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Scoping Report

Warragamba Dam Environmental Flows

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Acknowledgement

WaterNSW acknowledges the traditional custodians of the lands and water on which we work and pay our respect to all Elders past, present, and emerging.

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Introduction

This scoping report, including preliminary environmental assessment, has been prepared on behalf of WaterNSW for a proposal to provide infrastructure at Warragamba Dam that will enable the operational release of variable environmental flows into the Warragamba River and downstream river system (the proposal).

Environmental flows are water releases from a storage facility, such as dam, reservoir or weir, that mimic flow patterns as if the barrier to the river created by the dam did not exist. These environmental releases will improve the health of the river downstream of the dam, and also provide benefits for human recreational and economic activities, such as fishing and aquaculture, as well as amenity.

Strategic context

Warragamba Dam has a major effect on river health in the lower Hawkesbury-Nepean River. Its location within the catchment results in significant environmental impacts on the river below the dam with substantially reduced stream flows for prolonged periods of time. Warragamba Dam will be the last of the major dams in Greater Sydney to have environmental flows introduced. Most recently, the Greater Sydney Water Strategy Priority 4 (Our waterways and landscapes are healthy) identifies the need to introduce environmental flows from Warragamba Dam.

Release of variable environmental flows from Warragamba Dam will allow the river to better meet a range of uses that the community values. These include boating, fishing, swimming, river amenity for picnicking and other on-bank recreational activities, agricultural production, and ecosystem health.

Extensive modelling of a range of flow regimes was considered to identify a suitable environmental flow that also protects Sydney's water storage supply when required. The selected flow regime is described as a "90/10 scaled at 5%" scenario. This flow scenario represents a transparent / translucent discharge release rule, which is summarised as:

- All inflows are discharged up to the 90th percentile inflow; and
- For inflows above the 90th percentile, an additional 10% of those inflows (above the 90th percentile) will also be discharged.

From flow modelling under these rules, the 90th percentile inflow is 82 ML/day, with a maximum environmental flow of release capped at 3000 ML/day. These rules also take account of the level of water stored in the Greater Sydney system at the time by scaling the calculated release against the stored system volume versus capacity.

The adopted environmental flow regime would not operate under flood conditions, and release volumes are such that all environmental flows would remain within the existing downstream riverbank.

Proposal overview

The proposal involves the construction of new infrastructure and the modification and refurbishment of existing infrastructure at Warragamba Dam to enable variable environmental flow releases in response to inflows into Lake Burragorang as follows:

- Install a new multi-level independent intake structure feeding into the existing unutilised hydro-electric power station (HEPS) intake penstock. The multi-level intake structure would be constructed from precast concrete units anchored to the upstream face of the existing dam wall from the existing road deck down to around 55m below the full supply level
- Refurbish the existing penstock pipe running between the upstream face of the dam wall and the HEPS
- Modify the HEPS and install new infrastructure, including new outlets to allow water to be released into the Warragamba River immediately downstream of the HEPS.

The construction works would not require lowering the water level of Lake Burragorang.

Project support areas, including site office and laydown areas, will be required for the construction works. The selected support areas have previously been used to support other construction projects at the dam including the original dam, the auxiliary spillway and the operations building and visitors centre.

The duration of the construction works is planned to take around 2.5 years.

Statutory context

The proposal meets the criteria for State Significant Infrastructure (SSI) under section 2.13 of the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP).

The proposal would be characterised as works to a '*water storage facility*' under the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (T&I SEPP), which would be '*permissible without consent*' for WaterNSW (a public authority as defined under section 1.4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act)).

The proposal would also meet the criteria in Schedule 3 of the Planning Systems SEPP given its characterisation as a '*water storage facility*' and its estimated development cost of more than $30 million. Given the proposal meets the Schedule 3 criteria under the Planning Systems SEPP and would otherwise be 'permissible without consent' under the T&I SEPP, the proposal is declared to be SSI under section 2.13 of the Planning Systems SEPP. Environmental assessment of SSI applications requires the preparation of an Environmental Impact Statement (EIS).

The approval authority for the proposal would be the Minister for Planning and Public Spaces under section 5.14 of the EP&A Act.

Engagement

The proposal has been developed to deliver existing government policy in consultation with relevant government agencies by the former Department of Planning and Environment (now part of the NSW Department of Climate Change, Energy, Environment and Water [NSW DCCEEW]). As the owner and operator of Warragamba Dam, WaterNSW has been tasked by NSW DCCEEW to develop and deliver the proposal, including its ongoing operation.

WaterNSW has previously discussed the proposal with the Department of Planning, Housing and Infrastructure (DPHI), as well as State and Commonwealth agencies during a planning forum held in February 2024.

The proposal to install infrastructure at Warragamba Dam to enable environmental flows has been ongoing since the development of the Metropolitan Water Plan in 2004. There has been extensive consultation both with the community and across Government to increase awareness of the environmental flows proposal and understand community and stakeholder attitudes, issues and concerns.

Warragamba Dam is located within the area covered under the Gundungurra Indigenous Land Use Agreement (ILUA) and preliminary proposal details have been discussed with the members of the Gundungurra committee. Further stakeholder and community consultation would be undertaken during preparation of the EIS.

Environmental matters for consideration

Identification and characterisation of environmental matters of likely and potential relevance for this proposal has referenced *State significant infrastructure guidelines – preparing a scoping report* (DPIE 2022) and particularly Appendix D – levels of assessment. This has been informed by desktop reviews of publicly available information and a site visit, and by previous environmental studies which provide a significant amount of relevant information with regard to construction activities at the dam site.

It is considered that:

- The proposal is unlikely to result in significant impacts to the receiving environment (including cumulative impacts)
- There is a good understanding of likely and potential impacts associated with the proposal, these being well understood, relatively easy to predict using standard methods, and capable of being effectively mitigated to comply with relevant standards or performance measures
- Assessment of the proposal is unlikely to involve any significant uncertainties or require any detailed cumulative impact assessment.

Accordingly, consideration of the following matters relevant to the Proposal would be through a standard EIS assessment:

- Access – Traffic and parking, Access to property (construction/non-public)
- Air – Particulate matter and emissions

- Amenity – Noise and vibration, Visual
- Biodiversity – Aquatic, Terrestrial
- Built environment - Public land and infrastructure
- Social and economic
- Aboriginal heritage
- Historic (built) heritage
- Natural heritage / protected areas
- Hazards and risks – Contaminated or hazardous materials, Waste management
- Waters – Water quality.

Glossary

Term	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, legends and places) cultural practices and traditions associated with past and present-day Aboriginal communities.
Aboriginal object(s)	The legal definition under the NSW *National Parks and Wildlife Act 1974*, for any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.
Aquatic	Occurring in the water - including a creek river and lake.
Coffer dam	A temporary watertight enclosure pumped dry to permit construction work below the waterline.
Cold water pollution	An artificial decrease in water temperature of a river, such as through the release of colder waters (potentially over 10 ^{o}C colder) from outlets low in the dam wall, where stored waters are affected by thermal stratification. Cold water pollution impacts the presence, and the life cycles, of aquatic species. The level of impact is affected by interconnected spatial and temporal factors.
Development / proposal footprint	The area of land that is impacted by a proposal, including access roads, and areas used to store construction materials. For the purposes of this assessment, the development footprint includes areas used for construction as well as ancillary actions associated with the proposal.
Environmental flows	Releases of water from a water storage with the objective of improving the water quality and ecological health of downstream waterways. The environmental flow releases are typically based upon inflows to the dam and aim to mimic the natural variability in flows.
Eutrophication	A process where a water body receives excess nutrients that stimulate excessive plant growth.
Hydrology	Term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of river flows.
Life cycle	The series of reproduction, growth, development, aging, and death of an organism.
Riparian	Relating to the banks of a waterway.
Riverine	Relating to the river environment.
State Significant Infrastructure	Under the EP&A Act, development may be declared State Significant Infrastructure (SSI). SSI are projects of State significance that primarily involve the delivery of infrastructure, such as transport, and other linear infrastructure and

Term	Definition
	utilities (e.g. gas and water pipelines, energy transmission, telecommunication networks etc) along with environmental services.
Terrestrial	Occurring on dry land.
Thermal stratification	A natural process resulting in the layering of water within a large water body in temperature and density. Warmer less dense water is near the surface, with cold dense water near the base.
Threatened species	Critically endangered, endangered or vulnerable threatened species and populations as defined in Part 4 of the *Biodiversity Conservation Act 2016 (*BC Act), or any additional threatened species listed under Part 13 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as critically endangered, endangered or vulnerable.

Abbreviations

Acronym	Definition
ACHA	Aboriginal cultural heritage assessment
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANZECC	Australia and New Zealand Environment and Conservation Council
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BDAR	Biodiversity Development Assessment Report
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DPE	Former NSW Department of Planning and Environment
DPHI	NSW Department of Planning, Housing and Infrastructure
DPI	NSW Department of Primary Industries
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EPI	Environmental Planning Instrument
GBMWHA	Greater Blue Mountains World Heritage Area
GDE	Groundwater-dependent ecosystem
HEPS	Hydro-Electricity Power Station
FM Act	*Fisheries Management Act 1994* (NSW)
Heritage Act	*Heritage Act 1977* (NSW)
ILUA	Indigenous Land Use Agreement
LEP	Local Environmental Plan
ML/day	Megalitres per day
MNES	Matters of National Environmental Significance
NPW Act	*National Parks and Wildlife Act 1974* (NSW)

Acronym	Definition
NPW Regulation	National Parks and Wildlife Regulation 2019 (NSW)
NPWS	NSW National Parks and Wildlife Service
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
PCT	Plant Community Types
PMF	Probable Maximum Flood
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy (NSW)
SoHI	Statement of Heritage Impact
SSI	State Significant Infrastructure
WDR	Warragamba Dam Raising (project / EIS)
WM Act	*Water Management Act 2000* (NSW)
WSP	Water Sharing Plan

1 Introduction

1.1 Proponent details

The proponent details are set out in Table 1-1.

Table 1-1 Proponent details

Category	Proponent details
Proponent	WaterNSW (business name: Water NSW)
Address	Level 14, 169 Macquarie St Parramatta NSW 2150
Contact	Robert Cawley
ABN	21 147 934 787

1.2 Proposal summary

The proposal is to construct new and upgrade existing infrastructure at Warragamba Dam to enable selective withdrawal of water from Lake Burragorang, to be released as variable environmental flows (also known as environmental flows) into the lower reaches of the Warragamba River. This release water will subsequently flow into and benefit the downstream Hawkesbury-Nepean river system. The infrastructure to be installed would provide capacity to release up to 3,000 ML/day in environmental flows from Lake Burragorang.

The physical works for the proposal are located within the following two parcels of land:

- Lot 1124 DP1159978
- Lot 1 DP87998.

These parcels of land are within Wollondilly Shire Local Government Area (LGA). Downstream of Warragamba Dam, the Hawkesbury River runs through five LGAs: Blue Mountains, Penrith, Hawkesbury, The Hills Shire, and Hornsby.

This report provides a strategic overview and informs the scope of the environmental assessment that would be required for the proposal to meet the requirements under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The basis for the proposal falling under Part 5 of the EP&A Act is provided in Section 4. The report has been prepared in accordance with the *State Significant Infrastructure Guidelines - Preparing a Scoping Report* October 2022 (SSI Guidelines), in anticipation of the proposal being designated as State Significant Infrastructure (SSI) given the estimated development cost of the works and as the works affect state infrastructure providing Sydney's water supply (refer to Section 4.1).

This scoping report addresses the construction of environmental flows infrastructure at Warragamba Dam, and the operation of that infrastructure to provide environmental flows. The approvals process for the construction works and the operation of the proposal is considered in Section 4.

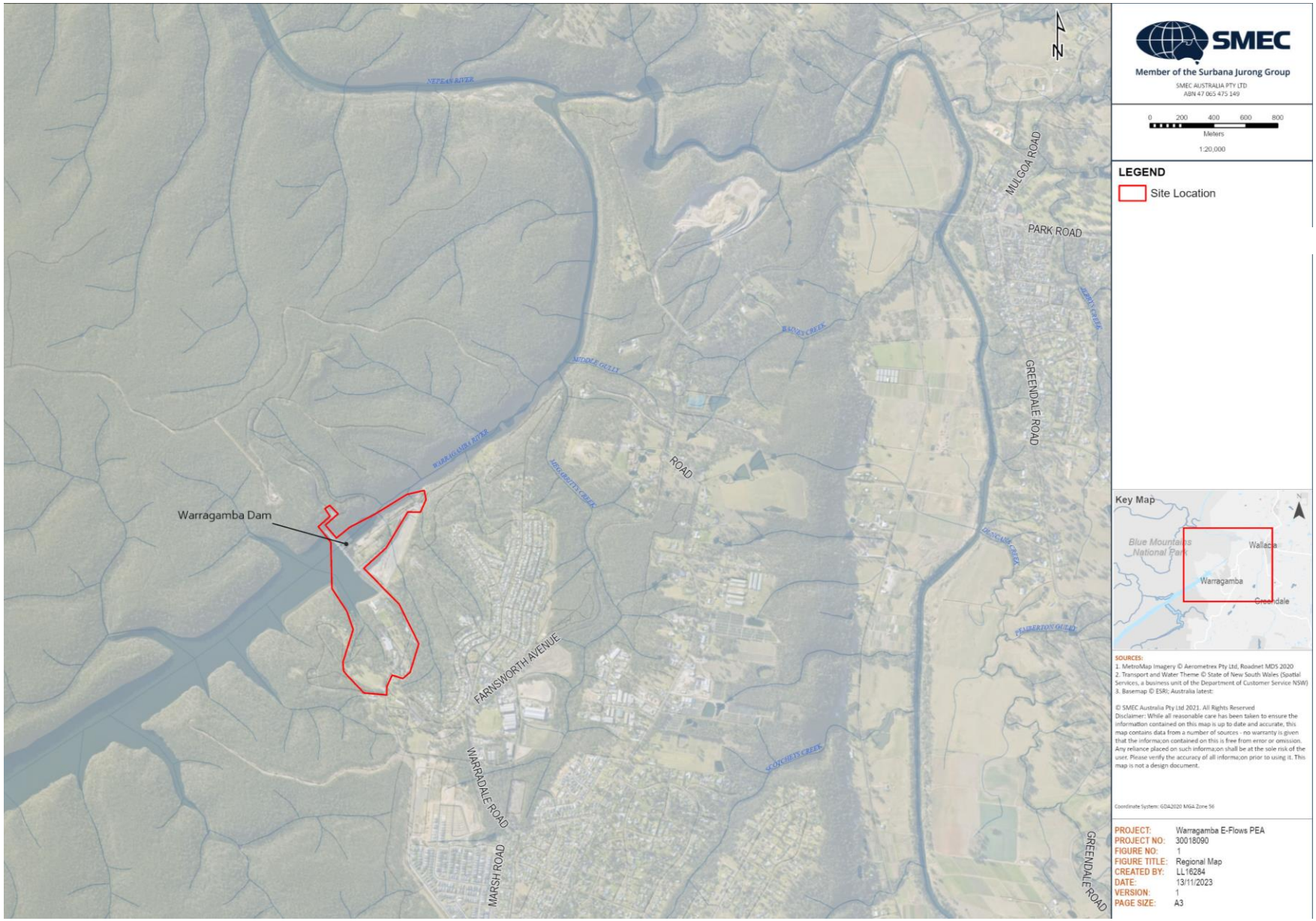

Figure 1-1 Location of the proposal

1.3 Proposal background and development

1.3.1 Environmental flows

To investigate the benefits that environmental flows could have on the health of the Hawkesbury-Nepean River downstream of Warragamba Dam, detailed research and analysis was undertaken by the former Department of Planning and Environment (Water) (DPE 2021). Different flow options were evaluated using a combination of environmental data, model outputs, scientific literature, and expert opinion to estimate the likely response of the current river condition to additional flows. The process considered the likely changes to river flows and water quality, predicted ecological responses to these changes, and assessed the benefits of these changes on the community's amenity and use of the river.

These investigations showed:

- Aquatic plants have become more abundant in recent years
- There is a history of toxic algal blooms in the river and the risk remains high
- Severe and immediate threats to aquatic ecosystems continue.

The benefits of environmental flows are further reinforced by a study undertaken by DPE Water (Krogh and Keenan 2023) which examined changes in water quality in the Nepean River since 2010. This identified that environmental flows had contributed to an improvement in water quality in the Nepean River, particularly with regard to pH and salinity. Nutrients were also observed to have decreased at monitoring sites in the upper reaches of the river. The report noted an increasingly complex picture of water quality moving downstream as other sources within the catchment, such as wastewater plant discharges and urban runoff exerting a greater influence on water quality.

The need for active and ongoing management of the water environment is well recognised, especially as pressures continue and demands escalate with Sydney's urban growth. The *Greater Sydney Region Plan: A Metropolis of Three Cities* (GSRP) (Greater Sydney Commission 2018) confirmed that two of the main growth areas in Sydney are within the Hawkesbury-Nepean catchment – the population of the emerging 'Western Parkland City' is projected to grow from 740,000 in 2016 to 1.1 million by 2036 and to well over 1.5 million by 2056, and the population of the 'Central River City' is projected to increase from 1.3 million people to 1.7 million people over the next 20 years.

Release of variable environmental flows from Warragamba Dam will allow the river to better meet a range of uses that the community values. These include boating, fishing, swimming, river amenity for picnicking and other on-bank recreational activities, agricultural production, and ecosystem health. Environmental flow releases will contribute to achieving these by:

- Reintroducing more natural flow conditions
- Improving water quality
- Reducing problems caused by excessive growth of algae and aquatic weeds
- Improving fish populations.

Environmental flows can be variable or non-variable (the latter also referred to as fixed):

- Variable flows can be used to reflect natural flow regimes, such as seasonality of flow volumes and temperatures, which benefit species with life cycles such as breeding or migration which respond to water characteristics. With appropriate infrastructure, the taking of water at the dam intakes can be tailored to meet these requirements, and to more closely align with qualities of the receiving waters
- Non-variable flows provide a constant rate of water flows and are not reflective of natural regimes which can have a detrimental effect on the environment and some species.

NSW river flow objectives[1] are identified as to:

- Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flow
- Protect natural low flows

[1] https://www.environment.nsw.gov.au/ieo/

- Protect or restore a proportion of moderate flows, 'freshes' and high flows
- Maintain or restore the natural inundation patterns and distribution of floodwaters supporting natural wetland and floodplain ecosystems
- Mimic the natural frequency, duration and seasonal nature of drying periods in naturally temporary waterways
- Maintain or mimic natural flow variability in all rivers
- Maintain rates of rise and fall of river heights within natural bounds
- Maintain groundwaters within natural levels, and variability, critical to surface flows or ecosystems
- Minimise the impact of in-stream structures
- Minimise downstream water quality impacts of storage releases
- Ensure river flow management provides for contingencies
- Maintain or rehabilitate estuarine processes and habitats.

The purpose of the river flow objectives is to produce specific environmental benefits such as:

- Improved survival of ecosystems and aquatic biodiversity
- Improved water quality
- Healthier wetlands
- Improved habitat quality and increased variability of habitat for native fish, frogs, waterbirds and other native fauna, including invertebrates
- More successful breeding of native birds, fish and other native fauna, which only breed in response to specific environmental triggers, for example, rising or falling water levels in the natural seasons
- More natural inundation of flood plains and wetlands, leading to better health and productivity (such as grazing), protection of endangered species, biodiversity and water quality
- Discouragement of alien pest species, such as carp, which favour regulated conditions
- Improved health of in-stream and riparian vegetation, leading to greater bank stability, improved efficiency of buffer strips in protecting water quality, and reduced erosion and turbidity
- Reduced frequency of algal blooms.

The Water Quality Australia report (2013) recognises the close and complex relationship between water quality, described as being the physical chemical and biological aspects which affect environmental values, and water quantity being the volume of water (stored or in flow) generally and temporal aspects such as seasonality, frequency, and duration of that volume. Water quality and water quantity affect the function of the environment and the health of ecological communities.

Krogh and Keenan (2023) investigated changes in water quality at sites in the Upper Nepean River following the implementation of environmental flow releases in 2010. The assessment considered 13 characteristics of water quality at nine locations of which two are downstream of the confluence with the Warragamba River. The assessment determined there was in improvement in the overall water quality of the Nepean River for most of the characteristics considered. The report also noted that the proposed introduction of environmental flows at the Warragamba Dam is likely to improve the water quality of the Nepean River below the junction with Warragamba River at least as far as Sackville.

1.3.2 History of environmental flows from Warragamba Dam

The need for and implementation of flows benefitting the environment, from Sydney's water supply dams and Warragamba Dam in particular, have been recognised and progressed over 20 years, as outlined in Table 1-2 (MetroWater 2017, Sydney Water 2021, DPE 2022c).

Table 1-2 Strategic guidance and activities for environmental flows from Warragamba Dam

Year	Document	Details / relevance to current scoping report
2004	Hawkesbury-Nepean River Management Forum (HNRMF) Metropolitan Water Plan	HNRMF recommended water releases from dams to improve the downstream river environment. The Metropolitan Water Plan identified a need to release environmental flows from the major water supply dams for Sydney to improve river health (DPE 2022c). However, further studies were identified as needed for Warragamba Dam, in particular for impact on drinking water supply and infrastructure capability.
2010	Metropolitan Water Plan	Committed to providing water to meet human and environmental needs with equal importance. This commitment was consistent with the National Water Reforms objectives and *Water Management Act 2000*. The National Water Reforms are outlined in the National Water Initiative (NWI) agreed by all states and territories in 2004. The NWI committed to included provisions for the environment in water plans.
2014 and 2016	Preliminary business case for Warragamba Dam environmental flows prepared (2014) and revised (2016) and approved (2016) Infrastructure NSW Gateway 1 Review	Reports setting out the preliminary business case for environmental flows at Warragamba Dam. Approval for project to proceed with preparation of final business case to commence. Reference to Warragamba Dam environmental flows options assessment scenario assessment reports.
2017	Metropolitan Water Plan	The 2017 MWP was a pivotal plan under which the environmental flows proposal was conceived and initiated, to help protect and improve the downstream health of the Hawkesbury-Nepean River. Its recommended strategies to achieve this included: • Implementing variable environmental flows from Warragamba Dam • Modifying Warragamba Dam to release the environmental flows • Protecting the benefits of environmental flows • Monitoring and adaptive management of environmental flows.
2021	Environmental flows cap	Analysis by DPE Water determined that the maximum flow rate for environmental flows is to be 3,000 ML/day. Revised modelling, incorporating updated inflow modelling including the Millennium Drought, changed the 90th percentile from 108 ML/day to 82 ML/day.
2021-2023	Warragamba Dam Raising Project EIS Public exhibition - submissions report	WaterNSW was directed to incorporate infrastructure to enable environmental flows into the design of the project for the proposed raising of Warragamba Dam. Accordingly, the environmental flows infrastructure formed part of the works considered under the Warragamba Dam Raising (WDR) project EIS and comprised a relatively small component of the overall project. The EIS for the WDR Project was placed on public exhibition from September to December 2021. The Response to Submissions report for that exhibition and the Preferred Infrastructure Report were placed on a second public exhibition in November and December 2022.
2022	Greater Sydney Water Strategy August 2022 Greater Sydney Water Strategy - Implementation Plan 2022-2023	The Greater Sydney Water Strategy (2022) recognises that infrastructure to enable environmental flow releases would be needed at the dam. At the time of the Strategy, the potential raising of the dam wall was under consideration and would have affected those environmental flow infrastructure works. Strategy Priority 4 – Our waterways and landscapes are healthy. Action 4.1 maintain and improve ecosystem health. Sub actions (from Implementation Plan):

Year	Document	Details / relevance to current scoping report
		• To maintain environmental flows from Greater Sydney water storages - including progressing new environmental flow regime for Warragamba Dam – to protect maintain and enhance river health and recreational opportunities within 3 years • Undertake baseline monitoring program ahead of the commencement of environmental flows from Warragamba Dam within 3 years • Monitor any change to environmental flow regimes – including scaling of flows for drought management – for changes to water quality, fish passage, floating weeds and threatened species downstream of water storages within three years.
2023	Water Sharing Plan for the Greater Metropolitan Region Unregulated Water Sources 2023	Water sharing plans (WSPs) provide environmental flow rules for the specified waterway. Environmental flow rules are based on river flow objectives identifying critical aspects of river flow for river health ecology and biodiversity. The objectives were endorsed by the NSW Government in 1999. This Plan replaces the 2011 Plan and took effect from 1 July 2023. Section 57I provides for an existing annual total combined volume of 9,000 ML from Avon Dam, Cataract Dam, Cordeaux Dam, Nepean Dam and Warragamba Dam as well as Upstream Warragamba Extraction Management Unit for environmental contingency. Environmental contingency is to be used for environmental purposes including weed management, manage water quality events, and support fish breeding migrations.

1.3.3 Existing environmental release flows from Warragamba Dam

Environmental flow releases are currently made from an existing water supply pipeline outlet at Megarritys Creek associated with the Warragamba Dam to Prospect Reservoir water supply network. This outlet point is approximately 100 m from the junction of Megarritys Creek with the Warragamba River which is approximately 1.8 kilometres downstream of the Warragamba Dam wall.

Current environmental flow releases, as required under WaterNSW Water Access Licence (WAL), are 17 ML/day and 25 ML/day in winter and summer respectively for drinking water supply at North Richmond Water Filtration Plant. An additional 5 ML/day is released to help dilute the Wallacia Wastewater Treatment Plant discharge into the Warragamba River below Megarritys Creek.

The current proposal is separate to the existing flows released at Megarritys Creek (which will remain in place) and will enable further release of variable environmental flow volumes at varying depths of storage from the dam to ensure appropriate water quality characteristics entering the downstream river system.

1.3.4 Proposed environmental flow releases

The proposed environmental flow regime comprises of two types of flow. These are:

- Transparent flows – low flows into the dam are released as if the dam did not exist, like light through a piece of clear glass. All water that flows into the dam up to a particular volume is passed downstream. These flows protect river ecology in periods of very dry weather and very low flow; and
- Translucent flows – the release downstream of a proportion of larger flows going into the dam, like light going through a piece of translucent glass. A percentage of the inflows above the level set for transparent flows is released. This allows water to be retained in the reservoir for water supply purposes.

The environmental flows infrastructure options have been developed based on the “90/10 scaled at 5%” scenario as recommended in the 2017 MWP. This flow scenario represents a transparent / translucent discharge release rule, which is summarised as:

- For inflows into the dam up to the 90th percentile (calculated as 82ML/day), the discharge equals the inflow; and
- For inflows above the 90th percentile, an additional 10% of the inflow (above the 90th percentile) is also discharged.

This rule takes account of the level of water stored in the Greater Sydney system at the time by scaling the outflow to the stored system volume versus capacity. This means that lower environmental flows are released during times of drought. A "5% step" is used for the scaling calculation. The step means that (for example) when Greater Sydney system storage is at 43%, the discharge calculated from a standard 90/10 rule would be adjusted to 45% (rounded up from 43%). The resultant outflow would therefore be 45% of the calculated maximum that was determined using the 90/10 principle detailed above. See Figure 1-2 for worked examples.

The adopted environmental flow regime would not operate when the dam is in flood operation mode, and release volumes are such that all environmental flows would remain within the existing riverbank (i.e. not create additional flood risk).

Text Box 1

Examples of flows released under the 90/10 rule, with different inflow volumes:

With an inflow of 200 ML
Transparent component = 82 ML,
Translucent component = (200 - 82) * 0.1 = 118 * 0.1 = 11.8 ML
Total release = 93.8ML (retain 106.2 ML)

With an inflow of 1,000 ML
Transparent component = 82 ML
Translucent component = (1000 - 82) * 0.1 = 918 * 0.1 = 91.8 ML
Total release = 173.8 ML (retain 826.2 ML)

With an inflow of 50 ML
Transparent component = 50 ML
Translucent component = 0 ML
Total release = 50 ML (0 ML retained in the dam)

*Examples of flows released under the 90/10 **scaled** rule, with different storage levels (scaling is described below):*

With an inflow of 200 ML, storage level at 100%
Total release = 93.8 ML

With an inflow of 200 ML, storage level at 80%
Total release = 93.8 ML * 0.8 = 75.0 ML, 18.8 ML additional saved

With an inflow of 200 ML, storage level at 60%
Total release = 93.8 ML * 0.6 = 56.3 ML, 37.5 ML additional saved

With an inflow of 200 ML, storage level at 40%
Total release = 93.8 ML * 0.4 = 37.5 ML, 56.3 ML additional saved.

With an inflow of 1,000 ML, storage level at 40%
Total release = 173.8 ML * 0.4 = 69.5 ML, 104.3 ML additional saved

Figure 1-2 Flows under 90/10 rule

1.4 Related development or infrastructure

There is no existing or approved development or infrastructure that would be incorporated into the proposal. The Upper South Creek Advanced Water Recycling Centre originally included a pipeline to release environmental flows as close as possible to the dam wall with the preferred option being to potentially locate the outlet upstream of

Warragamba Weir. That project, with the pipeline, was approved on 28 November 2022. However, the pipeline was subsequently removed through a modification to the approval (MOD1) which was determined on 26 May 2023.

There is no other development or infrastructure that is required for the proposal but would be subject to a separate approval process.

2 Strategic context

2.1 Proposal need and justification

Warragamba Dam has a major influence on river health in the lower Hawkesbury-Nepean River. Its size and location within the catchment results in significant environmental impacts on the river below the dam with substantially reduced stream flows for prolonged periods of time. These reduced flows contribute to poor water quality and extensive aquatic weed growth and algal blooms. These conditions compromise boating, fishing and swimming uses of the waterway, as well as impacting the amenity of the river for picnicking and other on-bank recreation activities.

The need for active and ongoing management of the water environment is well recognised, especially as pressures continue and demands escalate with Sydney's continued urban growth.

The intent of release of variable environmental flows is to mimic natural flow patterns and conditions downstream of a dam as if the barrier to the river created by the dam did not exist.

Healthy rivers need flows and temperatures that retain or mimic natural conditions. The environmental flows proposal will achieve this by:

- Reintroducing flow variability
- Improving water quality
- Reducing problems caused by excessive growth of algae and aquatic weeds
- Improving fish populations.

This will result in improved river health and recreational amenity for people using the lower reaches of the Hawkesbury-Nepean river system between Warragamba Dam and downstream at least as far as Sackville.

2.1.1 Risk assessment for the Greater Metropolitan unregulated management zones

The proposal sits within the areas covered by the following two water sharing plans (WSP) made under the *Water Management Act 2000*:

- *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2023*
- *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2023*.

In June 2022, DPE released a five-volume report on a risk assessment for the Greater Metropolitan unregulated management zones. Two of the reports are of relevance to this scoping report:

- *Risk assessment for the Greater Metropolitan unregulated management zones 2021 (Vol 1) along the Nepean River and tributaries below the major dams* (DPE 2022a)
- *Risk assessment for the Greater Metropolitan unregulated management zones 2021 (Vol 2) forming the tributaries of the Hawkesbury Nepean River system, excluding upstream of Warragamba Dam* (DPE 2022b).

The reports covered 16 and 17 management zones respectively. Not all management zones would be relevant to this proposal.

The risk assessments evaluated risks to water-dependent ecosystems and other uses, and covered the ecological needs of freshwater riverine systems, groundwater-dependent ecosystems (GDE) upstream of the tidal limit (around Yarramundi), estuarine ecosystems and GDEs downstream of the tidal limit.

For freshwater riverine systems the following was noted in relation to ecological needs:

- Low flows and refuge pools maintain habitat prior to zero flows periods
- Low flows maintain habitat and hydrological connectivity
- Fresh flows maintain important ecological functions and water quality
- High and infrequent flows maintain important ecological functions and water quality.

For estuarine ecosystems the following was noted in relation to ecological needs:

- Higher freshwater inflows (freshes and high flows) maintain connectivity and salinity levels below the tidal limit
- Low inflows maintain limited connectivity and minimal salinity levels below the tidal limit in drier periods.

For GDEs both upstream and downstream of the tidal limit, the ecological needs related to groundwater in highly connected surface and groundwater sources maintaining water levels for GDEs and baseflow instream.

The risk assessment used a standard 'Risk' = 'Consequence' x 'Likelihood' definition. The consequence for each of the management zone was based on calculation of the instream value. The likelihood component was based on calculation of hydrological stress. A value classification matrix (Figure 2-1) was used to determine risk, providing a value classification code between a and i that guided the development of WSP access and trading rules (NSW Office of Water 2011 cited in DPE 2022a).

The risk assessment evaluated current or future risks, which can be managed through mechanisms within the WSP, that directly related to the quantity or quality of water in the WSP area. Potential mitigation strategies that could be implemented through the WSP, such as improving flow for fish passage, were included for discussion in future options assessment. Where mitigation strategies were available, but could not be implemented through a WSP, they were identified in the risk assessment but not considered further.

	Low hydrologic stress	Medium hydrologic stress	High hydrologic stress
High instream values	a	b	c
Medium instream values	d	e	f
Low instream values	g	h	i

Figure 2-1 Value classification matrix used in the macro approach to determine value classification codes between a and i

(Note: in the value classification matrix, green indicates low risk, orange indicates medium risk, and red indicates high risk.)

The reports provide risk summary tables for each management zone assessing risks of:

- Insufficient water for freshwater riverine ecosystems (both reports)
- Poor water quality for freshwater riverine ecosystems (turbidity, nutrients, pH, DO and electrical conductivity) (both reports)
- Poor water temperature for freshwater riverine ecosystems (temperature outside of natural ranges) (only for Volume 1 report)
- Insufficient water for estuarine ecosystems (only for Volume 2 report).

2.1.2 Warragamba Environmental Flows Benefits Realisation Plan

The *Warragamba Environmental Flows Benefits Realisation Plan* (WaterNSW 2023, unpublished) defines the proposal objectives as to:

- Improve water quality and flows downstream of Warragamba Dam
- Provide value as well as positive net community benefits
- Meet NSW Government commitments to improve the condition of the Hawkesbury-Nepean river system
- Deliver the environmental flows scope of works in required timeframes and confirm completion dates
- Allow flexible staged construction with variable environmental flows releases.

The proposal will enable environmental flow releases into the Warragamba River immediately below the dam wall which support the river flow objectives of NSW Government and the benefits they are intended to achieve.

The proposal is intended to provide and/or support progress towards the following benefits and outcomes:

- Provide variable flow rates that are able to mimic natural river flow characteristics
- Provide environmental flows for the segment of Warragamba River between the dam wall and Megarritys Creek, which is currently receives limited inflows
- Improve water quality benefiting aquatic and riparian plant and animal (including fish) species
- Reduce occurrence of known environmental issues including outbreaks of aquatic weeds and algae blooms
- Allows for the future provision / installation of infrastructure of hydro-electricity generation (if required and this would be progressed as a separate project).

The improvements to river health will have subsequent benefits for human recreational and economic use of the river.

2.2 Existing infrastructure

Warragamba Dam was constructed between 1947 to 1960 (Heritage NSW 1999) as a water supply for the growing Sydney city.

In 1953, during the dam construction, a decision was taken by the government to incorporate a hydro-electric power station (HEPS) into the project (SMH article 1953). The power station, which was capable of producing 50 megawatts of power was operated by Eraring Energy, a NSW Government corporation. The HEPS ceased to operate around 1998.

Since the 1980s the dam has been modified and upgraded several times. These previous works included an increase in the height of the dam wall by five metres and works to protect the dam wall integrity and safety in extreme events (completed late 1989), construction of the auxiliary spillway (completed 2002), construction of a deep water pumping station (completed 2006) and an electrical upgrade (completed 2009). The current visitor centre with office area and grounds upgrade was opened to the public in 2009.

The existing Warragamba Dam site includes the following infrastructure relevant to this proposal:

- Warragamba Dam wall - new intake tower attached to upstream face
- Penstock from dam wall to the HEPS - to be relined
- HEPS facility - to be modified internally
- Supporting elements including access (roadways and boat ramps) and open spaces (sealed and unsealed).

All infrastructure associated with the proposal shall be retrofitted or incorporated within the above existing infrastructure, hence not requiring further clearing or excavation of previously undisturbed areas within the Warragamba Dam precinct.

2.3 Existing operational considerations

2.3.1 Water supply function of dam

As the principal source of drinking water for the Sydney metropolitan area, it is important that the water supply function is retained and protected. Additionally, it is important that the quality of intake water is not detrimentally affected as this would have implications on the water treatment and quality management required for public consumption. Any such quality changes to the intake water would affect the level of treatment required, with associated time, cost, process, equipment maintenance, and reputational implications.

The proposed intake tower for the environmental flow infrastructure is nominated for a location adjacent to the existing drinking water intake points. The proposed use of pre-fabricated intake tower components, that will require installation, will reduce the risk of potential impacts on the water quality around the drinking water intakes, as will management of which drinking water intakes are active / in use during the construction works.

The water quality of the lake for water supply purposes will need to consider not only the works associated with the installation of the intake tower, but also the cumulative impact with natural changes to the lake, such as water level, temperature as affects stratification as well as visibility and turbidity.

2.3.2 Water level of reservoir, spills and flood events

Spills over the dam wall, rainfall/flood events and releases of water from the dam when at full capacity as a result of high rainfall and runoff into the catchment and Lake Burragorang will result in increased water flow into the Warragamba River and downstream river systems outside of the environmental flow releases. These flows contribute to the objectives and outcomes sought by environmental flows.

The dam is operated in accordance with agreed flood operation protocols. When the lake is above FSL, the drum and radial gates automatically open to release water incrementally so as to minimise rapid rises in downstream water and flood levels. These managed releases are known as the H14 rules or protocol (WaterNSW 2021, Section 15.1.1 and Section 15.3.1.4). The H14 rules will continue to apply following the introduction of an environmental flow regime.

2.3.3 Climate change and resilience

Climate change projections for the Sydney area including the Warragamba Dam are as outlined in Table 2-1 (source: WaterNSW 2021, Table 14-2).

Table 2-1 Climate change projections for Sydney area

Climate variable	Climate projection for 2030[1]	Climate projections for 2070[1]
Mean maximum temperature	+0.7°C (range +0.3°C to +1.0°C)	+1.9°C (range +1.6°C to +2.5°C)
Hot days (>35°C) – Western Sydney	+5 to 10 days per year	+10 to 20 days per year
Heatwave events[2]	+0.4 events per year (range +0.1 to +0.8)	+3.5 events per year (range +0.4 to +7.0)
Average annual summer rainfall	0 to +5% change	+10% to 20% change
Average annual autumn rainfall	+5% to 10% change	+10% to 20% change
Average annual winter rainfall	-5% to + 5% change	0 to 10% change
Average annual spring rainfall	-5% to 0 % change	0 to 10% change
Extreme rainfall[3]	+ 5% (range -3% to +12%)	+2% (range -7% to +10%)
Rainfall frequency	Variable	Variable
East Coast Lows (ECL) frequency	Neutral	Neutral
ECL Intensity	Increase	Increase
Extreme fire weather days	0 to +2 days per year	+1 to +6 days per year
Atmospheric CO2	Increase	Increase

[1] Compared to current baseline
[2] Heatwaves are defined as more than three consecutive hot days compared to 'normal' seasonal averages
[3] Percent change 40-year, 1-day rainfall totals.'

In providing for variable releases of environmental flows that respond to natural flow regimes associated with rainfall across different time scales (days to months to years) and seasonality, the proposal will also provide additional

flexibility in responding to environmental changes driven by climate change and will provide resilience in the water supply system.

2.3.4 Operating rules

Operating rules would be established for the future operation of the environmental flow releases from Warragamba Dam and amended in the Water Access License held by WaterNSW. The operating rules will be structured around the following considerations:

- Release of environmental flows shall not impede, or add to, releases that may be in place during flood events and how the rules will integrate with the existing H14 rules (refer to Section 3.2)
- Any lake conditions that would pause or alter environmental flow intake requirements and/or inform the point of intake relating to the desired characteristics (e.g. very low capacity, turbidity)
- The method of calculation for the volume of releases and the duration of releases based on inflows. Suitable water characteristics are required such as temperature to inform decision on the level to draw water from for suitability for release into the Warragamba River.

The operation of the environmental flow releases would be undertaken as an operational activity of the dam, similar to the water supply function and the existing releases from Megarritys Creek and so will come under the overall operation and management of the Warragamba Dam. Similarly, the required future maintenance of the environmental flow infrastructure would be planned and undertaken as part of and in coordination with other maintenance works required for the overall dam structure, while ensuring the continued safe operation of the dam and continued water supply function.

2.3.5 Public accessibility

Areas of Warragamba Dam are accessible to the public. Vehicles, including private cars and tour buses/coaches, access the dam precinct via Production Avenue into a local street network and parking areas with pedestrians moving between these areas and destinations in and around the precinct (refer Figure 6-1).

Visitor access hours that the dam is accessible by the public, on foot or in vehicles, individually and in groups, with varying mobility levels and age groups are:

- The main gate allows entry along Production Avenue and Farnsworth Avenue to the precinct, including Haviland Park and other greenspaces and the upper viewing platform, between 8am and 5pm weekdays and 10am to 7pm weekends and some public holidays
- The visitor centre is open every day (except two public holidays) between 10am and 4pm
- The lower viewing area over the auxiliary spillway via part of Valve House Road is open only on weekends and public holidays between 10am and 4pm. However, the segment of Valve House Road leading to the HEPS and the base of the dam wall is gated to prevent access
- Gates and fencing of other areas allow for these to be readily blocked from public access as required. Gates restrict access to the public, such as the lower viewing area on weekdays, the dam crest at all times, to the boat ramp (off Twenty Third Street), and to the lower segments of Valve House Road via Core Park Road (gated just off Weir Road).

Further, open days or special events such as specialist tours also allow the public into generally excluded areas.

As Lake Burragorang provides the drinking water supply for Sydney, there are restrictions on what activities may be undertaken. No fishing, boating or swimming is permitted within the precinct. The public access restrictions within the vicinity of the dam wall assist in protecting water quality from uses. Designated Protected and Special areas are in place to protect water quality through controls on access and activities.

2.4 Local setting and features

2.4.1 Warragamba Dam and surrounds

Construction of the Warragamba Dam, with supporting infrastructure including the HEPS, valve house and various pipelines, was completed in 1960. The construction of the dam was supported by working and accommodation areas

in the adjacent land, in particular on the southern side of the dam much of which remain as part of the precinct, some of which now comprises parklands, open space and visitor facilities.

The original dam construction required extensive disturbance to the river channel and the rock valley walls, including excavation, and reclamation with concrete and fill materials to worksites and part of the downstream channel.

The concrete auxiliary spillway, completed in 2002, is separated from the main spillway of the dam wall by terraced open spaces. This spillway is approximately 500 metres length and required excavation of rock from the valley wall. The base of the spillway is elevated relative to the sealed roadway below.

The Warragamba township is located to the south and east of the Warragamba Dam precinct. The population of the Warragamba township (suburb and localities) in 2021 was 1,202 people (ABS 2021). The township includes a public school, sporting and recreational facilities, suburban areas and small commercial and industrial areas.

2.4.2 Lake Burragorang and catchment

Lake Burragorang was formed by the construction of the Warragamba Dam, which flooded the immediate upstream environment of part of the Warragamba River. The lake depth varies seasonally and across years, dependant on rainfall and subsequent inflows, water supply abstraction and releases.

Rivers flowing into the lake include the Coxs River, Tonalli River, Wollondilly River, Nattai River, Kowmung River, and Little River, as well as numerous smaller creeks and streams.

The lake catchment includes a number of protected areas including the Greater Blue Mountains World Heritage Area (GBMWHA), Blue Mountains National Park, Nattai National Park, and Yerranderie State Conservation Area. The dam precinct and immediate downstream are not within any protected lands.

2.4.3 Warragamba River, Nepean River, Hawkesbury River

The Warragamba River is part of the Hawkesbury-Nepean catchment. Following the formation of Lake Burragorang, the downstream section of the river now comprises the reach between the base of the dam wall and the Nepean River. A small weir is located approximately 1,200 metres downstream of the dam wall.

The downstream section of the Warragamba River runs beside Blue Mountains National Park (left bank) which also forms part of the GBMWHA. Further downstream, the Nepean River runs also through Blue Mountains National Park / GBMWHA for about 12 kilometres.

The Nepean River is fed by numerous rivers creeks and streams and becomes the Hawkesbury River at the confluence of the Nepean River and Grose River. Water quality in the Nepean River and Hawkesbury River is dependent on the quality of incoming waters, itself a factor of land use and catchment management.

2.5 Cumulative impacts potential

An assessment of cumulative impacts would need to consider the potential implications of the following to the construction phase of the proposal:

- Any bushfire event, as affecting for example access, or laydown areas
- Any flooding event, as affecting for example lake conditions and ability to undertake deep water works
- Any planned works at the dam, particularly as affecting the water supply inlets and affecting the construction area on the dam crest
- Western Sydney International Airport and related rail link – both under construction
- Upper South Creek Advanced Water Recycling Centre
- Other projects that may affect supply of resources (materials, personnel).

Major projects in the surrounding area are shown on Figure 2-2.

2.6 Agreements affecting the proposal

Currently, WaterNSW has not entered into any agreements with other parties to mitigate or offset the potential impacts of the proposal.

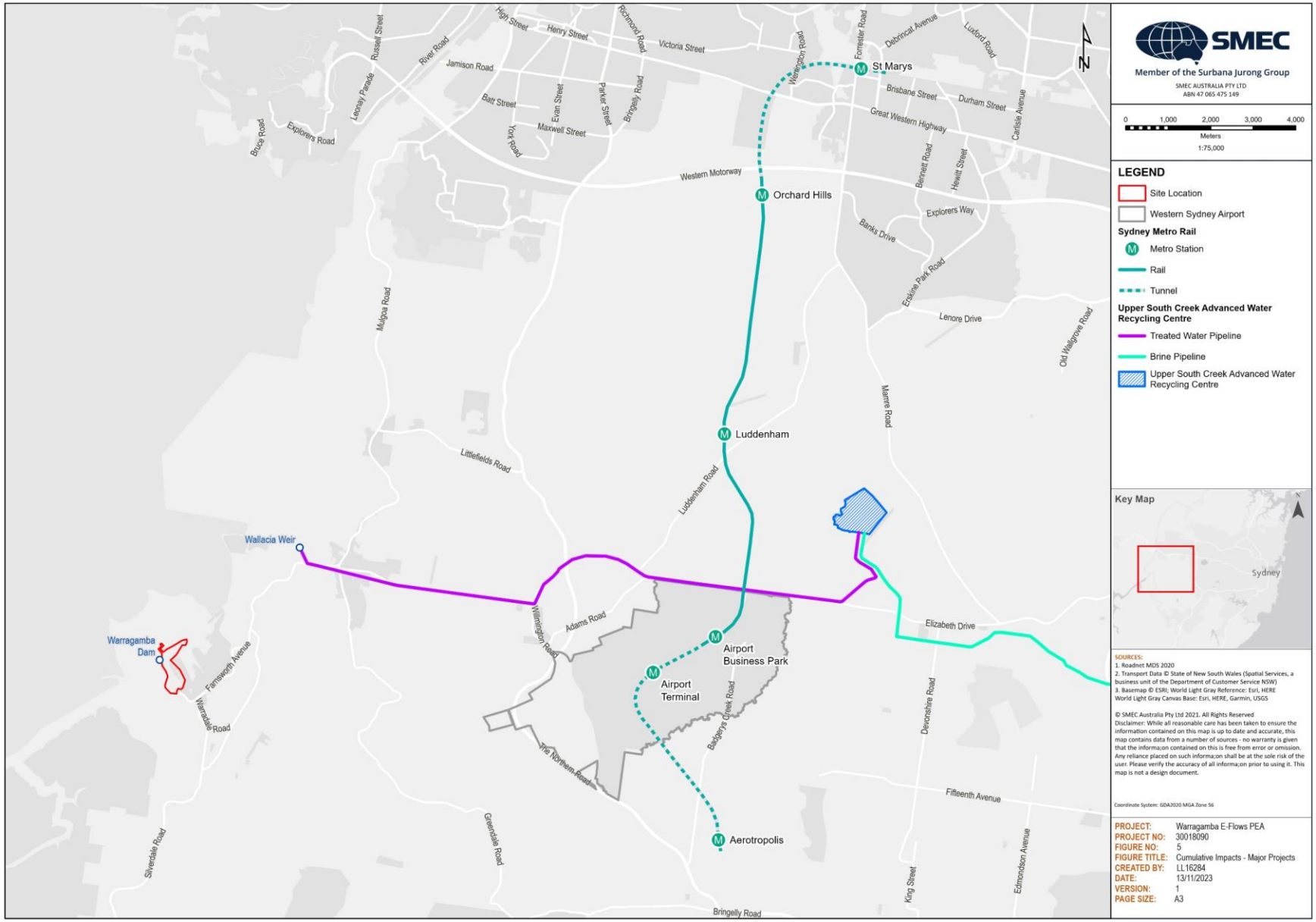

Figure 2-2 Major projects in the surrounding region

3 Proposal overview

3.1 Overview

The proposal is to install and operate infrastructure at the existing Warragamba Dam that will enable selective withdrawal of water from Lake Burragorang and enable variable environmental flow releases into Warragamba River just below the dam wall.

3.2 Operational considerations

The operational management of Warragamba Dam with respect to the environmental flows proposal can be broadly categorised to three activities. Operational considerations under the proposal are discussed below.

Water Supply Operations

Warragamba Dam supplies bulk water to Greater Sydney. Water supplied via the outlet works through to the Warragamba pipelines will not change. The processes and procedures currently used to supply water will be the same post construction.

Flood Operations

During a large rainfall event when the storage level rises above the FSL of the dam, flood operations commence. The existing flood operating procedures include the crest gates operating to a protocol known as “H14”. This is a protocol that operates the crest gates automatically in response to defined rise or fall in dam levels to achieve the required discharge characteristics. The processes and procedures currently used for flood operations will be the same post construction. Environmental flow releases will not take place when the dam is in flood operations (i.e. when the dam is spilling, or the gates are open).

Environmental Flow Operations

Although environmental flow operations are already dispensed through a valve at Megarritys Creek, the new environmental flow infrastructure operation rules and protocols will be an added function added to the dam’s existing operations.

The flow regime rule also accounts for a 5% scaled consideration for environmental flow discharge daily volumes which is based on the volume of water stored in the Greater Sydney system at the time by scaling the outflow to the stored system volume versus capacity at 5% steps. This means that lower volumes of environmental flows are released during times of drought. A “5% step” is used for the scaling calculation of the daily environmental flow release.

During project delivery, key WaterNSW operational and maintenance staff will be included in the governance arrangements. Prior to completion of the construction phase of the environmental flows project, WaterNSW operators will be trained and certified to operate the new assets and systems. This will be supported by detailed operating and maintenance manuals.

3.3 Proposed capital works

The proposal comprises two parts, being the permanent built infrastructure to enable the environmental flows, and the support facilities that will be in place during the construction phase only.

3.3.1 Permanent built infrastructure

The proposal will involve the following built infrastructure (refer to Table 3-1 and Figure 3-1), the details of which will be finalised and confirmed as the design progresses and related construction methodology is assessed and subject to technical assessments.

Table 3-1 Permanent built infrastructure for environmental flows

Element	Location	Details
New intake tower	To be constructed on the upstream face of the dam, between the existing HEPS penstock gate and the water supply outlets on the right side of the dam	The tower would include precast intakes attached directly to the upstream face of the dam. The intake tower would be supported by a concrete base. The precast units will be fabricated in sections off-site and brought to site for installation. Installation of the new intake tower will require saturation diving. This includes removal (and replacement) of existing trash racks to connect the intake to the existing penstock.
Existing penstock	Existing penstock between the upstream face of the dam and the HEPS	Refurbishment of the existing penstock (4.2 m diameter pipe) will comprise: • Refurbishment of the existing penstock control gate inside the dam wall • Dewatering of the existing penstock. This could be done with other releases to dilute any detrimental negative water qualities • Removal of existing surface coating (may contain hazardous materials), surface preparation and application of new coating. Water will move by gravity through the penstock to the release valves.
Existing HEPS structure	Re-use of existing building	Modification and alterations to existing structure: • Requires removal of a majority of existing non—operational equipment and materials • There are known hazardous materials (asbestos in electrical equipment, lead-based paint, PCBs) that are part of the existing plant and equipment in the HEPs, as well as residual fuels, lubricants, oils etc associated with machinery • Requires demolition of some internal structural components. For this assessment it is assumed that all internal components will be demolished and only the main structure to be retained. However, the extent of demolition required is to be confirmed on further design work with only partial or no demolition required for some internal elements.
		Modification (upgrades and/or alterations) to existing retained infrastructure: • Convert the existing chamber structure into a new valve chamber • Existing utilities and services including ventilation, electricals, sewage, fire response and drainage system.
		New infrastructure: • Install new pipework and a new series of discharge valves in the chamber that will control the environmental flow releases (rate of flow and quantity) • New penetrations into the existing structure walls to provide outflow (via pipework)
		Allow for potential future installation of a hydro-electric power plant (pipework connections and floor area) within existing HEPS. Any future plant proposal would be the subject of a separate environmental assessment process.

Figure 3-1 Proposed environmental flows infrastructure and HEPS

3.3.2 Construction support sites

The proposal will require construction support sites, initially scoped as follows, with locations indicated on Figure 3-2:

- Site office and amenities - existing greenspace between the auxiliary spillway and the HEPS. This site is in proximity to all work areas with existing pedestrian and vehicle access
- Laydown area 1 - an existing sealed parking area below proposed site office and amenities area. The existing hardstand provides an impermeable surface to store plant and equipment on. Use of this area will require public access exclusion
- Laydown area 2 – an existing sealed area below the auxiliary spillway. This area is not currently accessible by the public
- Laydown area 3 – park / open space (existing emergency helipad site). If required, this area would be used as temporary overflow should the other laydown areas provide insufficient capacity. This area has previously been used as a staging / laydown area (including for the auxiliary spillway construction and the new visitor centre construction). Fill materials are contained within the area. This area is adjacent to security and already predominantly fenced, can be readily excluded from public access. The helipad facility would require relocation – for which a preliminary site in Warragamba township has been identified
- Boat ramps – use of the existing upstream boat ramp to west of the visitor centre for water side access to the new intake tower. This ramp has vehicle access off Twenty-third Street which also runs near laydown area 3 and is part sealed. Use of the boat ramp will require continued restriction on public access. Additionally, potential use of the Warragamba River access from an existing downstream ramp and unsealed vehicle track off Valve House Road, to support the new outlets works
- Support area on the dam crest – adjacent to the proposed new intake tower location, to accommodate the saturation divers and working area generally for the intake tower construction
- Road access - within the property to and between each of the above sites, including for heavy vehicles carrying plant equipment and materials. Consideration of safety to public – avoid / minimise conflict potential (vehicles and pedestrian) of the public using the area generally and noting key points of the visitor centre, Haviland Park, facilities and parking areas.

Construction methods may also require installation of a temporary coffer dam adjacent to the HEPS facility within the Warragamba River channel, which may also be supported by use of the downstream Warragamba River access ramp and vehicle track.

The laydown areas and site office will require demobilisation, along with surface remediation, at the conclusion of the works. The requirement for this will be confirmed on further consideration, design development and construction methodology.

For the purpose of this report the proposal area is identified on Figure 3-2. The proposal area would be confirmed with progression of the design and construction considerations, and is likely to be refined rather than broadened, and the need for optional / potential sites reviewed.

Figure 3-2 also identifies exclusion areas (which are not to be used) to protect natural and heritage values.

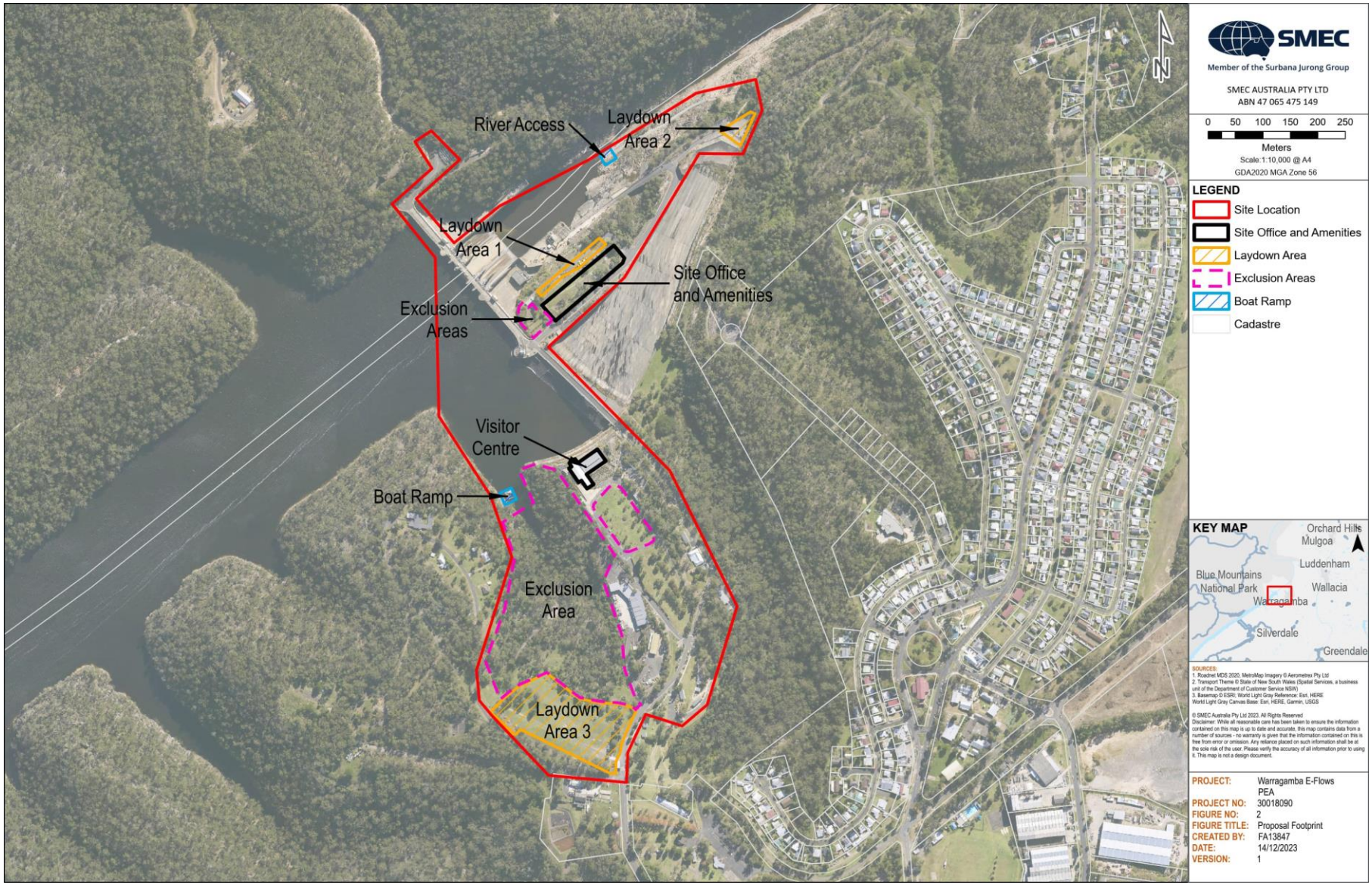

Figure 3-2 Proposal construction areas

3.3.3 Construction materials and volumes

The proposal is estimated to involve the following major quantities:

- Concrete 1,100m^3 (precast and in-situ)
- Reinforcing steel 80 tonne
- Formwork 550m^2
- Piping and valves 440 tonne

There will be disused electricity generating equipment in the HEPS to be removed (as necessary) to make way for new environmental flows infrastructure.

3.3.4 Construction methods

Working hours

The majority of works would take place during recommended standard construction hours for NSW, which are:

- 7:00am to 6:00pm Monday to Friday
- 8:00am to 1:00pm Saturday
- No hours on Sundays or on public holidays.

Most activities that generate high noise levels will be undertaken during these standard construction hours, including:

- Deliveries of materials including precast and premixed concrete
- Demolition works within the HEPS.

However, some works and activities would need to take place outside of the standard construction hours. These may include:

- Saturation diver support when divers will be operating from decompression facilities including accommodation, care, maintenance, and safety services for the dive crew. These support facilities will be required 24 hours per day for the duration of the saturation diving activities. These facilities do not generate excessive noise levels and will be installed on the dam crest directly above the underwater worksite. Such arrangements have been in place for previous diving works on the dam.
- Delivery of over-sized items or to address unexpected issues
- Attending to any safety matters if they extend beyond normal daily operations and in the case of emergencies.

It is anticipated that the work force will peak with up to 100 construction related workers, 25 delivery contractor staff and ten WaterNSW staff.

HEPS partial demolition

Partial HEPS demolition activities will take place, and be contained, within the existing HEPS structure as such there would be low likelihood for construction-based impacts to amenity such as visual, noise or dust impacts.

Concrete demolition will be achieved by a combination of rock breaking, hydraulic concrete scissors and concrete cutting. Existing steel structure and fixtures that are demolished will be cut into suitable transportation sizes and removed off-site. Concrete and other materials removed will be loaded into skips and hauled by crane to where it will be transported off-site to a recycling facility.

Saturation Diving

To facilitate saturation diving works and to provide a stable platform for the divers to work off during the saturation diving, a steel girdle shall be attached to the dam face. The girdle weighs approximately 150 tonnes. The girdle will remain in place for the entirety of the saturation diving works and be removed from the dam face once the integrity of the new inflow structure has been ratified and tested.

The main underwater works required, to be undertaken using saturation diving during standard working hours, include:

- Concrete demolition for parts of the existing HEPS intake tower and dam upstream face to facilitate new environmental flows intake tower construction
- Underwater placement of in-situ concrete for new intake tower support base and infill between existing columns that surround the penstock intake to the HEPS
- Installation of precast concrete intake tower units
- Installation of passive anchors including drilling and grouting to attached intake tower base, HEPS block-out wall and intake tower precast concrete units to the dam wall
- Installation of 17 auto gates and hydraulic lines.

Pre-cast sections and specialised formwork will be fabricated off-site. These items will be delivered to site prior to the mobilisation of the saturation diving team and stockpiled at the dam for incorporation into the works. Gates will be pre-installed to the sections before underwater fitment of the pre-cast sections.

3.4 Infrastructure options

WaterNSW prepared a report '*Assessment of alternative options for environmental flows infrastructure at Warragamba Dam'* dated 10 August 2023. The options outlined as follows are based on that report.

The report identified two locations for the environmental flows infrastructure as follows:

- On the right-hand side (looking downstream) of the dam, reusing the existing HEPS infrastructure, primarily the following existing redundant components:
    - HEPS intake structure with HEPS emergency gate and bellmouth transition
    - A 14-foot (4.267 metre) diameter coal-tar-epoxy coated steel penstock embedded in the 1950s dam construction
    - HEPS power station cavity

  This location is immediately adjacent to the water supply intakes.
- On the left side of the dam:
    - This location will require new conveyance infrastructure including a penetration through the dam wall
    - Removes significant risk of negatively impacting on the operation of the water intakes.

The report identified two options at each location to provide the infrastructure to enable environmental flows from Warragamba Dam. These essentially differ in whether the proposal makes allowance for potential future hydro-electricity capability within the facility.

All four options allow for:

- A 3,000 ML/day capacity for environmental flow releases
- Selective withdrawal of water by gated intakes within the new intake tower, that will enable compliance with variable environmental flow water quality requirements including for managing cold water pollution risk.

These are identified below with detailed descriptions in the following sub-sections.

3.4.1 Option 1: Reuse existing HEPS including related pipe infrastructure with allowance for potential hydro-electricity capability

This option comprises:

- Construct a new intake structure at the right side of the dam wall (facing downstream) adjacent to the current water supply intakes

- Refurbish and utilise the existing penstock (pipe) and control gate (located within the dam wall) as the water conduit
- Works within the existing HEPS as follows:
    - Remove the majority of non-operational equipment (and not required for the environmental flows) including partial demolition of some internal structures
    - Convert the existing chamber structure into a new valve chamber
    - Install new pipework and a new series of valves in chamber that will control environmental flow releases
    - Penetrations into the existing structure walls to provide outflow (via pipework)
    - Alterations and upgrades to a range of existing utilities and services including ventilation, electricals, sewage, fire response, and drainage system.
- Allowance for future installation of a hydro-electric power plant (pipework and floor area) within the existing HEPS. Indicative size / capacity of new power plant is 2 MW.

Key features for this option are shown in the cross section on Figure 3-3, and reproduced at Appendix B

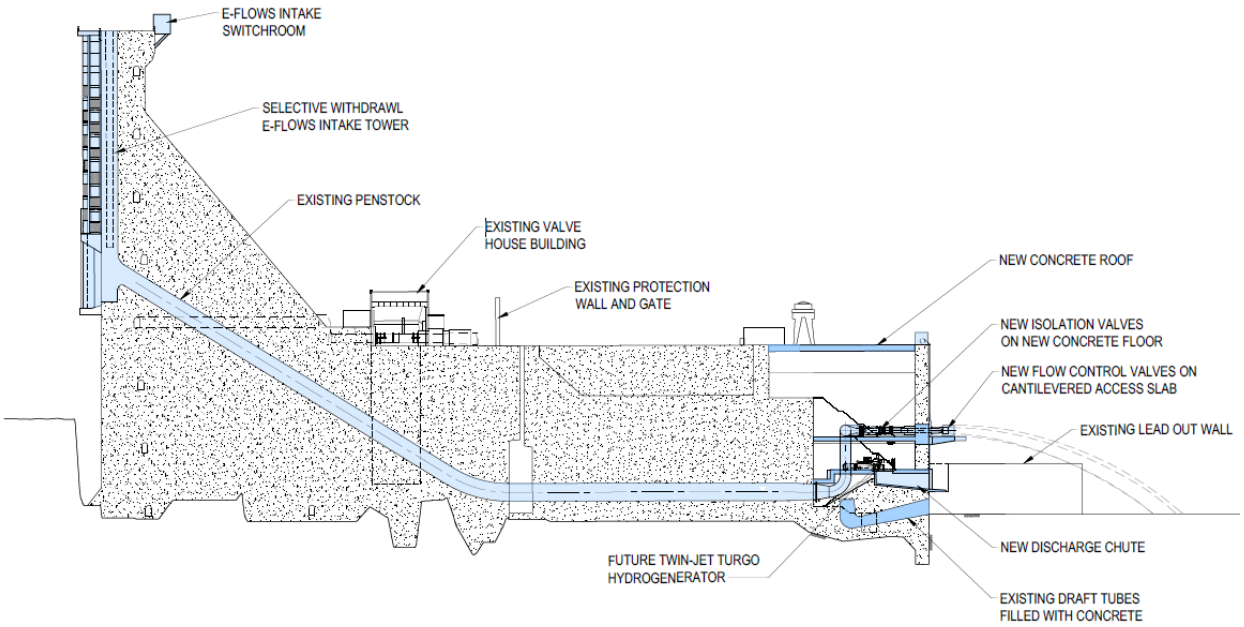

Figure 3-3 Option 1 – key features

Risks and benefits for this option are provided in the following table.

Table 3-2 Option 1 – risks and benefits

Risks	Benefits
• Interruptions to water supply by construction works – can be addressed in design and construction methodology • Saturation diving required – can be addressed through mitigation measures and use of specialist contractors • Hazardous materials in HEPS – to be assessed and managed accordingly	• Allow reuse of existing HEPS facility and penstock pipe infrastructure • Will address hazardous material in HEPS facility • Minimal impact on external appearance of HEPS and dam downstream • Operational elements of dam in one general location

3.4.2 Option 2: Reuse existing HEPS and related infrastructure with no allowance for future hydro-electricity capability

This option comprises:

- Construct a new intake structure at the right side of the dam wall (facing downstream) adjacent to the current water supply intakes
- Refurbish and utilise the existing penstock (pipe) and control gate (located within the dam wall) as the water conduit
- Penetration into the dam wall with piping to transfer water from the intake structure to the penstock
- Works within the existing HEPS as follows:
    - Remove the majority of non-operational equipment (and not required for the environmental flows) including partial demolition of some internal structures
    - Convert the existing chamber structure into a new valve chamber
    - Install new pipework and new series of valves in chamber that will control environmental flow releases
    - Alternations and upgrades to a range of existing utilities and services including ventilation, electricals, sewage, fire response, and drainage system.

As there is no allowance for a future hydro-electricity capability, the scale of works for the new valve chamber would be less than for Option 1.

Risks and benefits for this option are provided in the following table. These are the same as for Option 1.

Table 3-3 Option 2 – risks and benefits

Risks	Benefits
• Interruptions to water supply by construction works – can be addressed in design and construction methodology • Saturation diving required – can be addressed through mitigation measures and use of specialist contractors • Hazardous materials in HEPS – to be assessed and managed accordingly	• Allow reuse of existing HEPS facility and penstock pipe infrastructure • Will address hazardous material in HEPS facility • Minimal impact on external appearance of HEPS and dam downstream • Operational elements of dam in one general location

3.4.3 Option 3: New building and related infrastructure with allowance for future hydro-electricity capability

This option comprises construction of all new facilities as follows:

- Construct a new intake structure at the left end (facing downstream) of dam wall
- Construct a new conduit and install new penstock pipeline through the dam wall (requiring tunnelling); the pipeline would be located along the lower left abutment, running behind the dissipator training wall
- Construct a new concrete valve chamber downstream of the dissipator and install new valves to manage outflow
- Allowance for future installation of a hydro-electric power plant (pipework and floor area) within new chamber Indicative size / capacity of new power plant at 2 MW (consistent with Option 1).

Risks and benefits for this option are provided in the following table.

Table 3-4 Option 3 – risks and benefits

Risks	Benefits
• Dam safety and integrity with new penetrations – can be substantially addressed through analysis, construction methodology and design additions	• Separation of works from drinking water supply intakes • Less complex side of dam operationally • Avoids issues associated with the removal / demolition of HEPS internal equipment and materials including hazardous materials, and with the refurbishment of existing penstock

3.4.4 Option 4: New facility with no allowance for future hydro-electricity capability

This option comprises construction of all new facilities as follows:

- Construct a new intake structure at the left side (facing downstream) of the dam wall
- Construct a new conduit and install new penstock pipeline through the dam wall (requiring tunnelling); the pipeline would be located along the lower left abutment, running behind the dissipator training wall
- Construct a new concrete valve chamber downstream of dissipator and install new valves to manage outflow.

As no allowance would be made for future installation of a hydro- electric power plant (pipework and floor area) within new chamber, the scale of works of the new valve chamber will be less than Option 3.

Risks and benefits for this option are provided in the following table. These are the same as for Option 3.

Table 3-5 Option 4 – risks and benefits

Risks	Benefits
• Dam safety and integrity with new penetrations – can be substantially addressed through analysis, construction methodology and design additions	• Separation of works from drinking water supply intakes • Less complex side of dam operationally • Avoids issues associated with the removal / demolition of HEPS internal equipment and materials including hazardous materials, and with the refurbishment of existing penstock

3.4.5 Option to not proceed

If the proposal is not undertaken (the 'do nothing' option), the strategic guidance and direction of the government to implement environmental flows will not be met, and the benefits to the downstream environment will not be realised. The existing arrangements would continue without addressing associated detrimental impacts, such as low water flow releases, non-alignment in timing and/or characteristics with natural processes and regimes, cold water pollution, and issues of algae, poor river health and implications on species and ecosystem condition.

Sydney's growing population will place increasing pressure on the Hawkesbury-Nepean river system. Failure to deliver the required environmental flows is likely to result in the continued deterioration of Hawkesbury-Nepean river health.

3.5 Evaluation of infrastructure options

Each of the four infrastructure options to deliver the preferred flows were evaluated with regard to:

- Risks and benefits; risk types included business risk (interruption to water supply), health and safety risk (associated with construction), and dam safety risk (integrity of the dam structure)
- Compliance with cold water pollution guidelines
- Cost effective solution
- Provision for future hydropower generation.

3.5.1 Compliance with cold water pollution guidelines

The options evaluation report (Stantec/GHD 2022) included consideration of the performance of each option against the latest guidance provided in *Cold Water Pollution: report on implementation of Stage 2 of the Cold Water Pollution Strategy* (DPI Water 2017). The report identified that all four options provided the same level of compliance given the intake structures are similar in form, size, extent, and functionality, with the analysis indicating an expected compliance level of 97 percent when other water quality issues, such as algal blooms were considered.

3.5.2 Cost

The right-hand side options that are able to utilise existing components of the dam, such as the penstock and HEP's, were assessed as the most cost effective.

3.5.3 Provision for future hydropower generation

Options 1 and 3, for the right side options, provide simpler implementation of making provision for future hydropower generation.

3.6 Selected (preferred) option

The result of the comparative evaluation of the options resulted in Option 1 being selected as indicted in the general arrangement illustrated below (Figure 3-4 and Appendix B).

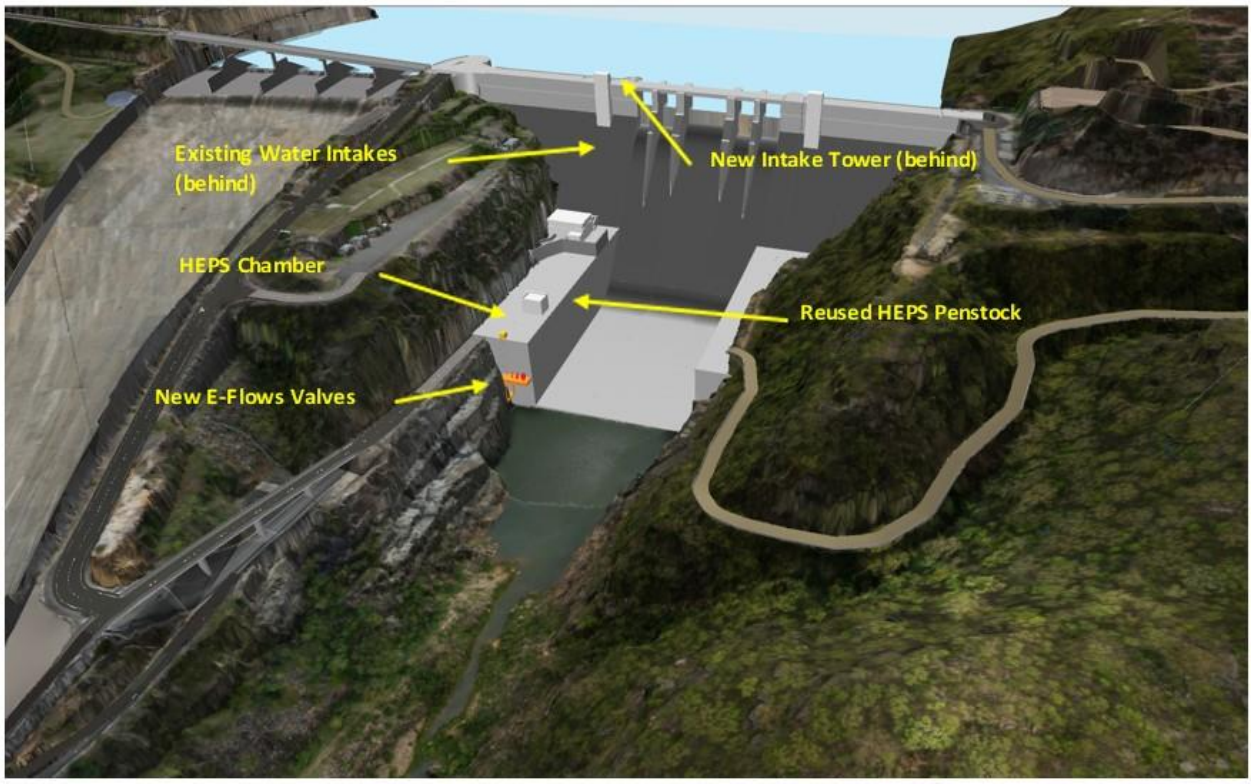

Figure 3-4 Selected Option – general arrangement

This option provides the following features:

- Reuse of the existing and redundant HEPS infrastructure, including the penstock and HEPS chamber avoiding the need to create a new conduit through the dam wall
- Minimal disruption to the physical characteristics of the dam and its structural integrity by using existing embedded pipework. The outward appearance of the structure remains largely unchanged
- The operational elements of the dam remain in one general location near the valve house

- Provides provision for utilising the existing HEPS for future hydropower generation if required.

The upstream arrangement for the preferred option is illustrated in Figure 3-5 and at Appendix B.

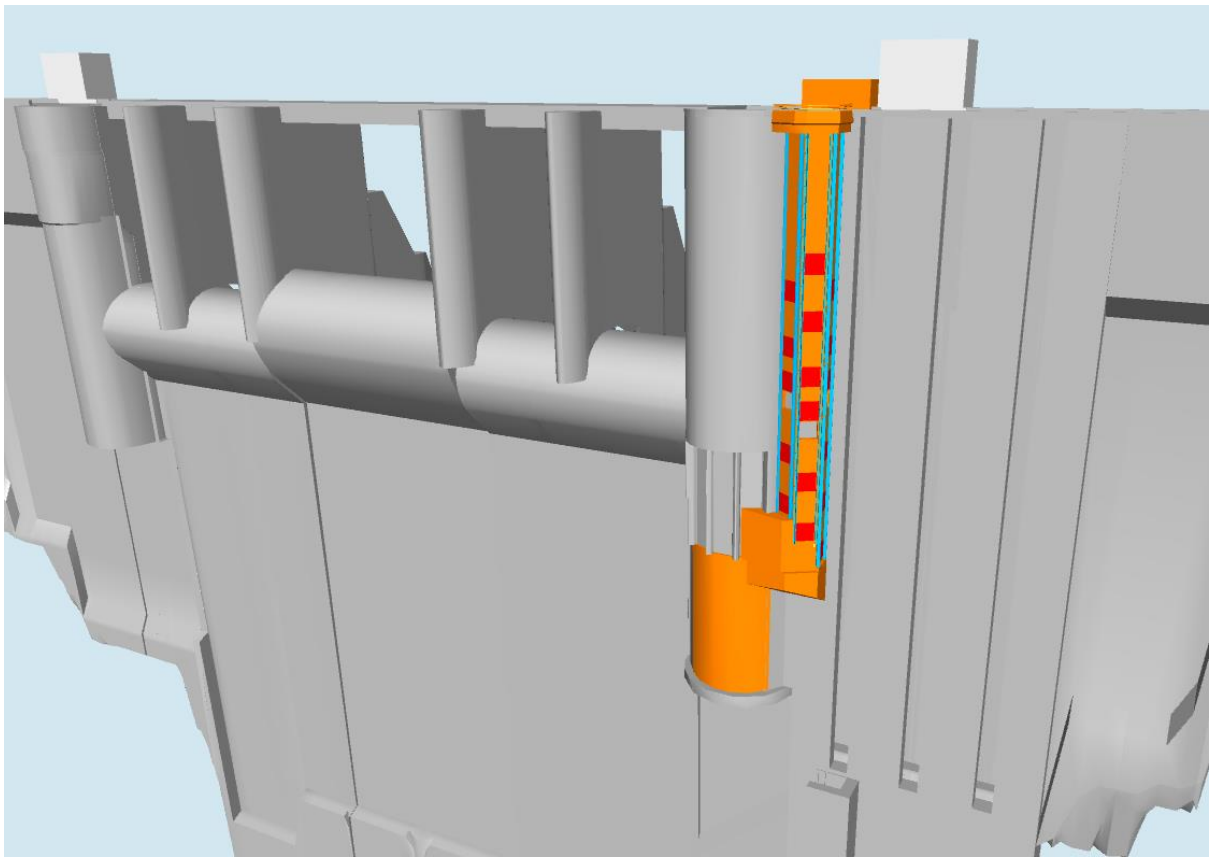

Figure 3-5 Selected Option – upstream arrangement

3.7 Timing of delivery of the proposal

The duration of the construction works is planned to take approximately 2.5 years.

4 Statutory context

4.1 Power to grant approval

The proposal meets the criteria for State Significant Infrastructure (SSI) under s 2.13 of the State Environment Planning Policy (Planning Systems) 2021 (Planning Systems SEPP) when characterised as a water storage facility.

4.1.1 State context

The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal environmental legislation in NSW regulating the planning approvals process for development. The approvals process is determined by the appropriate planning pathway, which is determined in accordance with the applicable environmental planning instruments, including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) and how the proposed works are characterised under the relevant SEPP or LEP.

4.1.2 Consideration of planning approval pathways

Three possible planning pathways were considered for this proposal:

1. **Permissible without consent when works are characterised as 'water reticulation system'**: Under section 2.159(a) of the State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP), 'development for the purpose of water reticulation systems' carried out by or on behalf of a public authority is permissible without consent. The Standard Instrument (Local Environmental Plans) Order 2006 defines '*water reticulation systems*' as a '*building or place used for the transport of water, including pipes, tunnels, canals, pumping stations, related electricity infrastructure and dosing facilities*'. The proposed works will fit the definition of '*water reticulation systems*' because its general purpose is to transport water from the water storage to downstream of the dam wall through an intake tower and existing pipelines. WaterNSW is a public authority as defined by section 1.4 of the EP&A Act.
2. **Permissible without consent when works are characterised as '*waterway or foreshore management activities*'**: Under section 2.165 of the T&I SEPP, '*development for the purpose of waterway or foreshore management activities*' including environmental management works carried out by or on behalf of a public authority is permissible without consent. Section 2.164 defines '*waterway or foreshore management activities*' to include '*instream management or dredging to rehabilitate aquatic habitat or to maintain or restore environmental flows… for ecological purposes*'. The proposed works are intended to be located instream to deliver environmental flows in a more ecologically sustainable way. WaterNSW is a public authority as defined by section 1.4 of the EP&A Act.
3. **State Significant Infrastructure (SSI) when works are characterised as '*water storage facility*'**: Under section 2.13 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), development is SSI where:
    a. it is permissible without consent and
    b. it is specified in Schedule 3 of the Planning Systems SEPP.

    Clause 4 of Schedule 3 of the Planning Systems SEPP declares as SSI '*water storage or water treatment facilities…carried out by or on behalf of a public authority that has an estimated development cost of more than $30 million*'. '*Water storage facility*' is defined in the Standard Instrument (Local Environmental Plans) order 2006 as '*a dam, weir or reservoir for the collection and storage of water, and includes associated monitoring and gauging equipment*'. There is a large body of case law that requires the works to be characterised in accordance with the broader purpose of the dam itself, rather than the independent purpose of the proposed works[2]. The works have an estimated development cost of over $30 million. Further, under the T&I SEPP, if the works were to be characterised as '*water storage facility*', the development would be permissible without consent, thereby meeting all the requirements of an SSI under section 2.13.

[2] Foodbarn Pty Ltd v Solicitor General (1975) 32 LGRA 157; Chamwell Pty Ltd v Strathfield Council (2007) 152 LGERA 400; People for the Plains Incorporated v Santos NSW (Eastern) Pty Ltd [2017] NSWCA 46.

4.1.3 Preferred planning pathway

On balance, it is considered that the proposed works are most appropriately characterised as 'water storage facility' given the body of case law that considers the concept of characterisation. Therefore, the preferred planning pathway is as SSI. Environmental assessment of SSI applications requires the preparation of an Environmental Impact Statement (EIS) responding to the requirements outlined with the Secretary's Environmental Assessment Requirements (SEARs).

4.1.4 Approval authority

The approval authority for the proposal is the Minister for Planning and Public Spaces under section 5.14 of the EP&A Act.

4.1.5 Wollondilly Local Environmental Plan 2011

Warragamba Dam is located within the Wollondilly Local Government Area (LGA). Development in the LGA is regulated through the *Wollondilly Local Environmental Plan 2011* (Wollondilly LEP). Warragamba Dam is located within the SP2 Infrastructure zone which is designated '*Water Supply Works'* on the land use zone map (refer Figure 4-1). Water supply works are permitted with consent in this zone. However, the Wollondilly LEP is not relevant to the proposed works as SEPPs, including the T&I SEPP and Planning Systems SEPP, prevail over LEPs to the extent of any inconsistency.

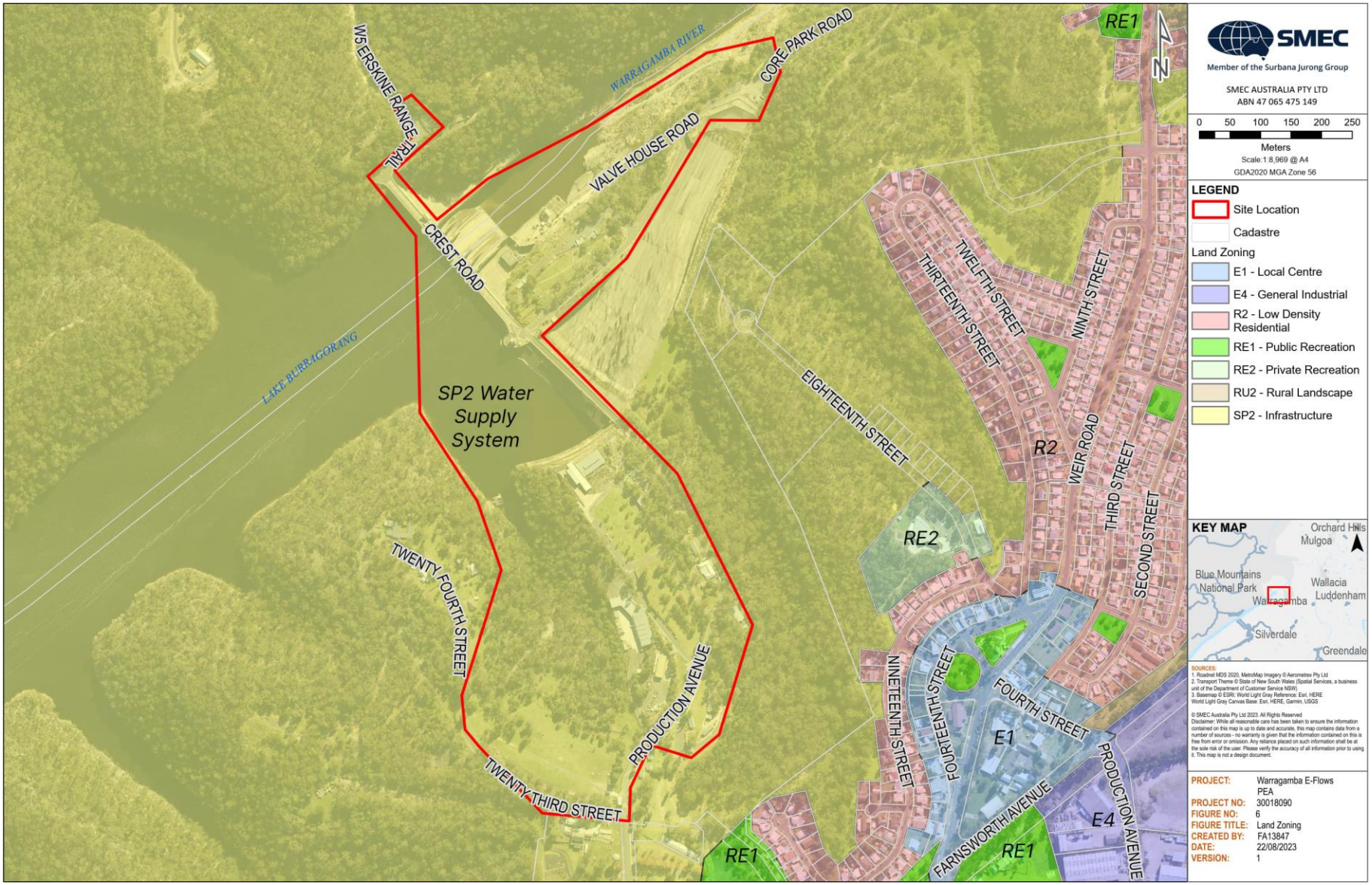

Figure 4-1: Land use zoning for proposal

4.2 Other approvals

4.2.1 Approvals that do not apply, or must be applied consistently

Under sections 5.23 and 5.24 of the EP&A Act, certain separate environmental approvals would not be required for the proposal or could not be refused if necessary for carrying out approved SSI.

Other approvals may be required in addition to those referred to under sections 5.23 and 5.24 of the EP&A Act and these would be considered as part of the EIS. Comment on the relevance of these to the proposal is provided in the following table.

Table 4-1 Approvals that do not apply or must be applied consistently

Approval	Relevance to the proposal
Separate approvals not required (section 5.23 of the EP&A Act)	
Fisheries Management Act 1994: a permit under Part 7, including sections 205 or 219	Unlikely to be relevant; the environmental flows construction works and operation would not affect marine vegetation (s205) or block fish passage (s219). However, if the proposed works involve the use of coffer dams during construction it may comprise 'dredging work" under section 198A of the Act and if so, WaterNSW would be required to comply with the notification and information requirements under section 199, providing the Minister written notice before the commencement of the works and to consider any matters raised by the Minister.
Heritage Act 1977: an approval under Part 4, or an excavation permit under section 139	Potentially relevant; the dam sits within the area identified under the Wollondilly Local Environmental Plan 2011 as the Warragamba Supply Scheme and Warragamba Emergency Scheme (Item I270). Although not directly impacted by the proposal, Haviland Park (SHR No. 01375), Megarritys Bridge (SHR No. 01367) and Warragamba Emergency Scheme (SHR No. 01376) are listed on the State Heritage Register (SHR).
National Parks and Wildlife Act 1974: an Aboriginal heritage impact permit under section 90	Unlikely to be relevant; the EIS for the WDR project did not identify any Aboriginal cultural heritage items within the area that would be affected by construction activities. Construction of the environmental flows infrastructure would occur within a generally similar, but smaller, impact footprint. An Aboriginal Cultural Heritage Assessment in accordance with Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (2010) may be used to identify whether or not Aboriginal objects are, or likely to be, present, and determine next steps.
Rural Fires Act 1997: a bush fire safety authority under section 100B	Not relevant.
Water Management Act 2000: a water use approval or a water management work approval	Relevant; WaterNSW holds existing combined water supply work & water use approvals for Warragamba Dam and environmental flow releases via the water supply pipeline at Megarritys Creek.

Approval	Relevance to the proposal
Approvals that must be applied consistently (section 5.24 of EP&A Act)	
Fisheries Management Act 1994: aquaculture permit under section 144	Not relevant
Coal Mine Subsidence Compensation Act 2017: section 22 approval	Not relevant
Mining Act 1992: mining lease	Not relevant
Petroleum (Onshore) Act 1991: production lease	Not relevant
Protection of the Environment Operations Act 1997: environment protection licence under Chapter 3	Relevant; an environment protection licence would likely be required for construction activities in relation to actual and potential emissions to air and water.
Roads Act 1993: consent under section 138	Not relevant
Pipelines Act 1976: licence	Not relevant

4.2.2 Other approvals not expressly integrated into the SSI assessment under the EP&A Act

Table 4-2 identifies NSW approvals that would or may be required for the proposal.

Table 4-2 Required and potentially required approvals

Statute	Requirement
Dams Safety Act 2015	Design and construction of the environmental flows infrastructure may require consideration of compliance obligations under the Act.

4.3 Pre-conditions to exercising the power to grant approval

4.3.1 Biodiversity Conservation Act 2016

Section 7.9 of the *Biodiversity Conservation Act 2016* (BC Act) provides for the assessment of biodiversity matters for SSI. This requires an application for approval of SSI:

- To be accompanied by a Biodiversity Development Assessment Report (BDAR) unless the Planning Agency Head and the Environment Agency Head determine that the proposed development is not likely to have any significant impact on biodiversity values
- To include the biodiversity assessment required by the environmental assessment requirements of the Planning Agency Head under the EP&A Act.

As SSI, the proposal would require the assessment of biodiversity in accordance with the Biodiversity Assessment Method (BAM) and will trigger the need for a BDAR unless it is determined that the proposed development is not likely to have any significant impact on biodiversity values in accordance with the BAM.

Notwithstanding this, the EIS would include a biodiversity assessment in accordance with the requirements specified within the SEARs for the proposal.

4.3.2 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CLM Act) establishes the process for investigating whether land is contaminated and, if required, land that the NSW Environment Protection Authority (EPA) considers to be contaminated significantly enough to be regulated.

A preliminary site investigation of the construction area for the WDR Project was provided as Appendix H to the Submissions Report (WaterNSW 2022). This would be used to inform consideration of contaminated land issues and risks for the proposal. The EIS would consider relevant mitigation and management measures that would be incorporated as part of the development to address potential contamination risks.

4.3.3 Dams Safety Act 2015

The *Dams Safety Act 2015* provides for the management of prescribed dams within NSW through Dams Safety NSW. Relevant matters under the Act related to the proposal would be addressed in the EIS.

4.3.4 Fisheries Management Act 1994

A permit under Part 7 of the *Fisheries Management Act 1994* to block fish passage, dredge or carry out reclamation work on water land respectively would not be required pursuant to section 4.41 of the EP&A Act.

4.3.5 Heritage Act 1977

An approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977* would not be required pursuant to section 4.41 of the EP&A Act. The EIS would conduct an assessment of potential impacts to non-Aboriginal heritage values in accordance with relevant NSW guidelines.

4.3.6 National Parks and Wildlife Act 1974

An Aboriginal heritage impact permit under Section 90 of the *National Parks and Wildlife Act 1974* would not be required pursuant to section 4.41 of the EP&A Act. Nevertheless, an Aboriginal Cultural Heritage Assessment would be undertaken for the proposal area. Any Aboriginal heritage sites identified within the proposal area would be avoided as far as practicable through the design process and the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) will be complied with.

4.3.7 Native Title (New South Wales) Act 1994

This Act establishes how land use and ownership/leasing activities which have occurred in NSW may interact with the Commonwealth's government's Native Title framework as set out within the *Native Title Act 1993*. At the time of preparation of this report no active claims applied to land covered by the proposal. An existing ILUA established under the Commonwealth *Native Title Act 1993* with representative of the Gundungurra People covers land including Lake Burragorang and the Warragamba area (including the location of the proposal).

4.3.8 Protection of the Environment Operations Act 1997

This Act and supporting Regulations provide for the regulation of pollution to the environment. The Act identifies premises based and non-premises based activities that, where specified thresholds are exceeded, are defined as 'scheduled activities' and require an Environment Protection Licence (EPL) to regulate emissions to the environment. Licences that may be required for the proposal are identified in Table 4-1.

4.3.9 Water Management Act 2000

WaterNSW holds combined water supply work and water use approvals for the operation of Warragamba Dam and existing environmental flow releases made from the water supply pipeline at Megarritys Creek. Further approvals under sections 89, 90 and 91 are not required for approved SSI. However, it is anticipated that existing water supply work approval and use approvals would be revised to incorporate the proposed environmental flow releases from Warragamba Dam.

4.4 Mandatory matters for consideration

4.4.1 Objects of the EP&A Act

Section 1.3 of the EP&A Act sets out the Objects of the Act. The consistency of the proposal with the relevant Objects is outlined as follows.

To promote the social and economic welfare of the community and a better environment by the proper management, development, and conservation of the State's natural and other resources (s1.3(a))

The proposal would provide for greater flexibility in delivery of environmental flows to the downstream river system and would promote improved health of the river system with consequent environmental and societal benefits.

To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities, and their habitats (s1.3(e))

The EIS would consider these matters in greater detail. Potential impacts to threatened flora and fauna, and to threated ecological communities are anticipated to be minimal. Potential impacts of the proposal with regard to other environmental aspects could be mitigated to an appropriate level of impact. The delivery of environmental flows to the downstream river system would promote improved environmental health of the river system.

To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage) (s1.3(f))

The proposal enhances the sustainability of Warragamba Dam through the introduction of variable environmental flows at the site. The EIS would consider these matters in greater detail as relevant.

To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants (s1.3(h))

The proposal would be designed and operated according to appropriate engineering and statutory standards and provide for the ongoing maintenance of currently unutilised HEPS infrastructure.

To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State (s1.3(i))

The assessment for this proposal will be subject to NSW and Commonwealth legislation. Consultation and appropriate consideration would be given to matters that may be subject to Local Government processes.

To provide increased opportunity for community participation in environmental planning and assessment (s1.3(j))

Preparation of the EIS would address relevant matters in Undertaking Engagement Guidelines for State Significant Projects (DPIE 2022a).

4.4.2 Environmental Planning and Assessment Regulation 2021

Clause 190 of the Regulation provides the requirements for an EIS.

An EIS must contain the following information (clause 190(1)):

- The name, address and professional qualifications of the person who prepared the statement
- The name and address of the responsible person (the applicant)
- The address of the land to which the development application relates, or on which the activity or infrastructure to which the statement relates will be carried out
- A description of the development, activity, or infrastructure
- An assessment by the person who prepared the statement of the environmental impacts of the development, activity, or infrastructure, dealing with the matters referred to in Part 8, Division 5 of the Regulation.

For SSI, the person preparing the statement must have regard to the *State Significant Infrastructure Guideline* (DPE 2022d) (clause 190(2)(b)).

An EIS must also contain a declaration by the person who prepared the statement of the following:

- The statement has been prepared in accordance with this Division
- The statement contains all available information that is relevant to the environmental assessment of the development, activity, or infrastructure
- The information contained in the statement is not false or misleading
- The information required under the Registered Environmental Assessment Practitioner Guidelines.

Clause 192 of the Regulation provides the requirements for the content of an EIS as follows:

- A summary of the EIS
- A statement of the objectives of the development, activity or infrastructure
- An analysis of feasible alternatives to the carrying out of the development, activity or infrastructure, considering its objectives, including the consequences of not carrying out the development, activity or infrastructure
- An analysis of the development, activity or infrastructure, including:
    - A full description of the development, activity or infrastructure
    - A general description of the environment likely to be affected by the development, activity or infrastructure and a detailed description of the aspects of the environment that are likely to be significantly affected
    - The likely impact on the environment of the development, activity or infrastructure
    - A full description of the measures to mitigate adverse effects of the development, activity or infrastructure on the environment
    - A list of the approvals that must be obtained under another Act or law before the development, activity or infrastructure may lawfully be carried out
- A compilation, in a single section of the environmental impact statement, of the measures referred to in paragraph (d)(iv)
- The reasons justifying the carrying out of the development, activity or infrastructure, considering biophysical, economic and social factors, including the principles of ecologically sustainable development set out in clause 193.

4.5 Commonwealth legislation

4.5.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes the legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places. These are defined as Matters of National Environmental Significance (MNES) under the EPBC Act. The following table (Table 4-3) lists the current MNES and provides comment on their relevance to the proposal.

Table 4-3 MNES relevant to the proposal

MNES	Relevance to the proposal
Listed threatened species and ecological communities	Relevant; there are several ecological communities and fauna species listed under the EPBC Act which are known or predicted to occur within the vicinity of the construction site and downstream of Warragamba Dam.

MNES	Relevance to the proposal
Listed migratory species	Relevant; there are migratory species listed under the EPBC Act which are known or predicted to occur within the vicinity of the construction site and downstream of Warragamba Dam.
Wetlands of international Importance	Not relevant; the nearest wetlands are in the Towra Point Nature Reserve in Botany Bay, approximately 50 kilometres to the east and not within the Hawkesbury-Nepean river system.
The Commonwealth marine environment	Not relevant; the proposal would not affect any Commonwealth marine areas.
World Heritage properties	Potentially relevant; operation of the environmental flows would be in proximity to the Greater Blue Mountains World Heritage Area. Environmental flow releases will mimic the natural river flow reducing the influence of the dam and shall remain within bank.
National Heritage places	Potentially relevant; operation of the environmental flows would be in proximity to the Greater Blue Mountains World Heritage Area. Environmental flow releases will mimic the natural river flow reducing the influence of the dam and shall remain within bank.
Nuclear actions	Not relevant; the proposal would not constitute a nuclear action.
Great Barrier Reef Marine Park	Not relevant; the proposal would not affect the Great Barrier Reef Marine Park
Protection of water resources from coal seam gas development and large coal mining development	Not relevant; the proposal would not constitute these types of developments.

Potential impacts of the proposal on relevant MNES would be considered in accordance with the Australian Government guideline *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Australian Government Department of the Environment 2013).

The proposal would be referred to the Australian Government Department of Climate Change, Energy, the Environment and Water (Commonwealth DCCEEW) for consideration as to whether the proposal would be a controlled action and therefore require approval under the EPBC Act in addition to approval under the EP&A Act.

Under the EPBC Act, the Commonwealth Environment Minister can make a written agreement with a state or territory government called a bilateral agreement[3]. There are two types of agreements that can be made:

- An assessment bilateral agreement allows a state or territory to conduct a single environmental assessment process. At the completion of the assessment the state provides a report to the Australian Government assessing the likely impacts of the proposal on matters of national environmental significance. Two approval decisions and two sets of conditions (if appropriate) are required before the proposal goes ahead.
- An approval bilateral agreement allows a state or territory to assess the likely impacts of a proposal on the environment and make a determination, accounting for both state matters and MNES. Only one approval decision and one set of conditions (if appropriate) is required before the proposal goes ahead.

There is an existing assessment bilateral agreement in place for NSW[4]. This only covers major projects where the NSW Government is the consent authority as it is an agreement between the NSW and Australian governments[5].

4.5.2 Native Title Act 1993

Section 3 of the *Native Title Act 1993* sets out the main objects of the Act, these being:

- To provide for the recognition and protection of Native Title

[3] https://www.dcceew.gov.au/environment/epbc/bilateral-agreements
[4] https://www.dcceew.gov.au/environment/epbc/bilateral-agreements/nsw
[5] https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/assessment-bilateral-agreement

- To establish ways in which future dealings affecting Native Title may proceed and to set standards for those dealings
- To establish a mechanism for determining claims to Native Title
- To provide for, or permit, the validation of past acts, and intermediate period acts, invalidated because of the existence of Native Title.

Native Title may be claimed in areas such as[6]:

- Vacant (or unallocated) Crown land
- Parks and public reserves
- Beaches
- Some leases (such as non-exclusive pastoral leases)
- Land held by government agencies
- Some land held for Aboriginal and Torres Strait Islander communities
- Oceans, seas, reefs, lakes, rivers, creeks, and other waters that are not privately owned.

Native Title rights cannot be claimed in relation to minerals, gas, or petroleum under Australian law. Native Title in tidal and sea areas can only be of a non-exclusive nature, as exclusive Native Title is considered inconsistent with other common law rights regarding marine access and navigation.

An ILUA was entered between the Gundungurra People, Gundungurra Tribal Council Aboriginal Corporation, Gundungurra Aboriginal Heritage Association Inc. and various NSW Government agencies in February 2015. The ILUA includes the 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 has been undertaken with this committee as part of the Proposal development.

4.5.3 Australian and Torres Strait Islander Heritage Protection Act 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* protects objects and places within Australia which are of particular significance to Aboriginal persons in accordance with their traditions. The Minister is able to make declarations regarding such objects and places.

An application[7] was made under section 10 of the Act on 28 January 2021 for the long term preservation and protection of a significant Aboriginal area (the Burragorang Valley), near Warragamba, New South Wales. Warragamba Dam and the downstream operational proposal area sit outside of the area subject to the application.

[6] https://nativetitle.org.au/learn/native-title-and-pbcs/native-title-rights-and-interests#:~:text=The%20Native%20Title%20Act%201993,their%20traditional%20laws%20and%20customs

[7] https://www.legislation.gov.au/Details/C2021G00074

5 Community engagement

5.1 Prior engagement

The proposal to install infrastructure at Warragamba Dam to enable environmental flows has been ongoing since the development of the Metropolitan Water Plan in 2004. There has been extensive consultation both with the community and across Government to increase awareness of the environmental flows proposal and understand community and stakeholder attitudes, issues and concerns. The environmental flows proposal is aligned to a number of key NSW Government and national acts, policies and plans in relation to supporting and investing in a better environment and improving waterway health.

Development of these metropolitan water strategies provided prior engagement with the community including through the 2017 Metropolitan Water Plan which was replaced in 2022 by the *Greater Sydney Water Strategy* which was subject to a public exhibition process. The environmental flows proposal supports Priority 4 (Our waterways and landscapes are healthy) of the Strategy and is consistent with Action 4.1 *Maintain and improve ecosystem health* which sits under Priority 4.

More recently the environmental flows infrastructure was included as a component of the design for the WDR Project for design and cost efficiency. The construction of this infrastructure was also included in the Critical SSI declaration for the WDR Project as:

> *the construction of an upstream multi-level intake and downstream valve house using existing pipe infrastructure to facilitate environmental flows.*

The environmental flows infrastructure was described in Section 5.2.6 of the WDR EIS which included:

- A multi-level offtake tower on the upstream face of the dam wall to draw water from Lake Burragorang
- The use of an existing pipeline, formerly for the HEPS, to transfer the water to a valve house
- A new valve house, downstream of the existing HEPS, to discharge water into the river (Note: after the EIS was displayed the environmental flows infrastructure was optimised enabling the valve house to be removed and valving to be installed inside the HEPS)

The EIS was placed on public exhibition from 29 September 2021 to 19 December 2021 inclusive. In May 2023 the WDR Project was cancelled by the NSW Government.

5.2 Stakeholder and community views

The environmental flows infrastructure component of the WDR Project received limited feedback from stakeholders or the community given it was within the context of the larger WDR Project.

Reference to environmental flows was made in some public submissions in the context of the WDR Project would reduce water flow in the downstream river systems affecting ecosystems and would reduce environmental flows.

Noting the public interest in the WDR Project, it is anticipated there would remain a level of community interest in the proposal.

5.3 Proposal specific engagement

WaterNSW has previously introduced the proposal to DPHI and presented to a briefing workshop with relevant government agencies including:

- NSW DCCEEW – Water Planning, Biodiversity Conservation and Science, Water Assessments, Floodplain Management
- NSW Department of Primary Industries (DPI) Fisheries
- NSW DPI Agriculture
- Heritage NSW
- NSW Environment Protection Authority (EPA)

- NSW National Parks and Wildlife Service (NPWS)
- Commonwealth DCCEEW

WaterNSW regularly consults with the Gundungurra Aboriginal Heritage Association as part of the ongoing ILUA consultative process. WaterNSW provided an overview of the proposed environmental flow infrastructure and operations to members of the Gundungurra committee at the December 2023 ILUA meeting.

5.3.1 Engagement in preparation of EIS

Engagement would be undertaken with relevant stakeholders for the proposal including but not limited to:

- Local councils – Wollondilly Shire Council, Penrith City Council, Hawkesbury City Council
- Relevant NSW government agencies
- Commonwealth DCCEEW
- Broadscale community awareness raising.

The method of engagement will be tailored and appropriate to the stakeholder group involved and information sought.

5.3.2 Public exhibition of EIS

The EIS would be placed on public exhibition with feedback invited, the duration of which will be advised by DPHI with the SEARs, but would be for a minimum of 28 days as required under the EP&A Regulation.

The details of the public exhibition will be notified in local newspapers (where relevant) and on the NSW Planning Portal.

Potential community engagement for the EIS would comprise a range of activities and methods, depending on community interest in the proposal.

Community submissions to the EIS will be invited.

5.3.3 Post-public exhibition of EIS

Following the public exhibition of the EIS, all submissions made will be considered and a response to submissions report prepared. This would be submitted to DPHI.

6 Proposed assessment of impacts

6.1 Overview

A preliminary environmental assessment has been undertaken based on the details provided in Section 3 for the proposed works, and with reference to previous assessments undertaken for works at the dam including the WDR proposal and the South Creek Advanced Water Recycling Centre. This has been informed by a site visit on 11 July 2023 to view the locations and context of the environmental flows infrastructure elements and their locations within the existing dam.

It is noted that the operation of the environmental flows releases, per the history of investigations and the outcomes sought for environmental flows generally and the Warragamba, Nepean and Hawkesbury river systems specifically, will have positive outcomes for river health, the health of dependant aquatic and riparian species and ecosystems, and these environmental flows would remain within the river channel.

The assessment of environmental impacts is anticipated to be mainly associated with the construction phase of the proposal. The operational impacts of the environmental flow releases below the dam wall will be limited in scale as the flows will be contained within the existing river channel, having no direct external deleterious impacts.

Identification and characterisation of environmental matters of likely and potential relevance for this proposal has referenced *State significant infrastructure guidelines – preparing a scoping report* (DPIE 2022) and particularly Appendix D – levels of assessment. This has also been informed by the detailed recent investigations that informed the WDR Project EIS which provides a significant amount of relevant information, particularly with regard to construction activities at the dam site.

As described in Section 3, construction activities will be confined to WaterNSW property within the Warragamba Dam precinct. Operation of the environmental flows infrastructure is expected to deliver positive outcomes similar to those observed for environmental flows in the Nepean River system (Krogh and Keenan 2023). Accordingly, it is considered that:

- The proposal is unlikely to result in significant impacts to the receiving environment (including cumulative impacts)
- There is a good understanding of likely and potential impacts associated with the proposal. These being well understood, relatively easy to predict using standard methods, and capable of being effectively mitigated to comply with relevant standards or performance measures
- Assessment of the proposal is unlikely to involve any significant uncertainties or require any detailed cumulative impact assessment.

Accordingly, it is not proposed to carry out any detailed assessments for the proposal, and consideration of the following matters would be through a standard EIS assessment:

- Access – Traffic and parking, Access to property (construction / non-public)
- Air – Particulate matter and emissions
- Amenity – Noise and vibration, Visual
- Biodiversity – Aquatic, Terrestrial
- Built environment - Public land and infrastructure
- Social and economic
- Aboriginal heritage
- Historic (built) heritage
- Natural heritage / protected areas
- Hazards and risks – Contaminated or hazardous materials, Waste management

- Water quality – upstream and downstream.

6.2 Access – traffic and parking (public)

6.2.1 Existing environment

The local road network around Warragamba Dam is shown on Figure 6-1.

Surrounding area

The Warragamba Dam precinct (the precinct) is accessed from Farnsworth Avenue or Warradale Road off Silverdale Road. Both roads connect to Production Avenue. Production Avenue skirts the Warragamba township and provides a route to access industrial and some commercial areas. Production Avenue continues into the precinct providing access to the public areas of the precinct. Outside of the precinct, Production Avenue is a two-lane road, partial kerb and gutter, with some driveway and sideroads along its length.

Within Warragamba township are local and residential streets used by private and commercial vehicles between homes, key destinations in the town centre and connecting to the surrounding area. Two bus services run along Weir Road, and other key streets, to connect the town with Penrith and Camden.

In the surrounding area, there is a new residential subdivision planned to the south of Warragamba (township) and west of Silverdale, with this development in progress.

Warragamba Dam Precinct, vehicle access, traffic and parking

Public access to the precinct is only permitted during the property opening hours, typically 8am to 5pm. The main security gate is closed to enforce those hours.

Production Avenue formally enters the precinct at the security office and gated entry point.

Farnsworth Avenue leads off Production Avenue providing the public route around parts of the precinct. A side street off Farnsworth Avenue loops around to the north providing one-way access to the visitors centre and around Haviland Park and also to the south providing access to a car park and amenity area. These roadways provide the key access to much of the publicly accessible areas of the precinct.

Other local internal streets, including Twenty Third Street, come off Production Avenue. Vehicles may also enter the precinct to access the built properties off Twenty Fourth Street, which includes the (non-operational) Warragamba Conference Centre.

Visitor parking is provided for cars and coaches at various locations within the precinct, including dedicated car parks and roadside parking. Dedicated public parking areas are carpark 1 south of Haviland Park, and carpark 2 mid way along Haviland Park, roadside car and bus parking up to and drop off area in front of the visitor centre.

Commercial vehicles with goods and materials for the dam, ranging from supplies for the visitor centre and trades and equipment for the operation of the dam also attend the precinct. In some cases, this access may be required outside of the standard (public) open hours.

Figure 6-1 Local road network

Emergency vehicles may need to enter the precinct and be able to access all areas in those situations. There is a helicopter landing area at the flat area to the left of the entrance gate that may be used for emergency evacuations by air.

Pedestrian traffic and access

Pedestrians move between the parking areas, the key destinations such as within the grassed open space of Haviland Park and the terrace, the visitor centre and amenities, and also generally walk around the precinct within the publicly accessible areas.

Pedestrians are of varying mobility level, social background, ages and may be individuals through to groups.

Public vehicles are restricted from some areas within the precinct. This restriction may be permanent such as to the dam crest and working areas below the dam wall, be periodic such as weekend / public holiday access or as required such as along Twenty-Third Street. These restricted areas are associated with the working areas of the dam.

6.2.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Traffic control of private and commercial vehicles to avoid construction laydown areas.
- Ensure continued restrictions (pedestrian and vehicle) from public access to key areas. Potential new restrictions would be required to protect construction sites and support areas
- Any oversize loads for material delivery to use the road around the industrial park to Production Avenue
- Continued emergency services access, including an alternative site for helicopter landings and access for emergency road vehicles
- One-way route off Farnsworth Avenue in vicinity of Visitors Centre and Haviland Park
- Pedestrians, comprising different age, mobility, safety awareness, site familiarity (e.g. wheelchairs, mobility aids and prams), as individuals to large groups.

6.2.3 Method of assessment

Undertake a traffic and transport impact assessment that will consider:

- Public access to and movements within the precinct as currently occurring
- Modification or exclusions of currently accessible areas to enable for construction traffic and works and alternative arrangements as required
- Parking arrangements and provision
- Pedestrian movement paths (origin-route-destination)
- Ensure safety and protection of all public and construction traffic and pedestrians
- Road network connectivity safety considerations.

6.3 Access – Access to property (construction / non-public)

6.3.1 Existing environment

Locally, the Warragamba Dam is accessed off Production Avenue. Production Avenue continues into the precinct through the main gate that is access controlled.

Within the precinct, there are several roadways and parking areas leading off Farnsworth Avenue and Production Avenue that are restricted in access to WaterNSW or other personnel and vehicles only. These roadways provide access to the operational areas of the property and may be used by private commercial / trade and construction vehicles. Access is controlled by boom gates and locked gates along roadways. Pedestrian access is restricted by fencing and signposts.

Outside the dam precinct, Production Avenue skirts the Warragamba township and provides a route to access industrial and some commercial areas. This avenue is a two-lane road, partial kerb and gutter, with some driveway and sideroads along its length, and connects to the main roads of Farnsworth Avenue and Warradale Road.

Regionally, Farnsworth Avenue and Warradale Road intersect with Silverdale Road. Heading north, Silverdale Road intersects with Greendale Road / Mulgoa Road which runs roughly north-south to connect with the M4 Western Motorway at Regentville in the north and with The Northern Road to the south. Continuing east, Silverdale Road becomes Park Road and connects to The Northern Road at Luddenham. Heading south, Silverdale Road intersects with other several minor roads with provide access to the Northern Road, the Old Hume Highway and the M31 Hume Motorway at Bringelly, Oran Park and Camden.

6.3.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Movement between laydown areas and work sites, related safety aspects for public (such as use of laydown area 3, methods of exclusion) and commercial / trade vehicles
- Pavement strength and condition of internal (within dam precinct) and external roadways and any upgrades to roadways required to support construction traffic (movement numbers and loadings)
- Partial loss of the crest roadway while used as a diver worksite and support area, and associated requirements for traffic management on the roadway and any impact on maintenance activities (schedules and methods) for the operational dam
- Use of internal roadways by construction vehicles, and the safety and management requirements with respect of other (public) vehicles and pedestrians
- Use of boat ramp that will provide access across the lake to intake tower site including the use of the roadway off Twenty-third / Twenty-fourth streets to access the boat ramp
- Use of access track and boat ramp (off Valvehouse Road) to access Warragamba River and the outlet site
- Risk of collision with native animals such as kangaroos, wallabies and wombats within the precinct and surrounding areas particularly around dawn and dusk.

6.3.3 Method of assessment

Undertake a traffic and transport impact assessment that will consider:

- Construction related vehicle access and movements within the site including routes, stopping and turning areas, destination accessibility requirements, and parking requirements
- Traffic control measures required to safely separate construction and non-construction traffic within the precinct
- Routes for construction vehicles to access the dam precinct (regional movement) for minimal local and regional impact and any alternative arrangements required.

Undertake a pavement / condition assessment of all internal tracks, roadways and boat ramps, and to identify any upgrades that may be required to support construction vehicle access requirements.

6.4 Air – Particulate matter and emissions

6.4.1 Existing environment

Sources / activities

The proposal site is located to the west of Warragamba township, with protected natural environments to the north, south and west. Warragamba and Silverdale to the south include some small-scale industrial sites, as well as roads, that would likely affect local air quality.

The proposal site is on the semi-rural outskirts of Greater Sydney, but with several smaller towns and urban centres in the surrounding area before the more urban areas of the metropolitan area. The nearest major road is The Northern Road approximately eight kilometres (direct) east of the dam site.

Receptors

The dam precinct includes the visitors centre and green spaces that may be used by vulnerable groups / sensitive receivers such as school children and the elderly, individually or in groups.

The Warragamba township, lying within one kilometre east of the proposal site, contains sensitive receptors of private residences, Warragamba Public School, and a neighbourhood centre.

Monitoring

There are no NSW Government air quality monitoring sites in the immediate vicinity of the proposal site. The nearest sites are in Bringelly and St Marys, on the edge of the Sydney metropolitan urban area. These monitoring sites are located in residential areas and in proximity to key roads. The air quality measured at these sites will therefore be affected by the urban surrounds and the emissions from vehicles on the nearby major roads.

6.4.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Use of vehicles plant and equipment that will produce emissions and particulate
- Internal demolition works and removal of plant and equipment that could produce dust and particulates if not appropriately contained within the structure, some of which may be potentially hazardous.

6.4.3 Method of assessment

An air quality assessment will be required for the construction of the proposal in accordance with relevant guidelines and criteria which includes:

- Identify sensitive receivers and environments
- Establish base line air quality
- Identify emission and particulate matter generation
- Assess the impact on air quality and to sensitive receivers
- The assessment will need to address in particular the demolition works within the HEPS and the refurbishment of the penstock, each involving hazardous materials in confined spaces potentially resulting in locally elevated concentrations of emissions and / or particulate matter.

6.5 Amenity – Noise and vibration

6.5.1 Existing environment

Sources of noise

Roadways within the precinct are used by private vehicles, coaches, commercial vehicles (such as providing goods and services to the visitors centre) and trade vehicles as required.

The operation and maintenance requirements for the dam infrastructure and for the precinct provide a source of noise of varying type characteristics and duration.

The Warragamba township includes some small-scale industrial sites, as well as roads, that would likely affect local noise generation. There is anticipated to be commonalities in the time of day, characteristics of the noise, for these sources. Development works for any site in or around the town would also generate noise, including the new residential subdivisions to the south of Warragamba township. The forested areas surrounding the town and between the town and the Warragamba Dam site may influence ground level noise propagation.

Approximately three kilometres to the north-east of the dam is a quarry surrounded by vegetation. Noise and vibration are anticipated to be generated at this site, the impacts of which may be mitigated by the location at distance from shared sensitive receivers. No other mine or quarry sites have been identified in the vicinity.

Noise may also be experienced from overhead sources, such as light fixed wing aircraft, helicopters, and commercial aircraft (passenger and freight) at higher altitudes. Light aircraft are likely to be occasional and variable in occurrence and impact. The landing field within the precinct is used on occasion by helicopter craft such as for emergency evacuations. The recent released aircraft overflight noise tool for the new Western Sydney (Nancy Bird Walton) Airport[8] shows draft flight paths as affecting areas around the dam and Warragamba township but not directly overflying. The N70 noise map of noise levels above 70 decibels for a 24-hour period shows that the Warragamba township or immediate surrounds are not affected (Australian Government DITRDCA 2023). The N60 noise map is shown to affect a larger area to the east and south but does not affect the Warragamba township or its immediate surrounds.

Receptors

The proposal site is in the semi-rural outskirts of Sydney with protected natural environments to the north, south and west.

Within one kilometre of the proposal site, the Warragamba township, east of the proposal site, contains sensitive receptors of private residences, Warragamba Public School, and a neighbourhood centre.

The Dam precinct includes the visitors centre and parklands that may be used by vulnerable groups such as school children and the elderly, individually or in groups.

Noise monitoring

No existing general noise monitoring locations have been identified in the vicinity of the dam or for roads in the surrounding region.

6.5.2 Matters for consideration

The background noise levels for the site will be a factor of the rural / natural setting.

The area affected by noise and vibration from the construction works will be limited in extent with much of the work being undertaken within existing structures.

6.5.3 Method of assessment

Undertake a construction noise and vibration assessment that includes:

- Undertake a baseline (existing) background noise assessment or confirm if a previously undertaken background noise study is suitable to use
- Identify sensitive receivers
- Assess the noise that may be generated in the construction phase at different stages of works across times and days
- Assess the vibration that may be generated in the construction phases at different stages of works across times and days
- Determine noise / vibration exposure for sensitive receivers.

[8] https://www.wsiflightpaths.gov.au/

6.6 Amenity – Visual

6.6.1 Existing environment

The Warragamba Dam site comprises two contrasting visual scenes, being the:

- Constructed and modified elements of the dam wall and spillway concrete structure with associated super structures, the smaller elements and buildings including the valve house, HEPS, visitor centre building, the green spaces within the precinct including Haviland Park and terraced gardens, and the various roadways.
- Natural vista of the densely vegetated rugged gorge downstream and upstream, Lake Burragorang, the downstream waterway and bed of the Warragamba River, and exposed (notably sandstone) rock. Much of this vista is protected by the natural heritage and national park listings, as well as measures to protect the quality of the water catchment as part of the Sydney water supply resource and the dam infrastructure.

  The attributes of the natural vista can change with the water level of the lake and associated extent of exposed rock face, while for the downstream channel the amount of water present will vary across periods of drought to those of higher or regular rainfall, with subsequent impacts on the visual health and vitality of vegetation.

6.6.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Previous temporary and permanent changes in visual amenity (associated with past construction projects) that have resulted in the existing constructed scene of the dam precinct.
- Minor changes in visual appearance at the dam wall associated with the new intake structure.

As described in Section 1.3.4, downstream the environmental flow releases will be contained within banks and it is anticipated that there would be negligible direct or indirect visual impacts associated with these.

6.6.3 Method of assessment

Provide a visual impact assessment that will cover the new structures as part of the existing dam structure, address post-works remediation and improvement works and consider the construction works at different stages or timings.

6.7 Biodiversity – Aquatic

6.7.1 Existing environment

The intake tower component of the infrastructure will be installed against the upstream face of the dam between RL 80.75 and 130.47 metres Australian Height Datum (AHD). The proposal will require demolition of some of the existing concrete structure that surrounds the existing HEPS intake and gate. The waters in this location are likely to be considered Moderate to Minimally sensitive under the *Policy and Guideline for Fish Habitat Conservation and Management* (DPI 2013). The lower part of the water column at this location may be de-oxygenated, while shallower waters near the wall lack complex structures offering fish habitat.

As of August 2023, DPI threatened freshwater species mapping[9] has not changed since investigations were done for the WDR Project. The only species habitat mapped at and near the proposal site is the Macquarie Perch, which is indicated in the waters of Lake Burragorang and its tributaries, the Warragamba River below the spillway and in the Nepean River as far as the Grose River confluence. This species like all other threatened aquatic species with a potential to occur in the environment upstream of the dam only has important breeding habitat in flowing (lotic) environments. There are no anticipated impacts to the tributaries of Lake Burragorang.

[9] https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal

Downstream of the dam

The findings of the previous studies for the WDR Project found the riverine environment in the weir pool immediately downstream of the dam, to be highly modified and does not support extensive native aquatic macrophyte beds or habitat for threatened aquatic species. This area is clearly subjected to a high degree of anthropogenic disturbance including negligible flows for extended periods and transient episodes of extreme flow during dam spill over events. Despite the presence of the dam wall, this section provides fish passage for two species of freshwater eels (*Anguilla* species) into and out of Lake Burragorang (WaterNSW 2018).

The tidal limit in the Hawkesbury River occurs at Yarramundi, approximately 140 kilometres upstream of the river mouth.

The Warragamba River and sections of the Nepean River are important fish habitat and mapped habitat for Macquarie Perch. The Australian Grayling (*Prototroctes maraena*) remains listed in a current search of the Protected Matters Search Tool as likely to be present in the Warragamba River downstream of the dam and in the upper Nepean River.

6.7.2 Matters for consideration

The benefits of environmental flows are identified in the study undertaken by DPE Water (Krogh and Keenan 2023) which examined changes in water quality in the Nepean River since 2010. This identified that environmental flows had contributed to an improvement in water quality in the Nepean River, particularly regarding pH and salinity. Nutrients were also observed to have decreased at monitoring sites in the upper reaches of the river. Similar benefits would be expected from improved operational flexibility of environmental flows from Warragamba Dam.

There is an assumption that the operational environmental flows facilitated by the proposal will have ecological benefits, or at very least have minimal ecological impacts in comparison to the status quo. The reasoning being that, the new environmental flows will:

- Have a greater range of flow rate options which will better reflect natural inflows to the dam
- Have greater control over the depth at which water is drawn from (thereby reducing cold water pollution).

There is a small tributary on the left bank downstream of the dam that is utilised by eels moving upstream and downstream of the dam. Works below the spillway may require construction of a small coffer dam directly around the downstream end of the HEPS. The location of the temporary coffer dam would be immediately around the outlet end of the HEP's and not across the full width of the river directly below the dissipator. This will allow the spillway and dissipator to operate as intended. As such, it is considered unlikely that construction activities would present a temporary barrier to fish passage. Operation of the proposal would not introduce any new barriers to fish passage.

Any potential construction impacts within Lake Burragorang, such as turbidity, would only be associated from installation of the intake tower on the upstream face. This activity will be contained and very localised and minor disturbance, if any, will rapidly dissipate when considering the size of Lake Burragorang.

The anticipated operational improvements in water quality, flow characteristics and stream health from the release of environmental flows will provide benefits for downstream aquatic biodiversity.

6.7.3 Method of assessment

Undertake an aquatic biodiversity assessment comprising:

- Review of listings for relevant threatened species under the NSW *Fisheries Management Act 1994* and the EPBC Act
- Aquatic habitat assessment in line with DPI permit requirements
- Detailed threatened species assessment in accordance with relevant guidelines.

6.8 Biodiversity – Terrestrial

6.8.1 Existing environment

Warragamba Dam locality

There is negligible native flora and fauna habitat on the structures to be modified on the existing built infrastructure of Warragamba Dam, including the dam wall, dissipator pool and HEPS building. The construction phase will utilise existing cleared areas of parkland or hard surfaces around the dam mainly for vehicle movements and the laydown of materials and equipment. Some of these areas may adjoin native vegetation, but no clearing or disturbance of vegetation or significant indirect impacts are required.

No threatened fauna species are anticipated to use the existing human-made landscape elements for movement and those that may occupy the proposal areas on occasion are not anticipated to have abundance impacted.

No areas within the proposal site location boundary are identified on the NSW Biodiversity Values Map as at 27 July 2023.

NSW has recently adopted new State-wide Vegetation Type Mapping (SVTM) and introduced the new Eastern Plant Community Types (PCTs). The mapped distribution of PCTs at the dam site are shown on Figure 6-2 and is based on the new SVTM.

Downstream

Vegetation and habitat across downstream sections of the Warragamba/Nepean/Hawkesbury river vary significantly in structure, floristics, and condition. Within the Cumberland lowlands, much of the vegetation has been subject to clearing and disturbance due to historical land use practices such as agriculture and, more recently, urban development. Consequently, most of the intact native vegetation is found within national parks, conservation reserves, council managed land and small remnant patches in farm paddocks. Approximately 73% of the study area has been previously cleared, disturbed or dominated by exotic vegetation.

Most of the remaining native vegetation on the Cumberland Plain is listed as a threatened ecological community (TEC) under State and Commonwealth legislation. Much of this vegetation shows evidence of disturbance, such as weed invasion, resulting in alterations to vegetation structure and floristics. However, more intact areas exist in small pockets. Vegetation communities on the Cumberland Plain are primarily driven by substrate and landform / drainage patterns and generally include:

- Grassy woodlands dominated by *Eucalyptus tereticornis* and *Eucalyptus moluccana* occur on clay substrates on rolling hills above the water table
- Castlereagh woodland communities occur on tertiary alluvium soil landscapes of varying drainage
- River-flat forests occur on alluvial soils adjacent to creek lines
- Banksia-dominated heath communities occurring on small pockets of aeolian sands, which are typical of coastal areas
- Dry rainforest occurs in gullies, however, much of this vegetation type has now been cleared.

As the landscape rises towards the Hornsby Plateau and Blue Mountains Plateau, transitional communities such as Shale-Sandstone Transition Forest and Sydney Turpentine-Ironbark Forest are found on transitional soils where Wianamatta shale grades into Hawkesbury Sandstone. These communities contain a mix of species typically found on either sandstone substrates or clay substrates.

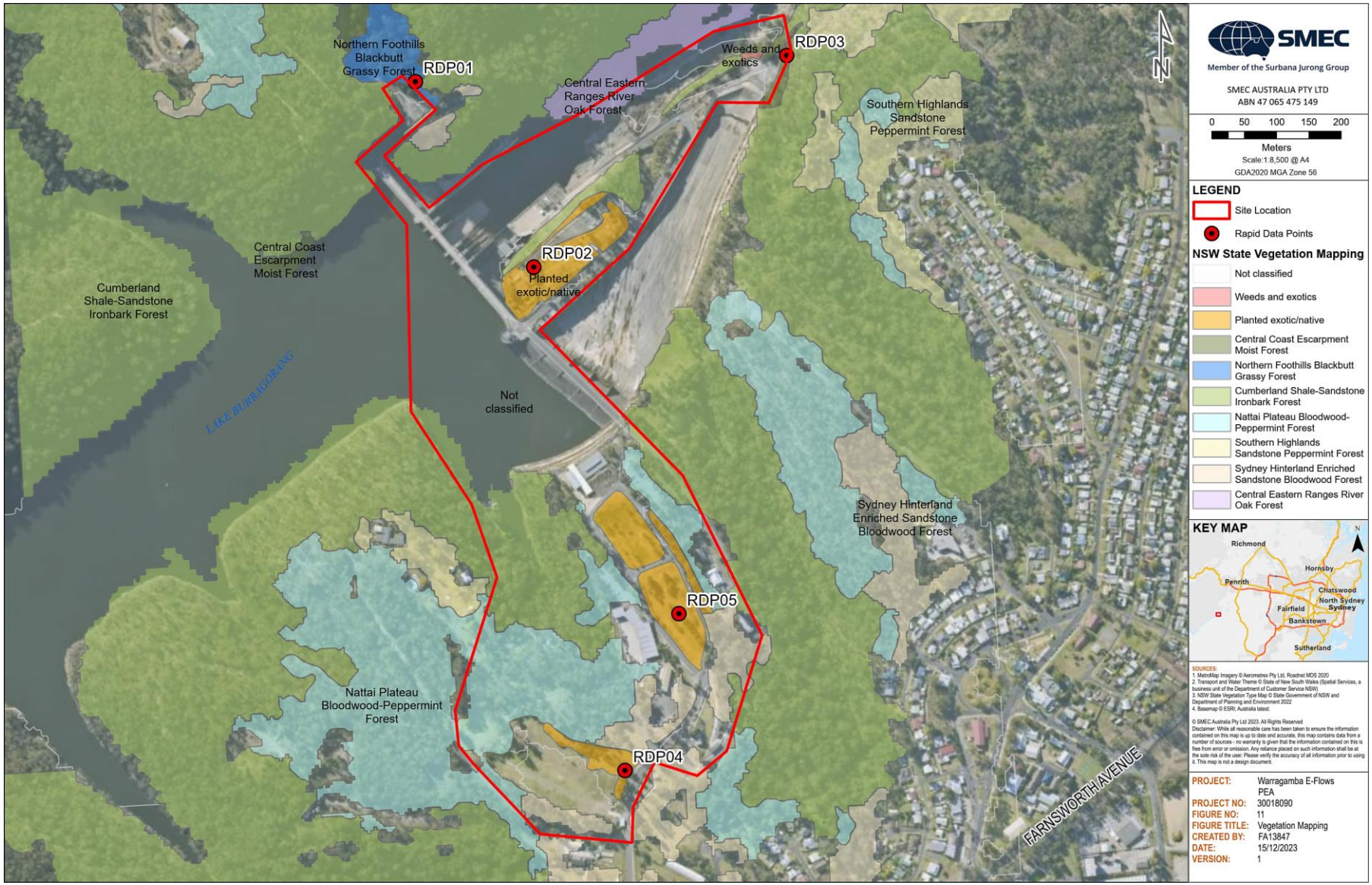

Figure 6-2 Plant community types in and around the proposal construction area

The composition and structure of these communities can differ significantly depending on the proportions of clay-sandstone in the area:

- Where the landscape is comprised of sandstone: sandstone heath, woodland, and forest communities are present and species composition and structure are driven by exposure, aspect and landscape position
- Sheltered forests typically occur on south facing slopes and within gullies
- Woodland and heath generally occur closer or on top of ridges where the soils are shallow and the landscape position more exposed.

The Hawkesbury-Nepean catchment supports a substantial range of fauna species and exhibits some of the highest levels of species diversity in Australia, largely due to the variety of rock types, topography and climates in the region. The broad fauna habitat types of grassland, riparian, and woodland and forest found within the study area are representative of the broad habitat types within the surrounding region. Many of these habitats, particularly on the floodplain, have been extensively cleared or modified for agriculture.

In intact vegetated areas, habitat is provided by woodland, forest and heath communities. Where habitats have been modified or disturbed, a range of native and naturalised perennial grasses and forbs are generally present. The grass and forb dominated groundcover includes log and stump cover that provides habitat for grassland mammals (small and large), birds and terrestrial reptile species. The highly scattered trees throughout grasslands provide potential nesting, roosting and perching habitat for bird species, roosting habitat for some micro-bat species and shade for larger grazing mammal species.

Threatened ecological communities occurring downstream (refer Figure 6-3) include:

- Cumberland Plain Woodland in the Sydney Basin Bioregion
- Moist Shale Woodland in the Sydney Basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Shale Gravel Transition Forest in the Sydney Basin Bioregion
- Sydney Turpentine Ironbark Forest in the Sydney Basin Bioregion.

The downstream study area for the current proposal will be constrained to existing riparian zones as the proposed environmental flow releases will not exceed bank-full capacity and are not made during flood operations. The WDR Project EIS identified 46 threatened species (including migratory species) occurring in the much broader downstream project study area (defined by the existing Probable Maximum Flood).

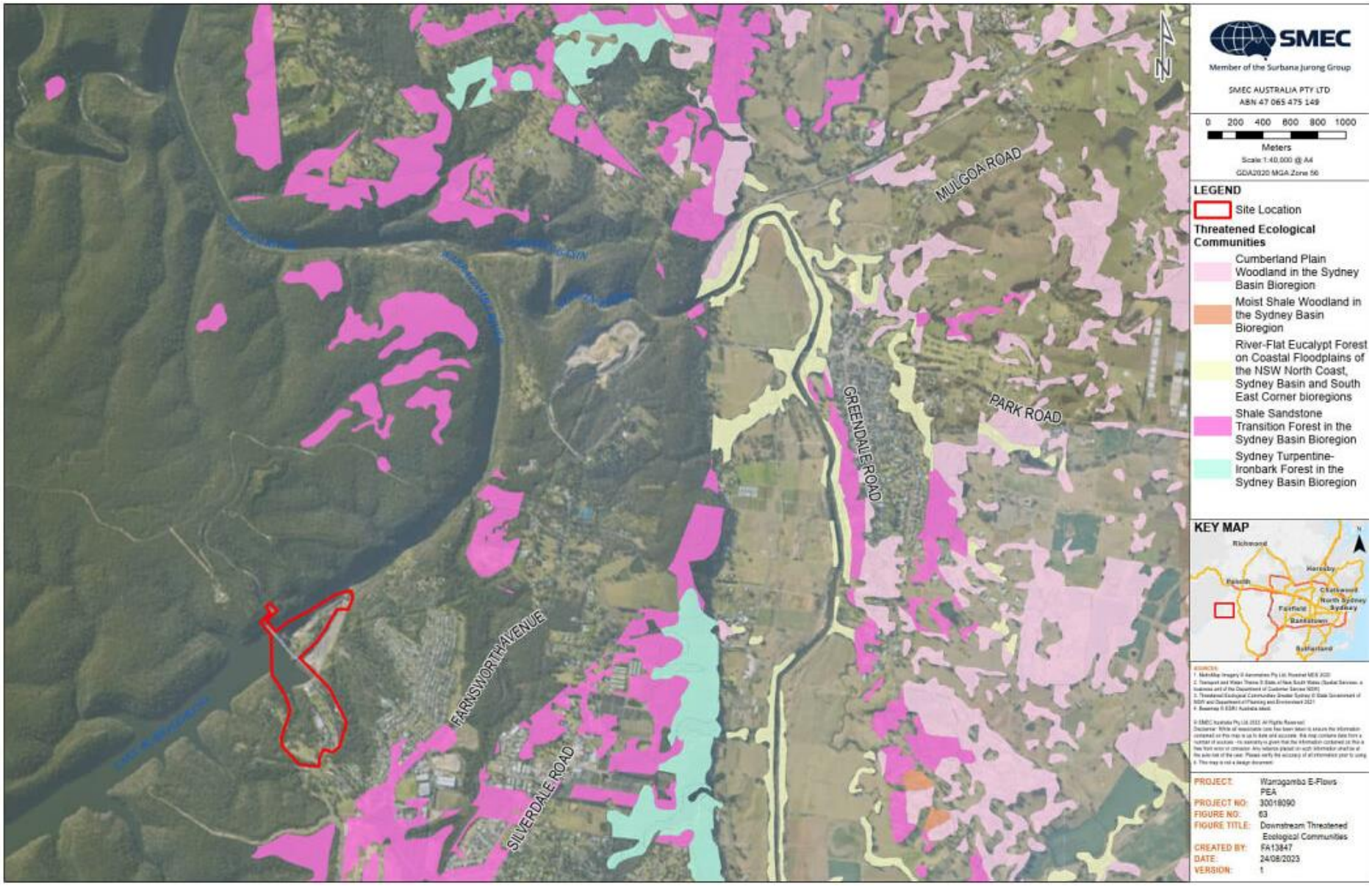

Figure 6-3 Downstream threatened ecological communities

6.8.2 Matters for consideration

Warragamba Dam locality

PCT 3321: Cumberland Shale-Sandstone Ironbark Forest is considered equivalent to the threatened ecological community Shale Sandstone Transition Forest in the Sydney Basin Bioregion, Listed as Critically endangered under both the NSW BC Act and EPBC Act. One potential laydown area is in the "Terraced Gardens" below the dam wall is indicated on the current SVTM mapping as PCT 3321. From the preliminary site inspection, this area was found to be non-native vegetation consisting of managed exotic lawn, and non-locally indigenous plantings (Figure 6-4).

A ground survey undertaken in October 2023 considered the potential PCT 3321 to the north-west of laydown area 1. However, this could not be confirmed due to the steep rocky terrain, but its presence appears unlikely from distant observation. Direct and indirect impacts to vegetation in that area are considered negligible due to the topography and use of the adjacent carpark.

Vegetation adjacent to laydown areas 1 and 2 are noted as affected by weed species. Large trees on the flat are non-local Lemon Scented Gums (*Corymbia citriodora*).

Figure 6-4 Non-native vegetation mapped as PCT 3321 at the Terrace Gardens.

Laydown area 3 also comprises non-native lawns with some adjacent areas of native planted vegetation including trees at the northern portion of the site. This northern portion is of steeper terrain and therefore of limited suitability to support construction activities. The communities adjacent to this location not associated with TECs would not be cleared.

Without native vegetation clearing expected there is little scope to consider habitat present for threatened flora or fauna under the BC Act or entities listed as MNES. Consideration must be given to potential habitat in man-made structures, or non-native vegetation. From preliminary survey, important habitat offered by these sources is unlikely.

The proposed laydown areas are assessed as providing few habitat features for threatened fauna. These features being isolated trees providing foraging habitat and tree hollows (in trees overhanging laydown area 2) and cliffs and caves features some of which are associated with past excavations.

As the construction does not require tree clearing, impacts on threatened fauna species would be negligible to nil. The works may increase noise and vibration, largely within the existing operational areas of the dam.

Downstream

Downstream, the environmental flows would be contained within the existing river channel and are designed to mimic the natural river flows as if the dam as a barrier did not exist. Accordingly, no material impacts to terrestrial ecology values sites downstream of the dam attributable to the environmental flow releases are anticipated as the flows will better reflect natural variability and will be contained within the existing river bank.

Over the longer term, it is anticipated that there may be benefits to the downstream riparian environment associated with greater variability in environmental flow releases. However, given that the environmental flows would be contained within the existing river channel and are anticipated to be consistent with and not exceed flows associated with existing dam operations, any such effects are anticipated to be minimal, particularly in the context of other downstream influences such as tidal cycles, low flow contributions from other catchments and contributions from other sources such as wastewater treatment plant discharges and other rivers downstream of the dam.

6.8.3 Method of assessment

Prepare a Biodiversity Development Assessment Report (BDAR) in accordance with BAM requirements within SEARs that includes:

- Mapping and quantification under the definitions under the NSW BC Act of the extent of native vegetation to potentially be impacted
- Desktop research for updates to the NSW Biodiversity Values Map
- Survey and review of potential listings of NSW threatened entities and under the MNES.

6.9 Built environment – Public land and infrastructure

6.9.1 Existing environment

The Warragamba Dam precinct is located within the Wollondilly Shire Council LGA and is covered by the Wollondilly LEP.

Under the Wollondilly LEP, Warragamba Dam, Lake Burragorang and the dam precinct are zoned as SP2 Water Supply System. This zoning is to provide for infrastructure and related uses, and to prevent development incompatible with or that may detract provision of that infrastructure use. WaterNSW is responsible for the land of the Warragamba Dam property, being a public authority responsible for this public infrastructure.

The grounds of the dam have undergone significant development in the past with the original construction of the dam and the construction of the auxiliary spillway (in an area that was formerly a vegetated river gorge wall) and the rebuilding of the visitor centre precinct. These construction works were enabled by support areas, notably of which includes the former construction housing estate (adjacent to the main security gate), later cleared of houses for use as a laydown area for the auxiliary spillway works, and also changed in landform by application of fill to create the existing greenspace.

Outside the precinct, land from the east to south associated with the Warragamba township is zoned R2 Low Density Residential, some of which is not yet developed, E1 Local Centre, E4 General Industrial, and RE1 Public Recreation and RE2 Private Recreational.

6.9.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- The land use zoning of the land which provides for infrastructure uses and activities and that do not detract from the water supply function

- The existing and long standing use of the proposal site for water supply and related activities
- The temporary nature of the construction activities including use of laydown areas and office site.

6.9.3 Method of assessment

Undertake an assessment that includes:

- Identification of areas of previous use and disturbance within proposal site
- Identification of details of that use and remediation activities undertaken
- How the proposal may affect these areas and the current land use.

6.10 Social and economic

6.10.1 Existing environment

The proposal site is in the vicinity of the Warragamba Dam visitors centre, and the grounds which are used for picnics, family events, and general recreation.

Local community comprises the centres of Warragamba and Silverdale within the Wollondilly LGA. The key socio-economic factors for this local community are:

- Infrastructure zoning around the proposal site, zoning in the surrounding area is being residential (associated with Warragamba township) recreational and environmental conservation (associated with the national park and world herniate areas)
- Land use is predominantly environmental values, agricultural and urban types
- Warragamba (suburb and localities) has a population of 1,202 people (ABS 2021 census). The percentage of indigenous people in Warragamba was recorded at 8.9% which is higher than Greater Sydney (at 1.7%). The highest education attainment levels in Warragamba are (each for over 10% of the population) for Certificate III level, Year 10, Year 12 or year 9 and below. Compared to the highest education attainment for the Greater Sydney area (each for over 10% of the population) as being: Batchelor degree and above, and Year 12 (ABS 2021 census)
- For the Warragamba locality over 60% of the labour force work full time, the occupations with the higher proportions of workers being technicians and trades, machinery operators, labourers, personal / community works and clerical / administrative workers (ABS 2021 census)
- Housing for the Warragamba locality is dominated by separate houses at over 97% of all housing types (ABS 2021 census)
- Median weekly income for the Warragamba locality is given for the household at $1,548 compared to Greater Sydney at $2,077 (ABS 2021 census)
- The majority of trips are by car, and public transport is limited to a bus service through Warragamba township (ABS 2021 census)
- Warragamba township provides a range of community services and facilities including the primary school and early learning centre, retail area, neighbourhood centre and town hall, sports centres and fields, swimming pool, and parks.

Downstream, the river system flows through natural areas to the semi-rural areas and suburbs around the urban centre of Penrith. The key socio-economic factors for the Penrith (Statistical Area Level 3) for the 2021 census are:

- Population of over 159,000 people, the distribution of which is fairly even across all age brackets up to 65 years
- Of the total population, approximately 5% identifies as being Aboriginal or Torres Strait Islander
- Over 60,000 dwellings, the majority of which is detached houses at over 75% of total dwelling types.

The Penrith City Council's *Sport and Recreation Strategy* (2020) is part of the Councils overall recognition of the value of the Nepean River for social and recreational activities for the area including walks, water-based activities such as boating, picnic sites and places of interest (Penrith City Council 2023). Under this Strategy, the council has identified a Nepean River Masterplan project for upgrades to facilities along the river including pathways, seating, and an amphitheatre.

6.10.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Economic benefit with focus on Warragamba township as a result of construction workforce spending at local businesses
- Economic benefit locally and regionally through procurement of services and materials, and employment opportunities
- Impact on tourism and visitor activity at the dam property which may be:
    - Positive through interest in the construction and the operation of the infrastructure, and associated with the additional water flows contributing to the natural values of the gorge and downstream riverine environment
    - Negative particularly during construction for perceptions on visual amenity and impact on natural vistas as well as construction related impacts such as access, noise, and vehicle movements.
- Social interest and potential positive response to the proposal intent - being the provision of environmental flows that will have environmental benefits as well as human benefits.
- Social impacts, real and perceived, associated with construction traffic, noise, workforce characteristics and use of local services and facilities, particularly for Warragamba township
- Social impacts downstream, including amenity improvements with additional water flow in river and improved river health
    - Indirect social benefits such as to fishing, walking or cycling, picnics in reserves / parks, accessing lookouts and viewpoints, and other recreational activities in and around the river
    - Aboriginal cultural benefits associated with river flows and traditional foods sourced from the river and environs.

The proposal is able to be undertaken within the existing Warragamba Dam precinct and no additional land is identified as required to be acquired or leased.

6.10.3 Method of assessment

Undertake a socio-economic impact assessment for the proposal in accordance with the DPE *Social Impact Assessment Guideline.*

6.11 Aboriginal heritage

6.11.1 Existing environment

The proposal site is within the traditional lands of the Dharug people, who lived in the area comprising roughly the Hawkesbury and Richmond in the north, Camden in the south, and Lithgow in the west.

Two searches were undertaken of the Aboriginal Heritage Information Management System (AHIMS) on 26 July 2023, being for the dam wall and some support areas, and of the precinct being the location of other support areas (refer to Appendix C). The search of the dam wall did not identify any Aboriginal sites or places, while the search on the precinct identified one Aboriginal site adjacent to Haviland Park.

The WDR Project EIS identified one site from the AHIMS within the construction area, however, a subsequent survey indicated this registered location was incorrect. No other site in the construction area was identified from the survey for the WDR Project EIS.

The Shaws Creek Aboriginal Place is located approximately 32 kilometres downstream of Warragamba Dam. Part of this area sits within the main channel of the Hawkesbury River (refer Figure 6-5[10]).

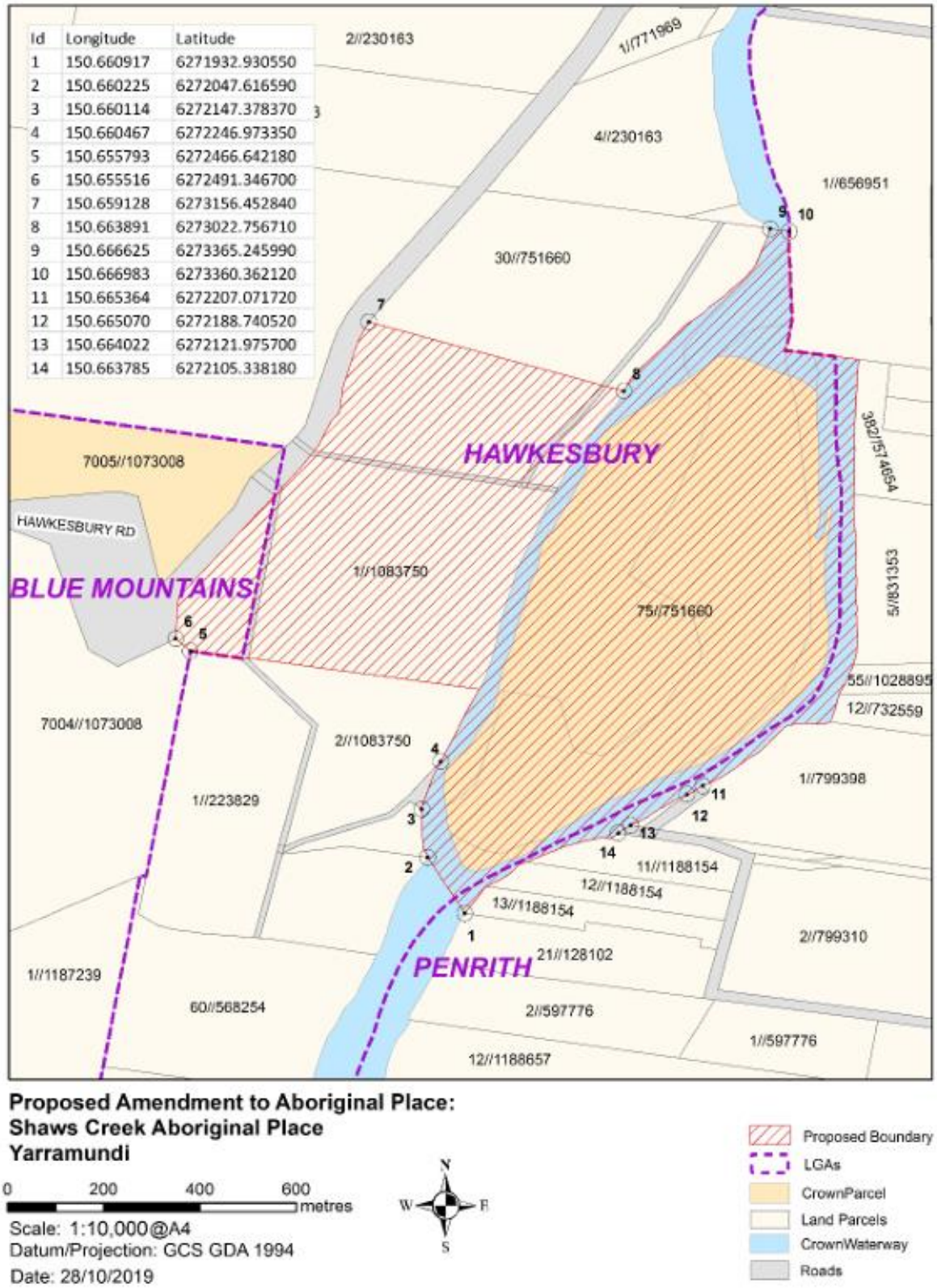

Figure 6-5 Shaws Creek Aboriginal Place

[10] Source: NSW Government Gazette No. 119, 18 March 2019.

6.11.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Assessment of potential uncovering of objects or sites, particularly on work sites where land surface will be disturbed
- Confirm status of the Aboriginal site adjacent to Haviland Park as identified on AHIMS search and if present any potential impact to this site.

It is noted that none of the proposed works will occur on previously undisturbed land.

The proposal site has previously been heavily disturbed during the original construction of the dam wall and associated infrastructure including the HEPS facility, and the later construction of the auxiliary spillway and the new visitor centre. The proposed laydown area 3 and site office area were used as laydown areas for previous construction works. Laydown area 3 was also previously used for housing that was subsequently cleared and had fill material added to it on the surface.

Downstream, the environmental flows would be contained within the existing river channel and are designed to mimic the natural river flows as if the dam as a barrier did not exist. Therefore, no impacts to Aboriginal heritage sites downstream of the dam attributable to the environmental flow releases are anticipated as the flows will be contained within the river bank.

The proposal may contribute positively to Aboriginal cultural practices with the additional downstream water flow improving river health and the availability and / or quality of traditional food and material sources.

6.11.3 Method of assessment

- Consultation with Aboriginal stakeholders to outline the proposal, extent of works, management measures initially proposed, and seek feedback
- Undertake an Aboriginal Cultural Heritage Assessment in accordance with applicable guidelines
- Confirm status of existing Native Title and related claims.

6.12 Historic (built) heritage

6.12.1 Existing environment

The construction site is not within listed areas of any:

- World Heritage Place for built heritage (refer Section 6.13 in respect of natural heritage values)
- National Heritage Place for built heritage (refer Section 6.13 for the natural heritage values listing)
- Commonwealth Heritage Place.

State heritage

Within the Warragamba Dam precinct, Haviland Park is identified on the State Heritage Register (SHR) – listing number 01375. The listing recognises the visitor facilities proved, the archaeological architectural and engineering remnants associated with the dam construction, species plantings and landscape values and its recognition of Mr Haviland (person). Downstream, the *Warragamba Emergency Scheme* (listing number 01376) at Megarritys Creek and *Megarritys Bridge* (item 01367) are also listed state heritage items.

WaterNSW maintains a heritage and conservation register in accordance with section 170 of the *Heritage Act 1977* (NSW). The Warragamba Supply Scheme is contained within this s170 register (item number 4580161).

Local heritage

The *Warragamba Supply Scheme and Warragamba Emergency Scheme* is listed as local heritage on the Wollondilly LEP heritage listing number I270. This listing encompasses the dam wall and lands to the south and the east of the Lake Burragorang, the Warragamba Dam and River including the HEPS.

The WDR Project EIS included an historic heritage assessment (Chapter 17) that considered the use of the dam for support areas notably at Haviland Park, and also considered the impact on the downstream state listed items near Megarritys Creek. The chapter also addressed the archaeological impact assessment.

A draft conservation management plan (CMP) has been prepared (Graham Brooks and Associates June 2010) for the Warragamba Supply Scheme. The CMP addresses the Warragamba Dam (component) including the dam wall, Haviland Park, HEPS, valve house, and former construction township. The CMP also addresses the emergency supply scheme including the pumping station, Warragamba Weir, its former construction township and Megarritys Bridge.

Regionally, the Warragamba township around the town hall forms the locally listing of the Warragamba Conservation Area. There are no local or state heritage listed items within the downstream river channel or its immediate vicinity until near Penrith.

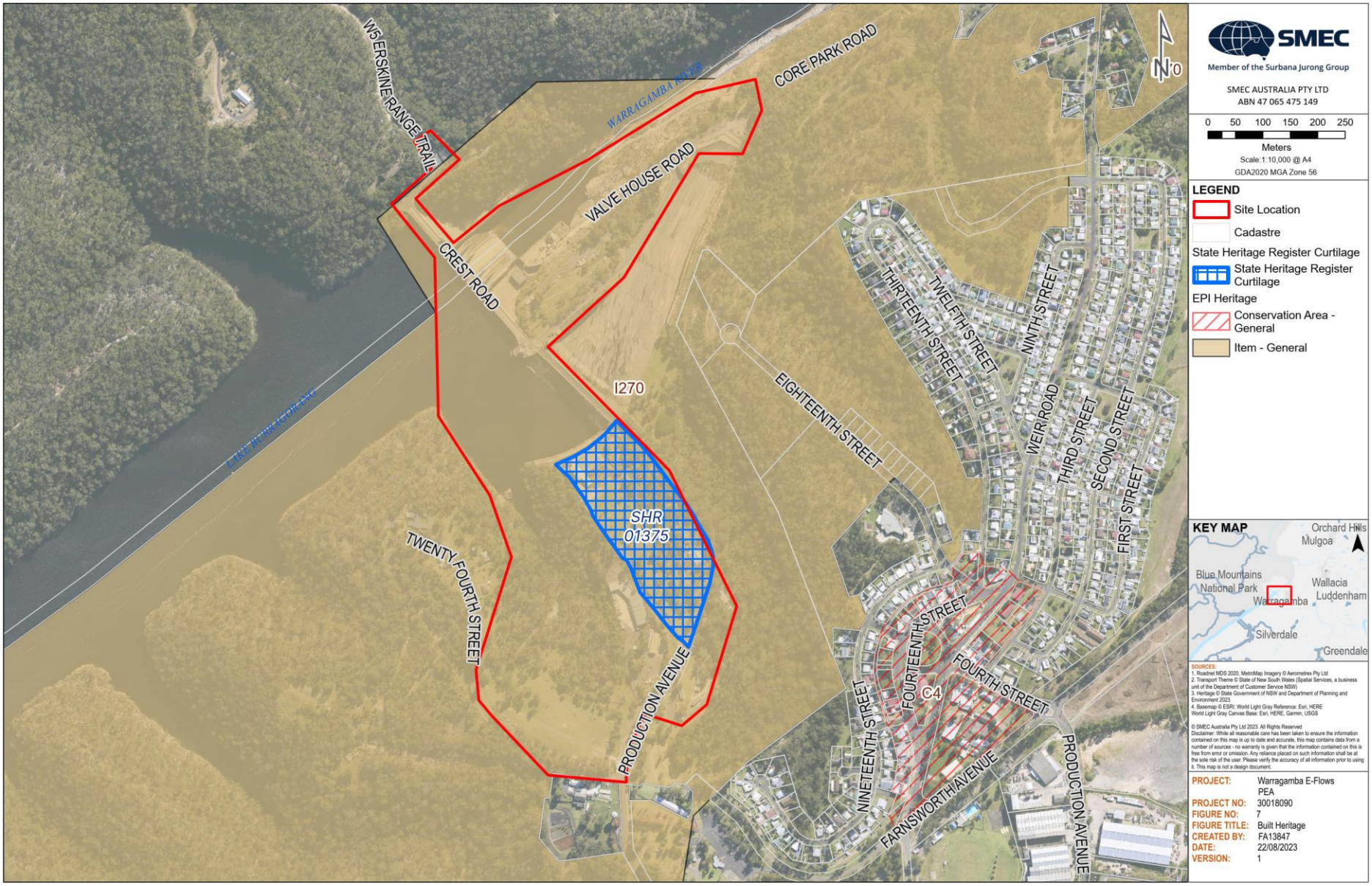

Figure 6-6 Listed heritage items in the vicinity of the proposal

6.12.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Removal of internal equipment and structural elements of the HEPS as a permanent / ongoing impact. The value of these as moveable heritage, and the actions that may be worthwhile in recognition of potential heritage value such as recording, restoration, or display
- Heritage values of the HEPS for structural alterations as a permanent / ongoing impact. These alterations will be internal to install the new infrastructure and connect to existing infrastructure, as well as external changes to install the new outlet values and related infrastructure
- Heritage values of the dam wall for structural additions for the new intake tower and works to the penstock as a permanent / ongoing impact. The alteration to the dam wall for the connection of the new intake tower to the penstock and works within the penstock will require a structural change but this will not be visible
- Heritage values due to temporary construction usage for laydown areas and office facilities of various areas of the precinct
- Construction impacts for temporary elements at the dam structure for the new intake tower and internal works such as the diver support areas, plant and equipment
- As the environmental flows will reflect existing flow variability and shall be contained within the existing river channel for the Warragamba, Nepean and Hawkesbury rivers, no additional impacts to maritime or built heritage values are anticipated.

6.12.3 Method of assessment

- Undertake a heritage assessment to determine if the HEPS building specifically holds any unlisted national or state historic heritage values
- Undertake a Statement of Heritage Impact (SoHI) of the proposal on the state listed (including s170) and local heritage listings potentially impacted by the proposal
    - This assessment should recognise the previous use of Haviland Park and other precinct areas as support area to previous construction works
    - The assessment should recognise the re-use of the HEPS building and investment in the structure for its ongoing maintenance and operation
    - The visual impact assessment (refer Section 6.6.3) would assist in the heritage impact assessment.
- Undertake a moveable heritage assessment for the contents of the HEPS building to determine if these objects hold any national, state or local historical heritage values, and if so to undertake a SoHI for these objects and provide advice on appropriate management and options for retention on or off site. An archival recording of these objects has been undertaken by WaterNSW.

6.13 Natural heritage / protected areas

6.13.1 Existing environment

The construction footprint of the proposal is clear of and will not impact the GBMWHA site (refer Figure 6-7). The listing is made for its natural values which recognises the area as an outstanding example of ongoing ecological and biological processes significant in the evolution of eucalypt-dominant vegetation and ecosystems and the diversity of habitats and plant communities supporting significant species and ecosystem diversity.

The GBMWHA is adjacent to the left-hand bank of the Warragamba River downstream of the confluence with Megarritys Creek. The GBMWHA listing also surrounds the Nepean River downstream of the confluence with the Warragamba River as far as Lapstone, the left bank of the Hawkesbury River at Wisemans Ferry and areas surrounding Lake Burragorang to the north and west.

The Greater Blue Mountains Area is also included on the National Heritage List, for values similar to those for, and protecting essentially the same area as, the World Heritage listing. An extension to the National Heritage List

protected area is under consideration and affects Lake Burragorang upstream of approximately Werribee Creek, and for Indigenous Cultural heritage values in the protected area. Neither the current National Heritage Listing or the extension of the protected area affects the land immediately around the dam wall or the immediate downstream area.

The proposal is also in the vicinity of the Blue Mountains National Park, however, the construction footprint is clear of the National Park, and will not result impact it. Operation of the environmental flows will provide benefits to the downstream river segments passing through the Blue Mountains National Park. Yengo National Park adjoins the left bank of the Hawkesbury River at Wisemans Ferry.

The proposal site is not in the vicinity of a Commonwealth Heritage Place of natural values.

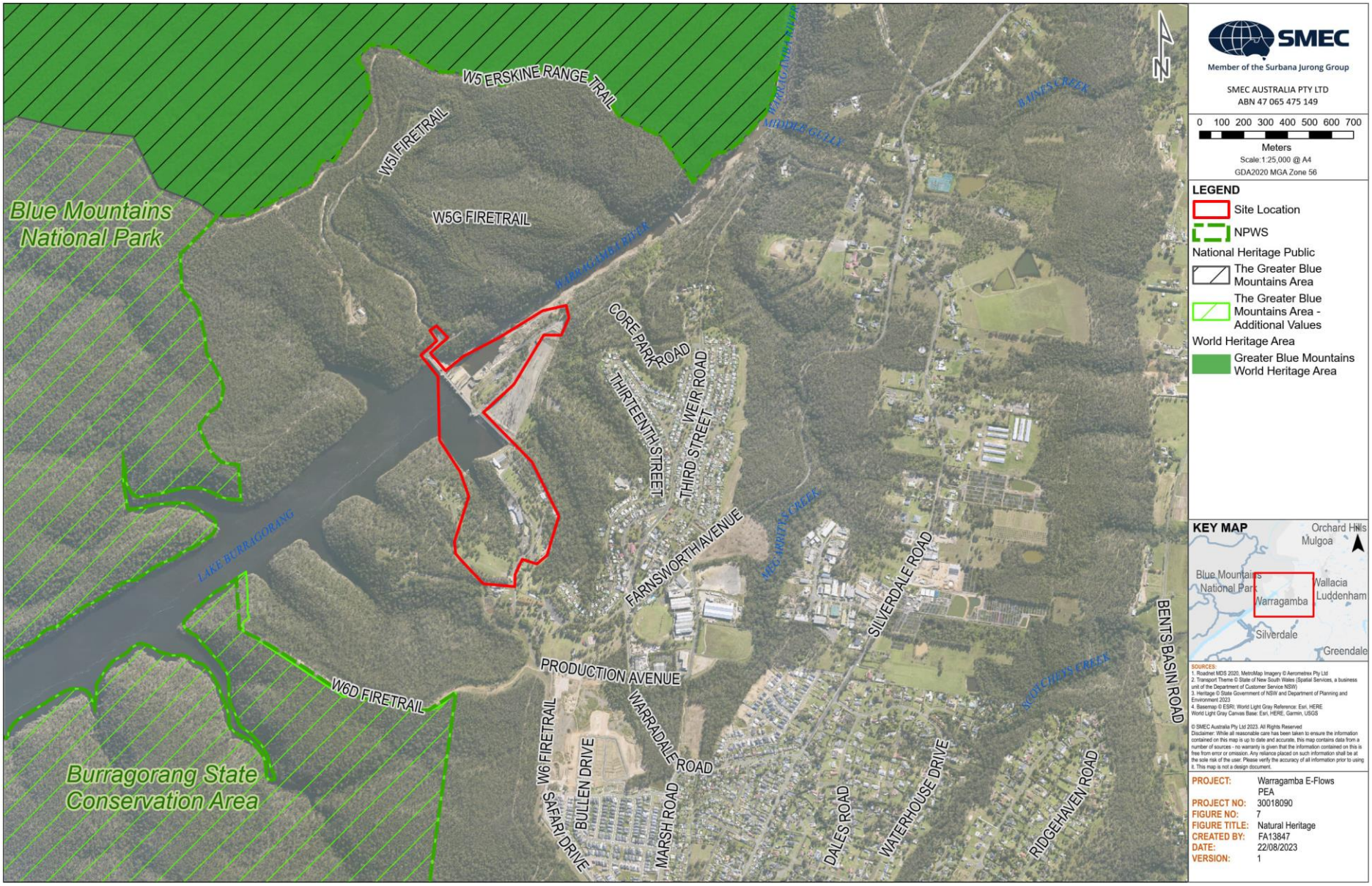

Figure 6-7 Location of proposal relative to Greater Blue Mountains World Heritage Area

6.13.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Temporary visual and amenity impacts, as part of the overall setting and landscape, to the GBMWHA and National Parks during construction
- Ongoing benefit of the environmental flows in downstream channels of the Warragamba, Nepean and Hawkesbury rivers as they relate to and are part of the protected areas adjacent to the riverbanks and channel.

6.13.3 Method of assessment

- Review of existing information and identification of any additional information regarding the environmental values, including natural and cultural heritage values, of areas of protected lands potentially affected, directly or indirectly, by the proposal
- Development of mitigation and management measures for identified impacts.

6.14 Hazards and risks – contamination or hazardous materials

6.14.1 Existing environment

The Warragamba Dam structure, including associated support elements of the HEPS and valve house was built in the 1950s. Although many elements have been upgraded, and new elements constructed, there are legacy contaminated and hazardous materials known to still be contained in structures and in the remaining equipment. Such materials pose a risk by absorption through the skin, flakes removed from the host material that may accumulate in the natural environment, become airborne travelling distances and being inhaled. Within the body they can cause a range of health issues and pose a threat to life.

The HEPS building is likely to contain a number of contamination / hazardous material risks due to its age and usage. Asbestos signage is present in some areas, associated with insulation of electrical elements in particular.

Lead-based paint may be present where paint has been applied for protective and aesthetic reasons.

The moving machinery and engine equipment of the HEPS will hold residual fuels, lubricants, oils and similar materials both on the equipment and potentially as a residual coating on surfaces where it has accumulated over time.

The penstock is a steel pipe with a coal-tar-epoxy lining that may not be in optimal condition (Stantec/GHD 2022).

6.14.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- The removal process, handling, storage, transportation and disposal of each of the contaminated and hazardous materials. The type and extent of these contaminants and hazardous materials will need to be confirmed and documented. These materials are known or expected to be associated with:
    - The penstock pipe is to be refurbished. The existing penstock contains hazardous materials being the coal-tar-epoxy coating which is likely to require removal and the pipe re-lined
    - The works to the HEPS building, for removal of internal components, structural changes and removal, will impact on the known areas of lead-based paint, asbestos, fuels and lubricants and similar materials, and potentially other residual hazardous materials
    - Waste management methodology is to address the risks of hazardous and contaminated materials entering the natural environment or exposure to people, resulting in harm.
- The works will require the use of plant equipment and vehicles that have the potential to cause contamination such as by spills, leaks, that may enter directly into water sources and green spaces that will be used in future by the public.

6.14.3 Method of assessment

- Identification and characterisation of existing and potential sources of contamination including the type, amount and condition of hazardous materials, handling and management requirements and disposal
- Undertake a site assessment of nominated site office and laydown areas to determine any materials that may be disturbed or otherwise require addressing prior to use of these sites
- Assess the types and respective indicative quantities of hazardous waste that may be generated and appropriate management responses for each waste type.

6.15 Hazards and risks – waste management

6.15.1 Existing environment

The ongoing operation of the Warragamba Dam site would result in waste associated with the visitor and office accommodation and as generated by routine maintenance and upgrade works to the precinct, plant and equipment.

The management of existing operational waste streams is regulated by legislation and policy. There would be no material change to existing practices arising from the proposal.

6.15.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Building material waste such as concrete associated with penetrations into (i) the dam wall for the new intake system and attaching the tower; and (ii) to the HEPS outer wall for the new outlet system and of HEPS elements
- Waste from refurbishment of penstock including removal of existing lining, works to the control gates, known to be hazardous, this is addressed in Section 6.14
- Wastewater from within the penstock pipe. This will require testing to confirm any detrimental qualities that will determine its release or treatment required.
- Material waste of disused equipment and plant from the HEPS. Some waste is known or has potential to be to be contaminated / hazardous (addressed in Section 6.14). Potential opportunity for some of the HEPS redundant plant and equipment to be refurbished for heritage value (to informed by heritage assessment), that may be retained on-site or elsewhere
- Waste associated with transport and packaging of new materials and equipment
- General construction waste such as formwork, scrap metal, concrete slurry, water used in construction
- Potential vegetation and soil wastes from the levelling of sites for use as the site office and laydown areas.
- Potential dredging waste, notably any riverbed comprising rock materials, from the construction of the temporary coffer dam (if required) at the HEPS facility
- Potential opportunity for some waste as scrap metal to be recycled (if not contaminated / hazardous)
- Domestic waste of construction personnel, including from the divers' facility on the crest and the site office (with amenities).

6.15.3 Method of assessment

- Assess the types and indicative quantities of waste that may be generated, to generally classify wastes to be generated and identify management approaches and disposal options including potential for recycling and / or re-use.

6.16 Water quality – Downstream

6.16.1 Existing environment

The river downstream of the dam can be distinguished into three reaches, being:

- Warragamba River from the Warragamba Dam wall to Megarritys Creek junction (approximately 1.8 kilometres)
- Warragamba River from Megarritys Creek junction to the Nepean River junction (approximately 1.9 kilometres)
- The Nepean River (downstream); numerous other waterways flow into the Nepean River, which subsequently becomes the Hawkesbury River near Richmond.

At present, the reach between the Warragamba Dam wall and Megarritys Creek receives very little inflow, being from dam seepage, surface runoff from the adjacent mountainsides directly or in small intermittent streams, and any releases or overflow from the dam (environmental contingency releases, capacity overflow). These inflows are sporadic and vary in quantity and duration, with some only occurring as a result of natural (rainfall) events. In periods of low or no rainfall, the water quality in this segment of the river can be poor. This has a direct impact on the aquatic environment of the river.

Currently, the limited volume and the characteristics of water flowing in the Warragamba River affect the quality of the waters of the receiving Nepean River, at the junction and also downstream. As noted in Section 1.3.1, Krogh and Keenan (2023) considered that environmental flows from the Warragamba Dam would improve the quality of water of the Nepean River below the junction with Warragamba River at least as far as Sackville.

6.16.2 Matters for consideration

The following matters would likely require further consideration in an EIS:

- Arrangements for access to the HEPS facility; construction works may include installation of a coffer dam to provide a safe and dry working environment (the coffer dam would be similar to the type used for maintenance of the dissipator)
- Identification and assessment of construction activities and construction materials that could affect river water quality.

The proposal is anticipated to have the following ongoing (operational) benefits that would be considered in the EIS:

- Supplementing the quantity and quality of water flow to the segment of Warragamba River immediately below the dam wall to Megarritys Creek, and subsequently the quantity and quality of water flow into the Nepean River
    - Indirectly, these inflows would contribute to meeting general environmental flow objectives including to redress risks of aquatic weeds and algae, and positively impact aquatic life and their life cycles.
- The new environmental flow releases will have characteristics, notably temperature and aeration, more closely aligned to the receiving waters, and eliminating the existing issues such as of cold water pollution due to the selective levels of the intake tower that waters can be drawn
- Restoring water flows into the river as though the dam did not exist and so reflect natural regimes and contribute to improvements in river health and biodiversity (species and ecosystems).

6.16.3 Method of assessment

- Definition of baseline water quality drawing on existing water quality monitoring data
- Identification and characterisation of construction activities that could present risks to water quality; carry out risk assessment considering likelihood and consequence and assign risk ratings to individual construction activities

- Identification and characterisation of operational activities that could present risks to water quality; carry out risk assessment considering likelihood and consequence and assign risk ratings to individual operational activities
- Assess potential impacts on water quality and identify mitigation and management measures (including existing measures) to manage risk to water quality.

6.17 Water quality – Upstream

6.17.1 Existing environment

The quality of water entering Lake Burragorang is important for the water supply function of the dam and is supported by the management of the catchment and restrictions on use of the lake.

Restrictions include the prevention of public access to the lake, on development and activities, and management of land, under legislation including through designation of Special Areas. The declaration of the National Parks that surround much of the lake and catchment also provides protections to water quality for waterways flowing through these parks.

The quality and characteristics of water in the Lake Burragorang is dependent on physical and chemical factors including inflow quality (nutrient loads, oxygen and chemical levels, acidity), inflow quantity affecting not only water depth and related characteristics but also the quality of water, rate of settling of sediment and other materials, temperature including seasonal variations and with depth. Specific events such as bushfire and major storms can result in changes to lake water quality by affecting inflow quality, of which some may be mitigated by physical interventions. These event-based water quality changes are notable in the short term although some impacts, including indirect impacts, may continue into the longer term. (Cooper 2020, WaterNSW 2022, Commonwealth DCCEEW 2021, Neris *et al* 2021).

The water temperature in the lake can vary seasonally and with depth through stratification due to the depth of the waterbody and clear seasonal variations in temperature in this area. Stratification is the layering of water with warmer water at the surface and colder denser water at depth. Breaking down of this stratification and inversions will change these characteristics at various depths.

The quality and characteristics of water within the lake will influence where in the vertical profile the intakes will draw water from for the Sydney water supply.

WaterNSW has set benchmarks for the water quality, against eleven criteria, for its water storage reservoirs, developed from the ANZECC Guidelines for fresh and marine water quality (WaterNSW 2022).

The Nepean River, upstream of the Warragamba River junction is highly regulated with Cataract Dam, Cordeaux Dam, Nepean Dam and Avon Dam all part of this river system as well as other tributary waterways.

6.17.2 Matters for consideration

The principal issue is potential impacts on water quality in Lake Burragorang from construction activities. Attachment of the precast intake tower to the upstream face of the dam will require works above and below the water level in the lake in close proximity to the dam. These works would include the core drilling into the dam wall to provide for the precast units to be bolted to the wall. There will also be some demolition of existing concrete elements around the HEPS intake. The works will not directly impact the lakebed. Water quality in the immediate vicinity of the works, which will be located next to the existing water supply intakes, may be detrimentally affected.

Operation of the environmental flows infrastructure will not present any significant risks to water quality in Lake Burragorang. WaterNSW currently carries out planned maintenance activities that present similar risks to water quality and these risks are effectively managed and mitigated through existing management practices.

6.17.3 Method of assessment

- Definition of baseline water quality drawing on existing water quality monitoring data

- Identification and characterisation of construction activities that could present risks to water quality; carry out risk assessment considering likelihood and consequence and assign risk ratings to individual construction activities
- Assess potential impacts on water quality and identify mitigation and management measures (including existing measures) to manage risk to water quality.

6.18 Matters requiring no further assessment

Table 6-1 identifies the environmental matters not requiring further assessment and the justification for this determination.

Table 6-1 Matters not requiring further assessment

Matter requiring no further assessment	Justification / Reasoning
Access: • Port and airport facilities • Rail facilities	The proposal would not directly or indirectly impact rail, port or airport facilities.
Amenity: • Odour	Considerations of air quality are addressed in Section 6.4, which includes odour at the immediate proposal site associated with the works. No odours that would impact amenity are anticipated to be generated by the proposal
Built environment: • Private property • Design quality	All works will be undertaken on the WaterNSW land of the Warragamba Dam precinct. No private property will be directly impacted by the proposal. Potential indirect impacts due to matters including noise and traffic are considered in the respective sections for those matters. The proposal has a single discrete new structure (intake structure) that will be functional in design.
Economic: • Natural resource use • Opportunity cost	The proposal will have limited natural resource use. The opportunity cost of not providing the environmental flows are primarily in environmental qualities that are difficult to quantify and would be a continuation of the existing conditions.
Hazards and risks: • Biosecurity • Bushfire • Coastal hazards • Dangerous goods • Flooding • Groundwater contamination • Hazardous and offensive development • Land contamination • Land movement	The proposal is within the built and previously disturbed areas of the dam property. There is the potential for biosecurity risks associated with movement of vehicles plant and equipment that can be managed. The bushfire risk to the proposal is similar to that of the overall dam property. The proposal, as for any construction project, poses a risk of starting a bushfire risk. The proposal site is not within a coastal location The proposal will not impact flooding regimes. The proposal will have marginal impact on groundwater and is not anticipated to result in groundwater contamination. The proposal not for hazardous or offensive development The proposal is not anticipated to cause land contamination. The proposal is within an existing built area of the property and is not anticipated to cause or be affected by land movement.
Land: • Stability • Soil chemistry • Land capability • Topography	As the proposal site is within an existing developed and operational portion of the dam property, and on previously disturbed sites for support areas, with new structures to be attached to existing structures, the stability, soil chemistry, land capability and topography of the proposal site are not anticipated to be impacted.

Matter requiring no further assessment	Justification / Reasoning
	The soil chemistry of the Warragamba River channel downstream of the dam may have marginal changes as a result of the new environmental flows in comparison to the drinking water sourced flows.
Social: • Way of life • Health and wellbeing • Accessibility • Culture • Surroundings • Livelihoods • Decision making systems	The construction works would be contained within the dam property and would have minimal impact on the surrounding community with the exception of traffic and noise which are addressed in Sections 6.2 and 6.5 respectively. Operation of the proposal is not anticipated to impact the social environment of the surrounding towns / villages.
Water: • Availability • Hydrology • Water quality (operational)	WaterNSW currently carries out routine maintenance at Warragamba Dam under the requirements of its Water Access Licence. These include maintaining water supply security during all such works. Operation (including maintenance) of the environmental flows infrastructure could be safely carried out under the same management practices. The proposal would provide for greater operational flexibility around environmental flow releases but is not anticipated to materially alter the hydrological regime from the existing situation. . The proposal would allow greater flexibility in drawing water from the storage to better match downstream water quality parameters, providing an improvement to downstream water quality.

7 Conclusion

WaterNSW operates Warragamba Dam under an existing water supply works and water use approval (Number: 10CA117212) and water access licence (Number: WAL27431), which were approved under the *Water Management Act 2000*.

WaterNSW proposes to construct infrastructure at Warragamba Dam that will allow for variable environmental flow releases into the Warragamba River. The need and benefit of flows to benefit the environment to the Warragamba River and broader system, have been recognised for over 20 years. The release of variable environmental flows, which are able to provide similarities to natural regimes in volume and characteristics, will provide benefits to the river heath, species and ecosystems of the waterway as well as provide human recreational benefits.

As Warragamba Dam is a critical component of the Metropolitan Sydney water supply system, works are not to interfere with or be detrimental to the continued operation of the water supply infrastructure.

The infrastructure required at Warragamba Dam comprises a new water intake tower attached to the lake side of the dam wall, the refurbishment and reuse of an existing penstock within the dam wall joining to the existing HEPS building, and the refurbishment and new equipment installation into the HEPS. New outlets will need to be installed into the outer wall of the HEPS to allow water to exit into the Warragamba River. Water will flow from the intake tower to the HEPS and outlets under gravity flow.

The proposal considered to be SSI under section 2.13 of the Planning Systems SEPP and accordingly requires the preparation of an EIS responding to SEARs provided by DPHI. The approval authority for the proposal would be the Minister for Planning and Public Spaces.

This scoping report has been prepared to support an application to DPHI for SEARs and includes a preliminary environmental assessment of matters that outlines the existing environment, matters for consideration regarding the impacts that may occur, and guidance for further investigations.

The preliminary environmental assessment identifies the following matters as affected by the proposal and requiring further assessment:

- Access - Traffic and parking
- Air - particulate matter and emissions
- Amenity - noise and vibration, visual amenity
- Biodiversity - Aquatic and terrestrial
- Built environment - public land and infrastructure
- Heritage - Historic (built) heritage, Aboriginal heritage and natural heritage / protected places
- Hazards and risks - of contaminated or hazardous materials, dam safety and waste management
- Social and economic
- Water - river waters including hydrology, lake waters and water supply function

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Appendices

A. Scoping summary table

B. Selected option diagrams

C. AHIMS search results

D. PMST search results

APPENDIX A – SCOPING SUMMARY TABLE

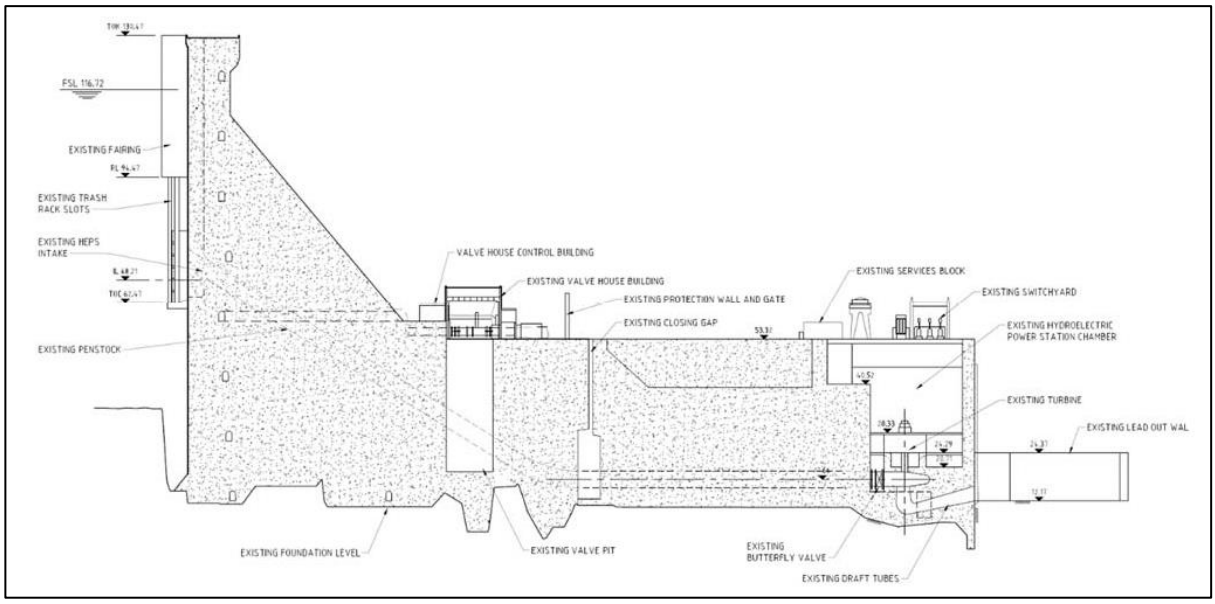
Level of assessment	Matter	CIA[11] (Y/N)	Engagement (general or specific)	Relevant government plans, policies and guidelines	Scoping report reference
Standard	Access - Traffic and parking (public) Access – – Access to property (construction / non-public)	N	General	Guide to Traffic Generating developments v2.2 (RTA 2002) Guide to Traffic Management Part 12 Integrated Transport assessments for developments (Austroads 2020)	Section 6.2 and Section 6.3
Standard	Air – particulate matter and emissions	N	General	National Greenhouse Gas Accounts Factors 2023 (Commonwealth DCCEEW) (published annually) Approved methods for the modelling and assessment of Air Pollutants in New South Wales (NSW EPA 2016)	Section 6.4
Standard	Amenity – noise and vibration	N	General	Interim Construction Noise Guideline (Department of Environment, Climate Change and Water, 2009) Assessing Vibration: A Technical Guideline (Department of Environment and Conservation, 2006) Noise Policy for Industry (NPfI) (EPA, 2017) Road Noise Policy (DECCW, 2011)	Section 6.5
Standard	Amenity – Visual	N	General	Guideline for landscape character and visual impact assessment: Environmental Impact Assessment Practice Note EIA-NO4 (TfNSW 2020)	Section 0
Standard	Biodiversity – Aquatic	N	Specific	Biodiversity Assessment Method (BAM) 2020 (DPIE 2020) Guidance to assist a decision-maker to determine a serious and irreversible impacts (DPIE 2019) Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE 2020) Threatened species test of significance guidelines (NSW OEH 2018) Policy and guidelines for fish habitat conservation and management (DPI 2013) Why do fish need to cross the road? Fish passage requirements for waterway crossings (Fairfull and Witheridge 2003) Aquatic ecology in environmental impact assessment – EIA guideline series (NSW Department of Planning 2003)	Section 6.7

[11] Cumulative Impact Assessment (refer to Cumulative Impact Assessment guidelines for State Significant Projects (DPIE July 2021))

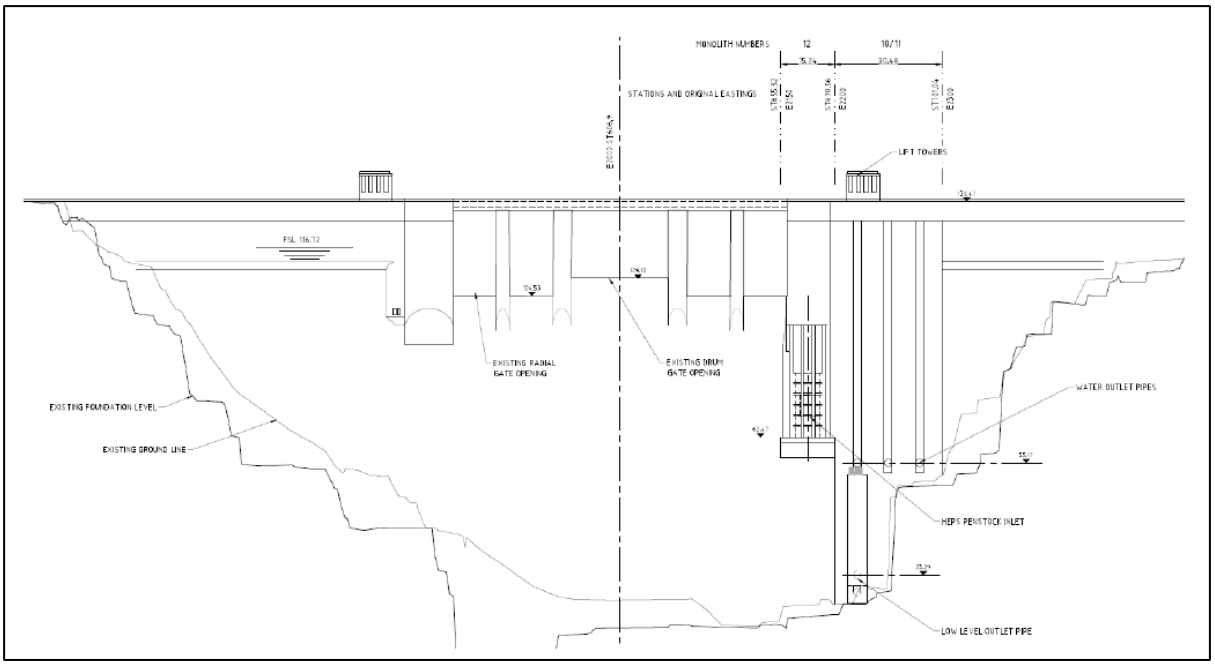
Level of assessment	Matter	CIA[11] (Y/N)	Engagement (general or specific)	Relevant government plans, policies and guidelines	Scoping report reference
				Approved methods for sampling and analysis of water pollutants in NSW (NSW EPA 2022) Survey guidelines for Australia's threatened fish (DSEWPC 2011)	
Standard	Biodiversity – Terrestrial	N	Specific	Biodiversity Assessment Method (BAM) 2020 (DPIE 2020) Guidance to assist a decision-maker to determine a serious and irreversible impacts (DPIE 2019) Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE 2020) Threatened species test of significance guidelines (NSW OEH 2018)	Section 6.8
Standard	Built environment - public land and infrastructure	N	General	Managing biosecurity risk management in land use planning and development (DPI 2020)	Section 6.9
Standard	Social and economic	N	General	Social Impact Assessment Guideline (DPIE 2023)	Section 6.10
Standard	Aboriginal heritage	N	Specific	Code of practice for archaeological assessment of Aboriginal objects in NSW (DECCW 2010) Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW 2011) Aboriginal cultural heritage consultation requirements for proponents 2010(DECCW 2010)	Section 6.11
Standard	Historic (built) heritage	N	Specific	Assessing Heritage Significance (NSW Heritage Office, 2023) State Agency Heritage Guide (Heritage Council of NSW and Heritage Office, 2005) Moveable Heritage Principles – Heritage Information Series (NSW Heritage Office 2000)	Section 6.12
Standard	Natural heritage / protected areas	N	General	Significant Impact Assessment Guidelines 1.1 Matters of National Environmental Significance (MNES) (Commonwealth DCCEEW 2013)	Section 6.13
Standard	Hazards and risks – contaminated or hazardous materials	N	General	Waste Classification Guidelines (NSW EPA) NSW Asbestos Waste strategy 2019-2021 (NSW EPA) Construction and demolition Waste – A Management Toolkit (NSW EPA 2020) Chemical Control Orders in relation to Scheduled chemical Wastes (NSW EPA 004)	Section 6.14

Level of assessment	Matter	CIA[11] (Y/N)	Engagement (general or specific)	Relevant government plans, policies and guidelines	Scoping report reference
Standard	Hazards and risks – waste management	N	General	Waste Classification Guidelines (NSW EPA) Construction and demolition Waste – A Management Toolkit (NSW EPA 2020)	Section 6.15
Standard	Waters – water quality – downstream Waters – water quality - upstream	N	General	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) NSW Water Quality Objectives (WQOs) (DECCW, 2006) Approved Methods for Sampling and Analysis of Water Pollutants in NSW (NSW EPA, 2022)	Section 6.16 and Section 6.17
No further assessment	Refer Table 6-1	-	-	-	Section 6.18

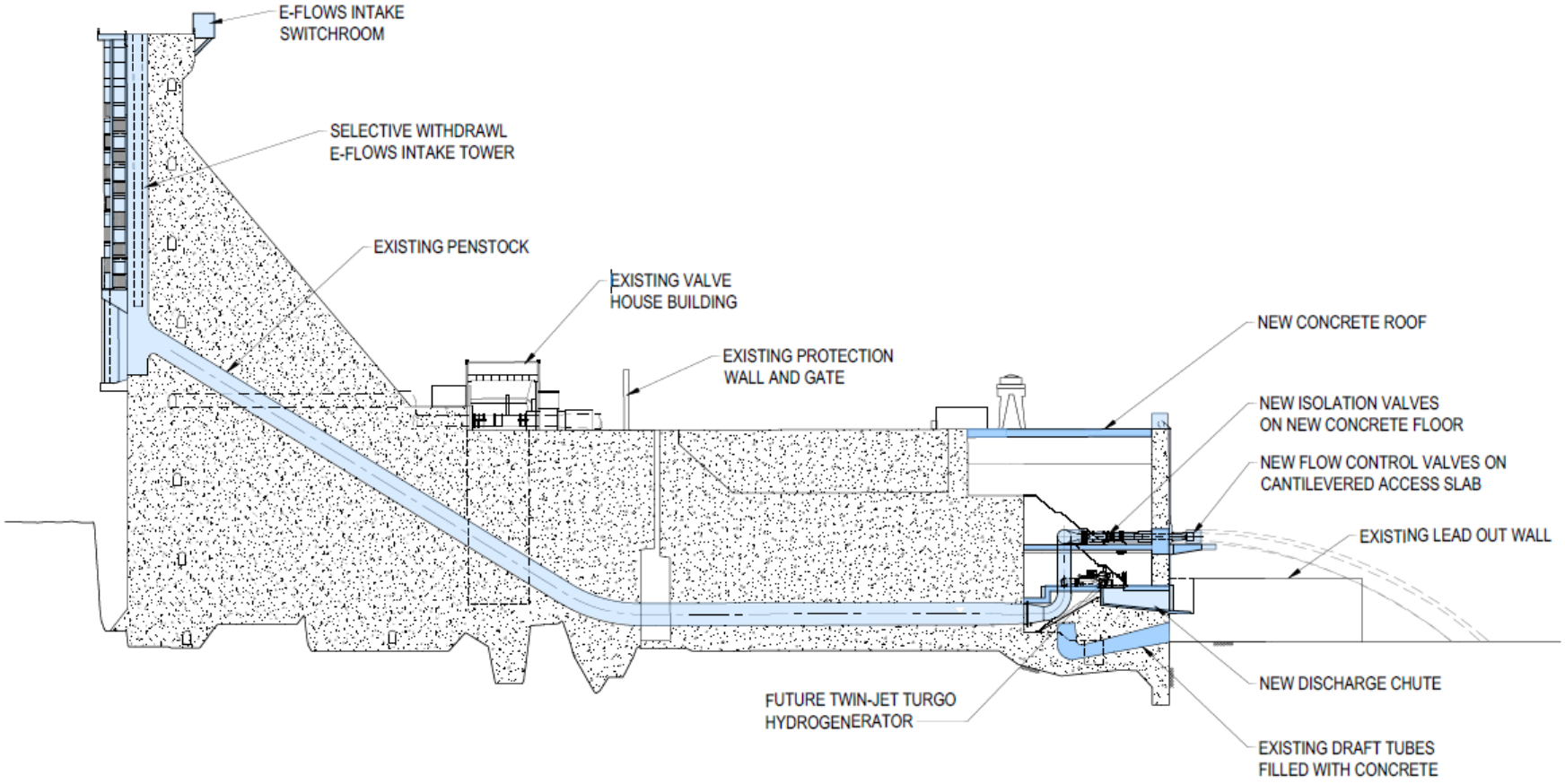
APPENDIX B – Existing configuration and preferred option diagrams



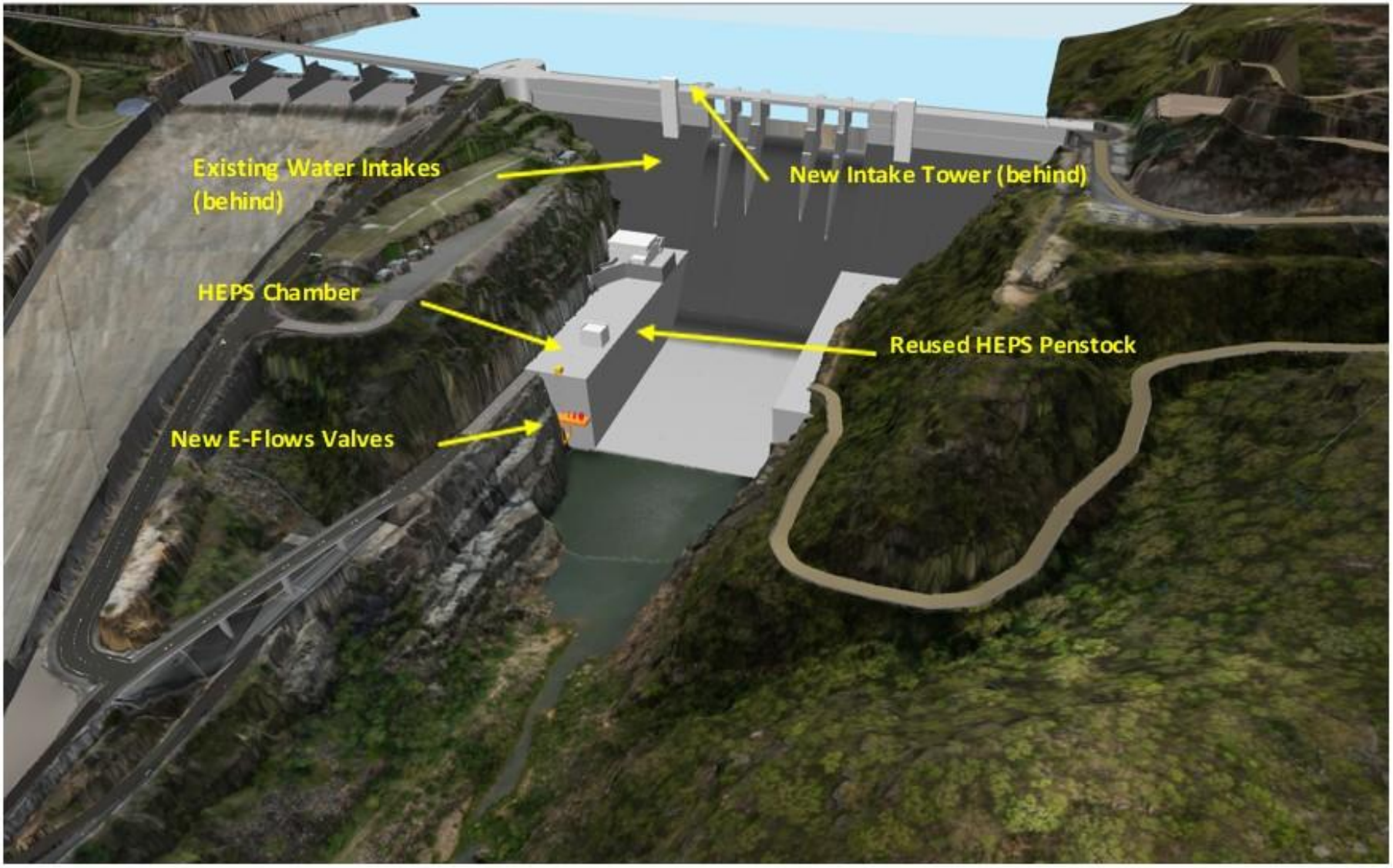
Existing Dam cross section through existing HEPS intake, penstock and chamber



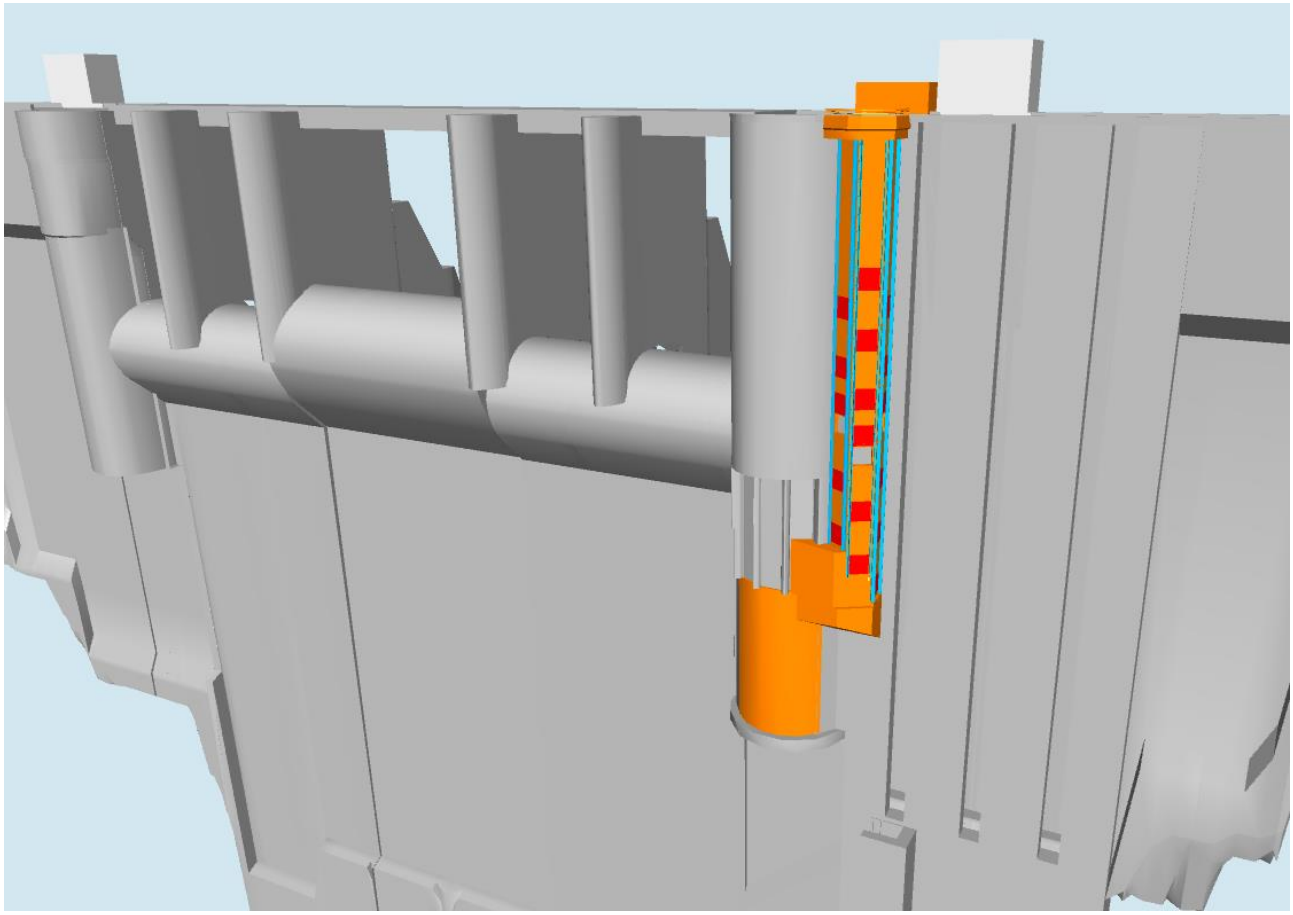
Existing dam – Upstream elevation



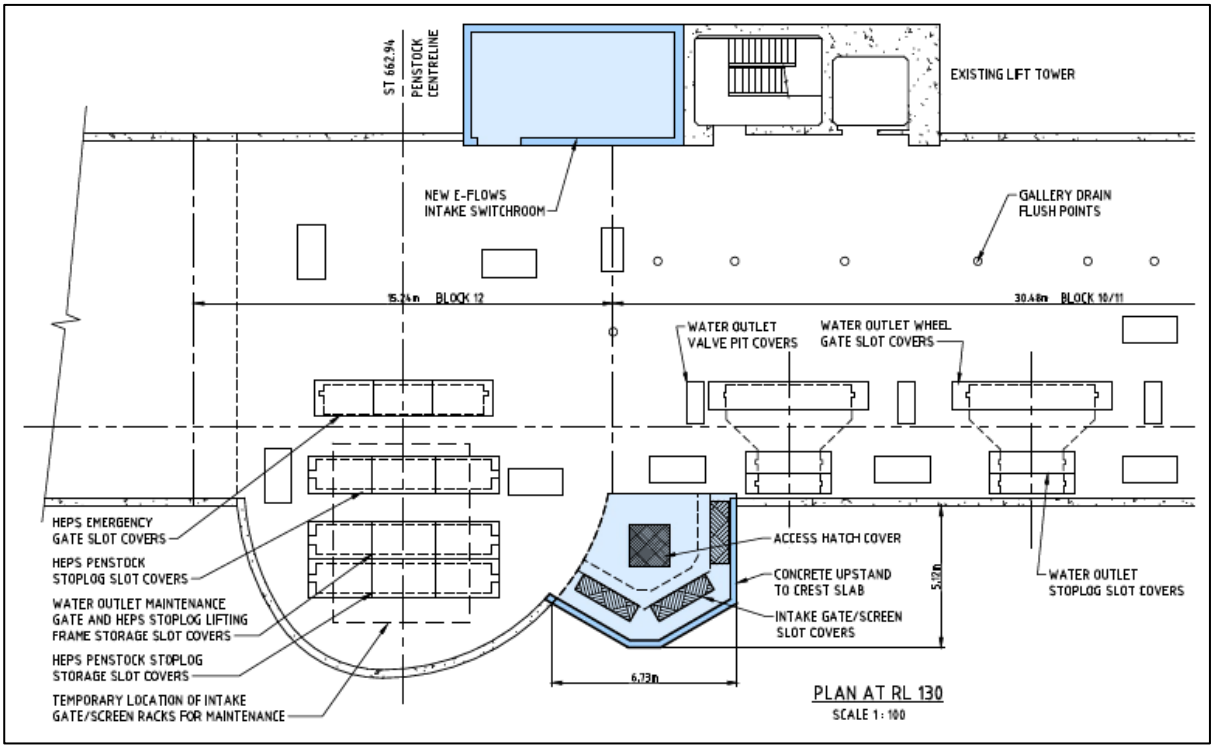
Selected (preferred) option - key features



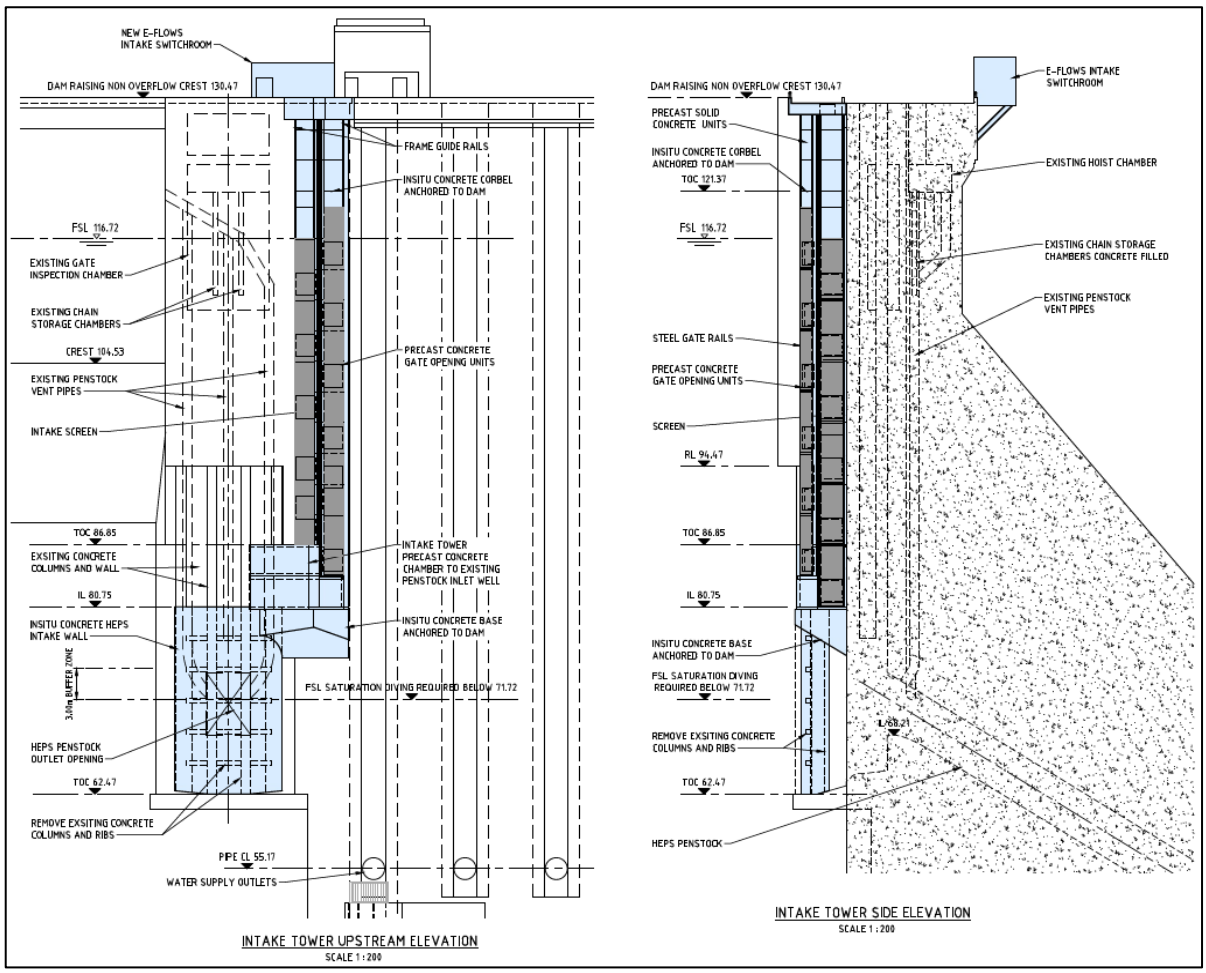
Selected (Preferred) option – general arrangement viewed from downstream looking towards dam wall



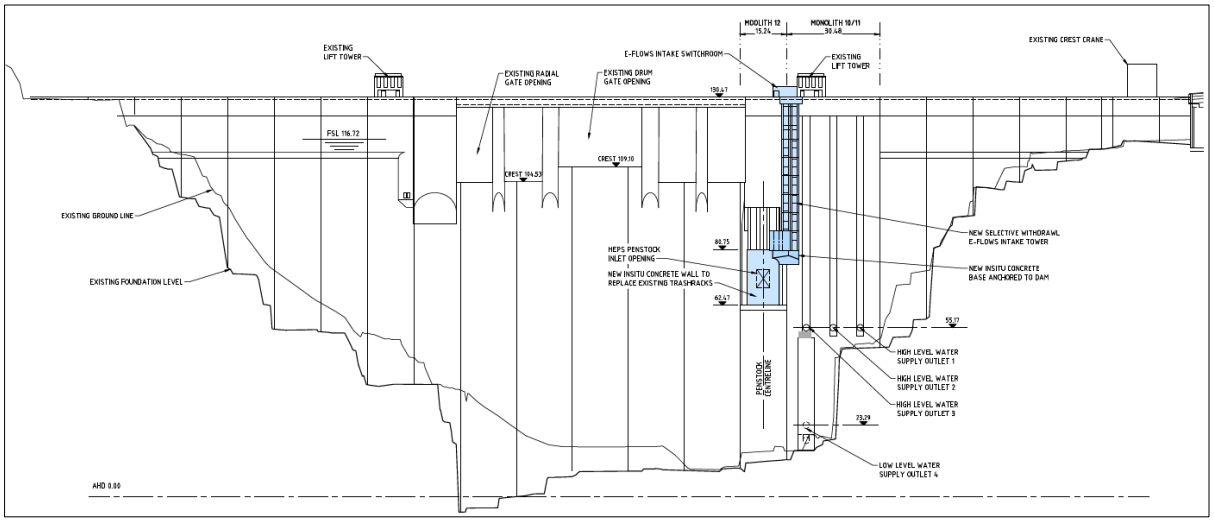
Selected (preferred) option – upstream arrangement



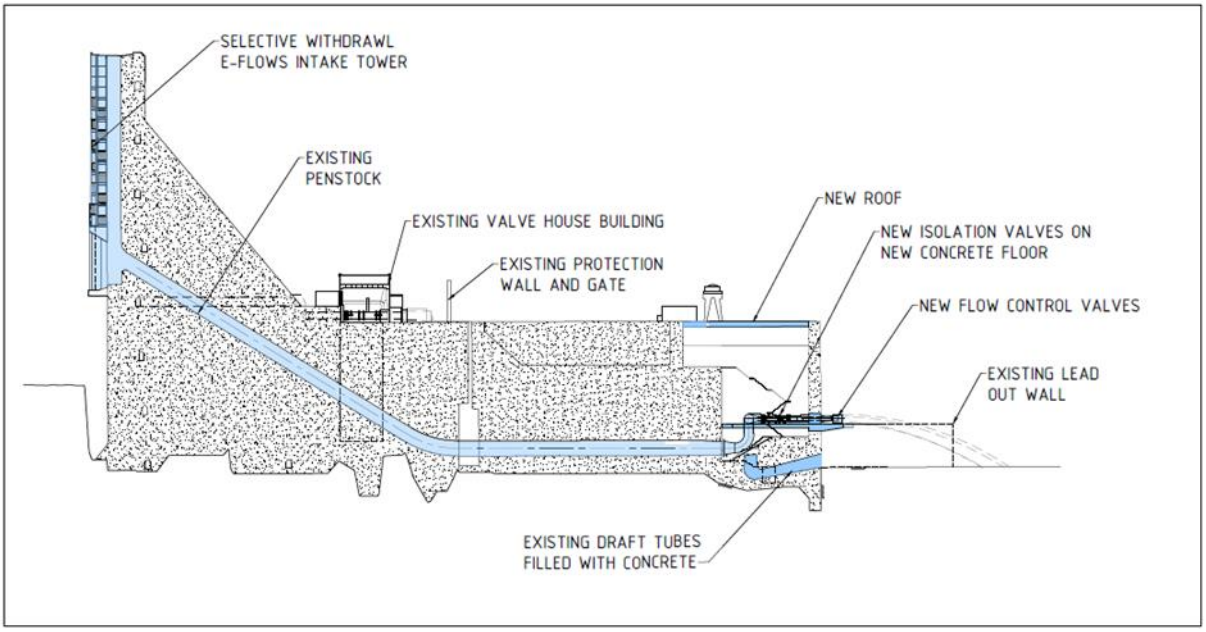
Selected (preferred) option - Crest Plan with Intake Tower location (Plan view)



Selected (preferred) option - intake tower elevations



Dam upstream face elevation



E-Flows cross-section

Construction photo of existing HEPS intake structure

APPENDIX C – AHIMS search results

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Scoping report

Client Service ID : 803756

SMEC

Date: 26 July 2023

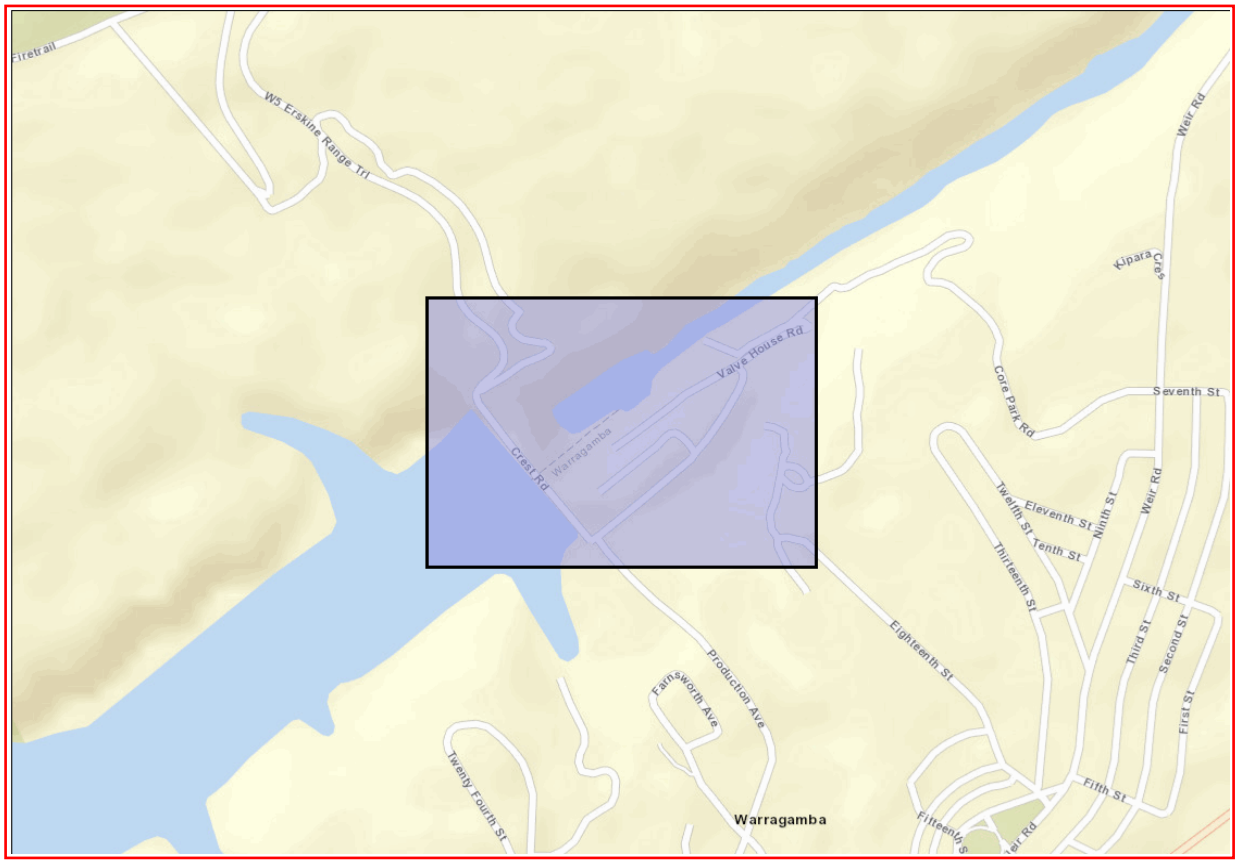
3 Horwood Place
sydney New South Wales 2150
Attention: Karen Hughes

Email: karen.hughes@smec.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -33.8848, 150.5934 - Lat, Long To : -33.8803, 150.6011, conducted by Karen Hughes on 26 July 2023.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : Scoping report

Client Service ID : 803757

SMEC

Date: 26 July 2023

3 Horwood Place
sydney New South Wales 2150

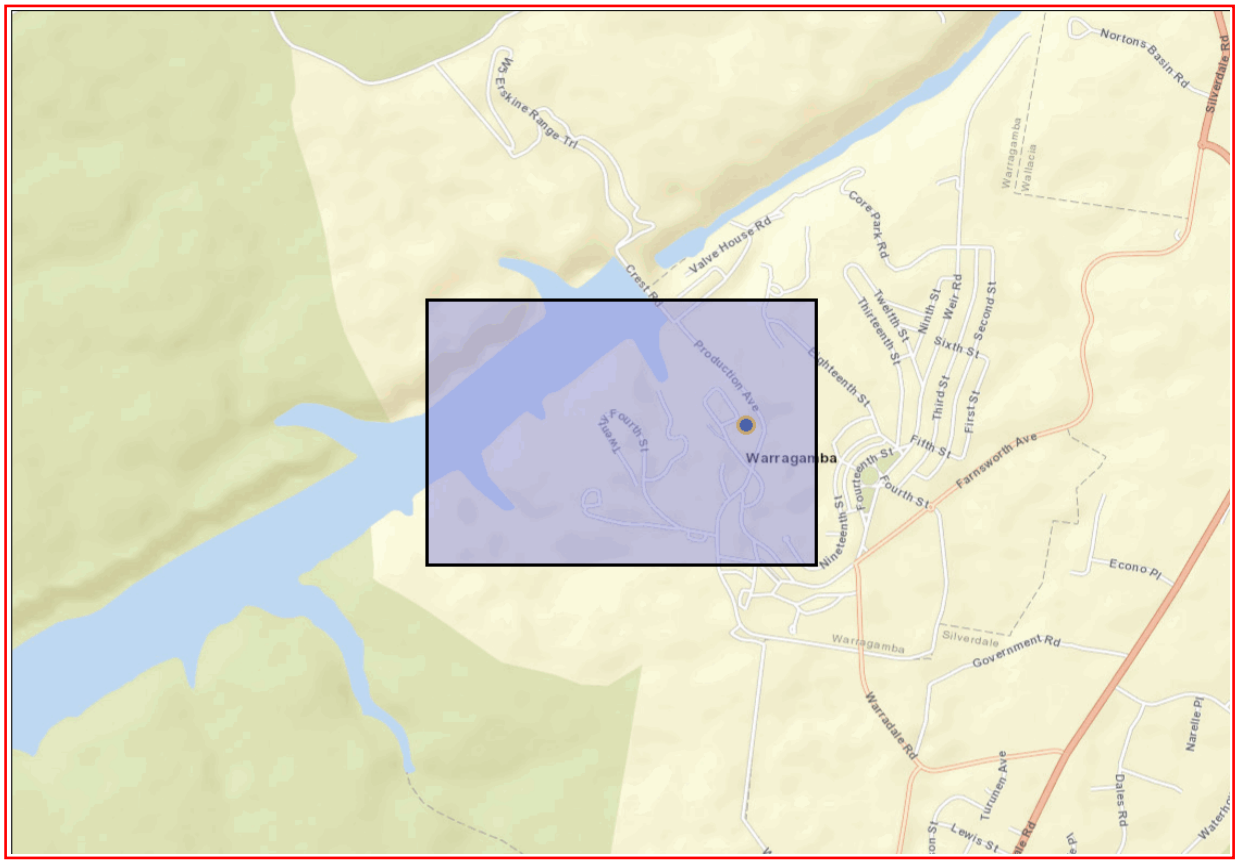
Attention: Karen Hughes

Email: karen.hughes@smec.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lat, Long From : -33.8925, 150.5869 - Lat, Long To : -33.8836, 150.6023, conducted by Karen Hughes on 26 July 2023.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

1	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

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APPENDIX D – PMST search results

Australian Government

Department of Climate Change, Energy, the Environment and Water

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. Please see the caveat for interpretation of information provided here.

Report created: 17-Jul-2023

Australian Government

Department of Climate Change, Energy, the Environment and Water

Protected Matters Search Tool

- Upload
- Draw
- My Features
- Layers
- Report
- About

COLLAPSE SIDEBAR

Summary

Matters of National Environment 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:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	49
Listed Migratory Species:	15

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	6
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	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

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	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
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Neophema chrysostoma		
Blue-winged Parrot [726]	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
Pycnoptilus floccosus		
Pilotbird [525]	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
Stagonopleura guttata		
Diamond Firetail [59398]	Vulnerable	Species or species habitat likely to occur within area
FISH		
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
FROG		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
MAMMAL		
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
Petauroides volans		
Greater Glider (southern and central) [254]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Petaurus australis australis		
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely 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]	Endangered	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
PLANT		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	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
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 may occur within area
Genoplesium baueri		
Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Hakea dohertyi		
Kowmung Hakea [66701]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	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, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat may occur within area
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Veronica lithophila [87479]	Endangered	Species or species habitat likely to occur within area
REPTILE		
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
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]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to 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 likely to occur within area
Migratory Wetlands Species		

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		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
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]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat likely to occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine 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
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area

Extra Information

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Warragamba Dam Raising Project	2017/7940	Controlled Action	Assessment Approach
Not controlled action			
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Sewerage Scheme for the three villages of Mulgoa, Wallacia and Silverdale	2003/1314	Not Controlled Action	Completed
Not controlled action (particular manner)			
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Replacement of flows with recycled water	2006/3050	Not Controlled Action (Particular Manner)	Post-Approval

Bioregional Assessments		
SubRegion	BioRegion	Website
Sydney	Sydney Basin	BA website

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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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. Please see the caveat for interpretation of information provided here.

Report created: 20-Aug-2023

https://pmst.awe.gov.au/#/map?lng=150.59827923774722&lat=-33.88631512528725&zoom=16&baseLayers=Imagery,ImageryLabels

Australian Government

Department of Climate Change, Energy, the Environment and Water

Protected Matters Search Tool

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Summary

Matters of National Environment 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:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	54
Listed Migratory Species:	15

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	8
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community may occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	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

Scientific Name	Threatened Category	Presence Text
Melanodryas cucullata cucullata		
South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat likely to occur within area
Neophema chrysostoma		
Blue-winged Parrot [726]	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
Pycnoptilus floccosus		
Pilotbird [525]	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
Stagonopleura guttata		
Diamond Firetail [59398]	Vulnerable	Species or species habitat likely to occur within area
FISH		
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
FROG		
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
MAMMAL		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Petauroides volans		
Greater Glider (southern and central) [254]	Endangered	Species or species habitat may occur within area
Petaurus australis australis		
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely 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]	Endangered	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
PLANT		
Acacia bynoeana		
Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat may occur within area
Allocasuarina glareicola		
[21932]	Endangered	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
Eucalyptus aggregata		
Black Gum [20890]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Eucalyptus benthamii Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Hakea dohertyi Kowmung Hakea [66701]	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
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat may occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat may occur within area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pterostylis saxicola		
Sydney Plains Greenhood [64537]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri		
Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens		
Scrub Turpentine, Brown Malletwood [15763]	Critically 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 may 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
Veronica lithophila		
[87479]	Endangered	Species or species habitat likely to occur within area
REPTILE		
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	Vulnerable	Species or species habitat may occur within area
SNAIL		
Pommerhelix duralensis		
Dural Land Snail [85268]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		

Scientific Name	Threatened Category	Presence Text
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to 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 likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
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
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State
Communications, Information Technology and the Arts - Telstra Corporation Limited	
Commonwealth Land - Australian Telecommunications Commission [12487]	NSW

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis		
Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine 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
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat may occur within area overfly marine area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Burragorang	State Conservation Area	NSW

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Residential development	2015/7578	Controlled Action	Post-Approval
Residential subdivision Lot 1 DP 588912 1-41 Marsh Road, Silverdale, NSW	2016/7684	Controlled Action	Post-Approval
Warragamba Dam Raising Project	2017/7940	Controlled Action	Assessment Approach
Not controlled action			
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Sewerage Scheme for the three villages of Mulgoa, Wallacia and Silverdale	2003/1314	Not Controlled Action	Completed
Not controlled action (particular manner)			
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Replacement of flows with recycled water	2006/3050	Not Controlled Action (Particular Manner)	Post-Approval

Bioregional Assessments

SubRegion	BioRegion	Website
Sydney	Sydney Basin	BA website

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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