Upper South Creek Advanced Water Recycling Centre

Sydney WATER

Environmental Impact Statement

Volume 2 Project Information and Consultation

September 2021

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EIS certification

Project	Upper South Creek Advanced Water Recycling Centre (SSI-8609189)
Address of the land	Lot 211 DP1272676, Part of Lot 21 DP 258414 and Part of Lot 104 DP1271336 in Kemps Creek and • Land between this lot and Lansdowne Reserve in Lansdowne for a distance of about 24 km • Land between this lot and Nepean River in Wallacia for a distance of about 16.7 km • Land between Bents Basin Road in Wallacia and Warragamba River in Warragamba, for a distance of about 4.5 km
Description of infrastructure	Construction and operation of a new wastewater treatment plant in Kemps Creek, and pipelines for releasing treated water to Nepean and Warragamba Rivers and South Creek and brine to the Malabar wastewater system. It also includes other associated infrastructure and ancillary development as described in this environmental impact statement (EIS).

EIS prepared by:

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Qualifications	Bachelor of Advanced Science (Environmental Science), Master of Business and Technology
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Responsible person:

Name and position	Paul Plowman, General Manager Asset Lifecycle
Address	Sydney Water, 1 Smith Street, Parramatta, NSW 2150

Declaration:

I certify that this EIS has been prepared in accordance with the Secretary's environmental assessment requirements issued on 28 January 2021 and relevant requirements of Division 5.2 of the *Environmental Planning and Assessment Act 1979* and Schedule 2 of the Environmental Planning and Assessment Regulation 2000. To the best of my knowledge, the EIS contains all available information relevant to environmental assessment of the project and does not contain false or misleading information.

Signature:

Name: Elissa Howie

Date:30 September 2021

1 Introduction

This chapter introduces the Upper South Creek Advanced Water Recycling Centre project, broadly outlines the approvals pathway for the project and provides an overview of the environmental impact statement (EIS) structure.

1.1 Project overview

Western Sydney is growing and wastewater services are needed by 2025 to enable population growth and economic development of the Western Sydney Aerotropolis Growth Area (WSAGA or Aerotropolis), South West Growth Area (SWGA) and the new Western Sydney International Airport. Sydney Water's wastewater servicing area for this catchment is known as the Upper South Creek Servicing Area. It includes already established suburbs such as Oran Park and Leppington, and the new precincts of Bradfield and the Northern Gateway.

Sydney Water is proposing to build and operate a project to provide wastewater services to this area. The project will comprise:

- a new Advanced Water Recycling Centre (AWRC) to collect wastewater from businesses and homes and treat it, producing high-quality treated water, renewable energy and biosolids for beneficial reuse
- a new green space area around the AWRC, adjacent to South Creek and Kemps Creek, to support the ongoing development of a green spine through Western Sydney
- new infrastructure from the AWRC to South Creek, to release excess treated water during significant wet weather events, estimated to occur about 3 – 14 days each year
- a new treated water pipeline from the AWRC to Nepean River at Wallacia Weir, to release high-quality treated water to the river during normal weather conditions
- a new environmental flows pipeline from Wallacia to Warragamba River, to release high-quality treated water to the river just below the Warragamba Dam
- a new brine pipeline from the AWRC connecting into Sydney Water's existing wastewater system to transport brine to the Malabar Wastewater Treatment Plant
- a range of ancillary infrastructure.

Figure 1-1 shows this project infrastructure and the Upper South Creek Servicing Area.

In addition to providing essential wastewater services, the project will also enable opportunities to:

- contribute to Sydney's water resilience by producing treated water suitable for a range of beneficial uses including industry, households, open spaces, environmental flows, agribusiness, and purified recycled water for drinking subject to future government decisions

- become a centre for circular economy activity in the Western Parkland City where resources are recovered and reused for their greatest economic value, through development of a bioenergy hub at the AWRC to reuse waste and generate renewable energy
- contribute to the NSW Government's vision for a liveable Western Parkland City and WSAGA by providing water that could be used for greening and cooling the landscape.

The project will deliver an essential service and major public benefits to the WSAGA and SWGA, which is critical to meeting Sydney's long-term development aspirations in line with the Greater Sydney Region Plan. The project is State significant infrastructure under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This EIS has been prepared to assess the impacts of the project and requires approval from the NSW Minister for Planning and Public Spaces.

In addition, the project is a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Although assessed as part of this EIS under the bilateral agreement between the NSW and Commonwealth governments, it will also require approval from the Commonwealth Minister for the Environment.

The EIS is based on Sydney Water's preliminary reference design and construction methodology for the project and that has informed the project's footprint, likely impacts, opportunities and benefits.

Ultimately, the size of the project is guided by population projections for 2056 and the resulting wastewater treatment demand. However, it will be developed over time and designed with adaptability and flexibility to respond to changes in forecast population, climate change, evolving technology and emerging circular economy opportunities. In the first stage, which will become operational in 2025, pipelines will be built to their ultimate capacity and the AWRC will be built to service demand from already established residential and industrial areas and near-term development. In the future, Sydney Water will continue to build capacity at the AWRC to enable and service future populations and growing demand in the Upper South Creek Servicing Area.

To accommodate these future uncertainties, Sydney Water is seeking a staged approval under section 5.20 of the EP&A Act where the ultimate concept is outlined and the EIS seeks approval to build and operate Stage 1 of the project, to treat wastewater flows up to 50 million litres per day (ML/day). Future stages will be timed to support growth, with an ultimate capacity of 100 ML/day, in line with the overall concept outlined further in this EIS.

What the project does not include

Sydney Water is planning to deliver the wastewater collection and recycled water distribution networks across the Upper South Creek Servicing Area under separate projects. These networks will be staged to match development timeframes and will be subject to separate development, assessment and approvals and are therefore not included in project scope for this EIS.

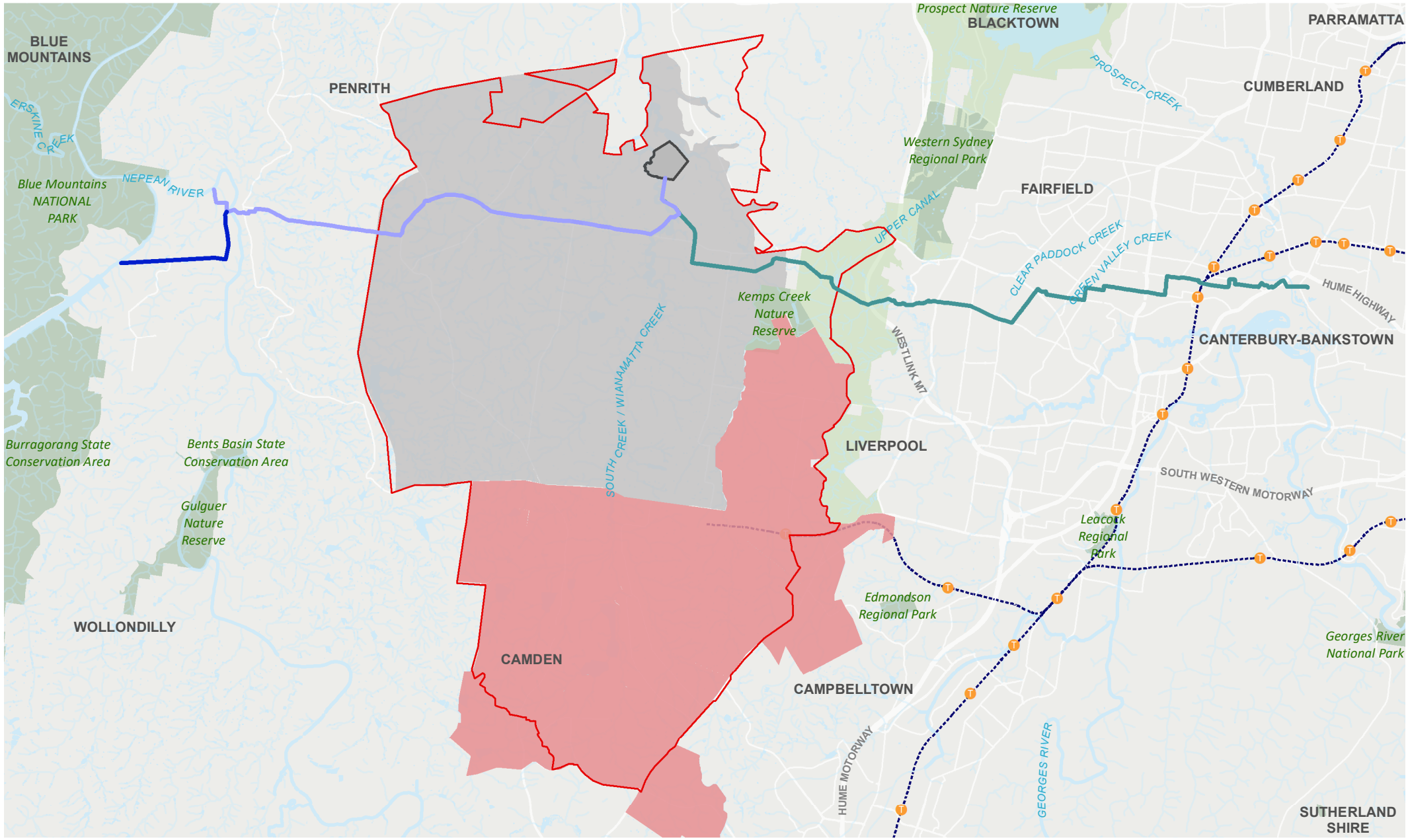

Figure 1-1 Project and servicing area

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

1.2 Project location

The project will be located in Western Sydney. The AWRC site will be at Kemps Creek, close to the proposed M12 Motorway and the Western Sydney International Airport, and adjacent to South Creek. The project pipelines will extend from Warragamba and Wallacia in the west to Lansdowne in the east, largely along road corridors, where they will connect into Sydney Water's existing wastewater network.

The project crosses five local government areas (LGAs) – Wollondilly Shire, Penrith City, Liverpool City, Fairfield City and City of Canterbury-Bankstown. Table 1-1 shows the suburbs in which the project will be located.

Table 1-1 Suburbs in which the project will be located

Project suburbs		
Badgerys Creek	Cecil Hills	Lansvale
Bonnyrigg	Cecil Park	Luddenham
Bonnyrigg Heights	Elizabeth Hills	Mount Pritchard
Cabramatta	Fairfield	Mulgoa
Cabramatta West	Green Valley	Wallacia
Canley Heights	Kemps Creek	Warragamba
Canley Vale	Lansdowne	West Hoxton

Land uses across the project area vary significantly and include rural, peri-urban, residential and parkland areas. The AWRC site is surrounded by large rural residential properties, agricultural land and commercial activities. Following the treated water pipeline west from the AWRC, the land uses include large rural properties, the Western Sydney International Airport as well as residential and rural residential areas around Wallacia. Following the brine pipeline east from the AWRC, the land use is rural residential and open space through Western Sydney Parklands. East of the M7 Motorway, the land use is mainly residential and commercial.

Where the AWRC and sections of the treated water and brine pipelines are located in the WSAGA, land uses are expected to change from rural residential to more urban and enterprise uses over time as land is rezoned and redeveloped.

1.3 Structure of the environmental impact statement

This EIS has been developed to address the requirements issued by the Secretary of the NSW Department of Planning, Industry and Environment (DPIE) and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

The Secretary's Environmental Assessment Requirements (SEARs) were first issued in August 2020 and re-issued in January 2021 to include assessment requirements for Matters of National Environmental Significance (MNES) and approval requirements under the EPBC Act. Appendix A outlines where the SEARs are addressed in this EIS.

The EIS is divided into various volumes as described in Table 1-2.

Table 1-2 EIS volumes

Volume	Chapter	Contents
Volume 1	Executive Summary	Provides a succinct summary of the Environmental Impact Statement
Volume 2	Chapter 1	Introduction - provides an overview of the project scope and location
	Chapter 2	Strategic context - explains the strategic context of the project, including the need and alignment with key legislation and planning documents
	Chapter 3	Project options – provides an overview of the options assessment process, and the alternatives that were considered
	Chapter 4	Project description - provides a detailed description of all project components, including design, construction, operation and commissioning activities
	Chapter 5	Statutory context - explains the NSW and Commonwealth planning approval framework for the project
	Chapter 6	Stakeholder and community engagement – outlines the approach to stakeholder and community engagement, the issues that were raised and how they have been addressed
Volume 3	Chapter 7	Impact assessment approach – outlines the approach to identifying key environmental issues and assessing any environmental impacts and provision of environmental management measures
	Chapter 8	Key waterways impacts – including water objectives and the impact on waterway quality and waterway flows of Nepean River, Warragamba River and South Creek
	Chapter 9	Physical and biological environmental impacts – including • Terrestrial biodiversity • Surface water • Flooding • Groundwater • Soils and contamination

Volume	Chapter	Contents
	Chapter 10	Heritage impacts – including • Aboriginal heritage • Non-Aboriginal heritage • World and national heritage
	Chapter 11	Social and amenity impacts – including • Air quality • Noise and vibration • Landscape character and visual • Traffic and access • Human health and hazards • Land-use and property • Socio-economics
	Chapter 12	Sustainability and resource management – including • Sustainability • Greenhouse gases • Climate change • Resource use and waste management
	Chapter 13	Adjacent infrastructure – including • Airport operations • Utilities
Volume 4	Chapter 14	Environmental management
	Chapter 15	Project synthesis
Volume 5	Chapter 16	Glossary and terms
	Chapter 17	References
Volume 6	Appendices	

2 Strategic context

This chapter describes the need for the project, its objectives and benefits. It demonstrates how the project makes an important contribution to the delivery of a range of Commonwealth, NSW Government and Sydney Water strategies.

2.1 Relevant Secretary's Environmental Assessment Requirements

Table 2-1 lists the SEARs addressed in this chapter and the section in which they are addressed.

Table 2-1 SEARs addressed in strategic context chapter

SEARs	EIS section where requirement addressed
General Requirements (c) a summary of the strategic need with regard to its State significance and relevant State Government policy including: i. NSW State Infrastructure Strategy: South Creek Corridor Strategy ii. Western Sydney Aerotropolis Plan (WSAP) iii. Western Sydney Aerotropolis Discussion Paper on proposed State Environmental Planning Policy (SEPP) iv. Western Sydney Aerotropolis DCP v. Wianamatta-South Creek Precinct Plan vi. Kemps Creek Precinct Plan vii. Draft Cumberland Plain Conservation Plan	Section 2.5, 2.6, 2.10 and Appendix B Western Sydney strategic context noting the following: • Western Sydney Aerotropolis SEPP Discussion Paper not addressed because SEPP has been enacted. Chapter 5 addresses this SEPP. • There is no separate precinct plan for Wianamatta-South Creek. The draft Aerotropolis Precinct Plan incorporates this precinct. • Kemps Creek Precinct Plan is not addressed because it has not yet been developed.
(d) a statement of the strategic objective(s)	Section 2.4
(f) (iii) identification of the existing environmental planning instruments and other current government strategic plans and policies relevant to the project and land subject to the project (including State environmental planning policies, land use and infrastructure strategies and local strategic planning statements)	Sections 2.5 to 2.11 address government strategic plans, policies, land use and infrastructure strategies. Chapter 5 addresses state environmental planning policies and local strategic planning statements.

SEARs	EIS section where requirement addressed
49. Assessing project impacts to the Western Sydney Parklands including: a) addressing the relevant objectives, strategic directions, land use opportunities and key management priorities of State Environmental Planning Policy (Western Sydney Parklands) 2009, the Western Sydney Parklands Plan of Management 2030, the Western Sydney Parklands Southern Parklands Framework and the Western Sydney Parklands Design Manual	Section 2.6.6 and Appendix B. Chapter 5 addresses the SEPP.

2.2 Strategic overview

2.2.1 Enabling development, home and job growth in the Western Parkland City

Greater Sydney's population is forecast to reach eight million people over the next 40 years, and about half of those people are expected to be living west of Parramatta. Much of this growth will occur in the Western Parkland City, driven by the new Western Sydney International Airport.

Over the coming years, the region is set to become the economic powerhouse of Greater Sydney. This area will need commercial and industrial developments to host the businesses, residential areas to house the workforce and infrastructure to service their access and utility needs.

The NSW Government's vision for the Western Parkland City is focused on creating jobs, a highly-skilled workforce and an innovation economy. However, it also seeks to support a landscape-led approach to new urban communities that will create quality places for the community, keep water resources in the catchment to protect the local climate from heat island effects, value Aboriginal and non-Aboriginal heritage and support the emerging circular economy. Development of the Western Parkland City presents a significant opportunity to maximise productivity, liveability and sustainability.

In the heart of the Western Parkland City, the Western Sydney Aerotropolis Growth Area (WSAGA) and South West Growth Area (SWGA) are expected to be home to up to 650,000 people by 2056. Framed by world heritage landscapes to the west and established urban communities to the east, the region is largely rural, providing considerable agricultural and mineral resources that supply Greater Sydney with fresh produce and construction materials. Its rural towns and villages are home to thriving communities and popular tourist destinations. Most of these areas are not currently serviced by Sydney Water.

In a modern economy, growth can only occur when properly serviced by water and wastewater services. Sydney Water already provides these services across much of Sydney and efficiently keeps pace with development to ensure the economy is supported. Most of the WSAGA and SWGA are not serviced by Sydney Water and use on-site systems such as septic tanks. The proposed new urban communities require water and wastewater services to be established to ensure the anticipated population growth and economic productivity is realised, and to provide equitable servicing across Sydney's metropolitan areas.

New water and wastewater services also bring considerable opportunity to maintain treated water in the local context, enhance the quality of public spaces, the health of the community and environment, and be a focal point for a new circular economy.

In developing new wastewater services for the region, the project is focused on achieving the best outcome for Western Sydney, and therefore for Greater Sydney more broadly. The project will enable growth and development of the region and offer value and benefits beyond those typically expected from a wastewater service. The project will provide the foundation for a circular economy hub in the Western Parkland City and, although not part of project scope, can enable future opportunities, including:

- using the highly treated recycled water by businesses, residents and for the environment
- collecting and processing organic waste that would otherwise go to landfill
- generating additional renewable energy for use on site and beyond.

2.2.2 Sydney Water's role in providing resilience to its water systems

Sydney Water is a State-owned corporation, wholly owned by the NSW Government. Its legislated principal function under the *Sydney Water Act 1994* (Sydney Water Act) is to use its regulated assets to provide, construct, operate, manage, and maintain systems and services for storing or supplying water, providing wastewater services and stormwater drainage systems. Under the Sydney Water Act, Sydney Water must operate efficiently, be a sustainable business and act in the interests of the communities in which it operates. It must protect human health and the environment in compliance with its operating licence.

Sydney Water provides water, wastewater, recycled water and some stormwater services to 5.1 million residential, commercial and industrial customers across Greater Sydney, Blue Mountains and the Illawarra. Every day, Sydney Water supplies about 1,500 megalitres (ML) of drinking water to its customers, sourced from dams (managed by WaterNSW) and the Sydney Desalination Plant (operated by Veolia Water Australia). Sydney Water then collects about 1,300 ML of wastewater per day from the same customers and treats it at one of 16 wastewater treatment plants or 14 water recycling plants. Most treated water is currently released to the ocean via one of three deep ocean outfalls at Malabar, Bondi and North Head.

Last year, Sydney Water supplied 47,000 ML of recycled water from its water recycling plants (around 10% of the volume treated), including 10,000 ML that went to residential, commercial and industrial uses and 3,000 ML that was used for other purposes such as irrigation of parks, open space and sports fields. This saved 13,000 ML of drinking water. In addition, 17,000 ML went to environmental flows (including to the Hawkesbury-Nepean River) to enhance river water quality and for agriculture purposes, and Sydney Water reused 17,000 ML at its own plants.

Using recycled water provides a source of water that can be used for a variety of purposes that can keep water in the landscape, reduce pressure on the water supply system and build resilience in the face of droughts and climate change. A key part of Sydney Water's role is to ensure water and wastewater services are well-managed and maintained for future generations and that water supplies are protected. There is considerable opportunity to increase the use of recycled water to further save Sydney's drinking water supplies, improve liveability and environmental outcomes.

2.2.3 Opportunities for improving liveability, sustainability and the environment

Sydney Water takes its role to provide water and wastewater services in a cost-efficient manner seriously, with a focus on sustainable development and inter-generational equity. In considering how best to service the new Upper South Creek Servicing Area, it was clear that treating the water to the highest quality using an advanced treatment process provided both the lowest cost solution and greatest opportunity for improving the region's liveability, sustainability and environment.

Enabling a circular economy by recovering valued resources

To protect the environment and improve sustainability, it is imperative to plan a future where waste is minimised through reuse and recycling. The NSW Government (Environment Protection Authority, 2019b) defines a circular economy as:

'A circular economy values resources by keeping products and materials in use for as long as possible.

Maximising the use and value of resources bring major economic, social and environmental benefits. It contributes to innovation, growth and job creation, while reducing our impact on the environment.'

By locating the new treatment capability at a single site, Sydney Water can take advantage of both the wastewater treatment process and the economies of scale to generate energy and recover resources, which could be sold to new customers and reused in a beneficial manner. In doing so, a new circular economy can be created and the AWRC can be a hub for this in the Western Parkland City.

As part of project scope, Sydney Water proposes to recover:

- high-quality treated water to be used as environmental flows in waterways
- organic material recovered during secondary wastewater treatment processes, known as biosolids, for use as an alternative to chemical fertilisers in farming and gardening
- renewable energy from co-generation within the AWRC and solar energy generation.

There are also a range of circular economy opportunities outside project scope, including:

- In the wastewater process, there is potential to treat and reuse water, capture nutrients such as nitrogen and phosphorus, produce gas (including gas-to-grid) and generate energy. It is also possible to bring organic waste in from other sources and use that to generate energy or for composting.
- By producing high-quality treated water, Sydney Water can reuse the water locally for a wide range of uses, protect waterways when treated water is released, and potentially pursue future options to directly augment drinking water supplies.

Once any further opportunities are identified and scoped in detail Sydney Water will progress any necessary consents or approvals under the *Environmental Planning and Assessment Act 1979*.

Environmental flows to Nepean and Warragamba Rivers

The Hawkesbury-Nepean river system and its tributaries, including Warragamba River, are a critical part of Sydney's water supply and have been modified with a series of dams and weirs, which over time have changed the natural flow regime.

This project proposes to use high-quality treated water for environmental flows released to Nepean or Warragamba Rivers. The water will be treated to a high level through an advanced treatment process that produces water so clean it could be used for drinking. Releasing clean water to rivers and creeks helps protect aquatic ecosystems, reduce weeds and the frequency of algal blooms. It also protects the values of the downstream Blue Mountains World Heritage Area.

The project can also potentially offset environmental flows that would otherwise need to be released from Warragamba Dam, saving drinking water. Sydney Water is continuing to explore the details of environmental flow releases from the project with Department of Planning, Industry and Environment (DPIE) and other agencies.

Supporting the health of South Creek

The project includes establishing a green space area on the AWRC site along South Creek to enhance biodiversity on the site, use best practice water sensitive urban design and provide visual screening of the AWRC. The green space area is an important link in the green spine along South Creek envisaged in the NSW Government's vision for the WSAGA. There is also an opportunity for public access to the green space area to form part of the Wianamatta-South Creek parkland envisaged in the Western Sydney Aerotropolis Plan.

Supporting South Creek's health is fundamental to the AWRC design. Sydney Water has designed treated water releases to support flow and water quality objectives in South Creek through best-practice management of stormwater, transferring treated water to Nepean River in normal conditions and releasing advanced treated water to South Creek in wet weather conditions. Sydney Water has also designed the project to have negligible impacts on flooding along Nepean River and South Creek.

Liveability, productivity and sustainability in Western Sydney

The project will have the capability to support the Greater Sydney Commission's place-making approach to urban design by:

- providing recycled water to complement stormwater (top-up of rainwater and stormwater tanks/basins), in the irrigation of open spaces and street trees to provide cooling and support recreational or sporting activities as well as active transport for residents and workers in Western Sydney. Recycled water can provide water security and protect investment and outcomes associated with private and public green spaces in drought
- providing recycled water for industrial processes and cooling towers to support industries around Western Sydney International Airport
- providing recycled water to support food production in the Agribusiness Precinct.

The project will produce recycled water suitable for these purposes but the infrastructure (such as recycled water pipelines) to enable these uses is outside project scope.

In addition, there is an opportunity for urban design of the AWRC and green space area to align with place-making principles and celebrate the site's Aboriginal and non-Aboriginal heritage.

2.3 Project need

2.3.1 Key project drivers

Significant residential and economic growth is expected in the Upper South Creek Servicing Area over the next 35 years, and wastewater treatment is crucial to enable and support that growth. The growth is driven by:

- opening of the Western Sydney International Airport by 2026 which is a key catalyst for development in the region
- government and private sector investment in the WSAGA and SWGA
- NSW, Commonwealth and local government investment in infrastructure, including major new road and rail assets, social infrastructure and utilities
- release of new land areas, particularly for additional housing
- support for the establishment of industrial, manufacturing, agribusiness, commercial and other businesses that will create a large number of high value jobs.

The Western Sydney City Deal includes commitments from a partnership between Commonwealth, NSW and local government that is fundamental in delivering the Western Parkland City vision. The project forms part of the backbone infrastructure to ensure government commitments in the Western Sydney City Deal can be realised.

Being mostly rural, a large proportion of the servicing area is currently serviced by on-site systems such as septic tanks. While these systems are suitable for rural properties with only small numbers of people, they are not suitable in urban environments to treat large wastewater volumes. They are limited by the range of materials they can treat, their high maintenance costs, the poor quality of the water produced and subsequent risk to human health in the event of a failure. As a result, reliance on septic tanks in the Upper South Creek Servicing Area is not an acceptable long-term option for the future Western Parkland City.

Other parts of the Upper South Creek Servicing Area are temporarily connected to Sydney Water's Liverpool and West Camden Water Recycling Plants (WRPs). These WRPs are experiencing rapid growth in their own catchments, even accounting for impacts of the COVID-19 pandemic.

In addition, the catchments for these WRPs also have downstream constraints. Liverpool WRP discharges treated water through some of Sydney Water's oldest and largest wastewater networks to the deep ocean outfall at Malabar. This network has limited capacity for any additional flows. West Camden WRP treats wastewater to tertiary quality (with a higher level of nutrients than advanced quality water) which limits its capacity to treat additional wastewater flows. Its network also has limited capacity for additional flows.

Together, this supports the clear need to build a new wastewater treatment plant for the Upper South Creek Servicing Area and to provide an advanced treatment process with reduced nutrient loads so treated water can be released to the Hawkesbury-Nepean river system.

2.3.2 Project sizing

Sydney Water has used DPIE's population growth projections for the WSAGA and SWGA to estimate the volume of wastewater to be generated in the Upper South Creek Servicing Area over time, and, through that, the proposed size and staging of the project. DPIE population growth projections consider the range of factors that affect population growth, including business statistics and travel zone analysis.

There are inherent uncertainties in all population projections, but these are exacerbated by the substantial disruption to the Australian and global economies from the COVID-19 pandemic (and its impact on immigration into Australia), the ongoing effect of climatic events (droughts and floods) and the impact of governance and policy changes in the water sector.

In the face of this uncertainty, Sydney Water has looked at a range of growth scenarios to determine which best reflects likely population growth and wastewater demand. These scenarios are reflected in Table 2-2 and Figure 2-1 and include:

- Scenario 1, developed in 2019, is based on DPIE's 2017 Housing Supply Forecast Model (HSFM) and the Bureau of Transport Statistics' 2016 Employment Projection, which was current when planning started for the project.
- Scenario 2 was developed in late 2020, based on updated information from DPIE and the Bureau of Transport Statistics. This is overlayed with information from other planning authorities, councils and the development industry to reflect proposed land release, rezoning, and detailed and strategic development activity.

- Scenario 3 builds on Scenario 2 and includes further updated growth forecasts provided by DPIE in January 2021 including predicted reduced growth.
- Scenario 4 includes additional and potential impacts of the COVID-19 pandemic provided by DPIE in 2021.

This EIS is based on Scenario 1, the scenario reflecting greatest demand. As a result, Sydney Water has taken a conservative view and is seeking approval for a project sized to meet the highest population growth projections, given that long term population growth forecasts are not well defined. This approach also provides greatest flexibility as, from an operational perspective, it is easier to scale down processing capacity than to meet increased demand. From an impact assessment perspective, assessing the larger project allows for the assessment of its maximum impact.

Sydney Water is seeking flexibility in planning approvals around AWRC size and staging to accommodate this adaptability. Section 4.13 describes this in more detail. Sydney Water will continue to work closely with DPIE, government departments, councils, developers and landowners about the progress of development and land use zoning in the Upper South Creek Servicing Area to inform ongoing growth sensitivity analysis, optimal investment and project sizing and staging.

Table 2-2 Population growth and wastewater flow scenarios in the Upper South Creek Servicing Area

Growth Scenarios			2026	2036	2046	2056
1	DPIE (2019)	Population (EP[1])	141,800	347,700	558,000	645,300
		ADWF (ML/day)[2]	21.3	52.2	83.7	96.8
2	DPIE (2020)	Population (EP)	96,800	285,000	417,000	478,200
		ADWF (ML/day)	14.5	42.8	62.6	71.7
3	DPIE (2021)	Population (EP)	83,300	245,800	349,000	397,000
		ADWF (ML/day)	12.5	36.9	52.4	59.5
4	DPIE (2021) with prolonged COVID-19 impacts	Population (EP)	67,500	197,300	287,300	329,300
		ADWF (ML/day)	10.1	29.6	43.1	49.4

Notes on table

1. EP – equivalent population. This includes residential population and an 'equivalent' population associated with industry and business based on the equivalent wastewater flows they generate compared with the typical residence. This ensures all wastewater flows are included in planning.
2. ADWF (ML/day) – average dry weather flow in megalitres (million litres) per day. This is the average wastewater flow into the AWRC in typical conditions. ADWF is explained in more detail in Chapter 4.

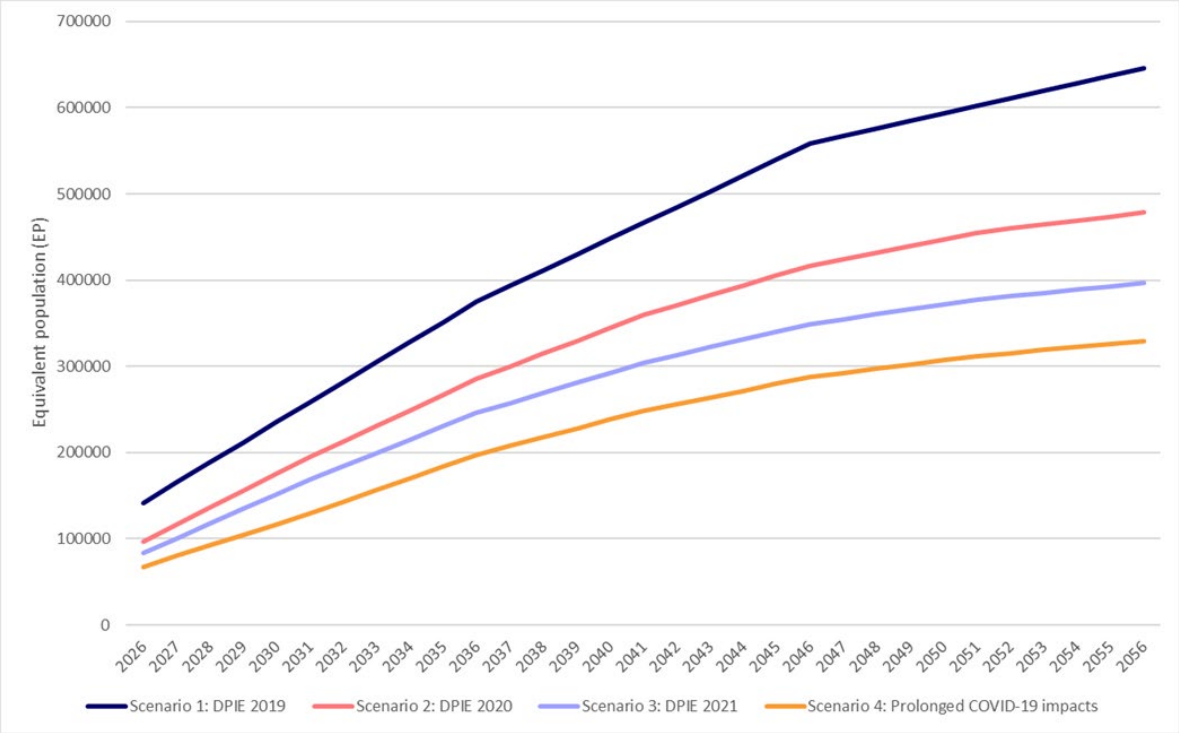

Figure 2-1 Population growth scenarios for Upper South Creek Servicing Area

2.3.3 Project timing and staging

The first stage of the project needs to be delivered by 2025 to service Western Sydney International Airport, from when it opens in 2026, and to service the projected growth in the WSAGA and SWGA. This stage will include building pipelines to their ultimate capacity of up to 100 ML/day and the AWRC to treat wastewater flows up to 50 ML/day. Figure 2-2 shows proposed timing of key project phases including construction, commissioning and operation.

Based on 2056 population projections, Sydney Water expects that the AWRC will ultimately require expansion to treat wastewater flows up to 100 ML/day. Sydney Water will remain flexible on the size and timing of these future upgrades to accommodate changes in population projections over time. Future stages will be subject to further environmental assessment, in line with the overall concept outlined in this EIS.

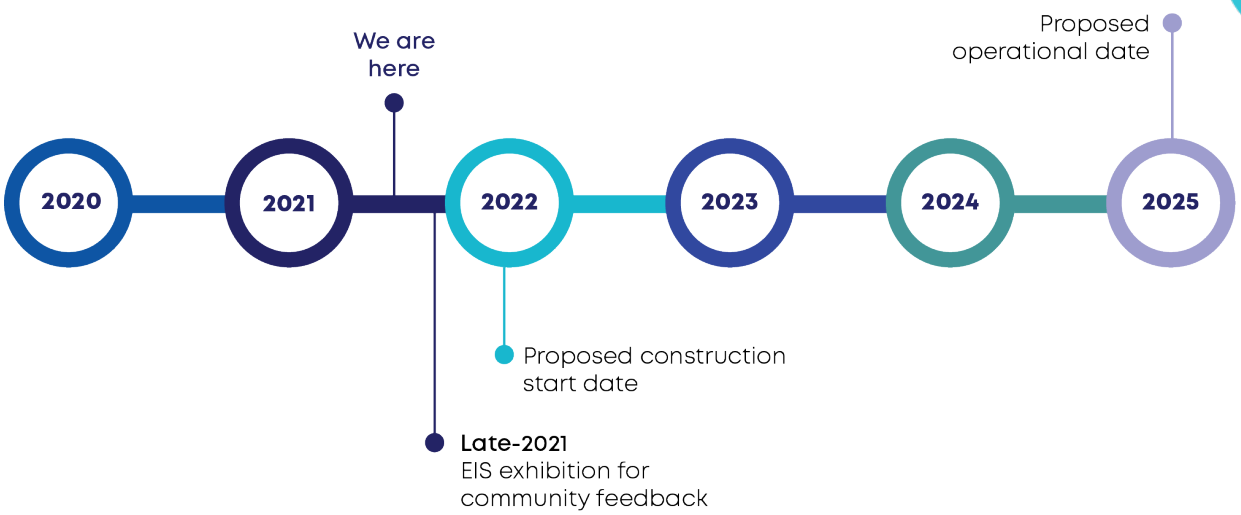

Figure 2-2 Project timing for Stage 1

2.4 Project objectives

To achieve the project's primary aim of wastewater servicing for the SWGA and WSAGA, Sydney Water has developed a series of strategic objectives as shown in Figure 2-3 and Table 2-3. Table 2-3 also describes how the project addresses these objectives.

Figure 2-3 Upper South Creek project objectives

Table 2-3 Upper South Creek project objectives description

Objective	How project addresses objective
Respond to growth Provide wastewater services to the SWGA and WSAGA, in line with the NSW Government's long-term population forecasts and Sydney Water's licence obligations.	Design and staging of the project has considered population growth forecasts and Sydney Water's licence obligations. The EIS describes how the project will provide wastewater services to the SWGA and WSAGA.
Provide cost effective service Provide a cost-effective value for money wastewater treatment service that is financially sustainable for Sydney Water and minimises impact on customer bills.	This objective is not addressed in the EIS. Sydney Water is regulated by the Independent Pricing and Regulatory Tribunal (IPART) that audits each project against prudency and efficiency measures. The project is assured through the Infrastructure New South Wales gateway process, which considers value for money and other criteria.
Minimise disruption Plan, construct and operate the infrastructure required to deliver the service with minimum disruption to the community.	The EIS describes project impacts and how they will be managed to minimise community disruption. It also discusses how Sydney Water has engaged with the community about the project and how it will continue to engage with them as detailed design and construction progresses.
Adaptable solution Incorporate into the solution, alternative futures, addressing a range of demand scenarios (including before 2025), meeting customers changing aspirations.	As described in the EIS, the project has been developed through assessing a range of alternative options and will be staged to remain flexible to factors including changing population projections, new technologies.
Sustainable solutions Demonstrate leadership in integrated and sustainable water management, including: • preserving waterways health and amenity values of the Hawkesbury-Nepean River, South Creek, and tributaries • retaining water in the landscape to mitigate urban heating and create green and vibrant places • supplying recycled water for non-drinking purposes for use in homes and businesses, for agricultural purposes or irrigation of public open space • pursuing circular economy approaches to waste management by explicitly adopting renewable energy solutions and resource reuse.	As described in the EIS, the project includes producing treated water that can be used for recycling and produces renewable energy and reuses resources. Sydney Water has designed the project to manage waterway health. Sydney Water is enabling the incorporation of sustainable infrastructure and services delivery through the design of the AWRC and pipelines. In addition, the project provides a foundation for developing a circular economy hub in the Western Parkland City.

2.5 Alignment with government infrastructure strategy and policy

2.5.1 Infrastructure Australia Infrastructure Priority List

Infrastructure Australia is an independent statutory body that provides research and advice to governments, industry and the community on nationally significant infrastructure needs. It audits Australia's nationally significant infrastructure and develops 15-year, rolling infrastructure plans that specify national and state level priorities.

The Infrastructure Priority List (Infrastructure Australia, 2021) includes development of the South Creek Integrated Land Use and Water Cycle Management as a priority initiative. DPIE is leading this initiative which aims to include the use of 'catalytic blue and green infrastructure', advanced water cycle management (water recycling schemes and reuse for non-drinking and drinking purposes) and investment in new or augmented water infrastructure.

The list also includes Greater Sydney water security as a high priority initiative. The initiative notes that options to address the initiative include 'better-use and new infrastructure investments, as well as non-infrastructure responses such as demand management to efficiently meet this need.'

There is an opportunity for the project to contribute to both these initiatives by producing high quality treated water that could be used in water recycling schemes or for environmental flows. This would offset demand for drinking water by providing treated water as a replacement.

2.5.2 NSW State Infrastructure Strategy

The NSW State Infrastructure Strategy (Infrastructure NSW, 2018) sets out the NSW Government's infrastructure priorities for the next 20 years, for each of NSW's major geographic regions and for each infrastructure sector. Of relevance to the project is the need to:

- protect and enhance the South Creek Catchment
- ensure flexible and adaptable wastewater systems, resilient to climate change driven effects such as increased temperatures, increased rainfall intensity and sea level rise
- leverage developments in contemporary wastewater systems allowing for energy and nutrient recovery
- remove regulatory impediments to water recycling for nutrient management, water supply augmentation and realisation of a vegetated 'green' urban form in new development areas
- develop the South Creek Corridor Strategy to provide a coordinated framework for major infrastructure investment decisions, support significant population growth in the corridor, underpin development of liveable and sustainable communities and provide regulatory certainty to test options for broad scale recycling of wastewater for non-drinking purposes.

The project provides infrastructure needed to achieve these priorities, particularly as a key part of a new wastewater system in the region, incorporating energy recovery and advanced treatment for a high level of nutrient removal. As outlined in the project objectives, the project aims to provide adaptable and sustainable wastewater services and supply recycled water that can be used for a range of purposes.

2.5.3 South Creek Corridor Strategy

As noted above, the South Creek Corridor Strategy has been identified in the NSW State Infrastructure Strategy. The latest step in the South Creek Corridor Strategy is developing a long-term delivery strategy to implement the recommendations about integrated water management, land use control and water-related infrastructure investment arising from the South Creek Sector Review. DPIE is developing this strategy throughout 2021, with initial planning focused on the WSAGA. Sydney Water is involved in developing this strategy and the project is an important part of delivering it by providing a source of recycled water and establishing a green space area on the AWRC site adjacent to South Creek.

2.6 Alignment with Western Sydney strategy and policy

2.6.1 Western Sydney City Deal

The Western Sydney City Deal is a planning, investment and delivery partnership involving the Commonwealth and NSW Governments, together with the eight local governments in Western Sydney (Commonwealth of Australia, Department of Infrastructure, Regional Development and Cities, and NSW Department of Premier and Cabinet, 2018). It is a critical part of successful delivery of the Western Parkland City vision.

The deal's 38 commitments lay the foundation for a liveable '30-minute city', with infrastructure and facilities that bring residents closer to jobs, services, education and the world. The commitments are grouped into six initiatives – connectivity, jobs for the future, skills and education, liveability and environment, planning and housing, implementation and governance.

The delivery of wastewater services under the project will support the deal's commitments to build 184,500 new houses (planning and housing initiative) and create 200,000 new jobs (jobs for the future initiative) over the next 20 years.

As part of a commitment in the Western Sydney City Deal, the NSW Government and local councils have formed the Western Sydney Planning Partnership to coordinate better quality land use planning outcomes, that can achieve the vision for the Western Parkland City. Sydney Water works closely with this partnership to help inform planning and infrastructure decisions.

2.6.2 Greater Sydney Region Plan and Western City District Plan

The NSW Government's vision sees Greater Sydney as a metropolis of three cities, the Western Parkland City, the Central River City and the Eastern Harbour City. The vision for the emerging Western Parkland city leverages new city-shaping infrastructure and investment to boost productivity. The spine of South Creek and its tributaries will re-imagine liveability and sustainability to provide new cool and green neighbourhoods and centres in a parkland setting.

The Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018a) identifies 40 objectives which will enable the vision to be realised. Of these, seven are considered most relevant to the project as outlined in Table 2-4.

The Greater Sydney Commission also produced the Western City District Plan (Greater Sydney Commission, 2018b) that envisions Western Sydney to be a Parkland City, paying homage to the unique landscape of the district.

The Western City District Plan recognises that over the next 20 years, the Western City will transform dramatically due to extensive aviation and non-aviation industry investment, increased housing supply, and a focus on commercial and industrial development supporting high-value jobs. All of this will be delivered while carefully managing impact on the surrounding sensitive landscapes.

The District Plan identifies 22 planning priorities, of which four are relevant to the project. Table 2-4 shows how the project contributes to these four planning priorities.

Table 2-4 Project contribution to relevant objectives and planning priorities from Greater Sydney Region Plan and Western City District Plan

Objective	Project contribution
Greater Sydney Region Plan Objective 1 – Infrastructure supports the three cities. **Western City District Plan Planning Priority W2** – Planning for a city supported by infrastructure.	The project provides essential infrastructure to support development of the Western Parkland City. It is also integral to supporting and realising the Government's vision of the Western Parkland City as liveable, with cool and green neighbourhoods and attracting globally-significant industry and jobs.
Greater Sydney Region Plan Objective 2 – Infrastructure aligns with forecast growth – growth infrastructure compacts (now called place-based infrastructure compacts)	Timing of project delivery is aligned with forecast population growth. Sydney Water worked closely with the Greater Sydney Commission on Place Infrastructure Compacts (PICs), including the now superseded PIC for Western Sydney Aerotropolis.
Greater Sydney Region Plan Objective 3 – Infrastructure adapts to meet future needs.	Sydney Water is designing the project to provide flexibility for new and emerging smart-city technologies. Staging the project provides greater adaptability for the future.

Objective	Project contribution
Greater Sydney Region Plan Objective 4 – Infrastructure use is optimised.	Sydney Water has to date optimised existing wastewater systems to service growth in Western Sydney. As the project develops, Sydney Water will also optimise its use in future wastewater servicing to make most efficient use of the infrastructure built.
Greater Sydney Region Plan Objective 25 – The coast and waterways are protected and healthier **Western City District Plan Planning Priority W12** – Protecting and improving the health and enjoyment of the District's waterways	Environmental flows could contribute to a healthier Hawkesbury-Nepean. Sydney Water has decided not to release dry weather flows to South Creek, to ensure alignment with waterways objectives. Sydney Water is also proposing water sensitive urban design on the AWRC site.
Greater Sydney Region Plan Objective 26 – A cool and green parkland city in the South Creek corridor **Western City District Plan Planning Priority W13** – Creating a Parkland City urban structure and identity, with South Creek as a defining spatial element.	Green spaces in non-operational areas of the AWRC site will contribute to the blue-green infrastructure along South Creek. There are opportunities to use recycled water produced by the AWRC to contribute to cooling and greening in the Parkland City.
Greater Sydney Region Plan Objective 34 – Energy and water flows are captured, used and reused. **Western City District Plan Planning Priority W19** – Reducing carbon emissions and managing energy, water and waste efficiently	The AWRC will produce recycled water suitable for a range of uses, renewable energy that will contribute to its energy needs, and nutrient rich biosolids for reuse in applications such as agriculture. Separate from the project, Sydney Water will also continue to explore carbon-neutral and carbon-reducing opportunities as part of its ongoing circular economy program. In addition, the project provides a foundation for developing a circular economy hub in the Western Parkland City.

2.6.3 Place-based Infrastructure Compacts

Sydney Water participated in the NSW Government's Western Sydney Place-based Infrastructure Compacts (PICs). The process was led by the Greater Sydney Commission in collaboration with NSW Government agencies, Western Sydney Planning Partnership, utility providers, and councils. The purpose of the PIC was to coordinate planning and delivery of new jobs and housing in Western Sydney and ensure the necessary infrastructure is in place to support that delivery.

The PIC initially focused on the Western Sydney Aerotropolis and Greater Penrith to Eastern Creek. It identified the AWRC as part of the capital investment for drinking water, recycled water and wastewater to realise the transformation of the area in line with the Western Parkland City vision.

The PIC proposed an action (proposed action 9) supporting whole-of-water-cycle management to create the Western Parkland City as a cool, green place with water as its defining focus. Although this action would be led by DPIE, there is an opportunity for the project to contribute by producing high-quality treated water.

The draft PIC was exhibited from November 2020 to February 2021. The work of the PIC including public feedback will now be incorporated in the Western Parkland City Authority's Blueprint.

2.6.4 Western Sydney Aerotropolis Growth Area

The project is partially located in the WSAGA, as shown in Figure 2-4. The AWRC site is in the Kemps Creek precinct and the Wianamatta-South Creek precinct. The treated water pipeline is in the Kemps Creek, Badgerys Creek, Northern Gateway and Agribusiness precincts and crosses the Wianamatta-South Creek precinct in several locations. Most of the brine pipeline is outside the Western Sydney Aerotropolis, although short sections cross the Kemps Creek and Wianamatta-South Creek precincts. There is no project infrastructure in the Bradfield precinct.

The Western Sydney Aerotropolis Plan (WSAP) was finalised in 2020 (Western Sydney Planning Partnership, 2020a). A range of planning instruments support delivery of the WSAP, including a State environmental planning policy (SEPP), development control plan (DCP) and precinct plan.

The WSAGA is built around the new global gateway of Western Sydney International Airport and contributes to diverse housing and a significant increase in jobs for Western Sydney. It proposes a landscape-led approach, integrating urban planning, landscape and urban design. This includes developing a network of parklands and waterways focused around the South Creek corridor and a foundation of respecting and connecting with Country. The WSAGA will be developed to facilitate and encourage innovative industries, including sustainable food production, and to align with circular economy principles. It will be supported by a range of sustainable and efficient transport options for people and freight.

The project provides an important contribution to the WSAP's vision and aligns with its planning principles. For example, it:

- provides essential wastewater services to facilitate population growth in the WSAGA and service Western Sydney International Airport
- has been designed to safeguard airport operations in terms of building height, lighting and wildlife management
- takes a landscape-led approach to urban design at the AWRC site, including establishing a green space area to form part of the green spine along South Creek, implementing water sensitive urban design and providing opportunities to celebrate heritage
- has been designed to avoid, minimise and manage potential impacts on biodiversity, waterways and flooding

- includes production of renewable energy, beneficial reuse of biosolids and enables further circular economy opportunities over time.

In relation to Western Sydney Aerotropolis principles and objectives, Sydney Water has considered how the project aligns with planning principles outlined in the WSAP, precinct-specific objectives from the draft precinct plan and relevant environmental or planning matters from the Phase 1 DCP. This is detailed in Appendix B.

2.6.5 South West Growth Area

The South West Growth Area has been established longer than the Western Sydney Aerotropolis Growth Area, and areas such as Oran Park, Turner Road, Austral and Leppington North are already well-established communities. DPIE is now leading strategic planning for the remainder of the SWGA, before developing plans for rezoning.

Sydney Water provides wastewater services to developed areas in the SWGA through connections to existing water recycling plants at West Camden and Liverpool. The project is designed to redirect connections in some developed areas to the AWRC. The AWRC will also service the remaining parts of the SWGA that are not yet developed.

This project does not propose construction works in the SWGA. While new wastewater pipelines will likely be delivered in this area over time, these will be planned and developed under separate projects to suit delivery timing requirements and are not included as part of this EIS.

2.6.6 Western Sydney Parklands

The brine pipeline requires a narrow corridor crossing Western Sydney Parklands in the Cecil Park/Cecil Hills area, south of Elizabeth Drive as shown in Figure 2-5.

The project is consistent with the Western Sydney Parklands Plan of Management (Western Sydney Parklands Trust, 2018a), the Southern Parklands Framework (Western Sydney Parklands Trust, 2018b) and Design Manual (Western Sydney Parklands Trust, 2018c), as detailed in Appendix B.

Sydney Water has worked with the Greater Sydney Parklands (formerly Western Sydney Parklands Trust) as the project has developed and will continue to do so as detailed design and construction planning progresses to ensure impacts on the parkland and rehabilitation of disturbed areas are appropriately managed.

Chapter 5 demonstrates how the project aligns with State Environmental Planning Policy (Western Sydney Parklands) 2009.

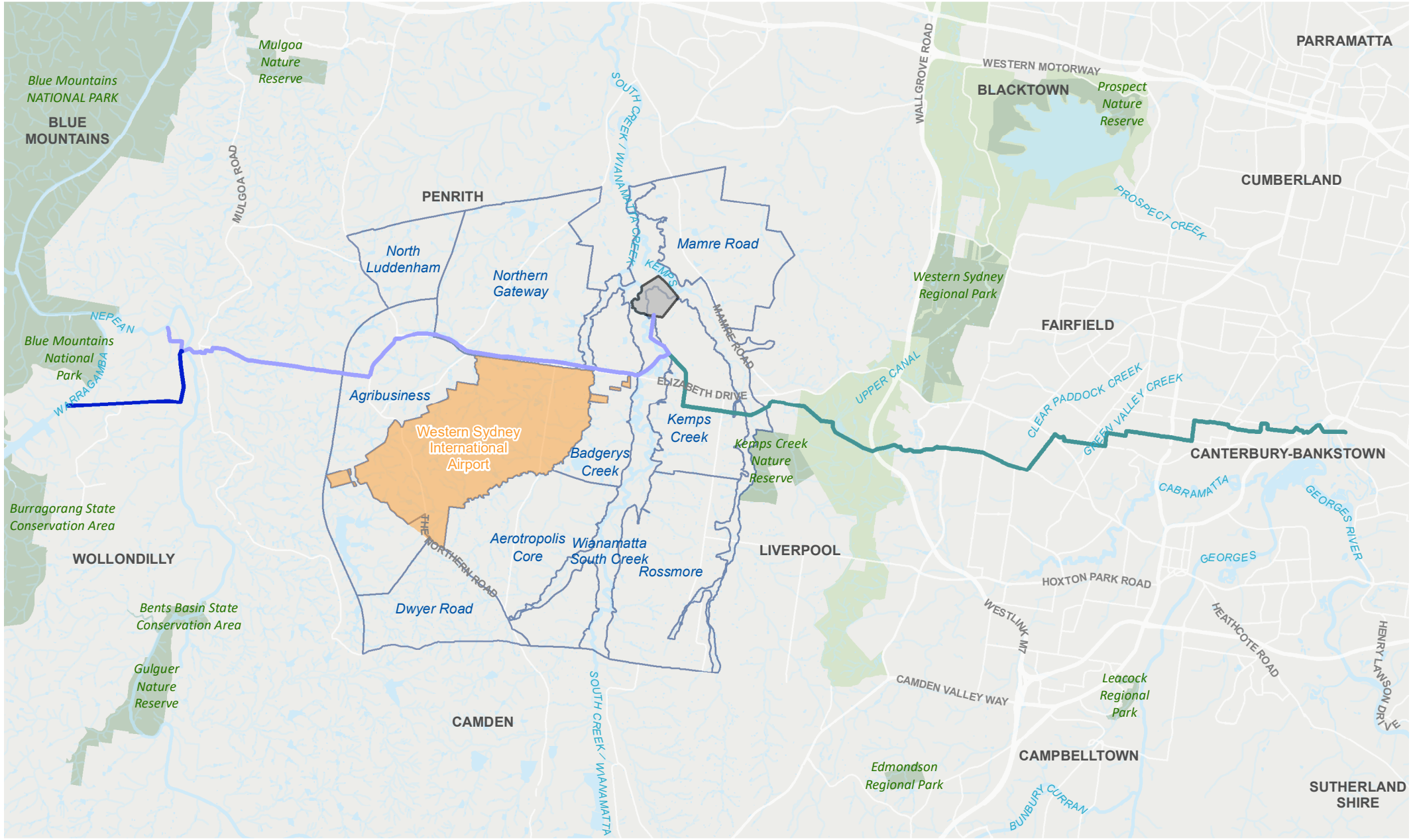

Figure 2-4 Project location in WSAGA

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

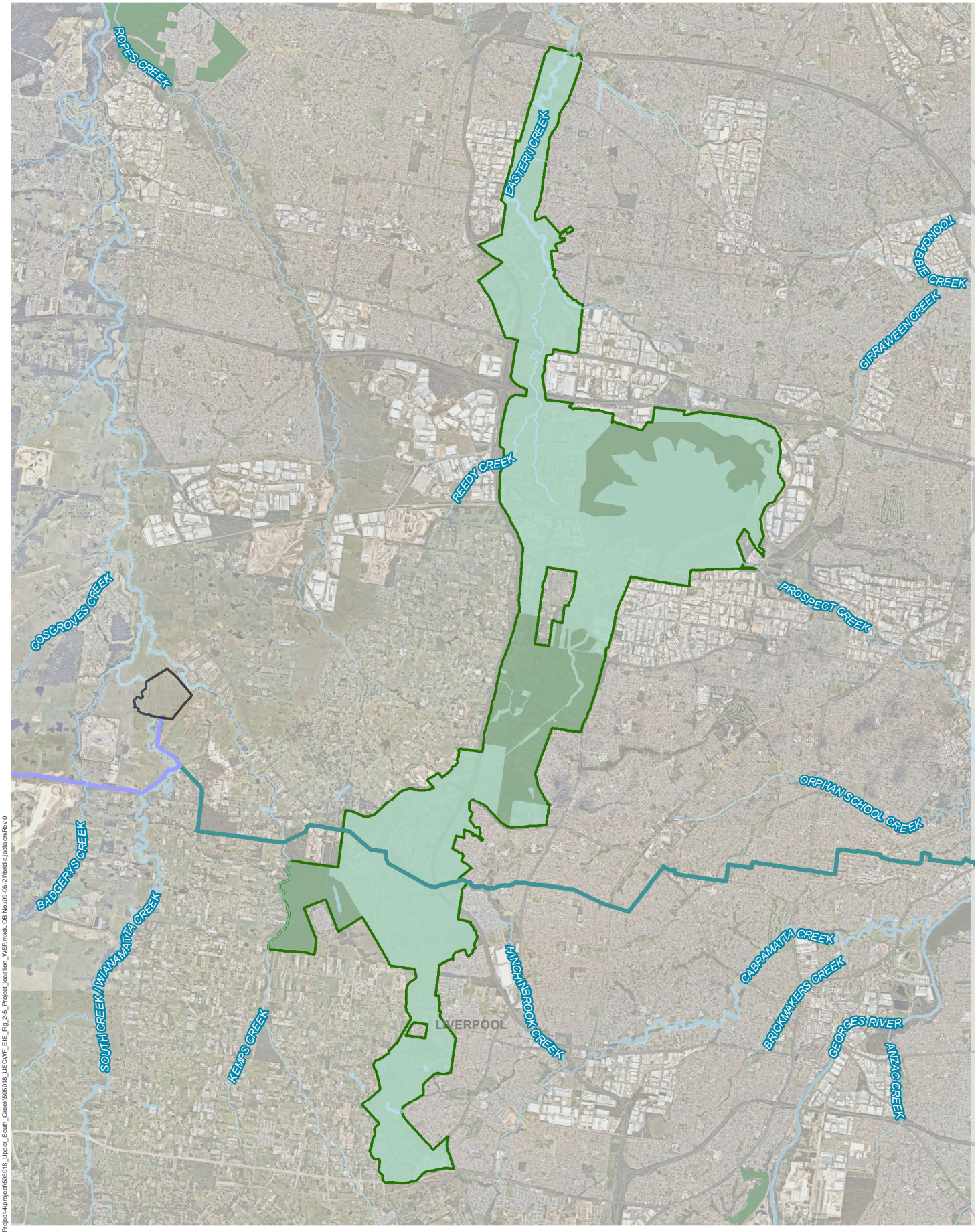

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Figure 2-5 Project location in Western Sydney Parklands

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

2.7 Water strategy and policy

2.7.1 NSW Water Strategy

The NSW Government has developed a new water strategy for the state (DPIE, 2021a) that has a vision for 'Sustainable water resources for thriving people, places and ecosystems, both now and for future generations'. To achieve this vision, the strategy sets high-level principles and objectives for water service delivery and management across NSW, identifies strategic priorities and actions, and articulates the water management and policy context across NSW. This will ultimately work in tandem with the Greater Sydney Water Strategy. The strategy has seven priorities, each with proposed actions. While Sydney Water will have a role to play in most priorities, Table 2-5 discusses those with proposed actions relevant to the project.

Table 2-5 Project alignment with NSW Water Strategy

Priority	Project alignment
Priority 2 – recognise Aboriginal rights and values and increase access to and ownership of water for cultural and economic purposes	Sydney Water has consulted with Aboriginal communities about the project. The project does not limit Aboriginal rights to water. Sydney Water also has a separate ongoing project consulting with the Aboriginal knowledge holders on the cultural values of South Creek and parts of Nepean River that will inform the project as it progresses.
Priority 3 – improve river, floodplain and aquifer ecosystem health, and system connectivity	The project has been designed to minimise impacts on waterways and improve waterway health. Sydney Water also proposes ongoing water quality monitoring to understand any waterway changes resulting from the project.
Priority 4 – increase resilience to changes in water availability (variability and climate change) Priority 6 – support resilient, prosperous and liveable cities and towns	The project provides an opportunity to diversify water supply options by producing high-quality treated water suitable for a range of uses. The project is mentioned in the case study for Wianamatta-South Creek as a key first step in a Delivery Strategy for an integrated water cycle management approach in the Western Parkland City.

2.7.2 Metropolitan Water Plan

In 2017, the NSW Government developed its long-term Metropolitan Water Plan for Sydney (Department of Industry, Skills and Regional Development, 2017). The plan aims to ensure Sydney's water needs will be met so it can withstand drought and support a growing population. The plan considers how to optimise existing water supplies, develop water efficiency and conservation programs, manage drought, and where to source new water supply options if required. The plan has four key outcomes:

- Outcome 1 – our water supply is secure and affordable.
- Outcome 2 – our water supply system is resilient to stresses and shocks.
- Outcome 3 – our urban communities are more liveable and resilient.
- Outcome 4 – rivers downstream from dams are healthy.

With reference to outcome 4, the plan was developed in consultation with community and industry stakeholders. A strong expectation was identified for the Hawkesbury-Nepean to be a healthy and productive river downstream of the water supply dams, to support amenity, water quality and the health of fish communities, and to enable boating and other recreational activities.

The plan recognises the benefits of, and commits to improve, environmental flows by releasing water from Warragamba Dam, which would otherwise supply drinking water for Sydney. The plan recommended implementing a new variable environmental flow regime, and further work to refine this is currently underway. This approach is being designed to balance the water needs of the environment and the 'cost' of reducing drinking water supplies and water security during drought.

Treated water produced by the AWRC can potentially contribute to environmental flows, liveability and water security either:

- directly by releases to Nepean or Warragamba River. This would directly contribute to the water needs of the environment and reduce the drinking water that is otherwise released as environmental flows from the dam, or
- indirectly by use in irrigation of open space, residences, business, industry or agriculture. This would offset demand for drinking water by providing treated water as a replacement.

Sydney Water is working closely with DPIE Water on how the project's contribution can be captured in future metropolitan water planning through the Greater Sydney Water Strategy, discussed in the following section.

2.7.3 Draft Greater Sydney Water Strategy

DPIE has developed a draft Greater Sydney Water Strategy (GSWS) which was released for public consultation in September 2021. When finalised, the GSWS will replace the 2017 Metropolitan Water Plan. The draft GSWS captures the new NSW water policy vision and considers how to achieve sustainable water resources for future generations. The draft GSWS includes priorities related to water security, enhancing and enabling economic growth, liveability and community wellbeing, environmental sustainability and improvement.

The draft GSWS specifically mentions the Upper South Creek Advanced Water Recycling Centre's contribution to these priorities in relation to:

- its contribution to integrated water cycle management and liveability outcomes in the Wianamatta-South Creek Delivery Strategy
- its importance in servicing new growth in Western Sydney
- its potential to establish a circular economy hub.

The project also aligns with the draft priorities more broadly by producing treated water suitable for a range of beneficial uses that contribute to Sydney's water resilience and providing water that could be used for greening and cooling the landscape.

Sydney Water worked with DPIE in developing the draft GSWS and will continue to work closely with DPIE as the strategy is finalised to ensure alignment of Sydney Water's relevant activities, including the project.

2.7.4 Metropolitan Water Sharing Plans

Two water sharing plans apply to the Sydney region – Greater Metropolitan Region Unregulated River Water Sources 2011 and Greater Metropolitan Region Groundwater Sources 2011. These plans have recently been reviewed by the Natural Resources Commission as part of a legislated 10-year review. The review identified opportunities to improve the plans in areas including:

- sustainable numeric extraction limits
- defining environmental water requirements
- considering water management holistically
- making the plans fit for purpose and making them equitable (including supporting outcomes for Aboriginal people).

The Minister for Water has approved extension of these water sharing plans to July 2023 to allow time for further research and testing to inform plan revisions and align with the provisions of the GSWS.

Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011

Waterway releases for the project are in the Hawkesbury and Lower Nepean Rivers Water Source. The release of treated water into waterways in this zone presents an opportunity to provide environmental water or water for extractions. Project operation does not require any extractions of water in this zone and does not affect any existing extractions.

Sydney Water will continue to work with DPIE to identify the most beneficial allocation of the project's treated water releases as the Greater Sydney Water Strategy and new water sharing plans are developed, including environmental flows. Ensuring these releases are accounted for in the water balance that underpins the plan rules will enable the benefits they provide to be acknowledged and may enable additional licensed extractions downstream or a change in how the source of environmental water is acknowledged.

Tunnelling for the environmental flows pipeline may require a one-off extraction of water from Nepean River for drilling fluid, given the closest drinking water connection is in Wallacia.

Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011

The project is primarily in the Sydney Basin Central zone as defined in this plan. Parts of the treated water pipeline and environmental flows pipeline are in the Sydney Basin Nepean Management Zone 2, around Wallacia and Warragamba. Some extraction from these water sources is expected during construction and operation of the project, for which Sydney Water will obtain any required licences. Section 9.4 includes more detail about licence requirements.

2.7.5 Water Resource Plans

The SEARs reference Water Resource Plans, which are developed by DPIE to meet requirements under the Commonwealth's Basin Plan for the Murray-Darling Basin. The project is not located in an area covered by a Water Resource Plan.

2.8 Hawkesbury-Nepean strategy and policy

2.8.1 Hawkesbury Nepean Statement of Joint Intent

The Hawkesbury-Nepean Statement of Joint Intent (NSW Government, 2001) records the commitment of NSW Government agencies (including Sydney Water) and councils to protecting the health of the Hawkesbury-Nepean river system. The commitment responded to the recommendations of a public enquiry held in the late 1990s and formed the basis for revising approaches to environment protection licensing, regional planning and environmental flows. Of most relevance to the project, it sought consideration of using treated water from wastewater treatment to contribute to environmental flows or water extractions, as this project is now proposing. Although legislation, policy and responsibilities have evolved since this Statement of Joint Intent, it provides a reminder that the beneficial use of treated water in the Hawkesbury-Nepean river system has been acknowledged as an opportunity for at least two decades.

2.8.2 Hawkesbury-Nepean Nutrient Framework

The EPA has developed a regulatory framework to manage nutrient load inputs to Hawkesbury Nepean River from wastewater treatment plants (Environment Protection Authority, 2019a). The objective is to meet the community's environmental values for the river.

The framework includes limits on nutrient concentrations, interim caps on nutrient loads and a framework for nutrient trading and offsets. It divides the Hawkesbury-Nepean River into zones and subzones. It has been applied to Sydney Water's existing Environment Protection Licences (EPLs) across the Hawkesbury-Nepean and will be applied to this project's EPL.

Sydney Water is designing the project to be consistent with the framework acknowledging the releases to Nepean River are in the Yarramundi 2 subzone, which also includes inflows from other treatment plants in the region. The releases to South Creek are in the Sackville 2 subzone. The framework drives the project to adopt advanced water treatment processes to meet these nutrient targets and other release requirements for relevant subzones. Chapter 8 provides more detail on the project's consistency with this framework.

2.9 Catchment management strategy and policy

2.9.1 Greater Sydney Local Land Service Transition Catchment Action Plan

The Greater Sydney Local Land Service Transition Catchment Action Plan 2013-2023 (Hawkesbury-Nepean Catchment Management Authority, 2013) was developed to support the transition of catchment management responsibility from the Hawkesbury-Nepean Catchment Management Authority to Local Land Services. The plan has 28 strategies to achieve goals related to community, productivity, biodiversity, urban liveability and resilient landscapes. Table 2-6 summarises the project's alignment with relevant strategies.

Table 2-6 Project alignment with Greater Sydney Local Land Service Transition Catchment Action Plan

Strategy	Project alignment
B1 – Maintain the diversity and health of natural systems B2 – Maintain viable population of native species, especially those found only in our region (endemic) and those under threat B4 – Reduce the risk of decline or extinction of native species UL4 – Improve aquatic and terrestrial habitat condition, connectivity and recreational value in urban areas UL5 – Enhance and protect Sydney's natural places to support a liveable city	Sydney Water has designed the project to minimise impacts on biodiversity and the EIS assesses project impacts on natural systems and native species.
UL2 – Create a more liveable and water sensitive city by implementing Water Sensitive Urban Design (WSUD)	The project includes a WSUD approach at the AWRC site.
UL3 – Promote actions which support urban resilience through mitigation and adaptation to impacts of climate changes	The project includes measures to provide resilience and adaptation to climate change.

2.9.2 Coastal Zone Management Plans

The parts of the coastal zone relevant to the project are the Upper Hawkesbury estuary and Georges River estuary. These areas have Coastal Zone Management Plans (CZMPs) in place, which will cease to have effect on 31 December 2021. These will be replaced by Coastal Management Programs.

Upper Hawkesbury estuary

The Upper Hawkesbury River Estuary Coastal Zone Management Plan (BMT WBM, 2014) was prepared for Hawkesbury Council and identifies a range of threats to the estuary, and actions (primarily for Hawkesbury Council) to address them. It applies to the tidal reaches of Hawkesbury River (downstream of Yarramundi) and tributaries including South Creek. Some of the identified threats include catchment and riparian landuse, weed invasion, sea-level rise, releases from wastewater treatment plants and water-based activities.

Treated water releases from the project to Nepean River, Warragamba River and South Creek ultimately reach the sections of the estuary covered by the plan. The project also includes building infrastructure in the broader catchment of these waterways. Sydney Water has designed the project to minimise impacts on the Hawkesbury-Nepean river system by releasing high-quality treated water. The EIS assesses the impacts of these releases and other project infrastructure in the catchment and includes management measures to minimise these impacts.

Six councils (Central Coast, Hawkesbury, The Hills, Hornsby, Ku-ring-gai, Northern Beaches) have partnered to develop a Coastal Management Program that would replace this CZMP. This program is currently being developed.

Georges River estuary

The Georges River Estuary Coastal Zone Management Plan (BMT WBM, 2013) was prepared for the Georges River Combined Councils Committee and identifies a series of issues requiring future management. It applies to Georges River downstream of Liverpool Weir and tributaries including Prospect Creek. Some of the issues identified as requiring future management include improving water quality, conserving ecological values, controlling future catchment development, conserving heritage, controlling foreshore activities and planning for climate change.

The project does not propose any waterway releases into Georges River and has been designed to avoid this, by transferring brine from the AWRC to the Malabar wastewater system for ocean release. Parts of the brine pipeline will be built in the Georges River catchment and the project has been designed to minimise impacts on waterways, including by tunnelling beneath Prospect Creek. The EIS assesses the impacts of project infrastructure in the catchment and includes management measures to minimise these impacts.

Georges Riverkeeper on behalf of its eight member councils (Bayside, Campbelltown, Canterbury-Bankstown, Fairfield, Georges River, Liverpool, Sutherland and Wollondilly) is currently developing a Coastal Management Program that would replace this CZMP.

2.10 Strategic biodiversity conservation

2.10.1 Draft Cumberland Plain Conservation Plan

The NSW Government is currently developing the Cumberland Plain Conservation Plan which is a strategic biodiversity plan for a large area across Western Sydney, including WSAGA. It aims to protect habitat in Western Sydney, while facilitating urban growth and development. The draft plan (DPIE, 2020a) was exhibited in late 2020 and is expected to be finalised in 2021.

Under the draft plan, the project is primarily located on certified urban capable land or excluded land, except:

- land on the AWRC site below the 1% annual exceedance probability (AEP) flood level, which is non-certified (Western Sydney Aerotropolis) or non-certified (avoided for biodiversity)
- where pipelines cross waterways which are non-certified.

The project would typically be classified essential infrastructure in accordance with Appendix A of the draft plan, which would allow project infrastructure to be built in non-certified areas. However, the draft plan does not specify how it is intended to apply to State significant infrastructure. Sydney Water has designed the project to avoid and minimise impacts on biodiversity, comprehensively assessed project impacts and identified management measures and offsets required. This aligns with the commitments relevant to essential infrastructure as outlined in Table 5 of Appendix A of the draft plan.

Sydney Water has provided comments to DPIE on the draft plan and will continue to engage with them as the plan is finalised.

2.10.2 Growth Centres strategic biodiversity assessment

The South West Growth Area is covered by a strategic biodiversity assessment under the former NSW *Threatened Species Conservation Act 1995* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* A small section of the project passes through the area covered by this agreement and is addressed in more detail in section 9.1 of the EIS.

2.11 Place-making and circular economy

2.11.1 NSW Smart Places and Smart Infrastructure Policy

In 2020, the NSW Government launched Australia's first Smart Infrastructure and Smart Places strategies, which will ensure that smart technologies to embed sensors, capture information or enable communication are built into future city infrastructure. INSW plans to develop a Digital Built NSW Program to be piloted in the Western Parkland City. All infrastructure projects subject to the INSW Assurance Framework must detail how they will incorporate smart technology as a significant component of the project.

The wastewater treatment design will include advanced digital technology to make operations as efficient and adaptive as possible. Sydney Water is also engaging with partner agencies to access the best real-time user and demand data and incorporate it into the design and staging so the solution is as responsive as possible.

2.11.2 Place-based outcomes and urban design

The NSW Government has developed a range of policies to facilitate better design and environmental outcomes in public spaces and new urban communities. These include Better Placed (NSW Government Architect, 2017a), Green Places (NSW Government Architect, 2017b), and Premier's Priorities 11 (Greening Public Spaces) and 12 (Greening our City), which Sydney Water has considered in developing the urban design principles for the AWRC site.

The NSW Government is also proposing a range other legislation and policies to facilitate good design, including a Design and Place State Environmental Planning Policy (DPIE, 2021b), Connecting with Country Framework (NSW Government Architect, 2020a) and Designing with Country Discussion Paper (NSW Government Architect, 2020b). There is also work underway in the WSAGA on guidelines for recognising Country. These documents are currently in draft and Sydney Water will consider how the project can align with the objectives of these policies once they are finalised, as it progresses to the detailed design phase.

As part of project scope, the project can contribute to place-based outcomes in the following ways:

- Treatment of wastewater generated in the Upper South Creek Servicing Area has the potential for beneficial reuse purposes including irrigation, agriculture, non-drinking domestic, commercial and industrial uses, as well as environmental flows. Re-using wastewater replaces drinking water that would otherwise be used for these purposes.
- As part of a total water cycle management approach, treated water can help retain water in the landscape for cooling and greening, contributing to improved microclimate.
- Delivery of a wastewater solution will meet best-practice criteria to protect the health of waterways by treating wastewater to an advanced standard.
- The design and landscape of the AWRC site will consider Country, support biodiversity and has the potential to provide public open space.

The project also enables future opportunities, including:

- Treatment of wastewater generated in the Upper South Creek Servicing Area has the potential for beneficial reuse purposes including irrigation, agriculture, non-drinking domestic, commercial and industrial uses, as well as environmental flows. Re-using wastewater replaces drinking water that would otherwise be used for these purposes.
- As part of a total water cycle management approach, treated water can help retain water in the landscape for cooling and greening, contributing to improved microclimate.

- The project can improve health and wellbeing of local communities by providing recycled water for greening of shared spaces, creating better places that can lead to a stronger sense of place-based identity.
- The project enables water to be valued and reused wisely in line with objectives of the Greater Sydney Region Plan and priorities of the Western City District Plan.

2.11.3 Circular economy

The NSW Circular Economy Policy Statement (Environment Protection Authority, 2019b) outlines a vision and seven principles to guide resource use and management. The project aligns with these principles by:

- producing recycled water that moves beyond single use to multi reuse (principles 1 and 2)
- designing infrastructure including materials selection to provide long asset life (principle 3)
- a maintenance program to keep assets in operation as long as possible (principle 4)
- using technologies such as co-generation for energy production and beneficial reuse of biosolids to increase resource efficiency, and investigating further opportunities as technologies develop (principle 5)
- employing staff at the AWRC to operate a facility that aligns with circular economy principles (principle 6)
- engaging with the community about the project's circular economy benefits (principle 7).

It presents a future opportunity (not in project scope) to further contribute to circular economy principles through digestion of additional waste such as food waste or co-location of suitable industries as part of a circular economy hub in the Western Parkland City.

2.12 Alignment with Sydney Water strategy and approach

2.12.1 Sydney Water strategy

Sydney Water's strategy 2020-2030 has a vision of 'Creating a better life with world-class water services'. One of the four strategic outcomes in Sydney Water's strategy is to support 'Thriving, liveable and sustainable cities' (Sydney Water, 2020a) by delivering world-class products and services to our city and being champions for public health, the environment, and resilience.

To support the delivery of its strategy and achieve the strategic outcomes, Sydney Water is developing strategic blueprints. The blueprints are providing the enterprise-wide directions to deliver on Sydney Water's obligations and its aspirations to consistently provide safe, affordable, reliable, and high-quality products and services for our city and its communities.

The blueprints, co-created with customer and stakeholder insights, propose positions, measures, and actions across a range of priority themes. The priority themes are:

- Corporate Social Responsibility ensures Sydney Water achieves a balance of economic, environmental and social imperatives through a conscious understanding of the impact they are having on all aspects of society.
- Resilient and Reliable Water Supply focuses on ensuring the continuity of sustainable water supply to Sydney Water's customers now and into the future.
- Healthy Waterways and Environment seeks to achieve world-class, healthy waterways that are safe for swimming and recreation, and support thriving, sustainable communities and the natural environment.
- Circular Economy and Resource Recovery looks beyond the current take-make-dispose extractive industrial model, aiming to keep resources in use, design out waste, and restore and regenerate natural capital.
- Sustainable Cities and Communities reimagines water to support thriving, liveable and sustainable communities and to deliver optimal long-term value of investment to meet our communities' needs and wants.
- Smart Cities sets the direction for how Sydney Water will use sensors, data, information and communication technologies to connect and collaborate with its customers and communities and enhance productivity, resilience and liveability.

The project is an important part of Sydney Water delivering all these priority themes in Western Sydney. In particular, the treated water produced can contribute to the resilience of Greater Sydney's water supply and liveability outcomes in the Western Parkland City. The AWRC also provides a foundation for a circular economy hub in the Western Parkland City.

2.12.2 Environmental Policy

Sydney Water's Environmental Policy outlines its commitment to protect, restore and enhance the natural environment, with commitments including:

- having no net impact from Sydney Water's discharges to the air, water or land
- maximising resource value and supporting a circular economy by responsibly managing energy, water and materials, and minimising waste creation
- managing the entire integrated water cycle in the catchment, including capturing, treating, distributing drinking water and collecting, treating and releasing wastewater
- protecting, restoring, and enhancing natural and heritage assets
- social responsibility by having at the forefront the wellbeing of the community to improve overall environmental performance.

This policy has informed design decisions for the project and Sydney Water's approach to managing impacts.

2.12.3 Strategic Capital Investment Plan

As a requirement of its operating licence, Sydney Water has developed a Strategic Capital Investment Plan (SCIP) to guide long-term strategic decision-making and support optimal servicing solutions.

The SCIP considered investment drivers from 2020 to 2044, and evaluated options for delivery of water, wastewater and some stormwater infrastructure by exploring three approaches to servicing:

- **Traditional** – associated with single use water and characterised by regular large infrastructure investments that direct wastewater to coastal discharge.
- **Localised** – represents a transitional approach where some wastewater systems are disconnected from coastal outfalls, allowing treated effluent to be managed locally.
- **Resilient** – considers water and wastewater in an integrated way, and enables the NSW Government's vision for liveability, sustainability and productivity at lowest cost.

These options were broadly evaluated for both cost and benefits, which supported the conclusion that the Resilient City approach should frame the strategic direction for Sydney Water. By adopting a Resilient City approach, potential outcomes for Western Sydney could be:

- greater consideration of circular economy principles in water use, which could improve resilience to climate change
- ability to stage investments, which allows infrastructure to be flexible and responsive to technological advances, changing community preference and regulatory requirements
- increasing supply of recycled water, which diversifies water sources and reduces nutrient loads of wastewater discharged to the environment
- adding flexibility to divert treated recycled water for urban cooling and greening locally.

The project reflects Sydney Water's transition to the Resilient City approach.

2.12.4 Western Sydney Regional Master Plan

In 2016, Sydney Water commenced work on the Western Sydney Regional Master Plan. The Master Plan was developed over a three-year period with significant input from about 30 Commonwealth and NSW Government agencies and Western Sydney local councils, including Greater Sydney Commission, Department of Planning, Industry and Environment (DPIE), Environment Protection Authority (EPA), Infrastructure NSW (INSW), Western Sydney Airport Co, WaterNSW, and the Western Sydney Parkland Trust.

Approved in March 2020, the Western Sydney Regional Master Plan:

- examined regional-scale servicing concepts and directions to consider how water can support the NSW Government's vision for the Western Parkland City
- presented opportunities for whole-water cycle and deliver more sustainable outcomes

- provided strategic guidance and feedback into service planning projects for growth areas and urban communities in the Western Sydney region and informed discussions with external stakeholders on potential servicing offerings.

The Master Plan sets a new direction for water and wastewater servicing that aligned with the government's vision for the Western Parkland City and set Sydney Water's aspirations for a more resilient city where communities enjoy affordable and essential water services, healthy waterways and vibrant, cool and green places.

Through analysis of water balance, financial costs and economic benefits, the Master Plan found:

- sending wastewater to the coast, as Sydney Water has traditionally done, would not deliver the vision of a green and blue Western Parkland City
- pathways for a Resilient City would deliver greater economic value and enable opportunities to be leveraged for the water reuse and circular economy approaches.

The project forms a key part of delivering the Master Plan's flexible and adaptive pathway to move towards high-value pathways delivering whole-of-community benefits.

2.13 Aligning with other major projects

In addition to the urban development in the WSAGA and SWGA, there are a range of other NSW Government infrastructure projects and other major projects either underway or proposed near the project. Sydney Water accessed DPIE's major projects portal in April 2021 and considered cumulative impacts of projects where there is enough information available and there is likely to be an overlap in construction or operational impacts. Sydney Water has also considered cumulative impacts of several other projects that are not on the major projects portal such as Western Sydney International Airport.

The projects addressed further in the impact assessment chapters of the EIS include:

- Western Sydney International Airport
- M12 Motorway
- Northern Road upgrade (Glenmore Road to Bringelly Road)
- Sydney Metro – Western Sydney Airport
- Warragamba Dam wall raising. This is considered briefly given proximity to the project, with assessment based on information available during EIS preparation.

These projects are also shown on Figure 2-6, along with several other transport projects that are in early planning stages.

Section 13.2 of the EIS also considers project impacts on other utilities and infrastructure and how Sydney Water will work closely with other major projects to coordinate construction.

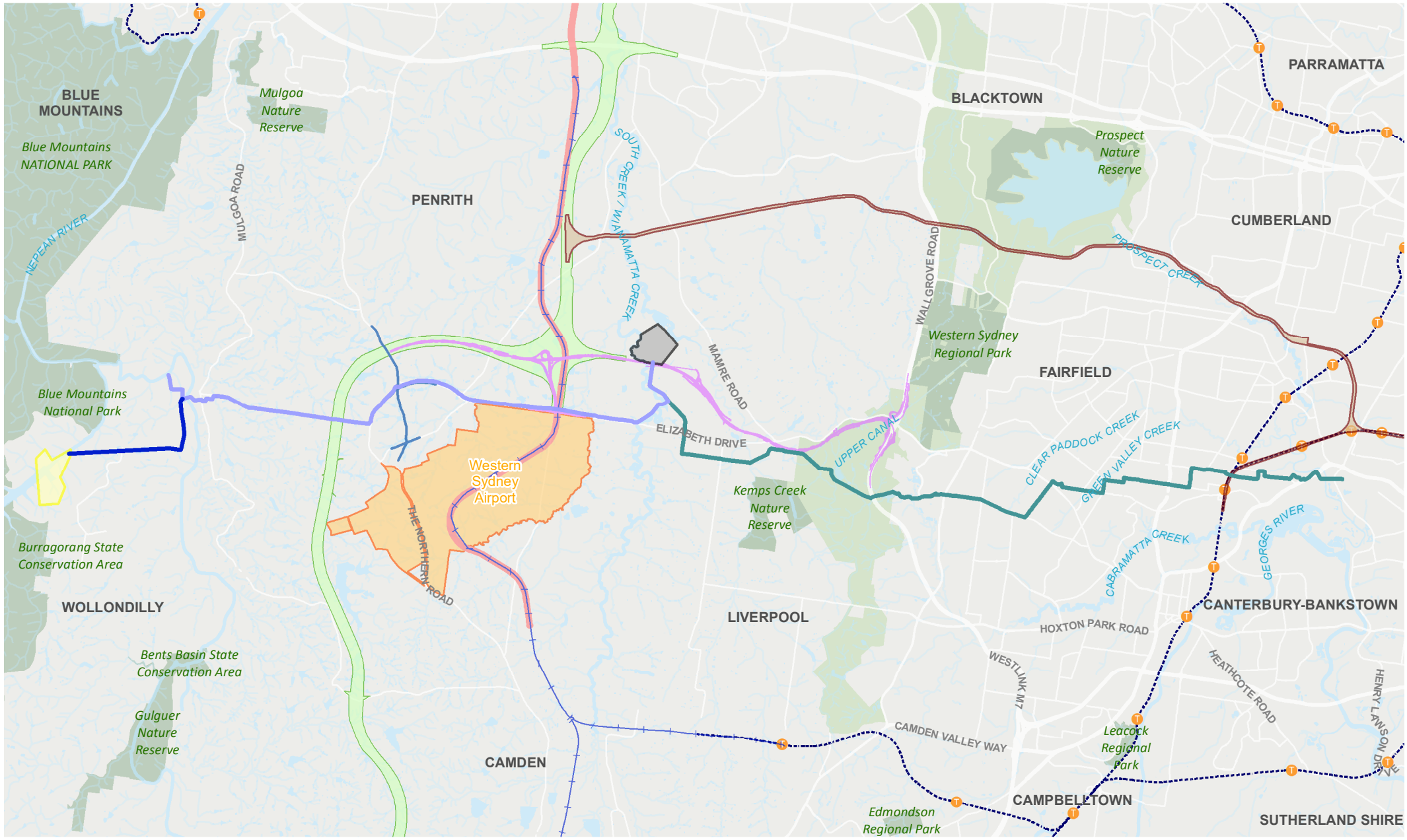


Figure 2-6 Other major infrastructure projects near the project

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

3 Project options

This chapter describes strategic options assessed to best achieve project objectives, and how decisions were made on project location, alignments and layouts including Sydney Water's approach to avoid and minimise social and environmental impacts.

3.1 Relevant Secretary's Environmental Assessment Requirements

Table 3-1 outlines the SEARs addressed in this chapter.

Table 3-1 SEARs addressed in project options chapter

SEARs	EIS section where requirement addressed
General Requirements (e) a description of how alternatives to and options within the project were analysed and optimised to inform the selection of the preferred alternative/option. The description must contain sufficient detail to enable an understanding of why the preferred alternative was selected over other option(s) considered for achieving the project strategic objective.	Sections 3.2 - 3.4
(g) (iii) a description and details of how the project has been designed to avoid, minimise and offset impacts (through design, or construction or operation methodologies)	Sections 3.3 and 3.4
5. Demonstrate that the project is consistent with the Environment Protection Authority's (EPA) framework for regulating nutrient discharges in effluent from STPs discharging to the lower Hawkesbury Nepean River (NSW EPA 2019a) including: (b) specify the location of discharge points, including but not limited to the Nepean River, Warragamba River and South Creek release location(s) for dry and wet weather justifying why the location was selected over other potential discharge points, including discussion of waterway characteristics at each point (eg depth, salinity, hydrodynamics) and consideration of the relative water quality risks.	Section 3.4 – b) Section 3.6 – c)

SEARs	EIS section where requirement addressed
(c) provide consideration of management measures, including but not necessarily limited to, options for storage capacity at Upper South Creek STP or elsewhere, improvement to sewers to increase capacity or reduce wet weather infiltration.	
6. Provide a detailed analysis of discharges into Warragamba River including e-flow needs going back 20 years. This analysis needs to consider: c) the need for flow releases for dilution flow for downstream wastewater treatment plants d) the need to maintain dam releases for extraction at the North Richmond Water Filtration Plant e) if the proposal will change any requirements on WaterNSW to deliver e-flows. If any changes to WaterNSW's current e-flow regime are required, they must be assessed for risks and opportunities in consultation with WaterNSW. This includes changes to dilution flows/ requirements.	Appendix C – detailed analysis of discharges Section 3.5 – c), d) and e) Other parts of SEAR 6 are addressed in Chapter 8.
7. Consult/coordinate with the Department of Planning, Industry and Environment (and Planning Partnership Office) in respect to environmental impacts on the South Creek catchment and the Wianamatta South Creek program. This includes: b) address the potential for dry weather releases and consider the amount of treated water to be released into South Creek.	Section 3.3 and Appendix D.
59. Identify how the project moves beyond 'business-as-usual' energy, water and waste technologies and aligns with circular economy principles including: a) opportunities for the integration of large scale high-tech intensive urban food production solutions or others water intensive industries, which will achieve circular economy principles. b) opportunities for a 'proof of concept' project of a glasshouse (intensive agricultural production). c) potential for cogeneration for heat and energy production within the Water Recycling Centre to service new development in the Aerotropolis. This could include addressing capabilities required within the facility and Aerotropolis to take advantage of cogeneration for heat and energy production.	Section 2.2.3 describes how the project can contribute to circular economy principles. Chapter 4 addresses energy, water and waste technologies that are in project scope, such as cogeneration, solar energy, biosolids ruse and the production of high-quality treated water. Section 3.5.2 address a), b) and c). These opportunities are out of project scope.

SEARs	EIS section where requirement addressed
60. Identify how the project can provide water that could supply future recycled water schemes.	Section 3.5.1

3.2 Strategic options

This section addresses the range of strategic options considered to reach the preferred strategic option for the project assessed in this EIS. It also considers the consequences of not proceeding with the project.

3.2.1 'Do nothing' option

New wastewater infrastructure will be needed by 2025 given the capacity of existing Liverpool and West Camden wastewater systems will be exceeded due to growth in their own catchments, and the demand from the Western Sydney International Airport becoming operational that year.

If Sydney Water does not act, wastewater from the South West Growth Area (SWGA) Liverpool catchment and SWGA West Camden catchment areas would continue to be transferred to the Liverpool and West Camden WRPs, with ultimate ocean or waterway discharge. The Western Sydney Aerotropolis Growth Area (WSAGA) would continue to be serviced by on-site systems.

Deferring the project or not proceeding would have a range of negative consequences including:

- inability to provide wastewater servicing to the Western Sydney International Airport (potentially impacting its opening or operations, and resulting in significant negative consequences for the economic development of the Western Parkland City) or requiring an airport-specific plan which is less efficient than a centralised solution
- flows to West Camden and Liverpool WRPs would exceed capacity, resulting in operational pressure and non-compliance, including overflows to South Creek and other waterways
- either an inability to provide wastewater servicing in the WSAGA (compromising the government's vision for new residential, commercial, industrial and economic growth in the WSAGA, and deferring or slowing investment in the Western Parkland City) or proliferation of decentralised solutions, which have been shown to be less cost-effective
- delaying the ability to provide a reliable supply of recycled water to support:
  - the NSW Government's liveability and sustainability vision for a green and cool Parkland city (complementing stormwater)
  - replacement for environmental flows out of Warragamba Dam
  - recycled water for businesses who rely on water for industrial processes
  - all leading to a less resilient water supply system and a less resilient Sydney

- on-site (septic tank) systems would continue to be implemented on a large scale in the Upper South Creek Servicing Area, increasing the risk to public and waterway health due to the progressive increase in wastewater overflows
- lost opportunity to implement circular economy solutions such as resource recovery through renewable energy generation and biosolids recovery
- risk of Sydney Water not complying with its obligations under the *Sydney Water Act 1994*.

3.2.2 Previous studies and options analysis

Sydney Water has been undertaking investigations into wastewater servicing of the Upper South Creek Servicing Area for over a decade. Several opportunities have recurred through multiple studies, including assessment of different configurations and variants.

Over time, various strategic, technical and economic assessments of the development options have been undertaken to determine which should be carried forward. With the emerging importance of integrated water management (IWM) and water reuse, particularly leveraging the recommendations of Sydney Water's Strategic Capital Investment Plan and Western Sydney Regional Master Plan, the strategic context and criteria for assessing the options have evolved. The following sections document Sydney Water's most recent analysis of options as part of the project.

3.2.3 Longlist options

Table 3-2 summarises the longlist of options for the project.

Table 3-2 Overview of long list options

Longlist option	Description
1. Transfer of treated wastewater to the Malabar wastewater treatment plant (base case)	Wastewater would be treated in the Upper South Creek Servicing Area at a new secondary WWTP and transferred to the Malabar ocean outfall. Major upgrades to the Malabar tunnel network, including Northern Georges River Submain, Liverpool to Ashfield Pipeline and the Southern and Western Suburbs Ocean Outfall Sewer, are required to transfer treated water to the Malabar WWTP. Recycled water may be produced but there is limited opportunity to offset Sydney's bulk drinking water demands. As a 'base case', this option represents the typical business as usual approach.
2. Extension of current servicing	In line with current servicing, parts of SWGA would continue to be serviced by the West Camden and Liverpool systems with treated water or primary treated effluent ultimately being released to Nepean River and Malabar deep ocean outfall respectively. The remaining parts of the Upper South Creek Servicing Area would continue with on-site treatment. Key components would include upgrades to the West Camden and Liverpool systems (network and WRPs) and trucking solids from on-site systems to Sydney Water's existing systems.

Longlist option	Description
	Recycled water would continue to be produced at Liverpool and West Camden WRPs for irrigation.
3. Transfer of untreated wastewater to the Malabar wastewater treatment plant	This option would require a new transfer network to carry raw wastewater from the Upper South Creek Servicing Area to the Malabar system, as well as an upgrade to the Malabar WWTP. No recycled water would be produced through this option.
4. Decentralised water recycling plants (WRPs)	Decentralised WRPs would be installed across the USC catchment to minimise pumping distances in the network - up to 15 new tertiary treatment plants, ranging from 0.3 million litres per day (ML/day) to 6.8 ML/day, built and upgraded progressively. Trucking of biosolids to other Sydney Water's facilities for further treatment would be required, such as West Camden or St Marys WRPs, triggering capacity upgrades at these plants. The decentralised option would produce tertiary treated water, available for reuse in irrigation, agriculture and industry. Energy generation would not be a feature of this decentralised option due to small plant size.
5. Advanced wastewater solution	All wastewater generated in the Upper South Creek Servicing Area would be treated at a centralised Advanced Water Recycling Centre and released to Nepean River. Treated water would be released to Nepean River with brine by-product transferred to Malabar WWTP for release to the ocean. The option would have future potential to transition to a full drinking water offset by using further treatment to produce high-quality, purified recycled water for drinking.

Sydney Water evaluated the longlist of options using a multi-criteria analysis (MCA) with non-financial and financial criteria aligned with project objectives. This evaluated and prioritised the options and identified a shortlist for detailed analysis.

3.2.4 Shortlist options

The top three options identified in the MCA, in the order of highest to lowest ranking were:

- Option 5 - advanced wastewater solution
- Option 1 – transfer of treated wastewater to Malabar WWTP (base case) and
- Option 4 – decentralised WRPs.

Sydney Water completed a more comprehensive assessment of the shortlisted options that included cost benefit analysis, risk assessment, benefits mapping and financial appraisal. The key findings from this assessment were:

- All options would achieve the benefits gained from treating the additional wastewater for the Upper South Creek Servicing Area and enable the growth of Western Sydney.

- The advanced wastewater solution and decentralised WRPs would both have significant upstream and downstream benefits compared to transferring treated water to the coast.
- The advanced wastewater solution benefits would outweigh costs, providing more value to the community than the base case by 2056. The advanced wastewater solution presented the lowest cost of all options, measured as net present value (NPV).
- The decentralised WRPs option costs would outweigh the benefits, providing less value to the community than the base case by 2056.
- The risks associated with the base case and decentralised WRPs would substantially outweigh risks of the advanced wastewater solution.

Additional benefits for the advanced wastewater solution relate to improved liveability and support for economic growth in Western Sydney, greater alignment with key NSW Government strategies, the ability to establish a circular economy hub, provide environmental flows and recycled water. The high-quality treated water produced as part of this option would support providing additional environmental flows in natural waterways or providing recycled water for greening and urban cooling, as well as increasing resilience against drought and climate change.

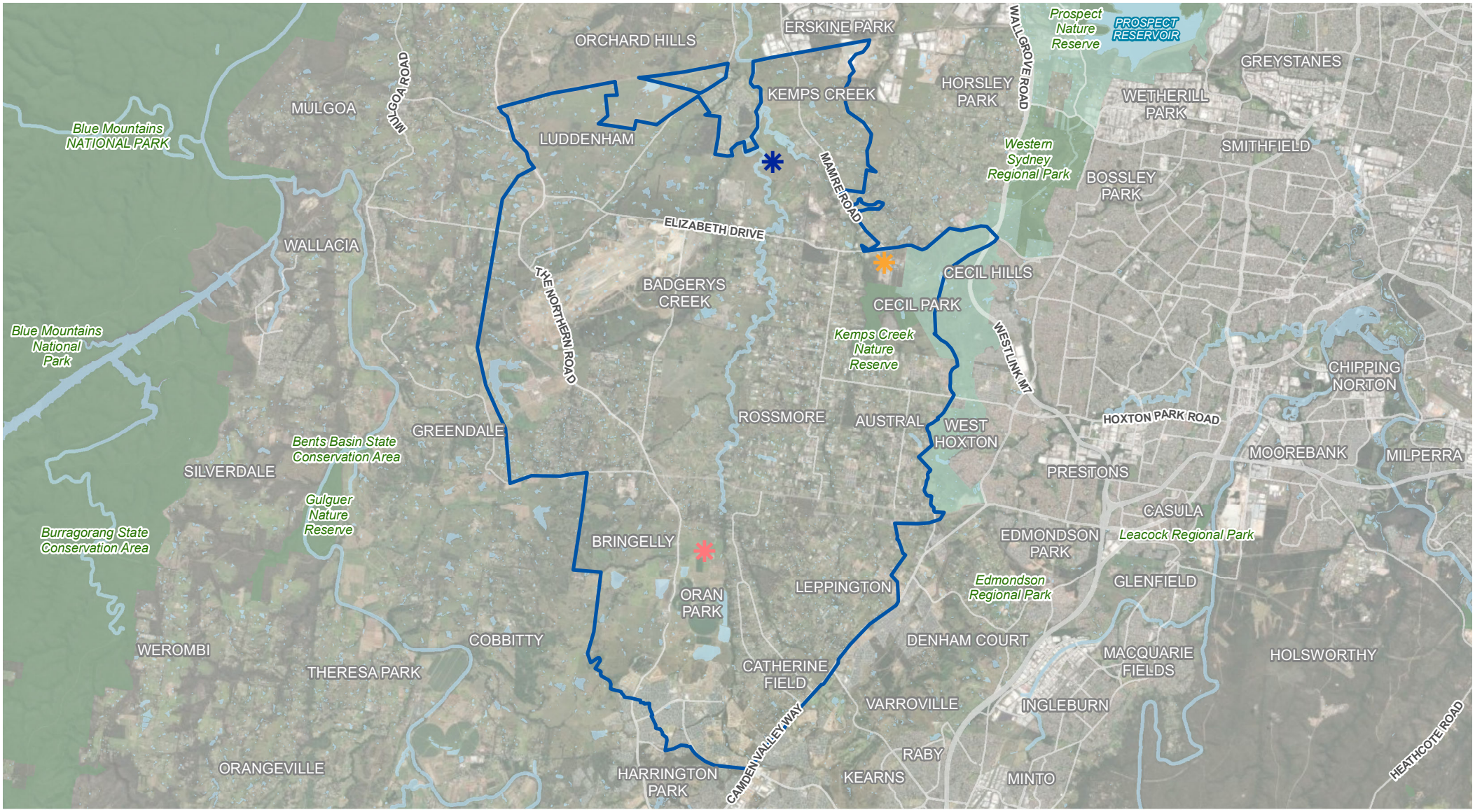
The assessment of the shortlisted options clearly demonstrated the advanced wastewater solution to be the optimal solution to address the project need and achieve superior benefits for Sydney Water's customers and Western Sydney. The advanced wastewater solution became the preferred option which has been further developed and refined as described in the following section.

3.3 Preferred option refinement - AWRC

For the AWRC, decisions were required on its site and how it would be sized and designed. Sydney Water has taken a range of design, construction and operational approaches to minimise impacts on the environment and community. Sydney Water balanced a range of factors in making decisions, including community and environmental impacts, heritage impacts, constructability, operability and cost. The following sections provide further details of these decisions and approaches and how Sydney Water reached the preferred option assessed in this EIS.

3.3.1 Site selection

When initially planning the servicing strategy for the Upper South Creek Servicing Area, Sydney Water investigated general site locations for siting the AWRC. These included in the suburbs of Oran Park, Cecil Park and Kemps Creek, all of which are shown indicatively in Figure 3-1. Table 3-3 provides an analysis of each of these locations and outlines why Oran Park and Cecil Park were excluded, and Kemps Creek was the preferred location.



AWRC longlist options

- Cecil Park
- Oran Park
- Kemps Creek
- Upper South Creek servicing area
- Waterbody
- Watercourse
- National Parks & Reserves

0 1 2km

Figure 3-1 Longlist of AWRC site locations

Projection: GDA2020 MGA Zone 56
Source: Nearmap, ESRI, Sydney Water, Aurecon

Table 3-3 Longlist of AWRC site locations

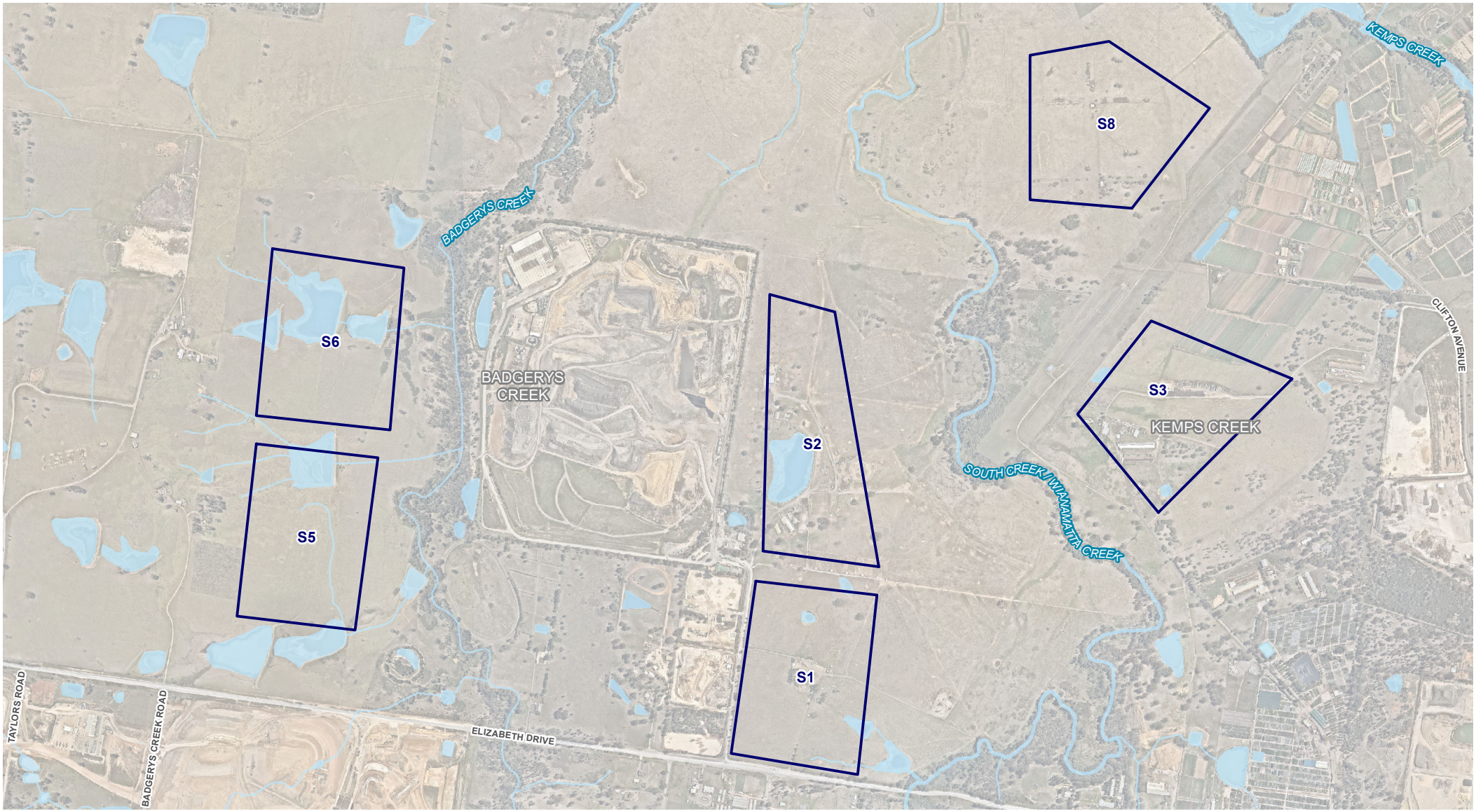
Location option	Option analysis
Oran Park	This option was eliminated because: • the area is largely zoned residential, which would result in an increased impact to the community and there would be limited land available • an AWRC would still have been required at Kemps Creek due to the size, topography and location of the servicing area.
Cecil Park	This option was eliminated because: • land acquisition costs would likely be excessive while the site would bring no advantage over the Kemps Creek location • a second AWRC would still have been required at Kemps Creek due to the size, topography and location of the servicing area • there were uncertainties regarding the feasibility of wet weather releases to Kemps Creek.
Kemps Creek Preferred option	Having ruled out plants located at Oran Park or Cecil Park, the preferred location of the AWRC was Kemps Creek because it: • would likely be unsuitable for residential development given its proximity to Western Sydney International Airport and the proposed M12 Motorway • would minimise community exposure to potential disruptions such as truck movements, land acquisition, noise and odour • would have lower land acquisition costs • would have lower risk of being impacted by future transport corridor changes • minimises the number of existing business interests impacted • would provide opportunity for future co-location of a resource recovery plant or other industries with waste or energy management synergies, given the proposed future adjacent industrial zoning • would provide greater flexibility on wet weather releases to South Creek, than Oran Park and Cecil Park sites • would eliminate the requirement of any treatment plants, or large transfer pump stations and pipelines, at Oran Park or Cecil Park.

Once Kemps Creek was identified as the preferred location for the AWRC, several sites were investigated and shortlisted. In total, six sites were selected on the northern side of Elizabeth Drive around Badgerys Creek and South Creek. Sites on the southern side of Elizabeth Drive were eliminated due to their proximity to Western Sydney International Airport. These six sites were assessed and ranked against more detailed selection criteria, including:

- size and proportion of land outside the 1% AEP flood level
- land acquisition costs

- proximity of waterways to release wet weather flows
- risks associated with environmental, heritage and geotechnical constraints
- limitations of future surrounding land use or infrastructure (mainly M12 Motorway and Western Sydney International Airport)
- impact on public amenity
- location of the site in the catchment to leverage catchment drainage.

Figure 3-2 shows the location of the six shortlisted sites. These locations are indicative only, with the intention that once a preferred site was identified, the exact area required would be identified.



Shortlisted AWRC locations

Waterbody

Watercourse

0 0.25 0.5km

Figure 3-2 Shortlisted AWRC site locations at Kemps Creek

Projection: GDA2020 MGA Zone 56
Source: Nearmap, ESRI, Sydney Water, Aurecon

Table 3-4 provides an overview of each of the shortlisted site options and a summary of the site selection analysis. Site 8 was the preferred site due to easier access, lower acquisition costs, lower impact from the M12 Motorway alignment and fewer ecology constraints.

Table 3-4 Shortlisted AWRC site locations

Location option	Option analysis
S1	This option was ruled out due to the land already being acquired and subject to a state significant development (SSD) application. The site also fronts Elizabeth Drive which would have increased the impact to public amenity.
S2	This option was ruled out due to the increased construction costs associated with filling the site, as well as potential geotechnical constraints as the site was a former landfill. There was also potential for the site to be developed as a future stage of the SSD project for site S1.
S3	This option was ruled out due to potential land acquisition costs, and the location of the M12 Motorway through the site which would have created access constraints.
S5	This option was ruled out given its likely imminent development potential due to its location in the Northern Gateway. The site also fronts Elizabeth Drive which would have increased the impact to public amenity.
S6	This option was ruled out given its likely imminent development potential due to its location in the Northern Gateway. The site also fronts Elizabeth Drive which would have increased the impact to public amenity.
S8 **Preferred option**	This option is the preferred site of the AWRC due to land acquisition costs, and reduced construction risk from geotechnical constraints. The site also has reduced potential of being developed for other uses due to its zoning. The site also has the potential for co-location of future resource recovery facilities, which the layout of Stage 1 has accommodated. As part of purchase negotiations, Sydney Water was asked to also purchase land that lies within the 1% AEP flood level, which would otherwise be unusable for the landowner. This represented minimal additional cost to Sydney Water and the case for selecting this option was unchanged.

Note to table: Sites S4 and S7 are not included as these were ruled out early on due to their location close to Western Sydney International Airport and Twin Creeks residential area respectively.

3.3.2 Sizing and staging

Sydney Water determines the capacity of its treatment plants using projected population and other demographic forecasts, converting these to equivalent expected flows. Sydney Water sizes plants to accommodate flows from the servicing area in normal and minor wet weather conditions, to minimise the risk of overflows and environment protection licence breaches.

Sydney Water balances cost and environmental factors to stage capacity upgrades. As population growth can be unpredictable, Sydney Water needs to be flexible and design treatment plants so they can be easily upgraded to cater for new populations before they arrive. For the AWRC, Sydney Water is building this flexibility into the EIS by seeking approval for the AWRC to be sized in line with the highest growth projections.

Sydney Water is seeking a staged approval to ensure prudent investment by not building substantially more infrastructure than needed in the first stage, retaining adaptability for future stages to align with changed growth conditions that may occur in the future.

3.3.3 Water quality and release locations

Like any water recycling or wastewater treatment plant, treatment process design considered the make-up of incoming flows and the likely end-use of treated water. Release to inland waterways requires a high level of treatment. To comply with the EPA's Hawkesbury-Nepean Nutrient Framework, the project needs to use an advanced treatment process. This reduces nitrogen and phosphorus to such low concentrations that the treated water contributes minimal nutrient load to waterways and protects the already stressed system against further degradation.

Operationally, it is most efficient to release treated water to the closest waterway. For the AWRC, this would be either Kemps Creek or South Creek. However, given the ephemeral nature of these waterways and the NSW Government's proposed flow objectives for the South Creek catchment, these waterways are unsuitable to take consistent flows of this treated water. Appendix D provides some additional context about why Sydney Water is not proposing treated water flows to South Creek during normal weather conditions.

Having ruled out releases to South Creek and Kemps Creek during normal weather conditions, Sydney Water identified Nepean River as the closest suitable waterway for these releases, and an option where the water could add benefit by supplementing environmental flows proposed from Warragamba Dam. Sydney Water also identified the potential for the high-quality treated water released to Warragamba River as an opportunity to maximise the benefits of environmental flows.

However, the AWRC will still release treated water and stormwater to South Creek. Based on historical climate and Sydney Water treatment plant data, Sydney Water expects treated water releases to South Creek will be infrequent and during periods of wet weather, typically between 3-14 days per year.

Options for release locations to South Creek on the AWRC site are substantially constrained by hydraulics and site grades. The natural surface slope of the site is very shallow, with grades generally ranging from 0.5 to 1%. Elevation across the site is also minimal, with about three to four metres of natural elevation between the high point on site and the 1% AEP flood level. The natural ground conditions and low elevation mean that the site requires significant earthworks to adequately drain stormwater runoff.

Design to date has identified two release locations will likely be required to allow effective releases of treated water and stormwater. The northern release point will release surface water captured from the north half of the site and the southern release point will release a combination of surface water captured from the southern half of the site and treated water. To ensure the release point is above the normal creek water level, the releases may need to be via a swale or a combination of a pipe and swale. Sydney Water has used the following principles in locating the release points:

- Locate release points on the AWRC site and minimise infrastructure length to waterway for more efficient operation and maintenance.
- Follow natural water flow paths on site where possible to minimise the extent of earthworks required.
- Avoid remnant patches of Swamp Oak Forest along South Creek.
- Avoid significant disturbance to existing oxbow of South Creek.
- Locate release points away from waterway bends where possible to minimise erosion risk.

3.3.4 Site layout and design

The indicative site layout has evolved over time as design has progressed and will continue to evolve through detailed design. Key considerations in developing the indicative site layout were:

- locating all operational areas, including detention and retention basins, in the RU2 land use zone and above the 1% AEP flood level to align with land use permissibility and ensure safe operation of the AWRC
- orienting the layout and treatment processes to achieve efficient operation and maximise the use of gravity where possible
- minimising the operational area as far as practical and locating it on one side of the site to provide flexibility for future uses of remaining land
- making effective use of the additional land being purchased to establish a green space area to contribute to the green spine along South Creek and implement best-practice water sensitive urban design.

The AWRC design also includes a range of measures to minimise environment and community impacts such as an odour management system, renewable energy generation, beneficial reuse of biosolids, and landscape-led urban design as described in Chapter 4.

3.4 Preferred option refinement – pipelines

In addition to the AWRC, the project includes a treated water pipeline to release treated water to Nepean River, a brine pipeline to transfer the waste stream from the advanced treatment process to the existing wastewater network at Lansdowne and an environmental flows pipeline to Warragamba River.

Similar to the AWRC, decisions were needed to determine release and connection locations, pipeline alignments, pipeline sizes and construction corridors. Sydney Water has worked to minimise impacts on the environment and community during design by balancing a range of factors including constructability, operability, environment and heritage constraints, community and cost.

The following sections provide more detail about these decisions and approaches. In many cases design was iterative and involved multiple sub-options that changed over time as new information became available. This section summarises the main options considered and the key environment and community constraints and impacts Sydney Water has avoided during design, to demonstrate how the preferred option for pipelines assessed in this EIS was developed. This section describes the key impacts avoided and the impact assessment chapters of this EIS assess the residual impacts and identify measures to appropriately manage them.

3.4.1 General approach

Sydney Water proposes to build the pipelines underground. This protects the pipes from damage and typically allows existing land uses to continue once construction is complete, except for any new development. It is typical for Sydney Water to protect corridors for some pipelines by an easement.

Sydney Water considered whether to stage construction of the pipelines. Staging construction would involve installing smaller pipes in Stage 1 and duplicating these pipes in the future. Sydney Water's preferred option is to build the pipelines to their full capacity in Stage 1. This limits community and landowner disruption to a once-off activity, after which the land is returned to its prior use. This is the most cost-effective and least disruptive approach.

Sydney Water has sought opportunities to select or refine the pipeline footprint as far as practical to minimise environmental impacts, particularly on biodiversity and heritage, or address matters raised by stakeholders. Sydney Water and its specialist consultants completed environment and heritage constraints assessments early in the design phase that informed pipeline alignments. Where the proposed pipeline alignments intersected with environment or heritage constraints, Sydney Water's designers and environmental specialists collaborated on opportunities to avoid or minimise impacts, balancing environment, heritage, community, constructability and cost.

Construction impact areas along pipelines are typically 25-30 m wide and use a trenched methodology for safe, fast and efficient construction. In areas with environment and heritage constraints Sydney Water has sought to narrow these corridors where possible or use tunnelling to avoid and minimise impacts.

In addition, Sydney Water has taken other approaches to designing the pipelines to avoid and minimise environment and community impacts including:

- following existing road alignments where possible to minimise disturbance to the environment and community
- aligning with future major infrastructure projects such as the M12 Motorway, Elizabeth Drive and Northern Road
- minimising the number of rail crossings and seeking to cross any rail lines at a 90-degree angle where possible
- avoiding the need for road closures during construction where possible
- considering likely future land use to avoid impact on future development where possible - this includes aligning pipelines along the edge of property boundaries or through land that is not suitable for development
- designing the treated water and brine pipelines as pumped systems (operating under pressure) which removes the need for uncontrolled overflow points
- where construction access is required, using existing access tracks or roads where possible and where additional access is required, preferentially locating it in areas with minimal environmental or heritage constraints
- where additional construction compounds are needed, locating them preferentially on Sydney Water land or public land to minimise the extent of private land impacted.

From discussions with DPI Fisheries, Sydney Water understands they prefer all waterway crossings to be constructed using tunnelling. The project proposes this for many waterways, but in balancing overall project cost and the ability to restore the waterways after construction, Sydney Water proposes that some will be built using trenching methodology.

While Sydney Water has not been able to avoid all impacts on environment and heritage, the collaborative process and multi-criteria assessment approach has substantially reduced them across the project.

3.4.2 Treated water pipeline

Release location

Sydney Water shortlisted treated water release locations to Nepean River between the confluence of Nepean and Warragamba Rivers and Wallacia Bridge at Silverdale Road.

Locations downstream of the Nepean/Warragamba River confluence were ruled out because they would require a pipeline and release structure to be built in the World Heritage-listed Blue Mountains National Park or would be too far away from Warragamba Dam to effectively offset flows released.

Similarly, locations upstream of Wallacia Bridge were also ruled out. Wallacia Bridge marks the boundary of the Yarramundi 2 subzone as defined in the EPA's Hawkesbury-Nepean nutrient framework (NSW EPA, 2019a). Releasing in this subzone is preferable as it is less stressed by nutrient loads than elsewhere along the river.

Between the Nepean/Warragamba River confluence and Wallacia Bridge, Sydney Water considered release locations in three areas as shown on Figure 3-3 and described in Table 3-5. The option that was preferred and is part of the project scope is Option N3b, upstream of Wallacia Weir.

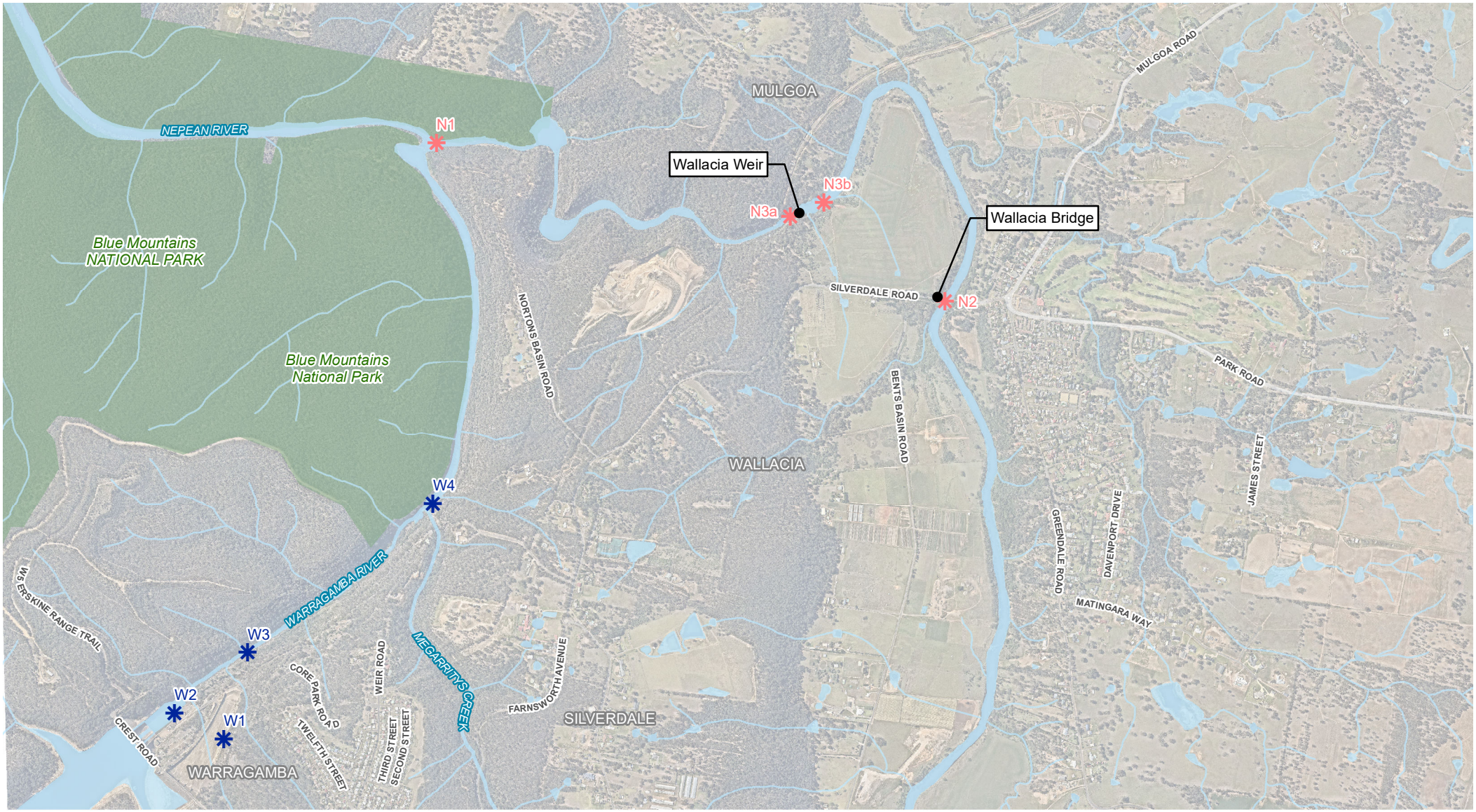


Figure 3-3 Release location options

Projection: GDA2020 MGA Zone 56
Source: Nearmap, ESRI, Sydney Water, Aurecon

Table 3-5 Nepean River release location options

Location option	Option analysis
N1 - Confluence of Nepean and Warragamba River	This option would require extremely complex construction for the release structure and part of the treated water pipeline, with steep grades and difficult access. It also has environment and heritage constraints. Similar constraints exist between this location upstream to around Wallacia Weir. For these reasons, once Sydney Water was able to confirm with the EPA that the Yarramundi subzone boundaries were further upstream at Wallacia Bridge, this option was ruled out.
N2 - Wallacia Bridge	Sydney Water consulted with Wollondilly Council around plans to upgrade the Wallacia Bridge and Silverdale Road. Council's plans are still being developed and Sydney Water ruled out this option to avoid potential need for later redesign or moving the release location to accommodate council's plans.
N3 - Wallacia Weir to Wallacia Bridge N3a – Downstream of Wallacia Weir N3b – Upstream of Wallacia Weir **Preferred option**	Having ruled out Options N1 and N2, Sydney Water considered the most suitable location between Wallacia Weir and Wallacia Bridge. Of the local waterway characteristics, in this area geology and hydrodynamics were the main factors that influenced the release location. Potential water quality impact was not considered a differentiating factor given the high quality of the treated water release and the locations being in the same subzone under the Hawkesbury-Nepean nutrient framework. A location around Wallacia Weir was preferred because: • it presented the lowest risk of increasing river bank erosion. A location further upstream of the weir would be at greater risk of bank erosion given the river bends and the erodible soils along river banks, especially during high flow conditions. This would likely require extensive scour protection downstream of the release location • the geotechnical profile of the area indicates that the rock strata dips steeply at the weir. A location further upstream of the weir would require deeper piling and foundations for the release structure at a greater cost and construction complexity • it is located further from any publicly accessible recreational areas in Wallacia.

Location option	Option analysis
	Sydney Water then considered whether the release location should be downstream of Wallacia Weir (Option N3a) or upstream (Option N3b). The key reasons for choosing a location upstream of the weir were that releasing treated water into the Wallacia Weir pool effectively serves as a plunge pool to substantially reduce its velocity and hence erosion risk, compared to a release downstream of the weir. Although releasing upstream of the weir would slightly increase water depth in the weir pool, geomorphology advice indicated this would be unlikely to be at a level that would exacerbate existing erosion under median conditions. Bedrock conditions downstream of the weir also presented constructability challenges. In addition, Sydney Water made some minor changes to move the release location slightly further upstream to minimise impacts on identified heritage features associated with Blaxland's Farm.

The treated water pipeline release structures will be set back from the river. Locating the structure outside of the waterway protects it from potential damage from flood waters and debris and allows access for maintenance. The outlet design will minimise exit velocity of the treated water and include erosion dissipation structures.

Alignment selection

Sydney Water considered two main alignments for the treated water pipeline from the AWRC to Nepean River as shown in Figure 3-4.

- TW1 – this alignment headed south from the AWRC site then west along Elizabeth Drive, Park Road and Silverdale Road.
- TW2 - this alignment headed north from the AWRC site then west along WaterNSW's Warragamba pipeline corridor. This alignment has benefits of minimising impacts on private land and largely being in a disturbed corridor. Sydney Water consulted with WaterNSW about this option. The treated water pipeline would use space in this corridor that WaterNSW has reserved for future upgrade of water supply pipelines. WaterNSW was also concerned about potential risks of the treated water pipeline construction and operation on its existing critical assets in the corridor.

As a result of WaterNSW concerns, Sydney Water has progressed with TW1 along Elizabeth Drive, Park Road and Silverdale Road. The pipeline is proposed to be offset from the current Elizabeth Drive to align with the edge of the road once it is widened in the future, in a proposed future utilities corridor. It is proposed on the northern side of Elizabeth Drive given constraints on the southern side, including existing utilities and Western Sydney International Airport.

Several sub-options were considered for sections of TW1 around the AWRC site (TW1a and TW1b) and to connect into Nepean River at Wallacia (TW1c). These are also shown in Figure 3-4. These options share a common alignment along Elizabeth Drive and Park Road to Wallacia.

TW1a was initially proposed to cross under a proposed bridge for the M12 Motorway but was ruled out given the risk of uncontrolled fill in the area and potential impacts to developable land.

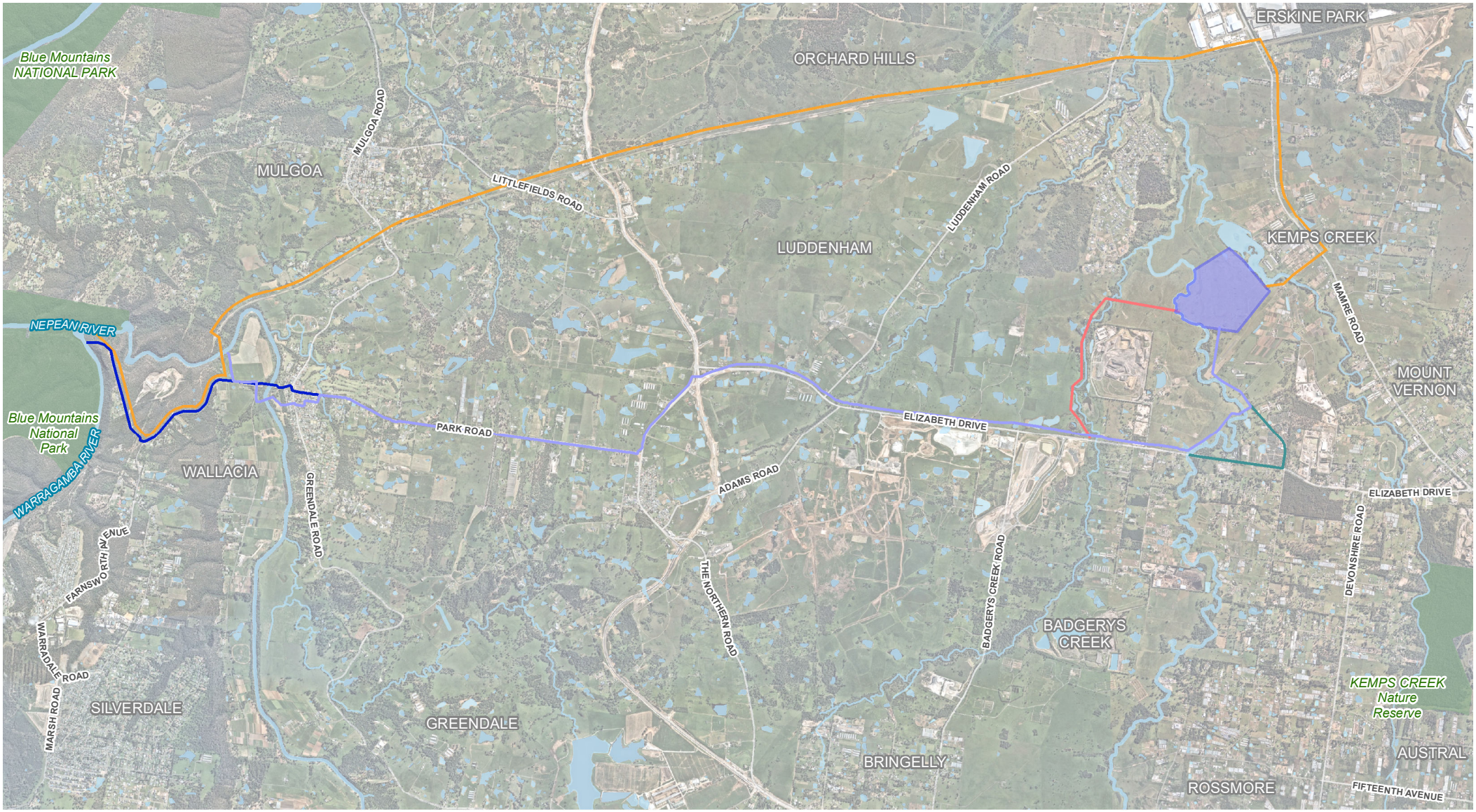
TW1b was ruled out due to impacts to private property, as well as being a longer pipeline route.

TW1c is the alignment connecting with release location N1. Once this release location was ruled out, this pipeline alignment was discounted.

Design, construction and operational measures

Key measures that Sydney Water has taken to avoid or minimise environmental or community impacts of the treated water pipeline alignment are:

- using tunnelling methods to cross Badgerys Creek, Jerrys Creek, Nepean River and several farm dams to minimise environment and heritage impacts and manage constructability issues. The crossing of Nepean River also avoids potential interactions with Wollondilly Shire Council's future upgrade of the Wallacia bridge and launch/receival compounds are located to minimise impacts on a grey-headed flying fox community near Wallacia bridge. Sydney Water proposes to cross several other waterways using open trenching, including South Creek, Oaky Creek and Cosgroves Creek
- avoiding some stands of sensitive vegetation along Park Road by constructing part of the pipeline in the road verge and part beneath the road surface. This was an example where Sydney Water was balancing multiple constraints – potential impacts on private property, space limitations on the northern road verge, sensitive vegetation in the road verge, traffic management in the road corridor and efficiency of construction and associated cost
- using tunnelling methods to cross Elizabeth Drive and Northern Road (to minimise traffic impacts), the future M12 Motorway (to avoid farm dams) and Sydney Metro Western Sydney Airport corridor (to ensure adequate depth beneath the future metro)
- reducing construction corridor from 30 m to 15 m to minimise impacts on sensitive vegetation through South Creek, Oaky Creek and Cosgroves Creek
- reducing impact area from 30 m to 15 m in several locations through known or potential Aboriginal sites
- moving alignment of the brine and treated water pipelines south of the AWRC into the roadway to avoid sensitive vegetation
- near Wallacia bridge, moving alignment off Park Road to back streets to avoid interaction with future council upgrade of this bridge. It also minimises community impacts as night works would likely be required along this section of Park Road to minimise traffic impacts and this is a higher density area with several apartment blocks
- where pipeline is on private property adjacent to Wallacia Weir, aligning it to minimise impacts on the highest sensitivity archaeological areas associated with Blaxland's Farm.



Treated water pipeline options

- TW1
- TW1a
- TW1b
- TW1c
- TW2
- Advanced Water Recycling Centre
- National Parks & Reserves
- Waterbody
- Watercourse

0 1 2km

Figure 3-4 Treated water pipeline alignment options

Projection: GDA2020 MGA Zone 56
Source: Nearmap, ESRI, Sydney Water, Aurecon

Changes still under consideration

Sydney Water is continuing to consider minor pipeline realignments to reflect the changing environment in the area. For example, Sydney Water is investigating a minor realignment around the Northern Road and Elizabeth Drive intersection to better align with the latest Transport for NSW work and minimise impacts on surrounding property owners. Sydney Water is also working closely with Transport for NSW as their designs progress for the Sydney Metro – Western Sydney Airport and considering whether minor pipeline realignments or construction methodology changes are needed in this area.

These opportunities have not been resolved for consideration in the EIS but Sydney Water will assess any revised treated water pipeline alignments in an amendment report.

3.4.3 Environmental flows pipeline

Release location

The intention of this pipeline is to release treated water as close to the dam wall as practical to replace environmental flows. On this basis, Sydney Water's approach to locating this release structure was to identify the closest location to the dam wall that did not compromise structural integrity of the dam wall, spillway or any associated WaterNSW assets, presented a safe and feasible construction and operation methodology and minimised environmental impacts. The terrain along Warragamba River is extremely rugged and constructability is a critical factor in choosing a release location. Sydney Water considered release locations in four areas as shown on Figure 3-3 and described in Table 3-6. The option that was preferred and is part of the project scope is Option W3, upstream of Warragamba Weir.

Table 3-6 Warragamba River release location options

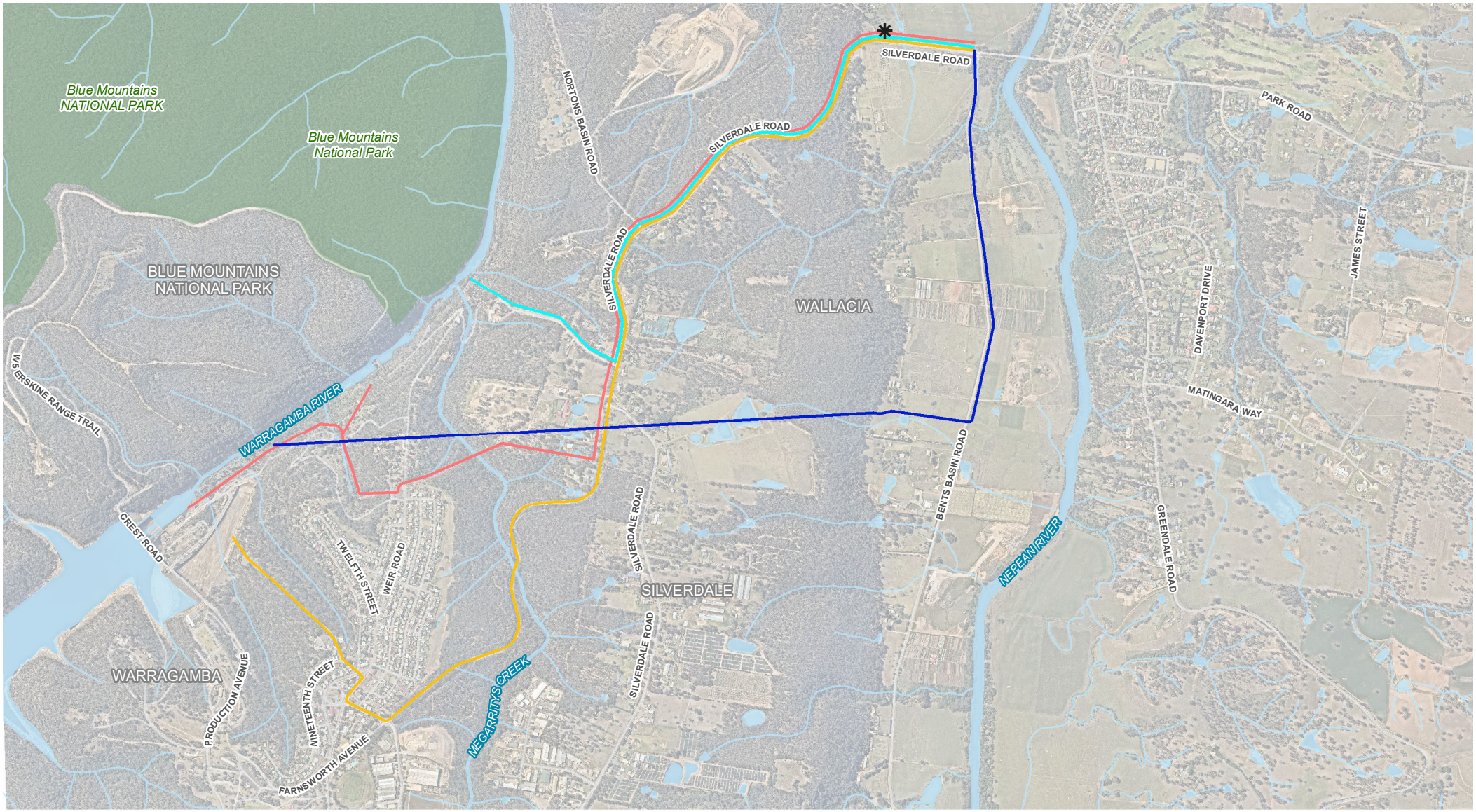
Location option	Option analysis
W1 – Warragamba Dam spillway	This option involved treated water releases into the dam spillway. It was ruled out due to potential risk to this critical WaterNSW infrastructure during construction and operation.
W2 – Near Warragamba Dam wall	This option was close to the dam wall. It was ruled out due to potential risk to this critical WaterNSW infrastructure during construction and operation.
W3 - Upstream of Warragamba Weir **Preferred option**	This option was able to take advantage of already disturbed land for construction access and presented an option that was close to the dam wall and spillway but outside their structural zone of influence. Several potential locations were considered in this vicinity, with the preferred location chosen due to existing access for construction and operation and reduced environmental impacts.

Location option	Option analysis
W4 – Near Megarritys Creek	This option was considered due to its proximity to the existing environmental flows release location. However, it was ruled out due to complex geology around Megarritys Creek and constructability issues of for the release location and associated pipeline.

Similar to the treated water pipeline, the environmental flows pipeline release structure is set back from Warragamba River. The outlet design will minimise exit velocity of the treated water and include erosion dissipation structures.

Alignment selection

Sydney Water considered three main options for building the environmental flows pipeline as shown on Figure 3-5 and in Table 3-7. EF1, a tunnel to Warragamba River, was the preferred option.



Environmental flows pipeline options

- EF1
- EF2
- EF3
- EF4
- Pump Station at option EF2
- National Parks & Reserves
- Waterbody
- Watercourse

0 0.5 1km

Figure 3-5 Environmental flows pipeline alignment options

Projection: GDA2020 MGA Zone 56
Source: Nearmap, ESRI, Sydney Water, Aurecon

Table 3-7 Environmental flows pipeline options

Location option	Option analysis
EF1 - tunnelled installation underneath Warragamba from Bents Basin Road to Warragamba River **Preferred option**	This option was preferred as it had the lowest net present value and significantly better non-cost outcomes than the other options, including: • significantly reduced biodiversity and heritage impacts, including on vegetation communities listed under the *Environment Protection and Biodiversity Conservation Act 1999* • reduced impacts to smaller waterways by eliminating the need to cross Megarritys Creek and release into Sawmills Creek • significant reduction (about 50%) in energy requirements due to reduction in pumping pressure and smaller pumping station size • simplified operational controls by having local control at the flow split arrangement • better community outcomes by minimising disruption, vegetation clearing, traffic disruption along Silverdale Road and easement requirements. The main disadvantages are: • it is at the limit of tunnelling technology. However, Sydney Water has sought specialist constructability advice that indicates it is feasible • it requires 24/7 construction activities. Sydney Water considered several route alignments for the tunnel which all had similar environmental and community impacts. The preferred option was the alignment that was considered have the lowest geotechnical risk based on desktop information.
EF2 - trenched pipeline to Warragamba River with additional pumping station at Wallacia	The main advantage of this option is simplified operational controls over EF3 and EF4. However, it has the highest energy use, would have substantial biodiversity impacts and potential heritage impacts, and requires additional land acquisition for a pumping station site in Wallacia.
EF3 – Control arrangement to split flow at Silverdale Rd (trenched pipeline to Warragamba River) with sub options for the crossing of Megarritys Creek, including trenching, micro tunnelling and a pipe bridge	This option has similar disadvantages to EF2 in terms of higher energy use than EF1, and substantial biodiversity impacts and potential heritage impacts. It has additional constructability and safety issues associated with crossing Megarritys Creek due to the steep topography and risks of impacts to WaterNSW Warragamba water supply pipelines. The options involving a pipe bridge would require above-ground pipelines and associated visual impacts.

Location option	Option analysis
EF4 - Control arrangement to split flow at Silverdale Rd (pipeline via existing Megarritys Creek bridge)	This option was ruled out due to the potential risk to critical WaterNSW infrastructure during construction and operation.

Design, construction and operational measures

The primary measures identified in refining the preferred option included locating the flow splitter and construction compounds in previously disturbed areas and aligning the pipeline at the edge of property boundaries along Bents Basin Road.

3.4.4 Brine pipeline

Release location

Given the brine is removed from the wastewater in its final treatment stage, Sydney Water concluded there are no opportunities for reuse and it is not suitable for release to local freshwater waterways. It therefore needed to be released via one of the coastal wastewater systems with sufficient capacity, the closest of which is the Malabar wastewater system.

Although there are closer connection points to the Malabar wastewater system, the connection point on the Northern Georges River Submain (NGRS) in Lansdowne Reserve was the closest location where the Malabar wastewater system had capacity for additional flows. The connection also needed to be made into an existing maintenance hole with sufficient hydraulic capacity. This limited the potential suitable locations, as upstream maintenance holes already contained several connections that prevented any further connections by the brine pipeline. The location of upstream maintenance holes that were investigated included north of Hume Highway around Bent Street and Tuncoee Road.

Sydney Water has undertaken a range of investigations and modelling to ensure the Malabar wastewater system has enough capacity to release the brine. Sydney Water has a large range of condition assessment information on the Malabar wastewater system including a full traverse inspection and assessment of all sections of the NGRS completed in 2020. Sydney Water has also used its wastewater model for the system to develop an operational approach to manage the brine, which led to incorporating brine storage tanks on the AWRC site and associated operational controls to delay release of brine to the Malabar wastewater system when flows in that system are high (for example, during wet weather or when dry weather flows are at their peak).

Sydney Water also has existing programs such as desilting, source control, internal visual inspections and proposed upgrades to the Malabar wastewater system which will ensure it has sufficient capacity over the longer term to accommodate the brine transfer from the AWRC.

Alignment selection

Sydney Water identified five broad alignment options for the brine pipeline as shown in Figure 3-6. Three of these were identified based on the potential to re-purpose a pipeline Sydney Water is building to provide recycled water to Western Sydney International Airport for construction (B1, B3 and B5). However, further investigation of these options confirmed that the airport recycled water pipeline does not have capacity for the brine volumes produced by the AWRC and these options were subsequently ruled out.

The other two alignment options (B2 and B4) were based on the potential to align part of the brine pipeline adjacent to a pipeline that forms part of Sydney Water's Prospect to Macarthur (PROMAC) water supply project. The preferred option is B4. Table 3-8 summarises these two options. In addition to the general approach in section 3.4.1, some of the key considerations for assessing these two options included the most suitable alignment through Western Sydney Parklands, minimising impacts on major roads, avoiding the centre of Cabramatta CBD, minimising existing utility and rail corridor impacts, and minimising safety risks for Sydney Water's operations and maintenance teams.

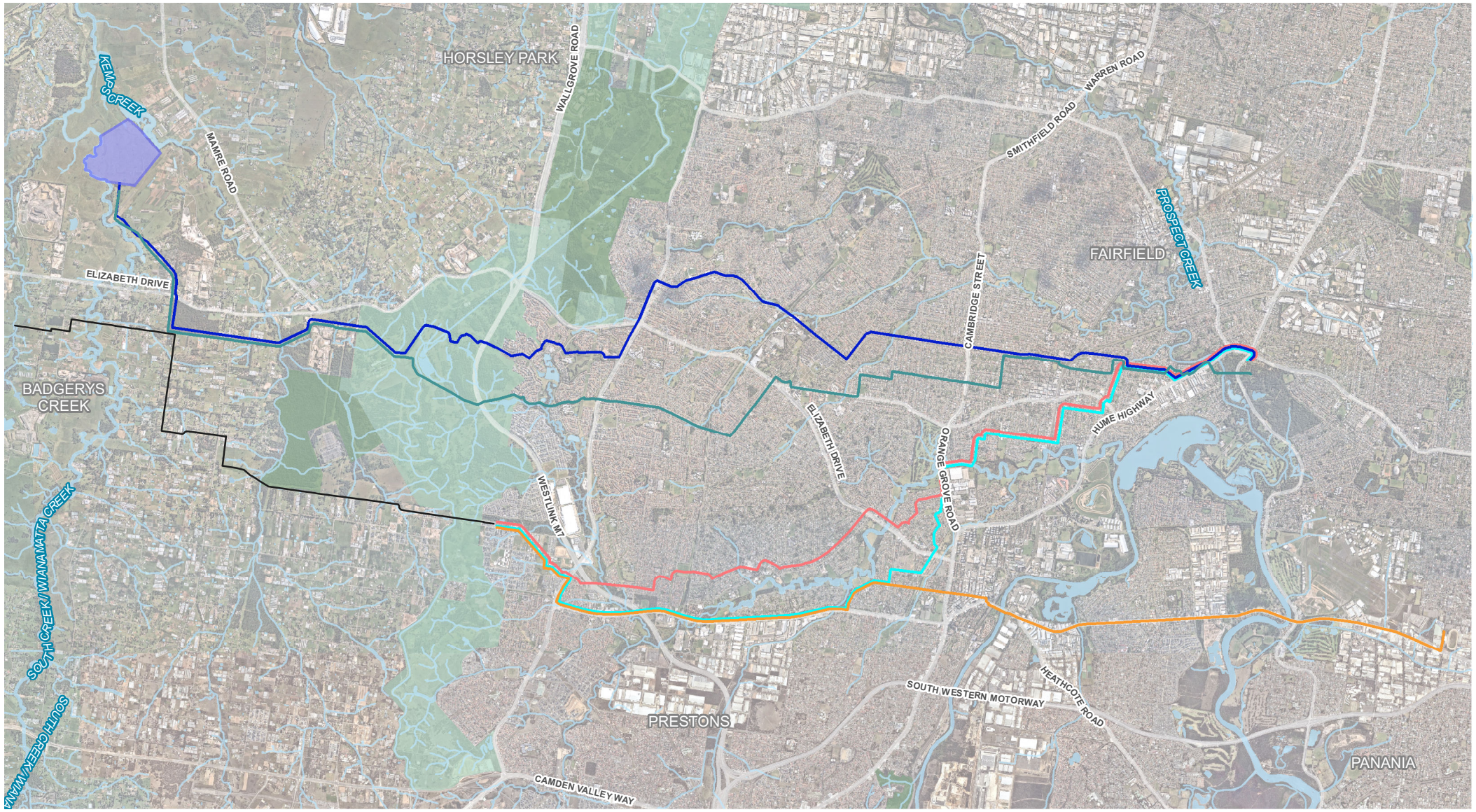


Figure 3-6 Brine pipeline alignment options

Projection: GDA2020 MGA Zone 56
Source: Nearmap, ESRI, Aurecon, Sydney Water

Table 3-8 Brine pipeline options

Location option	Option analysis
B2 - northern route	This alignment is located along more major roads (such as Cowpasture Road) compared to option B4, which would disrupt greater numbers of the community and road users. This also presents greater future safety risks for ongoing operation and maintenance of the pipeline. The alignment through Western Sydney Parklands was identified to have greater risk of landslip with potential to result in pipeline failures. It would also require crossing of two rail lines near Canley Vale station which increases construction risks and impacts to the local community.
B4 – southern route **Preferred option**	This alignment was chosen as the preferred option as it rated more favourably on non-cost criteria because it minimised biodiversity and heritage impacts by following roads, minimised creek crossings, minimised community and traffic impacts by typically preferencing local roads rather than major roads, and minimised interactions with other major services such as high-pressure gas pipelines. Through Western Sydney Parklands the alignment follows a decommissioned Sydney Water pipeline where the area has been disturbed in the past and has fewer geotechnical risks than option B2. For the pipeline to get to the required discharge location in the existing wastewater network, it would need to pass through Cabramatta and adjacent areas. This alignment option would: • minimise community disruption by avoiding the main business precinct of Cabramatta CBD and the highest density residential areas • provide the most direct and feasible route by following local and arterial roads aligned east to west • provide a safer operation and maintenance environment for Sydney Water staff, minimises traffic impacts and avoids significant heavy pavement reinstatement by avoiding busy major roads such as the Hume Highway • locate the tunnelling compound in open space at Cabravale Park as deep launch and receival shafts are required to tunnel under the rail line. The park location minimises the risk of impacting adjacent buildings (due to deep excavations) and traffic impacts. It was also the least expensive option.

Design, construction and operational measures

Key measures that Sydney Water has taken to avoid or minimise environmental or community impacts of the brine pipeline alignment are:

- using tunnelling methods to cross Green Valley Creek and Prospect Creek to avoid environmental impacts. Trenching is proposed across Kemps Creek and Hinchinbrook Creek
- extending tunnelling length under Prospect Creek to minimise impacts on sensitive vegetation on the eastern side of Prospect Creek. This involves using a complex bidirectional construction methodology to avoid impacts on the biobanking site at Lansdowne Reserve
- using tunnelling methods to cross Elizabeth Drive, Cumberland Highway, Cowpasture Road, railway lines near Cabramatta station, M7 Motorway, Hume Highway and Henry Lawson Drive to minimise traffic and railway impacts
- using tunnelling methods to cross the WaterNSW Upper Canal, to avoid heritage impacts
- realigning a short section of the pipeline away from the Hume Highway to minimise traffic disruption or need for night works on a major arterial road
- reducing impact area from 30 m to 15 m in several locations through known or potential Aboriginal heritage sites
- reducing construction corridor from 30 m to 15 m through Western Sydney Parklands and several other locations to minimise impacts on sensitive vegetation
- realignment to the southern side of Cross Street in Kemps Creek to avoid sensitive vegetation
- avoiding trees along Feodore Drive through reduced corridor and placement of pipeline in the road
- moving pipeline to the south side of Cabramatta Road to avoid sensitive trees on the northern side
- using pump out scours, which means that if a section of the pipeline requires maintenance, the brine is pumped out into a truck for disposal rather than being released into the environment
- designing pipeline hydraulics to avoid a barometric loop (a large above-ground structure) in Western Sydney Parklands.

Changes still under consideration

Sydney Water is currently working with Fairfield City Council on opportunities for realignment of short sections of the brine pipeline to minimise construction impacts in the Cabramatta CBD and Cabravale Park. Sydney Water is also working with Greater Sydney Parklands and Sydney International Shooting Centre on opportunities for minor realignment of a short section of the brine pipeline along their common property boundary. The realignment is being considered to minimise impacts on proposed landscaping along a newly constructed section of Range Road that runs east-west through Western Sydney Parklands. Sydney Water is also investigating an opportunity to realign a short section of the brine pipeline around its crossing of Kemps Creek. This change would be to realign the pipeline into areas previously disturbed by another Sydney Water project and avoid an area proposed for future development.

These opportunities have not been resolved for consideration in the EIS but Sydney Water will assess any revised brine pipeline alignments in an amendment report.

3.5 Opportunities to optimise the circular economy

The AWRC represents Sydney Water's largest investment in infrastructure for Western Sydney and will become a hub for the circular economy in the Parkland City. This section describes future options for the best use of the many resources that may be produced at the AWRC site. Some elements of this are in project scope and some present future opportunities to move beyond business as usual and would require separate assessment and planning approvals.

The AWRC will perform circular economy activities where resources are recovered and reused for their greatest economic value, through reusing waste and generating renewable energy.

The AWRC will use advanced technology to treat and reuse wastewater and aims for all treated water produced during normal conditions to be reused for beneficial use that saves valuable drinking water supplies. This approach will align with circular economy principles. There is a wide range of options for how this recycled water can be used in the future, which are explored below. In addition, Sydney Water is conscious of the adjacent opportunity for stormwater management and reuse, and will work to ensure that these products are planned together.

Sydney Water is also investigating the opportunity to develop a future bioenergy hub at the AWRC for waste collection, reuse, resource recovery and renewable energy generation. This aligns with the principles of a multi-utility approach to servicing Western Sydney and supports Commonwealth and NSW Government policies to promote a circular economy in the Western Parkland City.

3.5.1 Recycled water

The AWRC will produce high-quality treated water suitable for a wide range of uses including environmental flows, third pipe recycled water to homes, businesses (such as data centres), agriculture (including intensive agriculture) and open space. In addition, future uses could include adapting the AWRC for supplying purified water for drinking, subject to community support and government policy change.

Sydney Water has recently developed a position statement on recycled water that confirms recycled water as a critical component of Sydney Water's portfolio for delivering a water resilient city. It seeks to reduce demand on climate dependent supplies and contributes to water security during drought. Sydney Water has set targets to increase recycled water supply by 50% before 2025 increasing from 44 gigalitres (GL) per year in 2019 to 66 GL per year in 2025. The project has potential to make a significant contribution towards this target.

Given the WSAGA and SWGA are still developing and there is uncertainty around timing, volume and location of recycled water demand, the supply of recycled water to residents and businesses is not part of the project scope. In addition, Sydney Water's analysis is that demand for recycled water for household, business and irrigation uses shows it is unlikely to exceed the volume produced at the AWRC. Recycled water demand is highly seasonal, with more water used in summer than winter, and more in dry weather than wet weather. This means Sydney Water expects the ultimate use of treated water from the AWRC will always be a combination uses, including environmental flows and a range of other recycling options.

For the purpose of this EIS, project scope and assessments are based on releasing all treated water to Nepean River via the treated water pipeline or environmental flows pipeline. However, this section identifies the main opportunities for beneficially using treated water from the AWRC, and the current status of their consideration by Sydney Water.

Environmental flows

The option to release flows from Warragamba Dam to support the health of downstream sections of the Warragamba and Nepean Rivers was initially trialled from 1998 to 2000. However, there has always been concern about how to balance the benefit of environmental flows with protecting Sydney's drinking water supplies.

Since 2000, there has been much investigation of the ideal release regime, and this work is continuing. Today, while 25 ML/day is released through the dam wall in summer and 17 ML/day is released in winter, these flows are allocated to specific purposes, including to support extraction at the North Richmond Water Filtration Plant.

In 2010, Sydney Water started supplementing the flows further by releasing advanced treated water from the St Marys Advanced Water Treatment Plant to Nepean River at Penrith Weir.

In consecutive versions of the Metropolitan Water Plan (since 2004), environmental flows have been acknowledged as critical to the river for environmental and community health. Today, the NSW Government is continuing to plan for a new environmental flows regime from Warragamba Dam and balancing this with increasing pressure on Sydney's drinking water supplies. Appendix C describes the history of and current releases from Warragamba Dam in more detail.

For the project, there is an opportunity for treated water releases from the AWRC to contribute to the new environmental flows regime. Sydney Water is continuing to collaborate with other key agencies including DPIE on the details, including alignment with dam releases, drinking water offsets, and whether treated water releases could be allocated for other specific downstream purposes. In developing the project, Sydney Water has assumed that the offsets would be achieved by releasing treated water at the base of the dam wall, as close as possible to the current release location at Megarrity's Creek.

Sydney Water is also exploring with DPIE if the project can contribute to waterway health benefits of the new environmental flows regime by releasing treated water to Nepean River at Wallacia Weir and avoiding the significant cost of building the environmental flows pipeline. On this basis, the EIS assesses two operational scenarios and impacts to align with the main options being discussed with DPIE. One scenario is where releases are only to Nepean River at Wallacia Weir and the other where releases are to this location and Warragamba River. This will provide flexibility while cross-government discussions and cost-benefit analysis occurs.

The project will not immediately change any current requirements on WaterNSW to release flows from Warragamba Dam, including in relation to downstream wastewater treatment plants or the North Richmond Water Filtration Plant. This will depend on whether Sydney Water builds the environmental flows pipeline and any future government decisions on environmental flow releases. However, the project provides a good opportunity to both enhance the health of the waterways, save the water in Warragamba Dam and continue exploration of expanded extraction at North Richmond should further augmentation to drinking water supply be desirable.

Supply to recycled water users

In developing servicing plans for new precincts in Western Sydney, Sydney Water is investigating schemes to enable recycled water supply directly to developers (for residential and non-residential use) or other major users in the region.

Typically, Sydney Water supplies recycled water to customers through a commercial supply agreement. Sydney Water works with potential customers to identify their needs, determine the costs of supplying the service (including the infrastructure and approvals), and passes the cost through to the customer.

Sydney Water plans to provide reticulated recycled water to neighbouring precincts for non-drinking purposes, although this is not part of project scope. Sydney Water has completed service planning for the Mamre Road precinct and has issued advice to developers signalling its intent to provide recycled water services. Recycled water would be sourced from the AWRC.

Forward planning for 2021 is also focused on establishing recycled water servicing plans for the initial Aerotropolis precincts (Northern Gateway, Aerotropolis Core, South Creek and Agribusiness), including for a range of land uses proposed for the Aerotropolis. Ideally the initial precincts will form an interconnected supply system including Mamre Road. Sydney Water is also planning to provide recycled water to Western Sydney International Airport.

In addition, the AWRC will produce recycled water that could also provide recycled water to councils or private customers to complement stormwater for watering public or recreational places such as sports precincts and or public parks. It can provide for traditional irrigation or cooling sprays. As noted above, these elements are outside project scope and would be subject to separate approvals.

Purified recycled water for drinking

As part of a major review of water policy in NSW, the Greater Sydney Water Strategy is currently considering purified recycled water for drinking as a major new drinking water source for Sydney. Purified recycled water could provide bulk water supply of equivalent quality to drinking water into the raw water side of the water supply system. It provides a climate independent water source that is cost-competitive with other climate independent water sources such as desalination.

The AWRC will produce a very high-quality water close to drinkable water. To enable purified drinking water supply, an extra treatment process step is required. With Prospect Reservoir about 10 km away from the AWRC site, supply to the Prospect Water Filtration Plant for further treatment and distribution would be attainable.

While this option is out of scope for the current project, it is noted as a feasible option that could be realised in the life of the AWRC, subject to community sentiment and government decisions.

Stormwater harvesting

Sydney Water is currently investigating an innovative solution for recycled water that integrates stormwater harvesting with a reticulated supply of recycled water from the AWRC. This is out of scope for the project assessed in the EIS. This has the potential to reduce infrastructure costs by leveraging the distributed storage in rainwater tanks in place of large, centralised storages. Rainwater tanks can be under-utilised for significant periods in Western Sydney and struggle to provide the climate resilient supply for urban greening and cooling. Integration of stormwater and recycled water can provide better cost efficiency and more resilient water services. Sydney Water is working closely with DPIE in the WSAGA Wianamatta-South Creek precinct on the potential for measures such as storage wetlands to be used to achieve NSW Government waterway objectives and be leveraged for stormwater harvesting.

3.5.2 Energy generation and resource recovery

The AWRC infrastructure built in Stage 1 includes an anaerobic digestion process to treat solid waste that is separated from wastewater during secondary treatment. This produces biosolids, which can be reused for agricultural purposes. During anaerobic digestion, energy can be generated, and gas produced, creating additional products for reuse.

While the Stage 1 project incorporates the basic technology only, there is an opportunity for the future plant to further leverage opportunities to create energy and recover additional resources including energy, methane, nitrogen, phosphorus, biochar, carbon dioxide, green hydrogen and other products. This would require further infrastructure investment or use of spare capacity at the AWRC, both of which are outside current project scope.

Expanding the circular economy opportunities

Co-digestion is a process where organic waste from local industry is trucked to the AWRC, conditioned and added to the anaerobic digestors along with the wastewater solids. This acts to increase biogas production, which increases the amount of gas and energy produced. The environmental benefits include reducing greenhouse gas emissions through green energy production and diverting organic waste from landfill, which also greatly reduces greenhouse gases released to the atmosphere. Economic outcomes are improved by expanding waste, energy and other commodities markets.

Figure 3-7 shows how organic waste could be incorporated into solids treatment processes at the AWRC.

Figure 3-7 Incorporating organic waste into wastewater treatment process

Sydney Water recently partnered with the NSW Government to complete a detailed investigation of the nexus between food production systems, water and wastewater systems, organic waste management, renewable energy and carbon management. This work confirmed there is a significant opportunity for the AWRC to form part of an integrated model of food, energy, water and waste management as shown in Figure 3-8.

The concept for this model provides for organic waste, such as food waste, to be collected and added directly into the wastewater treatment process. Additional biogas is created which can then be used to produce biomethane for export to the grid or to produce electricity and heat.

A major opportunity for recovery and supply of bioresources like heat, electricity, gas, carbon dioxide and nutrients can be unlocked by the integration of organic waste processing with wastewater treatment and recycling. This is out of scope for the current project and would be covered in separate approvals. However, the AWRC could provide the foundational element for a circular economy hub.

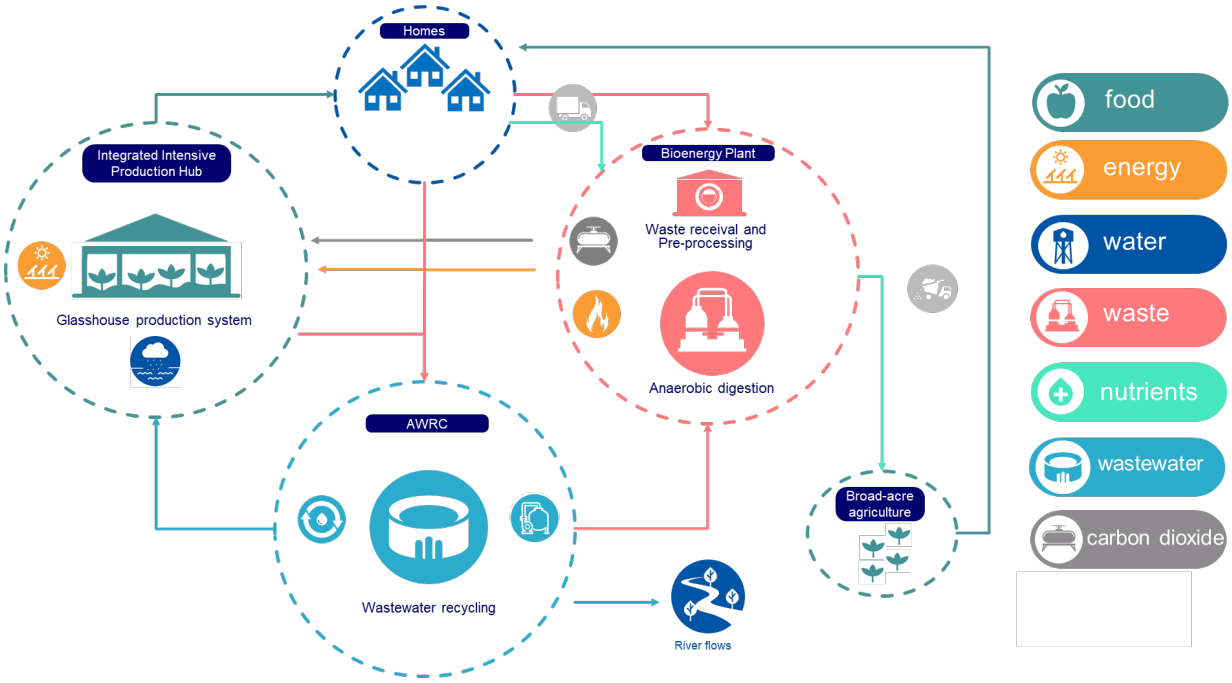


Figure 3-8 Integrated model for food, energy, water and waste management

Sydney Water is preparing to pilot this concept at a nearby facility in partnership with Western Parkland City Authority and the Western Sydney University. The proof of concept for this glasshouse project will inform concurrent planning and design for future stages of the AWRC to consider how the facility could ultimately form the hub of a circular economy precinct. This work will look at co-location to match supply and demand needs of different industries and land uses. It will also look at potential commercial and regulatory frameworks and identify what government incentives that may be available and/or required.

Supply of biomethane from a bioenergy hub into the gas grid is another important approach to the circular economy, complementary to a co-location approach and may be considered in the future but is outside project scope. It means that bioenergy customers do not need to be located next to this facility, allowing Sydney Water to potentially supply a wider customer base (which could include servicing new development in the Aerotropolis) with renewable gas. This can make for a more robust business model and allow a wider customer base to participate in circular resource models. Sydney Water has recently partnered with Jemena to demonstrate this concept for the first time in NSW at its Malabar Wastewater Treatment Plant.

3.6 Wet weather flows in Upper South Creek Servicing Area

Stormwater and groundwater can enter the wastewater collection network from several sources, including infiltration through damaged pipes or other infrastructure or illegal stormwater connections. This typically occurs in wet weather. This additional water ultimately ends up at wastewater treatment plants or can contribute to overflows from the wastewater collection network if the pipeline volume is exceeded.

The system-wide options for managing this additional water during wet weather by increasing storage capacity or reducing wet weather infiltration include:

- Provide full advanced treatment to all wet weather flows at the AWRC, which is not feasible in this system since the treatment process needs consistent flows to operate effectively. If the AWRC was built to cater for (or store) infrequent wet weather flows, it would need to be several times larger and its full capacity would rarely be used. It is standard practice for wastewater treatment plants to provide reduced levels of treatment for flows greater than normal dry weather flows.
- Store the wet weather flows in the network and progressively feed them into the AWRC treatment process after the wet weather event, which is considered not feasible due to the high cost and space requirements for storage of such large flow volumes.
- Design the wastewater collection network to reduce the wet weather flow volumes entering it (and therefore reaching the AWRC) as far as practical, which is the most efficient and cost-effective approach to managing wet weather flows, though it can never be fully reliable.

Wastewater collection network design always requires designing overflow points into the system as a contingency, so wastewater does not back up into houses and businesses if pipeline capacity is exceeded. This is a standard global approach to wastewater system design and Sydney Water also aligns with several Water Services Association of Australia (WSAA) codes and standards such as the Water Supply Code of Australia (WSA 03).

Most of the wastewater collection network for the Upper South Creek Servicing Area has not yet been built and is currently being designed by Sydney Water. The wastewater collection network is out of scope for the project. However, Sydney Water is considering the following key design measures to reduce additional water entering the new network during wet weather and reduce overflows to the environment:

- The network is modelled for a maximum of 10 spill events in 10 years. It is proposed that overflow infrastructure only be provided at pump stations and not along the pipeline network.
- Leak tight sewers. This will minimise infiltration to the wastewater mains. The system has been modelled with 2% infiltration, which is consistent with Sydney Water's wastewater system planning guidelines for new greenfield growth areas.
- Pump stations are typically proposed outside the 1% AEP flood level to reduce the likelihood of flood flows into the station.
- Pipelines are typically constructed outside the 1% AEP flood level to reduce the likelihood of infiltration, however there are locations where the assets need to be under-bored beneath creeks.
- Pressure wastewater system is proposed where viable and where a gravity solution significantly increases the overall cost.

- Lift pump stations are proposed in several locations to minimise the risk of overflows to waterways. If the pump fails, flows would be diverted to the downstream network by an overflow pipe.
- Where pump stations have a capacity of less than 250 L/s, four hours emergency peak storage or about 12 hours non-peak storage would be provided. For larger pump stations, generators would be provided to ensure they can still operate when power is lost.