Warragamba Dam Raising Preliminary Environmental Assessment

Date: December 2016

Warragamba Dam Raising Preliminary Environmental Assessment

Prepared for:	WaterNSW
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Synopsis: **This document outlines a Preliminary Environmental Assessment for the proposed Warragamba Dam Raising Project.**

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Executive Summary

The Hawkesbury-Nepean Valley Flood Risk Management Strategy's objective is to reduce flood risk to life, property and social amenity from floods in the Hawkesbury-Nepean Valley now and into the future. The Strategy announced by NSW Government in June 2016 includes a number of infrastructure, policy and other actions to achieve this objective.

Raising the Warragamba Dam wall by around 14 metres is included in the Strategy as the most cost effective flood mitigation infrastructure option. This Proposal aims to provide additional air space to temporarily store floodwaters upstream of the dam wall for flood mitigation purposes only. This would reduce flood risk by temporarily holding back floodwaters from the Warragamba catchment, and then releasing these floodwaters in a controlled manner. This reduces the depth and extent of the flooding downstream Hawkesbury-Nepean Valley and hence the associated flood risk to risk to life and potential flood damages.

This document is WaterNSW's application for Secretary's Environmental Assessment Requirements (SEARs) from the NSW Department of Planning and the Environment (DP&E) for this Proposal. The Proposal is considered to be State Significant Infrastructure (SSI) under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A) (s115U). The Proposal is also expected to be suitable for Critical SSI declaration based on the significant social and economic benefits that accrue at a State-wide scale. The Proposal will require an EIS under the EP&A Act and will be referred to the Commonwealth for assessment as a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* for potential impacts on matters of National Environmental Significance.

The impact of the dam wall raising will occur at the construction stage (primarily at or adjacent to the existing Dam), estimated 2020 – 2024, and when the dam is operating in flood events (both upstream and downstream of the Dam) post dam raising (~2025 onwards). Key environmental assessment issues identified for the Proposal will be assessed in greater detail during the preparation of the EIS. They are:

- Surface water and riparian impacts (including temporary incremental, increased duration of floodwater inundation upstream and downstream of the dam and prolonged elevated river levels from post flood dam releases) and associated potential geomorphic impacts;
- Ecological impacts including aquatic and terrestrial ecological impacts (flora / fauna species and communities);
- Air quality, noise and vibration impacts in the vicinity of the dam wall during the construction phase;
- Local traffic and construction material transport impacts during construction phase;
- Socio-economic and heritage impacts primarily during the construction and operation phases; and
- Visual amenity and landscape impacts primarily during the construction phase.

All other relevant environmental issues will also be considered by the EIS. Of particular importance are heritage and ecological impacts; these have both been prioritised as medium to high priority environmental values at potential risk, identified in Table 5.3.

A related component of the Proposal for raising Warragamba Dam includes the detailed design for portential construction of infrastructure to enable new variable environmental flows (e-flows) from the Dam, currently

being considered by the NSW Government. Pending approval, the undertaking of the e-flows works during the dam raising construction will reduce costs of Warragamba e-flows including major savings for establishment costs.

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1 Introduction

1.1 Background

As outlined in the State Infrastructure Strategy 2012-2032 (INSW 2012), the flooding history in the Hawkesbury Nepean Valley (the Valley) can be traced back to the very early years of European settlement -

> *'Despite proclamations as far back as the early 1800s to avoid living in flood affected areas in the Valley, significant development of homes and businesses has occurred. As more development has occurred, NSW has continued to invest in supporting infrastructure, which is also at risk.'*

During the 1980s and 1990s evidence emerged that floods significantly larger than any yet historically recorded could occur in the Valley. This eventually led in the late 1990s to major upgrades of Warragamba Dam to prevent dam break during extreme flooding events to protect Sydney's water supply. However, this decision primarily dealt with dam safety issues and did not fully address the major flood risks to the people and businesses in the Valley and the NSW economy as a whole.

An Environmental Impact Statement (EIS) was developed in 1995 (ERM Mitchell McCotter, 1995) which looked at all the possible options for reducing this risk. As outlined in the State Infrastructure Strategy 2012,

> *'The EIS reached the conclusion that raising the Warragamba Dam wall by 23 metres to temporarily store flood waters not only made the dam wall safe from the probable maximum flood but would also reduce flood losses in the Valley. The largest environmental impact of this option was the temporary inundation, upstream of the dam, to the undisturbed bushland.*
>
> *At the time, it was considered that these biophysical costs would not outweigh the social and economic benefits to be gained from raising the dam wall.*
>
> *A change in the NSW Government in 1995 saw a change in view where upstream biophysical costs were considered to be sufficient to outweigh the social and economic benefits as a whole.*
>
> *The previous NSW Government, in rejecting raising the wall of the dam, implemented a range of infrastructure projects that included the building of Jim Anderson Bridge and various public education campaigns including State Emergency SES's launch of the FloodSafe program.*
>
> *None of these actions comprehensively deal with the potential for homes to be flooded and destroyed and the significant economic and personal loss which could occur.*
>
> *Despite these measures, development has continued in the Valley in areas that would be significantly impacted by a flood on record. The economic and social risks still exist and are considerably greater than they were 20 years ago.'*

In 2012, extensive flooding across south-eastern Australia, including the Hawkesbury-Nepean Valley, saw Warragamba Dam spill for the first time in 14 years. These events raised community awareness about the potential impacts of flooding.

In 2013, the NSW Government began the Hawkesbury-Nepean Valley Flood Management Review to consider flood planning, flood mitigation and flood response in the Hawkesbury-Nepean Valley.

The review found that the current flood management and planning arrangements were insufficient in mitigating the risk and no single mitigation option can address all of the flood risk present in the Valley.

The raising of Warragamba Dam to capture floodwaters was concluded to be the most effective infrastructure measure that could have a major influence on flood levels during those events when the majority of damages occur.

In May 2014, the NSW Government established the Hawkesbury-Nepean Valley Flood Management Taskforce to lead Stage Two of the Review.

As part of Stage Two, a more detailed cost benefit analysis of specific flood mitigation infrastructure options was undertaken. To help inform the strategic cost benefit analysis, a high level environmental, social and cultural-heritage impact assessment was undertaken of various flood mitigation options.

The four projects related to flood mitigation infrastructure undertaken were:

- Options for operating the existing Warragamba Dam for flood mitigation;
- Raising Warragamba Dam for flood mitigation;
- Costing of selected downstream flood mitigation infrastructure; and
- Environmental assessment of the flood mitigation infrastructure options.

Based on these assessments, the most cost effective infrastructure option was to raise Warragamba Dam wall by around 14 metres.

However, while the Taskforce found that raising the dam wall will significantly reduce the risk, it cannot eliminate it, regardless of the raising height. As a result, the dam wall raising must be complemented with other non-infrastructure and policy actions in the Strategy to reduce ongoing flood risk. These actions include:

- Coordinated flood risk management across the Valley now and in the future
- Strategic and integrated land use planning
- Engaging and providing flood risk information for an aware, prepared and responsive community

1.1.1 Variable environmental flows

The NSW Government is currently considering new environmental flows at Warragamba Dam. If approved, this completes a program of work to improve the health of rivers in the greater Sydney region impacted by the large metropolitan water supply dams.

The infrastructure to enable new environmental flows to be released into the downstream river will be designed as a component of raising Warragamba Dam wall for flood mitigation. The timing of

the e-flow construction will depend on the outcome of the Government's decision and subsequent planning approvals for raising Warragamba Dam wall for flood mitigation.

1.2 Purpose of this Document

The purpose of this document is to request that the Department of Planning and Environment (DP&E) issue the Secretary's Environmental Assessment Requirements (SEARS) to enable the preparation of an Environmental Impact Study (EIS) for raising Warragamba Dam wall for flood mitigation to reduce the risk to life and the impacts on property and social amenity in the Hawkesbury-Nepean Valley. The EIS will be prepared for approval as State Significant Infrastructure under the *Environmental Planning and Assessment Act 1979* (EP&A Act) and for referral under the *Environment Protection and Biodiversity Conservation Act 1999*. To assist with this request, this document describes the project and its justification. This Preliminary Environmental Assessment (PEA) document has been prepared to accompany an application under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

WaterNSW, a NSW State Owned Corporation, is the proponent for the works and will take the lead in the preparation of a future EIS and approvals for this activity, as they are responsible for the management and operation of Warragamba Dam.

2 Justification for the Proposal

2.1 Flood Risk in the Hawkesbury-Nepean Valley

There is a high flood hazard in the Valley, with both historical and geological evidence of rapid widespread flooding across the Valley. Climate change may further increase the severity and frequency of the flood hazard in the future.

There is also a high level of flood exposure as the floodplain is located in the Western Sydney region, an area with a large and growing population and one of Australia's most significant and diverse economies. Expanding urban development across the Valley means that flood exposure will increase in the future. Up to 134,000 people live and work on the floodplain and could require evacuation. This number is forecast to double over the next 30 years. Over 25,000 residential properties and two million square metres of commercial space are currently subject to flood risk, and this will increase significantly in the coming years.

The flood risk is heightened by the limited application of planning controls in the floodplain, insufficient road capacity to safely evacuate the whole population in a timely fashion, a fragmented approach to managing flood risk and low community awareness about the risk.

The Insurance Council of Australia considers the Hawkesbury-Nepean Valley to have the highest single flood exposure in New South Wales, if not Australia.

The Hawkesbury-Nepean Valley Flood Management Taskforce investigated a range of feasible infrastructure and non-infrastructure options to reduce overall flood risk in the Valley, based on previous work completed in response to the State Infrastructure Strategy 2012-2032 by the subsequent 2013 Hawkesbury-Nepean Valley Flood Management Review.

The Hawkesbury-Nepean Valley Flood Risk Management Strategy is the result of the Taskforce's investigations, with the key actions adopted by the NSW Government in June 2016.

The Taskforce found that raising Warragamba Dam wall by around 14 metres is the infrastructure option with the highest net benefit reducing flood damages by 75% on average. This reduces the damages for a 0.2% probability flood for current levels of urban development from $5 billion to $2 billion. In 2041, raising Warragamba Dam wall would reduce flood damages for a 0.2% probability flood from $7 billion to $2 billion (2015 dollars).

While raising Warragamba Dam wall will make a significant difference to flood risk in Valley, it will not eliminate risk altogether. Other complementary non-infrastructure options are essential for managing ongoing flood risk.

2.2 Alternative Flood Mitigation Options

The decision to seek planning approval for raising the Warragamba Dam by around 14 metres for flood mitigation is based on this flood mitigation infrastructure option providing highest net benefits to the Hawkesbury-Nepean Valley. This was the outcome of an extensive investigation that included a long list of infrastructure options as part of the 2013 Hawkesbury-Nepean Valley Flood Management Review (2013 Review) and the Hawkesbury-Nepean Valley Flood Management Taskforce 2014-2016 (Taskforce) work. The 2013 Review shortlisted options which were subject to

more detailed analysis to reduce flood risk in the Hawkesbury-Nepean Valley, see Table 2-1. The recommendation for raising the Warragamba Dam wall by the Taskforce around 14 metres was because it generated the highest net benefit to the Hawkesbury-Nepean Valley.

There is no simple solution or single infrastructure option that can address all of the flood risk in the Hawkesbury-Nepean Valley. This risk will continue to increase with projected population growth. However, it is possible to reduce and manage the risks through a combination of flood prevention, preparedness, response and recovery. Therefore the proposed dam wall raising is a component of an integrated flood risk management strategy for the Valley that covers a full range of measures to reduce flood risk, including governance arrangements, policy settings, planning, community education and infrastructure.

Table 2-1 Flood mitigation options considered

Flood mitigation option	
Warragamba Dam wall raising	Raise Warragamba Dam up to 30 metres
Change operation of Warragamba Dam	Lower Warragamba Dam Full Supply Level by 5 metres
	Lower Warragamba Dam Full Supply Level by 12 metres
	Operate Warragamba Dam gates to hold back water during a flood
	Operate Warragamba Dam gates to pre-release water ahead of a flood
Downstream mitigation infrastructure	Currency Creek diversion channel
	Dredging of the Lower Hawkesbury River
Construction of a new dam	Assessed by 2013 Review as not feasibile
Levees	McGraths Hill
	Peachtree Creek

2.2.1 Raising the Warragamba Dam wall

The 2013 Review examined dam wall raising heights for flood mitigation from 12 metres to 30 metres. Following the 2013 Review, two dam wall raising heights, 14 and 20 metres, were shortlisted for further assessment by the Taskforce. This range was considered to cover the feasible range for addressing risk to life and flood damages in the Valley. It was identified that a 14 metre raising of Warragamba Dam crest would enable sufficient flood mitigation for evacuation of all downstream flood islands and was set as the lower raising height. A 20 metre raising was

selected as upper bound for this detailed feasibility assessment to provide greater flood mitigation benefits downstream and some scope for uncertainty such as climate change and growth.

However, based on the results of the cost benefit analysis, the 20 metre dam wall raising provided lower net benefits than the 14 metre dam raising, as the marginal increase in cost going from 14 metres to 20 metres exceeded the increase in flood mitigation benefits. A more detailed assessment of the flood probabilities, climate change and growth impacts will confirm the final height around 14 metres in the EIS.

2.2.2 Lowering Warragamba Dam Full Supply Level by 5 metres and 12 metres

The 2013 Review recommended further analysis of the potential to change the operation of Warragamba Dam to reduce flood risk. This included options to reduce the current Warragamba Dam Full Supply Level (FSL) to create airspace for flood mitigation. The Taskforce found that although these options reduce risk to life, there are significant water quality and supply costs that meant they were less cost effective than raising of Warragamba Dam by around 14 metres for flood mitigation.

2.2.3 Downstream mitigation options

Downstream mitigation options located downstream of Warragamba Dam and would, if constructed, work by improving drainage of water away from the Valley. These included:

- A diversion channel between the Hawkesbury River and Currency Creek near Wilberforce
- Dredging the Hawkesbury River between Windsor and Wisemans Ferry.

Based on 2013 Review assessments and additional cost estimate and preliminary social, environmental and cultural heritage assessments by the Taskforce, these downstream options were found to have construction costs similar to those of the raising Warragamba Dam wall, but without the comparable benefits.

2.2.4 Construction of a new dam

Previous reviews carried out from 1987 to 1995 considered a number of sites alternative to those on the Warragamba River for new flood mitigation dams, mostly located in National Parks. These were rejected at the time due to their low cost-effectiveness and significant environmental impacts. New dams were reconsidered in the 2013 Review, which found that there was no new information which would justify further consideration of new dam sites for flood mitigation.

Options to build another dam on the Warragamba River were assessed by the Taskforce. However, based on detailed multi-criteria analysis cost, environmental impact and operational impact, the construction of a new dam did not compare favourably with options to raise the existing dam (in mass concrete or hardfill) and was ruled out. The construction costs associated with these new builds were considered prohibitive, achieving the same dam storage outcomes as raising the existing Warragamba Dam wall but at three times the cost. In addition, uncertainty about the water quality between the new and existing dam reduced the attractiveness of new dam options. For these reasons a new dam was not short-listed for consideration in the final options analysis.

2.2.5 Changed operation of Warragamba Dam

The 2013 Review recommended further analysis of the potential to change the operation of Warragamba Dam to reduce flood risk. These options include:

- changing the operation of dam gates to hold back water for longer during flood events to delay the onset of flooding
- pre-releasing water ahead of flood events to create airspace for flood mitigation.

A preliminary assessment of the effectiveness of these options for reducing flood risk indicated that they were not suitable for detailed cost benefit analysis. This is primarily because the limited effective flood mitigation storage provided by these options only mitigates small flood events, and the options provide negligible flood mitigation benefit for the larger floods that pose a significant risk to lives or property. Other concerns were that they rely on uncertain flood forecasts, increase the reliance on and liability from gate operation, and could under some flood events increase the eventual rate of rise of downstream flooding and the risk to life.

2.2.6 Levees

Based on the recommendations for the 2013 Review, levees at McGraths Hill and Peachtree Creek were identified as cost effective options for providing local flood protection. These were not recommended as part of the Hawkesbury-Nepean Valley Flood Risk Management Strategy as they provide limited and localised benefits, not suitable for inclusion in the regional Strategy.

3 Proposal Description

3.1 Overview of the Proposal

The flood mitigation works proposed at Warragamba Dam involves raising the dam wall to provide additional 'air space' for flood detention purposes. Raising the spillway crest height by around 14 metres would provide approximately 991 gigalitres (GL) of airspace. It will also include the operation protocols for flood mitigation during a flood.

The Proposal's final concept design will build on the detailed feasibility study and preliminary concept design for Warragamba Dam undertaken by the Taskforce (2014-2016). The raising of Warragamba dam wall will include:

- Buttressing the downstream face of the existing Warragamba dam wall in mass concrete
- Construction of coffer dam and other works for management of flood risk during construction.
- Replacing the existing radial and drum gates with slide gates or narrow spillway for the controlled release of temporarily stored floodwaters
- Modifying the existing auxiliary spillway for extreme flood events
- Building a high level bridge for operational access across the top of the raised dam
- Construction of a temporary works area adjacent to the dam including material storage and concrete batching plant.

The Proposal will include an e-flows infrastructure component which involves the addition of a multi-level intake on the upstream face of the dam wall and associated pipework for transport of flows to downstream.

3.2 Final design and operation

The final proposal design and operation will be based on:

- Confirming the height around 14 metres for reduction to flood risk to life and property in the Valley, particularly in regard to impact of climate change on future flood risk.
- Based on environmental impact studies, balancing impacts of upstream inundation in Lake Burragorang due to Warragamba Dam temporarily storing floodwaters with increased durations of elevated downstream river levels associated with post flood dam releases. The imperative will be to restore the airspace in time for a subsequent flood event, hence this will be a trade-off between the inundation impacts and the flood mitigation benefits.
- Continued compliance with dam safety requirements.

3.3 Site Context

Warragamba Dam is situated in a narrow gorge on the Warragamba River about 65 kilometres west of the Sydney CBD. The township of Warragamba is located to the east of the dam wall and

according to 2011 census data is home to an estimated 1,236 people (ABS, 2011). A site locality map is shown in Figure 3-2.

Created by damming Warragamba River and flooding the Burragorang Valley, Lake Burragorang is four times the size of Sydney Harbour and is currently managed as a water supply dam (WaterNSW, 2015a).

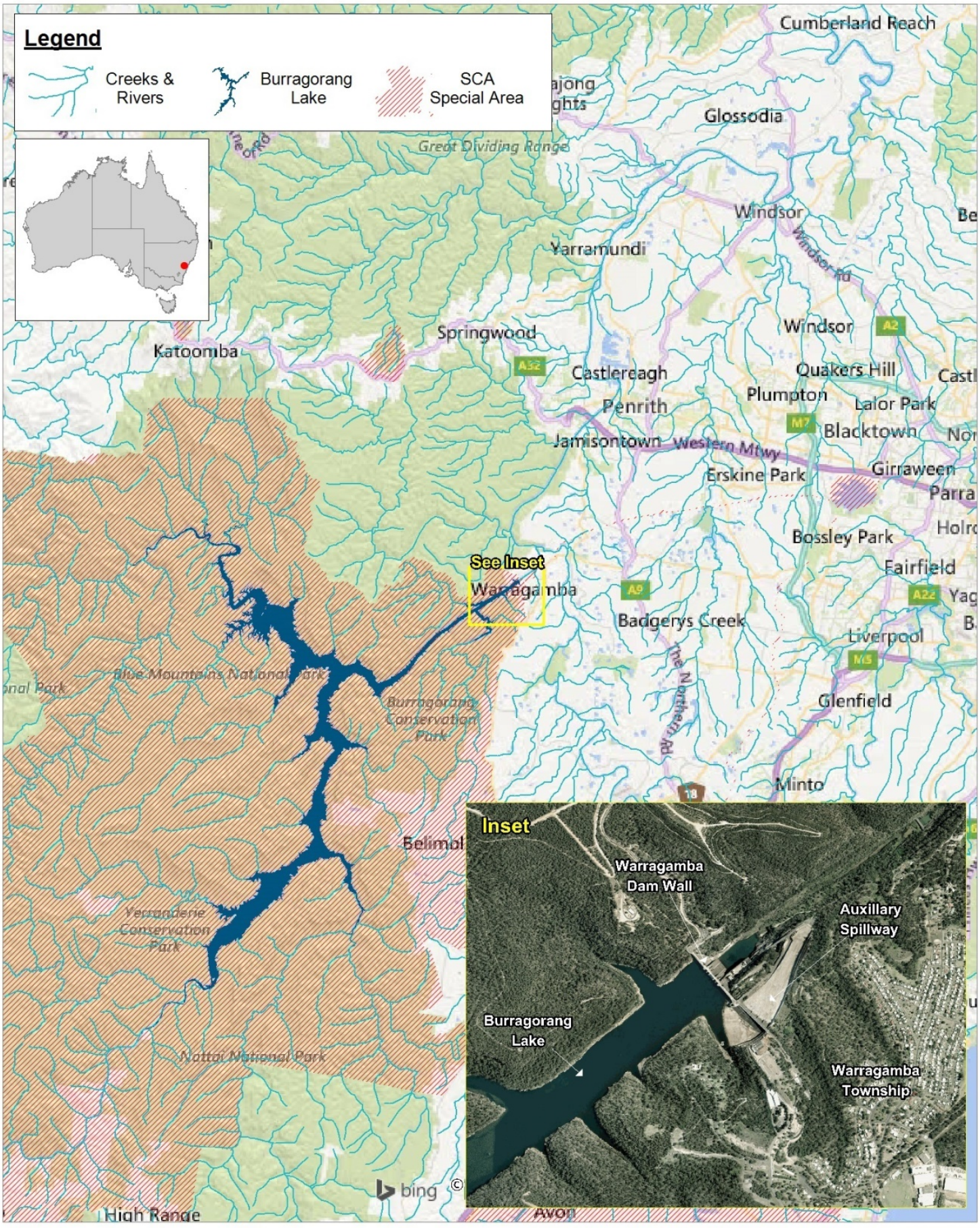
The Warragamba water supply system is illustrated schematically in Figure 3-1.

Figure 3-1 Warragamba Water Supply System (Source: WaterNSW)

Water from the dam flows by gravity through two pipelines (27 kilometres in length) to the Prospect water filtration plant located 15 km west of Sydney's CBD. Water treated at this plant supplies water for around 80% of Sydney's population. Water from the dam is also supplied to Warragamba, Penrith and the Lower Blue Mountains through filtration plants at both Warragamba and Orchard Hills. A deep water pumping station is located at Warragamba Dam to enable continued supply if the water level falls below the outlets during a severe drought. Water is also released into the Warragamba River in order to provide a secure water supply to the people of North Richmond.

Since the construction of the dam in 1960, the flow contribution from Warragamba Dam to the Warragamba River and subsequently the Hawkesbury-Nepean River has been limited to the following releases:

- Five megalitres of water each day from Warragamba Dam to dilute effluent discharge from the Wallacia sewage treatment plant into the Warragamba River.
- Fixed low flow releases (17 ML/d in winter and 25 ML/d in summer) for Sydney Water to extract at its North Richmond Water Filtration Plant. These releases are specified in the Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011;
- Operational releases; or
- Flows during heavy rainfall when the dam has filled and water flows over the spillway.



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Warragamba Dam Locality

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3.4 Project Areas

The area(s) to be considered for the assessment of the Proposal have been described in the context of both the stage of the works (construction and operation) and geographic extent of possible effects and impacts.

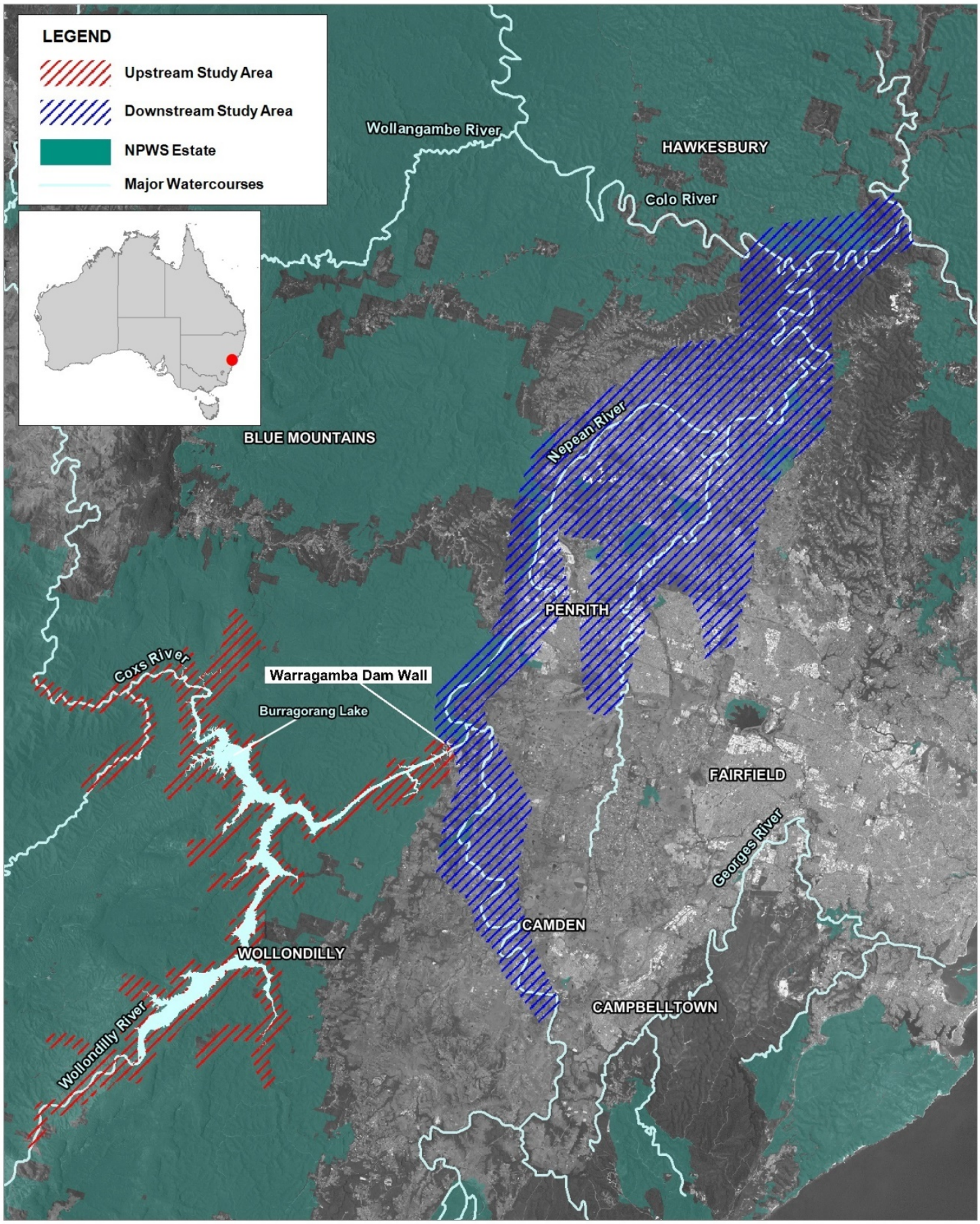
The **Construction Area** includes the area in and around the existing Dam (including the dam wall itself, a central drum gate and spillway, four radial gates and auxiliary spillway as well as auxiliary access roads and dam site buildings. The township of Warragamba and areas immediately upstream and downstream of the Dam could be affected by the construction works. The construction may also include impacts on the immediate road network. The indicative Construction Area is shown in Figure 3-4.

The **Operation Study Area** includes the areas upstream and downstream of the Dam that could be affected by the future operation of the Dam with a raised dam wall.

Upstream of the dam includes but is not limited to Lake Burragorang (i.e. the reservoir formed by Warragamba Dam), and part of the Burragorang State Conservation Area (SCA) and the broader Greater Blue Mountains World Heritage Area (GBMWHA).

Downstream of the dam includes the freshwater and estuarine reaches of the river system between Warragamba Dam where it joins the Nepean River near Wallacia (not including the reach of the Nepean River upstream of Warragamba River) and Wisemans Ferry as well as the adjacent riparian zone, floodplain and wetland/lagoon waterbodies.

A plan showing the indicative Operation Study Area is shown in Figure 3-3.



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Operation Study Area

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3.5 Construction

The construction activities to be undertaken as part of the Proposal would occur within the existing footprint of Warragamba Dam including immediate surrounds.

The design and construction methods assumed herein are subject to further modification as part of any EIS or detailed design process.

Key construction activities of the Proposal are shown in Figure 3-4 and include:

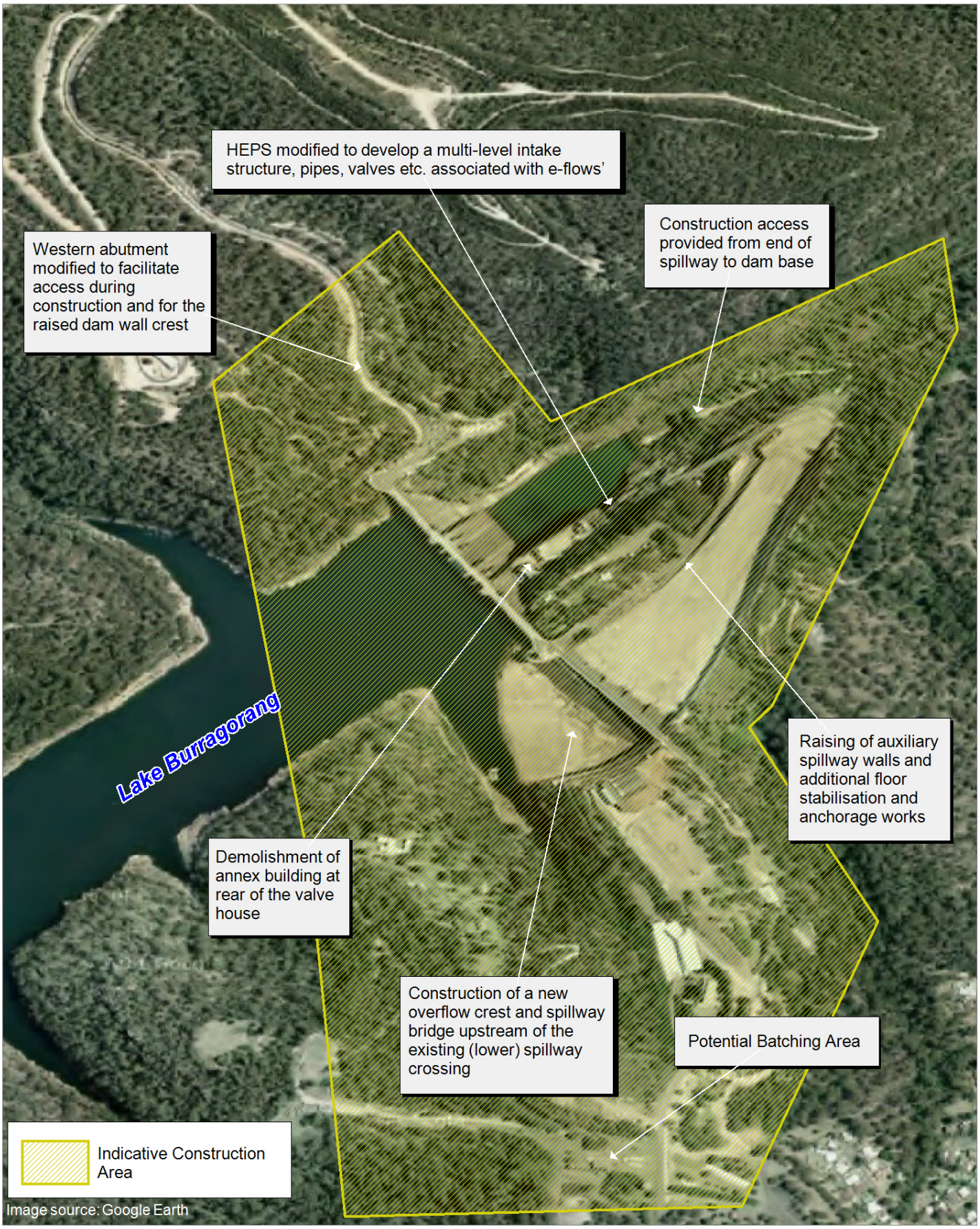
- Pending the water supply level at the time of construction, lowering the full supply water level (FSL) potentially up to five metres or drawdown to RL111.72 to facilitate construction of the proposed concrete gravity raising. Removal of the existing fuse plug embankments in the auxiliary spillway for the diversion of floods during the construction of the raised central spillway section of the dam would occur following lowering of the existing storage level
- Preparation of the downstream face of the existing dam wall (to a removal depth of 25 to 50 mm) via hydro-cutting to expose coarse aggregate for interfacing with the new concrete buttress. Excess waste of sand/concrete waste will be captured, treated, reused or transported offsite to a commercial disposal facility or recycled onsite as required;
- Demolishment of the existing small annex building at the rear of the valve house;
- Minor construction works on the western side of the dam to facilitate access and storage requirements during construction and permanent access for the raised dam;
- Transport of material for site offices, workshops, storage facilities, concrete batch plant, water treatment plant and other temporary facilities required for construction;
- Retention of the existing 11 metre wide access bridge across the auxiliary spillway in order to maintain access to the existing valve house building at the downstream right hand side of the main dam; and
- New anchor work along the main dam wall, upgrade works to existing auxiliary spillway including raising of the training walls and construction of a new overflow crest and access bridge.

The preferred environmental flow infrastructure option for the releases currently being considered by Government consists of a deep water multi-level intake attached to the upstream face of the dam wall and new pipework and valves to release the water.

The preferred option involves:

- Construction of a new multi-level independent intake structure feeding into the existing hydro-electric power station (HEPS) intake penstock. The intake structure would be constructed using precast concrete units that are anchored to the upstream face of the existing dam wall.
- The intake would house 17 multi-level gates to control selective withdrawal from the storage. Water from the intake would be released into the HEPS penstock via pipework connected to the bottom of the proposed intake.

- It is proposed that any environmental flows would be controlled (with flows ranging from zero to 6,750 ML/day (maximum capacity of the intake-penstock system at dam full storage level)) by trifurcating the existing HEPS penstock at its downstream end with a smaller fourth branch line off one of the trifurcates. It is necessary to do this to enable flow measuring equipment and control valves to be installed.
- Civil modification of the existing downstream HEPS chamber will be required to house the new pipework, flow measurement and valving equipment. The existing HEPS generator and associated equipment including support structure(s) will need to be decommissioned and dismantled to allow the civil modification and installation of new pipework and equipment.



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Warragamba Dam Construction Activities

Figure: **3-4**

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3.5.1 Construction Program

The construction program is estimated to take approximately 4 years for completion of the Proposal; a preliminary construction program summary is shown in Table 3-1.

Table 3-1 Preliminary Construction Program Summary

Overall Activity	Month of Program for Activity Commencement	Month of Program for Activity Completion
Set-up Establishment	1	5
Install Main Diversion Coffer Dams	5	8
Main Dam Raising	8	42
New Outlet Conduits	26	42
Auxiliary Spillway Modifications – Downstream Works and Stage 1 of New Spillway Creek	8	32
Auxiliary Spillway – Stage 2 of New Spillway Crest and New High Level Bridge	38	45
Disestablishment and Site Rehabilitation	45	49

This program assumes standard working hours and that some activities such as deliveries, plant maintenance, selected concrete pours and any emergency work to be undertaken outside standard working hours.

The program in Table 3-1 considers thatthe infrastructure works to accommodate e-flows (multi-level outtake and associated pipework) will be undertaken within the same overall period but this will be included pending Government's decision on an e-flow and integrated once greater detail about the intended design and construction components is known.

Broad construction phases and activities to be undertaken for the Proposal (including proposed infrastructure works for e-flows) are summarised in Table 3-2.

Table 3-2 Construction Phases and Activities

Site Establishment
Set-up site offices and car park
Set-up concrete batch plant and material stockpile areas
Set-up tower cranes
Provide power supply, water, communications
Install all environmental controls
Construction Works
Demolition, excavation, foundation preparation
Concrete buttress construction
Construct new outlet conduits, spillway bridge and raised crest
Install multi-level offtake (MLO)
Install new pipes and valves connecting MLO
Construct new spillway crest
Construct new spillway bridge and access roads
Spillway training wall modifications, chute slab anchorage and downstream erosion protection
Site Disestablishment
Remove all temporary construction facilities and temporary cofferdams
Landscaping and rehabilitation of all construction areas

3.5.2 Material and Transport Routes

With regard to material and transport routes during construction activities, the following is expected:

- The construction will require imported materials (sand/course aggregate).
- The importation of material from quarries would likely follow similar heavy vehicle bypass routes as proposed by the previous EIS (ERM Mitchell McCotter, 1995). At this stage, Silverdale Road, Marsh Road and Warradale Road would be likely transport routes for further consideration.
- Sites for sourcing of material (stone, rock, fly ash, sand and cement) include Marulan (147 km), South Coast (110 km), Central Coast (120 km) or Hartley (95 km). At this stage the most likely sites would be Marulan or the South Coast.
- It is estimated that the volume of material will equate to a large number of truck movements over the life of the program on the designated construction routes (based on similar truck movements experienced with the construction of the auxiliary spillway).

- Truck routes and construction access roads would be designed to remove the need for reversing, and lighting would be directed downward to minimise impact to nearby residences.
- Other materials to be imported onsite will include reinforcing steel/mesh/bar, formwork, valves, gates electrical equipment as well as site sheds, tower cranes, mobile batch plant and storages silos.

3.6 Operation

Following the construction of raising raised Warragamba Dam wall, the dam will continue to operate as a water supply dam. New environmental flow releases from the dam are currently being consideredby the NSW Government.

However, a new operational regime will need to be determined and implemented in relation to flood mitigation and when environmental flow releases cease and re-commence in non-flood operations. The dam wall raising is for flood mitigation only and water will only be above the full supply level during the management of flood events.

The following sections outline the function, operation, flow releases and the duration and predicted inundation extents associated with the flood mitigation zone and also addresses environmental flow releases. A summary of the operations for the raised dam are shown in Figure 3-5.

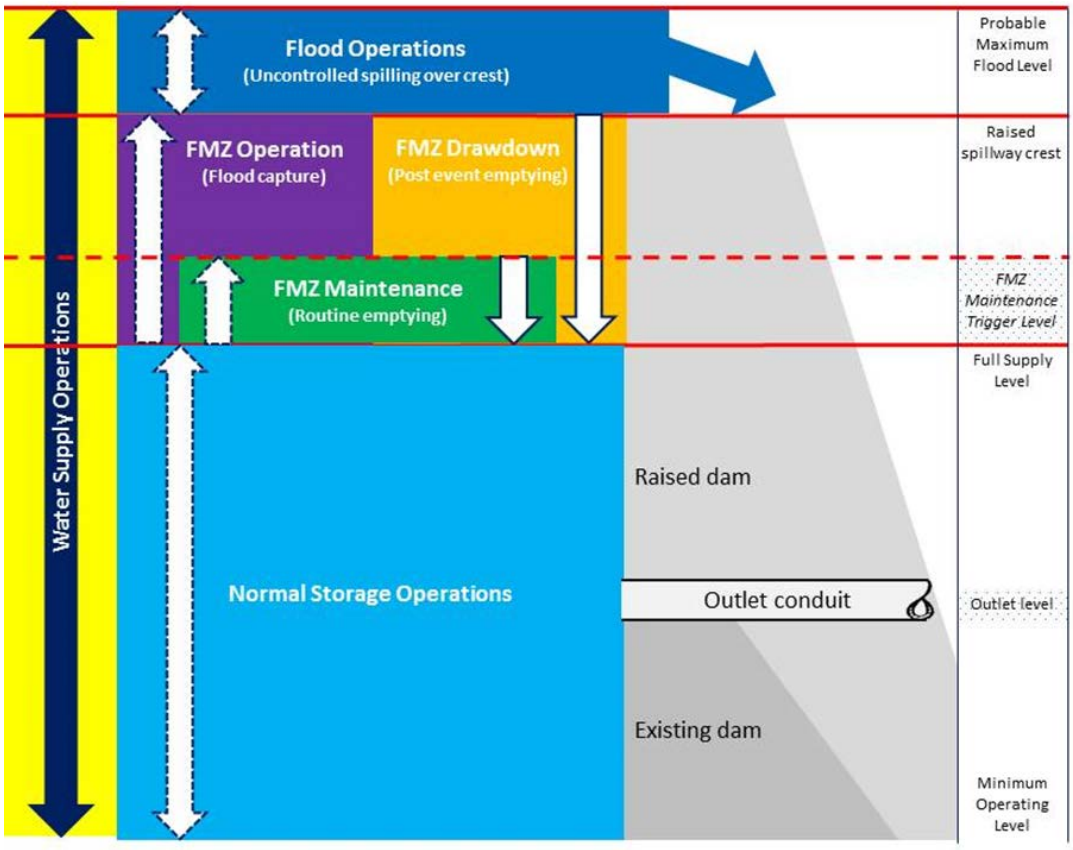


Figure 3-5 Summary of Water Supply Operations for a raised dam – Normal Storage Operations, FSL and FMZ Operation, Drawdown and Maintenance

3.6.1 Operation for Flood Mitigation

The function of Warragamba Dam for flood mitigation is reliant on managing the flood management zone (FMZ) before, during and after a flood.

The raised dam, whether it is depleted below FSL or is at FSL at the start of the inflow event, will continue to capture inflowing waters allowing for normal operational discharging until the new spillway crest level is reached.

For the raised dam, once the raised spillway crest is reached, the water will spill over. The water level will continue to rise until the outflow exceeds the inflow after which time the water level in the dam will begin to drop. Water levels will continue to fall until the lake level drops to the weir crest level and spills from the dam via the weir crest will then cease.

As part of the management of a flood event, flood waters captured within the FMZ would be released into the Hawkesbury-Nepean River. The time taken to drain the FMZ will depend on the rate of inflow and the discharged downstream flow rate identified in the operating rules (to be developed).

The aim of the Proposal is to hold back floodwater for longer and provide additional time for evacuation and to reduce the downstream flood peak.

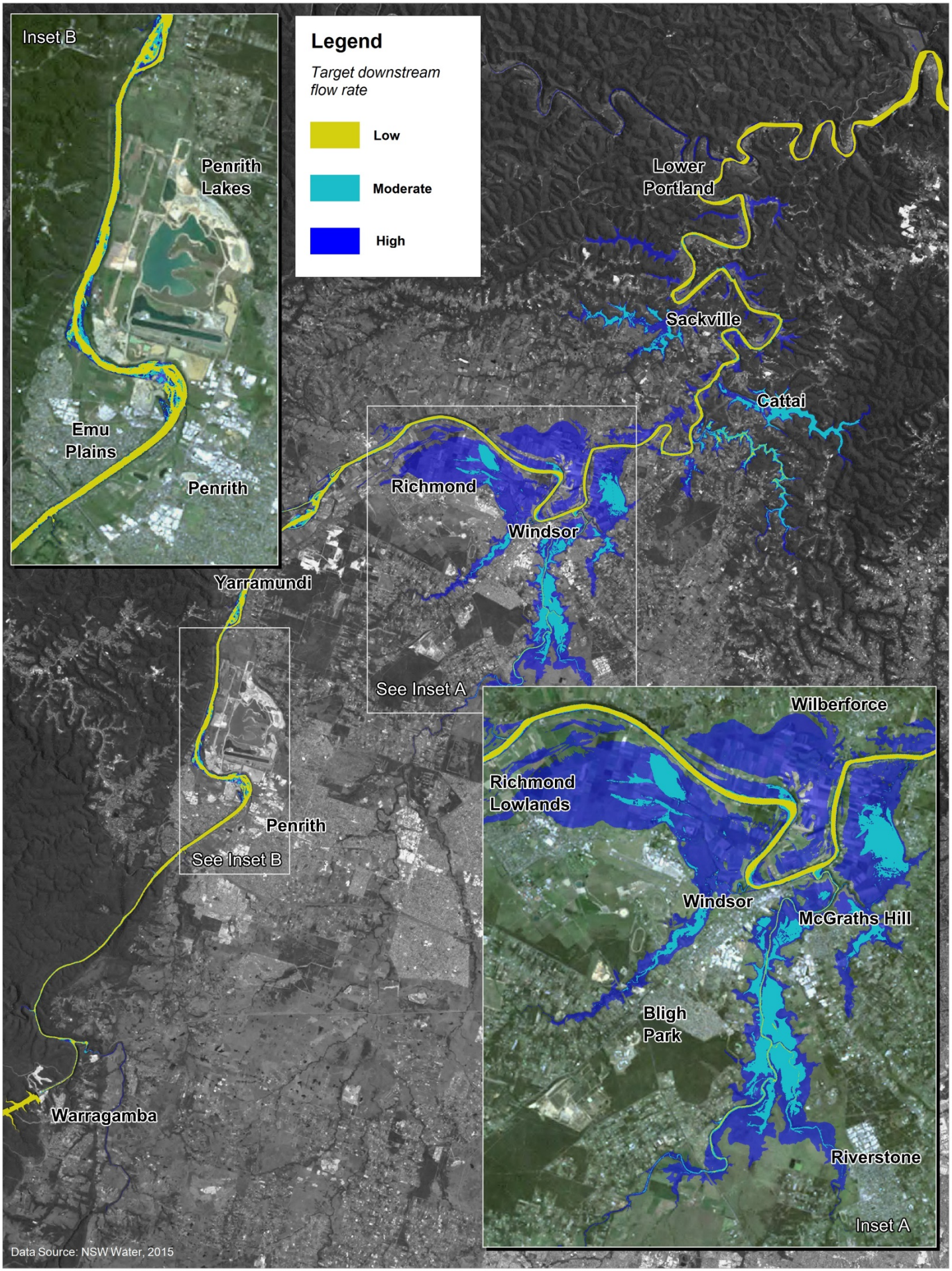
The operational scenarios to be assessed will consider a range of downstream target flow rates in the order of gigalitres per day. The operating rules to be adopted will depend on the balancing of upstream and downstream inundation impacts. The potential range of downstream inundation of managed post flood releases from Warragamba Dam are shown on Figure 3-6.

3.6.2 Duration of Lake Levels above FSL

Under the current dam operational rules releases are made in accordance with the H14 protocols. These protocols progressively open the gates when the dam storage level exceeds the full water supply level. Hence the lake levels in Lake Burragorang do exceed the full water supply level during dam spill events but typically this is less than a week.

The operation of a FMZ with a raised dam wall will result in increased duration of elevated lake levels in Lake Burragorang above full water supply level during flood events compared to the current dam operation. It is estimated that the total duration lake levels would be above full water supply level (which includes the days to fill, days to spill and days to drawdown) ranges between two weeks and five weeks depending on the size of the FMZ, the magnitude of the flood event and the adopted target downstream flow rate.

Inundation extents associated with the 2% probability flood and the probable maximum flood (PMF) upstream of Warragamba Dam are shown in Figure 3-7.



Title:

Downstream Inundation Extents, Possible Target Downstream Flow Rate Scenarios

Figure: **3-6**

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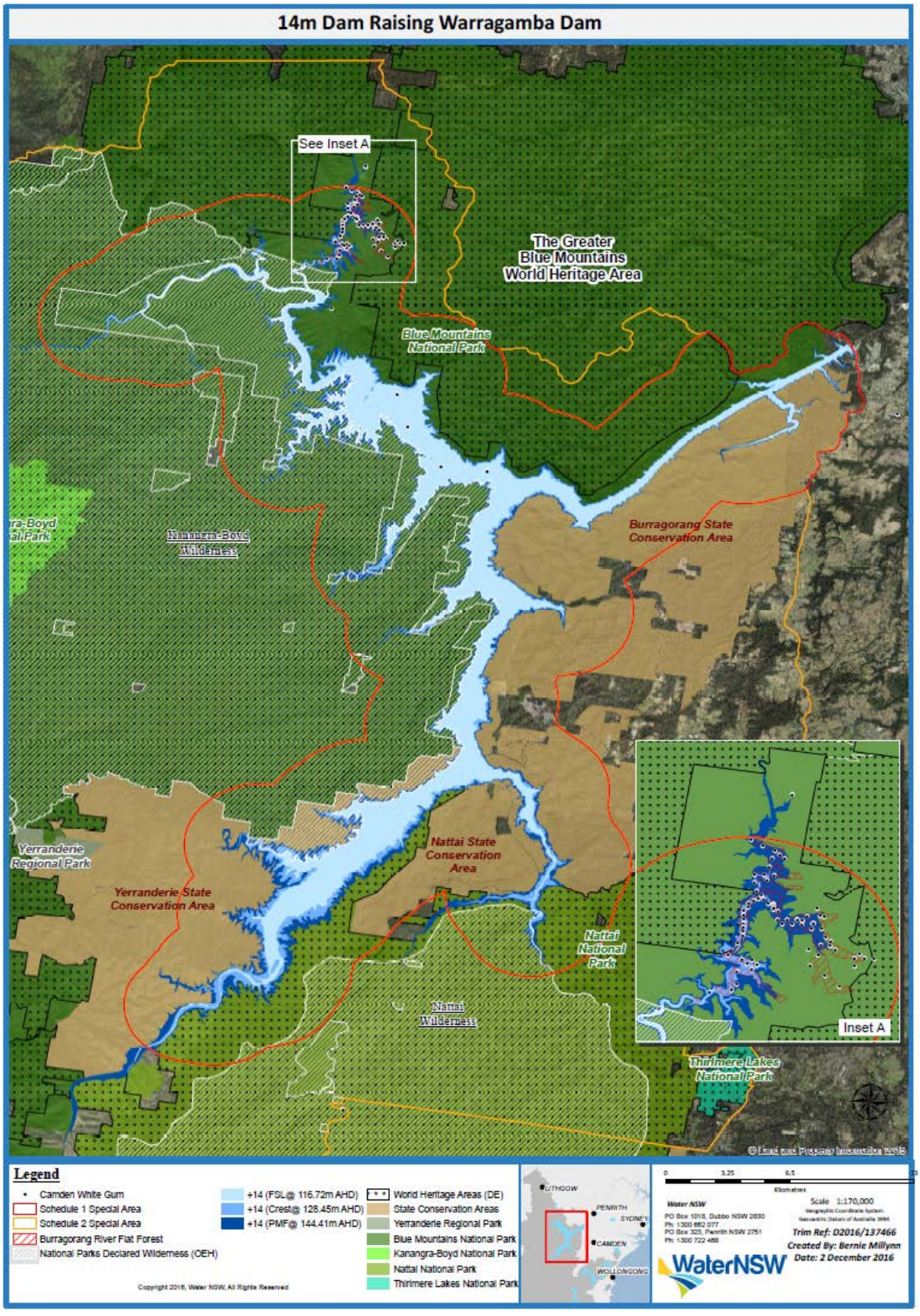


Figure 3-7 Upstream Inundation Extents

3.6.3 Predicted Upstream Flood Inundation Extents

The predicted extent and duration of temporary inundation is important to defining potential impacts on a range of environmental, heritage, social and economic values. The approximate change to upstream lake surface area based on recent hydrosurvey data of Lake Burragorang (data provided by INSW, 19 February 2015) is summarised in Table 3-3.

Table 3-3 Estimated Upstream Water Level and Inundation Extent Based on 2014 Lake Burragorang Hydrosurvey

Dam Condition	Maximum Water Level at Dam Wall (m AHD)	Lake Surface Area (km^2)	Change to Lake Surface Area Relative to Existing (%)
Existing Crest Level	116.72	75.1	0
Proposed Raised Dam Wall (around 14 metres)	128.45	93.7	+25%

The proposed dam wall raise is expected to temporarily increase the existing impoundment area within the upstream reservoir from approximately 75 km^2 ha to 94 km^2.

4 Permissibility and Strategic Planning

This Section of the PEA provides the discussion of permissibility under relevant environmental legislation, planning and assessment instruments, including its expected status under Commonwealth and State legislation.

4.1 Permissibility and Strategic Planning

4.1.1 State Significant Infrastructure

The Proposal is considered State Significant Infrastructure (SSI) under Part 5.1 of the EP&A Act (s115U) as Warragamba Dam raising is an activity for which the proponent is also the determining authority and in the opinion of the proponent, requires an environmental impact statement to be obtained under Part 5.

The construction works for raising the dam wall and incorporating a multilevel offtake for e-flows involve modifications to a water storage facility[1] and are for the purpose of flood mitigation works[2]. Therefore the Proposal is permissible as it may be carried out without development consent under the below clauses of the State Environmental Planning Policy (Infrastructure) 2007 (ISEPP).

- Clause 125(2) - '*Development for the purpose of water storage facilities…may be carried out by or on behalf of a public authority without consent on land in Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone SP1 Special Activities, Zone SP2 Infrastructure*[3] *or an equivalent land use zone…(cl125(2))';* and
- Clause 50(1) - 'Development for the purpose of flood mitigation work may be carried out by or on *behalf of a public authority without consent on any land'*

Clauses 125(5) and 50(2) of the ISEPP each allow for '*environmental management works'.*[4]', to be undertaken in connection with the development. On this basis, the environmental flow infrastructure works are permissible to be undertaken in conjunction with the raising.

4.1.2 Critical State Significant Infrastructure

Any SSI may also be declared to be Critical State significant infrastructure if it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental or social reasons.

WaterNSW will be seeking declaration of the Proposal as Critical State Significant Infrastructure on the basis that while the raising of the dam wall will significantly reduce the risk of all flooding in the Valley, the expected mitigation will provide significant social benefits to those living within the Valley as well as a key economic benefit for all of NSW. Additionally, the Insurance Council of

[1] '*Water storage facility' means a dam, weir or reservoir for the collection and storage of water, and includes associated monitoring or gauging equipment (cl124, ISEPP)*
[2] Defined under the Standard Instrument—Principal Local Environmental Plan 2006 to include 'enlargement of any fill, wall or levee that will alter riverine flood behaviour'
[3] *The area where construction works will be undertaken are zoned as SP2 Infrastructure (Water Supply) under the Wollondilly Local Environmental Plan 2011*
[4] *'Environmental management works' means (a) works for the purpose of avoiding, reducing, minimising or managing the environmental effects of development (including effects on water, soil, air, biodiversity, traffic or amenity), and (b) environmental protection works*

Australia has recognised the Valley as having the highest single flood exposure in NSW, and possibly within Australia.

4.2 Environmental Assessment Process

Given the Proposal potential environmental impacts and permissibility outlined in Section 4.1, it is expected that the Proposal will be SSI. The NSW Department of Planning and Environment will undertake an assessment process in accordance with Division 2, Part 5.1 of the EP&A Act. In addition, the Proposal will be referred to the Federal Minister for consideration of a controlled action under the EPBC Act.

If the Proposal is deemed to be a controlled action, it will require assessment under one the assessment tools provided for in the EPBC Act. In accordance with the Bilateral Agreement reached between the NSW and Commonwealth Governments[5], an Environmental Impact Statement (EIS) under the EP&A Act for SSI can also be used for an EIS under the EPBC Act for a controlled action, where directed by the Federal Minister. For this reason, a single EIS process under the EP&A Act for SSI is expected to be applied for the Proposal rather than two separate assessment streams. Once the EIS has been prepared, it will be assessed by relevant NSW departments in the first instance followed by assessment by the Federal Minister for final approval.

NOTE: *The assessment process for CSSI is the same as the process for SSI.*

Section 4.3 provides a summary of the relevant Commonwealth and State legislation and policy instruments that may apply to the proposal under these assessment processes.

4.3 Statutory Instruments

4.3.1 Commonwealth Legislation

Environment Protection and Biodiversity Conservation Act 1999

The Proposal will be referred to the Federal Minister for Environment for consideration as a controlled action due to its prospective impacts on key Matters of National Environmental Significance (MNES) identified within the study area (and as described below). The response from the Minister will indicate the assessment process to be undertaken under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Two protected matters searches have been undertaken of the construction area and operation study area, divided into areas upstream and downstream of Warragamba Dam (see Appendix A). These searches identified the following MNES features:

Upstream

- One World Heritage property;
- One National Heritage place;
- Five listed threatened ecological communities (TECs);
- 48 listed threatened species; and

[5] https://www.environment.gov.au/system/files/pages/43badfb2-b8be-4a10-a5b9-feab2d38a5d2/files/nsw-bilateral-agreement-assessment-2015.pdf

- 13 listed migratory species.

Downstream

- Two World Heritage properties;
- Two National Heritage places;
- Eight listed TECs;
- 83 listed threatened species; and
- 36 listed migratory species.

NOTE: A number of the matters listed above appear in both the upstream and downstream searches (e.g. Greater Blue Mountains World Heritage Area). The protected matters search tool (PMST) provided under the EPBC Act identifies matters based on a combination of sightings and broadscale modelling and may include some matters not actually occurring within the search area.

Of the matters identified in these two searches, the following are considered most relevant to a controlled action decision for the Proposal:

- Greater Blue Mountains World Heritage Area (GBMWHA). Parts of the GBMWHA within the upstream Operation Study Area may become temporarily inundated during the operation of the FMZ, while other areas to the north of Warragamba Dam (within the downstream Operation Study Area) may be impacted by changes in flow regimes;
- 'White box-yellow box-Blakely's red gum grassy woodland and derived native grassland' TEC (Critically Endangered) and 'shale-sandstone transition forest of the Sydney Basin Bioregion' TEC (Critically Endangered) both of which occurs within the Operation Study Area and may be impacted by changes in floodwater retention extents and times upstream of Warragamba Dam;
- *Eucalyptus benthamii* (Vulnerable), *Hakea dohertyi* (Endangered) and *Bossiaea oligosperma* (Vulnerable) which occur in the Operation Study Area and may be impacted by changes in floodwater retention extents and times upstream of Warragamba Dam; and
- Macquarie perch (*Macquaria australasica*) which occurs in the Operation Study Area with spawning habitat occurring in tributaries of Lake Burragorang.

Potential impacts to these matters are discussed in more detail in Section 5.5.

Native Title Act 1993

The Act provides for a national system for the recognition and protection of native title and its coexistence with the national land management system.

One of the mechanisms provided for under the Act is an Indigenous Land Use Agreement (ILUA) entered into between a native title group and government agencies for the purpose of directing the use of land and waters. An ILUA was entered into between the Gundungurra People, Gundungurra Tribal Council Aboriginal Corporation, Gundungurra Aboriginal Heritage Association Inc. and various NSW Government agencies in February 2015.

The ILUA has provided for establishment of a consultative committee and input by the Gundungurra people for management of land and waters covered by the ILUA, including Lake Burragorang and the Warragamba area. Consultation will be undertaken with this committee as part of the Proposal.

4.3.2 NSW Legislation

Dam Safety Act 2015

The Act provides for the management of dams within NSW under Dams Safety NSW. This body is responsible for examining the location, design, construction, operation and maintenance of prescribed dams, including any proposed changes. Changes to the operational management of Warragamba Dam will require consultation with Dams Safety NSW.

Environmental Planning and Assessment Act 1979

The EP&A Act is the primary legislative instrument regulating land use in NSW through a system of environmental planning and assessment. The Act also provides for the establishment of EPIs, including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs). The Act is administered by the NSW Department of Planning and Environment.

As the Proposal is expected to be SSI and CSSI under the Act, it requires an EIA that must be approved by the Minister administering the Act before the development can be undertaken. The EIA process is described in Section 4.2.

Fisheries Management Act 1994

The Act provides for the management of fisheries and aquatic vegetation and includes provisions for approval of actions impacting on endangered aquatic species, populations and ecological communities. These matters will be included in the EIA and approval process required under the EP&A Act (see above).

In addition, the Act requires projects involving alteration of a dam, weir or reservoir or involving blockage to fish passage to conduct an assessment to identify the potential impacts. The Proposal must also be referred to the Minister and, if requested, involve inclusion of a suitable fishway or bypass. This process will be undertaken as part of the EIA required under the EP&A Act (see above).

Heritage Act 1977

The Act establishes a framework for seeking approval for actions that may impact on a heritage feature, including archaeological relics. Heritage features at the study area include parts of Warragamba Dam. Consideration of heritage features and impacts will be conducted as part of the EIA required under the EP&A Act (see above).

The Warragamba Dam Supply System together with Haviland Park are listed under the Act and therefore would be the key items for consideration as part of a heritage impact assessment.

National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPWS Act) provides for the protection of Aboriginal sites and designated conservation areas as well as the flora and fauna within conservation areas. Features declared under the Act that are within the study area include:

- Warragamba Special Area (see below regarding the *Water NSW Act 2014*);
- Kanangra-Boyd and Nattai Wilderness Areas (see above regarding the *Wilderness Act 1987*);
- Kowmung, Colo and Grose Wild Rivers;
- Kanangra-Boyd, Blue Mountains and Nattai National Parks;
- Burragorang, Yerranderie and Nattai State Conservation Areas; and
- Yerranderie Regional Park.

The works related to the raising of the dam wall and modification of flow infrastructure will be conducted only within the Warragamba Special Area. As WaterNSW jointly manages the Special Area with the National Parks and Wildlife Service (NPWS) it has authority under the *Water NSW Act 2014* to undertake works associated with Warragamba Dam, subject to approval under the EP&A Act.

Impacts to Wild Rivers will be considered as part of the EIA under the EP&A Act (see above). As part of the EIA process, the Minister administering the NPWS Act will be consulted in regard to potential impacts, including changes of flow patterns in the Kowmung River, Colo River and Grose River. The Proposal will also be subject to any advice provided by the Minister as part of this process. However, no permit or assessment is required in relation to any national park, state conservation area or regional park as no works are planned within these areas.

Any potential impact to critical habitat or habitat for threatened species or endangered ecological communities will be subject to assessment and approval through the EP&A Act EIA process (see above).

NOTE: The *Biodiversity Conservation Act 2016* will repeal provisions in the NPWS Act related to threatened species, populations and endangered ecological communities when it comes into force. This is not expected to materially change the approvals and EIA process under the EP&A Act.

Native Vegetation Act 2003

The Act requires any clearing of native vegetation to be undertaken under a development consent prepared in accordance with the Act. However, this licencing requirement does not apply to vegetation cleared in accordance with an approval issued under the EP&A Act (see above).

Protection of the Environment Operations Act 1997

The Act provides for the licencing of activities that have the potential to cause environmental impacts, including activities that cause a discharge/pollution. Depending upon the exact activities undertaken during the construction phase, licences would be required for 'non-scheduled activities' (i.e. generic activities causing water pollution) as well as development of a temporary concrete batching plant and storage of chemicals in bulk.

Threatened Species Conservation Act 1995

The Act provides for the identification, conservation and recovery of threatened species and their populations and communities. A licence/approval is required under the Act, the NPWS Act or the EP&A Act for any action which would harm a threatened species, population or ecological community.

Appendix B provides a list of threatened species and endangered ecological communities (EECs) expected to occur in the Construction Area and Operation Study Area based on a search of the Office of Environment and Heritage (OEH) register and previous ecological studies. The key species and EECs of note are:

- *Hakea dohertyi* (Endangered), *Gyrostemon thesiodes* (Endangered), *Solanum amourense* (Endangered), *Eucalyptus benthamii* (Vulnerable), *Acacia clunies-rossiae* (Vulnerable), *Phyllota humifusa* (Vulnerable), *Epacris purpurascens var. purpurascens* (Vulnerable) and *Bossiaea oligosperma* (Vulnerable).
- White Box Yellow Box Blakely's Red Gum Woodland, Cumberland Plain Shale Sandstone Transition Forest (Low Sandstone Influence) and (High Sandstone Influence), River-flat Eucalypt Forest on Coastal Floodplains, Shale Gravel Transition Forest, Western Sydney Dry Rainforest, Moist shale Woodland, Turpentine-Ironbark Forest, Cooks River Castlereagh Ironbark Forest, Elderslie Banksia Shrub Forest, Castlereagh Swamp Forest, Freshwater Wetlands on Coastal Floodplains of NSW and Agnes Banks Woodland.
- Brown treecreeper (Vulnerable), diamond firetail (Vulnerable), hooded robin (Vulnerable), speckled warbler (Vulnerable), turquoise parrot (Vulnerable), swift parrot (Endangered), black-chinned honeyeater (Vulnerable), little lorikeet (Vulnerable), regent honeyeater (Critically Endangered), green and golden bell frog (Endangered), stuttering frog (Endangered), large-eared pied bat (Vulnerable), squirrel glider (Vulnerable), and brush-tailed rock-wallaby (Endangered).

See further Section 5.5 for a description of species and EEC occurrence.

The Proposal could cause impacts to some of these species and EECs during both construction and operational phases. Approval for impacts to the species and EECs will be integrated into the EIA process required under the EP&A Act (see above). This will require consultation with the Minister administering the *Threatened Species Conservation Act 1995*.

NOTE: The *Biodiversity Conservation Act 2016* will repeal and replace the *Threatened Species Conservation Act 1995* when it comes into force. It will not significantly affect the relationship to the EP&A Act, however, and thus is not expected to materially change the EIA or approval process.

Water Management Act 2000

The Act provides for the management of water in NSW, including discharges and releases from water infrastructure. As Warragamba Dam is being operated under an existing water management work approval under the Act, proposed changes in flow regime related to achieving environmental flows may require amendment to this approval. Amendments or a temporary approval are also expected where water levels will require change during construction phase. This will be determined as part of the design and assessment of the environmental flows regime.

Water NSW Act 2014

WaterNSW is the responsible authority for and owner of Warragamba Dam.

Under the Act, WaterNSW has the power to operate and modify works within its control (including Warragamba Dam) for the purposes of catchment management, subject to approval under the EP&A Act (see above). The act also establishes the Warragamba Dam site as a Special Area.

Wilderness Act 1987

The Act provides for the declaration and management of wilderness areas. Development cannot occur in a wilderness area unless subject to written consent from the Minister administering the Act.

Parts of the area upstream of Warragamba Dam form part of the Kanangra-Boyd and Nattai Wilderness Areas. While no development will occur within the footprint of these areas, the raising of Warragamba Dam will require the consent of the Minister to the extent it causes inundation within these areas. This will be sought as part of the EIA process under the EP&A Act (see above).

4.3.3 NSW State Environmental Planning Policies

State Environmental Planning Policy (Infrastructure) 2007

The Infrastructure SEPP describes development activities that can be undertaken without development consent. See Section 4.1 for the application of the Infrastructure SEPP to the Proposal.

State Environmental Planning Policy (State and Regional Development) 2011

The SEPP SRD establishes when a project is classed as SSI for the purposes of the EP&A Act. See Section 4.1 for the application of the SEPP SRD to the Proposal.

State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011

The SEPP establishes a requirement to consider drinking water quality impacts of any development within Sydney's drinking water catchment and to which Part 5 of the EP&A Act applies. This includes consideration of whether an activity will have a neutral or beneficial effect (NoRBE) on water quality. As part of the assessment of the Proposal drinking water quality impacts will need to be considered.

In addition, any development within Sydney's drinking water catchment is required to incorporate WaterNSW's most recent recommended practices and standards. This will apply to any operational changes required as part of the Proposal.

Sydney Regional Environmental Plan No. 20—Hawkesbury-Nepean River (No. 2—1997)

The Sydney Regional Environmental Plan No. 20 (Sydney REP 20) requires public authorities undertaking development within the Greater Metropolitan Region (which includes the study area) to consider the matters listed in cl5 and cl6 of the Plan. These include:

- The aims of the REP;
- The strategies of the Hawkesbury-Nepean Environmental Planning Strategy action plan; and

- Policies related to total catchment management, environmentally sensitive areas, water quality, water quantity, cultural heritage, flora and fauna, riverine scenic quality, agriculture/aquaculture and fishing, rural residential development, urban development, recreation and tourism, and metropolitan strategy.

These will need to be considered as part of an assessment of the Proposal under the EP&A Act.

Wollondilly Local Environmental Plan 2011

While the Proposal will not require assessment against Wollondilly Local Environmental Plan 2011 (LEP) as it relates only to development requiring consent, the LEP provides the basis for zoning within the study area. Under the LEP, Warragamba Dam and reservoir are mapped as Special Purpose Zone 2 (SP2) Infrastructure while the surrounding national park land is zoned Environment Protection Zone (EP) 1 National Parks and Nature Reserves. See further Section 5.12 for a discussion of land use.

4.3.4 Policies and Guidelines

NSW Weirs Policy

The Policy has been developed to guide actions in relation to the control of environmental impacts from weir structures (including dams). The policy sets expected outcomes in relation to expansion and management of existing weirs. These are:

- No approval should be granted to an expansion unless it is demonstrated that the primary component of the Proposal is necessary to maintain essential social and economic needs of the affected community; and
- Weirs that continue to provide significant benefits should be subject to structural changes to reduce their environmental impact.

The Proposal meets these policy expectations and will be highlighted in the assessment and approvals approach adopted under the EP&A Act.

Policy and Guidelines for Fish Habitat Conservation and Management

The Policy requires all proposals that involve the amendment of an existing weir structure (including dams) to be referred to the Department of Primary Industries for assessment in regard to impacts to aquatic habitat and fisheries. This will be a requirement for the Proposal as part of the EP&A Act assessment process.

Habitat Protection Plan No.3: The Hawkesbury-Nepean River System

The Plan has been prepared to guide activities within the Hawkesbury-Nepean river system. It has been prepared under the *Fisheries Management Act 1994* and is a relevant assessment requirement as part of the EP&A Act assessment and approvals process. The Plan has application for a number of activities, including flood mitigation and river control works that may have negative impacts on fish habitats within the river system.

The potential impact of the Proposal on fish habitat in the river system will need to be considered as part of assessments.

NSW Cold Water Pollution Strategy: Guidelines for Managing Cold Water Releases from High Priority Dams

The Strategy provides guidance to operators of water supply works and dams in relation to the operational management of cold water releases. It is primarily aimed at dams identified to be 'high priority' by the NSW Government (not including Warragamba Dam) but can be used for all facilities involving cold water releases. The multi-level offtake proposed as part of the e-flows works is designed to minimise temperature variation of the discharged flows.

NSW Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives are the agreed environmental values and long-term goals for NSW's surface waters. These include recreational use, healthy aquatic ecosystems, and water for drinking and irrigation. Any proposed changes to the operation of Warragamba Dam would need to be consistent with these objectives.

5 Preliminary Environmental Assessment

This section provides an overview of potential environmental impacts as a result of the Proposal. Although the Proposal will provide considerable social, economic and environmental benefits, the potential impacts from the construction and operation phases on the environment and local communities are complex and need to be carefully considered.

Impacts are considered in Section 5.1 below. The remaining Sections provide a more detailed description of impacts and benefits in the context of environmental 'themes', as well as providing an indication of further studies that would be required in order to understand these changes in more detail.

5.1 Potential Impacts

Floods naturally occur. The existing dam has already modified the flood regime. The key impact of a flood mitigation dam will be to extend the duration of water held behind the dam and lower levels of flooding downstream. The impacts would be incremental, compared to existing flood regime. The existing values that could potentially be adversely impacted by the Proposal are summarised in Table 5-1. The main impacting processes relevant to these values are:

- Construction phase activities, including potential installation of a coffer dam and other mechanism to draw down waters at work sites. These activities will generate noise and if not managed appropriately, sediment/pollutants that will be discharged into the local aquatic environment.
- Modified flood regime in upstream environment associated with temporary increased retention of floodwaters (in terms of extent, depth and time) as a result of increased flood capacity for the dam and how quickly the water can be released according to the operational release regime. Retention rates could vary from days to weeks depending on flood event, release rates and antecedent conditions.
- Modified flood regime and change in flow regime associated with releases from the raised dam in downstream environment associated with the Proposal.

Table 5-1 Values that could be Adversely Affected by the Proposal

	Values that could be Affected
Environmental Values	• Geomorphologic • Riparian / Terrestrial flora and ecological communities • Riparian / Terrestrial fauna and habitat • Aquatic flora, fauna and habitat • Groundwater dependant ecosystems and wetlands
Heritage Values	• World heritage areas • Nature conservation areas (State and Local) • Cultural heritage – Indigenous and European
Social Values	• Visual / landscape • Sense of place / wilderness / intrinsic value / community

	Values that could be Affected

	• Amenity (traffic, noise, air quality, etc.)
	• Recreational Uses
	  • Instream activities (swimming, fishing, boating, kayaking)
	  • Off stream activities (camping, cycleways, walking tracks, shore based fishing, bushcare and landscaping activities)
	• Public safety (incl. evacuation efficiency)
	• Public health

Economic Values	• Industrial and commercial uses:
	  • Aquaculture (oysters)
	  • Extractive Industry
	  • Agriculture, irrigation/turf, market gardening
	  • Tourism Operators
	  • Commercial Fishing
	• Potable water supply
	• Human consumption of aquatic animals

5.2 E-flows infrastructure impacts

The Government is currently considering a new variable environmental flow for Warragamba Dam. Pending the outcome, the infrastructure to enable these releases will be incorporated into the dam wall raising construction project.

The environmental flows are not subject to the EIS, only the potential construction impacts of the e-flow release infrastructure as part of a dam raising.

5.3 Surface and Ground Waters

The key waterbody within the Construction Area is Lake Burragorang/Warragamba River. As outlined in Section 3.6, the lake is typically maintained at or below FSL, with gates automatically releasing water once storage levels rise above the FSL (WaterNSW, 2016a). Daily base flow releases occur from the dam (between 20 ML and 30 ML per day) for nutrient dilution and water supply to North Richmond.

The construction of the Proposal will pose risk of contaminant discharge (e.g. localised sediment runoff, spills near the dam) into the aquatic environment immediately upstream or downstream of the dam wall. In addition, prior to construction if the water supply is near full supply level (FSL) then need to be lowered up to five metres while works are being undertaken.

Within the Operation Study Area, there are a number of other surface water values, primarily tributaries of Lake Burragorang (upstream of dam) and the Hawkesbury-Nepean River (downstream of dam). Within this area, are three Wild Rivers (Kowmung, Cox and Grose rivers), declared under the NPW Act. These represent areas in near-pristine condition and free from unnatural rates of siltation and bank erosion (NSW OEH, 2015). Other rivers identified as high value, based on River Styles® assessment by GHD (2013) include the tributaries of Lake Burragorang (listed as in ‘good’ condition), while the Hawkesbury-Nepean River in general was identified as being in ‘moderate’ condition.

The Proposal will lead to changes in flow regimes within these areas as a result of temporary increased duration of floodwater inundation (upstream of the dam) and changes in operational releases (downstream of the dam). Specifically, the following potential risks are identified for these surface water bodies:

- Kowmung River could be impacted by retention of floodwaters which would increase temporary inundation extents and flow regimes for the river for a period of weeks (depending on flood event).
- Water quality impacts in Lake Burragorang as a result of increased floodwater retention leading to slumping of riparian banks.
- Increased channel scour and bank erosion immediately downstream of the dam. Based on the dam raising concept plan, operation of the auxiliary spillway would be more frequent than its existing configuration. Thus, there would be an increased occurrence of channel scour and bank erosion immediately downstream of the flip bucket with no mitigation measures. Significant impacts on geomorphology of Warragamba River are unlikely, although some initial adjustment or response could be expected due to episodic and short-lived large spill events from the auxiliary spillway which has not previously been experienced.
- Risk of changes to duration of morphodynamic activity in the Warragamba River, downstream of the dam. Depending on the magnitude of flood events and the adopted release rate after such events, flows released from the FMZ may continue for several weeks or months for subsequential events. Consequently, the duration of active morphodynamic activity in the Warragamba River would be for longer than that experienced during past historical floods under existing dam operation conditions (albeit at smaller volumes). The potential for bed scour and bank erosion is also greater than would be the case for existing dam operation. This is because under typical flood conditions the main period of geomorphological activity corresponds to when the critical shear stress of the bed and bank material is exceeded. This may last for hours or days depending on the shape of the flood wave passing downstream through a catchment/valley and the physical properties of the bed and bank material. Operation of Warragamba Dam following raising is expected to result in longer elevated flow duration (i.e. where the flood is above the critical shear stress).
- Risk of alteration to the shape of the flood hydrograph. With the proposed operational regime, the peak of future floods will be attenuated and the duration of the flood extended. This is expected to result in longer flow duration when conditions are morphologically active. This could result in increased potential for sediment transport and bank erosion, particularly in areas of with poor vegetation cover and/or degraded river banks.
- Groundwater interactions in the Construction Area and Operation Study Area are not well known, though some wetlands in the Hawkesbury-Nepean Valley are groundwater-dependent (see Section 5.5). Significant impacts to groundwater are not expected as a result of the Proposal.

5.4 Soils and Geology

The local geology consists of Hawkesbury Sandstone overlaying Narrabeen Group of sandstones and shales. Wianamatta shale and sandstone groups also occur downstream of Warragamba Dam. Soils are closely related to this parent material, with three key soil landscapes within the Construction Area: a residual soil landscape on the plateau, erosional soil landscape on moderate slopes, and a colluvial soil landscape on steeper slopes (ERM, 1996). The erosion hazard associated with these soil landscapes is considered low generally but increases in areas of concentrated water flow. As a result, soil erosion could potentially occur during construction works if large areas of vegetation are cleared and soil is disturbed.

The Hawkesbury-Nepean River downstream of Warragamba River junction has been significantly modified with the building Penrith Weir and subsequent Weir pool, extensive historical sand and gravel mining from the river bed and surrounding areas, and clearing of riparian vegetation. This has resulted in the river geomorphically readjusting and as such there localised unstable areas where there are notable issues of bank instability. This has been exacerbated by human activity particularly wave generated recreational water activities and inconsistent measures to stabilise banks that redistribute the flow energy. Flood mitigation releases will increase the duration the riparian sediments are wetted, which may increase slumping of banks in areas in already vulnerable areas. The rate of ramping up and down of release flows will be important to minimise rapid changes in levels after periods of wetting downstream. Most of these impacts are expected to be localised.

5.5 Ecology

The Construction Area for the Proposal includes areas of remnant vegetation as well as aquatic habitat (in the reservoir and downstream of the dam wall). Remnant vegetation communities consist of 'shale sandstone transition forest' (Critically Endangered TEC/EEC) which has the potential to support a number of Vulnerable flora and fauna species: *Pimelea curviflora var. curviflora*, brown treecreeper (*Climacteris picumnus victoriae*), black-chinned honeyeater (*Melithreptus gularis gularis*), koala (*Phascolarctos cinereus*), eastern freetail bat (*Mormopterus norfolkensis*) and greater broad-nosed bat (*Scoteanax ruepellii*). Construction works may require the temporary or permanent loss of some areas of remnant vegetation as a result of clearing for Proposal infrastructure. The extent of clearing losses have not yet been determined; this will require further definition of construction methodology and the layout of ancillary infrastructure.

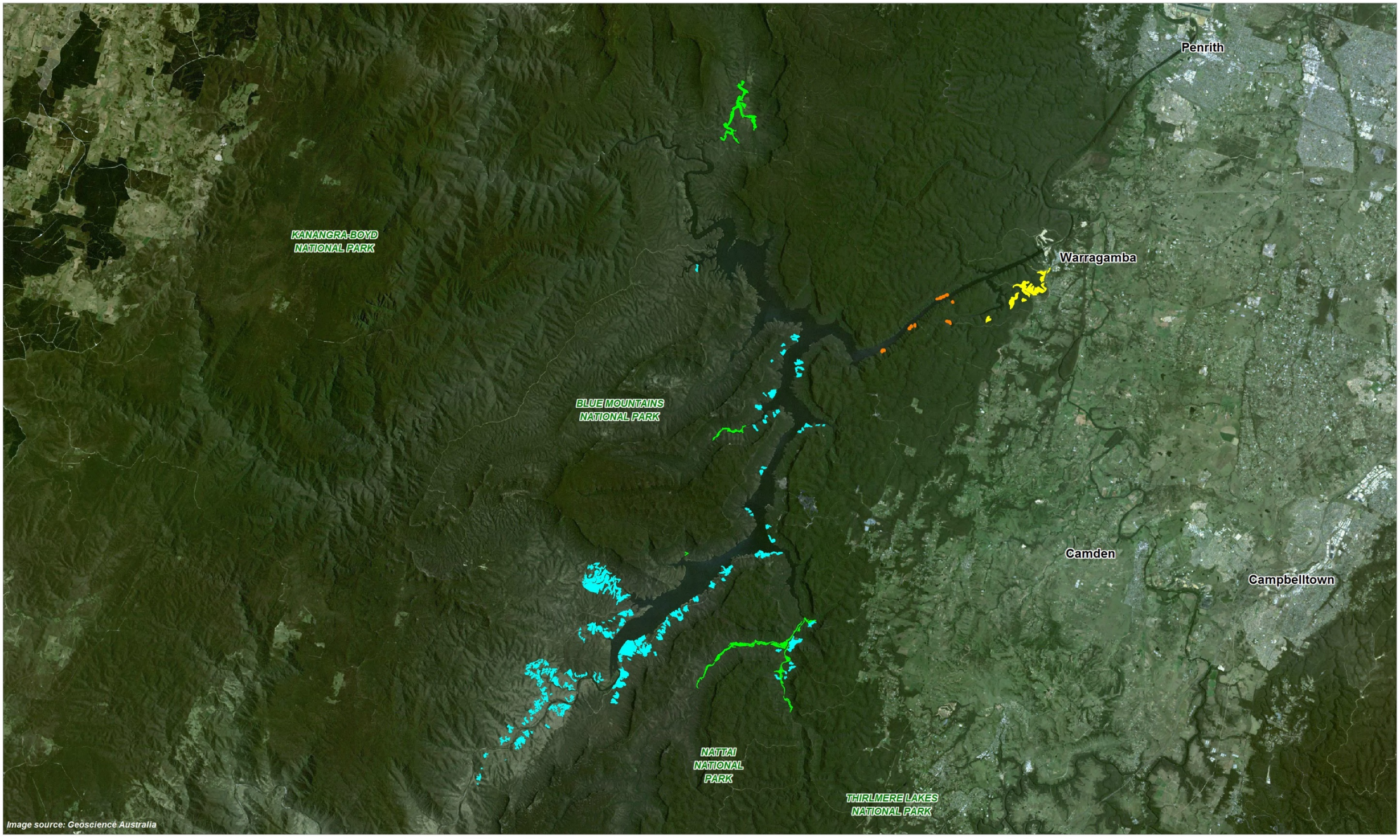
There are no known Ramsar or SEPP 14 listed wetlands within the Operation Study Area, although some of the EECs shown in Figure 5-1 are wetland systems, including groundwater-dependent wetlands. Most of these wetlands depend on flows from the Hawkesbury-Nepean River and many are currently in a degraded condition (Taylor-Wood and Warner, 2003).

If the storage is at 100 percent, construction may require the drawdown of the FSL by five metres, impacting on parts of the aquatic environment in the immediate area. Construction may also lead to disturbance of instream sediment and discharge of soils from construction activities. These potential impacts will need to be managed. Use of a temporary coffer dam or similar may also cause impacts on eel migration to and from Lake Burragorang, depending upon the location of dewatered zones.

Within the Operation Study Area, there are a number of important ecological values, including threatened species and TECs/EECs. These are shown in Figure 5-1, Figure 5-2, and Figure 5-3 for the area upstream of the Warragamba Dam wall.

These ecological values may be subjected to a number of impacting processes as part of the operation of the Proposal. These include:

- Alteration of flood regimes upstream and downstream of the dam as a result of modified operational capacity and processes, leading to potential stress on ecological values associated with riparian/aquatic areas as well as increasing the opportunity for invasive species to become established;
- Inundation of areas upstream of the Warragamba Dam wall during flood events to greater depths or extents than previously experienced and/or for greater time lengths (days to weeks). This includes the incremental impacts above exiting dam flood inundation and waterlogging of riparian communities and the banks of watercourses (leading to slumping), and alteration of riffle habitat to run and/or pool habitat; and
- Alteration of spillway design or operational regime (migratory eel access aquatic environments upstream and downstream of the dam).



LEGEND

- River-flat Eucalypt Forest
- White Box, Yellow Box and Blakely's Red Gum Woodland
- Shale Sandstone Transition Forest
- Southern Sydney Sheltered Forest

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Title:

TECs of the Construction Area and Operation Study Area Upstream of the Warragamba Dam Wall

Figure: **5-1**

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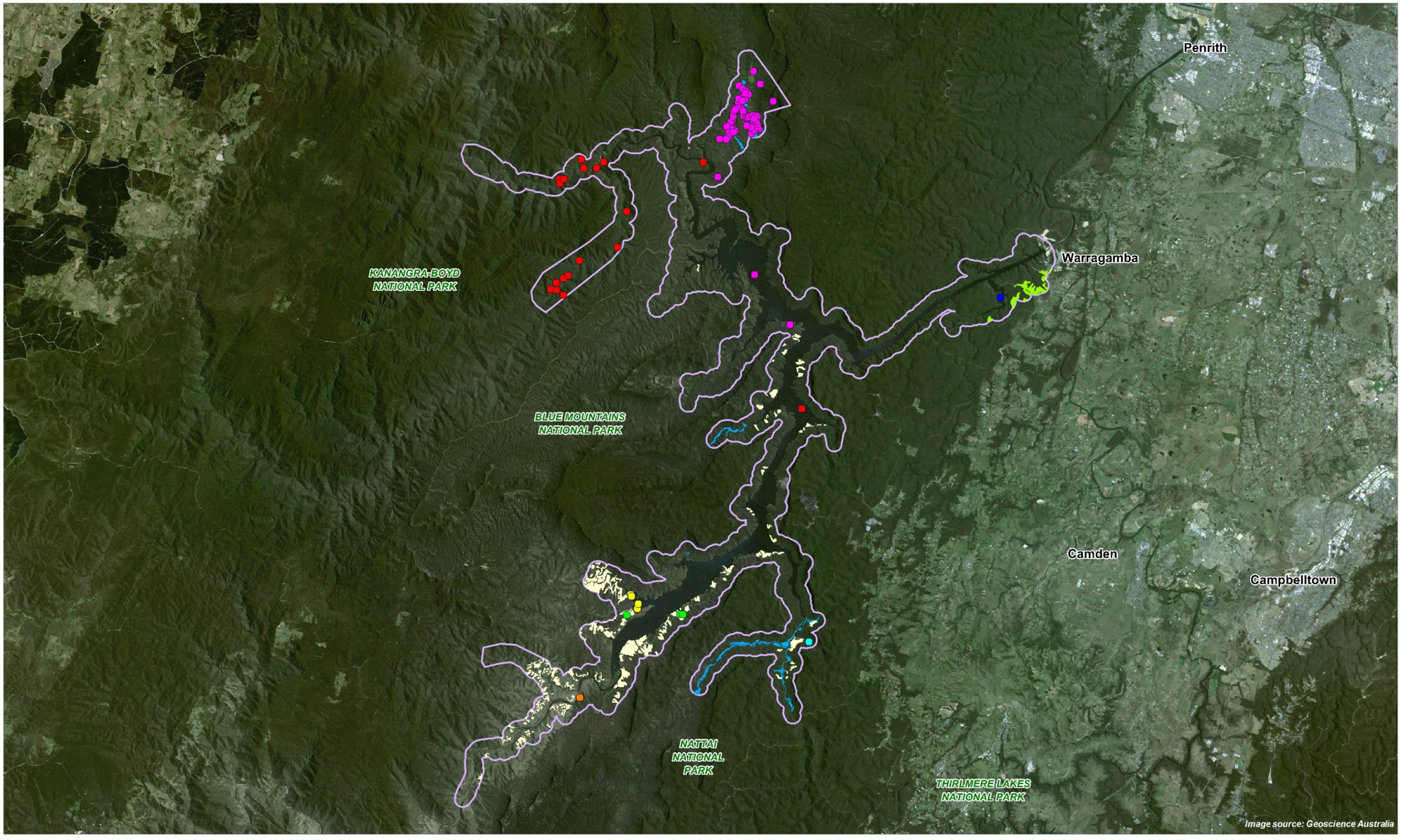

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LEGEND

Upstream Threatened Flora
- Acacia clunies-rossiae
- Bossiaea oligosperma
- Epacris purpurascens var. purpurascens
- Eucalyptus benthamii
- Hakea dohertyi
- Leucopogon exolasius
- Solanum amourense

Note: E. benthamii sites within Lake Burragorang were recorded prior to inundation and creation of the Lake.

Upstream Study Area

Threatened Communities

White box-yellow box-Blakely's red gum woodland TEC/EEC

ndst EEC

Sydney coastal river flat forest EEC

Title:

Threatened Flora Records and EECs of the Construction Area and Operation Study Area Upstream of the Warragamba Dam Wall

Figure **5-2**

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Upstream Threatened Fauna

- Anthochaera phrygia
- Artamus cyanopterus cyanopterus
- Callocephalon fimbriatum
- Calyptorhynchus lathami
- Chalinolobus dwyeri
- Chthonicola sagittata
- Circus assimilis
- Climacteris picumnus victoriae
- Daphoenositta chrysoptera
- Dasyurus maculatus
- Falsistrellus tasmaniensis
- Glossopsitta pusilla
- Hieraaetus morphnoides
- Lathamus discolor
- Melanodryas cucullata cucullata
- Melithreptus gularis gularis
- Meridolum corneovirens
- Miniopterus schreibersii oceanensis
- Mormopterus norfolkensis
- Myotis macropus
- Neophema pulchella
- Ninox strenua
- Petauroides volans
- Petaurus australis
- Petaurus norfolcensis
- Petrogale penicillata
- Petroica boodang
- Petroica phoenicea
- Phascolarctos cinereus
- Pseudophryne australis
- Pteropus poliocephalus
- Saccolaimus flaviventris
- Scoteanax rueppellii
- Stagonopleura guttata
- Tyto novaehollandiae
- Tyto tenebricosa
- Varanus rosenbergi

Penrith

Warragamba

KANANGRA-BOYD NATIONAL PARK

BLUE MOUNTAINS NATIONAL PARK

Camden

Campbelltown

NATTAI NATIONAL PARK

THIRLMERE LAKES NATIONAL PARK

Image source: Geoscience Australia

LEGEND

Upstream Study Area

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WaterNSW

BMT WBM

Title:

Threatened Fauna Species Occurrences in the Construction Area and Operation Study Area Upstream of the Warragamba Dam Wall

Figure **5-3**

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- Morphological changes upstream and downstream of the Warragamba Dam wall due to changes in water availability and flow rates, leading to conversion of existing habitat.

Table 5-2 provides a description of these impacts in the context of the key ecological values in the Operation Study Area (i.e. TECs/EEC and threatened and migratory species).

The Operation Study Area also includes wilderness area, wild rivers, national parks and the GBMWHA. These areas are discussed in Section 5.8 in the context of overall heritage (including environmental heritage) values.

Table 5-2 Ecological Values that could be Impacted by Proposal Operation

Value	Description of Impact
Upstream TECs/EECs and threatened flora species	Raising of the dam wall will increase the frequency, duration, depth and/or extent of inundation of terrestrial ecology values located upstream of the dam wall. Inundation can cause waterlogging which can lead vegetation mortality where it extends for a period of weeks. The severity of this impact will be dependent upon the tolerance of vegetation subject to waterlogging and the nature of the flood event. The vegetation values most at risk consist of: • White box-yellow box-Blakely's red gum woodland TEC/EEC • Shale sandstone transition forest TEC/EEC • River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions • *E. benthamii and H. dohertyi* Impacts may also occur to *B. oligosperma*; however, known populations of this species in the Operation Study Area occur along ridges and outside of expected inundation zones. Inundation can cause disturbance and slumping of riparian banks which can cause the loss of areas of important vegetation. Changes in flow regimes, including inundation regimes, can provide an opportunity for the establishment of invasive species (i.e. weeds) in native vegetation communities. Despite the above, inundation events may also promote growth of some vegetation communities, especially eucalypts, through the provision of silts that can be used as effective seedbeds.
Downstream TECs/EECs and threatened flora species	TECs/EECs in the Operation Study Area downstream of Warragamba Dam include the following riparian/wetland communities: • Shale Sandstone Transition Forest; • Shale Plains Woodland; • Shale/Gravel Transition Forest; • Western Sydney Dry Rainforest; • Moist Shale Woodland; • Turpentine-Ironbark Forest; • Cooks River Castlereagh Ironbark Forest; • Elderslie Banksia Shrub Forest; • Castlereagh Swamp Woodland; • Freshwater Wetlands on Coastal Floodplains of NSW;

Value	Description of Impact
	• Agnes Banks Woodland; and • Shale Hills Woodland. Altered flow regimes may cause some changes in the occurrence of vegetation communities due to changes in water availability and stream morphology. However, altered flow regimes can also cause the establishment of invasive species which may have a detrimental effect on riparian/wetland vegetation.
Aquatic fauna in Lake Burragorang and tributaries	The raising of the Warragamba Dam wall has the potential to cause conversion of upstream riffle habitat into run or pool habitat at times when floodwaters are retained (prior to release). This habitat is important for aquatic fauna, especially in the context of spawning. The Macquarie perch (*Macquaria australasica*) spawns in tributaries of Lake Burragorang (typically) between October and January. Retention events lasting a period of weeks during this time may disrupt important lifecycle processes for the species. Increased slumping of riparian areas during retention events will cause disturbance to water quality within Lake Burragorang which will impact on aquatic fauna, including the platypus (*Ornithorhynchus anatinus*). Change in operation of the spillway associated with increased flood retention capacity following raising of the dam wall may cause an impact to current *Anguilla* spp. migratory patterns. These eels currently use the spillway to migrate to and from Lake Burragorang; changes in discharges leading to higher flows may disturb this pattern.
Aquatic fauna downstream of Warragamba Dam	The only expected negative impacts are those associated with potential restriction of *Anguilla* spp. migration patterns (see above).
Terrestrial fauna	Terrestrial fauna impacts will be limited to those associated with potential loss and/or conversion of habitat, as described above.

5.6 Air Quality

Due to the World Heritage status of many of the surrounding catchments and the special area status of Lake Burragorang, air quality at Warragamba is high, which is expected of a small remote rural village surrounded by natural undisturbed bushland.

Air quality in the Construction Area could be impacted by earthworks and stockpiled material that has the potential to generate dust. The quantity of air borne dust generated at any particular time would depend on ambient weather conditions (i.e. wind), the quantity of material on site and the amount of cleared area. Dust suppression measures can be used to control this issue and will be identified during the EIA process.

5.7 Noise and Vibration

Existing levels of ambient noise and vibration in the Construction Area are low. This is to be expected as the Warragamba township is a small remote rural village that is surrounded by undisturbed bushland (as discussed in Section 5.10).

The Construction Area, of particular note the Warragamba Township, is likely to be affected by increased construction related noise. As the concrete batching plant and site office could be located nearby the Dam (off Production Avenue), noise impacts on residences on the other side of town are expected to be low. However, for this type of dam construction, there may be a need to generate additional noise during noise sensitive hours that may be difficult to mitigate during peak construction periods.

Noise and vibration impacts on the Operation Study Area (and the Township of Warragamba post-construction) are expected to be negligible.

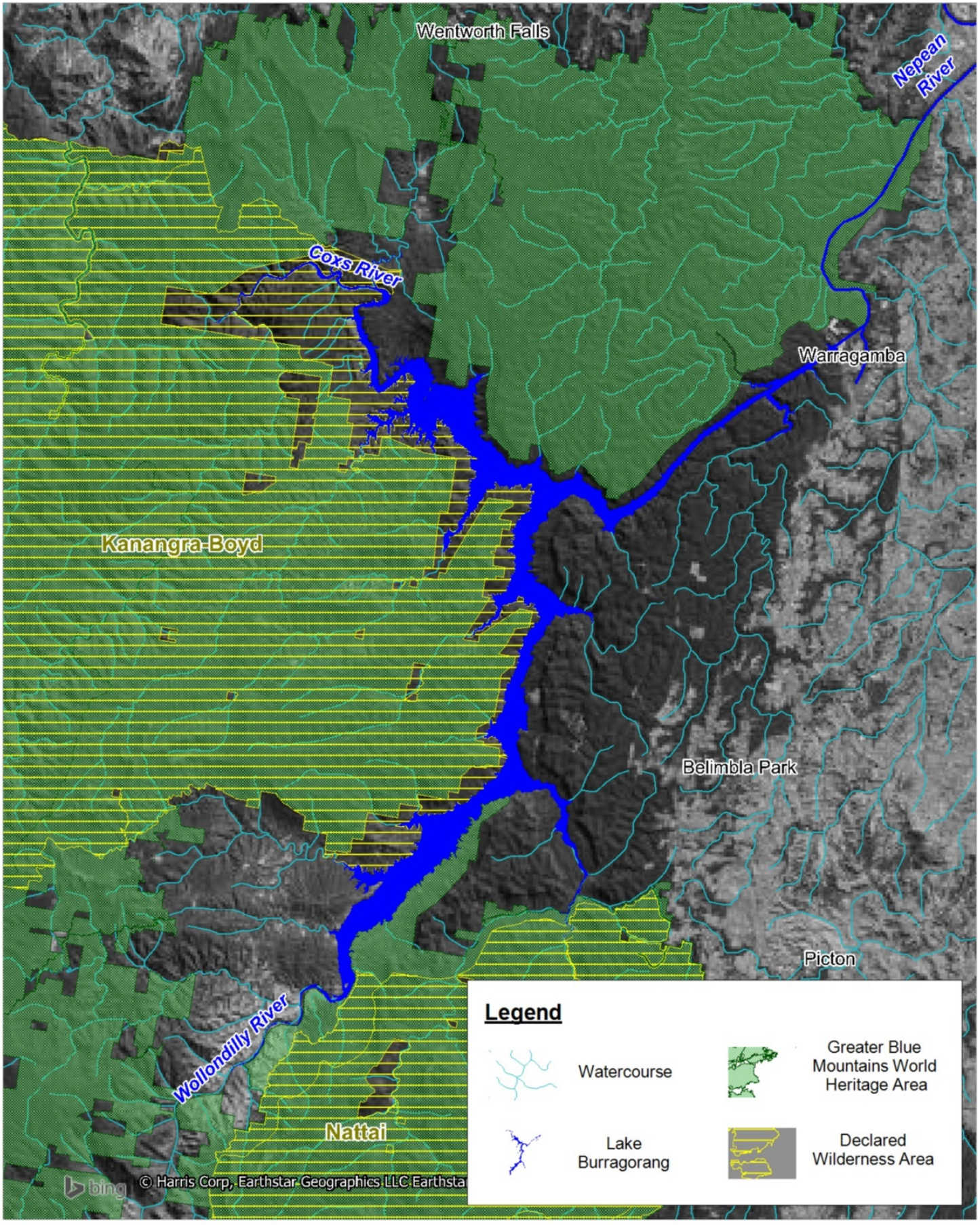
5.8 Heritage

The Warragamba Dam Supply Scheme is listed as a heritage item on the NSW State Heritage Register. While this listing relates to the entire system, some of the key items contributing to the heritage values of the dam include the main dam wall, apron drainage system, crest gates, dam outlets, valve house, HEPS, crest gantry crane and tail tower from the 18 tonne cableway. The Proposal will cause the modification of a number of these heritage values. This is not expected to cause the overall loss of heritage values associated with the listing but will still cause important changes from a heritage perspective. Haviland Park is also included in the heritage listing and may be temporarily impacted if it is used for construction laydown or similar activities.

Scattered heritage properties and items occur in the Burragorang Valley, including items of both European and Aboriginal cultural heritage significance. Majority of these features are either outside of expected floodwater retention zones or are already subject to periodic inundation during existing flooding events. The locally significant *Jooriland* woolshed is expected to be subject to more intense inundation events (lasting weeks rather than days) following the raising of the Warragamba Dam wall. In addition, undescribed Aboriginal cultural heritage items may also occur in areas of increased inundation. No other significant heritage items are expected affected in this area.

The Operation Study Area includes the GBMWHA as well as the Old Great North Road (near Wisemans Ferry). Of these, the GBMWHA is the only property that is expected to be impacted by the Proposal (see Figure 5-4). Retention of flood waters associated with a raised dam wall will cause the inundation of areas of the GBMWHA as well as (temporary) modification of geomorphological and hydrological features within the property boundaries (i.e. tributaries of Lake Burragorang).

Figure 5-4 World Heritage and Wilderness Areas in Upstream Study Area



Title:

World Heritage and Wilderness Areas in Upstream Study Area

Figure: 5-4

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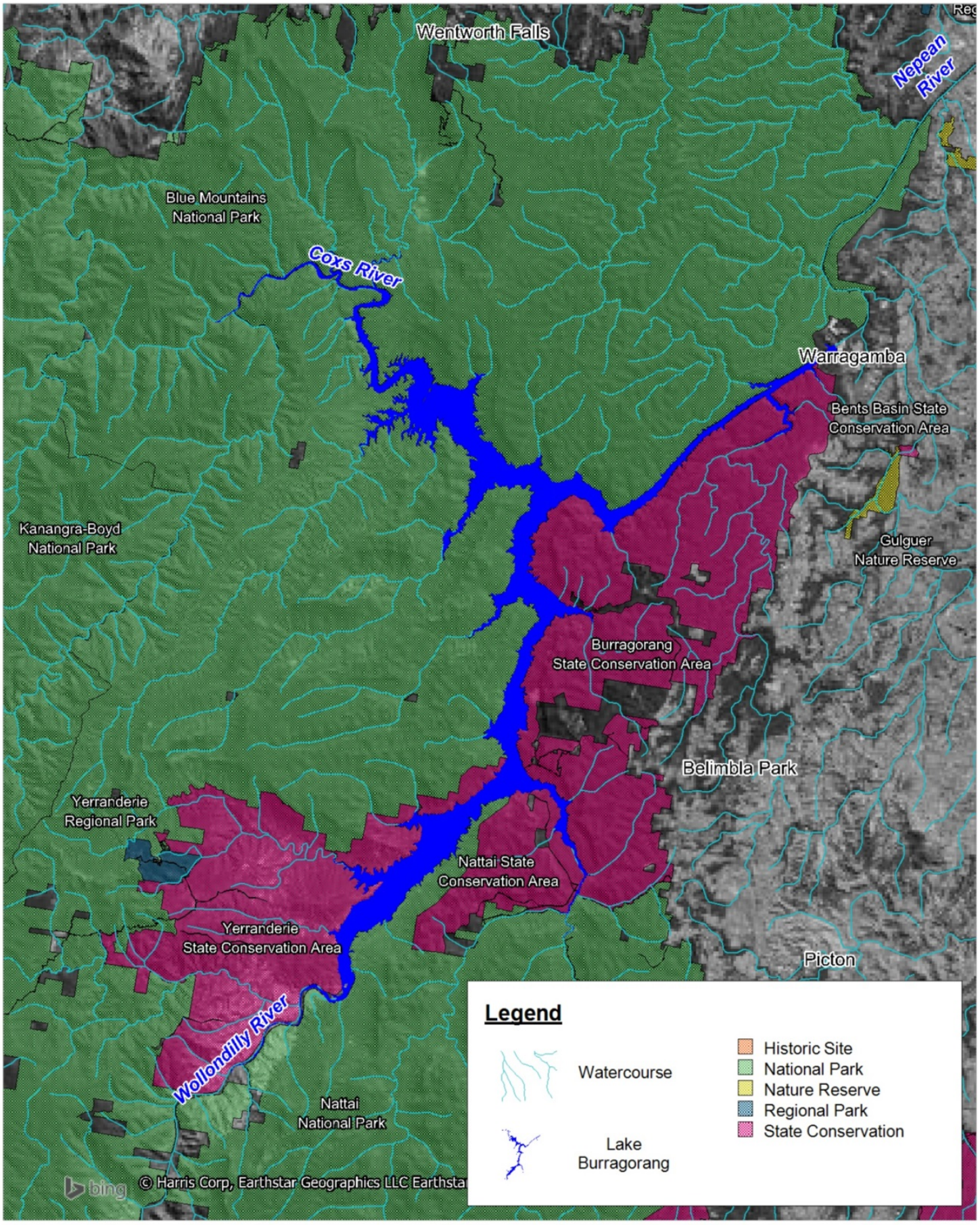

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State and Local Protected Areas in Upstream Study Area

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A number of national parks and reserves also occur within the Operation Study Area. Those that may be subject to impacts are (see Figure 5-4 and Figure 5-5):

- Kanangra-Boyd and Nattai Wilderness Areas (under Wilderness Act);
- Kanangra-Boyd, Blue Mountains and Nattai National Parks (under NPWS Act);
- Burragorang and Nattai State Conservation Areas (under NPWS Act);
- Yerranderie Regional Park (under NPWS Act); and
- Warragamba Conservation Area (under Wollondilly LEP 2011).

The main impacts to these protected areas will be change in inundation patterns associated with greater retention of floodwaters following raising of the Warragamba Dam wall. Downstream heritage properties and items are not expected to be impacted as a result of the Proposal.

5.9 Traffic and Transport

Currently traffic in the Construction Area is limited to day-time visits (typically 8:00am to 5:00pm). Existing traffic levels in the area are low and generally limited to local residents and tourists. The Proposal is likely to result in increased light vehicle traffic in the area as a result of personnel travelling to and from site. Heavy vehicle traffic will also be an issue for the duration of construction due to materials being transported to the construction site. Depending on the construction schedule, heavy vehicle traffic may be confined to specific periods or days. At this stage, it is likely that the major transport will use the Northern Road and Park Road through to Wallacia onto Farnsworth Ave and Production Ave. Transport routes for heavy vehicles will need further consideration during the EIS development. Construction related traffic is likely to have the greatest impact at Warragamba although it is possible traffic related impacts may occur on major roads in the downstream area.

The upstream component of the Operation Study Area is primarily national parks and conservation areas with no townships and limited access roads. Proposal Project is not expected to increase traffic movements through these areas. Downstream areas are more heavily populated, however, and include critical transport network, e.g. Wilberforce-King-Sackville Roads (MR182) together with Windsor Bridge, Sackville Ferry and Wiseman Ferry. There are existing congestion issues on Wilberforce Road (Cambray Consulting, 2011) associated with higher residential densities in this area. Traffic through these areas would increase during construction phase, though impacts would be concentrated in the Construction Area (see above). Following completion of the works, no significant operational impacts to traffic and transport are expected in the Operation Study Area.

5.10 Social and Economic

Warragamba is the principal community associated with Warragamba Dam and is located adjacent to the Construction Area. It is a small remote rural township with historical links to the construction of the dam. Within Warragamba and at the dam there are a number of tourist/recreational related activities available, including self-guided walks, free school tours, picnic activities, and visits to the Warragamba Dam Visitor Centre, Worker's Memorial, Haviland Park and Warragamba Township, and viewing platforms (WaterNSW, 2015b; NSW Environment, 2015). Proposal activities will cause

the disruption of these recreational activities for the duration of construction, especially at the dam and laydown areas. Construction will also cause noise and air impacts (see Sections 5.6 and 5.7) and intensification of traffic (see Section 5.9). At the same time, construction activities will provide additional employment opportunities at Warragamba and are likely to bring in additional workers and economic benefits to the town.

Upstream of the dam, within the Operation Study Area, the main socio-economic values are associated with tourist/recreational opportunities provided by the natural wilderness. These include helicopter tours and walking tracks. As most of the upstream area is included in the Warragamba Dam Special Management Area, walking tracks are limited to the Katoomba to Mittagong walking trail (5-6 day trek) which consists of two walking corridors. This trail crosses both the Cox and Wollondilly Rivers though additional flooding caused by the dam raising is not expected to pose an impact to these areas as current practice is to close these tracks prior to major rainfall events occurring.

Warragamba Dam is one of the largest domestic water supply dams in the world. The reservoir currently stores around 80% of Sydney's water (WaterNSW, 2015a) and is therefore of critical socio-economic value from the perspective of water supply. Pending the dam level at the time, lowering the full water supply level up to five metres during construction phase of the dam wall raising could temporarily reduce the water supply security if lower than average rainfall after the project is completed delays the recovery time of the full water supply level.

The Hawkesbury-Nepean River is a major recreational resource within Western Sydney, with passive riverside recreation the dominant activity. This has been recognised in a number of Council planning approaches. Industrial and commercial activities also occur within the Operation Study Area, including commercial fishing, agriculture and tourism. Agriculture is a significant industry, including citrus orchards, market gardens, turf farms and fodder crops, relying predominantly upon rainfall, supplemented with water extracted from the river for irrigation purposes. This provides significant employment opportunities and economic outputs for the region. Commercial fishing includes the harvesting of school prawn (*Metapenaeus macleayi*), eastern king prawn (*Penaeus plebejus*), greasyback prawns (*M. bennettae*) and eels. Within the lower estuary (outside of the Operation Study Area) significant prawn trawling and oyster farming also occur.

Changes in flood and flow regimes downstream of Warragamba Dam are not expected to cause significant impacts to any recreational or commercial activities.

5.11 Visual Amenity and Landscape

The amenity of the Warragamba Township and the dam is one of the more important baseline values for the study area. The amenity of the area is best described by the dam's nickname, 'quite beast', which refers to the immense size of the concrete structure surrounded by a calm and peaceful 'atmosphere' (WaterNSW, 2015c). Panoramic views of the dam and surrounding landscape are provided by a number of viewing platforms.

During construction activities, the visual amenity associated with both Warragamba Township and the dam will be restricted due to the presence. However, these impacts will not extend beyond the construction phase. As the dam is considered to be one of the best representations of a smooth concrete face dam, modification required for concrete raising (which will change the dam to a

stepped face) will cause the loss of some amenity values. However, this is not expected to represent a significant overall impact to visual amenity.

Amenity and landscape features of value in the Operation Study Area include the wilderness of Lake Burragorang and surrounding vegetation, as well as natural areas adjacent to the Hawkesbury-Nepean River between the dam and Wiseman Ferry. No long-term impacts to these areas are expected, though minor impacts associated with geomorphological changes and riparian slumping may occur.

5.12 Land Use

The Construction Area is zoned as SP2 Infrastructure (Water Supply) under the Wollondilly LEP. All proposed construction works will be contained within this zone and as a result there is no overarching land use change expected.

In the Operation Study Area, the following land use zoning applies:

- Lake Burragorang – SP2 Infrastructure (Water Supply) under Wollondilly LEP;
- Wilderness area surrounding Lake Burragorang – E1 National Parks and Nature Reserves, E2 Environmental Conservation and E3 Environmental Management under Wollondilly LEP; and
- Areas downstream of Warragamba Dam – RU2 Rural Landscape, E1 National Parks and Nature Reserves, E3 Environmental Conservation, R5 Large Lot Residential and RE2 Private Recreation under Camden, Blue Mountains, Penrith, Blacktown, The Hills and Hawkesbury LEPs.

The Operation Study Area downstream of the dam includes the townships of North Richmond, Windsor and Wisemans Ferry which have low to high density residential areas. The remainder of the downstream valley is made up of agricultural land and reserves, though some areas have been marked for future medium to high density residential development.

5.13 Hazard and Risk

The Construction Area and Operation Study Area of the Proposal are subject to bushfire, flooding and seismicity hazards. Of these natural hazards, flooding will be impacted by the Proposal during operations. The raising of Warragamba Dam will increase the flood mitigation capacity upstream of the dam wall, leading to a shift of inundation from downstream of the dam (where the catchment is largely developed) to upstream (where the catchment is undeveloped), allowing for a shift of risk.

5.14 Waste

There is no significant waste material (or by-product) arising from the operations of the existing Warragamba Dam. Waste generation in the Construction Area is minimal with most waste generated by on site staff and by tourists visiting the site. No significant changes are expected as a result of the Proposal, with the exception of construction-generated waste. This includes liquid waste (e.g. sand/concrete waste from hydro-cutting), hazardous wastes (e.g. compressed gas cylinders, aerosols, batteries, fuels) and putrescible and non-putrescible general solid waste. These items will be disposed of at local facilities in accordance with regulatory requirements.

5.15 Greenhouse Gas

Construction activities in the Construction Area have the potential to produce both direct and indirect emission sources. The direct emissions sources may related to: land clearing and the operation of construction plant, equipment and vehicles. The indirect emissions may include: the use of electricity, waste generation and transportation of resources, materials, waste and personnel.

The operation of the FMZ could generate potential direct and indirect emission sources (within the Construction Area). The direct emissions could be related to: the use of maintenance vehicles, plant and equipment, land clearing for maintenance purposes and the release of methane at the water's surface at the turbines and spillways. The indirect emissions may include the use of electricity (lighting, operation of dam gates).

5.16 Cumulative Impact Issues

The EIS for the Proposal will need to assess the cumulative impacts of any other development or activities occurring at the same time, or in proximity to the Proposal.

A search of Development Applications in the Warragamba area on the Wollondilly Shire Council website (http://www.wollondilly.nsw.gov.au/planning-and-development/da-tracker/) indicates that there are three large subdivision development applications currently proposed near Warragamba Dam. These include:

- 93 lot subdivision at 33-35 Warradale Road (and Marsh Road), Silverdale;
- 79 lot subdivision at 65 Marsh Road, Silverdale; and
- 425 lot subdivision at 1-41 Marsh Road (and Warradale Road), Silverdale.

It is noted that the 425 lot subdivision is planned for the previous African Lion Safari (Warragamba) site. These sites are all located in reasonably close proximity to the Warragamba Dam wall.

Other notable development is the proposed Badgery's Creek Airport. This is a significant development set to occur within a regional context of the dam and thus needs to be considered further as part of the EIA process.

As the timeframe and construction plan for the Proposal is 2019 - 2024, it is possible that these (or other) developments may be occurring at the same time as the Proposal construction. These developments will need to be taken into consideration as part of the cumulative impact assessment.

Additional potential cumulative impacts that need consideration include:

- Additive impacts or reduced resilience of values due to climate change;
- Existing impacts on downstream industries and uses including for example the oyster industry and commercial fishing industry;
- Cumulative impacts upon water quality when combined with existing flow regulation, catchment impacts such as population growth and discharges from wastewater treatment plants;
- World Heritage status;

- Existing pressures of river regulation and changes to the natural flow regime; and
- Further pressures to threatened or endangered vegetation species.

5.17 Summary

Prioritisation of environmental values potentially affected by the Proposal and the strategies to address impacts identified are summarised in Table 5-3. This prioritisation is based on the preliminary assessment undertaken by the Taskforce.

Table 5-3 Prioritisation of Environmental Values Potentially Affected by the Proposal and Strategies to Address Impacts

Prioritisation of Environmental Values Potentially Affected by the Proposal			Strategies to Address Impacts Identified
Surface and Ground Waters	LOW	• Discharge of construction sediment and pollutants • Lowering FSL by five metres (impacting on water supply) • Channel scour and bank erosion immediately downstream of the dam (and in downstream release areas) • Changes to morphodynamic activity in the Warragamba and Hawkesbury-Nepean Rivers • Alteration to the shape of the flood hydrograph • Impacts to water quality (construction and operation) • Modification of Kowmung River (listed Wild River) during floodwater retention • Changes in downstream flooding regimes • Water quality impacts during floodwater retention from slumping • Spread of algae or 'cold water' pollution from e-flow discharges (where outtake levels set incorrectly)	Assessments required need to focus on defining and identifying: • Risk of scour and changes in downstream geomorphology; • Erosion and sedimentation impacts, both during construction and operation; • Expected changes in flood conditions, both upstream and downstream of the dam; and In addition, work will be required in order to define the post-construction operational regime for the dam.
Soils and Geology	LOW	• Erosion and discharge of sediment to waterways during construction activities	A detailed review of soils and landforms in the study area is required in order to assess the impact of inundation and flow regime changes on soil erosion, as well as potential soil erosion from construction activities to inform erosion and sediment control procedures and release protocols to minimise identified impacts.
	MEDIUM	• Changes to the geomorphological character of the Hawkesbury-Nepean Valley region due to extended dam releases post flood • Environmental flows expected to provide positive benefit to low flow regime along the Warragamba River and Hawkesbury-Nepean River	

Prioritisation of Environmental Values Potentially Affected by the Proposal			Strategies to Address Impacts Identified
Ecology	MEDIUM	• (Potential) clearing of Shale Sandstone Transition Forest • Disturbance of aquatic ecology values	In order to understand the risks posed by the Proposal to terrestrial and aquatic ecology values, the following studies would be needed: • Species Impact Statement (SIS) focusing on potential impacts to threatened flora and fauna species. This will need to consider in particular the tolerance of threatened flora species (e.g. *E. benthamii*) and ecological communities (e.g. White Box Yellow Box Blakely's Red Gum Woodland) to waterlogging impacts as well as the benefits of short-term inundation on species propagation. This will also consider the potential impact to threatened aquatic species (e.g. Macquarie perch) associated with changes in flow regimes and lost values from vegetation clearing (if relevant) • Assessment of impacts to fish passage following amendments in dam infrastructure and spillway operation. • Assessment of the risk of invasive weed establishment associated with changes in flow regime. • Preparation of these assessments will need to consider the matters set out in the TSC Act, NPW Act and Fisheries Management Act.
	HIGH	• Retention of floodwaters for period of weeks causing inundation of threatened flora species (*E. benthamii*), TECs/EECs (White Box Yellow Box Blakely's Red Gum Woodland, Shale Sandstone Transition Forest, and Sydney Coastal River Flat Forest), GBMWHA, and protected areas • Increased risk of invasive species establishment in areas affected by changed flow regimes • Disturbance of spawning habitat used by threatened aquatic species (Macquarie perch) during periods of floodwater retention • Alteration of spillway regime causing disturbance (and potential barrier) to eel migration • Disturbance of aquatic ecology values upstream from bank slumping • Some geomorphologic changes in downstream environment	
Air Quality	LOW	• Construction generated air pollution impacting on amenity and community	An air quality impact assessment will need to be undertaken in the EIA process in accordance with the NSW EPA ''Approved Methods for the Modelling and Assessment of Air Pollutants in NSW'. Assessment should determine the nature and extent of impacts in isolation as well as the cumulative impacts the Proposal may have on the surrounding environment.
Noise and Vibration	MEDIUM	• Construction noise impacting on amenity and community	Noise will impact on the amenity of the area and the community and this issue will be considered during the EIA process and during construction planning. Assessment of the proposed construction activity noise and vibration levels will be required, which will determine the extent to which the Proposal is likely to adversely affect the ambient acoustic environment.
Heritage	MEDIUM	• Modification of heritage-listed Warragamba Dam,	A heritage impact assessment will be required for the Proposal in

Prioritisation of Environmental Values Potentially Affected by the Proposal			Strategies to Address Impacts Identified
		Haviland Park and associated features	order to identify the potential impacts to Warragamba Dam and Haviland Park. This will need to consider the potential loss of heritage values associated with the conversion of the dam structure and ancillary components. In order to mitigate risk of impact to Aboriginal cultural heritage items, a full Aboriginal Archaeological Assessment should be prepared and appropriate Aboriginal Community Consultation conducted in accordance with OEH's Guidelines 'Aboriginal cultural Heritage consultation requirements for proponents 2010'. An assessment of impacts to the GBMWHA will also be required in accordance with requirements under the EPBC Act. This will need to consider both the overarching World Heritage values of the property as well as individual biophysical (e.g. hydrology, landscape features) and ecological (e.g. threatened species, ecological communities) features that comprise these values.
	HIGH	• Increases in inundation frequency for *Joorilands* historic site • Increases in inundation (frequency, extent and duration) of Aboriginal sites close to major rivers and creeks draining into Lake Burragorang • Increases in inundation (frequency, extent and duration) of GBMWHA and associated Wilderness Areas and protected areas	
Traffic and Transport	LOW	• Increase light and heavy vehicle traffic at site during construction phase	The key issue for consideration regarding traffic and transport is the increase in light and heavy vehicle traffic during construction and the affect this would have on road infrastructure and the community. A traffic impact assessment will need to be completed as part of the EIA to assess the impact that additional traffic would have on the local and regional road network, and also on the local amenity of Warragamba.
	HIGH	• Increased light and heavy vehicle traffic on local and regional roads during construction phase	
Social and Economic	MEDIUM	• Disturbance of amenity and recreation/tourist activities	The most important socio-economic impacts for further consideration will be related to effects on dam supply levels drawdown during construction, as well as quantification of downstream environmental benefits. This will require detailed modelling studies to identify changes in flow and storage regimes, especially in drought conditions. A social impact assessment should also be undertaken for the Warragamba township.
	LOW	• Increased frequency of closure of Katoomba to Mittagong walking trail • Risk to water supply during construction drawdown and from e-flows • Changes in water availability downstream for recreational and economic activities (i.e. beneficial change)	
Visual Amenity and	LOW	• Modification in Warragamba Dam and associated amenity values	An assessment of visual amenity changes associated with the conversion of the dam from a smooth concrete face to a stepped

Prioritisation of Environmental Values Potentially Affected by the Proposal			Strategies to Address Impacts Identified
Landscape			face should be undertaken as part of an EIA in order to understand the potential impacts resulting from this change.
Land Use	MEDIUM	Adjustment in land use zone boundaries associated with changed upstream inundation extents	No proposed land use assessments are proposed as part of the Proposal with the exception of determining a revised boundary to SP2 Infrastructure (Water Supply) at Lake Burragorang.
Hazard and Risk	HIGH	• Shift of flooding risks from downstream to upstream of dam for large magnitude events (i.e. events with less than 2% probability) • Slight increase in flooding extents associated with low magnitude events due to e-flow releases	As part of the EIA for the Proposal, further detailed modelling studies will be required to refine estimated flood impacts arising from the Proposal.
Waste	LOW	• Generation of liquid, solid and hazardous waste	A waste management plan will be required for the Proposal construction phase, taking into account all waste sources/streams and options for reuse, recycling and disposal.
Greenhouse Gas	LOW	• Generation of construction and operation emissions	Despite the low risk of significant emissions from the Proposal, a Greenhouse gas assessment should be conducted in accordance with the most recent guidelines and standards i.e. AS ISO 14064.1 – 2006. After emission sources are identified an estimate of equivalent total carbon dioxide emissions from these sources can be estimated. The EIA will need to assess the potential for incorporating energy efficiencies and greenhouse gas minimisation strategies into the Proposal.

6 Consultation

6.1 Overview

There are three main periods of stakeholder consultation relevant to the Proposal:

(1) Engagement on flood management programs that predated the Hawkesbury-Nepean Valley Flood Management Taskforce.

(2) Engagement by the Taskforce and State Agencies that occurred as part of the development of the Hawkesbury-Nepean Valley Flood Management Strategy, including selection and design of the Proposal.

(3) Current and future consultation planned in relation to the Proposal.

Additionally, while not directly connected to the Proposal other consultation activities that have previously occurred and those that are proposed are outlined below.

6.2 Consultation Activities

6.2.1 Previously Undertaken

Consultation activities to educate the Hawkesbury-Nepean Valley community on flood risk have been undertaken for many years. The Hawkesbury-Nepean Valley Floodplain Management Strategy 1997-2004 recommended ongoing community programs to raise awareness of flood and improve understanding so the community can make better decisions about preparing for and responding to flood emergencies. Since this strategy was introduced, various public education campaigns have been delivered including State Emergency SES's launch of the FloodSafe program.

In 2012, the Hawkesbury-Nepean Valley experienced flooding which saw Warragamba Dam spill for the first time in 14 years. This helped raise awareness of the potential impacts of flooding and in response the NSW Government commenced the Hawkesbury-Nepean Valley Flood Management Review. The review identified one priority area for action was increasing flood awareness and preparedness amongst the community.

Most recently, the Taskforce has been working with key stakeholders (including local councils, flood and water management agencies, the insurance industry and other state government agencies) with the immediate priority of building a flood resilient and prepared community within the Hawkesbury-Nepean Valley.

Consultation activities undertaken by the Taskforce are guided by the Communications and Community Engagement Strategy which sets the high level objectives and principles for engagement. It is understood that more specific communication strategies will be developed for activities under the Hawkesbury-Nepean Valley Flood Management Strategy, including the Proposal.

Initial consultation has also been undertaken by the Proponent with key regulatory agencies for the EIS process including the Commonwealth Department of Environment and Energy (DEE) and NSW Department of Planning and Environment.

6.2.2 Proposed

The following presents an overview of the consultation required for the Proposal in accordance with statutory instruments relevant to the EIA process (see Section 4.3).

Agency Consultation

The EIS process for the Proposal (set out in Section 4.2) is overseen by the Minister administering the EP&A Act. In addition to consultation with the Minister and the Department of Planning and Environment, the following government agencies will be engaged throughout the EIA process:

- Office of Environment and Heritage (OEH) in relation to the following matters:
  - Threatened species, populations and ecological communities that may be impacted by the Proposal (in accordance with the TSC Act and NPWS Act);
  - Critical habitat and habitat for threatened species, populations and ecological communities that may be impacted by the Proposal (in accordance with NPWS Act);
  - Impacts on Wilderness Areas* (in accordance with Wilderness Act*);*
  - Impacts on Wild Rivers (in accordance with NPWS Act); and
  - Heritage features that may be impacted by the Proposal, including Aboriginal heritage features* (in accordance with Heritage Act and NPWS Act).
- NSW Department of Primary Industries (Fisheries) in relation to aquatic species, populations and ecological communities that may be impacted by the Proposal (in accordance with the Fisheries Management Act);
- Department of Primary Industries Water (DPI Water) in relation to amendments to approvals* (if required) associated with changes to operational flow regimes from Warragamba Dam (in accordance with the Water Management Act and Protection of the Environment Operations Act); and
- Dams Safety NSW regarding changes in operational management of Warragamba Dam (in accordance with the Dam Safety Act).

* For items marked with an asterisk, an additional approval may be required under a separate approvals process, depending upon the findings of the EIA.

In addition, assuming the Proposal is a controlled action being assessed under the EPBC Act, consultation will be required with the Commonwealth Minister for Environment and DEE.

Public Consultation

Clause 115Z of the EP&A Act provides for a public consultation process in relation to EIAs for SSI. Once submitted to the Secretary, the EIA must be made publically available for at least 30 days. This will be the same period required for assessment under the EPBC Act if the SSI assessment process is used, as per the Bilateral Agreement (see Section 4.2). If a different assessment process is used, the public consultation requirements will depend upon the nature of the elected process.

Consultation may also be required for approvals outside of the EP&A Act process that are needed for the Proposal (see Section 4.2). The nature of this consultation will depend upon the approvals required which shall be determined as part of the EIA process.

In addition to statutory required consultation, detailed engagement is also expected to occur subject to a specific engagement plan developed under the Taskforce Communications and Community Engagement Strategy. This will identify relevant stakeholders for consultation, including those identified as part of previous EIA works (e.g. Auxiliary Spillway EIS, Warragamba Dam Raising EIS) and other engagement activities of WaterNSW.

Other Consultation Activities

The study area is included within the Gundungurra ILUA. The ILUA establishes a Consultative Committee to provide input into the management of lands and waters in the Agreement Area. In relation to the Committee, it is the responsibility of WaterNSW under the ILUA to:

- Consider, and where appropriate adopt, the recommendations of the Consultative Committee, and advising why recommendations were not adopted
- Share information with the Consultative Committee in relation to future proposals for works
- Notify the Consultative Committee when tenders are publicly sought for work, services or consultancy to be carried out in relation to land and waters in the Agreement Area
- Consult with the Consultative Committee regarding survey and monitoring activities of sites within Agreement Area lands.

Consultation with the Gundungurra People and other associated organisations will occur as part of the EIS process.

7 Capital Investment Value

As part of guidance for applications for State Significant Infrastructure, the PEA must include an accurate estimate of the cost of carrying out the proposal. These have been undertaken independently for the dam wall raising and for e-flow modification works, though there is possibility for capital cost savings where works are undertaken together.

Dam Raising Capital Costs

The total project cost is estimated to be $690 million.

This cost estimate includes allowance for contingency, non-construction intangibles, insurance and ‘known unknowns’ and has been prepared using tendered rates from similar projects with specialist construction industry input.

8 References

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Appendix A EPBC Protected Matters Search

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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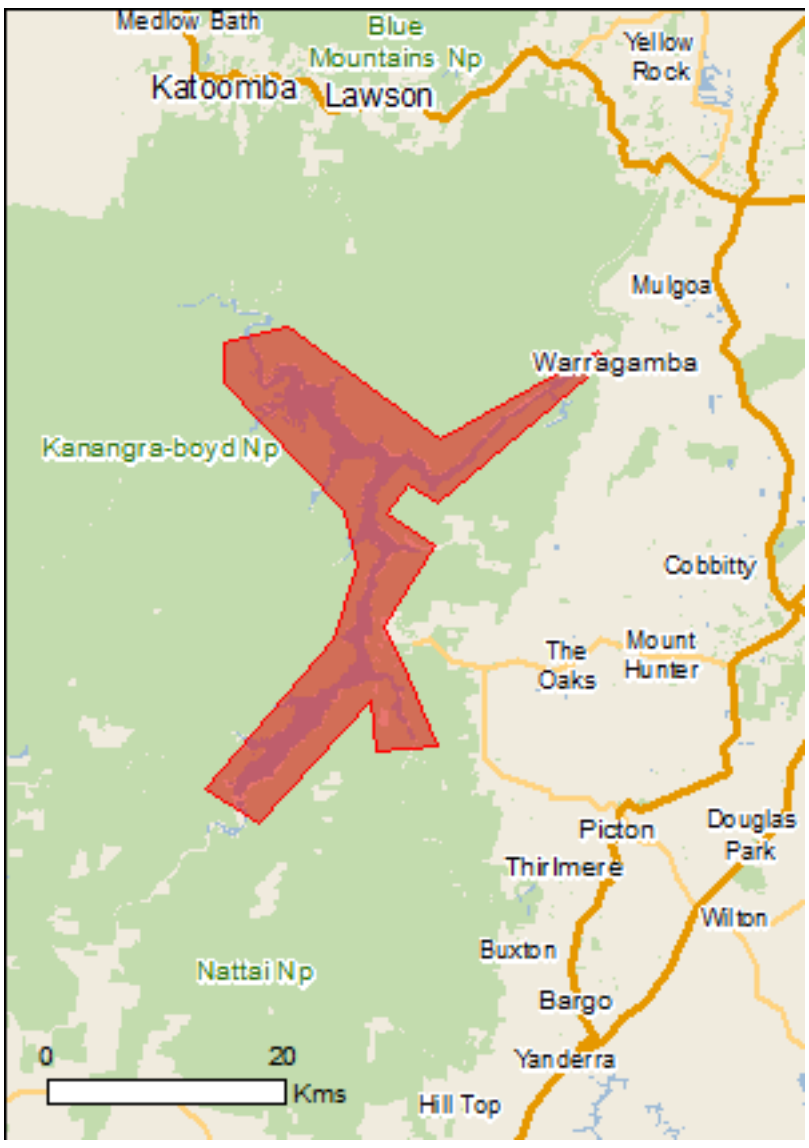

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

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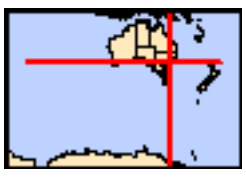

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	48
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	53
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Greater Blue Mountains Area	NSW	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The Greater Blue Mountains Area	NSW	Listed place

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Natural Temperate Grassland of the South Eastern Highlands	Critically Endangered	Community may occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Fish		

Name	Status	Type of Presence
[Macquaria australasica](#)		
Macquarie Perch [66632]	Endangered	Species or species habitat known to occur within area
[Prototroctes maraena](#)		
Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
[Heleioporus australiacus](#)		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
[Litoria aurea](#)		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
[Litoria littlejohni](#)		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
[Mixophyes balbus](#)		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
[Chalinolobus dwyeri](#)		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
[Dasyurus maculatus maculatus (SE mainland population)](#)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
[Isoodon obesulus obesulus](#)		
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat may occur within area
[Petauroides volans](#)		
Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
[Petrogale penicillata](#)		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
[Pseudomys novaehollandiae](#)		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
[Pteropus poliocephalus](#)		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
[Acacia bynoeana](#)		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area
[Acacia pubescens](#)		
Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat likely to occur within area
[Acrophyllum australe](#)		
[3983]	Vulnerable	Species or species habitat likely to occur within area
[Asterolasia elegans](#)		
[56780]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Bossiaea oligosperma [10059]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Eucalyptus aggregata Black Gum [20890]	Vulnerable	Species or species habitat may occur within area
Eucalyptus benthamii Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat likely to occur within area
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat may occur within area
Hakea dohertyi a shrub [66701]	Endangered	Species or species habitat likely to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Kunzea cambagei [11420]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area
Persoonia acerosa Needle Geebung [7232]	Vulnerable	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat may occur within area
Pomaderris brunnea Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Prasophyllum petilum Tarengo Leek Orchid [55144]	Endangered	Species or species habitat may occur within area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area
Prostanthera cineolifera [11233]	Vulnerable	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
[Pultenaea glabra](#) Smooth Bush-pea, Swamp Bush-pea [11887]	Vulnerable	Species or species habitat likely to occur within area
[Thelymitra kangaloonica](#) Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat may occur within area
[Thesium australe](#) Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
[Aprasia parapulchella](#) Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area
[Hoplocephalus bungaroides](#) Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]		Species or species habitat known to occur within area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area
[Monarcha trivirgatus](#) Spectacled Monarch [610]		Species or species habitat may occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Pandion haliaetus		
Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cuculus saturatus		
Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor		
Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Blue Mountains	NSW
Burragorang	NSW
Nattai	NSW
Nattai	NSW
Yerranderie	NSW

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Feral deer		
Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis		
Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus		
Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus		
Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides		
Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia		
Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus		
Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cabomba caroliniana		
Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera		
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera		
Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius		
Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes		
Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia		
Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.879888 150.593843,-33.887014 150.599679,-33.97475 150.471963,-33.963361 150.449304,-33.982152 150.434884,-34.001509 150.470933,-34.05301 150.431451,-34.07235 150.443811,-34.126935 150.47265,-34.130345 150.425958,-34.09851 150.421838,-34.175803 150.338067,-34.154214 150.296869,-34.060974 150.392999,-34.014316 150.412225,-33.98016 150.401239,-33.899268 150.311975,-33.874187 150.311975,-33.865065 150.358667,-33.935736 150.474023,-33.879888 150.593843,-33.879888 150.593843

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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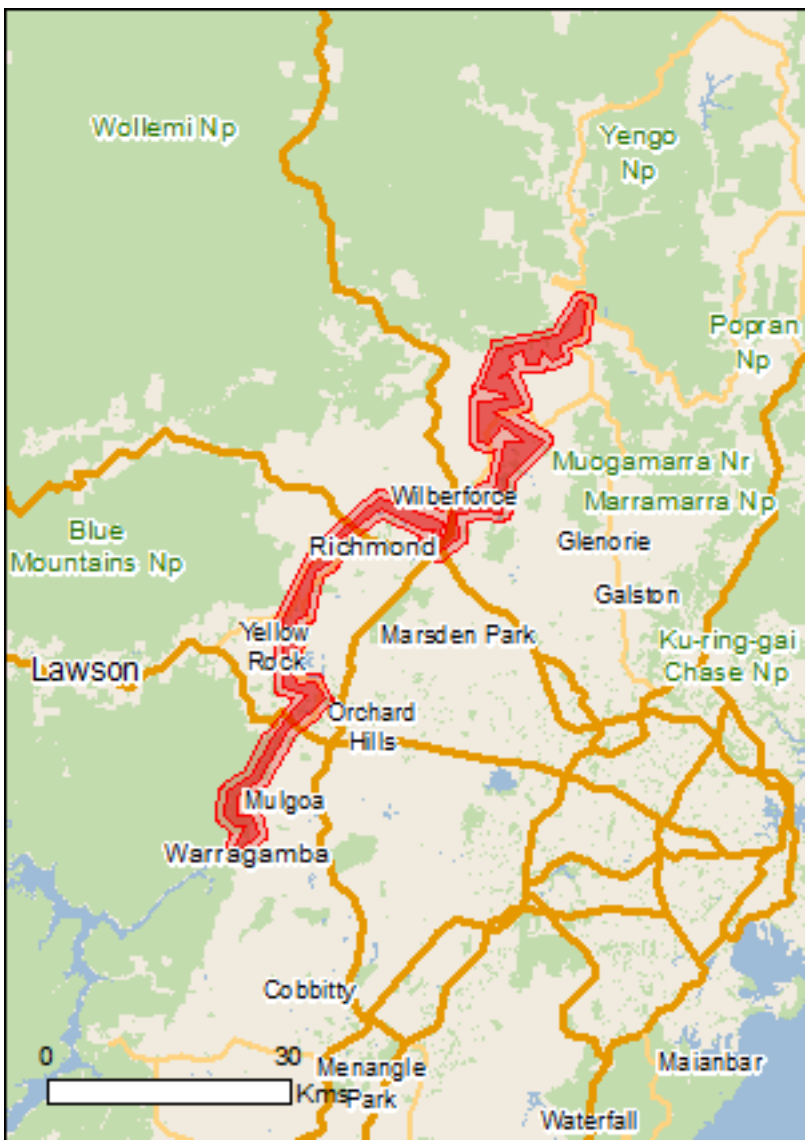
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

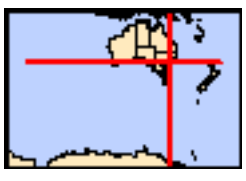
Report created: 29/11/16 13:09:03



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	3
National Heritage Places:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	8
Listed Threatened Species:	83
Listed Migratory Species:	36

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	12
Commonwealth Heritage Places:	None
Listed Marine Species:	41
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	1
Invasive Species:	53
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

World Heritage Properties		[Resource Information]
Name	State	Status
Australian Convict Sites (Old Great North Road Buffer Zone)	NSW	Buffer zone
Australian Convict Sites (Old Great North Road)	NSW	Declared property
The Greater Blue Mountains Area	NSW	Declared property

National Heritage Properties		[Resource Information]
Name	State	Status
Natural		
The Greater Blue Mountains Area	NSW	Listed place
Historic		
Old Great North Road	NSW	Listed place

Listed Threatened Ecological Communities		[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Temperate Highland Peat Swamps on Sandstone	Endangered	Community known to occur within area
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus		
Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Status	Type of Presence
		to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
[Thalassarche impavida](#) Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
[Thalassarche melanophris](#) Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
[Thalassarche salvini](#) Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
[Epinephelus daemelii](#) Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
[Macquaria australasica](#) Macquarie Perch [66632]	Endangered	Species or species habitat known to occur within area
[Prototroctes maraena](#) Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
[Heleioporus australiacus](#) Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
[Litoria aurea](#) Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
[Litoria littlejohni](#) Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
[Mixophyes balbus](#) Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
[Dasyurus maculatus maculatus (SE mainland population)](#) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
[Petauroides volans](#) Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
[Petrogale penicillata](#) Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
[Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)](#) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
[Pseudomys novaehollandiae](#) New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Other		

Name	Status	Type of Presence
[Pommerhelix duralensis](#) Dural Land Snail [85268]	Endangered	Species or species habitat known to occur within area
Plants		
[Acacia bynoeana](#) Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
[Acacia gordonii](#) [5031]	Endangered	Species or species habitat likely to occur within area
[Acacia pubescens](#) Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
[Allocasuarina glareicola](#) [21932]	Endangered	Species or species habitat likely to occur within area
[Asterolasia elegans](#) [56780]	Endangered	Species or species habitat known to occur within area
[Cryptostylis hunteriana](#) Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
[Cynanchum elegans](#) White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
[Darwinia biflora](#) [14619]	Vulnerable	Species or species habitat likely to occur within area
[Eucalyptus aggregata](#) Black Gum [20890]	Vulnerable	Species or species habitat may occur within area
[Eucalyptus benthamii](#) Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat known to occur within area
[Genoplesium baueri](#) Yellow Gnat-orchid [7528]	Endangered	Species or species habitat may occur within area
[Haloragis exalata subsp. exalata](#) Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
[Haloragodendron lucasii](#) Hal [6480]	Endangered	Species or species habitat likely to occur within area
[Kunzea rupestris](#) [8798]	Vulnerable	Species or species habitat likely to occur within area
[Melaleuca deanei](#) Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
[Micromyrtus blakelyi](#) [6870]	Vulnerable	Species or species habitat likely to occur within area
[Micromyrtus minutiflora](#) [11485]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Olearia cordata [6710]	Vulnerable	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat likely to occur within area
Persoonia acerosa Needle Geebung [7232]	Vulnerable	Species or species habitat likely to occur within area
Persoonia hirsuta Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat known to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Pterostylis pulchella Pretty Greenhood [6448]	Vulnerable	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat known to occur within area
Pultenaea glabra Smooth Bush-pea, Swamp Bush-pea [11887]	Vulnerable	Species or species habitat likely to occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat likely to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Zieria involucrata [3087]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Manta alfredi		
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris		
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Director of War Service Homes
Commonwealth Land - Telstra Corporation Limited
Defence - AIR HEADQUARTERS AUSTRALIA - GLENBROOK
Defence - PENRITH DEPOT (Army Stores)
Defence - RICHMOND - FUEL FARM, DENTAL, MEDICAL
Defence - RICHMOND - MIDDLE MARKER
Defence - RICHMOND RAAF BASE

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Cuculus saturatus Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Agnes Banks	NSW
Blue Mountains	NSW
Cattai	NSW
Dharug	NSW
Maroota Ridge	NSW
Mulgoa	NSW
Parr	NSW
Pitt Town	NSW
Scheyville	NSW
Yellomundee	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Longneck Lagoon	NSW
Pitt Town Lagoon	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.883368 150.594492,-33.883354 150.594481,-33.882085 150.593462,-33.863414 150.606165,-33.862844 150.593806,-33.853721 150.582133,-33.830338 150.586939,-33.816077 150.613718,-33.7807 150.635691,-33.755013 150.661097,-33.74074 150.67483,-33.734459 150.648051,-33.672194 150.646677,-33.611028 150.684443,-33.558974 150.754481,-33.579571 150.827265,-33.592727 150.822458,-33.595015 150.827265,-33.569845 150.836191,-33.550391 150.876703,-33.562407 150.880823,-33.518911 150.893183,-33.507461 150.89387,-33.506316 150.914469,-33.491429 150.89181,-33.508034 150.878077,-33.505744 150.86503,-33.467947 150.86503,-33.467375 150.896616,-33.461074 150.89387,-33.456491 150.86915,-33.418673 150.887003,-33.407783 150.953608,-33.375105 150.979014,-33.376825 150.987253,-33.40721 150.98176,-33.41638 150.957041,-33.427269 150.959788,-33.431854 150.948115,-33.420965 150.936442,-33.434719 150.934382,-33.434719 150.918589,-33.423258 150.915842,-33.426696 150.900049,-33.436438 150.907603,-33.447897 150.88975,-33.44446 150.902109,-33.47253 150.915842,-33.478257 150.884257,-33.505171 150.939188,-33.541234 150.896616,-33.560118 150.894556,-33.572134 150.893183,-33.569845 150.869837,-33.573278 150.841685,-33.595587 150.845118,-33.611028 150.821085,-33.604166 150.806666,-33.588723 150.816279,-33.587579 150.803232,-33.568129 150.757227,-33.596731 150.714655,-33.618462 150.702296,-33.62761 150.683756,-33.667051 150.67483,-33.672194 150.663157,-33.723037 150.66041,-33.730461 150.66659,-33.729319 150.684443,-33.744737 150.694056,-33.754442 150.683069,-33.77328 150.654917,-33.820641 150.621271,-33.834901 150.597925,-33.85315 150.597239,-33.85144 150.613032,-33.859423 150.618525,-33.869686 150.621271,-33.884508 150.600672,-33.883368 150.594492

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B NSW Threatened Flora and Fauna Species and Ecological Communities in the Proposal Impact Areas

Ecological communities of NSW are classified by the Office of Environment and Heritage. Based on these classifications vegetation at the dam and upstream and downstream areas falls is classified as:

- Sydney Hinterland Dry Sclerophyll Forest;
- Sydney Coastal Dry Sclerophyll Forest;
- Coastal Floodplain Forest;
- Coastal Heath Swamp;
- North Coast Wet Sclerophyll Forest;
- Coastal Valley Grassy Woodlands;
- Coastal Freshwater Lagoons and Floodplain Meadows;
- North Coast Wet Sclerophyll Forest; and
- Mangrove Swamp.

Warragamba Dam and the upstream area, including all of Lake Burragorang, are included in the Warragamba Special Area. Ecological communities of the Warragamba Special Area have been subject to a further technical assessment and refined as identified in NSW National Parks and Wildlife Service technical report, *The Native Vegetation of Warragamba Special Area* (NPWS 2003b). Table B-1 summarises these communities, including any TECs/EECs and threatened species associated with the community.

Threatened species include those protected under the TSC Act 1995 and EPBC Act 1999 as well as those classified as poorly known, rare, vulnerable or endangered under Briggs and Leigh (1995), *Rare or Threatened Australian Plants* (RoTAP).

Table B-1 Ecological Communities of the Warragamba Special Area at Warragamba Dam and Upstream Area

Map Unit	Name	Associated threatened species/communities
MU1	Sandstone Warm Temperate Rainforest	*Eucalyptus hypostomatica*
MU3	Grey Myrtle Dry Rainforest	*Acacia clunies-rossiae*, *Haloragis exaltata*, *Eucalyptus. hypostomatica*, *Senecio macranthus*
MU4	Kowmung Dry Rainforest	*Acacia clunies-rossiae*, *Parahebe ithophila*
MU6	Sandstone Riparian Scrub	*Lomandra fluviatilis*
MU8	Sandstone Moist Blue Gum Forest	*Lissanthe sapida*, *Parahebe ithophila*
MU9	Sheltered Sandstone Intermediate Blue Gum Forest	*Lissanthe sapida*, *Gonocarpus longifolius*, *Olearla quercifolia*
MU10	Sheltered Sandstone Smooth-barked Apple Forest	*Lissanthe sapida*
MU11	Sheltered Sandstone Blue-leaved	*Lissanthe sapida*

Map Unit	Name	Associated threatened species/communities
	Stringybark Forest	
MU13	Sheltered Escarpment Blue Gum Forest	*Parahebe ithophila*, *Eucalyptus hypostomatica*
MU14	Escarpment Grey Gum Forest	*Gyrostemon thesioides*, *Eucalyptus. benthamii*, *E. hypostomatica*, *Euphrasia bowenlae*, *Lissanthe sapida*, *Lomandra fluviatilis*
MU21	Kanangra Gorge Sheltered Grey Gum Forest	*Pterostylis saxicola*, *Parahebe ithophila*, *Gonocarpus longifolius*, *Ozothamnus adnatus*, *Senecio macranthus*
MU22	Oakdale Blackbutt Gully Forest	n/a
MU23	Burragorang River Flat Forest	*Eucalyptus benthamii*, *Notochloe microdon*
MU25	Blue Mountains Sandstone Dry Shrub Forest	*Lissanthe sapida*, *Rupicola sprengelloides*
MU26	Nattai Sandstone Dry Shrub Forest	*Rulingia prostrate*, *Persoonia hirsute*, *Tetratheca glandulosa*, *Lissanthe sapida*, *Lomandra fluviatilis*, *L. brevis*
MU27	Burragorang Sandstone Dry Shrub Forest	n/a
MU28	Kowmung Sheltered Red Gum Forest	*Acacia clunies-rossiae*, *Senecio macranthus*
MU29	Exposed Devonian Grey Gum Forest	*Acacia clunies-rossiae*, *Gonocarpus longifolius*
MU32	Permian Footslopes Grassy Grey Box Forest	*Hakea dohertyi*
MU33	Tonalli Escarpment Dry Shrub Forest	n/a
MU39	Tablelands River Oak Forest	*Acacia clunies-rossiae*, *Bossiaea oligosperma*, *Gonocarpus longifolius*, *Senecio macranthus*
MU40	Exposed Blue Mountains Sandstone Woodland	*Acacia flocktoniae*, *A. jonesii*, *Eucalyptus apiculata*, *E. cunninghamii*, *Hakea constabel*, *Rupicola sprengelioides Tetratheca neglecta*
MU41	Exposed Burragorang Sandstone Shrub Woodland	*Acacia bauera* subsp. *aspera*, *Persoonia acerosa*, *Pterostylis pulchella*, *Pultenaea glabra*, *Eucalyptus burgessiana*, *E. cunninghamii*, *Hakea constabel*, *Lomandra brevis*, *Lissanthe sapida*, *Monotoca ledifolia*, *Putteaea villifera*, *Rupicola sprengelioides*
MU42	Rocky Sandstone Heath Woodland	*Persoonia bargoensis*, *Lomandra brevis*, *Lissanthe sapida*
MU46	Kanangra Gorge Narrow-leaved Ironbark Woodland	*Acacia clunies-rossiae*, *Gonocarpus longifolius*, *Myoporum bateae*, *O. adnatus*, *P. lithophila*, *S. macranthus*
MU47	Exposed Permian Sandstone Woodland	*Grevillea kedumbensis*
MU48	Escarpment Slopes Dry Ironbark Woodland	*Acacia clunies-rossiae*, *Prostanthera cineolifera*, *Tetratheca glandulosa*, *Grevillea kedumbensis*, *G. longifolia*, *Lomandra brevis*, *Ozothamnus adnatus*
MU49	Dry Alluvial Paperbark Woodland	*Gonocarpus longifolius*
MU50	Douglas Scarp Woodland	n/a
MU51	Devonian Red Gum-Yellow Box Woodland	*Ozothamnus adnatus*
MU52	Devonian Red Gum-Ironbark Woodland	White Box Yellow Box Blakely's Red Gum Woodland TEC/EEC *Bossiaea oligosperma*
MU53	Devonian Red Gum-Grey Box	n/a

Map Unit	Name	Associated threatened species/communities
	Woodland	
MU57	Cumberland Plain Shale Sandstone Transition Forest (High Sandstone Influence)	Shale Sandstone Transition Forest TEC/EEC *Persoonia hirsuta*, *Acacia pubescens*, *Lomandra brevis*, *Lissanthe sapida*
MU61	Rock-Plate Heath Mallee	*Persoonia acerosa*, *A. asparagoides*, *Epacris muelleri*, *Eucalyptus apiculata*, *E. burgessiana*, *E. cunninghamii*, *Hakea constabel, Pseudanthus divaricatissimus*

Below is presented a list of threatened fauna and flora species that are known to occur in at Warragamba Dam and in upstream areas based on previous surveys and records. The threatened species is provided along with a list of the source identify its presence in the study area. The sources referenced are:

- Mount King Ecological Surveys (1992 and 1994);
- Ecotone Ecological Communities (1995); and
- Office of Environment and Heritage records from the NSW Atlas of Wildlife (2014).

More detailed assessments of relevant threatened flora and fauna are provided below.

Table B-2 Known threatened flora and fauna species at and upstream of Warragamba Dam

Common name	Scientific name	Threatened status[6]			Source		
		TSC Act 1995	*EPBC Act 1999*	RoTAP	MEKS 1992, 1994	EEC 1995	OEH 2016
Kanangra wattle	*Acacia clunies-rossiae*	V	-	V		✓	✓
(a shrub)	*Acacia gordonii*	E1	E	K			✓
Downy wattle	*Acacia pubescens*	V	V	V			✓
(a shrub)	*Acrophyllum australe*	V	V	V			✓
	Ancistrachne maidenii	V		K			✓
Few-seeded bossiaea	*Bossiaea oligosperma*	V	V	V		✓	✓
(a shrub)	*Dillwynia tenuifolia*	V	-	R			✓
Rudder's box	*E. rudderi*			R		✓	
(a shrub)	*Epacris purpurascens* var. *purpurascens*	V	-	-			✓
Camden white gum	*Eucalyptus benthamii*	V	V	V		✓	✓
Camden woollybutt	*Eucalyptus macarthurii*	E1	E	R			✓
	G. longifolia			R		✓	
	Gonocarpus longifolius			R		✓	
Juniper-leaved grevillea	*Grevillea juniperina subsp. juniperina*	V		-			✓
	Grevillea kedumbensis			K		✓	

[6] TSC Act – Vulnerable (V), Endangered (E), Critically Endangered (CE); EPBC Act – Vulnerable (V), Endangered (E), Critically Endangered (CE); RoTAP – Poorly Known (K), Rare (R), Vulnerable (V), Endangered (E)

Common name	Scientific name	Threatened status[6]			Source		
Small-flower grevillea	*Grevillea parviflora subsp. Parviflora*	V	V	-			✓
	Gyrostemon thesioides	E1		K			✓
Kowmung hakea	*Hakea dohertyi*	E	E	E			✓
	Hibbertia hermanniifolia			R		✓	
	Hibbertia puberula	E1		-			✓
Woronora beard-heath	*Leucopogon exolasius*	V	V	V			✓
Native cranberry	*Lissanthe sapida*			R		✓	
	Marsdenia viridiflora subsp. viridiflora	E2		-			✓
Deane's paperbark	*Melaleuca deanei*	V		R			✓
	Micromyrtus minutiflora	E1	V	V			✓
Needle geebung	*Persoonia acerosa*	V	V	V			✓
Hairy geebung	*Persoonia hirsuta*	E1	E	K			✓
Dwarf phyllota	*Phyllota humifusa*	V	V	V			✓
Spiked rice-flower	*Pimelea spicata*	E1	E	E			✓
Regent honeyeater	*Anthochaera phrygia*	E4A	CE	-		✓	✓
Dusky woodswallow	*Artamus cyanopterus cyanopterus*	V		-			✓
Australasian bittern	*Botaurus poiciloptilus*	E	E	-			✓
Gang-gang cockatoo	*Callocephalon fimbriatum*	V	-	-			✓
Glossy black-cockatoo	*Calyptorhynchus lathami*	V	E	-		✓	✓
Eastern pygmy-possum	*Cercartetus nanus*	V		-			✓
Speckled warbler	*Chthonicola sagittata*	V	-	-			✓
Spotted harrier	*Circus assimilis*	V	-	-			✓
Brown treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	-	-			✓
Varied sittella	*Daphoenositta chrysoptera*	V	-	-			✓
Tiger quoll	*Dasyurus maculatus*	V	E	-		✓	✓
Spotted-tailed quoll	*Dasyurus maculatus*	V	E				✓
Eastern false pipistrelle	*Falsistrellus tasmaniensis*	V	-	-			✓
Little lorikeet	*Glossopsitta pusilla*	V	-	-			✓
Giant burrowing frog	*Heleioporus australiacus*	V	V	-	✓	✓	✓
Little eagle	*Hieraaetus morphnoides*	V	-	-			✓
Broad-headed snake	*Hoplocephalus bungaroides*	E	V				✓
Southern brown bandicoot (eastern)	*Isodon obesulus obesulus*	E	E	-			✓
Black bittern	*Ixobrychus flavicollis*	V					✓
Swift parrot	*Lathamus discolor*	E	CE	-			✓
Black-tailed godwit	*Limosa limosa*	V					✓

Common name	Scientific name	Threatened status[6]			Source		
Green and golden bell frog	*Litoria aurea*	E	V	-		✓	✓
Littlejohn's tree frog	*Litoria littlejohni*	V	V				✓
Square-tailed kite	*Lophoictinia isura*	V	-	-			✓
Hooded robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	-	-			✓
Black-chinned honeyeater (eastern subspecies)	*Melthreptus gularis gularis*	V	-	-			✓
Cumberland plain land snail	*Meriodolum corniovirens*	E	-	-			✓
Little bentwing-bat	*Miniopterus australis*	V					✓
Eastern bentwing bat	*Miniopterus schreibersii oceansis*	V	-	-			✓
Stuttering frog	*Mixophyes balbus*	E	V	-		✓	✓
Eastern freetail-bat	*Mormopterus norfolkensis*	V	-	-			✓
Southern myotis	*Myotis macropus*	V	-	-			✓
Turquoise parrot	*Neophema pulchella*	V	-	-		✓	✓
Barking owl	*Ninox connivens*	V		-			✓
Powerful owl	*Ninox strenua*	V	-	-		✓	✓
Greater glider	*Petauroides volans*	P	V	-			✓
Yellow-bellied glider	*Petaurus australis*	V	-	-	✓	✓	✓
Squirrel glider	*Petaurus norfolciensis*	V	-	-		✓	✓
Brush-tailed rock-wallaby	*Petrogale penicillata*	E	V	-	✓	✓	✓
Scarlet robin	*Petroica boodang*	V	-	-			✓
Flame robin	*Petroica phoenicea*	V	-	-			✓
Koala	*Phascolarctos cinereus*	V	V	-			✓
Common planigale	*Planigale maculata*	V	-	-	✓	✓	
Red-crowned toadlet	*Pseudophyme australis*	V	-	-		✓	✓
Grey-headed flying-fox	*Pteropus poliocephalus*	V	V	-			✓
Yellow-bellied sheathtail-bat	*Saccolaimus flaviventris*	V	-	-			✓
Greater broad-nosed bat	*Scoteanax rueppellii*	V	-	-			✓
Diamond firetail	*Stagonopleura guttata*	V	-	-			✓
Masked owl	*Tyto novaehollandiae*	V	-	-			✓
Sooty owl	*Tyto tenebricosa*	V	-	-		✓	✓
Rosenberg's goanna	*Varanus rosenburgi*	V	-	-			✓