
- optimising the dam size, and pipeline size and route selection (including the need for land acquisitions and easements for the pipeline);
- inundation impact on existing assets and services (ie. roads etc);
- concern the project may not proceed;
- the need to consider other measures for drought proofing;
- the risks for water quality and catchment health;
- issues relating to water security for existing licence holders;
- opportunity to retain and re-use to some extent (recreation/water supply/pumped hydro) the existing dam; and
- opportunities for local participation in the project.

Communication with the broader community has also commenced through:

- media releases including the public announcement by the NSW Minister for Water, Property and Housing;
- updates via the WaterNSW website including a dedicated project page providing a description of the project and access to the supporting feasibility and investigative studies;
- initial identification and engagement of Aboriginal community members; and
- continuing community information sessions on WaterNSW projects in the Tamworth region (three sessions schedule for March 2020).

WaterNSW has committed to guiding principles for engagement on the project and will implement a comprehensive consultation and engagement strategy to inform the project throughout subsequent stages, as detailed in

Chapter 7. This will include an Aboriginal engagement communication strategy that will provide a foundation for close engagement with the Aboriginal community.

5.2 Identification of key issues

5.2.1 Scoping process

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for the project and the required level of assessment. This process was informed by desktop assessment and limited field survey undertaken by WaterNSW and the project team. This process included:

- consultation with DPIE and key stakeholders;
- undertaking a process of identifying and characterising relevant matters for assessment, involving an appraisal of likely environmental and social impacts; and
- reporting the outcomes of that assessment in this Scoping Report.

A checklist of matters was provided (DPIE 2019) and a preliminary impact and mitigation assessment was carried out. The full list of matters considered in the scoping assessment is provided in the Scoping Worksheet provided at Appendix A. Those matters relevant to the construction and operation of the project have been identified and allocated to one of the following categories:

- Key matters or issues – these have been defined as requiring detailed assessment, ie will require detailed field surveys and/or quantified modelling techniques to fully understand the impacts and identify project-specific mitigation and/or alternatives. It is assumed at this stage of assessment that each of the listed key issues will require separate technical responses and will be separately attached to the EIS.
- Other matters or issues – characterised as matters where the assessment approach and measures to manage impacts are well understood and routinely used on similar projects and will be subject to a standard assessment. Each of these issues will need to be addressed through the EIS process and require investigation, but which may or may not require a technical study.
- Scoping only issues or matters that require no further assessment in the EIS – matters in this group have been considered in this initial scoping assessment and justification provided as to why it is proposed that they not be investigated further.

The outcomes of the scoping investigations are provided in this report and the completed Scoping Worksheet at Appendix A.

5.2.2 Issues requiring assessment

Based on the findings of the scoping assessment (Appendix A), the environmental investigations that have been carried out to date and feedback received on the project, key assessment issues for the project have been identified as:

- biodiversity;
- hazards & Risks (dam and flood; contamination);
- heritage;
- land;

- social; and
- water.

Table 5.1 presents key issues or matters to be considered for the EIS, and are detailed further in Chapter 6.

Table 5.1 Identification of key and other issues requiring assessment

| Issue | Scoping assessment/consideration during scoping | Key or Other issue |
|-----------------------------------|---|-----------------------------|
| Access | Standard – inundation as a result of constructing and filling the dam has potential to impact a local road. | Other issue (Section 6.7.2) |
| Air quality | Standard – impacts to air is likely to be limited during construction and operation; however, should be considered further as the design develops. | Other issue (Section 6.7.3) |
| Amenity | Standard – Noise and vibration impacts may be experienced during construction. Visual impacts as a result of the proposed pipeline may also require consideration. | Other issue (Section 6.7.4) |
| Biodiversity | Detailed - the project would have direct impacts arising from the construction of the project and inundation. Potential direct impacts include impact on native vegetation; impact on threatened species habitat; and disturbance/inundation of aquatic habitats. | Key issue (Section 6.2) |
| Built environment | Standard - inundation as a result of constructing and filling the dam has potential to impact public infrastructure. | Other issue (Section 6.7.1) |
| Economic | Standard – construction of pipeline may impact the livelihood of some community members. | Other issue (Section 6.5) |
| Hazards and risks (dam and flood) | Detailed – constructing a new dam requires detailed consideration of dam safety and flood risks. | Key issue (Section 6.6) |
| Hazards and risks (other) | Standard – other hazards and risks such as bushfire, contamination and waste will require consideration but are considered unlikely to present a significant risk. | Other issue (Section 6.7.5) |
| Heritage | Detailed - the project has the potential to impact Aboriginal and historical heritage as a result of inundation. | Key issue (Section 6.3) |
| Land | Detailed - partial or complete inundation of land and infrastructure may impact land capability and should be considered in conjunction with social and economic impacts. Consideration of soils within the construction and inundation areas also required assessment. | Key issue (Section 6.4) |
| Social | Standard – potential for construction of the proposed dam and pipeline to affect safety and social cohesion. | Other issue (Section 6.5) |
| Water | Detailed – A range of issues including water quality, cold water pollution, changes to flow regimes and flooding required detailed consideration. | Key issue (Section 6.1) |

5.2.3 Matters requiring no further assessment in the EIS

As part of the scoping process a range of issue were identified that are considered to not require further investigation. Table 5.2 identifies these issues and provides a brief justification for no further consideration in the project EIS.

Table 5.2 **Matters requiring no further assessment**

| Issue | Justification |
|---|--|
| Access (port/airport facilities) | No ports or airports are located in proximity to the project and as such there will not be any direct or indirect impacts. |
| Hazards and risks (coastal hazards) | The project is in the Namoi River catchment, west of the Great Dividing Range in NSW and as such does not require assessment of coastal hazards. |
| Hazards and risks (hazardous/offensive development) | The project, and its associated ancillary development, is not considered to be hazardous or offensive development. |

6 Proposed assessment

Preliminary environmental investigations have been carried out to identify the relevant matters to be addressed in the EIS for the project and the required level of assessment. Based on these findings, issues have been defined as either key or other issues requiring a detailed or standard level of assessment. The proposed assessment for key issues are outlined in Section 6.1 to Section 6.5, and for other issues in Section 6.7.

6.1 Water

6.1.1 Existing environment

i Surface water resources and users

Dungowan Creek is a minor tributary of the Peel River, in northern NSW. Dungowan Creek is regulated by the existing Dungowan Dam and pipeline, while the Peel River system is regulated by Chaffey Dam, which is in the upper catchment near the town of Woolomin, approximately 45 km from Tamworth.

The Peel River supplies water for irrigation, stock and domestic, as well as Tamworth's town water supply and industrial water needs. Chaffey Dam, which was completed in 1979 and augmented in 2016, has a total storage capacity of approximately 100 GL. The Chaffey Dam storage is a shared resource servicing both the water supply needs of Tamworth and agricultural production in the area. Tamworth water supply is supplemented by Dungowan Dam, which is owned and operated by Tamworth Regional Council. The existing dam has a capacity of 6 GL.

From a water management perspective, the Peel Valley catchment is managed and operated independently of the regulated Namoi River catchment water sources. However, water allocations within the catchment are still subject to the provisions of the Murray-Darling Basin Plan (MDBP), including the Sustainable Diversion Limits (SDLs). Water allocations within the Peel Valley are controlled in accordance with the requirements of the *Water Sharing Plan for the Peel Valley Regulated, Unregulated, Alluvium and Fractured Rock Water Sources 2010* (Peel Valley WSP), which is made under Section 50 of the *Water Management Act 2000*.

ii Hydrogeological setting

The local flow system is a fractured rock groundwater aquifer contained within the surrounding terrain. The fractured rock is likely to have very low primary porosity with groundwater flow occurring within secondary porosity features such as fractures or along contact boundaries between different rock lithologies. The hydraulic conductivity and groundwater storage within these secondary porosity features is typically very low, making it an ideal surrounding rock for water impoundment.

Recharge areas to the fractured rock and upper reaches of the valley alluvial aquifers are generally considered to be via rainfall on the upper slopes, ridgelines and hilltops of the landscapes where the rock sub-crops or outcrops. Discharge points are likely to comprise of natural locations such as springs, spring fed dams, lower slopes and the relatively lower lying areas.

iii Groundwater management and users

Water sharing plans establish rules for sharing water between the environmental needs of the river or aquifer and water users, and between different types of water use such as town supply, rural domestic supply, stock watering, industry and irrigation. The purposes of these plans are to protect the health of rivers and groundwater, while also providing water users with perpetual access licences, equitable conditions and increased opportunities to trade water through separation of land and water.

The proposed dam is within the New England Fold Belt Murray Darling Basin Groundwater Source. The alluvium in the valley below the dam is within the Peel unregulated river water source and part of the Peel Valley WSP.

A search of the WaterNSW realtime water data website indicates that there is low groundwater use around the proposed dam, with one registered bore located within 10 km downstream of the proposed dam.

6.1.2 Issues for consideration

i Surface water

The project may have potential impacts on surface water hydrology, water quality, cold water pollution, and flooding. These impacts could extend beyond the project boundary and may, without appropriate mitigation measures, be significant. The project could adversely impact water users, aquatic and terrestrial ecology, downstream infrastructure and properties adjacent to the downstream watercourse.

The potential impacts of the project with reference to the above matters of consideration will need to be assessed in the EIS. Additional baseline data (flow and water quality) will need to be compiled and detailed flood modelling will be required to quantify and assess the potential impacts.

ii Groundwater

The main issues for consideration of groundwater impacts is a potential reduction of frequency of flooding and reduction in the volume of surface water runoff into the valley alluvium aquifer. This could impact downstream groundwater users that abstract groundwater and dependent environments. These potential impacts could be managed by controlling environmental flows from the dam to the downstream river environment and should be considered during the EIS and development of management plans. Impacts to groundwater resulting from the project are considered minor and could be managed by dam operating rules.

6.1.3 Approach to assessment in EIS

i Surface water

Operating rules are a key driver in understanding potential water related impacts. The EIS will identify interim operating rules prepared as part of the iterative design and assessment process.

A water assessment will be completed for the EIS. The assessment will characterise baseline conditions through review of available water quality data, supplemented with the collection of additional field data during the EIS. The assessment will identify and provide management measures for:

- potential impacts on ambient water quality parameters, as defined by the baseline data;
- potential geomorphological impacts including potential erosion and sedimentation within the storage, banks of the storage, and downstream impacts to the receiving environment; and
- cold water pollution relative to the downstream ambient water temperature.

Detailed flood modelling will be conducted to identify potentially impacted properties and to quantify any potential environmental impacts associated with the project, and to develop suitable mitigation strategies if required. Additional dam break modelling will be required as part of the spillway design and this will also be reported in the EIS as it pertains to downstream impacts and public safety.

Water balance modelling will be conducted to confirm yield and security of supply and will consider any requirements of the Peel Valley WSP and SDLs (such as cumulative impacts associated with water extraction/allocation), which have been developed in accordance with the MDBP.

ii Groundwater

A groundwater assessment will be undertaken to assess the incremental impact to the groundwater regime from the project. The key NSW policy the project will need to address is the *NSW Aquifer Interference Policy* (AIP). The AIP sets out the minimal impact considerations that are essentially a series of threshold levels for groundwater level drawdown and quality changes. The study will need to directly address the potential for the project to impact upon these thresholds.

6.2 Biodiversity

A preliminary assessment of terrestrial and aquatic ecology has been prepared. The assessment is provided in Appendix B and can be referred to for further detail on existing biodiversity values and considerations for detailed assessments to be carried out for the EIS.

6.2.1 Existing environment

i Terrestrial biodiversity

The Dungowan Dam project is in the Nandewar Interim Biogeographic Regionalisation of Australia (IBRA) region and *Peel IBRA subregion*. The study area spans the *Niangala Plateau and Slopes, Peel Channels and Floodplain and Tamworth - Keepit Slopes and Plains BioNet NSW Landscape* (formerly Mitchell landscapes).

Vegetation within the terrestrial study area is impacted by previous land use, including agriculture and an impoundment. As a result, native vegetation is partially cleared, and remnant vegetation, particularly along the creek and on lower slopes, is subject to moderate to high levels of weed invasion, past grazing and other disturbance. The area is under severe drought stress, which was evident of vegetation during preliminary survey, with some vegetation subjected to bush fire in January 2020.

Known and expected native plant community types (PCTs) within the project footprint are shown in Figure 6.1. Desktop assessment and preliminary surveys have identified the following threatened ecological communities (TEC) within the project area likely to occur within the project footprint:

- *White Box Yellow Box Blakely's Red Gum Woodland*, listed as endangered under the *NSW Biodiversity Conservation Act 2016* (BC Act); and
- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, listed as critically endangered under the EPBC Act (Box Gum Woodland).

No important wetlands, coastal wetlands, Ramsar wetlands or local wetlands are located within or immediately adjacent to the project footprint.

Of threatened species predicted to occur in the project, 13 threatened flora species and 37 threatened fauna species are identified as likely to occur and require further assessment.

Two of these flora species credit species and six fauna species credit species are identified as being candidate entities for 'serious and irreversible impact', which is defined as impacts that could contribute significantly to the risk of extinction of the species.

A total of 11 migratory species listed under the EPBC Act, with two assessed as moderate to high likelihood of occurrence.

ii Aquatic species and habitats

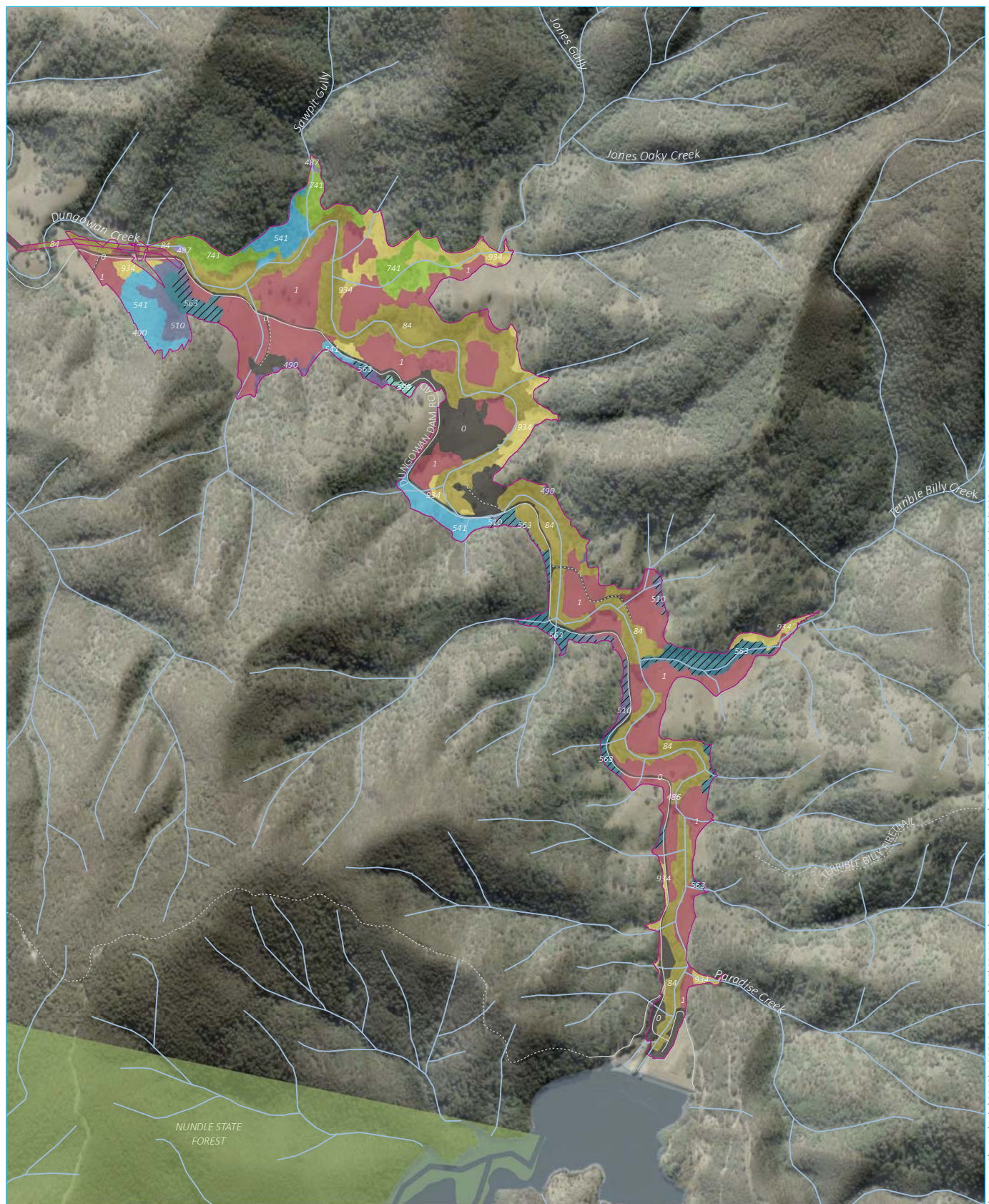
Background research did not identify any aquatic communities of ecological significance listed under the FM Act or the EPBC Act within, or adjacent to, the inundation area or within Dungowan Creek 1 km downstream of the proposed dam wall (aquatic study area). The key fish habitat map for the Tamworth local government area (LGA) indicates that the majority of the waterways within, and adjacent to, the aquatic study area are considered to contain key fish habitat (Figure 6.2). Within the aquatic study area Dungowan Creek is characterised by a series of pool and riffle habitats within a defined channel, with muddy clay to clayey sediments and banks.

A total of four threatened aquatic species were assessed as having a moderate to high likelihood of occurrence within, or adjacent to, the aquatic study area;

- Silver Perch (*Bidyanus bidyanus*) listed as vulnerable under the FM Act and critically endangered under the EPBC Act;
- Southern Purple-spotted Gudgeon (*Mogurnda adspersa*) listed as endangered under the FM Act;
- Murray-Darling Basin population of Eel-tailed Catfish (*Tandanus tandanus*) listed as endangered population under the FM Act; and,
- Murray Cod (*Maccullochella peelii*) listed as vulnerable under the EPBC Act.

iii Groundwater-dependent ecosystems

The *Groundwater Dependent Ecosystems Atlas* predicted that eight PCTs may be present in the downstream aquatic study area that could represent terrestrial groundwater-dependent ecosystems (GDEs). Of the eight predicted terrestrial GDEs, PCT 434, 496 and 599 may represent Box Gum Woodland. No aquatic GDEs were predicted to occur.



Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- Project footprint
- Local road
- Vehicular track
- Watercourse/drainage line
- Waterbody
- State forest
- Potential threatened ecological community
- PCT | Not Native
- PCT1 | Candidate Native Grasslands
- PCT486 | River Oak moist riparian tall open forest of the upper Hunter Valley, including Liverpool Range

- PCT487 | Sweet Pittosporum - Forest Oak - Rough-barked Apple depauperate gully rainforest on the Liverpool Range
- PCT490 | Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion
- PCT510 | Blakely's Red Gum - Yellow Box grassy woodland of the New England Tablelands Bioregion
- PCT541 | Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion

- PCT563 | White Box - Silvertop Stringybark +/- White Cypress Pine grass shrub open forest of the southern Nandewar Bioregion and New England Tablelands Bioregion
- PCT599 | Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT741 | Brown Barrel - gum moist open forest of the escarpment ranges of NSW North Coast Bioregion and New England Tableland Bioregion
- PCT84 | River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions
- PCT934 | Messmate open forest of the tableland edge of the NSW North Coast Bioregion and New England Tableland Bioregion

Plant community type mapping

Dungowan Dam Project
Scoping report
Figure 6.1

Source: EMM (2020); WaterNSW (2020); DFSI (2017); ELVIS (2013); DPI (2009, 2013); BoM (2011)
 *Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.



KEY

- Project footprint
- Local road
- ... Vehicular track
- Watercourse (Strahler stream order 3 and above)
- State forest
- NPWS reserve (refer to inset)
- Dungowan Dam catchment (refer to inset)
- Key fish habitat
- Aquatic species
- Purple Spotted Gudgeon

Aquatic habitat and species

Dungowan Dam Project
 Scoping report
 Figure 6.2

6.2.2 Issues for consideration

The main impacts of the project would be associated with direct impacts arising from the clearing works for construction of the project, including inundation of upstream environments between the existing dam and the new dam's FSL. Potential direct impacts arising from the project include:

- impact on native vegetation, including TECs;
- impact on threatened species habitat; and
- disturbance/inundation of waterways.

In addition to the direct impacts arising from the project, several indirect, prescribed and uncertain impacts, as described in the biodiversity assessment method (BAM) (OEH 2017), may also result. Indirect impacts include disturbance of fauna species due to increased noise, vibration and dust, lighting impacts, increase in weeds, pathogens and pest and predatory animals, impediments to fish passage and changes in downstream flow regimes that may impact aquatic ecosystems, species and habitats.

Measures to avoid, minimise and mitigate impacts will need to be considered during design and further environmental assessment undertaken as a part of the EIS. Any residual impacts would need to be offset.

6.2.3 Approach to assessment in EIS

An assessment of the biodiversity values and the likely biodiversity impacts of the project will be undertaken in accordance with the BC Act, FM Act and EPBC Act. Terrestrial ecology will be assessed in accordance with the BAM and be documented in a biodiversity development assessment report (BDAR). Aquatic ecology will be assessed in accordance with the FM Act and documented in an aquatic ecology assessment.

Further assessment of groundwater availability and changes to groundwater as a result of the project will need to be undertaken to inform a detailed GDE assessment. Further assessment as to whether the aquatic study area supports aquatic and/or subterranean GDEs, will also be required as part of the EIS assessment.

The assessment of biodiversity would be undertaken in accordance with relevant NSW and Commonwealth legislation and guidelines, including:

- *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia 2013);
- *Commonwealth Department of the Environment – survey guidelines for nationally threatened species* (various);
- *Biodiversity assessment method* (OEH 2017);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004);
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009);
- *Policy and guidelines for fish habitat conservation and management* (DPI 2013);
- *NSW Biodiversity Offsets Policy for Major Projects. Fact Sheet: Aquatic biodiversity* (DPI 2014);
- *Survey guidelines for Australia's threatened fish* (DSEWPC 2011); and

- *NSW Guide to Surveying Threatened Plants* (OEH 2016).

The BAM stipulates when surveys are required for native species. Surveys for the project would be undertaken within seasonal timeframes where possible and presence will be assumed for species where surveys cannot be undertaken.

6.3 Heritage

A preliminary assessment of Aboriginal cultural heritage and historic heritage has been prepared. The assessment is provided in Appendix C and can be referred to for further detail on existing heritage values and considerations for detailed assessments to be carried out for the EIS.

6.3.1 Existing environment

Hydrologically, the study area is entirely within the Dungowan Creek catchment. This is a substantial river that meanders along the centre of the valley floor and was likely extensively used by Aboriginal people in the past. Dungowan Creek is dammed, with the existing dam and reservoir situated at the southern end of the valley (partially within the proposed inundation zone). Various minor tributaries run from the steep escarpments and hills, notably Terrible Billy Creek and Jones Oaky Creek, into Dungowan Creek. The establishment of the existing Dungowan Dam in 1958 dammed Dungowan Creek and inundated an area of some 5 square kilometres (km²). Except for the dam activities, including access tracks along the valley base, remaining development in the region has been fairly limited, and constrained to farming, pastoralism and/or low-density residential activities.

i Aboriginal cultural heritage

Previous studies of the region are extremely sparse, and primarily constrained to cultural resource management studies for as part of various residential or industrial activities. While none of the sites or studies are near the study area, the findings at Chaffey Dam may provide a useful analogue. Along the edges of Chaffey Dam, some 28 sites are documented (Office of Planning and Infrastructure 2014). Except for a quarry, these sites are exclusively stone artefactual sites or areas with the potential for them to occur. These sites are primarily isolated Aboriginal objects and/or low-density artefact scatters (generally less than 20 objects). Given the site's relative proximity and similar environmental context, there is potential for similar such findings within the study area.

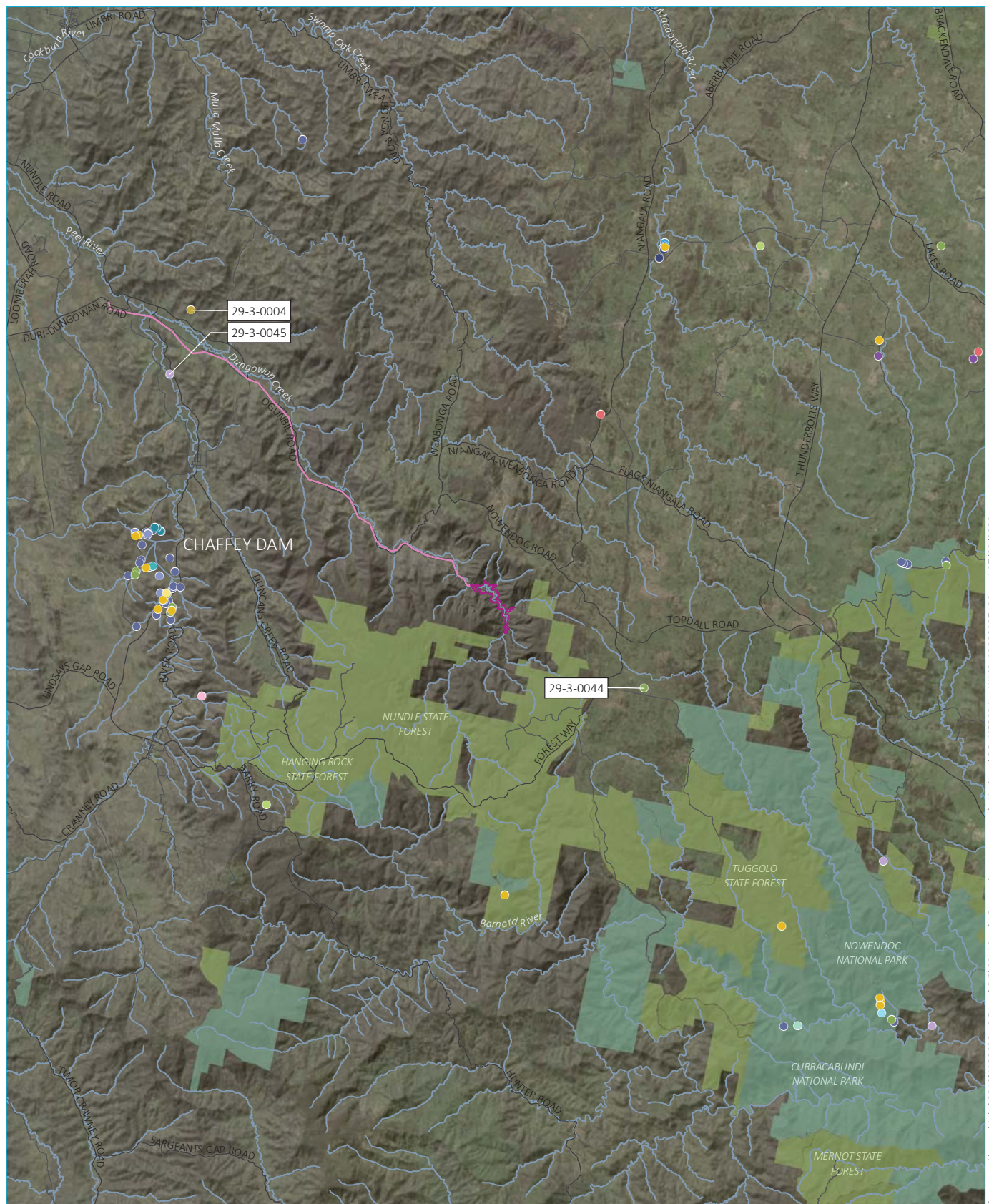
The *Commonwealth Heritage List* (CHL), *National Heritage List* (NHL) and LEP databases identified no Aboriginal objects, sites or places near the study area. Multiple searches of the NSW Aboriginal Heritage Information Management System (AHIMS) database identified 118 previously documented Aboriginal sites in an approximate area 6,000 km² area centred on the dam (Figure 6.3).

No sites are situated near the dam, with the only aggregation occurring around nearby Chaffey Dam; and no data closer than 9 km from the study area. The remainder of the sites are sparsely situated across the search area. Similarly, the proposed pipeline does not encompass any previously documented sites, with the nearest being a stone arrangement (#29-3-0004) and culturally modified tree (#29-3-0045), each about 1 km away. Areas of archaeological potential (Figure 6.4) have been defined by targeted landforms (ridge lines, spurs, crests, flat ground <5 degrees slope, and steep ground >45 degrees slope [rock shelter/outcrop potential]), a 100 m buffer around waterways, and a 20 m buffer around previously recorded Aboriginal sites (AHIMS).

ii Historical heritage

An extensive search of national, State and local heritage registers was conducted. No heritage listed sites were identified within 5 km of the project footprint. A total of 97 listed heritage items were identified within 50 km of the project footprint. A portion of the national heritage listed “Gondwana Rainforests of Australia” (NHL ID 105704) is present in the Oxley Wild Rivers, Werrikimbe, Barrington tops National Parks, over 50 km to the east and south of the dam.

The data drawn from the heritage registers reflects the primary constructed historical narratives of an area, which have been drawn from the NSW historical themes. Within Tamworth Regional, Walcha, Upper Hunter and Liverpool Plains LGAs the heritage focus is on the assets within the larger towns. Built, industrial, and mining heritage is a focus of the listings and several rural homesteads are also listed. Winterbourne Ruins (*Walcha Local Environmental Plan 2012* A001) is the only archaeological site specifically listed within the LGAs.



Source: EMM (2020); WaterNSW (2020); DPI (2020); DFSI (2017); GA (2011)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

0 5 10 km
GDA 1994 NSW Lambert

KEY

- Project footprint
- Indicative alignment for pipeline (project)
- Main road
- Local road
- Named watercourse
- NPWS reserve
- State forest

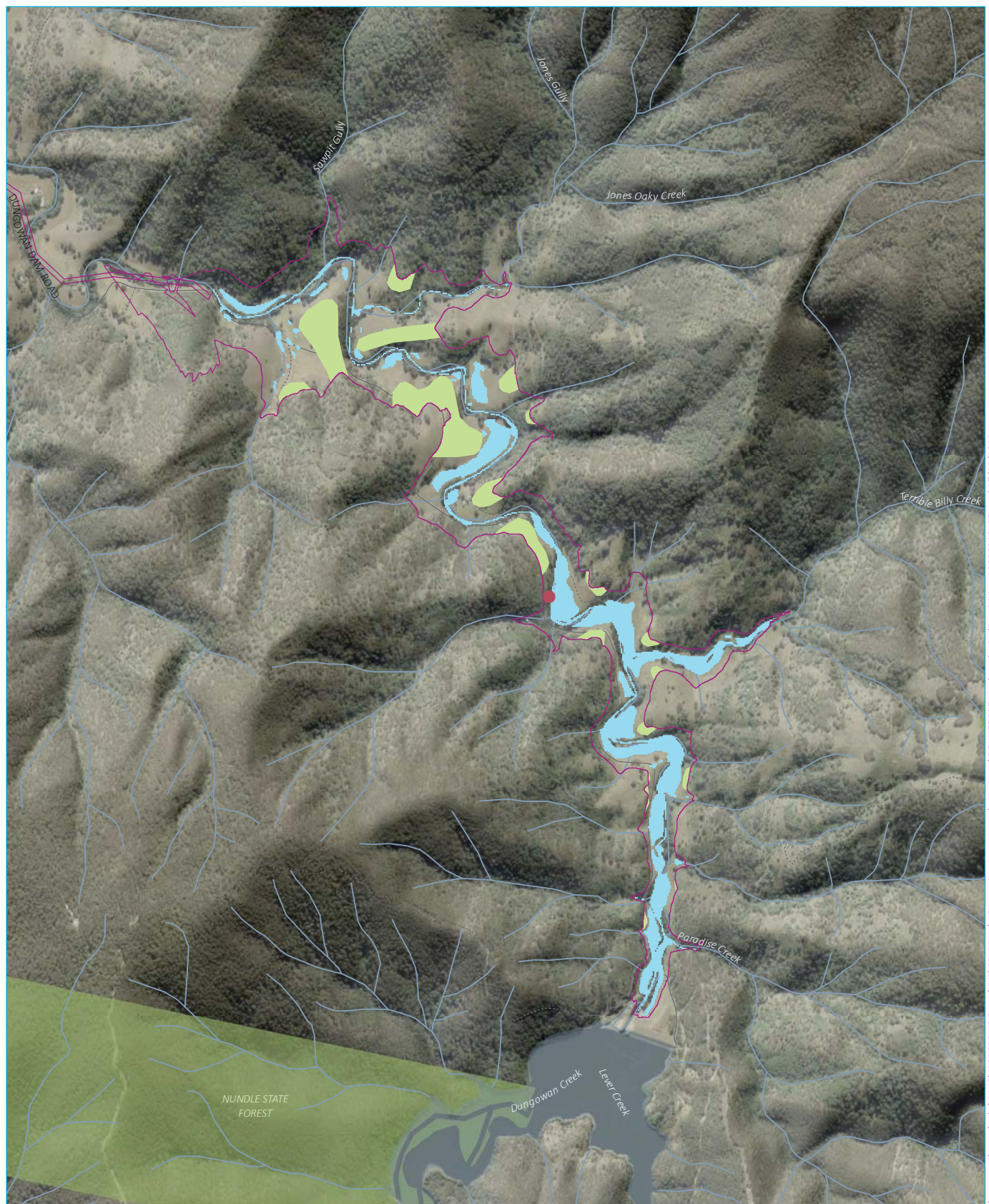
AHIMS site type

- Aboriginal place
- Bora/ceremonial
- Burial; ceremonial
- Contact site
- Culturally modified tree
- Grinding groove
- Habitation structure (post-contact)
- Isolated Aboriginal object
- Isolated Aboriginal object; potential archaeological deposit

- Moderate artefact scatter (20-50)
- Natural resource site
- Potential archaeological deposit
- Quarry
- Rockshelter
- Rockshelter (with art)
- Small artefact scatter (<20)
- Stone arrangement
- Undefined artefactual site
- Undefined artefactual site; potential archaeological deposit

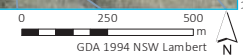
AHIMS site data

Dungowan Dam Project
Scoping report
Figure 6.3



Source: EMM (2020); WaterNSW (2020); DFSI (2017); GA (2011)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.



KEY

- | | |
|--|---|
| Project footprint | Area of archaeological potential |
| Local road | Crest landform |
| Track | Level to gently inclined landforms within 100 m of primary watercourse |
| Named watercourse | ● Very steep to precipitous terrain |
| Waterbody | |
| State forest | |

Areas of archaeological sensitivity

Dungowan Dam Project
Scoping report
Figure 6.4

6.3.2 Issues for consideration

The project has the potential to impact Aboriginal heritage during construction as a result of clearing and earthworks and other construction activities as well as during operation as a result of inundation. The proposed dam would result in inundation of an area of predicted archaeological sensitivity and which may contain Aboriginal objects and sites. The inundation would likely be considered an impact (rather than a form of conservation, such as 'burial in situ') to cultural material where present.

Several structures to be impacted by the project through inundation and construction require further research to determine if any are historically significant. While no confirmed specific sites or places were identified, the project footprint was used for pastoralism and, considering the history of the project area and sites identified during the database searches, a range of associated historic features may also be present.

6.3.3 Approach to assessment in EIS

An Aboriginal cultural heritage assessment (ACHA) would be conducted for the EIS. The ACHA will investigate, characterise, and assess the significance of cultural material and values within the project footprint, and provide guidance on its management and mitigation prior to, during and following construction. An expedited ACHA is anticipated and will be developed in discussion with DPIE and Aboriginal stakeholders, with consideration to:

- consultation requirements set out in the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW 2010); and
- assessment, survey and reporting requirements set out in the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010).

A heritage assessment and statement of heritage impact (SoHI) will be prepared as part of the EIS and will investigate significance and assess impacts arising from the project. The assessment would include a review and synthesis of the historical context of the area based on primary and secondary sources, including historical maps and various published and unpublished sources (eg academic theses and consultant reports).

The SoHI would be undertaken in accordance with the principles of the *Australia ICOMOS Burra Charter* (Australia ICOMOS 2013a) and its relevant Practice Notes (Australia ICOMOS 2013b, 2013c, 2017). It would also comply with the *NSW Heritage Manual* (1996) and its various updates and other guidelines published by the NSW Heritage Office (1996, 2001, 2009).

6.4 Land

6.4.1 Existing environment

The project area is in the New England Tablelands bioregion, and entirely in the New England fold specifically the Woolomin Texas Block. It is underlain by the Devonian Age Woolomin Beds, which are characteristic of slate, phyllite, tuff, sandstone, conglomerate, chert and jasper. The soil profiles along the flat terrain consists of deep alluvial and colluvial soil for depths of up to 2 m. High level soil mapping of the project area consists of lithosols and non-calcic brown soils concentrated to the steep slopes, and red brown earths concentrated to the valley flats. Chernozems, a fertile black soil rich in humus, is characteristic of valley flats in the project area mapped to generally occur along Dungowan Creek and Dungowan Dam. It should be noted that the soil landscape of the project area is not identified on eSPADE (DPIE 2018).

Existing land uses in and around the inundation area include:

- existing Dungowan Dam and associated infrastructure;
- residential areas of Ogunbil;
- pastureland currently or previously used for livestock grazing;
- rural landholdings and structures associated with past agricultural activities; and
- Nundle State Forest to the south of the existing Dungowan Dam. Nundle State Forest borders Hanging Rock State Forest to the west and Terrible Billy State Forest to the east.

Land that would be impacted within the project footprint is predominantly freehold, with one parcel of unknown ownership.

6.4.2 Issues for consideration

The flat valley-floor terrain around the project footprint has historically been used for agricultural purposes. Soils disturbed during construction of the pipeline may result in agrichemical residue entering surface water runoff. Within the project footprint, the proposed project infrastructure primarily traverses chernozems, non-calcic brown soils, red brown earths and lithosols. Generally, chernozems are not erodible due a high nutrients content. As such, limited erosion can be expected on the valley flats during or after rainfall events. Conversely, red brown earths and non-calcic brown soils are moderately erodible, which may result in gullyng, tunnelling and turbidity of disturbed soils within the project footprint if rainfall occurs during construction works. There is a risk that sediments infiltrated with agrichemical residue may enter surface water runoff and ultimately contaminating nearby waterways.

The project also has the potential to impact on existing land uses. Partial or complete inundation of agricultural land may impact the viability of some land holdings and there is potential for a significant impact to infrastructure, including access road, telecommunications and electricity.

6.4.3 Approach to assessment in EIS

Field investigations will be undertaken as part of the EIS to inform the assessment of potential risk to the environment. A soil and water management plan would be prepared in accordance with *Managing Urban Stormwater: Soils and construction, 4th Edition* (Landcom, 2004) (The Blue Book).

Construction of the proposed pipeline through agricultural land may impact the productivity of some land holdings and as such the assessment of impacts to land use will be undertaken in combination with the SIA and include consideration of potential economic impacts.

6.5 Social and economic

6.5.1 Existing environment

The project is completely within the Tamworth Regional LGA and would support water security for the town of Tamworth, including its associated industries. Many businesses within the Tamworth Regional LGA are associated with agriculture, forestry and fishing, while the largest employers are the health care and social assistance, retail trade and manufacturing industries. Unemployment in the region is greater than the State average.

6.5.2 Issues for consideration

The project would improve the long-term security and affordability of the water supply for Tamworth and surrounding areas supplied by Tamworth Regional Council, as well as increase the value of agricultural production from improvement in utilisation and reliability of water for Peel Valley irrigators. The construction of a larger dam downstream of the existing Dungowan Dam would also contribute to improved flood security and water storage benefits. Each of these provide flow-on benefits both locally to downstream residents and regionally for residents of the wider Tamworth Regional LGA that are dependent on the municipal water supply.

The project would also result in employment opportunities within the Tamworth Regional LGA throughout the construction of the proposed dam and pipeline and decommissioning of the existing dam, which would be of benefit in terms of contributions to an expanded workforce within the Tamworth Regional LGA, as well as diversification of skills for the local population. The project would also contribute to the ongoing diversification of the local and regional economy, providing an additional temporary income base to further boost the region's economic resilience.

An influx of workers to the region and locality would be expected during construction which would increase demand for accommodation, community services and other social infrastructure and facilities. These potential impacts could be both positive and negative. With positive impacts associated with economic benefits provided by local and regional business opportunities and contribution and negative impacts associated with local disruption to some parts of the community.

6.5.3 Approach to assessment in EIS

An economic assessment will be undertaken to demonstrate the regional and local economic benefits of the project during construction. The assessment will also consider changes to the regional economy during operation due to the permanent loss of property uses upstream as a result of inundation as well as the benefits of improved water security for users.

A social impact assessment (SIA) will be undertaken to define the project's area of social influence and identify the potential social impacts. The SIA will recommend mitigation, management and monitoring measures where required. The assessment will be undertaken generally in accordance with the principles of the NSW Government's (2017) *Social Impact Assessment Guideline for State Significant Mining, Petroleum Production and Extractive Industry Development*. The key objectives of the SIA will be to:

- understand the area of social influence through development of a social profile and collection of qualitative and quantitative data;
- predict and analyse the potential direct and indirect impacts (positive and negative) of the project including impacts on access to, and demand for, local social services and infrastructure including on-site and off-site housing requirements (primarily for construction staff);
- consider the social consequences resulting from the findings of other technical investigations such as investigations into noise, air quality, surface water and traffic to identify potential amenity impacts as well as the outcomes of the economic assessment; and
- develop appropriate mitigation and enhancement strategies.

The establishment of the area of social influence will be undertaken as the first phase of the SIA.

6.6 Hazard and risk

6.6.1 Dam safety

i Existing Environment

The proposed dam is a new impoundment downstream of an existing dam, which was constructed in 1958 and is owned by the Tamworth Regional Council. The proposed location for the dam wall is a narrow part of the valley, immediately downstream from which is a private residence. Further downstream beyond the private residence is agricultural land, private properties and residences, as well as public infrastructure such as roads and bridges and the township of Ogunbil. The existing Dungowan Dam is a declared dam, classified as having a 'High A' Consequence Category.

ii Issues for consideration

Dam safety management is paramount to protect life, property and the environment from dam failure. Dam failure can cause extensive damage to properties and loss of life. Dam failure can occur during probable maximum flood events due to overtopping or inadequate spillway design, as the function of the spillway is to prevent the dam from failure due to overtopping.

The project will require construction of a new dam wall and spillway and associated infrastructure to be constructed downstream of an existing dam wall which may be retained in part. Retaining the existing dam wall has safety implications for the proposed dam, including flooding risks and public safety risks of accessing the retained dam infrastructure. The design and construction of the dam and spillway will need to ensure it meet Dam Safety regulatory requirements and will need to demonstrate:

- partial inundation of the existing dam wall would not lead to instability of the existing dam if retained;
- the proposed dam can safely pass a dambreak flood resulting from the failure of the existing dam;
- that flood risks during construction and operation would not be increased; and
- that public safety risks downstream of the dam have been identified and mitigated through design and dam management.

In addition, constructing a new, larger dam with greater yields would necessitate changes to water sharing rules and operating licences once completed, as well as development and modification of a Dam Safety Management System, plans and flood operational rules.

iii Approach to assessment in EIS

The EIS will assess dam safety to ensure public safety risks have been identified and mitigated through design and dam management. The assessment will be undertaken with reference to ANCOLD (2003) *Guidelines on Risk Assessment* and Dams Safety NSW regulations and guidelines and be informed by:

- development of operation rules to cover normal operation, flood operation and environmental flows;
- confirmation of probable maximum flood events;
- dam break modelling – to simulate and predict dam break scenarios; and
- failure mode analysis – to consider all potential failure modes so all contingencies can be accounted for in the design.

6.7 Other issues

6.7.1 Built environment

i Existing environment

Downstream (west) of the proposed dam is the nearest receiver, which appears to be a rural residence nestled inside a bend of Dungowan Creek. The edge of the proposed spillway is approximately 120 m from the residence, while the study area for the proposed pipeline alignment runs through the property; ownership of this property needs to be confirmed through the EIS. The closest residential area to the proposed dam is Ogunbil village, a small settlement of approximately 148 people approximately 16 km downstream (north west) from the proposed dam along Ogunbil Road (ABS 2016). The nearest school to the proposed dam is Niangala Public School, located approximately 10 km north east of the proposed dam. The existing Dungowan Dam is the only relevant built structure upstream of the proposed dam.

Based on a review of available aerial imagery and a site visit undertaken by EMM, the landscape within the proposed inundation area is varied, with a largely cleared valley floor for scattered trees and a vegetated riparian corridor. Cleared rural areas are associated with rural structures, considered to be from past pastoralism and grazing.

The land either side of Dungowan Creek is sparsely populated and is largely used for agriculture and pastoral activities, although there are some small towns, such as Dungowan, that contain residential areas and sensitive receivers.

The proposed pipeline route is within the valley floor, containing agricultural land plots and some small urban areas. There are several, small residential areas and sensitive receivers located on the route of the proposed pipeline, including the villages of Ogunbil and Dungowan.

Issues for consideration

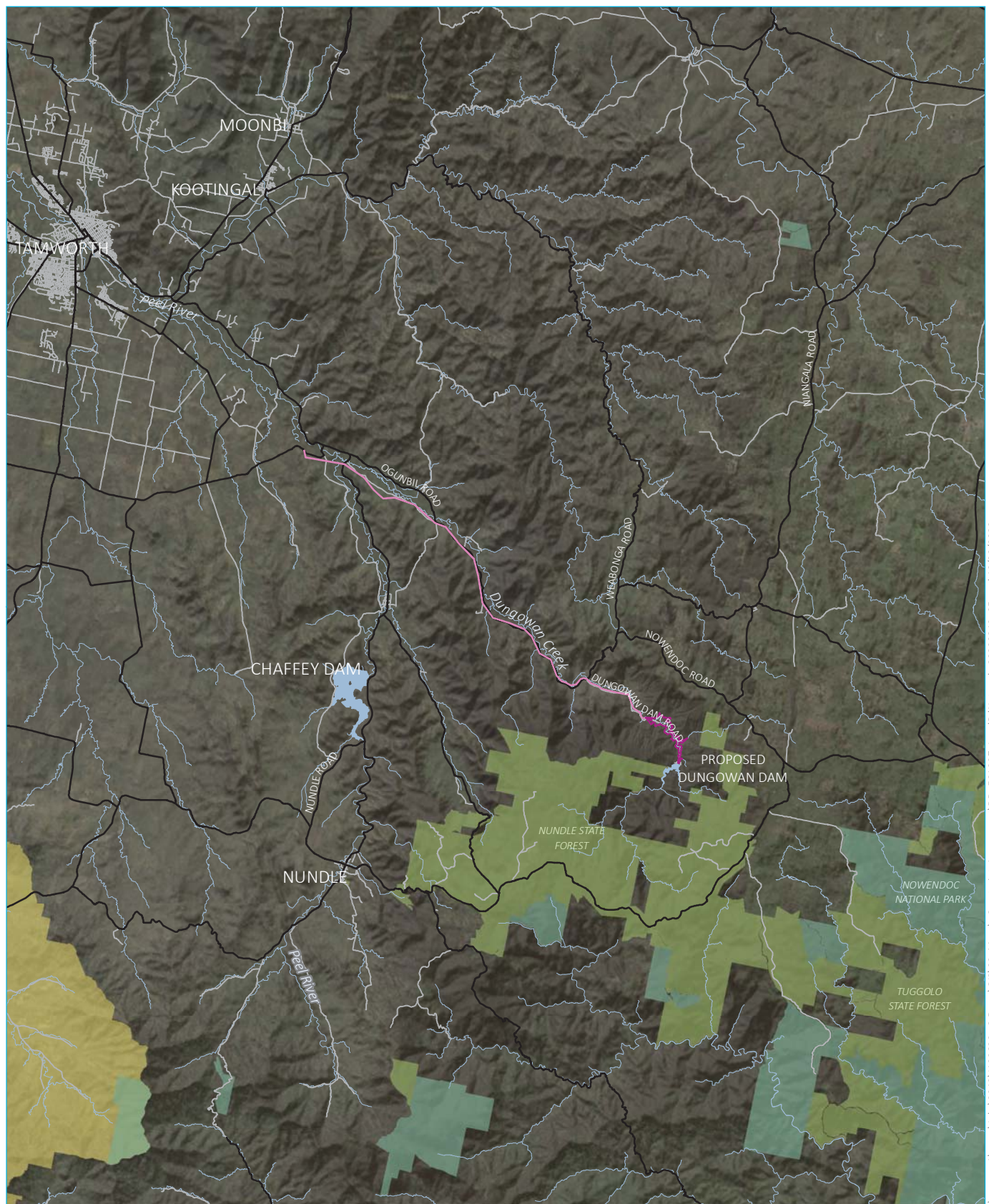
The landholdings, including built structures, within the project footprint are understood to be owned by Tamworth Regional Council, as is the existing dam and local access road. Infrastructure within the project footprint (access road, telecommunications and electricity) that would be inundated appears to only service the existing dam. As such, the project footprint would only impact infrastructure that is no longer required for the existing dam. A new access road to the existing dam would be constructed around the proposed dam.

The proposed pipeline route runs through several agricultural and residential areas, crossing roads and bridges that would be temporarily impacted during construction (Figure 6.5). Impacts during operation of the project are expected to be infrequent and low intensity as they would relate to routine and ad hoc maintenance requirements.

ii Approach to assessment in EIS

An initial assessment of impacts to private property and public infrastructure has been undertaken, however further refinement of the design and associated flood modelling is required to inform this during the EIS. Consultation with Tamworth Regional Council will be required to determine any relocation or upgrade requirements to local roads as a result of inundation.

The assessment of impacts to the built environment will be undertaken in combination with the SIA and include consideration of potential economic impacts.



Source: EMM (2020); WaterNSW (2020); RMS (2020); DFSI (2017); ELVIS (2013); DPI (2013)

*Inundation area should be considered approximate only. It is based on current limited available spatial data and is subject to future verification.

KEY

- Project footprint
- Indicative alignment for pipeline (project)
- Main road
- Local road
- Named watercourse
- Named waterbody
- NPWS reserve
- State forest
- Approved areas with travel conditions

Local road network

Dungowan Dam Project
Scoping report
Figure 6.5

6.7.2 Transport and access

i Existing environment

The local and regional road network is shown on Figure 6.5. There are no State roads within the proposed dam footprint. New England Highway is the closest State road, located approximately 43 km east of the proposed dam. Oxley Highway is also a State road located approximately 45 km north of the inundation area. All local roads are council owned, with a number of these to be impacted by the project. Given the low population density within the project area, existing traffic levels in the area are low and generally limited to local residents and operation staff for the existing dam; during the site visit in January 2020 EMM noted one vehicle, in a four-hour period, travelling along the access road within the project footprint.

ii Issues for consideration

Major transportation routes during construction would have to include use of Dungowan Dam Road, as it's the only access to the proposed project footprint. The final project routes will be confirmed once the source of construction materials has been determined.

The project is likely to result in an increase in light and heavy vehicle traffic within the valley downstream of the project footprint, mostly along Dungowan Dam, Ogunbil and Nowendoc roads. The heavy vehicle traffic would serve to transport construction materials to the site, and to take waste materials away from the site. The increase in traffic resulting from the direct impacts of the project would be temporary during the construction phase of the project. It is expected operational traffic would be consistent with current dam activities and therefore no long-term changes to traffic and transport are expected.

The proposed pipeline route crosses several properties, roads and bridges that would be temporarily impacted during construction. These access impacts will be addressed by providing alternate access arrangements for affected stakeholders. Impacts during operation of the project are expected to be infrequent and low intensity as they will relate to routine and ad hoc maintenance requirements.

iii Approach to assessment in EIS

Direct impacts within the project area will be due to partial inundation of Dungowan Dam Road, with potential temporary impacts to several roads and bridges during pipeline construction. Consultation with Tamworth Regional Council will be required to determine any relocation or upgrade requirements, including construction of a new access road to the existing dam. An assessment of impacts on these facilities and determination of access requirements during construction and operations will be undertaken as part of the EIS. Modelling of key intersections will be carried out as required and the likely traffic impact on the road network determined.

6.7.3 Air

i Existing environment

The project footprint is in a sparsely populated area on the outskirt of Nundle State Forest. The nearest receiver is located downstream proposed dam project footprint, approximately 120 m west of the proposed spillway, while the study area for the proposed pipeline alignment runs through the property.

There are multiple sensitive receivers along the proposed pipeline route, with a number of agricultural land plots and residential areas along the proposed pipeline trajectory.

Given that the project is predominantly located in areas typical of a rural environment, air quality is generally considered to be good. Wood fire smoke would be the main air pollutant expected to be emitted from the residential areas along the proposed pipeline route.

ii Issues for consideration

Temporary air quality impacts are expected within and surrounding the inundation area. Site establishment and construction of the project would result in disturbance of soil and generation of dust through clearing and earthmoving construction activities, as well as vehicles driving on unsealed roads. Dust, or particulate matter, is expected to be the primary air quality impact. Construction plant and equipment, including vehicles required to transport staff and materials to the site would contribute to combustion related pollutants.

Air quality impacts during operation of the project are expected to be minimal and would include minor and occasional vehicle and potential plant emissions associated with maintenance and inspection of project infrastructure.

iii Approach to assessment in the EIS

An air quality impact assessment will be undertaken as part of the preparation of the EIS and will assess the potential impacts of dust emissions during construction on sensitive receivers. The assessment will identify potential air quality impacts associated with the project in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2016) which lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

No operational modelling is proposed.

While likely to be minor, annual greenhouse gas emissions will be considered using the *National Greenhouse Accounts Factors* (July 2017).

6.7.4 Amenity

i Existing environment

The project footprint is largely cleared for the accommodation of agriculture and a road. This land is owned by Tamworth Regional Council and is uninhabited. The landscape is otherwise vegetated with large areas of native vegetation including TECs. There is a rural residence nestled inside a bend of Dungowan Creek, approximately 120 m from the edge of the proposed spillway, while the study area for the proposed pipeline route runs through the property; ownership of this property needs to be confirmed through the EIS. The proposed pipeline route passes through areas of vegetation and agricultural lands.

The ambient noise environment in the vicinity of the project is likely to be predominantly characterised by natural elements and agricultural activities. There are several residences in the landscape downstream of the proposed dam project footprint.

ii Issues for consideration

There are no indications the project footprint contains or is nearby any frequently visited tourism locations. It is likely that most traffic bypasses the project footprint as there is only one road in and out. This road only goes to the existing dam site, which isn't publicly accessible, and the land within the inundation area is not privately owned, so there is little reason for people to travel to the project footprint unless they're working at the existing dam.

Tamworth holds a large, annual, country music festival drawing tourists from around Australia and overseas. It is reasonable to consider that a portion of these tourists access the landscape surrounding Tamworth, including the proposed pipeline route. As such, the proposed pipeline potential to impact existing native vegetated landscapes during construction could also temporarily impact the visual amenity of these landscapes to tourists. For this impact to occur the pipeline construction would need to occur during the tourism high season associated with the music festival.

The primary noise impacts would occur during construction as a result of construction plant and equipment, construction activities and increased vehicle movements. Noise impacts may also be experienced during the relocation of services and structures likely to be affected by the FSL. Noise impacts may also be experienced in relation to quarry activities, however locations for these are yet to be defined. Blasting may also be required during the construction of the new dam and decommissioning of the existing dam. If blasting is required, it would be necessary to consider potential vibration impacts on surrounding structures (including the nearest sensitive receptor).

iii Approach to assessment in the EIS

A landscape and visual impact assessment will be prepared as part of the EIS. The assessment will consider potential changes to the landscape character and visual impacts (including lighting impacts) resulting from dam and pipeline construction, including associated infrastructure, in relation to identified sensitive receptors.

All construction activities are proposed during standard daytime construction hours in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC 2009). There are not likely to be noise impacts associated with the ongoing operation of the project. As such, a construction only quantitative noise assessment will be carried out in accordance with the ICNG. Operational impacts will be considered qualitatively in the EIS.

6.7.5 Hazards and risks

i Bushfire

The project is located within the Tamworth Bush Fire Management Committee area (BFMCA) which coincides with the Tamworth Regional LGA. Mapping provided in the *Tamworth Bush Fire Risk Management Plan* (BFRMP) indicates the Dungowan Dam, infrastructure and catchment are high bush fire risk assets (Tamworth BFRMP 2011).

The bush fire season generally runs from October to March, with prevailing weather conditions associated with the bush fire season usually north-westerly winds accompanied by high daytime temperatures and low relative humidity. There are also frequent dry lightning storms occurring throughout the area during the bush fire season. The main sources of ignition reported in the Tamworth BFMCA are lightning strikes, agricultural burns/practices, malicious fires, escaped pile burns, machinery and vehicles, welding/grinding and associated construction activities.

Construction of the project has the potential to result in unplanned fires, creating a risk to project staff as well as to members of the public. Key considerations include potential sources of ignition (eg machinery and equipment) and ensuring adequate construction standards and asset protection zones.

The potential for bushfire hazard and risk impacts, including ongoing land management practices, will be investigated further through the EIS with consideration of the relevant guidelines and standards, including the NSW Rural Fire Service (RFS) *Planning for Bush Fire Protection. A guide for Councils, planners, fire authorities and developers* (2006) and the relevant BFRMP.

ii Waste

It is anticipated that the project would produce a number of waste streams during construction. Minor quantities of waste would also continue to be generated by the day-to-day operation of the project.

Waste would also be generated as part of decommissioning at the end of the project's operational life and the relocation of services and structures affected by the FSL.

Waste streams likely to be generated during the construction and ongoing operation of the project would include:

- rock or clay core material removed from the existing embankment as part of the wall raising;
- rock excavated as part of the spillway widening that can't be beneficially reused;
- cardboard packaging, plastic wrapping, plastic ties, wood pallets and other timber offcuts for project infrastructure components;
- general waste from the construction compound, operations and management buildings;
- comingled recycling;
- oily rags, filters and drums (primarily during construction);
- waste batteries; and
- confidential documents.

In addition, consideration of the temporary and/or permanent storage of excavated material generated during construction of the additional embankment is required. Potential impacts from poor management of waste include contamination of land and water, and human and animal health impacts.

iii Contamination

There are no known contaminated land issues within the project footprint. However, agricultural activities have occurred on cleared areas with, and in the vicinity of, the project footprint. A number of landholdings would be inundated as a result of the project including agricultural properties. Further investigations will be required to assess potential for contamination as a result of inundation on these agricultural properties.

A contamination assessment of the project footprint will be completed as part of the EIS. The preliminary site investigation will include consideration of the existing environment and a review of the site history, identification of current or historical contaminating activities and potential receptors (including landholdings likely to be inundated as a result of the project). The assessment will provide key measures for managing soils during construction, operations and decommissioning.

The following government guidelines will be considered where relevant during the preparation of the EIS:

- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning 2008);
- *Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning 1998);
- *Guidelines for Consultants Reporting on Contaminated Sites* (Office of Environment and Heritage 2000);
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004);
- *Managing Urban Stormwater: Soils and Construction Volume 2* (Department of Environment and Climate Change 2009);

- *Guidelines on the Duty to Report Contamination under the CLM Act* (Department of Environment and Climate Change 2008); and
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000).

7 Proposed community engagement during the EIS

7.1 Overview of approach

WaterNSW is implementing a tailored framework for stakeholder engagement and communication for the project. A broad engagement framework and schedule has been mapped to support delivery of the project as shown in Figure 7.1.

A staged approach was developed by WaterNSW as part of the early consultation program (Phase 1 and 2) to allow response to initial community interest to the project following the government announcements made earlier in October 2019. The focus of EIS engagement will be during Phase 3 and Phase 4, with ongoing community engagement anticipated throughout the project's construction.



Figure 7.1 WaterNSW's phased community and stakeholder approach

The proposed approach is designed to progressively build the quality and depth of WaterNSW's conversation with stakeholders, set a basis for future engagement and support the project program. WaterNSW principles around stakeholder engagement are that it would be two-way, genuine communication and interaction with clear and accurate information, be timely, accessible, inclusive and sustainable, with stakeholders encouraged to become long-term partners.

7.1.1 Identified stakeholder groups

Early consultation has identified a number of key stakeholder groups. The broad stakeholder groups identified are:

- land holders;
- Aboriginal groups, including Local Aboriginal Land Councils and other traditional owners;
- industry and interest groups, including business, tourism, recreation, utilities and other interests;
- government, including local, state and Commonwealth Members of Parliament and regulatory authorities;
- general public; and
- media.

Future consultation and engagement activities will further identify and map individual community and stakeholders with an interest in or likely to be impacted by the project.

7.1.2 WaterNSW guiding principles

As part of initial planning, WaterNSW has developed a series of guiding principles to deliver the project. Given the projects are critical in ensuring water security, the project timeframes are aggressive and require a tailored approach for specific stakeholder groups to ensure a depth of engagement is achieved to support the overall delivery of the project. The guiding principles are described below.

The WaterNSW Way guiding principles

- Stakeholder and community engagement must, above all, be genuine and respectful, and tailored to the specific needs of stakeholders to avoid generic low-value activity
- Local community benefits will be maximised with capabilities in local regions identified and utilised where possible
- A ‘no surprises’ approach will be undertaken to ensure key stakeholders are briefed according to a set of agreed engagement, communication and media protocols
- Issues will be considered not just from WaterNSW perspective but also from a stakeholder view – a ‘walk in their shoes’ approach
- WaterNSW will listen, will be fact based in its communication and engagement, and will aim to have a comprehensive understanding of stakeholder issues
- WaterNSW will ensure internal conversations are held regularly and coordination achieved to avoid stakeholders being exposed to siloed thinking and ‘corporate speak’
- Baseline community (quantitative) and stakeholder (qualitative) sentiment will be established, followed up with ongoing regular research and monitoring to ensure the performance of the WaterNSW engagement, and to provide the ability to continue to tailor the engagement plan to meet emerging issues
- WaterNSW will be committed to the requirements of the plan, to stay the course for the long term and to be an active partner with stakeholders.

7.2 Engagement during the EIS

WaterNSW has developed a specific engagement action plan for Dungowan Dam that will outline the specific methods and timing for its implementation.

Engagement targeted specifically for the Dungowan Dam project leading up to the EIS exhibition will comprise:

- community briefings to be held in key local communities;
- discussions with affected and potentially affected land holders;
- engagement with Aboriginal stakeholders, groups, and organisations around mobilisation for opportunities associated with the project EIS (in line with the Aboriginal engagement communication strategy, see below);

- intergovernmental meetings with key representatives from DAWE, DPIE and other government agencies; and
- media briefings.

A broader Aboriginal engagement communication strategy is currently being implemented and aims to ensure early and close engagement with the Aboriginal community and provide a framework for ongoing consultation. The strategy involves:

- identifying key Aboriginal stakeholder for each region and establish points of contact;
- documenting any key issues or areas of concern raised during initial discussions;
- identifying key community areas or projects that may provide opportunity for integration into the project; and
- identifying interests and ideas raised by stakeholders about future involvement in the assessment process, and subsequent stages of the project (such as construction).

A comprehensive schedule of community participation and engagement will be developed. The following opportunities for when and how the community can be involved in the planning, design and environmental assessment phases of the project are likely to include:

- Attendance at community information sessions – to be announced;
- Participation in community sentiment analysis via qualitative and quantitative research;
- Community Reference Group meetings;
- Aboriginal Reference Group meetings;
- Cohort of key opinion leader meetings;
- Interest group round table meetings;
- Location engagement such as site tours / walkthrough Q&A opportunities, event tie-ins;
- Environmental Impact Statement (EIS) consultation during the exhibition of the documentation; and
- Via DPIE through making a submission on the project during the EIS public exhibition.

Project information will be provided to the local community and targeted stakeholders via the following:

- Directly with the local community through face-to-face meetings or community events;
- Directly with Aboriginal groups (identified through Aboriginal engagement communication strategy) through face-to-face meetings;
- Mail and/or email to local community and key stakeholders registering an interest;
- Mail and/or email to WaterNSW customers;
- Dungowan Dam pages on the WaterNSW website (www.waternsw.com.au);

- Social media including WaterNSW Facebook page; and
- A project email address to directly respond to concerns and enquiries (DungowanDam@waternsw.com.au as well as projects@waternsw.com.au).

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Appendix A

Scoping worksheet

| Scoping Report Dungowan Dam: Appendix A Scoping worksheet | | | | | | | | | |
|---|---|---------|---------------------|------------------|------------|--------------------|--|--|---|
| MATTERS | | IMPACTS | | ASSESSMENT LEVEL | | CUMULATIVE IMPACTS | COMMUNITY ISSUES | ASSESSMENT APPROACH | SCOPING REPORT |
| Potential matters that could be affected by the project | | | | | | | | | |
| Where was this addressed in the Scoping Report? | | | | | | | | | |
| Indicative approach to assessment in EIS | | | | | | | | | |
| Group | Specific | Impact? | Significant Impact? | Assessment Level | Cumulative | Concerns? | Category | Section | |
| ACCESS | access to property | No | | | | No | None (include short explanation in Scoping Report) | Section 2.3, Section 6.7.2 | |
| | parking | No | | | | No | None (include short explanation in Scoping Report) | N/A | |
| | port / airport facilities | No | | | | No | None (include short explanation in Scoping Report) | Section 5.2.3 | |
| | road / rail network | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.2 |
| AIR | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | atmospheric emissions | Unknown | | Unlikely | | No | Scoping Report | Section 6.7.3 | |
| | gases | Unknown | | Unlikely | | No | Scoping Report | Section 6.7.3 | |
| | particulate matter | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.3 |
| AMENITY | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | noise | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.4 |
| | odour | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.4 |
| | vibration | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.4 |
| BIODIVERSITY | visual | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.4 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | conservation areas | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.2, Section 6.4 |
| | native vegetation | Yes | | Likely | Detailed | No | No | Detailed Assessment | Section 6.2 |
| BUILT ENVIRONMENT | native fauna | Yes | | Likely | Detailed | No | No | Detailed Assessment | Section 6.2 |
| | other - please specify - aquatic | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | private property | Unknown | | Unknown | Standard | No | Yes | Standard Assessment with focussed engagement | Section 3.2.2, Section 6.4 |
| | public domain | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 3.2.2, Section 6.4 |
| ECONOMIC | public infrastructure | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 3.2.2, Section 6.4 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | livelihood | No | | | | No | No | None (include short explanation in Scoping Report) | Section 6.7.5 |
| | natural resource use | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.5 |
| HAZARDS & RISKS | opportunity cost | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.5 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | biosecurity | Unknown | | Unlikely | | No | No | Scoping Report | N/A |
| | bush fire | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.4 |
| HERITAGE | coastal hazards | No | | | | No | None (include short explanation in Scoping Report) | Section 5.2.3 | |
| | dams | Yes | | Likely | Detailed | No | Yes | Detailed Assessment with focussed engagement | Section 6.5.1 |
| | dangerous goods | Unknown | | Unlikely | | No | No | Scoping Report | Section 4.1.6 |
| | environmental hazards | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.5, Section 6.7.4 |
| LAND | floods | Yes | | Likely | Detailed | No | Yes | Detailed Assessment with focussed engagement | Section 6.1 |
| | groundwater contamination | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.1.2, Section 6.5.2, Section 6.7.4 |
| | hazardous / offensive development | No | | | | No | No | None (include short explanation in Scoping Report) | Section 5.2.3 |
| | land contamination | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.5.2, Section 6.7.4 |
| LAND | land movement | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.4.2 |
| | waste | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.7.4 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | Aboriginal cultural | Yes | | Likely | Detailed | No | Yes | Detailed Assessment with focussed engagement | Section 6.3 |
| LAND | historic | Yes | | Likely | Detailed | No | Yes | Detailed Assessment with focussed engagement | Section 6.3 |
| | natural | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.3 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | land capability | Yes | | Likely | Detailed | No | No | Detailed Assessment | Section 6.4 |
| LAND | soil chemistry | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.4 |
| | stability / structure | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.4 |
| | topography | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.4 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| SOCIAL | community services / facilities | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.6 |
| | health | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.6 |
| | housing availability | Unknown | | Unlikely | | No | No | Scoping Report | Section 6.6 |
| | safety | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.6 |
| WATER | social cohesion | Yes | | Unknown | Standard | No | No | Standard Assessment | Section 6.6 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |
| | ground water quality | Unknown | | Unknown | Standard | No | No | Standard Assessment | Section 6.1 |
| | hydrological flows (including flooding) | Yes | | Likely | Detailed | No | No | Detailed Assessment | Section 6.1 |
| WATER | surface water quality | Yes | | Likely | Detailed | No | No | Detailed Assessment | Section 6.1 |
| | water availability | Yes | | Likely | Detailed | No | No | Detailed Assessment | Section 3.1, Section 3.3, Section 6.1 |
| | other - please specify | N/A | | | | | None (include short explanation in Scoping Report) | | |

Appendix B

Preliminary biodiversity assessment

Appendix C

Preliminary heritage assessment
