Sydney WATER

Appendix A Amended Project Description

4 Project description

This chapter describes the proposed scope of work for the project, including the concept proposal. It provides a description of the construction, operation, commissioning and maintenance phases, including where flexibility is required.

4.1 Relevant Project Secretary's Environmental Assessment Requirements

Table 4-1 lists the SEARs relevant to the description of the project and where they are addressed in this chapter.

Table 4-1 SEARs addressed in the project description chapter

SEARs	EIS section where requirement addressed
General Requirements (b) a full description of the Upper South Creek Advanced Water Recycling Centre (the project), including: i. the design for the project that is proposed to be constructed and operated.	Section 4.4 outlines the design of the project.
ii. all components, disturbance areas, materials, activities, site preparation and construction infrastructure (e.g. storage compounds, dirty water areas, roads, concrete batch plants) required to construct the project (including any ancillary development that may require separate approvals).	Section 4.8, Section 4.9, Section 4.10, Section 4.10.2, Section and Section 4.10.3 outline the construction of all project components.
iii. the operation of the project, and associated water infrastructure that is proposed to be constructed.	Section 4.5 and Section 4.6, outline all operational components of the project.
iv. likely staging or sequencing of the project, including construction, operation, maintenance, decommissioning and rehabilitation.	Sections 4.3 and 4.12 outline the likely staging and timing of different stages of the project.
v. site plans, maps, drawings and diagrams at an adequate scale with dimensions in an electronic format that enables integration with mapping and other technical software, showing: i) the location and dimensions of all project components. ii) existing infrastructure, land use, and environmental features. iii) the development corridor that has been assessed and consideration of design options.	Section 4.8.2 and Figure 4-17 show all project components, including the areas that were assessed.

SEARs	EIS section where requirement addressed
vi. the likely interactions between the project and any other existing, approved, proposed, reasonably foreseeable development in the vicinity of the site, including an assessment of the cumulative impacts on the environment.	Section 2.13 outlines interactions with other major projects.
1. Describe background conditions for any water resource likely to be affected by the development including: (b) hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations	Section 4.5 outlines volume, frequency and quality of treated water releases
1. Provide a detailed analysis of discharges into Warragamba River including e-flow needs going back 20 years. This analysis needs to consider: f) impacts to the proposal's outlet infrastructure if WaterNSW may, at any time, be required to spill water from the dam and outline what assumptions have been made on flood inundation levels and water velocity at this location	Section 4.4.2. This would only apply to the release location at Warragamba River. The outlet infrastructure would be appropriately designed during detailed design to account for flood inundation and water velocity from Warragamba Dam spillway. This level of detail is not available from the current reference design.
17. Description of the type and extent of any dredging or reclamation activities within 'water land' as defined under the FM Act. This assessment must be prepared in consultation with, and have regard to the requirements of DPI Fisheries.	Section 4.9.3 describes the activities of the project within 'water land'. Consultation with DPI Fisheries is outlined in Chapter 6.
Attachment 1 - General Requirements 6. The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES.	Section 4.4 describes the design and location of all project components. Section 4.8, 4.9, and 4.10, outline the construction of all project components.
7. How the action relates to any other actions that have been, or are being taken in the region affected by the action.	Section 2.13 describes the project alignment with other major projects and Chapters 8-13 describe cumulative impacts with these projects. Section 4.14 outlines elements that are outside the project scope

SEARs	EIS section where requirement addressed
8. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	Sections 4.8 to 4.10.5 outline the construction methodology and phases of how the works will be undertaken. Section 4.4 outlines the design parameters of all structures.

4.2 Project overview

Sydney Water is proposing to build and operate a project to provide wastewater services to the Western Sydney Aerotropolis Growth Area (WSAGA) and South West Growth Area (SWGA). 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

The following sections provide more detail about each of these components.

4.3 Project staging

Sydney Water is seeking a staged approval for the project. The AWRC will likely be delivered in several stages as a response to growth in the servicing area. The timing of future upgrades at the AWRC will align with population growth forecasts and changes in the servicing area. The staging, to the extent it can be foreseen, is described below.

4.3.1 Stage 1

Stage 1 of the project includes:

- building and operating the AWRC to treat an average dry weather flow of up to 50 million litres per day (megalitres per day or ML/day)
- building all pipelines to cater for up to 100 ML/day flow at the AWRC (but only operating them to transport and release volumes produced by the Stage 1).

4.3.2 Future stages

Given the pipelines will be built to their ultimate capacity in Stage 1, future stages will only require expansion of the AWRC. Current growth projections suggest the ultimate capacity of the AWRC could be up to 100 ML/day. The timing and size of these stages will be established over time to align with growth in the servicing area. Sydney Water is seeking approval to build and operate Stage 1 and approval for the overall concept of the AWRC operating at up to 100 ML/day as part of the staged approval. Future stages will align with the overall concept presented in this EIS and will require further assessment and approval once development plans for future stages can be provided.

4.3.3 Maintaining flexibility

This EIS seeks approval to build and operate Stage 1 of the project. Although this is predicted to have an initial operating capacity of 50 ML/day, Sydney Water may elect to build the AWRC smaller given more recent growth projections suggest population growth has slowed, partly because of COVID-19. On this basis, by considering the AWRC sized to 50 ML/day, the EIS assesses a worst-case impact.

It is also likely that some elements of Stage 1 at the AWRC will be progressively installed after the initial construction phase where the main civil works occur in the initial construction phase but some processes, mechanical and electrical equipment are progressively installed over time to align with growth in the Upper South Creek Servicing Area. For example, if the AWRC is operating at 21.3 ML/day in 2026 as outlined in the growth projections in section 2.3, Sydney Water may install only the number of reverse osmosis membranes needed to treat that volume and install more membranes as flows to the AWRC increase. The impact assessment in this EIS assumes a worst-case impact scenario that all infrastructure is installed in the initial construction phase.

The detail will develop as detailed design progresses, including the exact location, layout and infrastructure for Stage 1 of the AWRC, within the impact area assessed in the EIS.

4.4 Project design

4.4.1 AWRC site

The AWRC site is about 78 ha and is shown in Figure 4-1. It is located on Lot 211 DP1272676, with construction also required on Part of Lot 21 DP 258414 (to become Lot 212 DP 1272676). Project infrastructure proposed on this site is located either in the operational area or green space area as described below. It is important these two areas of the site are managed and developed together to ensure water sensitive urban design, biodiversity and visual impacts are effectively managed across the whole site. The urban design approach for the whole AWRC site is also described below. Lot boundaries and numbers have recently changed around the AWRC site as a result of land acquisition by Sydney Water and Transport for NSW, and further changes may occur. Sydney Water is working closely with the relevant adjoining landowners, particularly Transport for NSW and University of Sydney, and will clarify any further changes in the project's amendment report.

Operational area

The operational area is about 40 ha and will contain the wastewater and advanced treatment infrastructure and a range of ancillary infrastructure including inlet works, tanks and process chambers, advanced treatment buildings, interconnecting pipelines, digesters, pumping stations, odour treatment units, and biosolids treatment units. The operational area also includes a range of ancillary infrastructure such as roads, carparking, an administration building, security fencing and visual screening. Other features ancillary to the main treatment process include chemical handling facilities and photovoltaic cells for solar energy production.

The operational area is above the 1% Annual Exceedance Probability (AEP) flood level and within the RU2 (Rural Landscape) land use zone under Penrith Local Environmental Plan 2010. A small section is zoned E2 (Environmental Conservation), as shown in Chapter 5.

Table 4-2 outlines the main treatment infrastructure of the AWRC and Table 4-3 outlines the main ancillary infrastructure. These tables provide an indication of the key project components which may change if different treatment technologies or processes are adopted in detailed design. These are not intended to be a comprehensive list as there is a complex suite of pipes, pumps, valves, screens and other treatment equipment that form part of the project. Most of the infrastructure will be above ground, with some below-ground components across the area including footings, pipelines, cables, utilities and the detention and retention basins.

The remainder of this section discusses project components for Stage 1. However, future AWRC stages will also be built in this operational area.

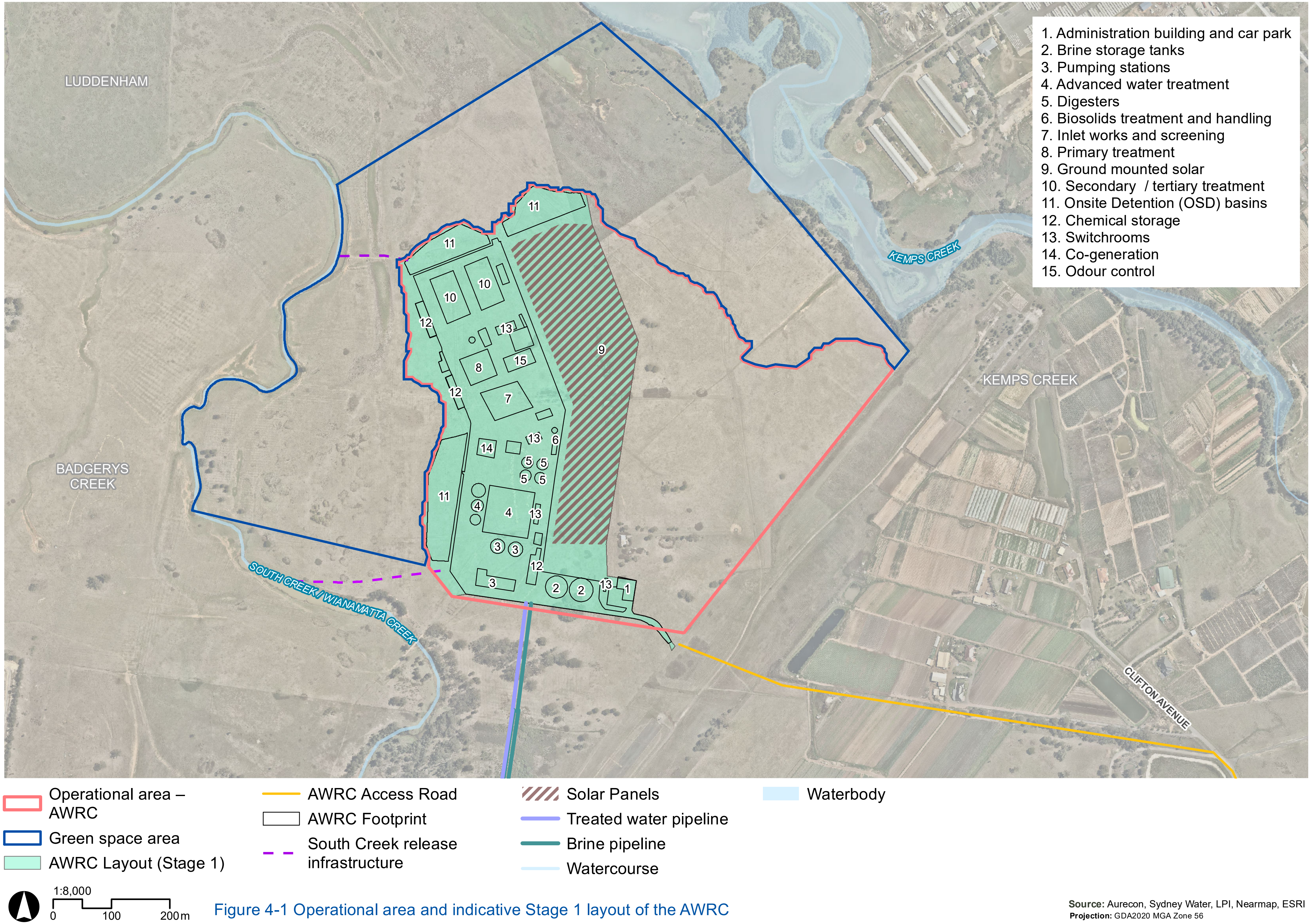


Figure 4-1 Operational area and indicative Stage 1 layout of the AWRC

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

Table 4-2 Indicative wastewater infrastructure at the AWRC

Wastewater infrastructure	Key design details	Figure 4-1 reference
Inlet work and screening	The inlet works consists of a combination of concrete structures and mechanical equipment. The main chamber of the inlet works is typically long and narrow, about 70 m x 10 m and 3 m deep to provide a series of channels to enable the wastewater to pass through mechanical screens. The inlet works may be constructed at ground level or elevated several metres to provide the wastewater with gravity head to convey it to the next process.	7
Primary treatment	The primary treatment unit is likely to consist of a single large concrete tank with internal walls to provide separate chambers. The tank is likely to be constructed at ground level and measure about 50 m x 50 m and 5 m in height. The tank will have access walkways around the edges of the chambers and it may be covered with removable covers.	8
Secondary treatment	The secondary treatment unit is likely to consist of two large open concrete tanks with internal walls to provide separate chambers. The tanks may be constructed at ground level, or partially buried and measure about 50 m x 60 m and 8 m in height. The tank may have access walkways around the edges of the chambers.	10
Tertiary treatment	The tertiary unit is likely to consist of two large open concrete tanks with internal walls to provide separate chambers. The tanks may be constructed at ground level, or partially buried and measure about 50 m x 20 m and 5 m in height. The tank may have access walkways around the edges of the chambers.	10
Advanced treatment	The advanced water treatment building will consist of a large equipment slab and a building. The slab will house pipework and pumping equipment while the building will be concrete, masonry or Colorbond construction and measure about 70 m x 30 m and 10 m in height.	4
Pumping stations	The pumping station will consist of concrete, masonry or Colorbond building(s) measuring about 10 m in height and about 60 m x 25 m total floor area. The pumping stations are likely to be located on the boundary of the AWRC site with their own dedicated access to support after hours maintenance.	3
Digesters	The digesters will be round concrete or steel tanks constructed at ground level and measure about 25 m in diameter and 20 m in height with a domed top which is the biogas holder.	5

Wastewater infrastructure	Key design details	Figure 4-1 reference
Biosolids treatment	Biosolids treatment and handling includes an outloading building that will likely be a steel and concrete building measuring about 50 m x 15 m and 30 m in height. The building will house mechanical equipment in the upper level and have access doors at each end to enable trucks at ground level to pass through it for top loading with biosolids.	6
Odour control unit (OCU)	The OCU will consist of a concrete slab at ground level, will house fans, large fibreglass ductwork, and an array of fibreglass tanks. The tanks will be about 10 m high and there will be stacks about 15 m high.	15
Brine storage tanks	The tanks will be about 40 m in diameter and about 15 m in height. They will have a capacity of about 30 ML in volume.	2
South Creek release infrastructure	The South Creek release infrastructure is likely to be a vegetated swale consisting of an earth embankment construction, rip rap (energy dissipation) and scour structure within the creek. It also includes a discharge chamber, headwall, swale and a bridge across the swale in the form of box culverts.	
Disinfection	Both tertiary and advanced treatment provide barrier disinfection for water that will be released to waterways or used for recycled water. Primary treated water will be disinfected with chlorine and dechlorinated with sodium bisulfite prior to release to South Creek.	
Other buildings and tanks	The AWRC site will also have a range of other steel and concrete tanks, mechanical equipment mounted on concrete slabs, and minor buildings for storage. All process units will be comprehensively fitted with pipework, supports, mechanical equipment and instrumentation, pumping equipment and electrical cabling. It also includes disinfection facilities to be used for future recycled water schemes.	

Table 4-3 Key operational ancillary infrastructure at the AWRC

Ancillary infrastructure	Key details	Figure 4-1 reference number
Administration building	The administration building will house the control room, laboratory, lunchroom, meeting rooms and amenities. It is likely to be located close to the entrance of the AWRC for security, convenience, and managing deliveries and visitors. The building may be two storeys.	1
Carpark	A car park will be provided at the administration building to provide parking for operational staff, visitors and contractors. The car park will include about 30 car spaces.	1

Ancillary infrastructure	Key details	Figure 4-1 reference number
Road network	Internal roads will divide the AWRC to provide operational and maintenance access to the process units for delivery vehicles and cranes. While the plant will be arranged to support access and functionality, consideration will be given to water sensitive urban design. This includes reducing the percentage of impervious area on site to reduce the overall runoff generated and leaving site and using grasses, trees and vegetation. Surface treatments for hardstand surfaces may include blue metal loose rock areas surrounding structures rather than concrete or compacted earth. A fire access road around the operational area of the AWRC will also be required to provide firefighting access in the event of a bushfire. This access road may be partially located within the green space area to ensure the road meets NSW Rural Fire Service (RFS) requirements.	
Renewable energy generation - solar	Solar panels up to about 4MW capacity, likely to be a combination of ground and roof mounted. The solar panels on the ground will be installed on poles to elevate them about two metres above ground and enable orientation for maximum efficiency. Spacing between the panels and a perimeter road will be provided for installation, inspection, and maintenance purposes.	9
Onsite Detention Basins (OSD)	The OSDs are designed to capture stormwater and runoff from the site and provide both treatment and storage. These basins are likely to be earthen construction with a polyethylene liner and measure about 250 m x 50 m and 1 m in depth. They also include release points to South Creek.	11
Chemical storage	The chemical storage consists of concrete bunds housing permanently installed fibreglass or plastic storage tanks and an adjacent a truck unloading bay. The concrete bunds will be open structures with a large concrete slab that provides spill containment, along with steel and Colorbond roof structure and fencing. Typical measurements for chemical bunds are about 60 m x 15 m and about 8 m in height. There is likely to be more than one chemical storage location at the AWRC site.	12
Switch rooms	There are likely to be several electrical switchrooms at the AWRC site to supply the various process units. Switchrooms will typically be concrete, masonry or prefabricated sandwich panel and measure about 40 m x 15 m and 10 m in height.	13
Renewable energy generation - Co-generation	The co-generation engines may be housed in a concrete building or container measuring about 10 m x 15 m and about 5 m in height. The building or containerised unit will also house ancillary infrastructure such as pipework and electrical equipment.	14

Ancillary infrastructure	Key details	Figure 4-1 reference number
Other ancillary infrastructure	A range of other ancillary infrastructure will be required across the site, including but not limited to perimeter fencing, security, lighting, visual screening, architectural cladding, first flush system, cabling and a workshop.	

Figure 4-2 to Figure 4-6 provide example images of AWRC components at other existing Sydney Water facilities. These give an indication of their size and appearance. Reference images have not been provided for all components due to difficulties in accurately capturing entire components.

Figure 4-2 Example chemical storage area from an existing Sydney Water facility

Figure 4-3 Example switchroom from an existing Sydney Water facility

Figure 4-4 Example odour control unit from an existing Sydney Water facility

Figure 4-5 Example primary treatment area from an existing Sydney Water facility

Figure 4-6 Example secondary treatment area from an existing Sydney Water facility

Green space area

This area of the site is about 38 ha and is within the 1% AEP flood level. As part of the project, it will be landscaped to develop a green space that enhances biodiversity, uses best practice water sensitive urban design and provides visual screening of the AWRC.

There is an additional opportunity for this green space to be developed into a publicly accessible recreation area to form part of the Wianamatta-South Creek parkland proposed in the Western Sydney Aerotropolis Plan. Sydney Water is working with Department of Planning, Industry and Environment (DPIE) to understand whether this is a realistic future opportunity, given the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 currently prohibits use of this land for a recreation area. Chapter 5 discusses the permissibility of this recreation area in more detail.

The green space area will also include infrastructure to release water to South Creek. This includes treated wastewater during wet weather and water from retention and detention basins. Sydney Water expects up to two release locations as shown indicatively on Figure 4-1. The infrastructure crossing the green space area will be either a pipeline or a swale, with energy dissipation structures at release points to South Creek. The type of infrastructure is influenced by the low grade of the AWRC site and the hydraulics of operating the AWRC and the detention and retention basins. The decision about type of infrastructure will be made during detailed design based on more detailed hydraulic calculations.

Urban design

Sydney Water has developed an urban design approach for the AWRC site. Considering both the operational and green space area, the design will include architectural treatments for visual screening and potential to adopt a landscape-led approach by integrating aspects of the heritage and natural assets around infrastructure requirements. The Western Parkland City landscape vision has been a fundamental input to Sydney Water's urban design approach.

Sydney Water has developed urban design principles for the AWRC site and an indicative concept of how these could be achieved, as described in this section. Table 4-4 summarises the urban design themes, principles and opportunities for the AWRC site. Figure 4-7, Figure 4-8 and Figure 4-9 show a concept for how these principles and opportunities could be implemented. Sydney Water will use these concepts to develop a more detailed design for the operational area and green space area that aligns with technical design and document it in an Urban Design and Landscaping Plan.

These figures include potential components such as walking tracks, seating, shading and signage that could be incorporated if the future recreational opportunity proceeds. Public access could be provided through an extension of the AWRC access road so visitors would not need to enter the AWRC site. Appropriate visitor parking and toilets would also be required.

If the recreational opportunity in the green space area does not proceed, these components will be substantially scaled back to focus on biodiversity and water sensitive design elements and any infrastructure needed to maintain these areas.

Sydney Water will continue to work closely with DPIE teams responsible for place management and green spaces about its urban design approach as design of these elements progresses to ensure the project aligns with the NSW Government's vision for the green spine along South Creek.

Figure 4-7 Indicative visualisation of AWRC site

Figure 4-8 Indicative Master Plan for AWRC site

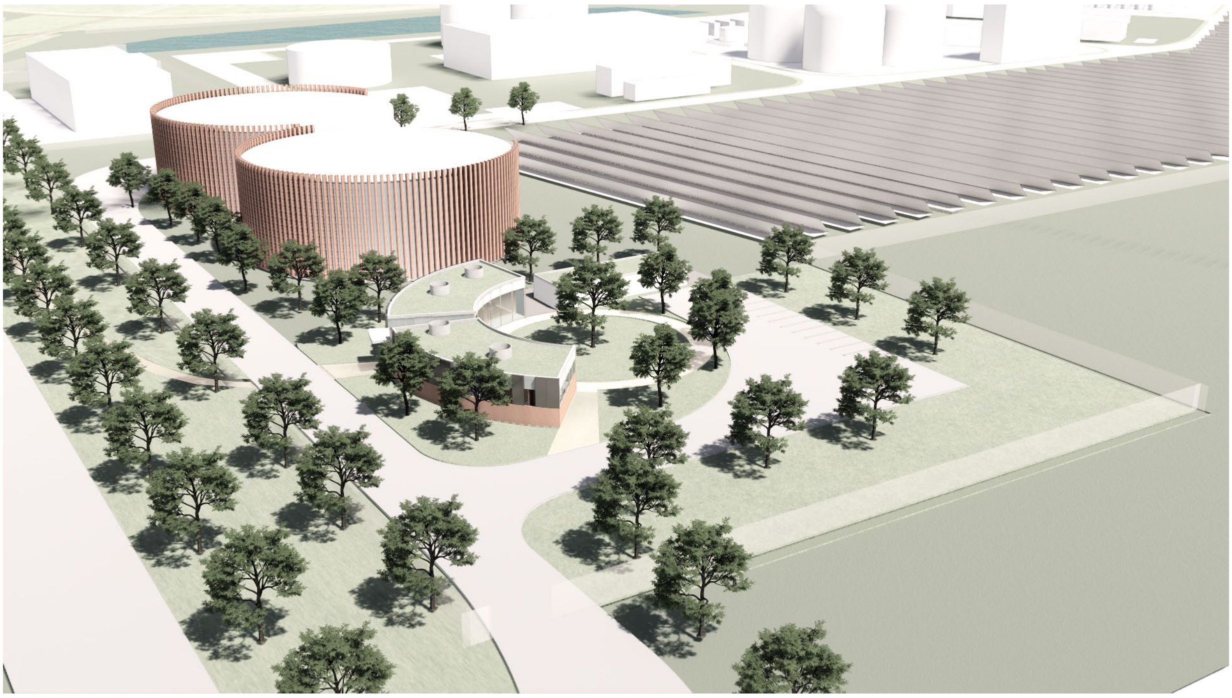


Figure 4-9 Indicative impression of administration building and architectural treatments for tanks

Table 4-4 Summary of the urban design themes, principles, and opportunities for the AWRC site

Urban design theme	Urban design principles	Opportunities to be considered in detailed design
Water treatment Safe and sustainable water treatment that addresses the ever-increasing issue of water security and drive awareness and education in water management.	Future proof expansion and the introduction of advanced technologies in water treatment and recycling with a flexible design.	Use natural topography of the site where possible to maximise use of gravity treatment processes.
Resource recovery Generation of: • clean water for recycling • biosolids for beneficial reuse • renewable energy through solar and co-generation.	Maximise opportunities in implementing circular economy approaches. Optimise nutrient recovery through biosolids processing. Maximise ecosystem services opportunities. Minimise waste and maximise reuse. Minimise energy use and maximise energy recovery. Maximise opportunities for stormwater harvesting stormwater runoff.	To be considered as part of design of operational components of AWRC.
Sustainability Showcase innovation and leadership in sustainable water management, energy capture, waste reduction and environmental management.	Minimise off-site impacts of treated water release. Restore and protect waterway health and amenity values; the natural landscape; and biodiversity. Minimise impact of built form and hard surfaces. Demonstrate an integrated functional design and landscape-led design across the site, aligning to the WSAP and Western Parkland vision. Ensure high-quality landscaping that is sympathetic to Western Sydney climate and native environs Maximise integration of water in the landscape to mitigate urban heating and create green and vibrant places.	A range of landscape zones such as riparian corridors, wetlands and grasslands in the parkland area and streetscaping in the operational area. Use landscaping, earthworks, material selection and architectural screening to mitigate visual impact from key viewpoints Landscape design supporting passive or interactive education opportunities (if recreation area progresses). Capture resource recovery and sustainability principles in architectural design.

Urban design theme	Urban design principles	Opportunities to be considered in detailed design
Community Continue to contribute to the site's rich cultural and environmental context, playing an important role in the future of Western Sydney.	Maximise opportunities for partnership with local community and businesses, including Aboriginal communities. If recreation area proceeds, provide quality public amenity by connecting into existing and future recreational and social infrastructure and networks.	Celebrate Aboriginal and non-Aboriginal heritage on the site. Consider opportunities to co-design features or architectural treatment with community and stakeholders where appropriate. Retain select existing heritage features such as parabolic antennas associated with Fleur's Radio Telescope for use in the landscape. Align layout to celebrate the cross formation of the former radio-telescope array.
Built environment approach A unique opportunity to positively integrate with the natural environment and urban fabric of the Western Parkland City.	Built form responds to the contextual landscape and future urban character. Design accommodates the functional properties of the AWRC. Address aerial views experienced by passengers departing and arriving at the new airport. Minimise negative environmental impacts. Embody the urban design principles of surrounding district and precinct plans.	Quality and sustainable architecture for the administration building. Set the administration building within its landscape and incorporate open spaces, natural lighting and ventilation. Unified architectural language across the site, for example in cladding and screening.

As urban design of the site progresses it will also factor in the following key constraints:

- Bushfire protection.
- Flooding.
- Airport safeguarding approaches, including in relation to wildlife attraction.

Sydney Water is also working with the Western Sydney Planning Partnership on a riparian revegetation strategy for the WSAGA. Once this strategy is finalised, Sydney Water will consider it in developing detailed design for the green space area.

4.4.2 Pipelines

The project includes pipelines to take treated water and the brine waste stream away from the AWRC and release and dispose of them responsibly. Pipelines required include the treated water pipeline to Nepean River at Wallacia Weir, the environmental flows pipeline from Wallacia to Warragamba River and the brine pipeline from the AWRC to the existing Sydney Water wastewater network at Lansdowne. All pipelines will be built to their full capacity (that is, for a 100 ML/day AWRC capacity) in Stage 1.

Treated water pipeline

The treated water pipeline is planned to be about 16.7 km long and up to 1.2 m in diameter. The treated water pipeline will transfer treated water from the transfer pumping station at the AWRC, to the release point at Nepean River, upstream of Wallacia Weir. Figure 4-10 shows the treated water pipeline location.

From the AWRC, the pipeline crosses South Creek then runs along the north side of Elizabeth Drive. This is outside the current road verge in an area that will become a utilities corridor next to the upgraded Elizabeth Drive. Along Elizabeth Drive it crosses several waterways including Badgerys Creek, Oaky Creek and Cosgroves Creek. The pipeline then crosses the Northern Road and runs along the southern side of Park Road, partly in the road verge and partly beneath the road surface.

At Wallacia, the pipeline runs through back streets to Fowler Reserve and crosses beneath Nepean River. It then runs along Bents Basin Road and Silverdale Road before crossing private property to connect to Nepean River at Wallacia.

The treated water pipeline does not have any provisions for recycled water offtakes. Any future recycled water schemes would require additional pipelines connecting to the AWRC, which is out of scope for this project.

The treated water pipeline has a range of ancillary infrastructure as described Table 4-5. The pipeline itself will be below-ground but some of the ancillary infrastructure will be above ground, such as pit covers and scour valves.

Environmental flows pipeline

The environmental flows pipeline is about 4.5 km in length and up to one metre in diameter. It will transfer high-quality treated water from the treated water pipeline to Warragamba River, downstream of Warragamba Dam. Figure 4-11 shows the environmental flows pipeline location.

The environmental flows pipeline diverts from the treated water pipeline at Bents Basin Road, near the intersection with Silverdale Road, Wallacia, via the flow splitter structure. The environmental flows pipeline continues south following Bents Basin Road for about 1.4 km before it runs west and is tunnelled for about 2.5 km to end at the release structure at Warragamba River.

The flow splitter enables remote operation for diverting the treated water between the Nepean River and Warragamba River release locations. It is mainly a below ground structure, with some above-ground structures such as a concrete slab, electrical equipment and fencing. The electrical equipment will be housed in a structure measuring about 0.6 m by 0.6 m and about 1.5 m in height. The entire flow splitter measures about 33 m x 30 m and will be located on the western side of Nepean River, and will be accessed off Bents Basin Road.

As noted in section 3.5.1, 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. The EIS assesses the construction and operation impacts of this pipeline but depending on the outcome of these conversations, it (and its associated infrastructure) may not be built.

Brine pipeline

The brine pipeline will be about 24 km in length and about 0.6 m in diameter. The advanced treatment process at the AWRC will produce a brine waste product, which will be transferred from the AWRC to the existing Malabar wastewater system at Lansdowne. Figure 4-12 shows the location of the brine pipeline.

From the AWRC, the brine pipeline heads south to Elizabeth Drive, sharing a corridor with the treated water pipeline for half of this length. It then crosses Elizabeth Drive and heads south along Western Road and east along Cross Street in Kemps Creek, through the Western Sydney Parklands, under the M7 Motorway and then generally follows existing roads through Abbotsbury, Cecil Park, Bonnyrigg, Cabramatta and Lansdowne. It will also pass through several public parks including Lansvale Park.

The brine pipeline will connect to the existing wastewater network via a new maintenance hole into the Northern Georges River Submain (NGRS). The NGRS is part of the existing Malabar wastewater network, which transfers wastewater to the Malabar wastewater treatment plant (WWTP) for treatment and release via the deep ocean outfall.

During the design of the brine pipeline, Sydney Water modelled the capacity of the NGRS and Malabar wastewater network to ensure the system could accommodate brine from the AWRC. The aim was to develop an operational regime for brine transfer to the NGRS without triggering any additional wet weather overflows into Georges River. The modelling identified the need for a brine storage and pumping regime that can manage brine flows into the NGRS during significant wet weather events or other times when the NGRS does not have capacity.

The brine pipeline has a range of ancillary infrastructure as described in Table 4-5. The pipeline itself will be below ground but some of the ancillary infrastructure will be above ground, such as air valves to assist operation.

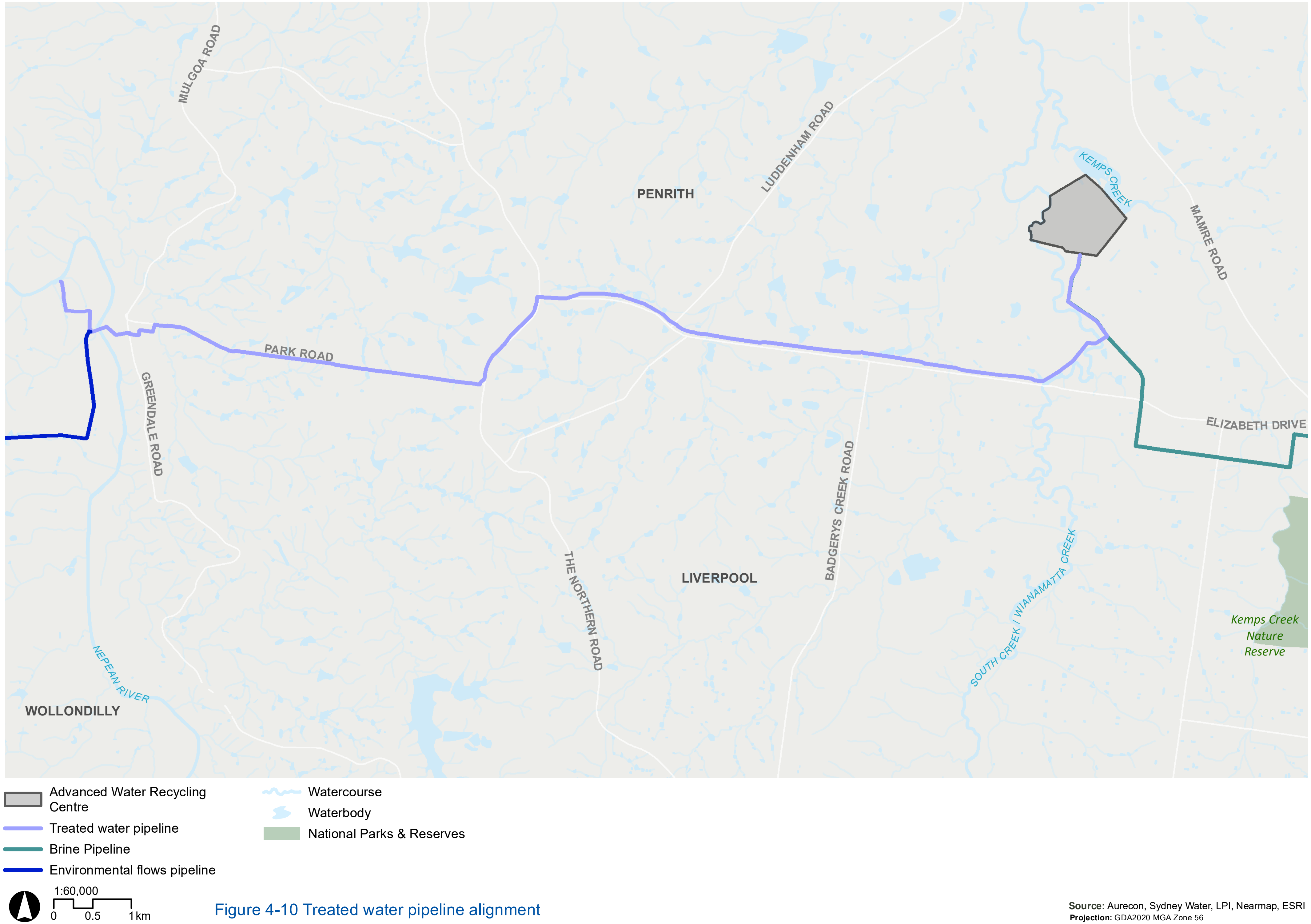
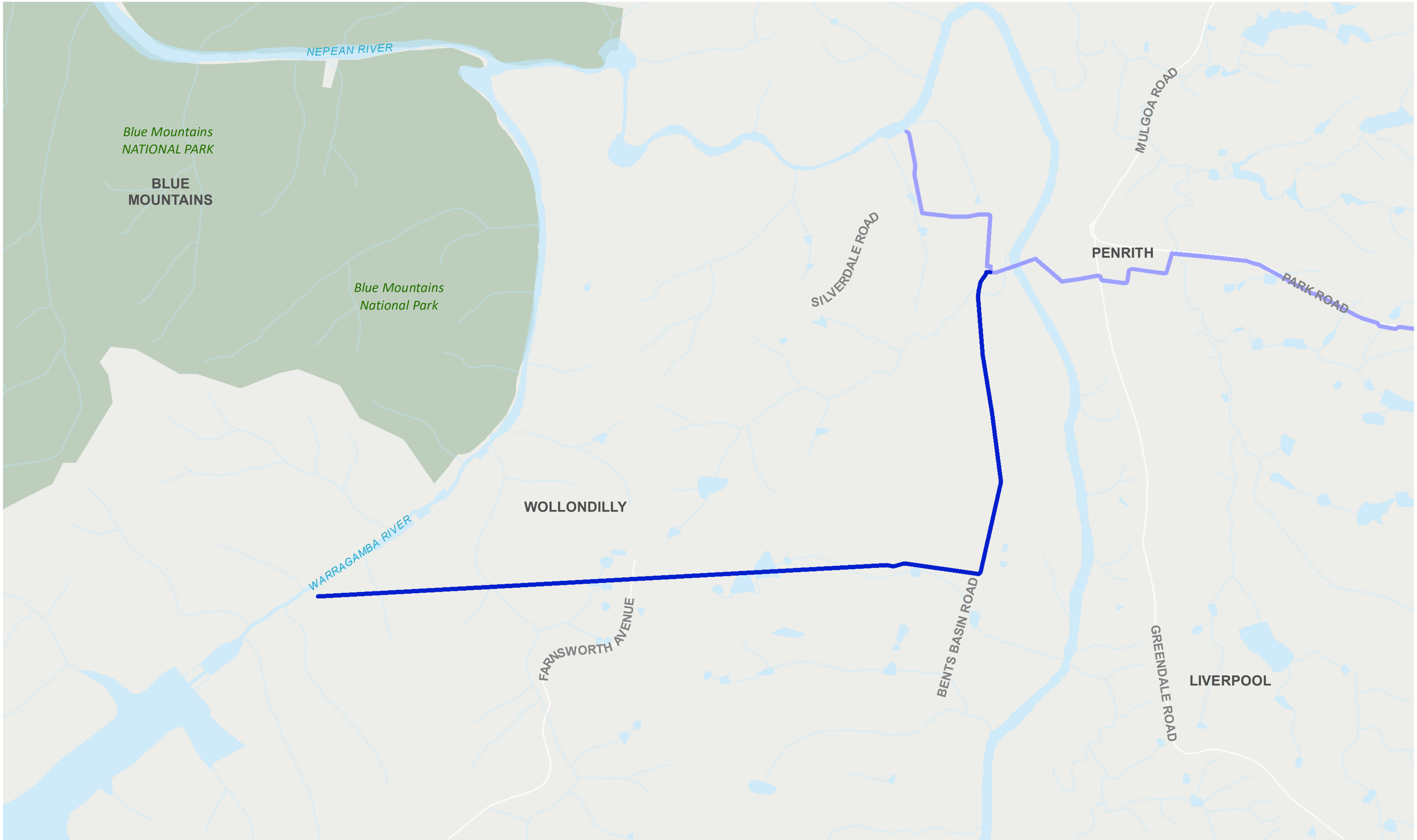


Figure 4-10 Treated water pipeline alignment

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



Treated water pipeline
Environmental flows pipeline
Watercourse
Waterbody
National Parks & Reserves

1:23,000
0 250 500 m

Figure 4-11 Environmental flows pipeline alignment

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

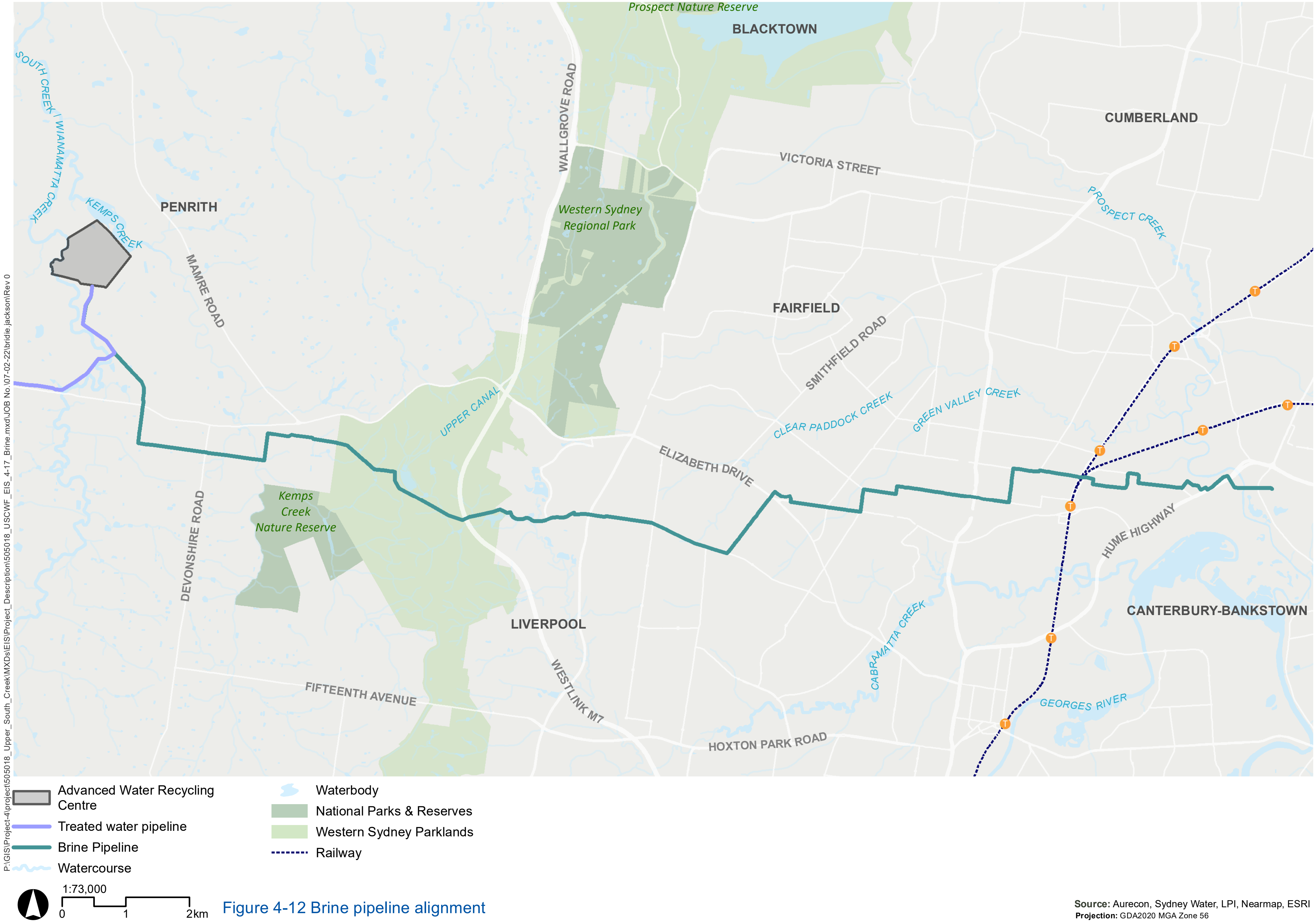


Figure 4-12 Brine pipeline alignment

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

Pipeline ancillary infrastructure

The pipelines will be supported by ancillary infrastructure to enable assets to be easily monitored, accessed and operated. Table 4-5 provides a description of the main types of ancillary infrastructure required for the pipelines, and where they will be located.

Table 4-5 Description and location of the main ancillary infrastructure required for pipelines.

Ancillary infrastructure	Description	Location
Air valve	A valve used to expel air on filling the pipeline that also prevents a vacuum being formed when emptying the pipeline for maintenance. These valves are inside the pipe, however a small cover that extends about 30 cm above the ground level may be required.	These will be located at high points of the pipelines. Numbers below are current estimates and exact number and location will be identified in detailed design. Treated water ≈ 44 Environmental flows ≈ seven Brine ≈ 60
Scour valves and scour chambers	Scour valves are located at the low point of a pipeline to allow sections to be drained or flushed for maintenance. Scour valves may also be connected to a scour chamber that allows the fluid to be dechlorinated if needed or pumped to a tanker for disposal at a suitable facility. Releases from the treated water and environmental flows pipeline will be directed to the nearest waterway by overland flow. Releases from the brine pipeline will be pumped to a tanker and disposed of at a liquid waste facility or into a nearby Sydney Water wastewater network. No above-ground infrastructure is proposed for these structures.	These will be located at low points of the pipelines. Numbers below are current estimates and exact number and location will be identified in detailed design. Treated water ≈ 27 Environmental flows ≈ three Brine ≈ 47
Other valves including isolation valves and actuated control valves	These stop or control the flow of fluid along a pipeline. They can be manually or automatically operated and usually provided for maintenance or safety purposes. These are located below ground.	About every one kilometre along all pipelines (except the tunnelled section of environmental flows pipe). Also located at flow splitter. Exact number and location will be identified in detailed design.

Ancillary infrastructure	Description	Location
Flowmeter	Inground instrument along a pipeline that measures fluid flow rate. These are located below ground.	Flowmeter instruments located at flow splitter structure and pipeline release locations
Electrical control panel	Above-ground stainless steel panel to house electrical, instrument and control hardware to facilitate operation and monitoring of actuated control valves, flowmeters and other pipeline components. Electrical kiosks will measure about 0.6 m by 0.6 m and about 1.5 m in height.	Control panels are located at flow splitter structure at Bents Basin Road, Wallacia, and at the NGRS connection in Lansdowne Reserve for the brine pipeline.
Maintenance hole	Point of access into the pipeline system for inspections and maintenance. This is a circular access point at ground level.	Upstream of the treated water release structure in Wallacia.
Scour protection	Energy dissipation structures, such as rock and concrete, to reduce the energy of the released wastewater and minimise erosion to the surrounding environment.	Associated with release structures.

Treated water and environmental flows release structures

The treated water and environmental flows release structures will control the release of treated water into the receiving waterways. The release structures will include:

- a concrete chamber structure set back from the waterway
- measures to dissipate the energy of the treated water flows, for example baffle blocks, concrete rip rap (concrete slab with rocks/boulders)
- measures to prevent unauthorised access into the chamber and pipeline, for example grated covers and fencing
- scour protection along the nearby banks of Nepean and Warragamba Rivers to minimise erosion
- measures to protect the structure from flood impacts, for example gabion wall structure.

The environmental flows release structure is located downstream of the Warragamba Dam and spillway. There is potential for the structure to be inundated when the dam releases water during a major spill event which may damage the structure. WaterNSW have indicated that flows will be turbulent with highly variable water levels during these events (WaterNSW 2020a). The detailed design phase of the project will include the structural detailing of the release structure and what flow velocities and flood inundation levels it can withstand.

Figure 4-13 and Figure 4-14 show the indicative designs of the treated water and environmental flows release structures. Some infrastructure shown in the figures is located below ground, including the incoming pipeline, maintenance hole and concrete chamber. Above-ground infrastructure includes the concrete outlet structure, handrails and concrete rip rap.

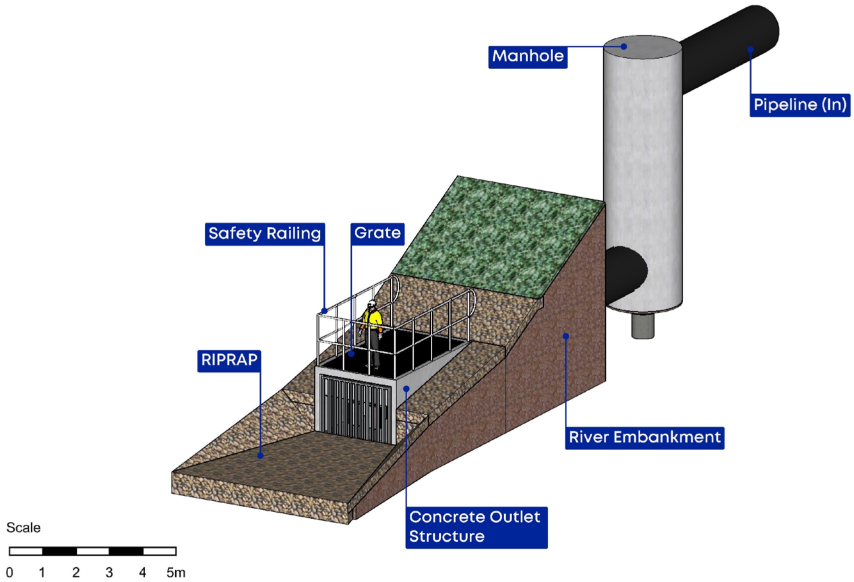


Figure 4-13 Indicative design of the treated water release structure

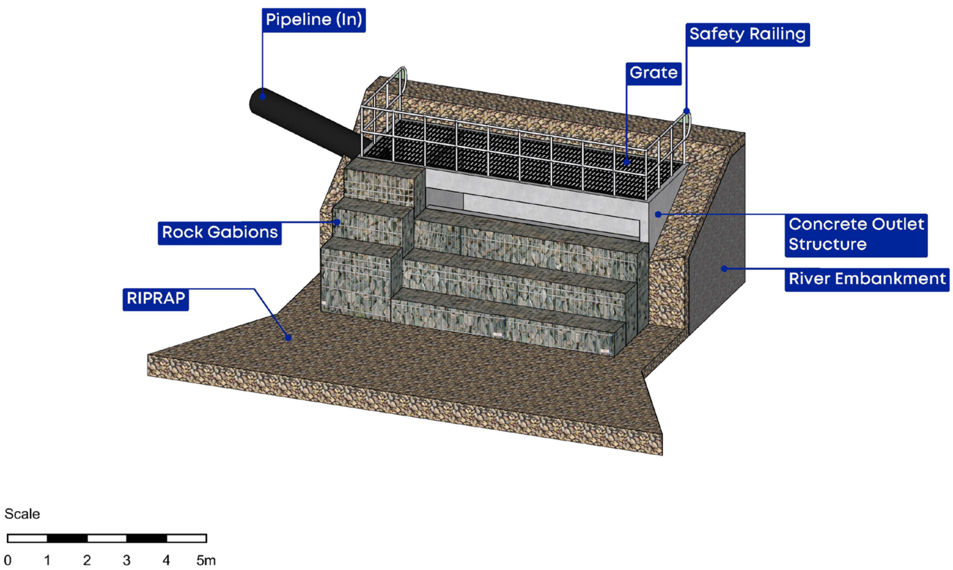


Figure 4-14 Indicative design of the environmental flows release structure

4.4.3 Design standards

Sydney Water follows industry design, construction and operation standards and codes to ensure the quality of installations. This is supplemented by Sydney Water's own deemed to comply drawings and technical specifications. Post construction monitoring and testing regimes are designed to ensure the quality of assets delivered. Those monitoring requirements are usually embedded to the technical specifications.

All structural elements of the project, especially the AWRC treatment processes will be designed with suitable materials or will be provided with suitable corrosion protection to ensure the specified design life. Redundancy via a duty and standby infrastructure arrangement will be factored into the AWRC design so that components can be taken offline for maintenance without disrupting plant operation.

Sydney Water has standards for the design life of infrastructure to ensure it will operate reliably. Generally, pipelines are designed for a minimum 50-year life. The design life of other components of the project include:

- structures and civil (excluding buildings): about 100 years
- buildings: about 50 years
- pumps and motors: about 30 years
- electrical assets: about 30 years
- general mechanical assets: about 20 years
- control assets: about 15 years
- general mechanical assets: about 20 years
- structures and civil (excluding buildings): about 100 years.

Sydney Water does not have any plans for decommissioning particular components of the project. The AWRC and pipelines will receive ongoing maintenance and upgrades to ensure they operate as intended and designed. Sydney Water designs its infrastructure to minimise maintenance, protect public health and the environment, and reduce service interruptions during operation and maintenance.

4.4.4 Design measures to minimise impacts

Measures have been incorporated into the reference design to minimise impacts to the environment and community, including:

- Suitable pipe material has been selected that will not be damaged by the contents being transported. For the brine pipeline, polyethylene (PE) is proposed that can transport the brine material under the required pressures without the risk of leaks and failure.
- The treated water and brine pipelines will operate under pressure which eliminates the need for uncontrolled overflow points that would release treated water into the environment.

- Pump out scours will be located along the brine pipeline, so that if a section of the pipeline requires maintenance or repair, the pipeline contents can be pumped into a truck for disposal, and not released into the environment.
- Tanks for temporary brine storage will be located at the AWRC in weather when the NGRS that receives the brine is at full capacity. This will minimise the potential for the brine to displace wastewater in the NGRS, resulting in wastewater overflows into the environment.
- Odour control units will be located at the AWRC to treat and minimise odour to avoid foul air being released into the environment.
- Renewable energy will be generated at the AWRC site in the form of solar and co-generation to offset a portion of the power required to be purchased from the grid to operate the AWRC.
- The layout of the treatment processes at the AWRC will use gravity to move wastewater through the site and reduce the need to pump and use electricity.
- The AWRC will be located outside the 1% AEP flood level to minimise flooding and damage to the plant that may result in release of wastewater into the environment.

4.5 Operation of the AWRC

The AWRC will service the SWGA and WSAGA, with potential to service other areas in the future. It will receive wastewater from industry, businesses and residences and process it through a series of primary, secondary, tertiary and advanced treatment processes. Each stage provides a higher level of treatment to remove more inorganic and organic material.

The sections below provide more details on treated water and brine volume and quality and AWRC treatment processes. Figure 4-15 shows the flow of wastewater through the different AWRC treatment processes. The detail is based on Stage 1 and also applies to future stages.

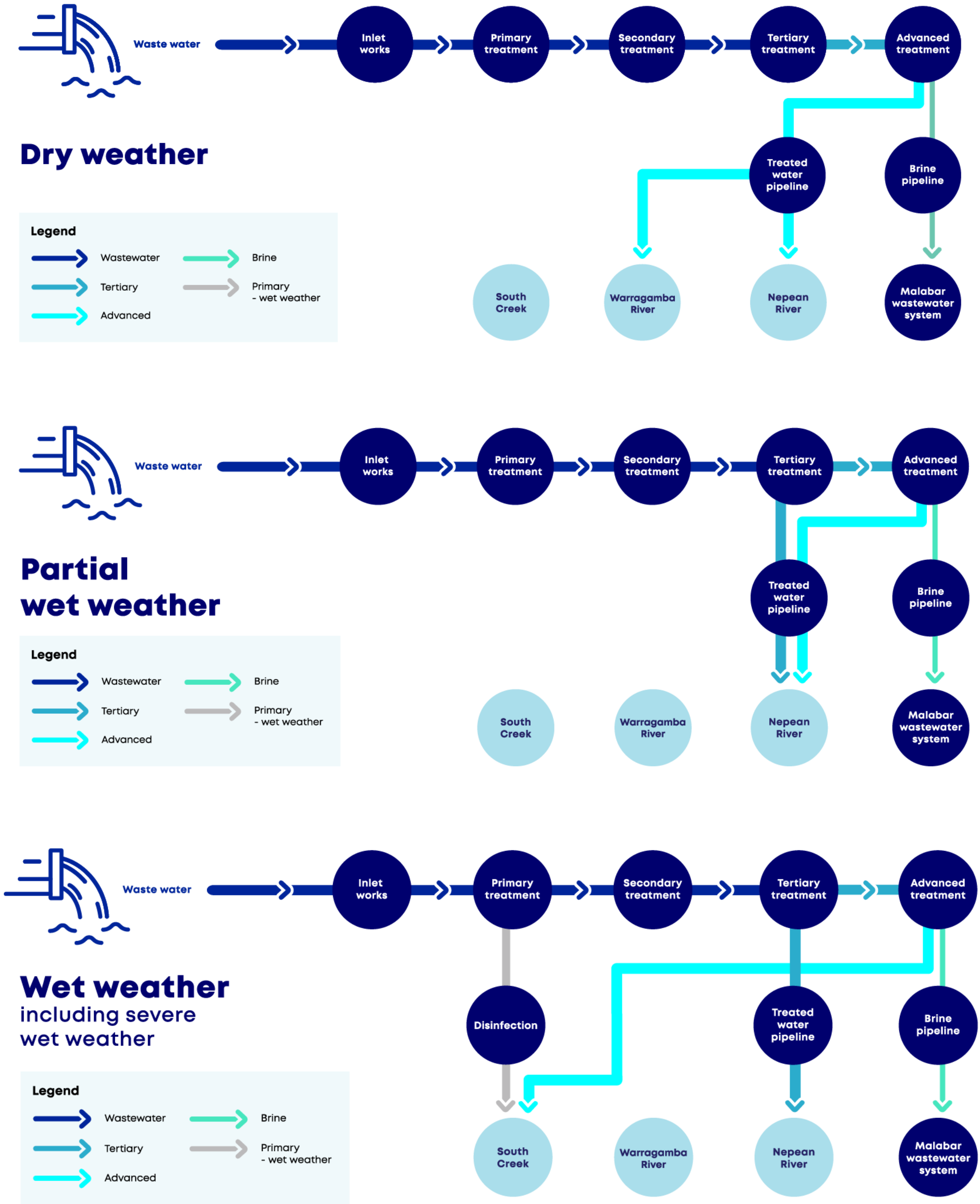


Figure 4-15 Flow of wastewater through the AWRC

4.5.1 Treated water

Treated water quality

The AWRC will produce treated water at three different quality levels including:

1. advanced (very high-quality) treated water
2. tertiary (high-quality) treated water
3. wet weather quality (lowest level of treatment – primary treatment).

Wastewater that receives higher levels of treatment will have lower concentrations of total nitrogen, total phosphorus and ammonia, and lower conductivity and enterococci. Table 4-6 provides indicative concentrations and measurements of different water quality parameters for the different levels of treatment.

Table 4-6 Indicative concentration of water quality under different treatment levels

Parameter	Units	Median concentrations		
		Advanced treated water	Tertiary treated water	Wet weather treated water
Total nitrogen (TN)	mg/L	0.35	2.5	18
Total phosphorus (TP)	mg/L	0.009	1	1
Oxides of nitrogen (NO_x)	mg/L	0.12	1.8	0
Ammonia (NH_3)	mg/L	0.03	0.2	15
Filterable reactive phosphorus (FRP)	mg/L	0.006	0.66	0.66
Chlorophyll *a* (Chl *a*)	µg/L	0	0	0
Dissolved oxygen (DO)	mg/L	9.2	5.9	0
TSS	mg/L	0	1	35
TDS	mg/L	20	540	240
pH	pH units	7	7	7
Conductivity	$\mu S/cm^2$	150	1500	1500
Enterococci	CFU/100mL	0	0	7400

In addition to the parameters considered in the above table, toxicant analysis has also been completed on advanced treated water from other Sydney Water treatment plants. This analysis has assisted in predicting the likely toxicant load and concentrations in the treated water. This detail is provided in Chapter 8.

Treated water volume and release location

Sydney Water designs treatment processes based on average dry weather flow (ADWF), which is the average volume of incoming wastewater the AWRC is expected to receive from the servicing area each day. For this project, Sydney Water calculated expected ADWF based on population forecasts and typical wastewater generation for households, business and industry.

While these calculations are useful for design purposes, the actual incoming wastewater volume may be lower or higher than the average, depending on how much wastewater is generated and how much rainfall there has been. To account for these fluctuations, the advanced treatment process is designed to treat up to 1.3 times the ADWF, which Sydney Water considers as dry weather flows.

Sydney Water must design for additional volumes of wastewater entering the AWRC during wet weather which can occur from illegal stormwater connections to the wastewater system or stormwater entering the system through damaged wastewater pipes. Given these larger volumes are infrequent, and highly diluted, they receive lower levels of treatment.

Where flows that are greater than 1.3 times ADWF are referenced, this refers to flows during wet weather. This approach to treatment is typical for wastewater treatment plant design.

During normal dry weather operating conditions, all advanced treated water up to 1.3 times ADWF will be released to Warragamba River or Nepean River. Beyond 1.3 times AWDF, the AWRC will be operating under wet weather flows scenarios which include:

- During flows up to 1.7 times AWDF, treated water will be released to Nepean River via the treated water pipeline. This treated water will be a combination of advanced and tertiary treated water, with a minimum quality of tertiary treated water shown in Table 4-7.
- Once flows exceed 1.7 times ADWF, advanced treated water will also be released to South Creek via the South Creek release infrastructure. Once flows exceed three times ADWF, wet weather quality water will also be released to South Creek. Based on historical climate and Sydney Water treatment plant data, releases to South Creek are expected between 3-14 days per year.

Table 4-7 shows the different treatment levels for these incoming wastewater volume scenarios and the proposed release locations.

Table 4-7 Flow scenarios for Stage 1 of the AWRC and the respective release locations

Flow Scenario	Releases to Nepean River and Warragamba River		Releases to South Creek	
	Treatment level	Indicative volume (ML/day)	Treatment level	Indicative volume (ML/day)
Dry weather Flows up to 1.0 x ADWF	Advanced (≤1.0 x ADWF) to Warragamba River or to Nepean River if the environmental flows pipeline is not built.	0 – 45	-	-
Partial wet weather Flows from >1.0 x to 1.7x ADWF	Advanced (1.0 - 1.3 x ADWF) to Nepean River	45 – 59	-	-
	Tertiary (≤0.4 x ADWF) to Nepean River	0 - 20	-	-
Wet weather Flows from 1.7 x to 3x ADWF	Advanced (≤1.3 x ADWF) to Nepean River	59 - 0	-	-
	Tertiary (0.4 - 1.7 x ADWF) to Nepean River	20 - 85	Advanced (≤1.3 x ADWF)	0 – 59
Severe wet weather Flows ≥3 x ADWF	Tertiary (≤1.7 x ADWF) to Nepean River	85	Advanced (1.3 x ADWF)	45 – 59
			Wet weather (>3 x ADWF)	See note below

Notes on table:

- ADWF (ML/day) – average dry weather flow in megalitres per day. This is the average wastewater flow into the AWRC in typical conditions.
- Volumes of advanced treated water released to waterways are less than incoming flows as about 10% of incoming wastewater becomes brine and is not released as treated water. The release volumes in Table 4-7 account for this.
- Indicative volumes for each flow scenario represent a transition in treatment level and release location. For example, under the wet weather flow scenario, the preference is to minimise releases to South Creek. However, once incoming flows increase above 1.7 x ADWF and the treated water pipeline is at capacity, advanced treated releases will be incrementally diverted to South Creek which is reflected in the range of volume of 0 – 59 ML/day up until the incoming flows reach 3.0 x ADWF. As the incoming flows to the AWRC increase, the advanced treated releases to Nepean River will reduce, being replaced by tertiary treated water.

- This table assumes there are no alternative recycled water customers, which could be supplied from the AWRC but are not specifically included in this project scope. Such supply would typically be taken from ADWF.
- Incoming flows >3.0 x ADWF will receive primary treatment, including disinfection, and be released to South Creek.

Brine volume and quality

The advanced treatment process produces brine as a by-product which will be transferred to Sydney Water's Malabar wastewater system.

Table 4-8 gives an indicative breakdown of the concentration of different analytes likely to make up the brine stream. These numbers are indicative only and may change depending on the type of advanced treatment selected. However, any changes are likely to be minimal and are unlikely to have an impact on the operation of the AWRC or brine pipeline. At full operation at 50 ML/day ADWF, Stage 1 of the AWRC will transfer between 5 ML - 8 ML of brine from the AWRC to the NGRS each day.

Table 4-8 Indicative concentration and chemical composition of the brine stream

Analyte Name		Units	10%ile	50%ile	90%ile
Ammonia	NH4+ + NH3	mg/L	0.28	0.40	0.81
Potassium	K	mg/L	75	75	89
Sodium	Na	mg/L	537	537	634
Magnesium	Mg	mg/L	61	61	64
Calcium	Ca	mg/L	90	90	96
Strontium	Sr	mg/L	0.32	0.34	0.37
Carbonate (part of alkalinity measure)	CO3	mg/L	1.7	2.3	3.8
Bi-carbonate (part of alkalinity measure)	HCO3	mg/L	331	361	452
Nitrate	NO3	mg/L	4.9	6.7	18.7
Chlorine	Cl	mg/L	804	823	854
Fluoride	F	mg/L	2.8	2.8	2.9
Sulfate	SO4	mg/L	283	283	377
Silicon dioxide	SiO2	mg/L	24	24	27
Boron	Boron	mg/L	0.13	0.13	0.13
Carbon dioxide	CO2	mg/L	9.6	10.2	12.1
Total dissolved solids	TDS	mg/L	2235	2248	2622
pH	pH	pH units	7.5	7.6	7.7

Brine storage is also a factor in wet weather. If the capacity of the brine storage tanks is exceeded during prolonged wet weather because there is insufficient availability in downstream networks to allow for brine discharge, then the advanced treatment process will switch off temporarily so that the brine does not overflow. In this rare case, only wet weather quality water will be released to South Creek. The brine storage tanks have about three days of storage capacity.

4.5.2 Treatment process

Screening and screening handling

The screening process will remove materials such as rags, plastics, papers and large objects (screenings) from incoming wastewater, to avoid damage to downstream equipment and allow efficient operation of the AWRC. This will be located at the inlet works where all incoming wastewater enters the plant.

The wastewater will pass through mechanical screens with small openings. The screenings will be transferred to screening presses to wash off organic materials and remove excess water, before being stored in fully enclosed screenings bins. Screenings bins will be emptied and the waste material disposed at a solid waste landfill. Section 4.6.6 provides further details on operational waste.

A range of equipment is required, including penstocks and manual stopboards upstream and downstream of the screens to control water flow, and trafficable covers across the screening channels. Figure 4-1 shows the indicative location of the inlet works and screening process.

Grit removal

The grit removal process will treat screened wastewater and capture materials such as sand and gravel so they do not adversely impact downstream treatment processes.

Screened wastewater will enter the grit vortex chambers where the grit is removed from the wastewater. The grit accumulates in the grit vortex where it is pumped into the grit bins for offsite disposal as solid landfill waste, or for beneficial reuse if opportunities are available. The screened wastewater then continues into further primary treatment processes.

Primary treatment

Primary treatment will remove some organic solids from the wastewater. This typically occurs in sedimentation tanks where solids settle at the bottom. The solids are pumped to the thickening process for further treatment, and the liquid portion continues on to secondary treatment. Several technologies including primary sedimentation tanks are available for primary treatment and may be adopted during detailed design. Figure 4-1 shows the indicative location of the primary treatment process.

Secondary treatment

Secondary treatment involves the biological removal of nutrients, particularly organics, nitrates, ammonia and phosphorus from the wastewater. Secondary treatment will use a combination of anoxic and aerobic treatment. Anoxic relates to molecular oxygen not being present, and aerobic relates to the presence of molecular oxygen. Secondary treatment uses biological processes to remove organics and nutrients such as nitrogen and phosphorus. Figure 4-1 shows the indicative location of the secondary treatment process.

Tertiary treatment

Tertiary treatment removes further organic and inorganic solid components and can be designed to remove nutrients such as nitrogen and phosphorus. Some bacteria, virus and parasites which are harmful to public health are also removed at this stage. The AWRC will likely use membrane technology for tertiary treatment. This involves the wastewater from secondary treatment being pushed through a semi-permeable filtration barrier which acts to retain impurities. The retained impurities are returned to prior treatment phases. The tertiary treated wastewater continues to the advanced treatment process. Figure 4-1 shows the indicative location of the tertiary treatment process.

Advanced treatment

Advanced treatment removes any remaining impurities in the wastewater following the primary, secondary and tertiary treatment processes. This includes smaller-sized particles of biological, organic and inorganic material that may have passed through the previous stages due to their small size. The AWRC is likely to use Reverse Osmosis (RO) which achieves a high quality of treatment by forcing the wastewater through a membrane under high pressure.

The outputs of the advanced treatment process are the treated water stream and the brine stream. The brine stream consists of the waste products from the advanced treatment process. Figure 4-1 shows the indicative location of the advanced treatment process.

The advanced treated water will also be treated to remineralise the water and adjust the pH. This prevents concrete corrosion in the treated water and environmental flows pipelines and returns salinity and pH to levels similar to receiving waterways.

Disinfection

During the treatment process, the wastewater is disinfected to remove bacteria, viruses and other pathogens. This ensures that they are not released into the environment where they can impact on health and safety. Disinfection can be achieved using chlorine or ultraviolet radiation, as well as through the membrane barriers used during tertiary and advanced treatment processes.

Both tertiary and advanced treatment provide barrier disinfection for water that will be released to waterways or used for recycled water. Primary effluent is disinfected (chlorine) and dechlorinated (sodium bisulfite) prior to release to South Creek.

4.5.3 Supporting processes and infrastructure

Thickening and Digestion

Solids which are drawn from the both the primary and secondary processes have the water content reduced in the thickening process. This is typically carried out in drum thickeners, with the removed liquid (centrate) pumped back to earlier processes for treatment, and the thickened solids transferred to the digesters.

The digesters perform biological digestion to break down and stabilise the thickened solids in accordance with the biosolids targets. This process reduces the total mass of the solids, reducing pathogens and odour. This process also produces biogas that will be used for renewable energy generation.

Solids dewatering and reuse

Solids from the anaerobic digesters will be dewatered to reduce the volume required for offsite beneficial reuse. This uses a centrifuge to separate the solids from liquid. The remaining liquid (centrate) will be pumped back to the inlet works, with the remaining biosolids transferred to storage bays in an out-loading building, enabling a truck to drive through for loading and off-site beneficial reuse. The out-loading building will allow several days' storage. Figure 4-1 shows the indicative location of the biosolids outloading building and digesters.

Transfer pump stations

Two pump stations (one for treated water and one for brine) will be located at the AWRC site in standalone building(s). The treated water pump station will pump advanced and tertiary treated water for release at Nepean and Warragamba Rivers via the treated water pipeline. The brine pump station will pump the brine to the NGRS at Lansdowne via the brine pipeline.

Both pump stations will be automatically controlled via an Integrated Instrumentation Control Automation and Telemetry System (IICATS). Figure 4-1 shows the indicative location of the transfer pump stations.

Renewable energy

Biogas produced in the anaerobic digesters can be delivered to co-generation engines to generate electricity and provide digester heating. Biogas is produced in the digesters and mainly comprises methane and carbon dioxide. Biogas is temporarily stored in the top portion of the digesters prior to transport to the co-generation engines or waste gas burners. It is estimated that the AWRC will produce up to three million cubic metres of biogas each year once Stage 1 is fully operational.

Biogas volumes above the maximum amount the co-generation engines can consume will be combusted in the waste gas burners. This is only required if generation of biogas exceeds co-generation and storage capacity and is estimated at about 8% of the total biogas produced. The AWRC is proposed to have up to 1.2 MW co-generation capacity that will convert the biogas to electricity.

In addition to co-generation, Stage 1 of the AWRC will also include rooftop and ground mounted solar panels.

The combined renewable energy generation capacity is expected to be about 5 MW (based on the available technology and expected design outcomes at time of writing the EIS) to allow for standard protection and connection schemes. When the AWRC is operating at full Stage 1 capacity of 50 ML/day, the peak power demand is estimated to be about 6 MVA. This number will be lower in the earlier years of operation when incoming flows are lower as the energy requirements to operate the plant will be lower. As such, the amount of renewable energy generation will fluctuate over time. When renewable energy generated cannot be used for the AWRC, Sydney Water may export excess self-generated electricity to the grid.

Antiglare treatment will be provided to solar panels as required to reduce risk to aircraft in accordance with the National Airports Safeguarding Framework (NASF) requirements.

Odour control

Odour is generated by wastewater at different stages of treatment. It is mainly generated in the form of hydrogen sulfide. Sources of odour from the AWRC will include inlet works, primary treatment and the biosolids handling area. Each of these processes will be covered during operation, with the air extracted and sent to an odour control facility for treatment.

The AWRC will have an odour control facility that is likely to be centralised and use biotrickling filters (BTF), activated carbon filters (ACFs), or similar, to treat odour prior to release to the atmosphere. Figure 4-1 shows the indicative location of the central odour control facility.

Chemical storage

Various chemicals will be required to dose the wastewater at different stages of the treatment process. These are added for a range of reasons including as neutralising agents, and to combine components of the wastewater together to assist in their removal. Each chemical required for dosing requires a storage tank and dosing pump. Chemical storage tanks will be installed in dedicated concrete bunds to contain any spills and covered with protective coatings to prevent concrete corrosion. All chemical storage facilities will meet the relevant codes for safe storage and handling.

Each chemical storage area will ideally be located close to the dosing point to minimise transport and pumping around the site. Chemicals will be delivered to the site on a frequent basis via truck. The size, location and number of tanks and pumps required for chemical storage and dosing will be detailed during the next design phase. Table 4-9 provides an indicative list of the chemicals that will be stored on site that are required for operation of the AWRC. The indicative location of chemical storage areas is shown in Figure 4-1.

Table 4-9 Chemicals that will be stored and used at the AWRC

Chemical	Required use
Ferric chloride	Primary and solids treatment
Alum	Secondary and advanced treatment
Methanol	Secondary treatment
Sodium hydroxide	Secondary and advanced treatment
Citric acid	Tertiary treatment
Sodium hypochlorite	Tertiary and advanced treatment
Sodium bisulfite	Tertiary and advanced treatment
Sulfuric acid	Advanced treatment
Detergent	Advanced treatment
Ammonium sulfate	Advanced treatment
Phosphonic acid	Advanced treatment
Lime	Advanced treatment
Carbon dioxide	Advanced treatment
Liquid polymer	Solids treatment
Powder polymer	Solids treatment

South Creek release

The AWRC will release treated wastewater to South Creek during wet weather events via infrastructure including swales, pipelines, headwalls and scour protection.

Resource recovery

Digested solids from the anaerobic digesters will be dewatered before being taken off-site for beneficial reuse as an agricultural biosolid. Biosolids are currently handled in accordance with the Sydney Water Bioresources Master Plan (Sydney Water, 2018a) and the NSW EPA's Environmental Guidelines – Use and Disposal of Biosolids Products (1997). Targets for biosolids quality include Grade B stabilisation and Grade C contaminant. Stage 1 of the AWRC will produce about 15 tonnes of dewatered biosolids per day at its ultimate capacity. The ultimate destination and use of biosolids generated at the AWRC is not part of the scope of the EIS as Sydney Water has arrangements in place to manage reuse of biosolids across its whole wastewater network. Biosolids are primarily used for land application in agriculture or further processed into compost.

Power supply

The AWRC will receive power by two separate high voltage (HV) supply feeds from one distribution zone substation. Under normal operation each feed will supply about half of the power supply to the AWRC. This provides reliability and contingency in the event of power outage, as the AWRC is not relying on a single source of power to operate.

In the event of one incoming power supply failing, auto-changeover will occur to transfer the load of the full AWRC to the single active supply feed, and the AWRC can continue to operate normally. During the changeover the AWRC still has the capacity to continue to operate, but is limited to treating 1.5 x ADWF. Any flow above this level will receive wet weather treatment, including disinfection, and be released into South Creek.

In the event both incoming supply feeds fail, the AWRC will lose power. In this scenario, flows up to 3 x ADWF will bypass into South Creek after being disinfected. The collection network will also limit the amount of incoming flow into the AWRC by using emergency storage at pump stations and in the network. It is highly unlikely that both incoming power supply feeds to the AWRC will fail. Despite multiple layers of redundancy, a complete power failure event is possible, however the risk is considered low.

4.5.4 Maintenance activities

The AWRC, pump stations and pipelines will require regular maintenance to ensure optimum and efficient operation. Maintenance activities generally involve inspections, planned maintenance, refurbishment and minor improvements to the mechanical and electrical assets of the AWRC and pumping stations. Maintenance work is usually carried out by a small number of staff using light vehicles, often by operational staff already working at the AWRC.

As outlined in the project's scoping report, ongoing maintenance activities are outside the scope of this project. Sydney Water would seek separate environmental approvals if needed for maintenance activities.

4.5.5 Operational workforce and hours

Operational staff requirements are still to be determined but Sydney Water expects the AWRC may require up to 10 operational staff for Stage 1.

Typically, the AWRC will operate in automatic mode, and the role of operational workers includes:

- responding to alarms (including out of business hours)
- taking equipment offline for maintenance activities
- carrying out inspections to check operation of plant and equipment and safety
- reviewing operating trends and performance
- troubleshooting faults with instrumentation or the SCADA system
- sampling and testing wastewater
- assisting contractors and maintenance workers
- maintaining management systems
- intervening in extreme weather and power outages.

The AWRC and pipelines will operate 24 hours a day, seven days a week. Operational staff will likely only be present during standard hours unless emergency work or maintenance is required. The AWRC will be designed to operate autonomously and will be linked to Supervisory Control and Data Acquisition (SCADA) and IICATS systems for remote operation.

4.5.6 Operational transport and access

Vehicle movements during operation of the AWRC will be related to:

- staff journeys (up to 10 two-way trips each day)
- biosolids removal (about two trucks per day at peak biosolids production)
- screening removal (about one truck per week)
- grit removal (about one truck per fortnight)
- other deliveries (typically between three and seven vehicles each day for chemical deliveries) and
- maintenance requirements (ranging from daily to every six months).

4.5.7 Operational waste

The AWRC will produce a range of operational waste which includes special, liquid, hazardous and general solid waste. Most of the waste produced by the AWRC will be the screenings separated from the incoming wastewater at the inlet works and the dewatered grit, including sand. This has been estimated at about 91 and 110 tonnes per year, respectively. Other waste generated by the AWRC relates to the maintenance of equipment, such as oil, batteries, chemical containers, and waste generated by the operational staff such as food waste and electronic waste.

4.6 Operation of pipelines

This section describes how each of the pipelines will operate once they have been built. This includes how the treated water and brine are transported to their release locations, the release regime and how Sydney Water will maintain this level of operation.

4.6.1 Treated water pipeline and environmental flows pipeline

The default operating regime for the treated water pipeline is for the transfer pump station at the AWRC to pump very high-quality treated water to Warragamba River via the treated water and environmental flows pipelines.

If the volume is less than 1.3 x ADWF the flow splitter diverts the flow to Warragamba River via the environmental flows pipeline. If the volume of treated water from the AWRC is greater than 1.3 x ADWF (or the environmental flows pipeline is not built) the flow will only be to Nepean River via the treated water pipeline. Sydney Water is seeking flexibility in the operating releases if the environmental flows pipeline is built, to establish an approach that aligns with the NSW Government’s future environmental flow regime and ensures efficient operation of the pipelines.

Releases from these pipelines are expected to be at velocities between about 1.5 to two metres per second, and temperature will vary between 15°C – 26°C but is likely to average about 20°C.

4.6.2 Brine pipeline

When brine is produced via the advanced treatment process, it will first be stored in tanks before release into the NGRS via the brine pipeline. These tanks will have a storage volume of about 30 ML. This equates to a storage duration of about six days in 2026 and three days when the AWRC is operating at 50 ML/day. This will ensure that the brine does not displace wastewater in the NGRS and the supporting Malabar wastewater network when this system experiences capacity issues, typically during wet weather. Once the system has capacity, the brine that is stored in the brine tanks can be released into the NGRS via the brine pipeline.

During wet weather events, the advanced treatment process will be switched off if the brine storage tanks reach capacity and are unable to release brine into the NGRS via the brine pipeline. Modelling of the wastewater system suggests this is likely to be happen about six times in 10 years in 2026, and up to 15 times in 10 years when the AWRC is operating at 50 ML/day. Sydney Water expects that by 2036, upgrades to the Malabar wastewater system will increase its capacity so brine storage at the AWRC is unlikely to be required.

Pipeline leaks and failures

Unless an overflow point has been included in the design of a wastewater pipeline, modelling leaks and failures is not feasible. The only way the brine pipeline can fail is if it gets damaged by ground disturbance. This cannot be predicted, so it cannot be modelled.

Sydney Water considers standard design elements during the design process of all wastewater pipelines, to minimise the potential for leaks and failures, including:

- appropriate pipeline materials
- appropriate pipeline sizing
- adequate system capacity
- alignments and locations
- operational access
- contingency capacity to temporarily store or divert wastewater.

The brine pipeline has been designed as a fully enclosed system with air entry and exit via air valves. The valves are designed to release air, not brine. There are no discharge points along the pipeline except at the connection to the Malabar wastewater system at Lansdowne. Sydney Water has completed a steady state and water hammer assessment on the pipeline and incorporated measures into the design to ensure no discharge to the environment from the pipeline will occur even during extreme failure scenarios. Design measures to minimise the potential for leaks and failures include:

- sealed system which will be tested during commissioning of the pipeline to ensure no leaks occur
- pressurised system to avoid the need for overflow structures as with a gravity system
- pipe material that can withstand the pressure and force of the flow
- scour valves (which allow emptying brine from the pipeline for maintenance) located outside of sensitive environments, including Western Sydney Parklands)
- maintenance work requiring emptying of sections of brine pipeline will involve tankering of the contents offsite via pump out scour valves with no releases into the local environment.

Sydney Water has processes and procedures in place to respond to the unlikely event of system failures, including leaks, of pressurised wastewater systems such as the treated water and brine systems. This includes isolating damaged areas for repair and rehabilitating any impacted areas.

As detailed design progresses Sydney Water will undertake a more detailed risk assessment of pipeline failures. If any further mitigation measures are identified, these will be incorporated into the design and the standard operating procedure for the brine pipeline.

4.6.3 Maintenance activities

Maintenance of assets can be planned or unplanned and is required throughout the life of the infrastructure. Planned maintenance includes visual condition assessments to ensure long-term operation of the assets. Unplanned maintenance relates to activities in response to a failure or emergency.

Maintenance activities will be required during early stages of operation with an increased focus on inspection and testing. This is particularly important for the release structures at Nepean and Warragamba Rivers to monitor flow and erosion.

Several trenchless sections of pipeline have been designed to be maintenance free due to the difficulties in accessing them for future maintenance. These sections include the environmental flows pipelines between Bents Basin Road and Warragamba River, railway crossing at Cabramatta, and crossing of Prospect Creek at Lansdowne. As noted in the project scoping report and in section 4.5.4, maintenance activities are outside the scope of the project.

4.6.4 Operational workforce and hours

The pipelines will not require any permanent staff, but there will be regular routine inspections and maintenance of the pipelines and release structures during operation. These inspections will be completed as needed and typically by a small number of workers about every six months in any particular location. Water quality sampling at the release structures will occur about once a quarter. The pipelines will operate 24 hours a day, seven days a week.

4.6.5 Operational transport and access

A small number of operational vehicle movements will be required for operation and maintenance of pipelines. Activities will include condition assessments, wastewater sampling and monitoring of flow conditions. Vehicle movements will be infrequent and scattered across all pipeline alignments and are expected to have negligible impact on the local traffic network. A sealed access track to the environmental flows release structure will be required off Core Park Road for vehicle operational access. A footpath and staircase will also be provided at this location. No other permanent sealed access tracks for operational use will be required.

4.6.6 Operational waste

Any maintenance activities required once the pipelines are operational will be done by Sydney Water operations teams or contractors. Operational waste is expected to be minimal.

4.7 Early construction work and site investigations

Some site investigations and early works will be required before the main construction work begins. These works are generally low impact activities relating to preparing the work sites, gathering additional information and installing some environmental controls. These early works will be managed with separate environmental management plans or work method statements prior to preparation of the Construction Environmental Management Plan for the overall project.

Site investigations and early works may include:

- archaeological investigations and salvage work
- survey work and geotechnical investigations
- relocation, adjustments and protection of existing services
- site establishment activities:
  - removal of waste and any site contamination for site
  - preparation installation of community advisory signs
  - installation of security fencing
  - construction of site access points
  - installation of environmental controls
- activities prior to vegetation clearing:
  - pre-clearance surveys
  - delineation of ‘no-go’ zones
- other activities the project’s environmental representative considers will have minimal impact on the environment.

4.8 Construction of the AWRC

Figure 4-16 shows the construction impact area for the AWRC site with one area designated for the AWRC and ancillary components and another for the green space area and release infrastructure to South Creek. Environmental impact assessment for the AWRC is based on these impact areas.

The following sections describe the different construction phases of the AWRC, including indicative timing, activities and required equipment and machinery.

Figure 4-16 Construction area of the AWRC

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

4.8.1 Construction phases

There are seven main phases of construction for the AWRC:

- Phase 1 – site establishment and mobilisation.
- Phase 2 – site earthworks, stockpiling, storage and removal of materials.
- Phase 3 – civil works.
- Phase 4 – AWRC structure construction.
- Phase 5 – mechanical and electrical installation.
- Phase 6 – landscaping works and rehabilitation.
- Phase 7 – commissioning.

Although these phases represent the general progression of construction activities, these phases are expected to overlap. The overall duration of construction at the AWRC site is expected to be about 36 months, starting in mid-2022.

Table 4-10 provides more details about the construction phases, including indicative duration, typical activities and typical equipment required. These will be developed in more detail by the construction contractor during detailed design and construction planning.

Table 4-10 AWRC construction phases, timing, activities and required equipment

Phase	Duration	Typical construction activities	Typical equipment	
Phase 1: Site establishment and mobilisation	About two months	• Install environmental controls and delineate site. • Ancillary construction works such as access roads and fencing. • Traffic control. • Plant and equipment delivery. • Establish site compound and construction access. • Remove surface vegetation. • Demolish existing buildings. • Contamination management.	Backhoe loaders Chainsaws Concrete saws Cranes Dozers Dump trucks	Excavators Excavators hammer Front end loaders Hand tools Trucks Water trucks
Phase 2: Site earthworks	About 12 months	• Cut and fill to prepare site, including stockpiling top soil, removing spoil and importing fill. • Establish temporary site drainage and soil and water management controls. • Excavate for detention basins, underground infrastructure etc. • Excavation dewatering. • Waste disposal.	Backhoe loaders Chainsaws Compactors Concrete saws Cranes Dozers Dump trucks Excavators Excavators hammer	Front end loaders Grader Hand tools Pumps Roller Paver Profiler Trucks Water trucks

Phase	Duration	Typical construction activities	Typical equipment	
Phase 3: Civil works	About 12 months	• Construct roads and stormwater infrastructure. • Construct permanent internal roads and utility connections. • Construct permanent storage basins.	Compactors Concrete pumps Concrete trucks Cranes Dozers Excavators Front end loaders	Grader Hand tools Piling rig Road paving machinery Roller Trucks Water trucks
Phase 4: AWRC structure construction	About 18 months	• Construct buildings, treatment infrastructure, erect storage tanks and other treatment process units. • Install treatment equipment. • Build pipelines to South Creek.	Concrete pumps Concrete trucks Cranes Dozers Front end loaders Grader	Hand tools Piling rig Roller Trucks Water trucks
Phase 5: Mechanical and electrical installation	About 18 months	• Utility connections. • Operations equipment installation and testing.	Hand tools Light vehicles Trucks	Cranes Delivery trucks
Phase 6: Landscaping and rehabilitation	About three months	• Native planting and landscaping works on AWRC operational area. • Remove environmental controls. • Develop green space area (this is likely to continue into subsequent phases).	Hand tools Light vehicles	

Phase	Duration	Typical construction activities	Typical equipment
Phase 7: Commissioning	About six months	• Equipment testing and commissioning. • Operational testing. • Process proving. • Discharge commissioning wastewater.	Light vehicles Trucks Pumps Cranes

4.8.2 Construction workforce

The number of construction staff will depend on the schedule of works and construction program which will be developed during the detailed design and construction planning phase of the project. The AWRC site will have up to about 200 construction staff at any given time during construction. This number will fluctuate across the construction program and represents the peak construction of the program.

4.8.3 Landscape and restoration

Section 4.4.1 describes the landscaping and urban design approach for the AWRC site. This will include landscaping in the operational area and the green space area.

4.9 Construction of pipelines

4.9.1 Construction phases and timing

There are five main phases of pipeline construction:

- Phase 1 – site establishment and mobilisation, installation of environmental controls, such as erosion and sediment control.
- Phase 2 – site earthworks, including excavation for trenches and launch and receival pits for trenchless pipe sections.
- Phase 3 – installation of pipe bedding material and pipeline, as well as backfilling of trench. Civil works such as pipeline and ancillary infrastructure will also be installed during this stage.
- Phase 4 – commissioning.
- Phase 5 – landscaping works and rehabilitation.

Construction of the pipelines will likely occur in several locations at one time, rather than moving progressively from one end to the other, and each location is likely to be in a different phase at different times. The construction program will be established by the construction contractor during detailed design and construction planning.

Construction of pipelines is likely to occur over the entire 36-month construction phase, starting mid-2022. Open trench construction will progress at a rate of about 12 m – 24 m per day and have a duration of between eight to 10 weeks in any given area. Tunnelling construction will have a duration of between one to six months depending on the location and depth of bore.

Table 4-11 provides an indicative staging and construction approach to pipeline construction. This includes the typical equipment and machinery that is required at different stages of construction.

Table 4-11 Pipeline construction phases, timing, activities and required equipment

Phase	Typical construction activities methodology	Typical equipment
Phase 1: Site Establishment	• Install environmental controls and delineate site. • Traffic control. • Ancillary construction works such as roads, site compounds and fencing. • Plant and equipment delivery. • Clearing.	Backhoe loaders Chainsaws Concrete saws Cranes Dozers Dump trucks Excavators Excavators hammer Front end loaders Hand tools Trucks Water trucks
Phase 2: Excavation	• Excavate trenches, drilling pits (trenchless construction) and install shoring. • Dewater excavation. • Waste disposal.	Concrete trucks Concrete pumps Dozers Loaders Excavators Drilling rig Excavators breaker Rock breakers Rock screens Delivery trucks Pumps and other dewatering equipment Trenching machines Waste trucks

Phase	Typical construction activities methodology	Typical equipment
Phase 3: Pipe installation	• Pipe delivery and placement of the section of the pipes near the trench in a line (pipe stringing). • Field bending of pipe. • Welding of each section of pipe together into one continuous length. • Pipe lowering into trench (trenchless construction). • Pulling pipe through bore (trenchless construction). • Backfilling. • Inspection and test of pipes.	Bending machines Compactors Cranes Delivery trucks Excavators Drilling rig Light vehicles Side booms or pipe layers Powered hand tools Semi-trailers Truck and dog Shoring equipment Welding equipment
Phase 4: Commissioning	• Pipe pressure testing and disinfection. • Discharging commissioning wastewater.	Light vehicles Trucks
Phase 5: Landscaping and restoration	• Topsoil placement and restoration.	Compactors Excavators Graders Road paving machinery Rollers Skidsteers Hand tools

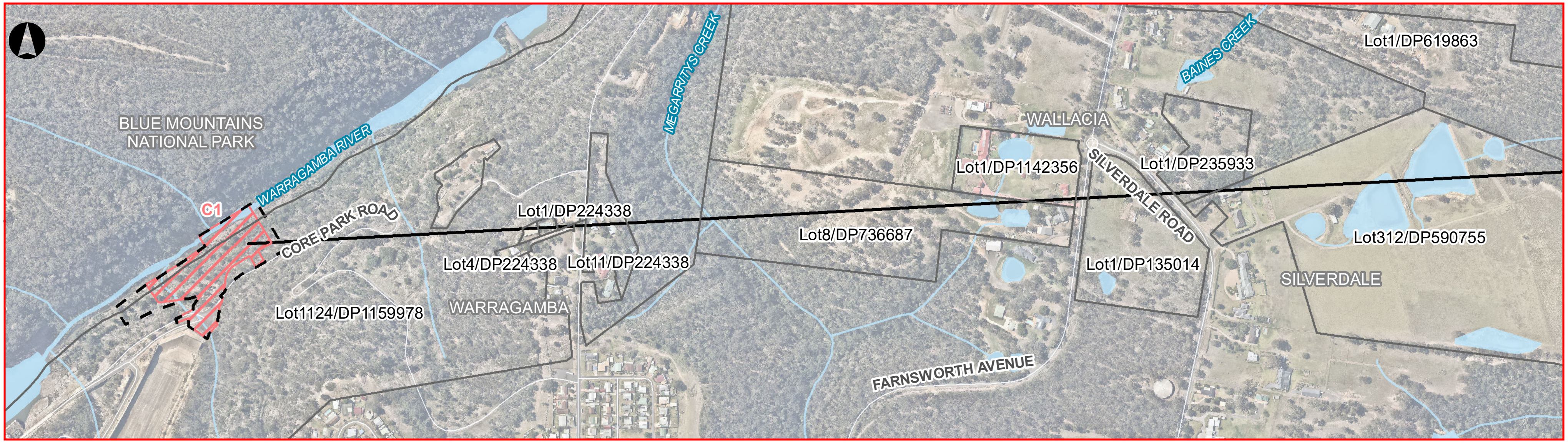
4.9.2 Construction corridors

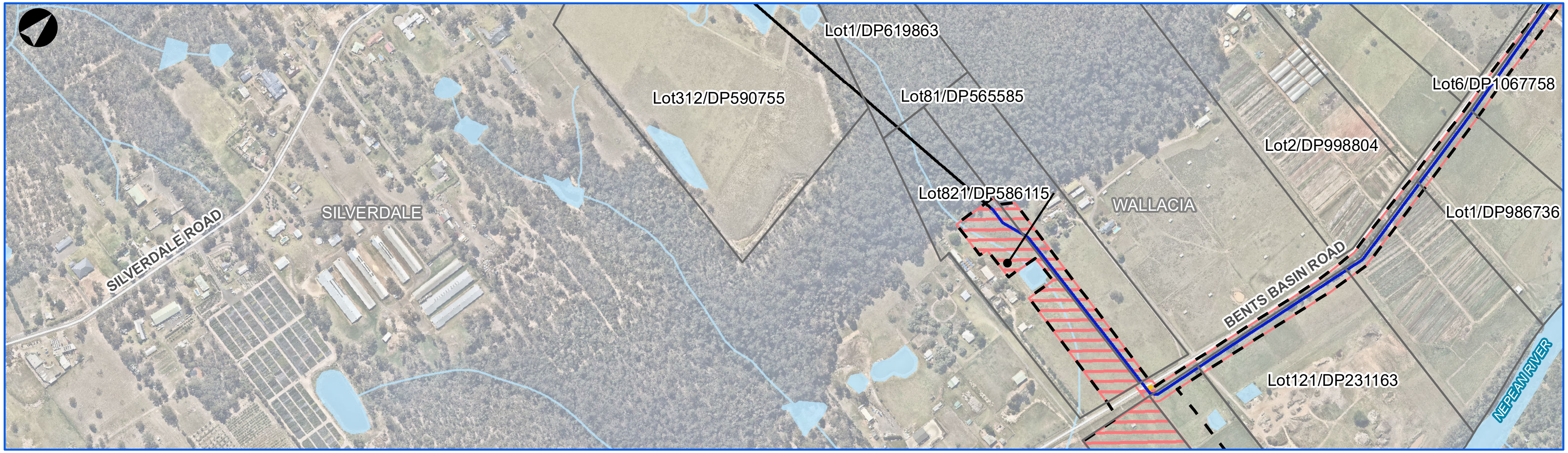
Figure 4-17 shows the impact area for the project. This is the area required to install the pipelines and ancillary facilities such as compounds and access routes. Environmental impact assessment for the project is based on this area.

Figure 4-17 also shows an impact assessment area where relevant specialist studies have identified environmental constraints.

Sydney Water is seeking flexibility in the planning approval to locate the project anywhere in the impact assessment area, provided changing the location has no additional net environmental impact. This is to allow flexibility for any small alignment changes resulting from detailed design investigations, progress of development plans in growth areas or other constraints.

The following sections describe the different construction methods and their associated impact area.





Environmental flows pipeline

Tunnelled pipeline

Scour Valves

Indicative compound

Impact area

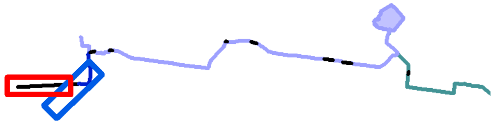
Impact area - acces track

Impact assessment area

Lot boundary

Waterbody

Watercourse



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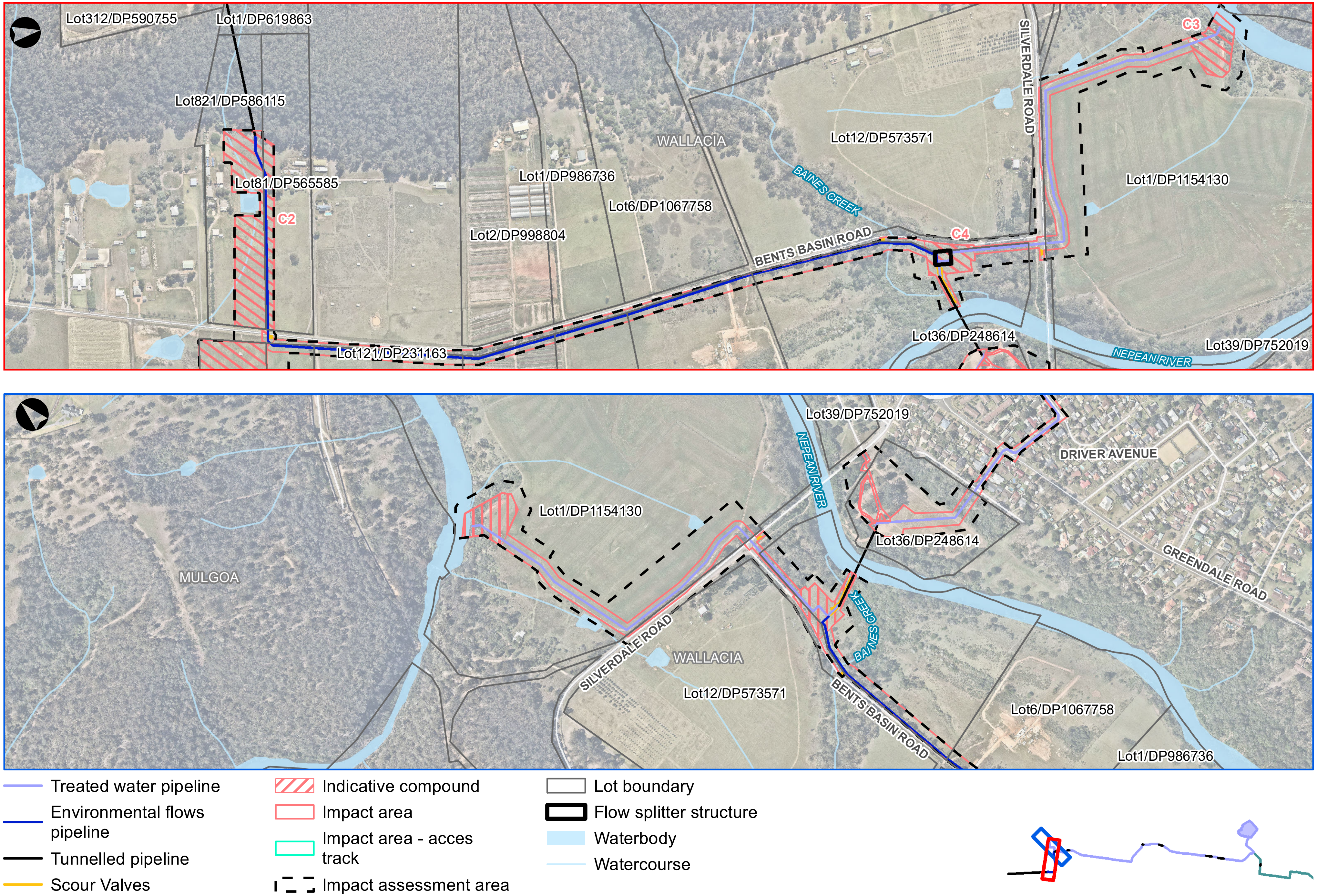
0 100 200 m

Figure 4-17a Construction area of pipelines

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI

Projection: GDA2020 MGA Zone 56



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Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI

Projection: GDA2020 MGA Zone 56

Figure 4-17b Construction area of pipelines

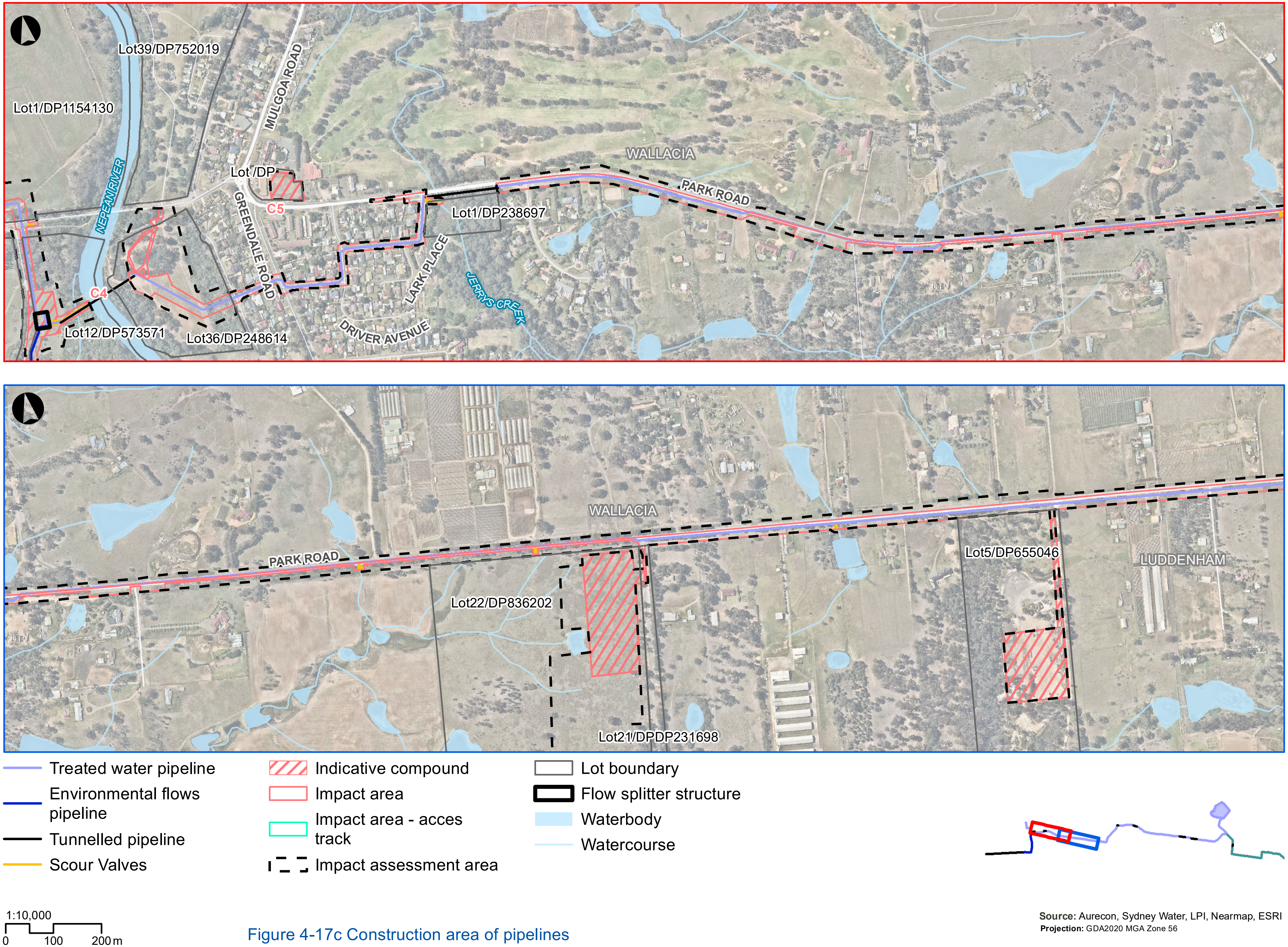


Figure 4-17c Construction area of pipelines

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

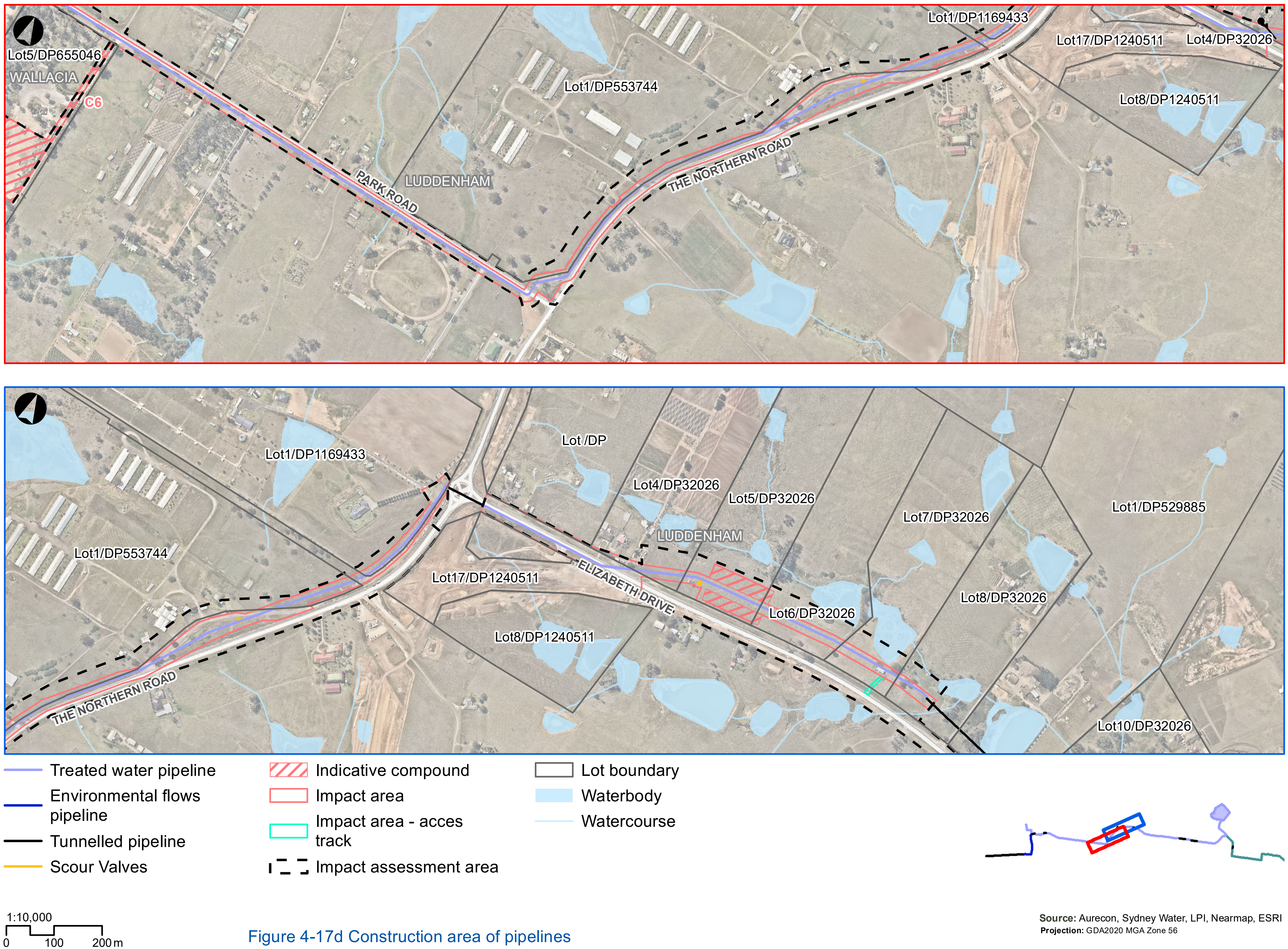


Figure 4-17d Construction area of pipelines

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

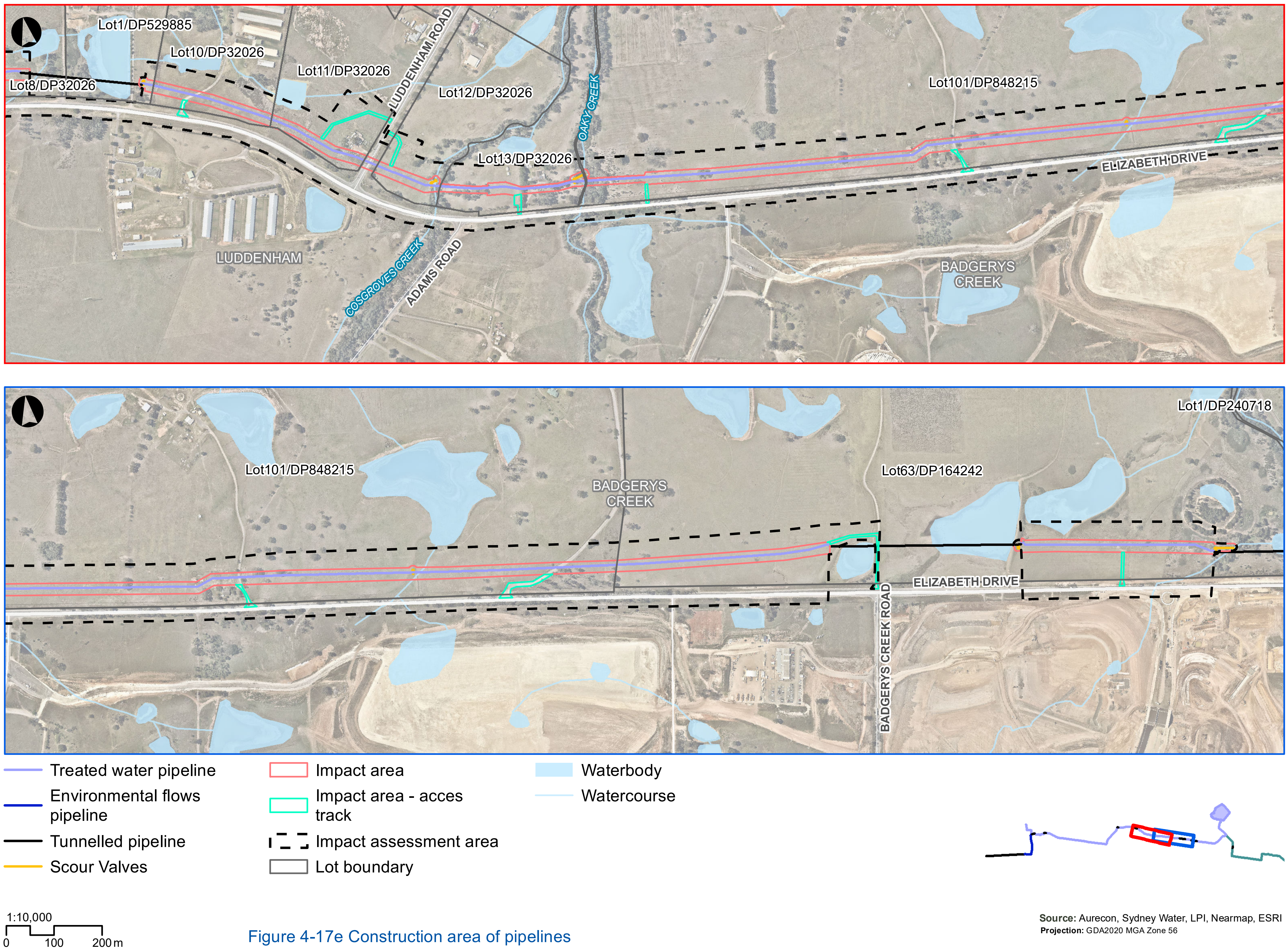
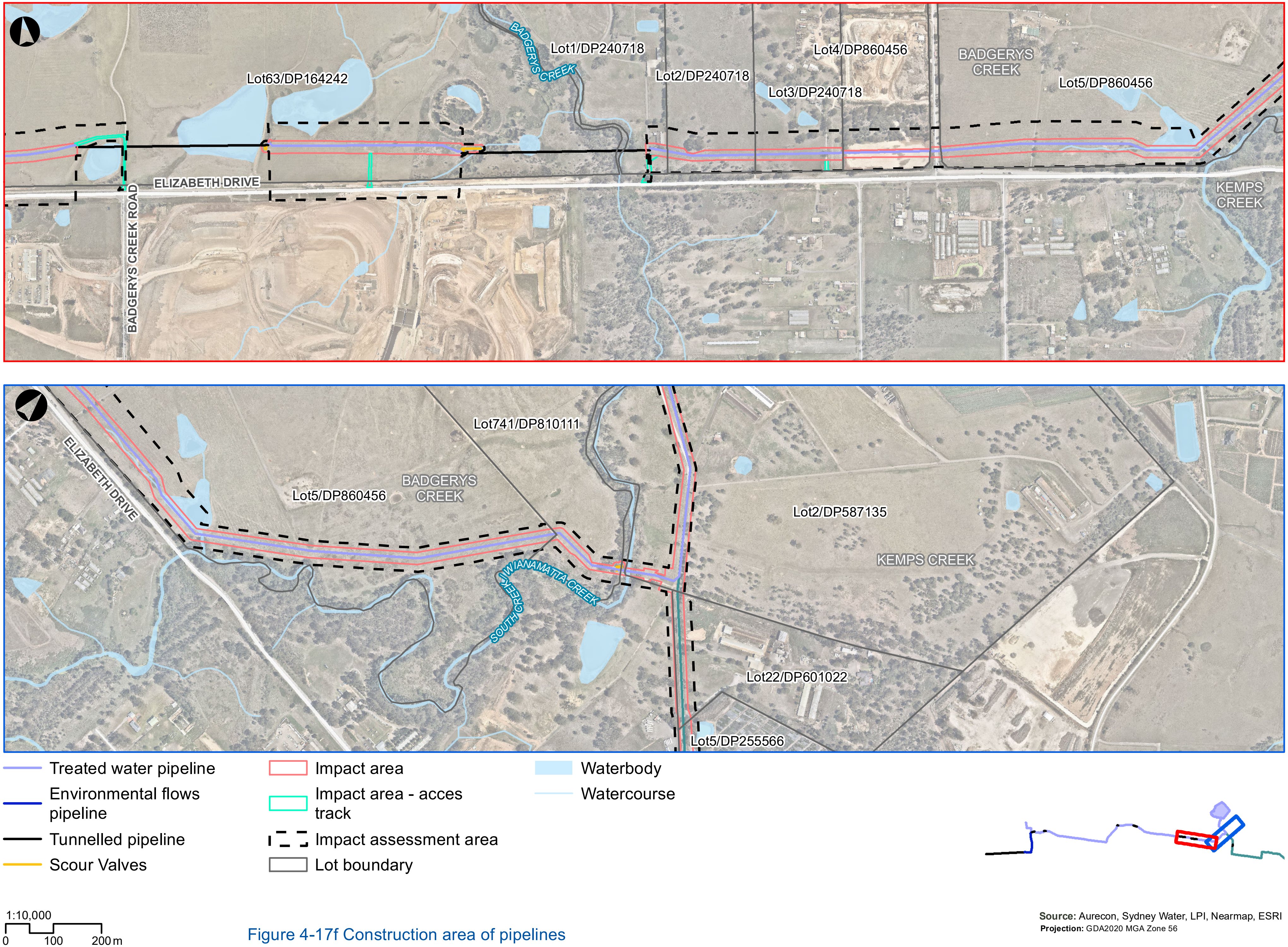


Figure 4-17e Construction area of pipelines

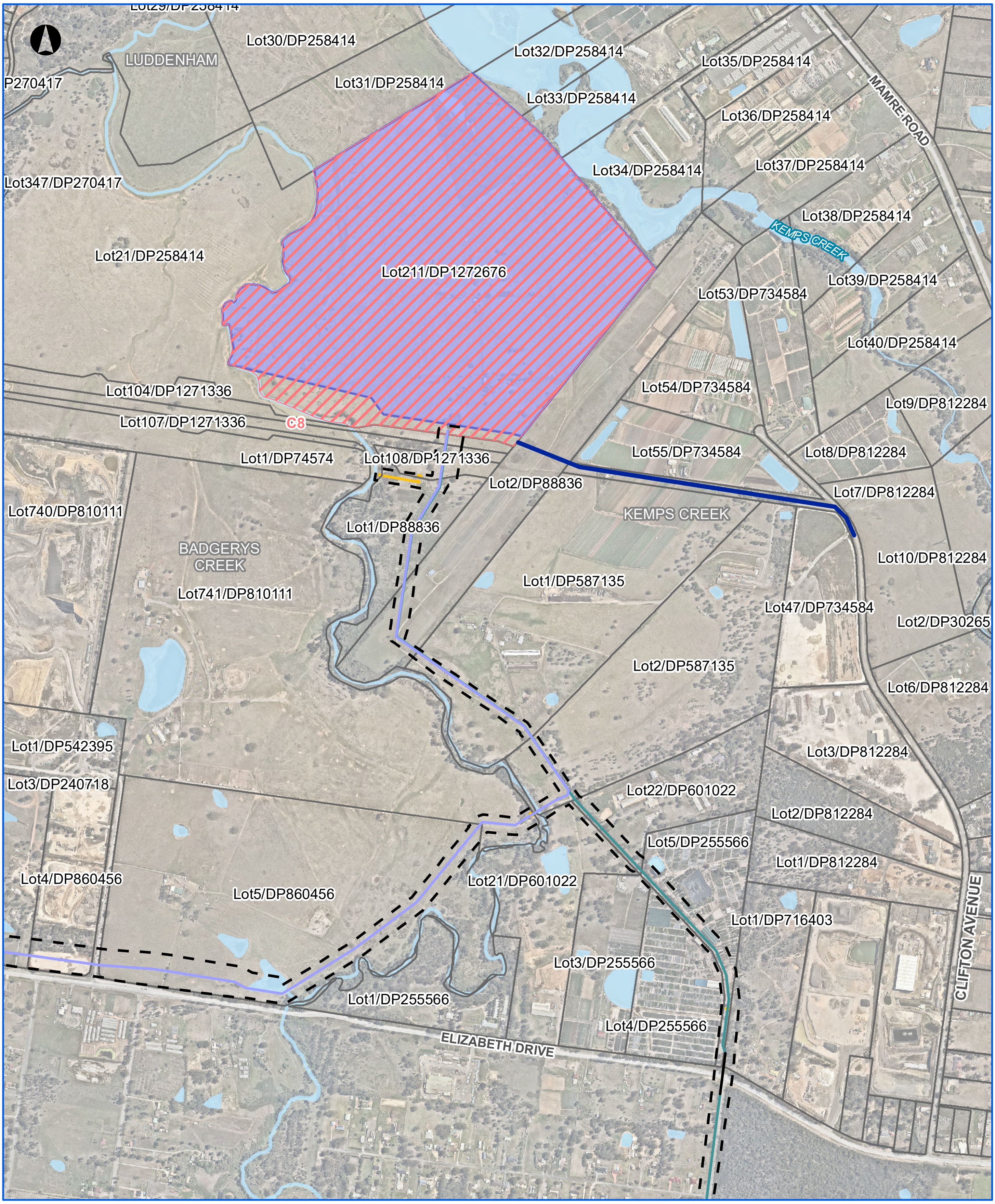
Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56



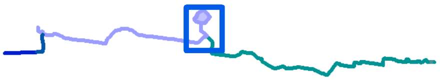
Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

Figure 4-17f Construction area of pipelines

Sydney WATER



Tunnelled pipeline
Treated water pipeline
Brine pipeline
Advanced Water Recycling Centre
Impact assessment area
Scour valves
Indicative compound
AWRC access road
Lot boundary
Waterbody
Watercourse



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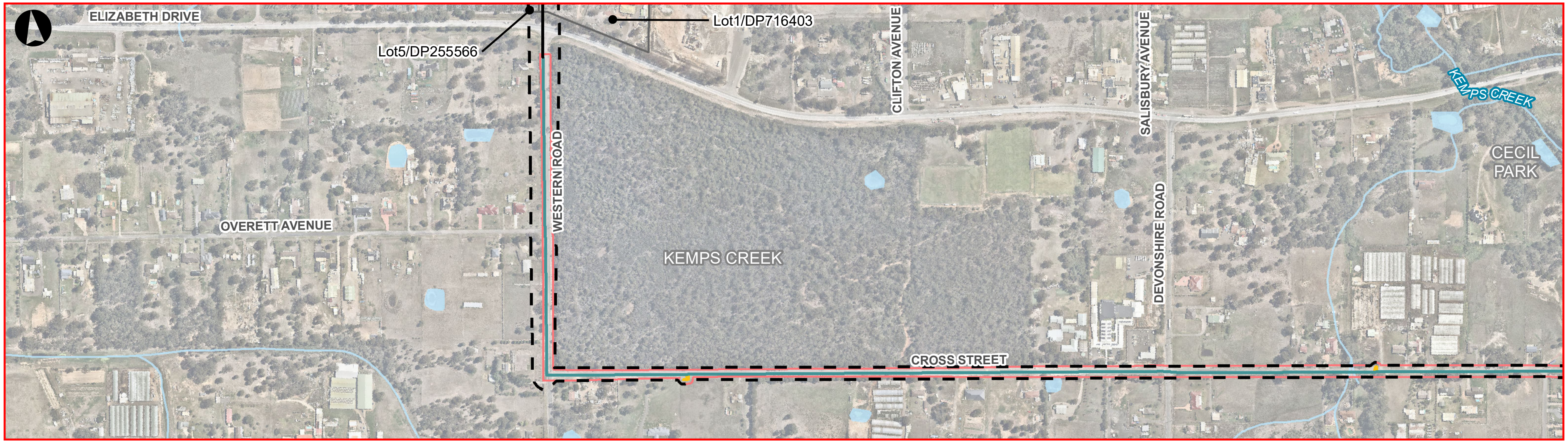
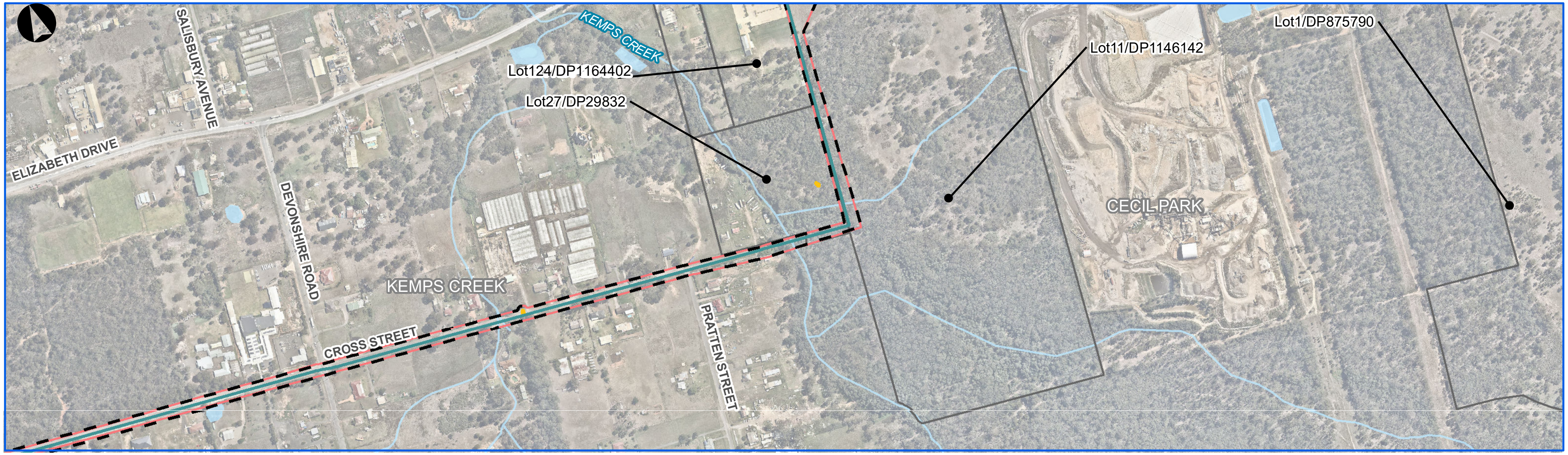
Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

Figure 4-17g Construction area of pipelines





Brine pipeline
Tunnelled pipeline
Scour valves
Impact area
Impact assessment area
Lot boundary
Watercourse

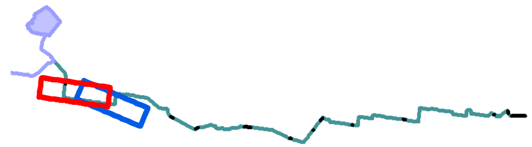


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Figure 4-17h Construction area of pipelines

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA 1994 MGA Zone 56

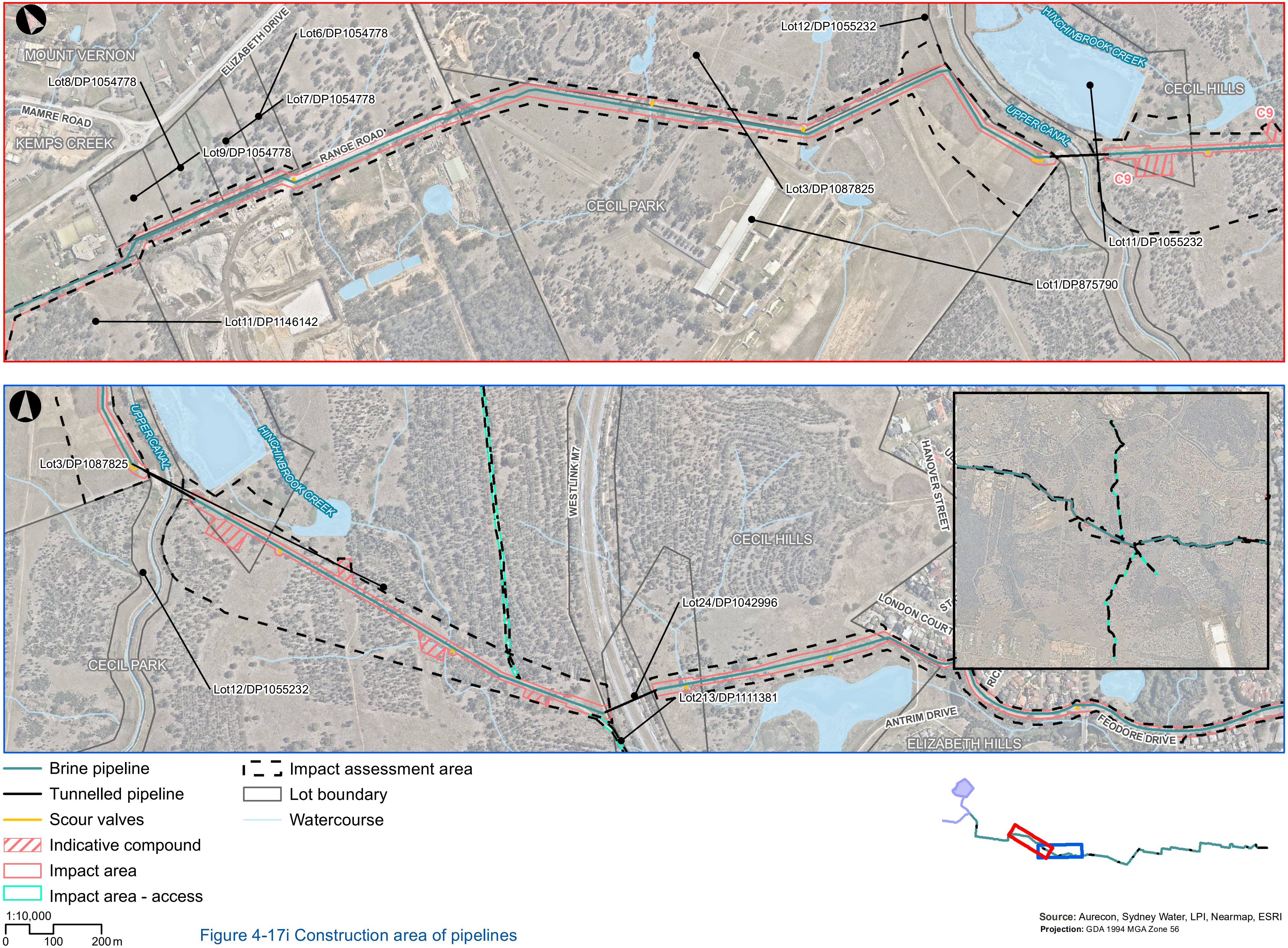

Figure 4-17i Construction area of pipelines

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA 1994 MGA Zone 56

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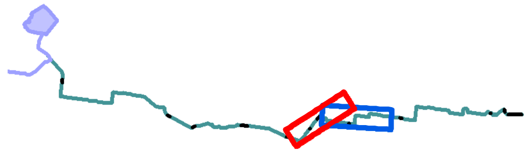
0 100 200 m

Figure 4-17j Construction area of pipelines

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA 1994 MGA Zone 56

- Brine pipeline
- Tunnelled pipeline
- Scour valves
- Indicative compound
- Impact area
- Impact area - acces track
- Impact assessment area
- Lot boundary
- Watercourse



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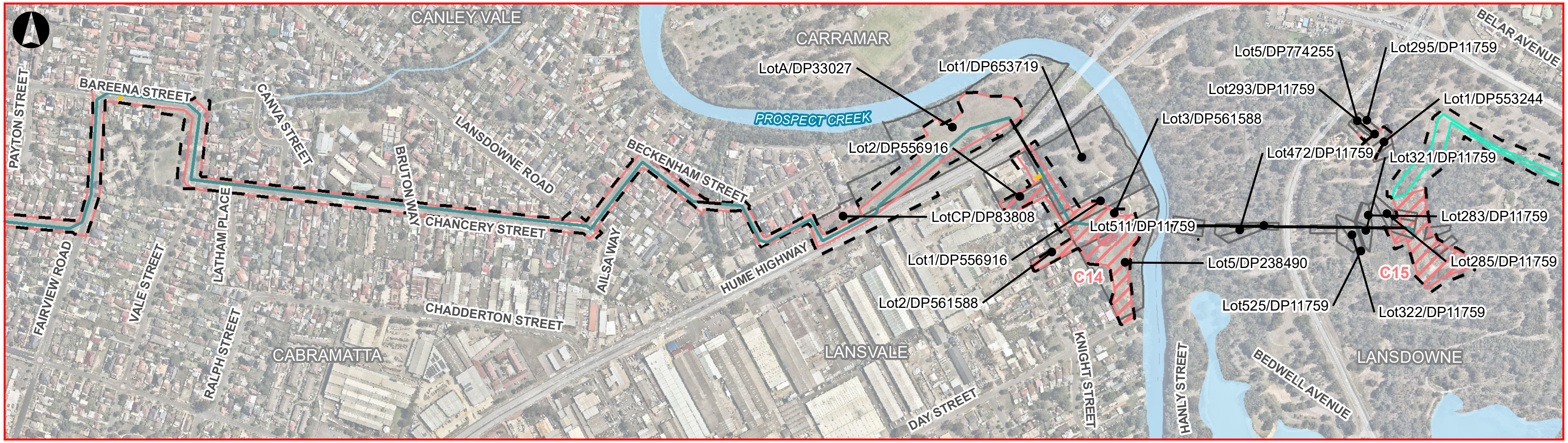
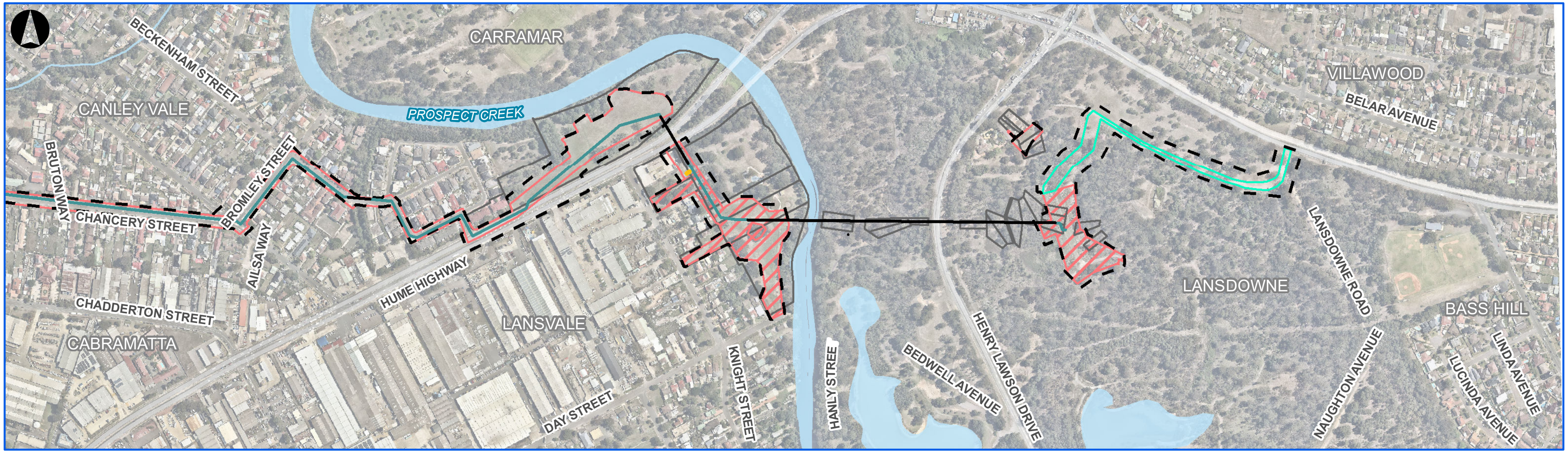
Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA 1994 MGA Zone 56

Figure 4-17k Construction area of pipelines

Figure 4-17l Construction area of pipelines

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA 1994 MGA Zone 56





Brine pipeline
Tunnelled pipeline
Scour valves
Indicative compound
Impact area
Impact area - acces track
Impact assessment area
Lot boundary
Watercourse

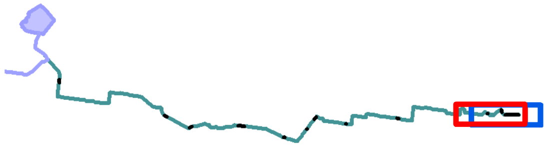


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Figure 4-17m Construction area of pipelines

Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA 1994 MGA Zone 56

4.9.3 Construction methodology

All pipelines will be constructed using a combination of open trench and tunnelling construction methods. Most of the pipelines will be constructed by open trenching, follow existing road alignments, either in the road or road verge. Tunnelling is planned beneath some existing and proposed infrastructure, waterways and environmental constraints. Tunnelling may be used in additional locations provided it does not result in any additional environmental impact.

Open trench construction

Open trenching involves digging a long linear trench in which the pipeline is placed. This requires excavation of the ground surface along the entire length of the pipeline. This method of construction is the most conventional for pipeline installation when depths are relatively shallow and there are minimal constraints such as structures, vegetation and large waterways. Figure 4-18 and Figure 4-19 show a typical set up open trench excavation for pipeline construction. Figure 4-18 shows the use of shore boxes which are used for deep excavation and narrow construction corridors such as in a roadway. Figure 4-19 shows open trenching with a benched trench when a wider construction corridor is required. The project will use a range of open trenching methods for pipeline installation.

Figure 4-18 Trenched pipeline construction with shoring

Figure 4-19 Trenched pipeline construction with benching

Depending on the depth of the pipeline, the construction area and size of the trench can range in size. If deep excavation is required, the trench needs to be benched, stepped or reinforced with shoring to prevent collapsing. The typical construction corridor width for open trench construction is 15 m – 30 m.

Generally, a narrower corridor is adopted when constraints like vegetation or water bodies are present. Where there are no constraints, a wider corridor is adopted, allowing room for movement of machinery, people and construction materials. Figure 4-20 shows a typical construction layout for different construction corridor widths.

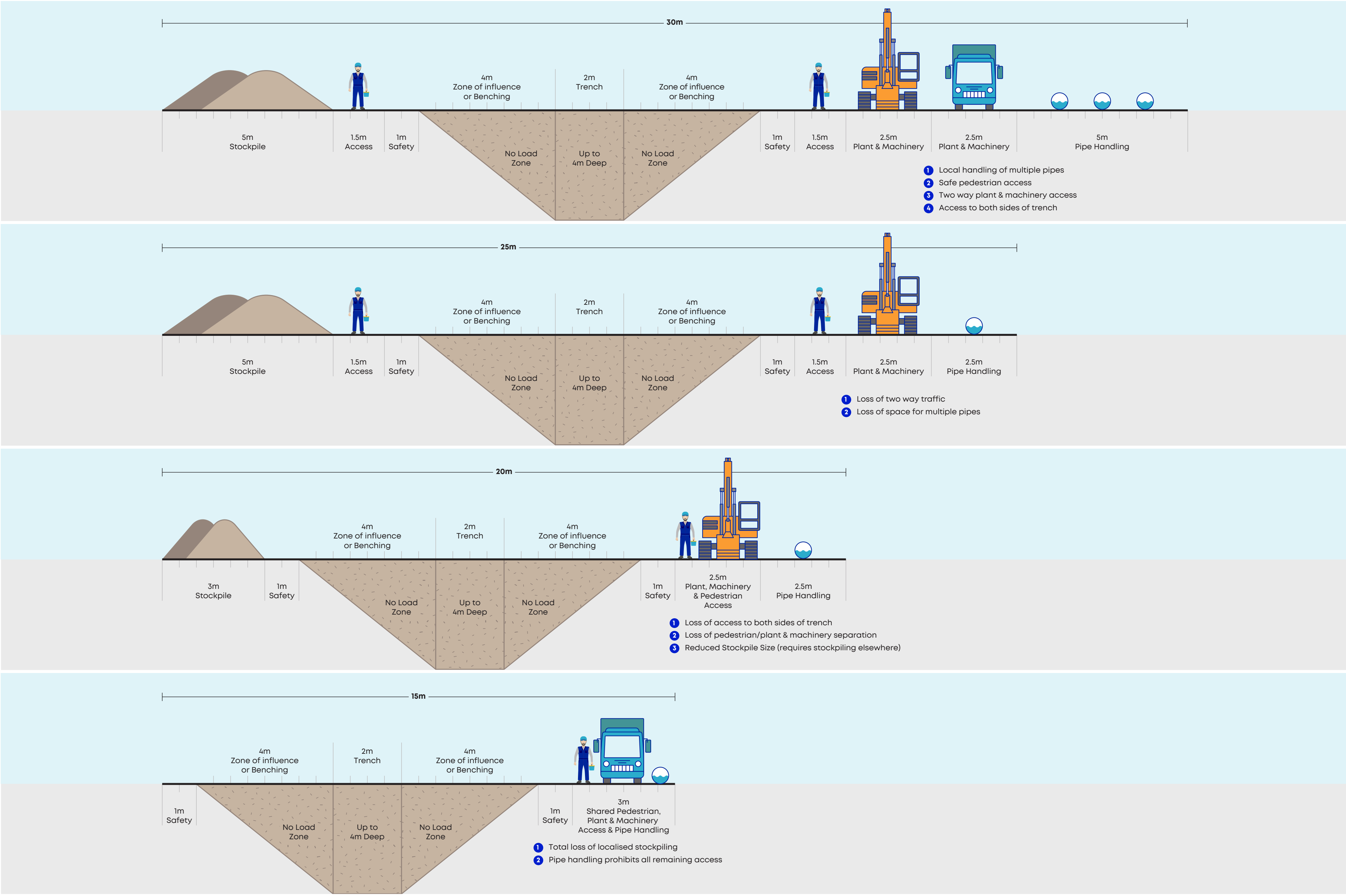

Figure 4-20 Pipeline construction corridor widths and layouts

Many pipeline crossings of waterways will avoid impacts on 'water land' by tunnelling. However, some crossings will be constructed by open trenching across the waterway. As such, the project will involve activities within 'water land' and be classified as dredging under the *Fisheries Management Act 1994*. Determining the construction methodology across waterways includes balancing considerations such as environmental constraints, waterway size and flow, geotechnical conditions and cost.

Construction of the release structures at South Creek, Nepean River and Warragamba River will also involve excavation within 'water land'. Chapter 8 provides an assessment on the potential impacts of the project to ‘water land’.

The following construction methodologies will also be implemented where trenched creek crossings are required. A typical construction area is also shown in Figure 4-21.

- Survey and delineate pipeline alignment and working corridor.
- Install fencing and security measures.
- Clear site to form access track and construction corridor.
- Establish land and waterway environmental controls, including any required coffer dams, portadams or turbidity curtains.
- Set up bypass pump system.
- Create temporary seal or dam by installation of a cofferdam, portadam, soil filled sandbags upstream to segregate wet section and provide a dry section of works.
- Excavate from bank to bank of the waterway to the required depth of the pipeline, up to 8 m in depth.
  - Length of excavation depends on the width of the waterway and will be up to 50 m in length.
  - Width of construction through waterways will be about 15 m to enable a safe working environment.
- Install pipes.
- Backfill and compaction works.
- Reinstate banks and creek bed to original profile. May require further measures to stabilise the banks and prevent erosion. Geotextiles may be used in conjunction with seeding of an appropriate grass mix.
- Remove temporary seal of creek eg cofferdam and bypass pump.
- Restoration and rehabilitation.
- Remove security and environmental controls.

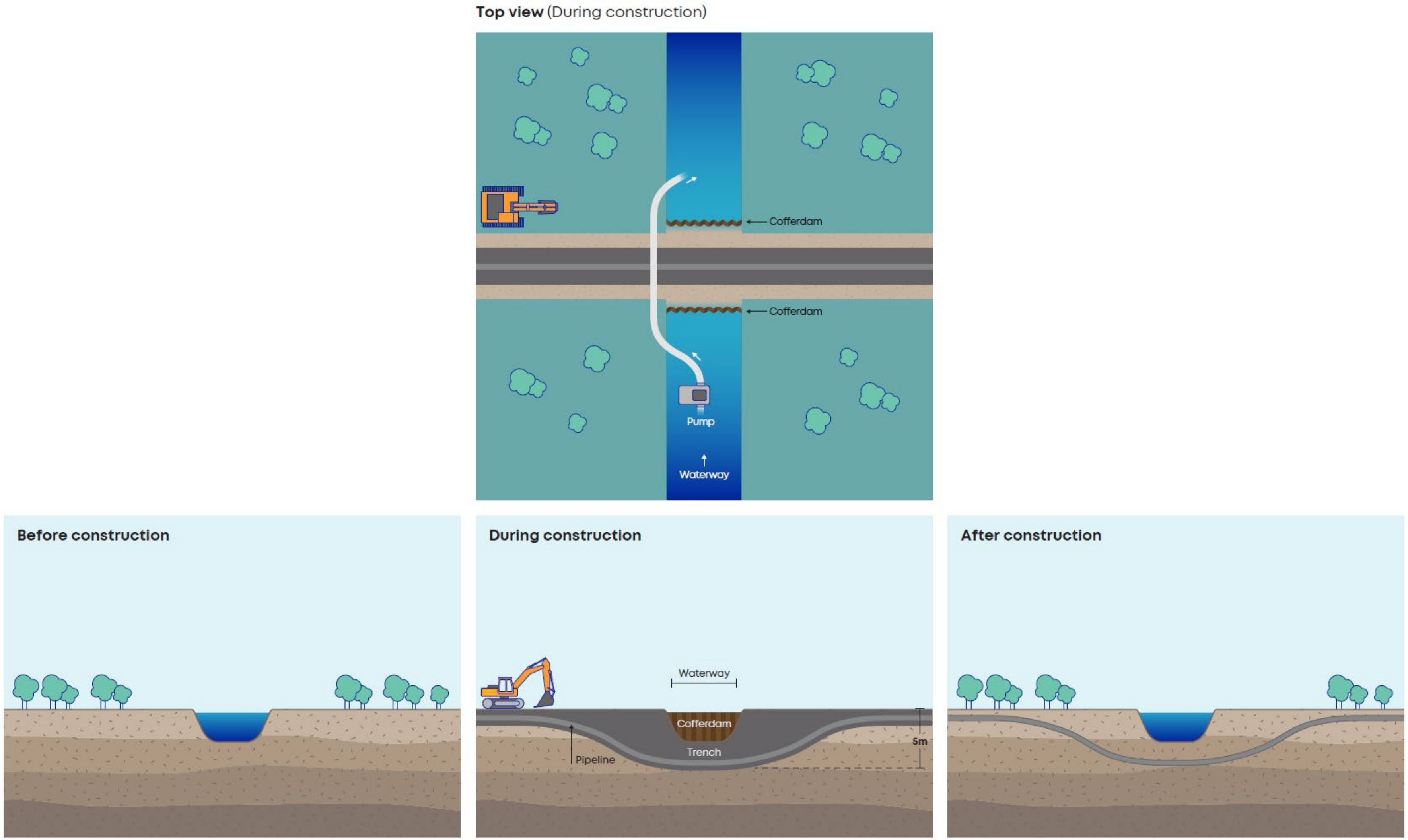

Figure 4-21 Illustration of trenched pipeline construction through a waterway

Tunnelling

Building a pipeline by tunnelling involves the drilling of an underground bore in which the pipe is installed. This method of construction can reduce environmental and community impacts by minimising the amount of excavation and ground disturbance required. Ground disturbance is not required along the entire length of the pipeline alignment as in open trench construction, and usually only at launch and receiving pits at each end. Figure 4-22 and Figure 4-23 show a typical tunnelling set-up for pipeline construction, including the excavated pits at either end, the path of the bore beneath the constraint, and the placement of the pipeline that is pulled through. Two construction methodologies are shown - horizontal directional drilling (HDD) and pipe jacking.

For horizontal directional drilling, the pipeline cannot be installed in small sections. The entire length of pipeline is joined together above ground and pressure tested prior to it being installed in the bore. This requires the pipeline to be strung out on the ground surface prior to installation.

Tunnelling is proposed at several locations including crossing major roads (including Transport for NSW roads), railways, waterways, and farm dams. The construction methodologies likely to be used include pipe jacking and HDD, but these will be determined during detailed design. In general, pipe jacking is used for shorter distances, and HDD for longer distances. Table 4-11 provides details on the construction steps and equipment required for tunnelling.

General construction activities and methodology for tunnelled creek crossings include:

- survey, delineation of pipeline alignment and working corridor
- site set up, including installation of environmental controls
- excavation of launch and receival pits for drilling rigs (about 12 m x 4 m)
- drilling of pilot hole and pipe bore
- installation of pipe
- commissioning
- site remediation and restoration.

Tunnelled crossings that are proposed include:

- environmental flows pipeline from Bents Basin Road to Warragamba River
- Nepean River at Wallacia
- Jerrys Creek at Wallacia
- Elizabeth Drive and Northern Road
- Badgerys Creek and existing farm dams on northern side of Elizabeth Drive
- Kemps Creek at Kemps Creek
- WaterNSW Upper Canal
- M7 Motorway
- Clear Paddock Creek at Green Valley

- Joseph Street at Cabramatta West
- Cowpasture Road
- railway at Cabramatta, including the T2, T3 and T5 lines
- Hume Highway, Prospect Creek and Henry Lawson Drive at Lansdowne.

Environmental flows pipeline

The environmental flows pipeline will be constructed using open trenching and tunnelling. The trenched section will extend south from Silverdale Road, down Bents Basin Road, and the tunnelled section will be from private property near Bents Basin Road to Warragamba River. The tunnelled section will be about 2.5 km long and up to 115 m deep. The exact construction methodology will be determined during detailed design once a construction contractor(s) has been engaged.

The construction of the environmental flows pipeline will include:

- drilling rig at both ends of the alignment, near Warragamba River and at Bents Basin Road
- removal of spoil via truck from both ends of the alignment
- 24 hour a day works for 3-6 months
- placement of ground level GPS devices at regular intervals along the alignment to monitor the drill position
- management of drilling fluid and groundwater
- temporary construction access tracks to both ends of the pipeline
- water, via the drinking water network or from Nepean River, for drilling operations.

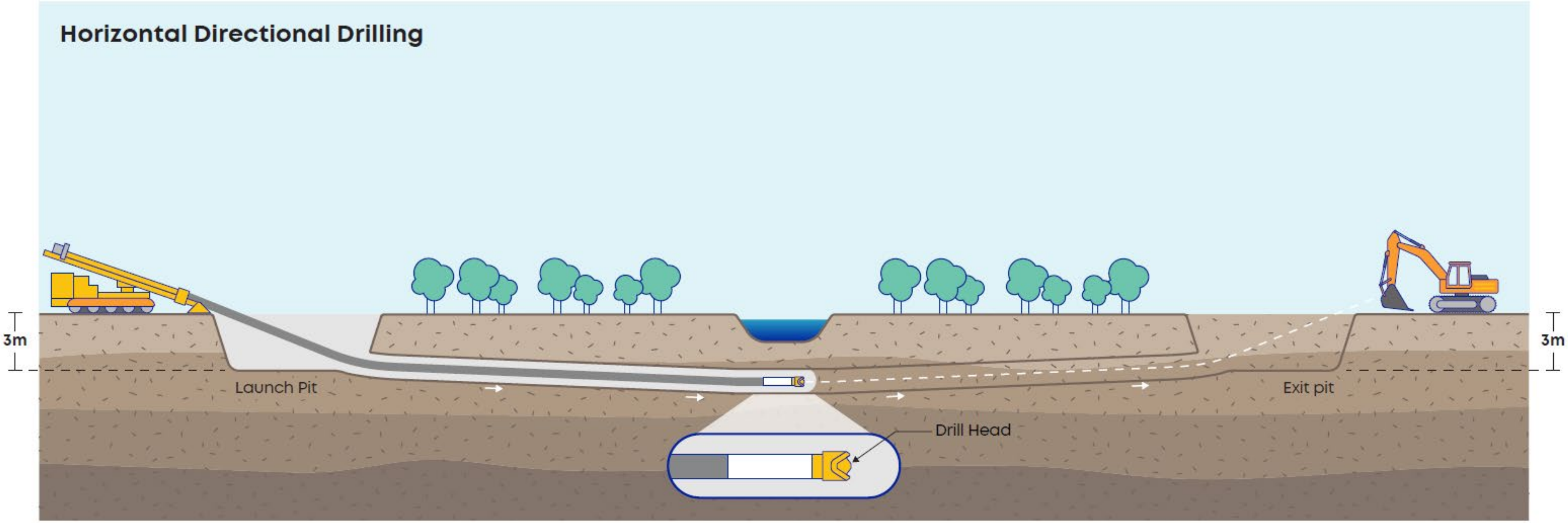

Figure 4-22 Illustration of HDD tunnelling construction

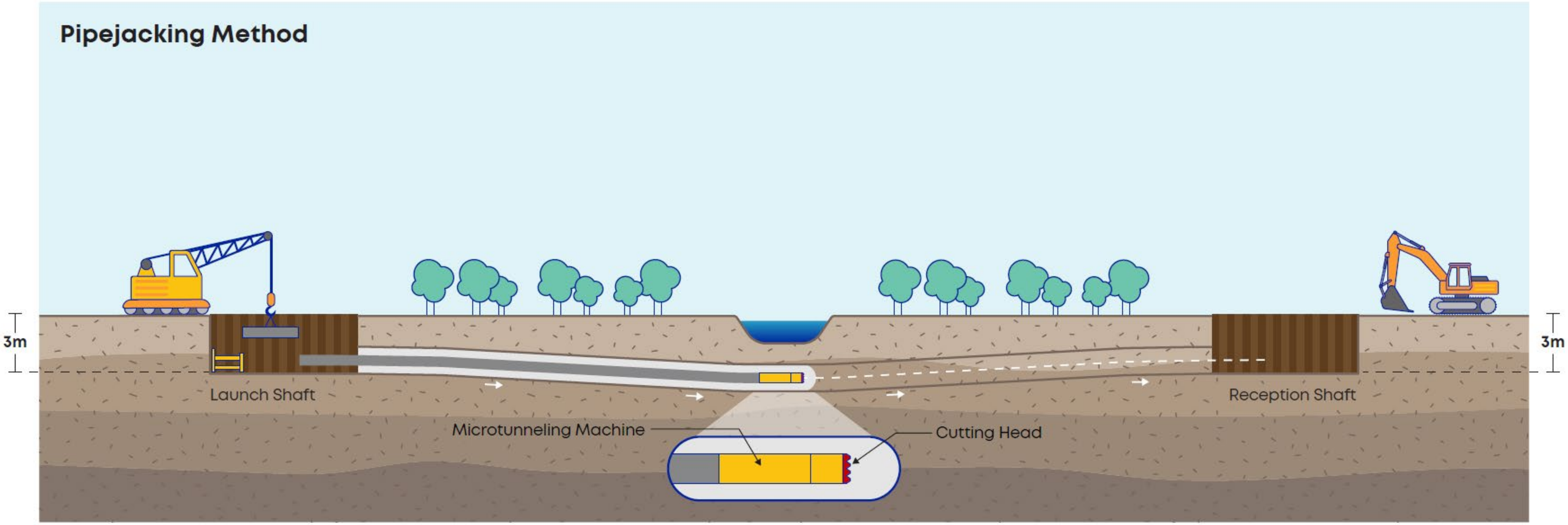

Figure 4-23 Illustration of pipe jacking tunnelling construction

Construction of the pipeline release structures

The release structures at Nepean River and Warragamba River will take about 12 months to construct. Construction of these release structures will include:

- survey, delineation of pipeline alignment and working corridor
- installing fencing and security measures
- clearing to form access track and construction corridor
- establishing land and waterway environmental controls, sedimentation fence, silt curtain. Geofabric will be laid over the bed and bank of the stream prior to filling with high clay content soils. The soil will be compacted and then covered with geofabric to prevent erosion
- installing a flow diversion barrier (portadam or temporary cofferdam) to segregate wet section and provide a dry section of works. Material will be de-watered on site or at the closest compound prior to reuse or disposal
- dewatering work area
- excavating existing embankment, including any required rock breaking
- installing pipeline, chambers, release structures and energy dissipation structures such as baffle blocks
- installing concrete outlet and apron with energy dissipation rock rip rap
- reinstating impacted banks and creek bed
- removing flow diversion barrier
- landscaping works
- removing security and environmental controls.

Construction of the flow splitter structure

The flow splitter structure at Bents Basin Road, Wallacia will take about six months to build. Construction of the flow splitter structure will require activities including:

- survey and delineation of work area
- installing fencing and security measures
- clearing site to form access track off Bents Basin Road and construction corridor
- establishing environmental controls, for example sedimentation fencing
- excavation and earthworks for pipeline construction
- installing below ground equipment, for example pipelines, services and concrete pad
- backfilling and compaction works

- installing valves, and permanent above-ground structures such as fencing, gates and electrical kiosk
- restoration and rehabilitation
- removing security and environmental controls.

4.9.4 Construction workforce

The number of construction staff will depend on the schedule of works and construction program which will be developed during the detailed design and construction planning phase of the project. It is likely multiple crews will be working at various places along the pipeline at the same time. The pipelines will have about 200 construction staff at any given time during construction. This number will fluctuate across the construction program and represents the peak construction of the program.

4.9.5 Landscape and restoration

All areas impacted by pipeline construction will be restored upon completion of works. Where possible, impacted areas will be restored to their pre-construction condition. However, this is not always possible when mature vegetation has been removed as Sydney Water needs to ensure that plants over the pipeline would not develop root systems that could damage the pipeline. Sydney Water will consult with relevant landowners and local councils in planning for restoration after pipeline construction.

4.10 Construction across the project

4.10.1 Construction compounds

Construction compounds will store equipment and materials and provide site office facilities and parking for construction staff. They will be required throughout the construction phase of the project at several locations close to the project. Table 4-12 and Table 4-13 describe indicative locations and types of compounds required, and Table 4-14 describes the activities likely to occur at each compound. Figure 4-24 shows indicative compound locations.

Sydney Water may not need all compounds that are proposed, or alternative locations may be required. Depending on the type of compound, they will be required for different lengths of time during construction. In general, main compounds will be required for the entire 36-month construction duration, and smaller satellite and tunnelling compounds will be required for about three to 12 months.

Flexibility is sought for compound locations provided they meet the requirements outlined in section 4.13. This means that Sydney Water is seeking approval for the construction compounds identified in Figure 4-24 and set out in Table 4-13, but also for potential alternative construction compounds, where those alternative compounds meet the criteria outlined in Table 4-14. Sydney Water notes that construction compounds in Table 4-12 would normally not require development consent and Sydney Water would assess them under Division 5.1 of the *Environmental Planning and Assessment Act 1979*. Compound locations, layouts and their timing will be established during detailed design.

Table 4-12 Overview of types of construction compounds

Compound type	Key activities and description	Duration
Main	Large compounds that will be active for the entire construction of the project. Temporary buildings such as offices and meeting rooms, amenities and first aid facilities. Stockpiling and sorting of waste material prior to disposal or reuse. Storage of site equipment, including bunded storage for any chemicals such as fuel.	Entire 36-month construction period of the project
Satellite	Smaller compounds that will be active for the entire construction of the project. They will have similar activities to main compounds.	About 3 – 12 months
Tunnelling	Only identified for larger tunnelling locations where an increased construction presence will be required. Include the launch and receival pits for sections of pipeline constructed by tunnelling. Accommodate activities associated with drilling such as the drill rig, spoil management and pipe placement. Only required during tunnelling.	About 3 – 12 months
Laydown	Small rolling compounds located at pipeline construction sites. These will only be required for short periods of time and will move along the pipeline alignments as construction progresses.	Entire duration of pipeline construction

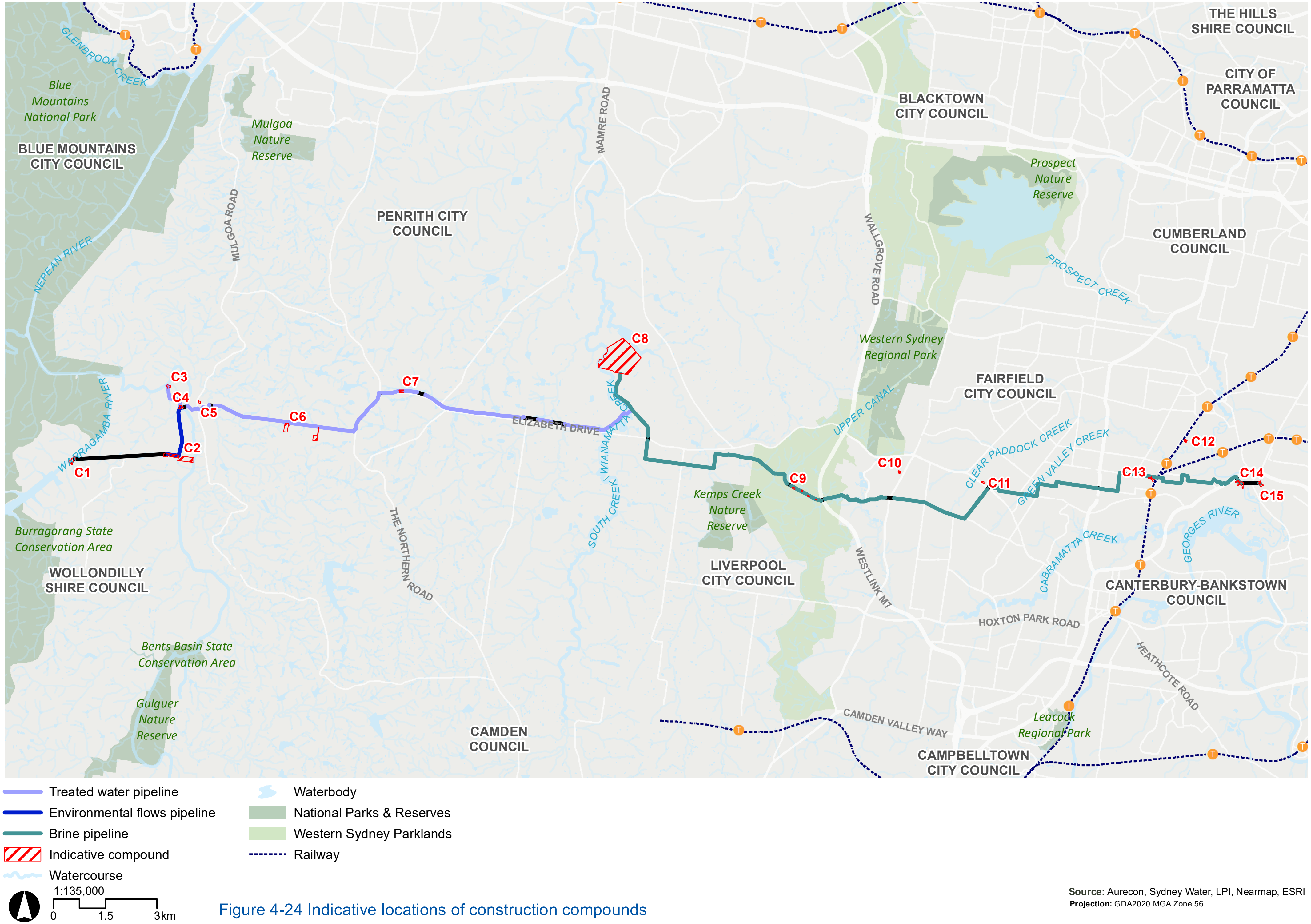

Figure 4-24 Indicative locations of construction compounds

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

Table 4-13 Numbering, location and type of indicative compounds

Number	Location	Compound type
C1	Warragamba River via Core Park Road	Tunnelling
C2	Bents Basin Road, Wallacia	Tunnelling
C3	Treated water release location near Wallacia Weir at Nepean River	Satellite
C4	West of Wallacia and Nepean River	Tunnelling
C5	1 Park Rd, Wallacia	Main
C6	344 Park Rd, Wallacia 260 Park Road, Wallacia (alternative location)	Main
C7	Elizabeth Drive between The Northern Road and Luddenham Road	Satellite
C8	AWRC site	Main
C9	Western Sydney Parklands, near Liverpool Offtake Reservoir – multiple small compounds, including tunnel under M7	Satellite/ Tunnelling
C10	Liverpool reservoir, Cecil Hills	Main
C11	Lot 419 DP262454, Bonnyrigg	Satellite
C12	East Parade, Fairfield	Main
C13	Cabravale Leisure Centre car park	Tunnelling
C14	Lansvale Park, Lansdowne - west of Henry Lawson Drive and Prospect Creek	Satellite/ Tunnelling
C15	Lansdowne east of Henry Lawson Drive	Tunnelling

Table 4-14 Indicative activities required at each construction compound

Activity	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Earthworks	✓	✓	✓	✓			✓	✓	✓				✓	✓	✓
Site office	✓	✓			✓	✓	✓	✓		✓	✓	✓			
Worker parking	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spoil storage	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Drilling	✓	✓		✓			✓		✓				✓	✓	✓
Equipment storage	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Materials laydown	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pipe welding	✓	✓		✓			✓	✓	✓				✓	✓	✓

4.10.2 Construction materials

During construction, a wide range of materials will be required. The indicative types of materials include:

- sand
- stabilised sand
- gravel
- clay
- spoil (backfilling)
- concrete
- steel (both pipe and reinforced concrete)
- structural steel and cladding
- carpet
- paint
- gyprock
- timber framing
- structural aluminium and cladding
- insulation building materials
- waterproofing membranes
- polyurethane coatings
- sarking
- compressed fibre cement sheeting
- bitumen/asphalt
- Polyethylene (PE) pipe
- Poly Vinyl Chloride (PVC) pipe.
- copper pipe
- PE liner for ponds
- fibre glass
- plastic (pipe and civil construction)
- geo textile
- glass (buildings)
- timber (formwork)
- paint for corrosions protection (chemical bunds and buildings)
- mech install will depend on equipment selected
- brick and block
- cementitious mortar
- epoxy mortar
- epoxy coating and lining material
- solvent cements, glue, epoxy, polyester resin
- mastics, sealants
- nuts, bolts, screws, fastening hardware, nails
- rubber sheeting, isolators, gaskets.

4.10.3 Excess spoil

The AWRC site will require the removal of spoil that is unsuitable as a foundation for construction. Topsoil material will be temporarily stockpiled on the AWRC site for later use in landscaping. As spoil from these areas is removed, they will be filled with imported engineered fill that is suitable for construction.

Where spoil quality is suitable and timeframes align, Sydney Water proposes to use excess spoil from pipeline construction at the AWRC site. Estimates indicate the project will generate about 181,000 m^3 of excess spoil that cannot be reused on site. Excavated materials will be transported to project construction compounds for storage and ultimately reused or disposed. Storage of excess spoil at compounds will be in accordance with the indicative compound duration outlined in Table 4-15, however extended presence may be required if there are any delays in available disposal locations. Section 12.2 of the EIS provides further details on waste and excess spoil.

4.10.4 Construction schedule and hours

Where reasonable and feasible, construction will be carried out during standard working hours as defined by the Interim Construction Noise Guidelines (DECC, 2009a) and presented in Table 4-15. Due to the size and duration of the project, out of hours work will be required for certain project locations and activities. These include:

- delivery of oversized plant or structures that police or other authorities determine to require special arrangements to transport along public roads
- trenched pipeline construction along busy roads, such as along the brine pipeline alignment, to minimise traffic impacts
- works that cannot be completed within the standard respite periods for engineering reasons. This includes large trenchless pipeline construction sections such as tunnelling for the environmental flows pipeline which might require 24 hours drilling for three to six months.

The exact locations and duration of out of hours work will be determined during the construction planning phase of the project when a construction contractor has been engaged. Communities will be notified of any out of hours works in line with the Interim Construction Noise Guidelines and as outlined in the project's Community and Stakeholder Engagement Plan.

Table 4-15 Indicative construction hours for the project

Period	Days and hours	
Standard hours	Day	Monday to Friday – 7 am to 6 pm Saturdays – 8 am to 1 pm
OOHW Period 1	Day	Sundays and public holidays – 8 am to 6 pm Saturday – 7am to 8am and 1 pm to 6 pm
	Evening	Monday to Saturday – 6 pm to 10 pm
OOHW Period 2	Evening	Sunday and public holidays – 6 pm to 10 pm
	Night	Sundays and public holidays – 12 am to 8 am and 10 pm to 12 pm

4.10.5 Construction traffic and access

Most impacts associated with traffic and access will be during the construction phase of the project. Construction traffic related to the project will be generated by activities including:

- worker crews - crews undertaking tunnelling and open trenching along the pipeline alignment
- light vehicles accessing site compounds, including the AWRC construction site

- heavy vehicles accessing site compounds, including the AWRC construction site, construction materials and equipment deliveries and removing waste.

Table 4-16 provides the estimated peak traffic movements for light vehicles and heavy vehicles during construction. Section 11.4 provides further details on traffic impacts and management.

Table 4-16 Indicative construction traffic generated by the project

Segment	Location	Estimated peak daily vehicle movements within standard construction hours	Estimated peak daily vehicle movements outside standard construction hours
1	Warragamba River to Northern Road	180 light vehicles 33 heavy vehicles	75 light vehicles 26 heavy vehicles
2	Northern Road to AWRC	400 light vehicles 302 heavy vehicles	30 light vehicles 0 heavy vehicles
3	AWRC to M7 Motorway	40 light vehicles 1 heavy vehicle	10 light vehicles 0 heavy vehicle
4	M7 Motorway to Joseph St, Cabramatta West	140 light vehicles 51 heavy vehicles	40 light vehicles 50 heavy vehicles
5	Joseph St, Cabramatta West to Lansdowne Reserve, Lansdowne	115 light vehicles 29 heavy vehicles	70 light vehicles 25 heavy vehicles

Construction access for the AWRC will be via a new access road off Clifton Avenue, Kemps Creek. This access road will be built before construction of the AWRC and has not been included in the scope of works assessed by the EIS. Sydney Water has completed a separate environmental impact assessment for this access road.

The pipelines will generally be built along existing roads, mostly in the road or road verge. Construction access for the pipelines will be via existing roads. In some instances, such as along Elizabeth Drive, temporary access will be needed to access the pipeline construction areas. These temporary access tracks are included in the project's impact area and shown on Figure 4 17. All temporary access tracks will be restored to pre-construction condition at the completion of works.

Most truck movements during construction of the AWRC will occur in the first 18 months. This will be associated with the removal and importing of spoil. For pipeline construction, the number of daily truck movements is likely to be consistent for most of the pipeline construction.

4.11 Commissioning and decommissioning

Commissioning is the process of managing all activities required to verify and document the compliance, performance, functionality and transitioning to operation of new assets. All assets will need to pass several tests and checks before being integrated into Sydney Water's operational network. Commissioning is an important step that ensures the assets will function and perform in an adequate manner and avoid potential environmental issues after they become operational.

Commissioning is required for all project components, including AWRC treatment process trains, pump stations, electrical, control elements and pipelines. The activities will ensure the components can perform their required function, in some cases by using drinking water in place of the final process fluid. Once the pre-commissioning tests have passed with drinking water, wastewater will be introduced to complete process commissioning and transition into operation.

The activities involved in commissioning include:

- pressure testing
- factory testing of mechanical and electrical components
- mechanical and electrical installation testing
- control functionality check
- wet commissioning,
- process and operational testing,
- performance and acceptance testing
- process proving
- training.

Commissioning and testing activities will occur throughout construction, as sections of pipelines and components of the AWRC are installed. Drinking water from the nearby drinking water network will be used for certain aspects of wet commissioning. This water will be treated before release into the environment.

Once the pipelines and the AWRC have been commissioned, there will likely be a proving period as the operational arrangement of the treatment processes is optimised in response to the quality of the incoming wastewater. During this interim period, treated water and brine quality is likely to be variable which will require flexibility in the Environment Protection Licence water quality release limits.

The AWRC and pipelines are unlikely to be decommissioned, as this is not Sydney Water's usual practice for this type of infrastructure. Instead, infrastructure will be repaired and upgraded throughout its design life to maintain its operation. However, as the AWRC undergoes future stages of upgrade, the ground mounted solar will likely be decommissioned to make room for additional wastewater treatment infrastructure. There may be opportunities to reuse the ground mounted solar as roof mounted solar.

4.12 Project timing

The construction phase of the project is planned to start in mid-2022 and take about 36 months to complete. The exact timing of construction and operation of the project is linked to growth projections and forecasts in the servicing area. If these projections change, this may result in changes to the timing and staging of construction and operation of the AWRC.

The staging of construction will be determined once construction contractors have been engaged. It is likely that construction activities will occur concurrently across the entire footprint, with some components, such as the AWRC, having longer construction periods then other project components. Pipeline construction is likely to be staggered across the project alignment.

Figure 2-2 shows proposed timing of key project phases.

4.13 Project flexibility for Stage 1

This EIS has been prepared based on a reference design, described throughout this chapter. The reference design was prepared throughout the planning phase of the project and will be further developed after appointment of a construction contractor or contractors after the contract is awarded.

Sydney Water's general principle for flexibility is that changes to design, construction and operation will be consistent with or better than the environmental impact, environmental performance outcomes and management measures described in this EIS. The following sections summarise more specific elements of flexibility.

4.13.1 Design and operation

Table 4-17 outlines the key elements of flexibility Sydney Water proposes during design and operation.

Table 4-17 Flexibility during design and operation of the project

Flexibility proposed	How Sydney Water will confirm approach
Treatment technology or equipment at the AWRC site, provided it meets the treated water quality specified in the EIS and has no additional noise or air quality impacts on sensitive receivers.	During detailed design
Location, layout, structure sizes and number of units of the AWRC and its ancillary infrastructure within the operational area shown in Figure 4-1 provided it has no additional noise or air quality impacts on sensitive receivers.	During detailed design

Flexibility proposed	How Sydney Water will confirm approach
Location and design of retention and detention basins provided they can achieve the nominated water quality objectives and are above the 1% AED flood level.	During detailed design
Urban design and landscaping at the AWRC site provided it aligns with the principles described in section 4.4.1.	During detailed design for urban design. During landscaping design in construction phase.
Location and design of the release infrastructure to South Creek provided it is within the construction area shown in Figure 4-16.	During detailed design
Location and size of pipelines provided they are located within the impact assessment area described in section 4.8.2 and shown in Figure 4-17.	During detailed design
Location of environmental flows pipeline provided it meets the following principles: • No changes to construction methodology, i.e. sections currently proposed to be tunnelled. • No additional environmental impact, including no additional vegetation removal. • Release location will be located at Warragamba River downstream of the dam wall within the identified impact assessment area. • The eastern drill site is located along Bents Basin Road between current location and Silverdale Road. This flexibility is needed due to potential geotechnical constraints along the alignment, which may result in the need to change tunnelling alignment.	During detailed design and construction planning
Operating regime (including proportion of releases) from the environmental flows pipeline and treated water pipeline to balance operability and align with NSW Government environmental flows regime, in consultation with DPIE Water.	During detailed design
Location of ancillary infrastructure on pipelines provided that are located within the impact assessment areas described in section 4.8.2 and shown in Figure 4-17.	During detailed design

Flexibility proposed	How Sydney Water will confirm approach
Proportion of renewable energy generated between solar and co-generation	During detailed design
Flexibility in treated water quality during commissioning and early stages of operation.	During commissioning planning in construction phase
Assessment of low impact activities to be completed prior to the approval of the project CEMP.	During detailed design
Providing recreational access to the green space area on the AWRC site.	Timing and whether this proceeds depends on ongoing consultation and agreement with DPIE on Cumberland Plain Conservation Plan and South Creek Corridor Strategy.

4.13.2 Construction

Table 4-18 outlines the key elements of flexibility Sydney Water proposes during construction.

Table 4-18 Flexibility during construction of the project

Flexibility proposed	How Sydney Water will confirm approach
Construction compound locations and layout within the impact assessment area	During detailed design and construction planning
Construction compound locations outside the impact assessment area, provided they meet the following principles as assessed by the project's Environmental Representative: • do not increase total number of compounds described in section 4.9.4 • do not increase traffic movements • landowner agrees to use of site for compound • no nearby sensitive receivers • no disruption to property access • no impact to known items of non-Aboriginal and Aboriginal heritage • outside high-risk areas for Aboriginal heritage • use existing cleared areas • no impacts to remnant native vegetation or key habitat features • no disturbance to waterways	During detailed design, prior to and during construction

Flexibility proposed	How Sydney Water will confirm approach
• no disturbance of contaminated land.	
Access tracks to pipelines, where the pipeline is not located in a road or road verge and the alignment follows areas disturbed by other projects such as the M12 Motorway and Elizabeth Drive widening, or other existing access tracks.	During detailed design, prior to and during construction
Timing for construction and installation for some Stage 1 components. It is likely that the incoming flows at the start of operation will be below the Stage 1 capacity of the AWRC, and flexibility is proposed to delay the installation of some treatment equipment beyond the 36-month construction timeframe.	During detailed design, prior to and during construction and operation
Pipeline construction methodology if it can be demonstrated it has equivalent or reduced environmental and community impact (for example, changing from open trenching to tunnelling methods).	During detailed design, prior to and during construction
Location of construction activities provided they are in the impact area or impact assessment area, as described in section 4.8.2, and have equivalent or reduced environmental and community impact	During detailed design, prior to and during construction
Locations and timings in which out of hours works are required, provided it can be assessed within the CEMP and supporting management plans during detailed design and construction planning.	During detailed design, prior to and during construction
Release location of water from AWRC and pipeline commissioning provided it has been tested, treated and demonstrated not to result in an adverse impact on the environment. Options for release include, but are not limited to, South Creek, local stormwater network, local wastewater network and overland flow.	During detailed design, during construction and commissioning

4.13.3 Staging

Table 4-19 outlines the key elements of flexibility Sydney Water proposes regarding staging of the project.

Table 4-19 Flexibility relating to staging of the project

Flexibility proposed	How Sydney Water will confirm approach
Size of Stage 1 and future stages of the AWRC, provided Stage 1 is 50 ML/day or less and future stages do not exceed 100 ML/day.	During detailed design and operation
Incremental operating capacity of Stage 1. Sydney Water may operate Stage 1 at a lower capacity than what is built, depending on the growth and incoming wastewater flows in the servicing area. This means installation of treatment equipment at the AWRC may be staged beyond the construction timeframe outlined in the EIS.	During detailed design and operation
Timing of delivery of the environmental flows pipeline to build it later than other Stage 1 components and/or to align with NSW Government decisions on whether it is required as outlined in section 3.5.1.	During detailed design and operation

4.14 Project exclusions

This section outlines what components are not part of the project (including concept proposal and Stage 1) and therefore excluded from this project description and the application the subject of this EIS.

4.14.1 Wastewater collection network

A wastewater collection network will be required to transfer wastewater from residences and businesses to the AWRC for treatment. Sydney Water has started planning for this network but it is excluded from the project scope because it will likely be built progressively to integrate with future precinct planning and align with development. This means exact locations and timing are not yet known and this network will be subject to separate planning approvals.

4.14.2 Recycled water schemes

The AWRC will produce treated water that is suitable for a range of recycled water uses. However, recycled water schemes, associated additional facilities on the site (in addition to those described in section 4.4.1), and associated supply pipeline infrastructure are excluded from the project scope. This is because there is uncertainty about recycled water demands in terms of location, quantity and timing. There is also uncertainty about the commercial arrangements for delivering recycled water schemes. Section 3.5.1 provides more detail about how Sydney Water is progressing recycled water schemes.

Having clarity now of future recycled water schemes would not remove the need for waterway releases proposed in the project. Even if recycled schemes were in place, demand varies (for example, it is typically lower over winter). Sydney Water must maintain the ability to manage excess recycled water when supply exceeds demand, or if a recycled water scheme stops for any period.

4.14.3 Additional resource recovery

As the full biosolids digestion capacity of Stage 1 of the AWRC will not be required when it is first built, Sydney Water may consider opportunities to temporarily accept other wastes for co-digestion to produce energy. Sydney Water aspires to build a separate resource recovery plant at the AWRC to become a circular economy hub and co-digest waste to generate energy as outlined in more detail in section 3.5.2. Both these elements are excluded from the scope of this project and will be subject to further investigations and separate planning approval.

4.14.4 Access, utility connections and other infrastructure

The site will require connection of utilities such as electricity and water. These are outside the scope of this project and will be delivered under separate planning approvals. An infrastructure management plan has been provided in section 13.2 which provides further details on the utility connections and impacts of the project.

An access route to the AWRC site is required from Elizabeth Drive including an access road from Clifton Avenue. Upgrade of the Clifton Avenue/Elizabeth Drive intersection is also proposed. These road works are outside the scope of this project and will be delivered by Sydney Water under separate planning approvals.

4.14.5 Property management

Sydney Water may need to carry out a range of property management activities on the AWRC site before the project is approved and during operation. These are excluded from the project scope and will be subject to separate planning approvals if needed. These include:

- relocating/adjusting utility connections
- vegetation management
- vermin/animal control
- site drainage management
- establishing site security
- demolition works
- land remediation activities
- use of surplus land on the AWRC site for other activities.

4.14.6 Minor works and maintenance

Sydney Water proposes that after Stage 1 is built and operational, any maintenance, replacement and repair of that infrastructure, or any minor works or upgrades will be out of scope of the project and assessed as exempt development or in separate planning approvals if needed. Similarly, any activities or works that improve environmental performance or have neutral environmental impact are excluded from the project scope.

4.14.7 Integration with interim servicing arrangements

Development and associated wastewater demand will commence before the AWRC opens in 2025. Interim servicing is required to address this demand but is outside the scope of the project.

Sydney Water is currently planning or delivering several interim servicing projects, including:

- transfer to West Camden Water Recycling Plant (WRP). For parts of the SWGA, wastewater is already transferred to West Camden WRP. Additional projects are underway for servicing the Lowes Creek and Kemps Creek precincts with additional infrastructure, including interim pumping stations to transfer flows from the precincts to West Camden WRP for up to five years
- transfer to Liverpool WRP. For parts of the SWGA wastewater is already transferred to Liverpool WRP, including Leppington and Leppington North. Additional infrastructure, including interim pumping stations, will be constructed to continue to support growth in this area, until the AWRC is operational. In the WSAGA, Sydney Water is also investigating options for the transfer of wastewater from Badgerys Creek, Western Sydney International Airport and Aerotropolis Core to Liverpool WRP until the AWRC is operational
- transfer to St Marys WRP. In the WSAGA, servicing of the Mamre Road precinct is already underway. The eastern catchment of the precinct will be permanently serviced by the St Marys wastewater network and WRP with infrastructure to be delivered by a developer rather than Sydney Water. Concept design is currently underway for interim servicing of the western and northern catchments by St Marys WRP until the AWRC is operational
- additional servicing for WSAGA. Sydney Water is currently discussing additional interim servicing with developers. Potential options include tankers, decentralised water recycling plants and temporary pumping stations.

The process of transitioning from interim servicing arrangements to permanent servicing in the Upper South Creek Servicing Area will need to be managed progressively for each precinct and treatment plant.