Review of Environmental Factors

Prospect South to Macarthur Distribution System Link (December 2019)













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Determination

This Review of Environmental Factors (REF) assesses potential environmental impacts of Drought Response: Prospect South to Macarthur Distribution System Link and was prepared under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water both the proponent and determining authority. The State Environmental Planning Policy (Infrastructure) 2007 allows the proposal to be carried out without development consent. The proposal has also been considered against the matters listed in clause 228 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) (Appendix A).

During construction, the main potential environmental impacts of the proposal are typical construction impacts such as vegetation clearing, traffic, noise, Aboriginal heritage and erosion and sedimentation. During operation, the main impacts are associated with noise and visual impact. The assessment shows that if we adopt the measures identified in this REF, the proposal would not have a significant environmental impact. Accordingly, we do not require an Environmental Impact Statement (EIS).

The Sydney Water Project Manager will make sure the proposal is carried out as described in this REF. If the scope of work or work methods described in this REF change significantly following determination, additional environmental impact assessment may be required.

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1 Executive summary

Sydney Water proposes to construct the Prospect South to Macarthur distribution system link. The link will supply drinking water to the Western Sydney Aerotropolis Growth Area (WSAGA) and the South West Growth Area (SWGA) to meet the demand for drinking water due to urban growth. Additionally, the proposal has been identified as a drought response option to transfer water between delivery systems. This will provide greater flexibility to balance the demand on the bulk water sources that supply the Prospect South and Macarthur systems and as a result, reduce the drought related supply risk to customers within these systems. The proposal will use new and existing infrastructure to transfer around 120 million litres (ML) per day. The proposal will deliver around 35km of additional pipework, three new water pumping stations, upgrades to two pumping stations, 100ML of additional reservoir capacity and upgrades at Macarthur Water Filtration Plant.

Construction is expected to start in mid-2020 and take approximately 18 months, with early works commencing in the first quarter 2020. Pipelines will mostly be constructed in road corridors and generally using open trenching. However, pipelines will also be constructed in Western Sydney Parklands, Mount Annan Botanic Gardens, developer land and some privately opened small lots. Trenchless technology will be used to cross some creek lines and major roads. Construction of reservoirs at Oran Park will require extensive earthworks and installation of piles to retain the hill. Pumping station construction and upgrade work will follow standard Sydney Water construction methods.

Sydney Water consulted with key stakeholders including Western Sydney Parklands, Mount Annan Botanic Gardens, WaterNSW, Roads and Maritime Services, Sydney Trains, Liverpool Council, Campbelltown Council and Camden Council. No major issues were identified during consultation.

The main construction environmental impacts associated with the proposal are vegetation clearing, Aboriginal heritage, traffic, noise, dust, erosion and sedimentation. Around 4.8 ha of vegetation offsets will be required for clearing of existing native vegetation in the South West Growth Centre. An Aboriginal Heritage Impact Permit will be required for impact to 12 Aboriginal heritage sites. Construction will occur within the curtilage of three State Heritage listed items. However, no more than minor impact is expected and two s57(2) exemptions and one s60 permit will be obtained. Operational impacts include visual impact of the proposed Oran Park reservoirs and potentially operational noise at new and upgraded pumping stations. Further noise assessment is required during detailed design to ensure that operational noise impacts are minimised at sensitive residential receivers.

A Construction Environmental Management Plan, including a Soil and Water Management Plan, Waste Management Plan and Traffic Control Plan will be prepared by the delivery contractor to mitigate potential environmental impacts.

The proposal will result in positive long-term environmental improvements by servicing future growth and reducing drought related supply risks to customers in the Prospect South and Macarthur systems, aligned with the principles of ecologically sustainable development.



2 Introduction

2.1 Context

We provide water, wastewater, recycled water and some stormwater services to almost five million people. We operate under the Sydney Water Act 1994 and have three equal objectives to: protect public health, protect the environment and be a successful business.

We are a statutory State-owned corporation and are classified as a public authority, and a determining authority for the proposed work under Division 5.1 of the EP&A Act. This REF assesses the potential environmental impacts associated with Prospect South to Macarthur distribution system link and identifies safeguards that avoid or minimise potential impacts.

2.2 Proposal background and need

The Prospect South to Macarthur link will supply drinking water to the Western Sydney Aerotropolis Growth Area (WSAGA) and the South West Growth Area (SWGA) to meet the demand for drinking water due to urban growth (**Figure 2-1**). The link is required to service growth and will also provide reliability and resilience by providing a bidirectional link between the Prospect South and Macarthur Delivery Systems.

Additionally, the proposal has been identified as a drought response option to transfer water between delivery systems. The drought driver will bring forward growth related trunk infrastructure as well as some additional infrastructure that is required for the purpose of drought response. This will provide greater flexibility to balance the demand on the bulk water sources that supply the Prospect South and Macarthur systems and as a result, reduce the drought related supply risk to customers within these systems.

The proposal will use existing infrastructure and align existing projects currently in design to transfer around 120 million litres (ML) per day. The proposal will deliver around 35 km of additional pipework, three new water pumping stations, upgrades to two pumping stations, 100ML of additional reservoir capacity and upgrades at Macarthur Water Filtration Plant and associated infrastructure.

The proposal consists of:

- Pipelines, approximate lengths:
 - o DN1200 4km
 - o DN1050 6km
 - o DN900 7km
 - o DN750 7km





- o DN600 5.5km
- o DN450 5.5km
- Two new reservoirs at Oran Park (WS0477 and WS0478)
- New pumping stations at Lowes Creek (WP0432), Harrington Park (WP0414), Carnes Hill (WP0434)
- Upgrades to existing pumping stations at Prospect (WP0184A), Sugarloaf Valves (WP0185)
- Water chlorination facilities at Oran Park Reservoir, Narellan South Reservoir (WS0301), Sugarloaf Valves and Campbelltown South Reservoir (WS0180)
- Upgrades to Macarthur Water Filtration Plant (WFP) (WT0046)
- Other associated infrastructure, such as pressure release valves, pipework modifications at existing assets.







Figure 2-1 Regional context of the proposal



2.2.1 Proposal need

Growth

The Prospect South and Macarthur water supply system areas are forecast to experience significant residential growth over the next 30+ years, mainly due to the release of greenfield developments in the South West Growth Area (SWGA) and Western Sydney Aerotropolis Growth Area (WSAGA). The Federal Government has committed delivery of the new Western Sydney Airport in 2026 and this is expected to be the catalyst for rezoning within the WSAGA. The majority of land in the SWGA has been rezoned or released for urban development. The forecasted growth will impact the performance of the existing system, resulting in capacity issues.

The forecast growth data in the Macarthur Water Delivery System (WDS) and the Prospect South WDS is provided in **Table 2-1**.

Delivery system	Forecast growth
Macarthur	80,000 dwellings;
	34,000 jobs
Prospect South	40,000 dwellings;
	95,000 jobs
Total	120,000 dwellings
	129,000 jobs

Table 2-1 Forecast growth

Drought

The proposal aims to minimise drought affects, reduce reactive emergency capital investment on infrastructure and improve system resilience. The proposal is needed to protect bulk water storages and water filtration plants from running out of water. The Prospect South to Macarthur link will reduce the drought effects on customers within the Macarthur, Prospect South and Illawarra drinking water systems by enabling more robust and flexible balancing between the bulk water sources that supply these systems. The proposal relieves the Metro Dam systems (specifically Nepean and Avon Dams).

The Prospect South WDS will support the Macarthur WDS via the proposed bi-directional transfer link under certain water restriction conditions. The transfer from Prospect South will supply the entire Macarthur WDS, reducing the drawdown on the southern metropolitan dams (i.e. prolonging storage in Avon dam and the Nepean system). Reducing the rate of drawdown will allow Avon dam to focus on supplying the Illawarra region over a longer period.

The reverse transfer (bi-directional) requirement from Macarthur WDS to Prospect South WDS represents a similar support function to Prospect WFP, reducing the drawdown on the Metropolitan





Dams (i.e. prolonging storage in Warragamba Dam). The reverse transfer will be required if the southern metropolitan dams are less affected by drought than Warragamba Dam.

2.2.2 Proposal objectives

The proposal objectives are to:

- meets the demands for growth in Sydney's south west,
- increase resilience in Sydney's drinking water system,
- make the most of water we have.

2.2.3 Consideration of options/alternatives

The Prospect South to Macarthur link was divided into three fronts, Western Front, Eastern Front and Northern Front; based on their location within the system. Each front was divided into sections, with a number of options identified for each section. The Western Front comprised five sections (W1 to W5) (**Table 2-2**) and represents the primary alignment for the transfer link. In support of this, the Eastern Front comprised of two sections (E1 and E2) and the Northern Front a single section (N1) (**Table 2-3**). Due to the change in system configuration the Macarthur WFP will also require upgrades and is included in W5.

Table 2-2 Western Front sections

Section ID	Description
W1	Prospect WFP (WT0015) to Cecil Park Reservoir (WS165 and WS0336)
W2	Cecil Park Reservoir to Oran Park Reservoir
W3	Oran Park Reservoir to Narellan South Reservoir (WS301)
W4	Narellan South Reservoir to Campbelltown South Reservoir
W5	Sugarloaf Valves to Appin Reservoir (WS0412) via Macarthur WFP

Table 2-3 Eastern Front and Northern Front sections

Section ID	Description
E1	Prospect to Mt Pritchard Reservoir (WS0179), via Bossley Bush Main
E2	Carnes Hill Reservoir to either of Raby (WS0100), Leppington (WS0315) or Ingleburn (WS0257) Reservoirs
N1	Minchinbury Reservoir (WS0269) to Cecil Park Reservoir





Options were considered for each section (**Table 2-4**). There are several mandatory and desirable criteria that were incorporated into the options assessment. These criteria are:

- option can be delivered in two years from 2019 this is a key fatal flaw criterion
- high risks can be adequately controlled. Key risks are:
 - o adaptability/flexibility
 - o construction risk
 - o resilience and reliability
 - o land acquisition/community impact
 - o operation and maintenance
 - o environmental constraints
 - o geotechnical constraints
 - o contamination constraints.

The options were subject to a fatal flaw analysis to determine the risk level of each option. Options were subject to further detailed technical, environmental, stakeholder and community related investigations, including the development of lifecycle costing and a non-cost assessment to identify the preferred option. Options with unacceptable risk and/or high capital costs were eliminated (**Table 2-4**).

Section	Option	Description	Fatal flaw/high risk	Short-listed
W1	W1a	WP0184A to Cecil Park Reservoir via Liverpool Reservoir. Use existing DN1350 pipeline	 using existing pipelines minimises environmental and community risk 	\checkmark
	W1b	WP0184A to Cecil Park Reservoir via Liverpool Reservoir. New pipeline on Cowpasture Road	high capital costdelivery time-frame riskhigh impact to Cowpasture Rd.	×
	W1c	WP0184A to Cecil Park Reservoir via Liverpool Reservoir. New pipeline through Western Sydney Parklands	impact to National Parkdelivery time-frame riskhydraulically not feasible	×
	W1d	WP0184A to Cecil Park Reservoir	 not required for 2026 drought response 	×

Table 2-4 Options assessment



Section	Option	Description	Fatal flaw/high risk	Short-listed
W2	W1a	Cecil Park Reservoir to Oran Park Reservoir. New pipeline via Badgerys Creek Road	Badgerys Creek Road congestedprivate property impact	×
	W2b	Cecil Park Reservoir to Oran Park Reservoir. New pipeline via Ramsay and Jersey Road	 avoids congested roads pipelines mainly located in road corridors, minimising environmental impacts 	✓
	W2c	Cecil Park Reservoir to Oran Park Reservoir. New dual pipelines via Badgerys Creek, Ramsay Road and Jersey Road	Badgerys Creek Road congestedprivate property impact	×
	W2d	Cecil Park Reservoir to Oran Park Reservoir. New pipeline via Upper Canal	 impact to State Heritage listed Upper Canal System work within WaterNSW Special Area 	×
W3		Oran Park Reservoir to Narellan South Reservoir. Use existing pipelines	 using existing pipelines minimises environmental and community impacts reservoir construction on certified land 	✓
W4		Narellan South Reservoir to Campbelltown South Reservoir. New pipeline	 new inlet main at Narellan South Reservoir aligns with servicing of future residential growth provides operational flexibility 	✓
W5	W5a	Narellan South Reservoir to Appin Reservoir via Macarthur BOO main. Use existing pipelines	 using existing pipelines minimises environmental and community impacts majority of work confined to Sydney Water operational land 	✓
	W5b	Rosemeadow Reservoir to Appin Reservoir. New pipeline along Appin Road	high capital costpoor economy of scale	×

0



Section	Option	Description	Fatal flaw/high risk	Short-lis
			 potential significant impact on threatened ecological communities and koala habitat delivery time-frame risk 	
E1		Prospect Gravity Main to Mt Pritchard Reservoir via Bossley Bush Main. New pipeline	 delivery time-frame risk community impact	×
E2	E2a	Carnes Hill Reservoir to Ingleburn/Minto Reservoirs. New pipeline	 delivery time-frame risk community impact longer route with constructability challenges 	x
	E2b	Cares Hill Reservoir to Leppington Reservoir. New pipeline	delivery time-frame riskconstructability challenges	×
	E2c	Cares Hill Reservoir to Raby Reservoir. New pipeline	likely to meet time-frameeasier constructability	✓
N1		Minchinbury Reservoir to Cecil Park Reservoir. New pipeline	delivery time-frame risk	×



The preferred option is (Figure 2-2 and Figure 2-3):

Table 2-5 Preferred option

Proposal section	Description
W1	use existing pipelines
	 install pressure reducing valves (PRVs) on main offtakes
	upgrade WP0184A
W2	 around 20km of new pipelines between Cecil Park Reservoir and Oran Park Reservoir
	chlorine dosing facilities at Cecil Park Reservoir
	 new pumping station at Lowes Creek (WP0432)
W3	use existing pipelines
	 two new reservoirs at Oran Park and inlet pipelines
	chlorine dosing facilities at Oran Park Reservoir
	 new pumping station at Harrington Park (WP0414)
W4	 around 3km of new pipelines between Narellan South Reservoir and Sugarloaf Valves
	chlorine dosing facilities at Narellan South Reservoir
	chlorine dosing facilities at WP0185
	chlorine dosing facilities at Campbelltown South Reservoir
	• upgrade WP0185
W5	pipework and cross connections at Macarthur WFP
E2	 around 7km of new pipelines between Carnes Hill Reservoir and Raby Reservoir

new pumping station at Carnes Hill Reservoir









Figure 2-2 Preferred option – W1, W2, W3 and E2







Figure 2-3 Preferred option – W4 and W5



2.3 Consideration of Ecologically Sustainable Development

The proposal has been considered against the principles of ecologically sustainable development (ESD) (Table 2-6)

Table 2-6 Consideration of principles of ecologically sustainable development (ESD)

Principle	Consideration in proposal
Precautionary principle - <i>if there are threats of</i> <i>serious or irreversible environmental damage,</i> <i>lack of scientific uncertainty should not be a</i> <i>reason for postponing measures to prevent</i> <i>environmental degradation. Public and private</i> <i>decisions should be guided by careful evaluation</i> <i>to avoid serious or irreversible damage to the</i> <i>environment where practicable, and an</i> <i>assessment of the risk-weighted consequences of</i> <i>various options.</i>	The proposal will not result in serious or irreversible environmental damage and there is no scientific uncertainty relating to the proposal. The proposal is designed to locate pipes in disturbed road corridors where possible and to use existing infrastructure to minimise environmental impact.
Inter-generational equity - the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations. Conservation of biological diversity and ecological integrity - conservation of the biological diversity and ecological integrity should	The proposal will help to meet the needs of future generations by providing a reliable water service. The proposal will meet the needs of future growth, improve system resilience and alleviate drought affects by protecting bulk water storages. The proposal will not significantly impact on biological diversity or impact ecological integrity. The proposal will require clearing of native
be a fundamental consideration in environmental planning and decision-making processes.	vegetation. However, the proposal was designed to minimise clearing by using existing assets where possible and constructing pipelines along road corridors.
Improved valuation, pricing and incentive mechanisms - environmental factors should be included in the valuation of assets and services, such as 'polluter pays', the users of goods and services should pay prices based on the full life cycle costs (including use of natural resources and ultimate disposal of waste) and environmental goals	The proposal will provide cost effective use of resources and provide optimum outcomes for the community, environment and with respect to financial cost. All options were subject to a lifecycle cost analysis.





3 Proposal Description

3.1 Proposal details

3.1.1 Land ownership and location

The proposal is located on Sydney Water land, private land and in Roads and Maritime Services (RMS) and council road corridors. These lands include:

- Western Sydney Parklands
- Private property including:
 - o Greenfields Development Corporation (GDC)
 - o Bouyan holdings Limited (BHL)
 - o Harrington Park
 - o Ten small lots
- Mt Annan Botanic Gardens
- Sydney Water land:
 - WP0184A at Prospect
 - o Cecil Park Reservoir
 - WP0414 at Harrington Park
 - o Narellan South Reservoir
 - o WP0185 at Sugarloaf Valves, Menangle Park
 - o Campbelltown South Reservoir
 - o Macarthur WFP
 - o Carnes Hill Reservoir
 - o Raby Reservoir
- RMS road corridors
- Liverpool City Council road corridors
- Camden Council road corridors
- Campbelltown City Council road corridors.



3.1.2 Proposal description

W1 Prospect WFP to Cecil Park Reservoir

This section of the proposal will use existing pipelines. Pumping station WP0184A will be upgraded to increase capacity to pump water from Prospect to Cecil Park Reservoir via Liverpool Reservoir. The increased pressure in the pipelines will require pressure reducing valves (PRVs) on some offtakes from the main to maintain adequate water pressure for customers.

The upgrade to pumping station WP0184A will require (Figure 3-1):

- an additional pump and associated valves and manifolds,
- new high voltage switch room building with access gantry to existing building,
- two 12m high surge vessels and a compressor,
- retaining wall around the surge vessels
- new access road.

Seven PRVs will be installed on the offtakes of the existing pipeline. The PRVs will be located in the road verges of the following roads (**Figure 3-1** and **Figure 3-2**):

- Newton Road, Wetherill Park (2 PRVs)
- near McIlwraith Street, Wetherill Park
- The Horsley Drive, Bossley Park
- Quarry Road, Bossley Park
- Richard Street, Bossley Park
- Prairie Vale Road, Bossley Park.

W2 Cecil Park Reservoir to Oran Park

Around 20km of pipeline will be constructed from Cecil Park Reservoir to Oran Park (**Figure 3-3** to **Figure 3-10**):

- DN1200 4km
- DN1050 6km
- DN900 7km
- DN750 2.6km.

The northern part of this section is located in Western Sydney Parklands. Air and scour valves will be installed at various locations along the pipeline. Concrete bulkheads and encasement will be used to anchor the pipeline in areas of ground instability. An additional pipeline may be constructed under Kemps Creek. This pipeline could be used for future Sydney Water works and would minimise future environmental impacts. The inclusion of this pipeline is not expected to increase the direct impact area.





Trenchless construction will be used to minimise environmental and access impacts. This method will be used at South Creek, The Northern Road and potentially other locations such as culverts, ephemeral creeks and major access roads. The pipeline is likely to constructed at Kemps Creek using open trenching due to a geotechnical fault.

A new pumping station (WP0432) will be constructed at Lowes Creek. The main elements of the pumping station are:

- pumping station building
- three water pumps
- variable speed drives
- inlet and outlet piping, and associated valves
- high voltage (HV) switch room
- access road, turning bay and car parking
- security fence.

W3 Oran Park Reservoir to Narellan South Reservoir

This section of the proposal will use existing pipelines. Two new 24ML reservoirs will be constructed at Oran Park. Infrastructure at the site will include (**Figure 3-11**):

- two welded steel surface reservoirs with a height of 20m and around 40m in diameter
- inlet pipelines with associated valves
- tank scours and overflows
- chlorine dosing facilities including:
 - o controls and a generator in case of controls failure
 - o tanker unloading bund
 - o pad mounted transformer
- 7m wide access road and truck
- stormwater infrastructure including pits, gullies and pipes
- retaining structures around the reservoir tanks:
 - o secant pile wall to a depth of 6m within 10m of the reservoir tanks
 - o soldier pile wall to a depth of 7m around the edge of the site.

A new pumping station will be constructed at Harrington Park (WP0414). The pumping station will include (**Figure 3-13**):

- pumping station building
- two water pumps



- variable speed drives
- inlet and outlet piping, and associated valves
- HV switch room
- transformer
- access road, turning bay and car parking
- security fence.

W4 Narellan South Reservoir to Sugarloaf Valves

Around 4.5km of DN750 pipeline will be constructed (**Figure 3-14** and **Figure 3-15**). Air and scour valves will be installed at various locations along the pipelines. Existing crossings under the Southern Highlands rail line and the Hume Motorway will be used to install the pipeline. The new pipe will be pulled through the existing crossing and no trenching or underboring will be required.

The upgrade to pumping station WP0185 will include:

- four new pumps and associated valves and manifolds
- connecting pipework within the pumping station
- mechanical ventilation
- electrical works.

Chlorine dosing facilities will be constructed at Narellan South Reservoir, Sugarloaf Valves and Campbelltown South Reservoir, including:

- controls and a generator in case of controls failure
- tanker unloading bund
- pad mounted transformer.

W5 Macarthur Water Filtration Plant

Macarthur WFP treats water extracted from the Cataract River at Broughtons Pass. Treated water is supplied to Appin Reservoir and Campbelltown South Reservoir via WP0185. The proposal will require modifications to the WFP to allow operation of the new bi-directional link, including:

- controls at Broughtons Pass
- chlorine dosing facilities at the clear water tanks at the WFP
- pipework around the clear water tanks
- control valves to facilitate changed operation.

All work except for the new control equipment at Broughtons Pass will be contained within the existing footprint of the WFP.



E2 Carnes Hill to Raby

Around 5.5km of DN450 pipeline will be constructed (**Figure 3-16** and **Figure 3-17**). Air and scour valves will be installed at various locations along the pipelines. The proposed alignment follows road corridors. However, a shorter alignment through Western Sydney Parklands will be considered during detailed design. Both alignments are assessed as part of the proposal.

A new pumping station will be constructed at Carnes Hill Reservoir (WP0434). The pumping station will include (**Figure 3-16**):

- pumping station building
- three water pumps
- variable speed drives
- inlet and outlet piping, and associated valves
- two surge vessels
- HV switch room
- transformer
- access road, turning bay and car parking
- security fence.







Figure 3-1 W1 (Wetherill Park)







PRV





Figure 3-2 W1 (Bossley Park)







Figure 3-3 W2 (Western Sydney Parklands)







Figure 3-4 W2 (Elizabeth Drive)







Figure 3-5 W2 (Kemps Creek)







Figure 3-6 W2 (Cross St)







Figure 3-7 W2 (Western Road)







Figure 3-8 W2 (Ramsay Road)







Figure 3-9 W2 (South Creek)







Figure 3-10 W2 (Lowes Creek)







Figure 3-11 W3 (Oran Park reservoir)






Figure 3-12 W3 (Oran Park)







Figure 3-13 W3 (WP0414)







Figure 3-14 W4 (Narellan South Reservoir)







Figure 3-15 W4 (Sugarloaf Valves)







Figure 3-16 E2 (Carnes Hill Reservoir)







Figure 3-17 E2 (Raby Reservoir)



3.1.3 Site establishment and access tracks

Pipelines

The proposed drinking water assets have been designed to avoid areas of native vegetation wherever possible. Most of the pipelines will be located in road corridors. Where road corridors are narrow, trenching will be undertaken in the road verge or in the road.

Appropriate temporary access requirements (i.e. use of existing easements or access tracks) will be negotiated with property owners for the construction period. Should there be a need to develop additional access tracks or provide turning circles in order to transport plant and equipment to and from the works area during construction, previously cleared areas will be used where feasible. Such access tracks will be confirmed during construction planning and may be subject to additional environmental assessment and approvals. Access to Western Sydney Parklands will be in accordance with a vehicle access permit and access to Mount Annan Botanic Gardens will be in accordance with the botanic gardens requirements.

Access to the Brandon Quarry, Kemps Creek may be impacted by pipe construction. Consultation, traffic management and potentially nightworks will be required.

Impacts relating to traffic and access are outlined in Section 6.8. During construction, an increase in traffic will be generated by:

- construction site establishment activities, including establishment of site offices and storage areas
- movement of work crews to and from the construction site
- delivery of construction materials and removal of waste materials such as excess spoil.

Pumping stations

The existing pumping stations (WP0184A and WP0185) to be upgraded and the new pumping station (WP0434) at Carnes Hill Reservoir will be accessed via existing driveways to Sydney Water land. A new access for operational purposes will be constructed at WP0184A.

New driveways will be required for construction and operation at pumping stations WP0432 and WP0414. Access will be from The Northern Road at both stations.

Oran Park Reservoir

Construction and operational access will be designed to align with future development in the area, as far as possible. Two construction access tracks from The Northern Road will be established. The southern access will follow the inlet pipeline alignment and be retained for operation. The northern construction access will use an existing driveway on The Northern Road and be constructed across paddocks.





Other sites

Existing driveways will be used to access Narellan South Reservoir, Campbelltown South Reservoir and Macarthur WFP during construction.

3.1.4 Ancillary facilities (compounds)

Construction compounds will be required to house site sheds, construction amenities, equipment and materials laydown. The location of these will be chosen by the Delivery Contractor, in consultation with the landowners and approved by Sydney Water's Project Manager as described in the safeguards in Section 5.

At least two large compound sites are likely to be required. Sydney Water may lease private land to accommodate the compound sites. Topsoil will be removed and stored for site rehabilitation. Road base will be imported to the sites to provide a stable surface. Smaller compound sites and storage areas will be required throughout the proposal area. Potential locations are:

- Oran Park Reservoir
- Lowes Creek pumping station
- site near Glenlee Road, Menangle Park
- Liverpool Reservoir site.

The potential compound sites are included in the direct impact area of the proposal.

3.1.5 Scope of work

Investigations

Further investigations such as geotechnical, contamination and survey may be required during detailed design. Geotechnical and contamination investigations may include boreholes, test pits and monitoring wells.

Pipeline installation

The majority of the new water pipelines will be constructed using conventional open trenching, which allows for open access to pipelines during construction. The pipeline will generally be installed using 20-30 tonne excavators.

Trenching will be undertaken within a direct impact area of up to 20 m. The construction corridor width may be restricted in certain areas such as along road reserves to avoid private property impact.

Pipelines will generally be installed in a trench at a standard cover of 0.75 m and a width of up to 2 m.

Trenching

Construction activities associated with trenching will include:



- establish temporary site compounds at appropriate locations along the route of the pipeline
- install erosion and sediment control measures
- implement traffic management measures
- prepare site, including pavement, footpath and/or road surface and remove vegetation
- provide temporary access to properties where trench routes impact driveways
- excavate trenches, including stockpiling of spoil material on the upslope side of trenches, or at temporary site compounds
- shore and dewater trenches, depending upon trench depth and groundwater levels
- spread granular material such as sand or gravel along the bottom of the trench before pipe laying
- install the water pipeline
- backfill the trench with bedding material and excavated soil
- compact trench fill material and restoring areas disturbed by the construction works
- test and commission the pipeline.

Trenchless construction

Trenchless crossings will be required at major roads, environmentally sensitive areas including creeks and major culverts. This will include South Creek, Upper Canal System at two locations and roads such as Bringelly Road and Camden Valley Way. Crossing the Southern Highlands rail line at Menangle Park and the Hume Motorway will be done using existing infrastructure. The proposed trenchless pipeline construction is shown in **Table 3-1**. The pipeline through Kemps Creek is likely to be trenched due to a geotechnical fault and the risk of a frac-out during underboring. The pipeline through Lowes Creek is likely to be trenched due to the high level of disturbance to the creek.

Table 3-1 Proposed trenchless locations

Location	Approximate distance of trenchless section
Access to Sydney International Shooting Centre	50m
South Creek and Bringelly Road	200m
Unnamed creek at Watts Road	50m
New access road from The Northern Road to future residential development	100m



Location	Approximate distance of trenchless section
New access road from The Northern Road to future residential development	100m
Across the The Northern Road	85m
Upper Canal near Bringelly Road	95m
Bringelly Road	80m
Cowpasture Road	40m
Bonds Creek	50m
Cowpasture Road	40m
Camden Valley Way	50m
Bonds Creek	50m
Denham Court Road	105m
Upper Canal	100m
Denham Court Road	50m

Due to the large diameter of the pipes and the requirement to meet high pressure specifications, microtunnelling will be used for trenchless construction. The microtunnelling set up will include:

- launch and receiving pits
- tunnelling machine
- vacuum truck
- tools and equipment
- laydown area.

The direct impact area of the launch pit and associated equipment will be up to around 20 x 20 m. Environmental controls to protect existing vegetation and sediment run off controls will need to be in place prior to any works commencing on-site.

Activities associated with trenchless construction techniques include:

- removing road/footpath surfaces and clearing vegetation, as required
- civil works required to level and stabilise the site
- installing fencing and security measures





- establishing sites for the entry and exit pits. Pits are likely to be around 5-12 m long and around 4 m wide
- installing measures to manage drilling fluids and cuttings
- installing measures to manage groundwater, if required
- drilling the borehole, using bentonite-based drilling fluid to lubricate the drilling head and flush the drilled hole
- drill cuttings are removed and collected, then recycled at the drill launch site. The drill fluid recycling plant is self-contained and powered by an on-site generator
- removing spoil, cuttings and slurry and disposing excess spoil, cuttings and slurry that cannot be used in site restoration at a licensed facility
- inserting and commissioning the water pipelines and grouting the annulus if required
- restoring affected areas, including backfilling the bore shafts.

Pumping station construction

Pumping station construction will include:

- earthworks to establish required levels
- construct a concrete pad
- construct pumping station building
- install pumps
- install switch rooms
- install connecting inflow/outflow pipelines using open trenching
- electrical and mechanical fitout
- construct site access
- commissioning
- site restoration.

Chlorine dosing facilities construction

Chlorine dosing facilities construction will include:

- establish concrete pad
- construct building
- install tank
- install connecting pipes and valves to dose water mains and reservoirs as required
- electrical and mechanical fitout





- commissioning
- site restoration.

Reservoir construction

Construction of the reservoir tanks will include:

- vegetation clearing
- bulk excavation of soils to remove up to 10 m of soil from the top of the hill at Oran Park
- piling to construct:
 - o 6 m deep secant piles
 - o 7 m deep soldier piles
- construct reservoir footings
- planting vegetation to stabilise disturbed areas on the hill
- lay perimeter floor plates, weld floor plates
- erect shell rings by welding
- sand blast or similar to remove oxidised layers. Where possible the contractor will perform and maximise sandblasting off-site
- primer coat and painting
- install blade mixer
- install aluminium roof with chlorine dosing access
- construct stairwell
- install reservoir overflow pipes and scour
- install stormwater pipes and pits
- construct operational assess road
- site restoration.

Pressure reducing valves

Pressure reducing valves (PRVs) will be install in disturbed road corridors and construction will include:

- site levelling civil works.
- excavating the existing watermain and trenching works for the electrical conduits to the closest power pole
- concrete work including construction of a concrete chamber for the PRV and two new electrical pits



- installing the PRV and associated pipework
- installing electrical conduits
- connecting the PRV to the existing watermains.

Connection to existing system

Disruptions to water supply may be required at all works locations during the commissioning of the new drinking water infrastructure. Disruptions to water supply will need to be managed in accordance with a Flow Management Asset Isolation Plan to be prepared as set out in HSP 0070 Flow Isolation and/or Flow Management (FIFM).

3.1.6 Commissioning

Commissioning involves testing and running the new equipment to ensure the equipment is working correctly and integrated with existing plant and network operations. The exact commissioning steps depend on the type of the equipment, but typically include:

- reservoirs:
 - o disinfect tanks
 - o fill tanks for pressure testing
 - \circ $\,$ if leaks are found the tanks are dewatered and leaks repaired
- pumping stations
 - o disinfect pipes
 - o pressure test pipes
 - o acceptance testing on pumps
 - $\circ~$ if leaks are found the pipes are dewatered and leaks repaired.

3.1.7 Restoration

The work sites will be rehabilitated following construction in consultation with landowners. The Delivery Contractor's CEMP will detail site restoration works to be undertaken once construction works are finished. Site restoration activities will include:

- backfilling of trenches as soon as works are finished (in addition to at the end of each work day as required)
- dismantling of construction compounds, removal and disposal of waste material and removing construction signage
- restoration of road pavement surfaces and drainage where pipework is trenched into place
- compensatory planting in disturbed areas containing vegetation of a moderate to high condition that is not covered by the *Biodiversity Certification Order for Sydney Region Growth Centres 2006*. This planting will be located near areas where tree removal is





required. Native re-vegetation will be managed in accordance with SWEMS0025.11 and Sydney Water's *Biodiversity Offset Guide*

 planting vegetation at Oran Park Reservoirs to stabilise disturbed areas, including planting deep rooted plants.

The Delivery Contractor will maintain an appropriate photographic record of pre-construction site conditions for reference purposes during site restoration works and to verify/document that restoration activities have been completed satisfactorily.

3.1.8 Materials and equipment

Equipment required will include:

- 20-30 tonne excavators
- piling rigs
- front end loaders
- delivery trucks
- compactors
- microtunnelling machines
- vacuum trucks
- water recycling plants
- concrete trucks
- concrete pumps
- rock breakers
- generators
- skip bins.

Materials required for pipeline construction:

- water pipes (indicative pipe materials):
 - o ductile iron pipes
 - o steel pipes
 - o polyethylene pipes
- valves and other fixtures
- concrete for encasements.
- granular materials for pipe embedment.
- reused excavated materials for pipe trench fill.



Materials required for pumping stations include:

- reinforced concrete
- fill
- steel works: covers, ladder, step irons, electrical kiosk / cabinet
- pumps
- chlorine storage tank typically made of polyethylene or fiberglass.

Materials required for reservoir construction include:

- concrete
- carbon steel (reservoir floor, shell and columns)
- aluminium sheeting (reservoir roof)
- primer and paints
- electrical switches, lines and cathodic protectors.

3.1.9 Work hours

Work and deliveries will be scheduled to occur during standard daytime hours:

- 7am to 6pm, Monday to Friday
- 8am to 1pm, Saturdays

Sometimes work is required at different times (eg. for work in roads or delivery of oversize equipment). Sydney Water's Project Manager can approve work outside of standard daytime hours, following the approval process described in the safeguards in Section 5.

Connections to the existing system will require out of hours shutdowns. This may result in periods of continuous work for a number of days.

3.1.10 Proposal timing

Construction is expected to start in mid-2020 and take approximately 18 months. Early works are expected to start in the first quarter of 2020.

3.1.11 Operational requirements

The operation of the system during drought conditions will be different to that of non-drought conditions. During drought conditions up to 120 ML of water can be transferred between the Prospect South and Macarthur water distribution systems. This assumes that there is sufficient water in one system to supply the other. The two drought scenarios are:

- Storage level of the southern dams is less than or equal to 30%
 - Prospect South supplies the Macarthur WDS (~120ML/day)





- Macarthur WFP production is minimised to preserve water in the southern dams
- during periods of high demand Macarthur WFP production is increased to supplement the transfer from Prospect
- Storage level of Warragamba Dam is less than or equal to 30%
 - Macarthur WFP supplies the Prospect South WDS (~120ML/day)
 - o WP0184A operates at the minimum requirements
 - During periods of high demand WP0184A operation is increased to supplement the transfer from Macarthur WFP.

3.2 Field assessment area and changes to the scope of work

The field assessment area was defined as a 40m corridor along pipeline alignments and the footprint of all fixed assets (pumping stations and reservoirs etc). The direct impact area is

- a 20m corridor for pipelines
- footprint of fixed assets as shown in Figure 3-1 to Figure 3-17.

Where pipelines are in roads, construction will be limited to the road corridor and there will be no impact to private property.

The proposal shown in this REF is indicative and based on the latest concept design at the time of REF preparation. The final design and pipeline alignments design may change based on detailed design and/ or construction planning. If the design, scope of work or construction methods described in this document change significantly, supplementary environmental impact assessment must be prepared for the amended components in accordance with SWEMS0019. An addendum is not required provided the changed design:

- remains within the field assessment of the REF and has no net additional environmental impact; or
- is outside the field assessment the REF but reduces the overall environmental impact of the proposal (s.5.4(a) of the Act).

Changes to the proposal outside the field assessment can only occur:

- to reduce impacts to biodiversity, heritage or human amenity; or
- to avoid engineering (for example, geological, topographical) constraints; and
- after consultation with any potentially affected landowners and relevant agencies.

The Delivery Contractor will demonstrate in writing how the changes meet these requirements and Sydney Water's Project Manager will review the request, in consultation with the environmental and communications representatives.



4 Consultation

4.1 Community and stakeholder consultation

Our approach to community and stakeholder consultation is guided by the Community and Stakeholder Engagement Policy (CSEP) (Sydney Water, 2016).

Stakeholder and community engagement is a planned process of initiating and maintaining relationships with external parties who have an interest in our activities. Community and stakeholder engagement:

- enables us to explain strategy, policy, proposals, projects or programs
- gives the community and stakeholders the opportunity to share their knowledge, issues and concerns
- enables us to understand community and stakeholder views in our decision-making processes alongside safety, environment, economic, technical and operational factors.

If our work will impact the community in some way, we will consult with affected groups through a variety of ways and through different stages of a project. This includes engaging the broader community and stakeholders during plan or strategy development or before making key decisions.

We will also provide local councils with reasonable notice when we intend to start works, regardless of the need for development consent. Local councils will be consulted about: public safety issues, the placement of any temporary site sheds or laydown areas on council land, or full or partial road closures of council managed roadways.

4.2 Consultation required under State Environmental Planning Policies and other legislation

Sydney Water must consult with councils and other authorities for work in sensitive locations, (eg. Part 2 Division 1 of the *State Environmental Planning Policy (SEPP) Infrastructure 2007*).

Consultation was required under clause 13(1) and clause 16(2) as the proposal involves excavation of council managed roads and work within the mine subsidence district respectively. The Delivery Contractor is required to consult with Fairfield Council, Liverpool City Council, Camden Council and Campbelltown City Council as per clause 13. Sydney Water must consult with the Mine Subsidence Board Public Authority as per clause 16. Further detail is provided in **Appendix B**.

Consultation with the Department of Planning, Industry and Environment is required for clearing of native vegetation within non-certified land under the SEPP (*Sydney Region Growth Centres*) (2006). As the proposal involves clearing 1.13 hectares of Native Vegetation Retention and/ or Existing Native Vegetation, the Department will be notified prior to the start of construction. Suitable offsets must be identified prior to the start of construction.





Consultation with Department of Industries (Water) may also be required under s 199 of the *Fisheries Management Act 1994* prior to the start of construction, if the work involves crossing or dredging of a waterway classified as 'Key Fish Habitat'.

The proposal will not directly or indirectly impact on land administered under the *National Parks and Wildlife Act 1974*. However, the proposal area is "*adjacent to a national park, nature reserve or other area reserved under the National Parks and Wildlife Act 1974*". In accordance with ISEPP we consulted with National Parks and Wildlife about the proposal.

Key stakeholders

Key stakeholders were consulted during concept design of the proposal. Issues raised and Sydney Water's response is included in **Table 4-1**.

Stakeholder	Date of consultation	Issues raised	Sydney Water response
Western Sydney Parklands (WSP)	15/08/2019	Effective communication and co-ordination between infrastructure projects and organisations required to avoid duplication of work and minimise disturbance to the parklands operations and visitors	Implement the CSEP
		Infrastructure must blend in aesthetically with the parklands	Will be considered in detailed design
		Pipelines should be constructed near paths and roads to avoid bushland	The proposal was designed to avoid bushland areas
		Consider bush regeneration during design and maintenance	Sydney Water will consult with WSP about rehabilitation
		Consider impact to visitors during construction and maintenance	Sydney Water will minimise impact to visitors
		Avoid doubling up on work to minimise impact to the parklands	Sydney Water is consulting with WSP and RMS about work that may interact
		Consider easement requirements for construction and maintenance access	Sydney Water will consider current

Table 4-1 Proposed trenchless locations



Stakeholder	Date of consultation	Issues raised	Sydney Water response
			easements and future requirements
Mount Annan Botanic Gardens	20/11/2019	Potential impact to the Cumberland Plain Land Snail	Safeguards will be implemented to minimise impact (Section 6.2.3)
		Swift Parrots are known to use a waterway near the proposed alignment	Safeguards will be implemented to minimise impact (Section 6.2.3)
		The proposed alignment may impact the Garden's 'living collection'	Sydney Water will further consider this in detailed design and seek to avoid
		The proposed alignment may impact regenerating vegetation communities	Sydney Water will further consider this in detailed design and seek to avoid
		The Botanic Gardens do not support a widening of the existing easement through the gardens	Widening of the easement may be required, to accommodate the new infrastructure. Sydney Water will continue to consult with Mount Annan Botanic Gardens
WaterNSW	18/10/2019	The Upper Canal must not be impacted during work	We do not anticipate impact. Safeguards will be implemented to minimise impact (Section 6.2.7)
		Ground settlements and vibration have potential to impact the canal during crossing work	Safeguards will be implemented to minimise impact (Section 6.2.7)
		Upper Canal crossing must be carried out in accordance with WaterNSW's <i>Guidelines for</i>	We will carry out works at the Upper Canal in

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Stakeholder	Date of consultation	Issues raised	Sydney Water response	
		Development Adjacent to the Upper Canal and Warragamba Pipelines	accordance with the guideline	
		Sydney Water must consider a future bridge over the Upper Canal at Denham Court Road, Denham Court	This was considered during concept design	
		Further consultation with WaterNSW is required during detailed design	Sydney Water will continue to consult with WaterNSW	
Roads and Maritime Services	2/09/2019	The proposal will interact with current and future RMS work	Sydney Water will continue to consult with RMS	
		There is a 132KV underground electricity cable on the north western side of South Creek at Bringelly Road	This was considered during concept design	
		There are four asbestos pits on the south eastern side of the Bringelly Road/Cowpasture Road intersection	The alignment was moved to avoid the asbestos	
Sydney Trains	24/10/2019	Work in Sydney Trains property will require Sydney Trains approval	Sydney Water will seek Sydney Trains approval where required	
National Parks	4/10/2019	No issues raised	Sydney Water will continue to consult with National Parks as required	
Camden Council	29/10/2019	The pavement in the residential area at Mount Annan is relatively new and council requests that this is not impacted due to	Sydney Water will consider other options to avoid the pavement	
		high rehabilitation cost	during detailed design	
		 construction of the proposal would introduce weaknesses in the pavement and potentially result in future failure of pavement and drainage lines due to the disturbance 		
		high community impact		



Stakeholder	Date of consultation	Issues raised	Sydney Water response
		The Spring Farm Parkway will be constructed in the vicinity of the proposal. Council requests that Sydney Water liaise with RMS and Camden Council to ensure coordination between the projects	Sydney Water is aware of the planned road and will continue to consult with RMS
Liverpool Council	3/09/2019	Road reinstatements should be done to Council specifications	Sydney Water will consult with Liverpool Council about road restoration
		Valves should be outside the road pavement	This will be considered during detailed design
		Detailed design should consider future Council stormwater upgrades around creeks and rivers	This will be considered during detailed design
		Road closures with local access will likely be possible. Sydney Water to consult with Council about work that may have traffic impacts	Sydney Water will consult with Liverpool Council about work that may impact traffic
Campbelltown Council	29/10/2019	Groundwater dependent ecosystems (GDEs) along the alignment	Ecological assessment concluded that the proposal is unlikely to impact GDEs
		Council provided advice on existing services	This will be considered in detailed design
		Council were concerned about road restoration	Sydney Water will consult with Campbelltown Council about road restoration





5 Legislative requirements

The following environmental planning instruments (**Table 5-1**) and legislation (**Table 5-2**) are relevant to the proposal. **Table 5-2** also documents any licences and permits, timing and responsibility for obtaining them.

Table 5-1 Consideration of environmental planning instruments relevant to the proposal

Environmental Planning Instrument	Relevance to proposal	
Fairfield Local Environmental Plan (LEP) 2013 Liverpool LEP 2008 Camden LEP 2010 Campbelltown LEP 2015	The proposal is located on land zoned: Primary Production (RU1) Rural Landscape (RU2) Primary Production Small Lots (RU4) Special Activities (SP1) Infrastructure (SP2) General Residential (R1) Low Density Residential (R2) Large Lot Residential (R5) Neighbour Centre (B1) Environmental conservation (E2) Environmental Living (E4) Land in Western Sydney Parklands is not zoned under an LEP.	
State Environmental Planning Policy (Infrastructure) 2007 (ISEPP)	Clause 125(1) of ISEPP states that development for the purposes of water reticulation systems, which includes water supply reservoirs, may be carried out by or on behalt of a public authority without consent on any land. Clause 125(3A) of ISEPP states that development for the purposes of water treatment facilities may be carried out by or on behalf of a public authority without consent on land ir a prescribed zone. As Sydney Water is a public authority and the Macarthur WFP is in a prescribed zone, the proposal is permissible without consent.	
<i>SEPP (State and Regional Development)</i> 2011	Clause 14 of the SEPP states that development is declared to be State Significant Infrastructure (SSI) if it is permissible without consent and specified in Schedule 3 of the SEPP. Schedule 3 states that development of water treatment	



Environmental Planning Instrument	Relevance to proposal
	facilities that have a capital value of more than \$30 million are SSI.
	Work at Macarthur WFP will be less than \$30 million and therefore the proposal is not declared to be SSI.
SEPP (Sydney Region Growth Centres) 2006	The Growth Centres SEPP coordinates the release of land for residential, employment and other urban development in the North West Growth Centre, South West Growth Area and the Wilton Priority Growth Area.
	The proposal is partly located within the South West Growth Centre (SWGC), both on 'certified' and 'non- certified land' according to the order to confer biodiversity certification on the <i>State Environmental Planning Policy</i> <i>Sydney Region Growth Centres 2006</i> . Therefore, the benefits of biodiversity certification do not apply to the sites identified as 'non-certified'. Accordingly, an ecological assessment of the proposed works to assess the potential impact to native vegetation, threatened species, populations or ecological communities on land identified as non-certified is required.
	Clause 7 and 8 of the Biodiversity Certification Order for the Growth Centres requires offsets to be provided for clearing of existing native vegetation (ENV) within non-certified areas at a ratio of up to 3:1.
SEPP (Western Sydney Parklands)	Clause 6(2) of the SEPP states that Part 3 of the Infrastructure SEPP, including Clause 125, applies as if the parklands were in a prescribed zone under that policy. Therefore, works in the parklands are permitted without consent.
	Schedule 1 of the SEPP identified heritage items in the parklands. The proposal will not impact heritage items in the parklands.
SEPP 55 Remediation of Land	State Environmental Planning Policy 55 – Remediation of Land (SEPP 55) provides for a consistent State-wide planning approach to the remediation of contaminated land.
	The proposal is not located on any known contaminated land.
SEPP (Vegetation in Non-Rural Areas) 2017	This SEPP applies as it is in an area listed in Clause 5.1a and/ or land within the zones listed in Clause 5.1b. However, section 6.1 states: <i>'This Policy does not affect the</i>



Environmental Planning Instrument

Relevance to proposal

provisions of any other SEPP....' As the works are permissible under SEPP (Infrastructure) a Council permit to clear vegetation under this SEPP is not required.

Table 5-2 Consideration of key environmental legislation

Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
Environmental Planning and Assessment (EP&A) Act 1979	Sydney Water is the proponent and determining authority under this Act. The proposal does not require development consent and is not classified as State Significant Infrastructure. We have assessed this proposal under Division 5.1 of the EP&A Act. This REF has concluded that the proposal is unlikely to have a significant impact on the environment.	REF	Pre- construction, Sydney Water
Protection of the Environment Operations Act 1997	Construction and operation of the proposal is not a scheduled activity. An EPL is not required	NA	NA
	There is a requirement under Part 5.7 of the PoEO Act to immediately report any pollution incidents to the relevant authority where material harm to the environment is caused or threatened. The definition of material harm and the relevant authorities are identified in Part 5.7 of the PoEO Act.		
	The Contractor is responsible for immediately reporting such incidents in accordance with SWEMS0009 Responding to incidents with an environmental impact.		
<i>Biodiversity Conservation</i> <i>Act 2016</i>	Protection of listed species and ecological communities in NSW falls under the Biodiversity Conservation Act 2016 (BC Act). Threatened species and communities are listed in the Schedules of the Act. Assessment of impact to threatened species and communities in certified land within the SWGC is not required. The impact of the proposal on threatened species, communities and their habitats in non-	Offset strategy	Pre- construction, Sydney Water



Legislation	Relevance to proposal	Permit or approval	Timing and responsibility
	certified land and land not in the SWGC is described in Section 6.2.3. Significant impacts to threatened species or communities are unlikely.		
	The proposal will impact 1.13 ha of non- certified land that must be offset. This must be offset in accordance with the Biodiversity Certification Order, for clearing of ENV.		
National Parks and Wildlife Act 1974	Under Section 86 of this Act, it is an offence to harm or desecrate an Aboriginal place or object unless authorised by an Aboriginal heritage impact permit (AHIP), or where it is reasonably determined that no Aboriginal object will be harmed.	AHIP	Post REF, pre- construction, Sydney Water
	The proposal will impact Aboriginal sites and an AHIP under Section 90 of the Act will be sought.		
Heritage Act 1977	Section 57(1) identifies activities, including any development in relation to the land where an item that is listed on the State heritage register is situated, that a person must not carry out.	S57(2) exemption and s60 approval	Pre- construction, Sydney Water
	A permit under Section 60 of the Heritage Act 1977 is required for works that may impact a site listed on the State Heritage Register, except for that work which complies with an exemption under 57(2). Section 139 of the Heritage Act 1977 prohibits a person from disturbing or excavating any land on which the person has discovered or exposed, or is likely to disturb a relic, except in accordance with an excavation permit or a notification granting exception for the permit.		
	The potential impact of the proposed works on heritage items and values is described in Section 6.2.7 of this REF. The assessment determined that an exemption under 57(2) is required for work within the State heritage curtilage of:		

egislation	Relevance to proposal	Permit or approval	Timing and responsibility
	Upper Canal system		
	• Sugarloaf Farm.		
	An approval under section 60 is required for work in the State heritage curtilage of:		
	• Prospect reservoir and surrounds.		
Fisheries Management Act 1994	For a public authority to undertake works in Key Fish Habitat, we are required to give the Minister notification of the works and consider any matters raised within 21 days of giving the notice.	Notification and/or permit potentially required	Pre- construction, Sydney Water
	A permit under Part 7 of the Act is required for obstructing fish passage in key fish habitat. A permit may be required if trenching through creeks is the preferred construction method.		
Vater Act 1912/ Water Ianagement Act 2000	Section 60A of the Water Management Act states that it is an offense to take water without a licence. A Water Access Licence (WAL) is required under section 61 where groundwater extraction will be greater than 3 ML.	WSW Approval and WAL potentially required	Detailed desigr pre- construction, Sydney Water
	A water supply work (WSW) approval is required under Section 90(2) of the Act to construct or use a water supply work.		
	There is potential for groundwater in excess of 3 ML to be extracted during construction. If so, a WSW approval and a WAL is required with a temporary allocation of the estimated volume of water to be extracted.		
Roads Act 1993	Section 138 specifies that if an applicant for works in roads is a public authority, consultation must be given prior to the start of works. There is potential for some sites to require a road occupancy licence, and RMS notification or approval for the set-up of temporary facilities on road or road verge.	Road Occupancy Licence	Pre- construction, Contractor







6 Environmental assessment

The potential environmental aspects and impacts associated with construction and operation of the proposal are identified in Section 6 as well as safeguards to minimise these. These safeguards will be incorporated into contract documents and a Construction Environmental Management Plan (or similar) to be developed by the Contractor prior to commencement of work.

A risk assessment will be undertaken by the Project Manager following Sydney Water's Corporate Risk Framework (<u>QMAF0081</u>).

6.1 Existing environment

6.1.1 W1 – Prospect to Cecil Park Reservoir

The heritage listed Prospect Reservoir has been an important part of Sydney's drinking water infrastructure for over 120 years. The reservoir is surrounded by parkland, native bushland and water infrastructure. WP0184A is located on the southern side of the reservoir. The pumping station is located beside Cumberland Plain Woodland, large water pipelines and pumping station WP0184B.

Pressure reducing valves (PRVs) will be installed on existing water mains that generally follows roads between Prospect and Liverpool Reservoir. The PRVs will be located in an industrial area in Wetherill Park and in residential areas in Bossley Park.

6.1.2 W2 – Cecil Park Reservoir to Oran Park Reservoir

Western Sydney Parklands is a major recreational park with extensive bushland and sport and recreation areas. Around 2.3km of DN1200 is proposed in the parklands. The alignment follows a ridge line from Cecil Park reservoir in the east and follows a section of gas easement through mainly open parkland. The alignment passes through Sydney International Shooting Centre in the west of the parklands.

There is sparse, poor to moderate condition Cumberland Plain Woodland along the alignment. Nine Aboriginal heritage sites are found along the alignment, with a large site located near Cecil Park Reservoir.

Western Sydney Parklands is planning substantial development of recreational facilities around the proposed alignment. Construction of the M12 will impact the Wild MTB track. Western Sydney Parklands is working with RMS to construct new tracks. Parklands propose to construct a new access road to the Sydney International Shooting Centre and to the mountain bike track. The Ridgeland Route walk follows the pipeline alignment around Cecil Park Reservoir.

The proposed alignment will cross three ephemeral drainage lines and is located close to the State Heritage listed Upper Canal System.





The proposed pipeline alignment follows minor roads through semi-rural areas with market gardens, small allotments and occasional larger properties. The proposed alignment is mainly located in road reserves between Western Sydney Parklands and Bringelly Road. The alignment crosses Kemps Creek, South Creek and Lowes Creek, all are key fish habitat.

W2 is located within the SWGC and the alignment is mostly in certified land. Riparian zones generally contain existing native vegetation (ENV), with a significant area of ENV around Kemps Creek.

RMS are currently upgrading Bringelly Road and the area is highly disturbed. Three subsurface 132kV electricity lines are located on the north side of Bringelly Road and on the western side of South Creek. South Creek has been highly disturbed by the road work and the creek bed below the creek crossing is now hard stand. The South Creek riparian zone contains remnants of River Flat Eucalypt Forest and is heavily weed infested. The alignment crosses numerous drainage lines and stormwater culverts. Lowes Creek is highly disturbed and has been modified by RMS's The Northern Road upgrade work.

Range Road, Kemps Creek is used as the access to Brandon Quarry, Waste and Recycling Services. Kemps Creek Sporting & Bowling Club on Elizabeth Drive is located to the north of the proposed alignment. Sensitive receivers include:

- residents
- Kemps Creek Public School and Heritage School Sydney at Cross Street, Kemps Creek
- Kemps Creek Cemetery and Crematorium at Western Road, Kemps Creek
- church at 215 Western Road, Kemps Creek
- Russian Sports Club, 84 Watts Road, Kemps Creek
- Buddhist temple, 42 Wynyard Road, Rossmore.

The area is semi-rural with residences and some businesses located along the alignment.

6.1.3 W3 - Oran Park Reservoir to Narellan South Reservoir

The proposed reservoir site has an elevation of around 150m, with land falling away steeply from the south, east and west sides. The north side is more gently sloping and has an informal access track. Geotechnical investigations found that the ground in unstable and there is evidence of past landslips.

There is poor condition Cumberland Plain Woodland across the site, with large hollow-bearing trees and an understory of African olive. However, the site is on certified land. The reservoir inlet alignment is through grazed paddocks with isolated mature trees and small patches of vegetation.

Residential development is planned to occur around the reservoir site. However, to date development has only occurred around 600m south of the site and the remaining surrounding area is paddocks. Large residential developments in this area are located in Cobbitty, Oran Park and Harrington Park.

A large Aboriginal site is found on top of and to the north of the hill.





The WP0414 site is Sydney Water owned and contains high quality Cumberland Plain Woodland. Part of the site is on certified and the remaining part is outside the SWGC. The site is directly north of the Harrington Park residential development and within around 50m from residences.

6.1.4 W4 - Narellan South reservoir to Sugarloaf Valves

The proposed alignment follows local roads through a residential development, passes through bushland in the Spring Farm Resource Recovery Facility and then to the Mount Annan Botanic Garden. Narellan South Reservoir is adjacent to NPWS managed William Howe Regional Park.

The Hume Motorway, the Southern Highlands rail line and Menangle Road will be crossed by the alignment. The alignment passes through a number of rural properties. The State Heritage listed Sugarloaf Farm is located beside WP0185. There are three Aboriginal sites on the W4 alignment.

Residential areas in this area are located in Mount Annan and Glen Alpine.

6.1.5 W5 – Macarthur Water Filtration Plant

Macarthur WFP treats water extracted from the Cataract River at Broughtons Pass. Treated water is supplied to Appin Reservoir and Campbelltown South Reservoir via WP0185. The operational part of the site is cleared and grassed. The WFP is operated by Trility in partnership with Sydney Water.

6.1.6 E2 - Carnes Hill reservoir to Raby reservoir

The proposed alignment follows road alignments including Cowpasture Road, Camden Valley Way and Denham Court Road. Roads have been substantially upgraded and the road reserve are highly disturbed. There is subsurface asbestos on the south eastern side the intersection. The alignment crosses under the Upper Canal at two locations. There is an area of Cumberland Plain Woodland at the intersection of Camden Valley Way and Denham Court Road.

There are a number of AHIPs covering much of the road upgrades. However, an Aboriginal site is located near the intersection of Denham court Road and Fox Valley Road.

The land around Carnes Hill Reservoir is part of Western Sydney Parklands. E2 has largely suburban areas, with residential developments in Leppington and Denham Court.

6.2 Environmental aspects, impacts and safeguards

6.2.1 Topography, geology and soils

Existing environmental and potential impacts

During construction, we will need to disturb ground, remove vegetation, excavate and stockpile soil which could result in potential offsite erosion and sedimentation of surrounding land and waterways.



The proposal is in an area with:

- potential soil contamination asbestos at the Bringelly Road/Cowpasture Road intersection, dumped waste at South Creek, Brandon Quarry, Spring Farm Resource Recovery Facility, two petrol stations on Camden Valley Way
- potential localised areas of unstable land in Western Sydney Parklands, Oran Park Reservoir site, Narellan South reservoir and in Mount Annan Botanic Gardens
- fault zone at Kemps Creek
- potential soil salinity throughout the entire proposal area
- known areas of salinity in the Western Sydney Parklands, around Kemps Creek, around Lowes Creek and along an unnamed creek at Cowpasture Road and Denham Court Road as indicated on DLWC Salinity mapping
- South Campbelltown Mine Subsidence to the south of the Hume Motorway. Around 630m of pipeline and WP0185 are located in this area.

Extensive excavation will be required to construct the proposal. Erosion can lead to the degradation of soil substrates and reduction in soil stability (slumping and gully erosion). Pipelines will be installed progressively with a typical (staged) disturbed area of 30m long by 20m wide and up to around 2.5m deep. Once pipelines are installed disturbed areas are progressively rehabilitated. Due to the scale of the project pipeline construction may occur concurrently at a number of different locations. Construction of reservoirs and pumping stations will require a total disturbance area of around 9.8 ha (**Table 6-1**).

Location	Area (ha)
WP0184A	0.7
WP0432	1.6
Oran Park reservoir	5
WP0414	1.1
Narellan South Reservoir	0.9
WP0185	0.3
Carnes Hill Reservoir	0.2
Total	9.8

Table 6-1 Area of disturbance at reservoir and pumping station sites





Substantial earthworks will be required to construct pipelines and Oran Park reservoirs (**Table 6-1**). Around 155,000m³ of material will be removed from the hill at Oran Park to create a level, stable platform for construction of two tanks.

Geotechnical investigations (Sydney Water, 2019) found that the Oran Park reservoir site has a capping sandstone layer over fine grained siltstones. This results in instability at the hill and retaining structures are required to support the reservoirs and to prevent future land slips. Around 400 secant piles (interlocking piles) will be installed around the top of the hill and installation of soldier piles near the base of the hill. Extensive vegetation clearing will be required to allow the piling rig move around the site.

Material will be stockpiled along the pipeline alignments and at reservoir and pumping station sites. The progressive nature of pipeline construction will minimise the risk of erosion of stockpiles as excavations will be backfilled and stabilised as work progresses. However, given the estimated volume of spoil generated during construction there is high potential for erosion of stockpiles and dust generation from poorly managed stockpiles (**Table 6-2**). Earthworks at the Oran Park Reservoir site poses a high erosion risk due to the volume of material to be excavated, steepness of terrain and presence of unstable land. Stockpiles will be managed in accordance with the safeguards and mitigation measures outlined in this section to minimise erosion of stockpiles.

Proposal component	Construction method	Estimated volume of spoil (m³)	Estimated number of truckloads (based on 22 m ³ per load)
Pipelines	Trenching and underboring	75,000	3,410
Reservoir	Excavations for foundations and construction of access road	155,000	7,045
Pumping stations	Excavations for foundations	2,500	114

Table 6-2 Estimated spoil volumes

Geotechnical investigations identified a fault near Kemps Creek. The fault increases the potential for a frac out if trenchless methods are used. A frac out would result in soil and water contamination, and impact vegetation. Trenching across Kemps Creek may be used to eliminate the potential for a frac out. This would impact the creek bed and banks. A creek restoration plan would be prepared and implemented if trenching across the creek is required.

Excavation works will occur in areas with moderate to low potential for salinity. The disturbance of saline soils will have the potential to impact the local environment if not managed appropriately. The erosion and transfer of saline sediments offsite has the potential to alter the water quality of





receiving environments which in turn has the potential to impact upon flora and fauna that are sensitive to elevated levels of salinity. Implementation of the safeguards and mitigation measures outlined in this section will ensure that impacts associated with improper management of re-use of excavated soils are avoided during construction and impacts from salinity are unlikely.

During the construction there is potential for contamination to occur as a result of spills of hydraulic oil and fuels from equipment or vehicles. In the instance of a spill occurring, the impact will be minor and localised as the quantity of hydraulic oil and fuels will be kept to a minimum and will be stored in a suitably bunded and covered area.

Adequate storage and refuelling controls will be installed to mitigate impacts. Plant and equipment will be maintained to minimise the potential for leakages. Any accidentally contaminated soil will be excavated, stockpiled, chemically classified for disposal and transported to an appropriately licensed waste facility.

A Detailed Site Contamination Investigation identified potential sources of ground contamination as illegally dumped waste (South Creek), uncontrolled filling in road corridors, Brandon Quarry, Spring Farm Resource Recovery Facility and two petrol stations on Camden Valley Way. The investigation concluded that hazards to human and ecological health within the study area from chemical contaminants in soil and water are considered to be low. However, asbestos containing material was identified near South Creek on the W2 pipeline alignment (**Figure 6-1**). The pipeline alignment at Bringelly Road was modified to avoid known asbestos in the area. A location near Ramsay Road has elevated levels of polycyclic aromatic hydrocarbons that means that material from this location may be classified as restricted solid waste (**Figure 6-2**).

Soil samples were used to classify material along the proposed alignment in accordance with the NSW EPA (2014) Waste Classification Guidelines. Results indicate that majority of excavated spoil (typically fill materials and underlying natural soils) will meet the General Solid Waste (non-putrescible) classification. One location near the Upper Canal on Denham Court Road presented elevated levels of Polycyclic Aromatic Hydrocarbons (PAHs) and may be classified as Restricted Solid Waste. Inappropriate management of contaminated soils include potential impacts to surrounding land and waterways from off-site leaching of contaminants.

Pipeline and pumping station works are not proposing to permanently change the surface topography and drainage patterns of the area. The area will be returned to its original topography and drainage pattern following construction. However, the Oran Park Reservoir site will be lowered by 10m to allow construction of two 20m high reservoirs. This will change the topography of the site.















Figure 6-2 Polycyclic aromatic hydrocarbon location



Safeguards

Prepare a soil and water management plan, including an erosion and sediment control plan prior to the start of construction. The plan must identify stockpile locations at reservoir and pumping station sites and identify management measures to minimise erosion and sedimentation, and dust generation.

Contamination management measures must be included in the soil and water management plan:

- Method for assessing the handling and disposal of illegally dumped waste
- No asbestos containing materials, soil mixed with wastes or wastes should be used for trench backfill or surface compaction
- If unexpected contamination is identified during construction, the works would cease, access would be restricted, and the nature and extent of the contamination determined. Contaminated excavated material would be classified in accordance with the Waste Classification Guidelines before any off-site disposal at a suitably licensed waste facility.

Prevent sediment moving offsite in accordance with Managing Urban Stormwater, Soils and Construction, Volume 1 and 2A (Landcom 2004 and DECC 2008), including:

- divert surface runoff away from disturbed soil and stockpiles
- install sediment and erosion controls before construction starts
- reuse topsoil where possible and stockpile separately
- inspect controls at least weekly and immediately after rainfall
- rectify damaged controls immediately
- remove controls once surfaces have been stabilised, including removing trapped sediment in drainage lines.

Carry out further geotechnical investigations at Kemps Creek to understand the fault zone. Underboring the creek must be considered if geotechnical conditions permit. If underboring is used to cross Kemps Creek, the bore will be at a depth and in a material that will ensure that a frac out will not occur.

Minimise ground disturbance and stabilise disturbed areas progressively.

Delivery Contractor to ensure imported material is certified for intended use.

Stop work in the immediate vicinity of suspected contamination. Indicators of contamination include discoloured soil, asbestos, strong chemical or petrol odours and leachate. Contain disturbed material on an impermeable surface and cordon areas off. Notify the Sydney Water Project Manager and the Environmental Representative. Contact Property Environmental Services for advice management options.

Stop work during heavy rainfall or in waterlogged conditions when there is a risk of sediment loss off site.

Sweep up any sediment/soil transferred off site at least daily, or before rainfall.

Eliminate ponding and erosion by restoring natural landforms to the pre-works condition.




Adopt appropriate soil salinity mitigation measures in accordance with <u>Western Sydney Salinity Code of</u> <u>Practice</u> (Western Sydney Regional Organisation of Councils, 2003). This may include:

- (if relevant) treat existing salinity with gypsum
- (if relevant) establish salt tolerant species in existing or potential salinity problem areas after construction
- stabilise existing areas of erosion
- minimise water use on site
- avoid rotation and vertical displacement of the original soil profile
- backfill excavations deeper than one metre in the same order, or treat or use this material as fill at depths more than one metre from the finished level.

Progressively stabilise and plant vegetation on disturbed areas at Oran Park Reservoir.

Stable access will be established for all sites.

6.2.2 Water and drainage

Existing environment and potential impacts

The pipeline alignments cross large creeks, ephemeral creeks, drainage lines and stormwater channels. The alignment crosses Kemps Creek, South Creek and Lowes Creek. All three creeks are identified as key fish habitat by Department of Primary Industries (Fisheries). Kemps Creek is a 4th order stream and both South Creek and Lowes Creek are 5th order.

Generally creeks will be underbored (**Table 3-1**). However, the pipeline under Kemps Creek may be trenched due to the risk of a frac-out during boring due to a fault zone under the creek. Lowes Creek may also be impacted by trenching. Trenching may also be used at Lowes Creek due to the high level of previous disturbance and current low water levels.

Trenching through creeks may require use of coffer dams or similar to create a dry work area. Depending on the creek level, water would be pumped around the dammed area to maintain flow. The creek bank and bed would be impacted during the work. Rain in the creek catchment will increase flow in the creek, potentially resulting in removal or failure of the dam. Inundation of an unstabilised work area will result in the release of sediment to the creek. Construction work around Kemps Creek, South Creek and Lowes Creek is likely to be in flood prone land. Flooding has the potential to impact construction and increase movement of spoil offsite.

Sediment-laden runoff from the excavations and stockpiles has potential to enter watercourses resulting in elevated turbidity, impacting light levels for submerged aquatic vegetation and smothering benthic organisms. In addition, potentially hazardous products required for construction, such as fuels, lubricants, grease and other chemicals, will be contained in small volumes within designated construction compounds. Refuelling activities will also be restricted to bunded areas within the construction compound.

Frac outs can occur during underboring where the pressure from the overburden is less than the horizontal pressure on the drill head or where the drilling fluid finds another pathway such as fault lines, fractures or loose material. This results in a release of drilling to the environment. Underboring creeks and the Upper Canal carries a risk of frac out, potentially impacting water



quality in the creeks and the canal.

Geotechnical investigations identified that the main regional groundwater aquifer is present within the underlying fractured shale and sandstone. Due to the comparatively shallow depth of construction works (depths up to 2.5 m) the risk of intercepting permanent groundwater tables is considered to be low, although perched groundwater tables may be encountered. The exception to this will be areas where trenchless crossings of creeks and infrastructure are required within the Wianamatta Group basement rocks.

Geotechnical investigations found that groundwater inflows occur at various depths across the proposal area (**Table 6-3**). The proposal is likely to require dewatering from trenches and pits in some areas. This water is likely to be sediment laden and will be manged to ensure the impact to downstream waterbodys is minimal. Excavations for pipeline construction are not expected to require a substantial amount of groundwater extraction due to the excavation profile. However, underboring launch and receiving pits at creeks have potential to require groundwater extraction. The fault at Kemps Creek could lead to a groundwater ingress. The volume of groundwater extracted will be monitored across the proposal area, a water supply work approval and a water access licence will be sought prior to construction if the volume is anticipated to be close to, or exceed 3ML.

Proposal section	Depth of boreholes (m)	Depth where groundwater inflow occurs (m)
W2	2.9 – 14.7	3 – 3.8
W4	4 – 8.6	No inflows
E2	3 – 16.4	0.8 – 3.2

Table 6-3 Groundwater levels

The commissioning of pumping stations and the reservoir at Oran Park may require dewatering. A large volume of water may be dewatered from the reservoirs at Oran Park. This water will be dechlorinated in accordance with the Sydney Water Discharge Protocol.

Construction of two reservoirs at Oran Park will change the drainage conditions at the site. The reservoir roofs will act as two hardstand areas. The stormwater system around the reservoir will connect to the local stormwater network. If the reservoir will be constructed before the local stormwater system a detention basin will be constructed. The reservoir stormwater system is designed to have capacity for a 1 in 5 year rain event. In the event of the failure of an inlet valve the flow from the reservoir is expected to be around three times higher than the capacity of the stormwater system. Water would flow down the access road and dissipate into the road stormwater system.

The proposed alignment crosses the Upper Canal in two locations. Water quality in the canal is not expected to be impacted during construction because the canal will be underbored. No



construction work will be carried out within WaterNSW Controlled Areas. The underboring will be carried out in accordance with the WaterNSW *Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines*.

Safeguards

Sydney Water will obtain any groundwater Water Supply Approval and/or Water Access Licence. The Delivery Contractor is responsible for:

- providing expert hydrogeological technical information to obtain the approvals preparing a Dewatering Management Plan
- complying with the approval conditions (such as protecting water quality; minimising aquifer extraction volumes, monitoring extraction with flow meters and recording volumes).

Use appropriate controls to avoid potential sedimentation to waterbodies.

Detailed design will consider the need for a stormwater detention basin at Oran Park Reservoir.

Minimise the impacts to creeks where creek crossings are required. Prior to construction the methodology of each creek crossing will be assessed on:

- geotechnical and constructability issues (eg depth of cover, potential for future scouring)
- construction footprint and duration
- ease of reinstatement
- environmental issues (flora and fauna, geomorphology, contamination, heritage, water quality and hydrology)
- any issues raised during consultation with Department of Primary Industries.
- inspect coffer dams daily
- ensure bypass pumps at coffer dams do not pump sediment laden water downstream
- remove coffer dams in advance of heavy rain in the creek catchment

The decision and reasons for the decision will be documented by the contractor in consultation with the Sydney Water Environmental Representative.

Sydney Water will consult with Department of Primary Industries in accordance with s.199 of the *Fisheries Management Act 1994* and consider any matters raised prior to excavation in waterways (Lowes Creek and Kemps Creek).

Bund potential contaminants and store on robust waterproof membrane, away from drainage lines.

Monitor the weather forecast and predicted rain in creek catchments. In advance of heavy rain:

- remove all plant and equipment from creeks and flood zones
- stabilise the creek bed and banks.

Restore creek bed and banks to its pre-construction condition or better on completion of work.

Stabilise creek banks on completion of works in creeks.

Store potential contaminants on robust waterproof membrane, away from drainage lines.





Keep functioning spill kit on site for clean-up of accidental chemical/fuel spills. Keep the spill kits stocked and located for easy access.

Locate portable site amenities away from watercourses or drainage lines.

Formulate groundwater protection measures during detailed design following geotechnical investigations (eg protect water quality; minimise aquifer extraction volumes, determine if approval and licence is required under *Water Management Act 2000*).

Discharge all water in accordance with Sydney Water's Discharge Protocols Standard Operating Procedure (WPIMS5021), including erosion controls, discharge rate, dechlorination, monitoring. Re-use potable / groundwater water where possible.

Install a flow monitor(s) and record volume of dewatering.

Dewater excavations in accordance with the Delivery Management Guidance Standard 9.1 Excavation Dewatering.

Store all chemicals and fuels in accordance with relevant Australian Standards and Safety Data Sheets. Record stored chemicals on site register. Bunded areas to have 110% capacity of stored liquid volume. Chemicals and fuels in vehicles must be tightly secured.

Conduct refuelling, fuel decanting and vehicle maintenance in compounds where possible. If field refuelling is necessary, designate an area away from waterways and drainage lines with functioning spill kits close by.

Store all chemicals and fuels in accordance with relevant Australian Standards and Safety Data Sheets. Record stored chemicals on site register. Bunded areas to have 110% capacity of stored liquid volume. Chemicals and fuels in vehicles must be tightly secured.

Conduct refuelling, fuel decanting and vehicle maintenance in compounds where possible. If field refuelling is necessary, designate an area away from waterways and drainage lines with functioning spill kits close by.

The Soil and Water Management Plan must include measures to avoid impacts from drilling, including:

- contain and monitor drilling fluids at entry/exit points
- identify and manage frac-outs
- re-use and/or disposal of drilling fluids.

Contain concrete washout in a sealed container with appropriate volume. Washout will be disposed of at an appropriately licensed waste facility.

No construction work is permitted in WaterNSW Controlled Areas.

Underboring under the Upper Canal must be carried out in accordance with *Guidelines for Development* Adjacent to the Upper Canal and Warragamba Pipelines.



6.2.3 Flora and fauna

An Ecological Assessment was prepared by Ecological Australia. This chapter summarises the report and the full report is provided in Appendix C.

Assessment method

Field surveys were carried out between July and October 2019. The assessed area comprised:

- a 40m corridor centred on the pipeline alignment
- pumping station and reservoir sites.

The proposal is primarily located in the SWGC, within certified and non-certified land; and contains areas of vegetation mapped as Existing Native Vegetation (ENV) and Native Vegetation Retention (NVR). A small component of the proposed works is also located outside of the SWGC. The field assessment area comprises remnant patches of native vegetation, cleared land previously used for agricultural purposes, riparian corridors and existing road corridors. Vegetation communities and threatened flora species on certified land do not require assessment because they have already been considered under the *Order to confer biodiversity certification on the State Environmental Planning Policy (Sydney Region Growth Centres) 2006*. These species and communities are not included in the impact assessment. Fauna habitat features in certified land were identified to inform mitigation measures to minimise the impact to fauna during vegetation clearing.

The likelihood of occurrence for each species was determined using recent records, the likely presence of suitable habitat and knowledge of the species ecology. The presence of threatened fauna species identified as having potential to occur in the field assessment area was determined through a habitat assessment.

Targeted survey for threatened flora and fauna species considered likely to occur was not conducted during the field survey. Instead, an assessment of habitat features was undertaken to determine the suitability of the field assessment area to provide habitat. This was considered sufficient to assist in determining whether any threatened species were likely to be present and inform the potential requirements for impact assessments and pre-clearance and clearance surveys prior to works commencing.

Existing environment

The BioNet Atlas and Protected Matters Search Tool returned seven threatened ecological communities, 82 threatened fauna species (including migratory species) and 45 threatened flora species either known or considered likely to occur in the field assessment area.

South Creek, Lowes Creek, Kemps Creek and their tributaries were mapped within or adjacent to the field assessment area.

The Biodiversity Certification Order identifies areas that have been mapped as certified land under the Growth Centres SEPP. The proposal has different areas of certified and non-certified land, containing ENV and/or NVR, as well as being located outside of the SWGC (**Table 6-4**).



Proposal component	Certified land	Non-certified land	ENV/NVR	Land outside the SWGC
W2	Yes	Yes	Yes	No
W4	No	No	No	Yes
E2	Yes	Yes	Yes	No
WP0414	Yes	No	No	Yes
WP0432	Yes	No	No	No
Oran Park Reservoir	Yes	No	No	No
Narellan South reservoir	No	No	No	Yes
Carnes Hill Reservoir	No	Yes	No	No

Table 6-4 Classification of vegetation in the proposal area

Eight vegetation communities were recorded during the field surveys. These communities and their status under the BC and EPBC Acts are outlined in **Table 6-5**.

Table 6-5 Vegetation communities identified during the field survey

Vegetation community	BC Act status	EPBC Act status	Proposal section
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion (CSGW)	VEC	E	W2
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (CRCIF)	EEC	CE	W2
Cumberland Plain Woodland in the Sydney Basin Bioregion (CPW)	CEEC	CE	W2, W4, E2, Oran Park Reservoir, Narellan South Reservoir, WP0414
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (RFEF)	EEC	-	W2, E2





Vegetation community	BC Act status	EPBC Act status	Proposal section
Shale Gravel Transition Forest in the Sydney Basin Bioregion (SGTF)	EEC	CE	W2
Moist Shale Woodland in the Sydney Basin Bioregion (MSW)	EEC	CE	W2
Urban exotic/native	-	-	E2
Planted exotic/native	-	-	E2

Figure 6-3 to **Figure 6-11** show the vegetation communities recorded in the field survey. The maps also include:

- certified land
- non-certified land including:
 - ENV shown as green light and red light in areas of the SWGC where precincts have yet to be gazetted
 - ENV and NVR in areas of the SWGC where precincts have been gazetted. This has only occurred in E2
- land outside the SWGC.







Figure 6-3 W2 (Cecil Park Reservoir)







Figure 6-4 W2 (Kemps Creek)







Figure 6-5 W2 (Western Road)







Figure 6-6 W2 (Ramsey Road)







Figure 6-7 W2 (South Creek)







Figure 6-8 W2 (Lowes Creek)















Figure 6-10 W4







Figure 6-11 E2





Dillwynia tenuifolia plants were located during the field surveys within the impact area of W2. *Dillwynia tenuifolia* is listed as Vulnerable under the BC Act and not listed under the EPBC Act. These plants were located within the road verge of the Western Road in certified land. The plants are located in certified land, there is no need to assess the impact of the proposed works on these species under the BC Act. *Dillwynia tenuifolia* plants were also identified within the non-certified land adjacent to the W2 alignment. Therefore, an impact assessment for this species and the endangered population has been prepared for where the proposed works are located in noncertified land.

Weeds identified during field surveys included seven that are listed as State level priority weeds and two as regional priority weeds (**Table 6-6**). Kemps Creek Nature Reserve is located around 400 m south of the proposal. The reserve is currently closed due to Phytophthora contamination. The Delivery Contractor will be required to implement hygiene protocols to prevent the spread of the pathogen.

Scientific name	Common name	WoNS	Management objective
State level priority weed			
Asparagus aethiopicus	Asparagus fern	Yes	Asset protection
Asparagus asparagoides	Bridal creeper	Yes	Asset protection
Lantana camara	Lantana	Yes	Asset protection
Lycium ferocissimum	African Boxthorn	Yes	Asset protection
Opuntia stricta	Common Prickly Pear	Yes	Asset protection
Rubus fruticosus agg.	Blackberry	Yes	Asset protection
Senecio madagascariensis	Fireweed	Yes	Asset protection
Regional priority weed			
Cestrum parqui	Green Cestrum	No	Asset protection
Olea europaea subsp. cuspidata	African olive	No	Containment

Table 6-6 State and regional level priority weeds identified during the field survey

Asset protection: These Weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread must be minimised to protect priority assets.





Containment: These weeds are widely distributed in the region. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably practicable.

Twenty-nine fauna species were identified during the field survey and consisted of bird species common to peri-urban environments. A list of the fauna observed in the field assessment area is provided in Appendix C. No threatened fauna species were recorded.

Vegetation within the field assessment area provides suitable habitat for a number of common peri-urban species and potential habitat for threatened fauna species. The habitat features relevant to each fauna group are identified in **Table 6-7**.

Habitat feature	Group	Presence of habitat features in the assessed area
Native vegetation	Birds, microchiropteran bats (microbats), megachiropteran bats (fruit bats) and arboreal mammals	Intact sections of native vegetation were located within and adjacent to the impact areas
Winter flowering species	Winter migratory birds, arboreal mammals and megachiropteran bats (fruit bats)	<i>Eucalyptus tereticornis</i> trees were present within the field assessment area
Hollow-bearing tree	Birds, arboreal mammals, snakes, frogs and microbats	Hollow-bearing trees were located in the impact area
Coarse woody debris	Terrestrial mammals, reptiles, invertebrates	Present in moderate amounts
Native/exotic grassland	Reptiles and predator bird species	Exotic grasslands were present on road verges and adjacent to the field assessment area on neighbouring private properties and native grass land was located in the impact area of WP0414
Riparian corridor	Amphibians, wader and wetland birds, fish passage	Lowes Creek, South Creek, Kemps Creek and their riparian zones present within the field assessment area

Table 6-7 Habitat features and associated fauna groups recorded in the assessed area

Four areas of the W2 alignment intersect with waterways that are mapped as Key Fish Habitat (KFH):

- Kemps Creek (two locations)
- South Creek
- Lowes Creek.



Potential impacts

The impact assessment refers to the non-certified areas and the area outside of the SWGC. Assessment of impacts to threatened species, populations or ecological communities is not required for land that is biodiversity certified, however identification of habitat features such as hollow bearing trees and mapping of exotic flora species infestations within these areas have been included in the assessment below.

Direct impact

The direct impact area is a 20 m wide construction corridor centred on the pipe alignment and the construction of, or upgrade to, reservoirs and pumping stations. Impact to certified land is not considered in this section. The proposal will require a total direct impact of 5.914 ha of native vegetation, comprising 2.654 ha of non-certified land and 3.26 ha outside the SWGC (**Table 6-8**). Of this 1.604 ha, located in the W2 section of the proposal, is ENV and must be offset in accordance with Clause 8 of the Biodiversity Certification Order. We also propose to offset 4.812 ha in accordance with our Biodiversity Offset guideline. An area of 0.057 of EPBC Act listed Cumberland Plain Woodland located WP0414 will be cleared. This vegetation is outside the SWGC. However, a significance assessment concluded that clearing this vegetation will not be a significant impact.

Indirect impact

Indirect impacts are those impacts that do not directly affect habitat and individuals but that have the potential to interfere through indirect action. Indirect impacts considered for this assessment include site impacts such as noise, light and weed invasion or spread; and downstream or downwind impacts such as edge effects, sedimentation, dust, accidental spills and leaks resulting in soil or water pollution.

During the construction, noise, dust and to a small degree vibration will be emitted which could have an indirect impact on local fauna. These impacts result from the operation of heavy machinery to clear vegetation and construct the infrastructure. These impacts are short term only and therefore are unlikely to significantly impact fauna.

Indirect impacts can also occur where clearing ENV result in the remaining ENV to be less than 0.2 ha in area. In this case the indirectly impacted ENV must also be offset. Clearing of ENV will not reduce any ENV area to less than 0.2 ha.



Table 6-8 Impact to native vegetation

Vegetation community	Proposal section	Direct impact non- certified land (ha)	Indirect impact non- certified land (ha)	Direct impact outside SWGC (ha)	Indirect impact outside SWGC (ha)	Total impact (ha)
CPW						
	W1	NA	NA	0.165	NA	0.165
	W2	1.322	1.916	NA	NA	3.238
	W3	NA	NA	0.507	NA	0.507
	W4	NA	NA	2.588	1.6	4.188
	E2	0.084	0.065	NA	NA	0.149
CSGW						
	W2	NA	0.182	NA	NA	0.182
CRCIF						
	W2	NA	0.253	NA	NA	0.253
MSW						
	W2	0.065	0.23	NA	NA	0.295
RFEF						
	W2	1.174	2.21	NA	NA	3.384
	E2	NA	0.071	NA	NA	0.071
SGTF						
	W2	0.009	0.016	NA	NA	0.025
Total		2.654	4.943	3.26	1.6	12.457



Removal of hollow bearing trees

Around 83 hollow-bearing trees and 17 stags will be removed as part of the proposal. Eighteen hollow-bearing trees and two stags are located in non-certified land. Pre-clearance surveys will be required to be implemented prior to their removal to ensure no hollow-dwelling species would be directly impacted by the proposed works.

Potential impact to threatened species

Tests of Significance and Assessments of Significance were applied to species and communities for which the proposal has the potential to significantly impact on their breeding, movement or foraging habitat or resources. Tests of Significance under the BC Act were prepared for:

- Castlereagh Scribbly Gum Woodland
- Cooks River / Castlereagh Ironbark Forest
- Cumberland Plain Woodland
- Moist Shale Woodland
- Shale Gravel Transition Forest
- River-Flat Eucalypt Forest
- Dillwynia tenufolia population of Kemps Creek
- 10 threatened flora species
- 18 bird species
- Meridolum corneovirens (Cumberland Plain Land Snail)
- eight mammal (bat) species
- Litoria aurea (Green and Golden Bell Frog)

These assessments concluded that it is unlikely that the proposal will significantly impact threatened species, communities or populations for the following reasons:

- the area to be impacted is small
- no critical habitat will be impacted for these species
- the proposal will not fragment or isolate any fauna habitat
- large amounts of similar habitat are available within the survey area and adjacent to the direct impact areas
- the habitat is likely to be used in a transitory nature as no key breeding habitat is likely to be present within the field assessment area.

Assessments of significance under the EPBC Act were prepared for:

• four flora species



- two bird species
- one mammal species.

These assessments concluded that it is unlikely that the proposed action will significantly impact the threatened community and species for the following reasons:

- the area of impact is relatively small compared to the local occurrence of the community
- the area of potential habitat to be impacted is small
- the proposed action will not fragment or isolate the habitat for these species
- the proposed action is unlikely to exacerbate KTP affecting these species.

Safeguards

Prepare site revegetation plans. These should be prepared in consultation with a suitably qualified specialist or the Project Environmental Representative as part of the CEMP.

Prepare a creek restoration plan for any creeks that will be trenched.

Minimise vegetation clearance and disturbance, including impacts to standing dead trees and riparian zones. Where possible, limit clearing to trimming rather than the removal of whole plants and adjust methodology (eg avoid area, hand excavate, implement exclusion fencing) to protect sensitive areas where possible.

Confirm the amount of Existing Native Vegetation (ENV) to be cleared prior to the start of project activities. Offset clearing by purchasing an equivalent amount of biobanking credits from Western Sydney Parklands Trust, or from an alternative Biodiversity Stewardship Site owner. Monitor and areas of ENV cleared during construction to report to DP&E.

ENV cleared will be offset in accordance with Clause 8 of the Biodiversity Certification Order. Sydney Water will clear ENV must be in accordance with a plan of management or under an agreement with DPIE.

Residual impacts to native vegetation and trees will be offset in accordance with the Biodiversity Offset Guideline (<u>SWEMS0019.13</u>). Sydney Water will identify a suitable offset area for residual offsets.

Potentially affected residents will be notified of any tree removal.

Vegetation clearing must not occur until the following are complete:

- the area to be removed has been physically delineated by fencing,
- the Contractor's Environmental Representative has confirmed consistency with approval documentation
- pre-clearing surveys, if relevant and
- written authorisation to commence clearing from Sydney Water Project Manager.



Pre-clearance surveys will be carried out by a suitably qualified ecologist:

- check hollows-bearing trees to be removed for fauna species. An inspection process must be developed that includes:
 - o marking hollows
 - o protecting hollows during loping of other parts of the tree
 - o lowering hollows for inspection by the ecologist
 - o retain felled hollow-bearing tree in-situ to allow fauna to self-relocate
 - o method to safely remove nests
 - o relocation areas for fauna
 - o nearest RSPCA or veterinary clinic for injured fauna
- any threatened flora species identified should be flagged and the individuals and their habitat protected where possible
- relocate threatened fauna species such as the Cumberland Plain Land Snail. Cumberland Plain Land Snail habitat should be surveyed immediately prior to the start of any works.

Protect trees in accordance with the requirements of Australian Standard 4970-2009 for the Protection of Trees on Development Sites eg do not damage tree roots unless absolutely necessary, and where roots >50mm are impacted within the Tree Protection Zone, engage a qualified arborist to maintain structural integrity and tree health.

Ensure activities adjacent to the bushland do not alter existing drainage and existing light conditions. Ensure fertilisers, turf, mulch, weeds and imported soils are not unintentionally introduced into bushland areas (i.e. through natural drainage pathways or general proximity).

Retain dead tree trunks, bush rock or logs in-situ unless they are in the direct impact area and moving is unavoidable. Reposition material elsewhere on the site or approved adjacent sites. If native fauna is likely to be present, a qualified ecologist should inspect the habitat feature prior to removal and undertake fauna relocation.

Manage biosecurity in accordance with:

- Biosecurity Act 2015 (see <u>NSW Weedwise</u>)
- contemporary bush regeneration practices, including disposal of sealed bagged weeds to a licenced waste disposal facility
- wrap straw bales in geofabric to prevent seed spread
- Implement hygiene protocols to minimise the potential to spread soil pathogens.

In TOBAN period:

 Check specific TOBAN notice to confirm whether the work can be carried out under standard exemptions (Govt Gazette No18 Feb 2018)

If not, apply to RFS for specific exemption.





If any threatened species (flora or fauna) is discovered during the works, stop work immediately and notify the Sydney Water Environmental Representative. Work will only recommence once the impact on the species has been assessed and appropriate control measures provided.

If any damage occurs to vegetation outside of the direct impact area (as shown in the CEMP), notify the Sydney Water Project Manager and Environmental Representative so that appropriate remediation strategies can be developed.

Map and report native vegetation clearing greater than 0.01 ha in extent (and any associated rehabilitation) to the Sydney Water Environmental Representative. Track vegetation clearing as per SWEMS0015.26 Contractor Native Vegetation Clearing and Rehabilitation template.

6.2.4 Air and energy

Existing environment and potential impacts

The proposal is generally in semi-rural and suburban areas with some parts of the proposal in parklands.

Potential sensitive receivers include:

- residents
- users of Western Sydney Parklands and Mount Annan Botanic Gardens
- Heritage College Sydney, Kemps Creek
- Kemps Creek Public School, Cross Street, Kemps Creek
- church at 215 Western Road, Kemps Creek
- Kemps Creek Cemetery and Crematorium, 252 Western Road, Kemps Creek
- Russian Sports Club, 84 Watts Road, Kemps Creek
- Buddhist temple, 42 Wynyard Road, Rossmore.

The proposal will potentially result in air pollution from:

- dust generated during excavation works, concrete and road cutting, stockpiling spoil
- dust generated by construction vehicles travelling on disturbed/ unsealed access routes
- emissions from machinery, equipment and vehicles used during construction
- dust from hazardous materials, such as asbestos, due to encountering unexpected hazardous waste during construction
- emissions from plant and equipment
- odour from welding or painting.

Pipeline construction will progress past sensitive receivers, reducing any potential impact from dust or equipment emissions. Earthworks, stockpiling and truck movements at Oran Park Reservoir have a high potential to produce dust. Dust mitigation measures will be implemented to minimise the impact to surrounding receivers.





Operation of pumping stations will consume energy. Under normal conditions, pumping stations will supply customers or not operate. Under drought conditions, pumping stations will be required to pump water long distances between delivery systems. This is likely to have high energy consumption. Sydney Water assessed the pumping station locations for the potential to install solar energy. Most sites were not suitable due to their intermittent or low energy consumption. However, Sydney Water identified opportunities to install solar energy at Liverpool Reservoir and this would offset energy consumed by the operation of the proposal.

Safeguards

Use alternatives to fossil fuels where practical and cost-effective.

Track energy use as per SWEMS0015.28.

Maintain equipment in good working order, comply with the clean air regulations of the Protection of the Environment Operations Act 1997, have appropriate exhaust pollution controls, and meet Australian Standards for exhaust emissions.

Switch off vehicles/machinery when not in use.

Implement measures to prevent offsite dust impacts, for example:

- water exposed areas (using non-potable water source where possible such as groundwater from excavation pits) The use of groundwater for dust suppression is exempt from approvals and licences
- cover exposed areas with tarpaulins or geotextile fabric
- modify or cease work in windy conditions
- modify site layout (place stockpiles away from sensitive receivers)
- vegetate exposed areas using appropriate seeding.

Cover all transported waste.

6.2.5 Waste and hazardous materials

Potential environmental impacts

The proposal will require the disposal of large volumes of spoil from:

- construction of pipelines
- undeboring launch and receiving pits
- removing around 10m in depth of material from the Oran Park reservoir site.

Given the large volume of waste a Waste Management Plan (<u>SWEMS0025.09</u>) is required. Waste from construction will be disposed of in accordance with the Waste Avoidance and Resource Recovery Act 2001 (WARR) hierarchy. Re-use of waste on site is the preferred waste management options and will be carried out if possible. Opportunities for reuse on other projects in





the local area will be investigated during detailed design. There is potential for spoil from construction in Western Sydney Parklands to be reused as fill for the new Wylde Mountian Bike Track in the parklands. The pumping station at Lowes Creek (WP0432) may require some filling. Suitable spoil will be reused at this site.

There is potential to encounter contaminated soil and/or waste material:

- Brandown Quarry, Waste and Recycling at 90 Elizabeth Drive, Kemps Creek
- service station at 1370-1380 Camden Valley Way, Leppington
- Spring Farm Resource Recovery Park
- asbestos around the Bringelly Road/Cowpasture Road intersection (as advised by RMS)
- dumped waste near Bringelly Road at the South Creek crossing.

Other waste generated during the work will include:

- drilling fluids generated during microtunnelling. All drilling fluids will be captured and stored for off site disposal
- green waste from vegetation clearing
- waste concrete and concrete washout
- waste pipe, wood, metal and packaging.

The proposal may involve the transportation of asbestos and other hazardous waste. Waste may need to be tracked using the EPA's <u>WasteLocate online tracking System</u>.

Safeguards

Prepare a Waste Management Plan (SWEMS0025.09).

Identify spoil disposal options during detail design.

Manage waste in accordance with relevant legislation and maintain records to show compliance eg waste register, transport and disposal records.

Provide adequate bins for general waste, hazardous waste and recyclable materials. Remove bins when 80% full.

Minimise the generation of waste, sort waste streams to maximise reuse/recycling in accordance with the *Waste Avoidance and Resource Recovery Act 2001*.

Manage waste and excess spoil in accordance with the NSW EPA Waste Classification Guidelines. Dispose wastes at an appropriately licenced facility.

Securely store all wastes to prevent pollutants from escaping.





Dispose excess vegetation (non-weed) that cannot be used for site stabilisation at an appropriate green waste disposal facility.

If fibro or other asbestos containing material is identified, restrict access and follow Sydney Water's Asbestos Management procedure, WHSMS0064. Contact Property Environmental Services for advice.

Track waste as required using EPA's WasteLocate online tracking system.

Consult with Western Sydney Parklands about reusing spoil in the parklands.

6.2.6 Aboriginal Heritage

An Aboriginal Cultural Heritage Assessment Report (ACHAR) was prepared by Kelleher Nightingale. The full report is provided in Appendix D. The ACHAR supports an application for an AHIP to the Department of Planning, Industry and Environment under s90 of the *National Parks and Wildlife Act 1974*.

Existing environment and potential impacts

Current land use in the area is predominantly semi-rural and includes horticulture (market gardens) and small farm allotments, with occasional larger properties. Urban development has expanded across the Cumberland Plain in the last 50 years and parts of the area contain residential, commercial and industrial structures in addition to associated infrastructure and utilities. Landscaping and construction activities associated with land use practices over the past 200 years have caused varying levels of disturbance. In areas of intensive agriculture, road or utility construction or residential, commercial or industrial development, disturbance is generally higher. Channelisation, drainage works and dam construction along the creek lines has also altered the flooding characteristics of the area and contributed to disturbance along the waterways.

The proposal area overlaps several areas that have been previously assessed for Aboriginal cultural heritage values and are covered under the existing AHIPs and State Significant Infrastructure (SSI) approval (**Table 6-9**.)

Permits and Approval	End date	Areas of proposal affected
AHIP 1116799	June 2024	Area near Cobbity
AHIP 1131710	June 2022	Areas near Camden Valley Way and intersection of Denham Court Road
AHIP 1132182	May 2028	Areas near Denham Court Road
AHIP C0000436	September 2029	Bringelly Road including areas near Jersey Road, Old Cowpasture Road and Stuart Road
AHIP C0000533	August 2029	Old Cowpasture Road

Table 6-9 Existing AHIP/SSI areas that overlap the proposal area

Permits and Approval	End date	Areas of proposal affected
AHIP C0002382	December 2031	Old Cowpasture Road
SSI 7127		Areas near The Northern Road

Sydney Water may carry out the proposed works under the existing AHIPs/SSI approval, provided that work is undertaken in accordance with the AHIP/SSI approval conditions. Details of existing AHIPs are provided in Appendix D. Sydney Water will obtain authorisation from the relevant AHIP/SSI approval holders to complete the proposed works under their respective permits.

The remainder of the proposal is located outside of planned or existing AHIP/SSI areas and constitutes the 'field assessment area' for this assessment.

The archaeological assessment undertaken as part of the current proposal identified 12 Aboriginal archaeological sites (comprising 14 AHIMS registrations) and two areas of potential archaeological deposit (PAD) within the field assessment area. The Aboriginal archaeological sites consisted of surface artefact scatters with associated areas of PAD and isolated artefacts.

Three sites identified in field assessment area can be avoided, resulting in 11 Aboriginal archaeological sites and one registered area of PAD being at least partially impacted by the proposed works (**Figure 6-12**). The archaeological sites are a mix of low and moderate significance sites (**Table 6-10**). Aboriginal heritage sites that will be impacted by the proposal are shown in **Figure 6-13**, **Figure 6-14**, **Figure 6-15**, **Figure 6-16** and **Figure 6-17**. Note that the Aboriginal heritage assessment area varies depending on the presence of existing AHIPs.

Site name	Proposal section	AHIMS number	Site feature	Type of harm	Degree of harm	Consequence of harm	Significance of harm
Bringelly 1	W2	45-5- 0905/45- 2-0369	Artefact	Direct	Partial	Partial loss of value	Low
Cecil Park Water Reservoir AFT 1	W2	tbc	Artefact	Direct	Partial	Partial loss of value	Moderate
Cross Street Kemps Creek AFT 1	W2	tbc	Artefact	None	None	No loss of value	None

Table 6-10 Impact to Aboriginal sites



Site name	Proposal section	AHIMS number	Site feature	Type of harm	Degree of harm	Consequence of harm	Significance of harm
Recovery Park IF 1							
Wynyard Avenue South Creek AFT 1	W2	tbc	Artefact	Direct	Partial	Partial loss of value	Low





Figure 6-12 Aboriginal heritage overview







Figure 6-13 Aboriginal heritage in W2 (north)











Figure 6-14 Aboriginal heritage in W2 (south)

Aboriginal heritage study area

















Figure 6-16 Aboriginal heritage in W4









Figure 6-17 Aboriginal heritage in E2




An AHIP under s90 of the *National Parks and Wildlife Act 1974* is required to impact the Aboriginal sites. Sites considered low significance based on the disturbed nature of the area and lack of a subsurface archaeological deposit are:

- Mt Annan Macarthur Sub Station Site 6
- SUEZ Spring Farm Resource Recovery Park IF 1
- Denham Court Road AFT 1
- Isolated Object 2033-5
- IFSC7;Cecil Park
- impacted portion of Bringelly 1
- impacted portion of Wynyard Avenue South Creek AFT 1
- impacted portion of Ramsay Road South AFT 1.

Archaeological mitigation is not required within the impacted areas of these sites.

Sites of at least moderate significance require mitigation through salvage excavation. Sites Denbigh Trig AFT 1, Cecil Park Water Reservoir AFT 1, GLC1 (including Artefact Scatter PAD 2023-846) and the registered area of PAD, Lowes Creek PAD, are considered to display moderate significance based on their scientific value and potential to inform on Aboriginal landscape use within the south western portion of the Cumberland Plain. Their archaeological value is linked to the information that they contain. Recovery of this information through archaeological salvage excavation will mitigate the impact of the proposal and offer an opportunity to better understand the distribution of Aboriginal archaeological material in these locations. The loss of intrinsic Aboriginal cultural value of impacted sites cannot be offset or mitigated. However, the salvaged information will assist in a better understanding of the local archaeological context, particularly as much of the immediate area is impacted by historic and contemporary land use. The AHIP will include provision for impact mitigation through archaeological salvage excavation.

Safeguards

Impact to Aboriginal heritage sites can only occur when an Aboriginal Heritage Impact Permit (AHIP) is granted. Work must be in accordance with AHIP conditions.

Do not make publicly available or publish, in any form, Aboriginal heritage information on sites / potential archaeological deposits, particularly regarding location.

Obtain authorisation from the relevant AHIP/SSI approval holders to complete the proposed works under their respective permits.

Harm to any Aboriginal objects and declared Aboriginal places is only permitted once an Aboriginal Heritage Impact Permit (AHIP) has been granted.

All site workers must be inducted in protection measures required by the AHIP.





If any Aboriginal object or non-Aboriginal relic is found outside the AHIP area, cease all excavation or disturbance in the area and notify Environmental Representative in accordance with SWEMS0009.

6.2.7 Non-Aboriginal Heritage

Existing environment and potential impacts

There are 10 non-Aboriginal heritage items within 100 m of the proposal (**Table 6-11**) and construction will occur within the curtilage of four items:

- Prospect Reservoir and surrounding area
- Upper Canal System
- Sugarloaf Farm
- Bringelly Road cultural landscape area.

The Bringelly Road cultural landscape area is a locally significant item and represents a historic road alignment. The area is heavily disturbed from road upgrade works and the proposal will not impact this alignment. Around 20 m of pipeline will be located in the curtilage of the Maryland homestead item. However, this area is an existing construction site and the proposal will not impact heritage values.

Prospect Reservoir and surrounding area, Upper Canal System and Sugarloaf are State significant items. Statements of Heritage Impact (SoHI) were prepared by Extent Heritage to assess the impact of the proposal on the items. The SoHIs are provided in Appendix E.

ltem	Listing	Significance	Description	Distance from the work
Prospect Reservoir	State Heritage Register (SHR)	State	Reservoir and surrounding bushland	Within curtilage
	Sydney Water S170			
	Growth Centres SEPP			
Upper Canal system	SHR	State	Canal system between Pheasants Nest and Prospect	Within curtilage
	WaterNSW S170			
	Growth Centres SEPP			
	Various LEPs			
Maryland	Camden LEP	Local	Residential buildings	Within curtilage
Orielton	SHR	State	Homestead and estate	95m
	Camden LEP			

Table 6-11 Heritage items

ltem	Listing	Significance	Description	Distance from the work
Sugarloaf	SHR	State	Homestead and farm	Within curtilage
Failli	DPIE s170			
	Campbelltown LEP			
Carnes Hill vegetation group	Growth Centres SEPP	Local	Landscape	Adjacent
Bringelly Road cultural landscape area	Growth Centres SEPP	Local	Historic road alignment	Within curtilage
Row of Bunya Pines	Growth Centres SEPP	Local	Row of pines	30m
Brown memorial and water trough	Growth Centres SEPP	Local	WWI war memorial	30m
Cowpasture Road cultural landscape area	Growth Centres SEPP	Local	Landscaping	40m

Prospect Reservoir

Prospect Reservoir is historically significant because it is a central element of the Sydney water supply system. The reservoir supplied water to Sydney for over 120 years, and generally still operates in the same way as it was originally constructed. The reservoir area is aesthetically significant, as a picturesque site with a large expanse of water, parklands, landscaping and bush.

Upgrade work to water pumping station WP0184A will be within the heritage curtilage. WP0184A was constructed in 1977 and consists of:

- pump house with large hardstand area
- inlet/outlet pipes and valves
- access road.

The pumping station is located within an area that has substantial surrounding infrastructure and commercial development.





The SoHI concluded that the pumping station does not have heritage significance. WP0184A is a functional structure with no substantial aesthetic values, these works represent a minor modification and extension that will not impact heritage significance. Existing internal equipment will not be impacted. However, two 12.3m high surge vessels will be installed as part of the work. This has potential to alter the landscape around WP0184A. A s60 permit is required for the work within the SHR listed Prospect Reservoir and surrounding area.

Upper Canal System

The Upper Nepean Scheme originally transferred water from through a series of rivers (Cataract, Cordeaux, Nepean, Avon) to Prospect Reservoir. The Upper Canal is an integral element of the Upper Nepean Scheme and is the man-made section between Pheasants Nest and Prospect Reservoir. Cataract, Cordeaux, Nepean and Avon dams were progressively built across the four rivers between 1902 and the 1930s. These dams now form part of the Upper Nepean Scheme and feed the Upper Canal at Pheasants Nest. The Upper Canal continues to operate as originally intended largely using the original infrastructure built in the 1880s.

The proposal crosses the Upper Canal at two locations (Figure 6-18 and Figure 6-19):

- Denham Court Road the canal consists of a trapezoidal sandstone section. Associated canal elements in this section generally include flumes, culverts, canal overbridges and roadways. The trapezoidal canal is of exceptional heritage significance
- Bringelly Road the canal consists of a trapezoidal concrete lined section of the canal. The trapezoidal canal and wrought iron flume are of exceptional heritage significance

The canal will be underbored at both locations, with a clearance of at least 2m. The launch and receiving pits will be located outside the heritage curtilage. Construction of the launch pits and underboring may have vibration impacts on the canal due to its proximity to the canal structure.

Geotechnical investigations will be undertaken to determine the geology of the area to ensure the positioning of the launch pits and the microtunneling will have no impact on the Canal structure or associated elements. Vibration monitoring will be undertaken during underboring to ensure there is no impact to the canal structure or associated elements.

This SoHI assessed the proposed works against the heritage significance of the Upper Canal and concluded that it will have a minor impact on the significance of the canal, as well as a nil impact on the physical structure of the canal. As such, the work can be considered exempt in accordance with the following statutory controls:

• *Heritage Act NSW 1977* – Section 57(2), exempt work as per Standard Exemption No. 7, Minor Works with Little or No Impact on Heritage Significance.





Figure 6-18 Upper Canal crossing at Bringelly Road







Legend E2 alignment

Local heritage Item - General State heritage Upper Canal System (Pheasants Nest Weir to Propsect Reservoir)





Figure 6-19 Upper Canal crossing at Denham Court Road



Sugarloaf Farm

Sugarloaf Farm is a largely intact farm complex dating from the 1840s through to the 1940s demonstrating a range of uses throughout its life. Sugarloaf Farm is of State Significance for its association with the early settlement and development of Menangle as a farming district. The farm has high historical, visual, aesthetic and research value as a remnant of an earlier cultural landscape.

The proposed works are located at the northern extremity of the site in an area which is not known to have undergone any prior building or other development associated with the historical occupation and use of Sugarloaf Farm (**Figure 6-20**). The area has been previously disturbed for the construction of Upper Canal, for two existing underground pipelines and for the construction of WP0185 pumping station. The proposed works will have no impact upon Sugarloaf Farm's heritage value.

The proposed works will intersect an area assessed in the Conservation Management Plan as having low-nil historical (Non-Aboriginal) archaeological potential. Therefore, the risk of impact to areas of archaeological potential is minimal. This risk will be mitigated through the inclusion of an unexpected finds procedure, to be distributed to construction personnel prior to the proposed works.

The work can be considered exempt in accordance with the following statutory controls:

• *Heritage Act NSW 1977* – Section 57(2), exempt work as per Standard Exemption No. 7, Minor Works with Little or No Impact on Heritage Significance.







Figure 6-20 Sugarloaf Farm



Safeguards

A s60 permit will be obtained prior to the start of work at WP0184A. Any additional conditions of consent must be complied with.

Section 57(2) heritage exemptions will be obtained before the start of work at the Upper Canal and Sugarloaf Farm.

Prior to works, contractors must be inducted on the heritage sensitive nature of:

- Prospect Reservoir and surrounding area
- Upper Canal System
- Sugarloaf Farm

and informed of any recommended mitigation measures or controls required.

Any building extensions to WP0184A and new build on the site should match and/or complement the colour and materials of the existing pumping station structure.

The surge vessels at WP0184A should be of a material that ensures glare is reduced as much as practicable and should be in a neutral colour palette.

Geotechnical investigations are required to understand the ground conditions at the Upper Canal crossings. Deeper bores must be considered where there is a risk to the canal structure.

Vibration monitoring must be undertaken during work at the Upper Canal crossings.

All construction-related compounds, access routes and stockpiles should be located away from the Upper Canal structure and outside of the canal curtilage.

No construction-related material, structures or plant should be positioned, stored or deposited into the Upper Canal.

If any Aboriginal object or non-Aboriginal relic is found, cease all excavation or disturbance in the area and notify Environmental Representative in accordance with SWEMS0009.

A dilapidation survey on the Upper Canal at both crossing locations must be carried out before the start of work.

The Delivery Contractor must maintain an appropriate photographic record of pre-construction site conditions for reference purposes during site restoration works and to verify/document that restoration activities have been completed satisfactorily.



6.2.8 Noise and vibration

Approach

A Construction Noise Assessment was prepared by Aurecon to assess potential noise impacts on residential sensitive receivers at pumping station and reservoir locations. The assessment report is provided in Appendix F.

Pipeline construction will temporarily impact sensitive receivers. However, noise impacts will only be experienced by a receiver as pipeline construction progresses past that receiver. Noise impact from pipelines construction will be managed by implementing standard safeguards and management measures.

There is potential for operational noise to impact sensitive receivers at new and upgraded water pumping stations. Air extraction equipment and valve operation is likely to be the main noise source. Operational noise will be assessed during detailed design and noise attenuation measures identified.

Existing environment

The noise environment varies along the proposal alignment. W1 has industrial and suburban residential areas. W2 is mainly semi-rural with sensitive receivers found along the pipeline alignment:

- residents
- Heritage College Sydney, Kemps Creek
- Kemps Creek Public School, Cross Street, Kemps Creek
- dog kennels at 125 Western Road, Kemps Creek
- church at 215 Western Road, Kemps Creek
- Kemps Creek Cemetery and Crematorium, 252 Western Road, Kemps Creek
- Russian Sports Club, 84 Watts Road, Kemps Creek
- Buddhist temple, 42 Wynyard Road, Rossmore.

W3 and W4 have suburban areas as well as rural residences. Large residential developments in this area are located in Cobbitty, Oran Park, Harrington Park, Mount Annan and Glen Alpine.

E2 has largely suburban areas, with residential developments in Leppington and Denham Court.

Pipeline construction

Pipeline construction will generate noise and/or vibration during construction from excavation during pipeline construction. Works will generally occur during standard daytime hours. Some out of hours work may be required to connect new pipelines to the existing system. The works have the potential to exceed the Interim Construction Noise Guideline and impact on sensitive receivers, including residences, two schools, three places of worship and a social club. However, pipeline construction will progress past sensitive receivers and all reasonable and feasible measures will be implemented to reduce noise impacts during construction.



Pumping stations and reservoirs

The Construction Noise Assessment assessed the potential noise impact at the following locations, due to their proximity to sensitive residential receivers:

- Lowes Creek pumping station (WP0432)
- Carnes Hill Reservoir (WP0434)
- Oran Park Reservoir (WS0477 and WS0478)
- Sugarloaf Valves (WP0185)
- Narellan South Reservoir (WP0301)
- Harrington Park pumping station (WP0414).

Background noise monitoring was carried out at these six locations (**Table 6-12**). Background monitoring was not carried out at WP0184A due to industrial nature of the area and lack of sensitive receivers.

Table 6-12 Background noise levels

Location	Nearest receiver	Distance (m) to nearest receiver	Background noise (L _{A90}) at receiver
Lowes Creek pumping station	1020 The Northern Road, Bringelly	40	46
Carnes Hill Reservoir	Residence on Twenty- fifth Avenue, West Hoxton	50	40
	Residence on Sixth Avenue, West Hoxton	105	41
Oran Park Reservoir	2 Bensley Road, Cobbitty	775	42
Sugarloaf pumping station	122 Abington Crescent, Glen Alpine	85	37
Narellan South Reservoir	15 Moyengully Avenue, Mount Annan	75	42
Harrington Park pumping station	32 Brady Place, Harrington Park	50	38

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In Accordance with the *Interim Construction Noise Guidelines* (DEC, 2009) the background noise levels were used to identify Noise Management Levels (NMLs) (**Table 6-13**). The NMLs apply during standard working hours.

Indicative plant used for the construction of the pumping stations and reservoirs are:

- front end loaders/backhoes
- excavator (20t)
- spoil trucks
- delivery trucks
- mobile crane
- hand tools
- chainsaw
- generators
- concrete truck
- concrete pump.

Construction at Oran Park Reservoirs would also require a piling rig in addition to the plant listed above.

Construction noise was predicted for all plant operating at the same time giving a worst-case scenario (**Table 6-13**). A range of noise levels was predicted to represent the progression of construction within a site. The range provides an indication of construction noise impacts when activities are occurring nearer (upper bound) or further (lower bound) to the receiver. Construction noise levels at five of the six sites are predicted to exceed the NMLs. Construction noise at Oran Park Reservoir is not predicted to impact sensitive receivers under this worst-case sceanrio. Generally predicted noise levels will be around 19-25dB(A) above NMLs, with noise at the receivers at WP0432 potentially highly noise affected (<75dB(A)).

Work at each location will take around 12 months to complete and construction noise has potential to result in elevated noise levels at residential properties for the duration of construction, however it is unlikely that all plant will be operating at the same time. Reasonable and feasible measures will be implemented.



Table 6-13 Predicted noise levels

Location	NML (dB(A)	Predicted noise (dB(A)	Exceedence (dB(A)
1020 The Northern Road, Bringelly	56	75-78	19-22
Residence on Twenty- fifth Avenue, West Hoxton	50	71-75	21-25
Residence on Sixth Avenue, West Hoxton	51	62-66	11-15
2 Bensley Road, Cobbitty	52	35-36	-
122 Abington Crescent, Glen Alpine	47	67-69	20-22
15 Moyengully Avenue, Mount Annan	52	71-75	19-23
32 Brady Place, Harrington Park	48	70-73	22-25

Construction vibration

Vibration may be generated during piling work for reservoir footings and retaining structures at Oran Park Reservoir. However, the nearest residential receivers are located around 775m from the reservoir site and are unlikely to be impacted by vibration.

Vibration may also be generated during works at the pumping stations during excavation and construction of access roads. The nearest residences to a pumping station is 40m from the pumping station at Harrington Park (WP0414). Vibration impacts are not expected at this distance.

Vibration generated during underboring the Upper Canal has a high potential to impact the structure of the canal. Guidance of limiting vibration values for heritage structures, or other structures particularly sensitive to vibration, is provided in the German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures* (**Table 6-14**). The conservative value of 3 mm/s presented in the 1 Hz to 10 Hz range has been used to derive the safe working distances for heritage structures in this assessment. Vibration monitoring during underboring will be carried out to ensure that there is no impact to the canal.



Table 6-14 Guideline values for short term vibration on structures (DIN 4150-3) used for heritage structures

Type of structure	Guideline values for velocity (mm/s)			
	1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	
Buildings used for commercial purposes, industrial buildings, and buildings of similar design.	20	20 to 40	40 to 50	
Dwellings and buildings of similar design and/or occupancy.	5	5 to 15	15 to 20	
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (for example heritage listed buildings).	3	3 to 8	8 to 10	

Operational noise

During pumping station operation air extraction equipment and the operation of valves has potential to result in elevated noise levels. This equipment will be designed during the detailed design phase of the proposal. Noise mitigation such as acoustic louvres will be considered during detailed design, if required. Noise modelling will be carried out to ensure that the extraction equipment meets the criteria of the Noise Policy for Industry (NPI, 2017).

During operation of the reservoir, the periodic operation of pumps and mixers will generate some noise. However, noise levels will be low due to the relatively small size of motors and are expected to meet the criteria of the Noise Policy for Industry (NPI, 2017).

Safeguards

Schedule work and deliveries during standard daytime working hours of 7am to 6pm Monday to Friday and 8am to 1pm Saturday. No work to be scheduled on Sundays or public holidays (DECC Interim Construction Noise Guideline, 2009).

The proposal will be carried out in accordance with:

- Sydney Water's Noise Management Procedure SWEMS0056
- Noise Policy for Industry (EPA, 2017).

Incorporate_standard daytime hours noise management safeguards into the CEMP:

- identify and consult with the potentially affected residents prior to the commencement:
 - describe the nature of works; the expected noise impacts; approved hours of work; duration, complaints handling and contact details.
 - determine need for, and appropriate timing of respite periods (eg times identified by the community that are less sensitive to noise such as mid-morning or mid-afternoon for works near residences)







- acceptance by the community of longer construction periods in exchange for restriction to construction times
- implement a complaints handling procedure for dealing with noise complaints
- plant or machinery will not be permitted to warm-up near residential dwellings before the nominated working hours.
- appropriate plant will be selected for each task, to minimise the noise impact (eg all stationary and mobile plant will be fitted with residential type silencers)
- engine brakes will not be used when entering or leaving the work site(s) or within work areas.
- regularly inspect and maintain equipment in good working order
- arrange work sites where possible to minimise noise (eg generators away from sensitive receivers, minimise use of vehicle reversing alarms).
- schedule noisy activities around times of surrounding high background noise (local road traffic or when other noise sources are active).

If works **beyond standard daytime hours are needed**, the contractor's environmental representative would:

- justify the need for out of standard daytime work
- consider potential noise impacts and: implement the relevant standard daytime hours safeguards; Sydney Water's Noise Management Code of Behaviour (SWEMS0056.01) and other reasonable and feasible management measures
- identify community notification requirements
- seek approval from the Sydney Water Project Manager.

If night works are needed, the contractor's environmental representative would:

- justify the need for night works
- consider potential noise impacts and implement the relevant standard daytime and out of hours safeguards and other reasonable and feasible management measures
- identify community notification requirements (ie for scheduled night work (not emergency works)),
- notify all potentially impacted residents and sensitive noise receivers not less than one week prior to commencing night work.
- seek approval from the Sydney Water Project Manager.

If works on Sundays or public holidays are required, the contractor's environmental representative would:

- justify why all other times are not feasible
- consider potential noise impacts and, implement relevant standard daytime, out of hours and night-time safeguards and other reasonable and feasible management measures
- identify community notification requirements





• seek approval from the Sydney Water Project Manager.

Conduct a dilapidation survey / asset condition assessment prior to works which have potential to damage existing structures.

Monitor compliance with the recommended vibration levels in DIN 4150-3 1999: Structural Vibration – Part 3; Effects of vibration on structures.

The pumping stations must be designed to meet the requirements of the Noise Policy for Industry (NPI, 2017) and this must be verified on commissioning.

Vibration monitoring will be carried out to ensure that there is no impact to the Upper Canal during construction. Vibration levels must be within guideline values of the German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures.*

6.2.9 Traffic and access

Existing environment and potential impacts

The proposal is located mainly in road corridors. The roads are Council and RMS operated. Partial road closures will be required and there is potential for full road closures to be necessary at some locations. Sydney Water will consult with Council and RMS as required by the ISEPP and obtain road occupancy licences. Partial road closures will typically involve temporary closure of one lane of traffic adjacent to pipeline construction to accommodate equipment, removal of spoil and delivery of bulk materials. This may result in traffic delays and/or traffic diversions depending on the number of lanes available. Generally, these temporary partial closures will only occur when trenching works are in progress.

Underboring techniques will be used where water pipelines cross large RMS roads to avoid traffic diversions and delays in these areas (**Table 3-1**).

During construction, an increase in traffic will be generated due to:

- establishing construction sites, including setting up compounds, offices and storage areas
- moving work crews to and from the construction sites
- delivering construction materials and removing waste materials such as excess spoil.

A large number of truck movements will be required to move spoil from the construction areas:

- pipelines 3,410 truck movements
- Oran Park Reservoirs 7,045 truck movements
- pumping stations 114 truck movements.

For the water pipeline construction, the increase in traffic movements will be relatively minor as the pipe laying crews generally consist of about 10 people, the construction site moves as pipeline installation progresses, deliveries occur on an as needs basis, and the daily volumes of spoil requiring removal are small. In addition, truck movements associated with pipelines will be





distributed across the 35 km of new pipelines. This will minimise the impact on traffic flow in any one area. The minor increase in traffic associated with water pipeline construction is not expected to affect the capacity or waiting times on surrounding roads.

Truck movements associated with Oran Park Reservoirs have potential to impact traffic flow on The Northern Road. This road is currently being upgraded by RMS and there is heavy construction traffic associated with residential and utility work in the area. The addition of more than 7,000 truck movements has potential to impact traffic flow in the area. The site is likely to be accessed from two locations on The Northern Road. Trucks turning to and from The Northern Road have potential to have a negative impact on road safety.

Access to, and use of, some pedestrian pathways will be temporarily impacted during the construction of pipelines. Some pipelines may also be laid directly within existing footpaths, rather than in road reserves. This will require temporary diversion of pedestrian traffic. Generally, the access to, and use of, pedestrian pathways will only be disrupted when pipe trenching works are in progress. Councils and local community members will be informed of any potential loss of access and appropriate measures will be negotiated to either provide alternative pedestrian access ways or reinstate access as soon as possible.

During the construction of the pipelines, access to properties may be temporarily affected. Properties will only be affected for a relatively short period of time (generally up to one to two days for a small property). Property owners will be informed of any potential loss of access and appropriate measures will be negotiated to either provide an alternative access or reinstate access at the end of the day. Any access ways affected by construction will be reinstated to their original condition. Additional measures may be required at the following properties due to potential access issues during construction:

- Brandon Quarry
- Sydney International Shooting Centre
- Heritage College Sydney, Kemps Creek
- Kemps Creek Public School, Cross Street, Kemps Creek
- Kemps Creek Cemetery and Crematorium, 252 Western Road, Kemps Creek.

Work in Western Sydney Parklands and Mount Annan Botanic Gardens will require consultation with land managers to minimise impact to the operations of the parklands and botanic gardens.

Safeguards

Prepare a Traffic Control Plan (TCP) in consultation with the relevant traffic authority to meet NSW Roads and Maritime Service's Traffic Control at Worksites Manual V4 requirements.

Consult with RMS about site access to sites from The Northern Road and the high volume of truck movements associated with Oran Park Reservoir.





Minimise traffic impacts near residential properties, schools and businesses by consulting with them (eg no major materials deliveries at school drop off or pick up times etc.).

Manage sites to allow people to move safely past the works, including alternative pedestrian, bicycles, pram and wheelchair access.

Consult with the relevant traffic authority about managing impacts to pedestrian traffic, signposting, meters, parking, line-marking or if traffic control or pavement restoration is required.

Erect signs to inform road users of the proposed works and any temporary road closures.

Ensure work vehicles do not obstruct vehicular or pedestrian traffic, or private driveway, public facility or business access unless necessary and only if appropriate notification has been provided.

Consult with landowners where access impacts may occur, in particular:

- Brandon Quarry
- Sydney International Shooting Centre
- Heritage College Sydney, Kemps Creek
- Kemps Creek Public School, Cross Street, Kemps Creek
- Kemps Creek Cemetery and Crematorium, 252 Western Road, Kemps Creek

Follow Western Sydney Parklands and Mount Annan Botanic Gardens protocols when accessing their land.

6.2.10 Social and visual

Existing environment and potential impacts

Social

The proposal will have a positive community impact by improving the resilience and reliability of the drinking water supply in the area. The bi-directional link will allow transfer of water between water distribution systems, protecting bulk water supplies and reducing drought effects on the community.

The main construction impacts to the community will be from noise, air quality and traffic impacts. Construction of pipelines through Western Sydney Parklands (**Figure 6-21**) and Mount Annan Botanic Gardens (**Figure 6-22**) has potential to impact users through limited access and the disturbance of recreational areas.

There are a number of businesses along the pipeline alignment, including:

- market gardens along the W2 alignment
- Camden Farm Mushrooms, 305 Ramsey Road, Kemps Creek
- Australian Koi Farm at 79 Jersey Road, Bringelly.





The Delivery Contractor will be required to consult with businesses owners to minimise impacts to business operation.

Other sensitive receivers include:

- Heritage College Sydney, Kemps Creek
- Kemps Creek Public School, Cross Street, Kemps Creek
- church at 215 Western Road, Kemps Creek
- Kemps Creek Cemetery and Crematorium, 252 Western Road, Kemps Creek
- Russian Sports Club, 84 Watts Road, Kemps Creek
- Buddhist temple, 42 Wynyard Road, Rossmore.

Impacts to these receivers can have a negative impact on the community. However, these receivers will be impacted by pipeline construction only and impacts will be short-term as the pipeline is progressively constructed.

Sydney Water will acquire land at the three properties. Details of the properties is provided in **Table 6-15**.

Table 6-15 Land acquisition

Lot/DP	Address	Area to be acquired	Whole or part of lot
Lot 203 DP1216419	1010 The Northern Road, Bringelly	1.6 (approx.)	Whole lot
Lot 2 DP1241819	621 The Northern Road, Oran Park	2.857	Part of lot
Lot 137 DP271067 and Lot 29 DP270613	Harrington Park	1.5 (approx.)	Part of each lot













Figure 6-22 Mount Annan Botanic Gardens



Visual

A Visual Impact Assessment for the Oran Park Reservoirs site was prepared by Aurecon. This section summarises the report. The full Visual Impact Assessment is provided in Appendix G. Visual impact was assessed in terms of impact to landscape character and impact to viewpoints of sensitive receivers:

- Landscape character relates to the built, natural and cultural character. The assessment of landscape character considers the overall impact of a project on an area's character and sense of place.
- Visual impact refers to the quality of a view, type of viewer, and number of viewers considering how sensitive the view is to the proposed change and the magnitude of the impact (e.g. scale, colour, materials).

Impacts are rated using a matrix (Table 6-16).

Table 6-16 Landscape character and visual impact rating matrix

		Magnitude of Impact			
		High	Moderate	Low	Negligible
	High	High	High-Moderate	Moderate	Negligible
tivity	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
Sensi	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

The proposed reservoir site is located on the high point of a ridge on the western side of the Northern Road. Large native trees and a thick understorey of African olive would be cleared to construct the reservoir tanks and construct retaining structures. Due to the existing and future residential development in the area the sensitivity was assessed as moderate to high. The tanks will be a distinct feature in the landscape and the magnitude of the change will be moderate. The impact of the proposed reservoir to landscape character of the area is moderate-high. Nine viewpoints were used to assess the visual impact on existing receivers (**Figure 6-23** and **Table 6-17**). The assessment found that the reservoirs would have a moderate to high impact on VP6 (**Figure 6-24**) and a high impact on VP8 (**Figure 6-25**). The tanks would be visually prominent from these viewpoints and may impact sensitive receivers. The lower impact of the other viewpoints is due to their distance from the reservoir and/or screening from vegetation. Sydney Water will plant native vegetation around the hill to both stabilise the ground and provide visual screening. Mitigating visual impacts will be considered when deciding on the colour of the reservoirs during detailed design.







Figure 6-23 Viewpoints



Table 6-17 Visual impact assessment

Viewpoint	Receiver	Sensitivity to Change	Magnitude of Change	Overall rating
VP1	Agricultural site. Bringelly NSW Residents of the farming areas	Low to moderate	Low	Low to moderate
VP2	Industrial site. The Northern Rd, Bringelly NWS	Low to moderate	Low to moderate	Low to moderate
VP3	Jack Brabham Reserve. Oran Park Dr., NSW	Moderate	Moderate	Low to moderate
	Residents and Recreational users.			
VP4	Car Parking, Jack Brabham Reserve. Oran Park Dr NSW	Moderate	Moderate	Low to moderate
	Residents			
VP5	Future Development, Oran Park Dr	Low	Low	Low
	Residents			
VP6	Williamson St. Oran Park, NSW	Moderate	Moderate	Moderate to high
	Residents			
VP7	Future residential development construction site. 21-49 Courtney Loop, Oran Park	Low	Low	Low
	Residents			
VP8	Residential Zone, 99-101 Holden Dr., Oran Park	Moderate	Moderate to high	High
	Residents			
VP9	Residential Zone, Olive Hill Dr., Cobbitty NSW	Moderate	Moderate	Moderate
	Residents			







Figure 6-24 Photomontage for VP6



Figure 6-25 Photomontage for VP8

Safeguards

Undertake works in accordance with Sydney Water Communications policies and requirements including:





- notify impacted residents and businesses
- erect signs to inform the public on nature of work
- personnel treat community enquiries appropriately.

Direct artificial light away from sensitive receivers where possible (ie residents, fauna or roadways).

Maintain work areas in a clean and tidy condition.

Maintain ongoing consultation with Western Sydney Parklands and Mount Annan Botanic Gardens. A vehicle permit will be obtained for construction work in Western Sydney Parklands.

Avoid work near the schools during exam periods.

Plant screening vegetation around the reservoir.

Paint the reservoir with a colour that reduces contrast, reflectivity and visual prominence.

Retain large mature trees to provide screening where possible.

6.2.11 Cumulative

Potential environmental impacts

The potential for cumulative impact is high due to the changing nature of the wider area and extensive infrastructure work currently underway throughout the proposal area including:

- RMS upgrade of The Northern Road, Bringelly Road, Camden Valley Way
- Other Sydney Water works
- Council road and other infrastructure upgrades
- residential development.

The local community is experiencing years of infrastructure construction and residential development and may experience 'construction fatigue'. There is also potential for negative community perception where Sydney Water is seen to be impacting recently constructed infrastructure.

There is potential for Sydney Water interaction with other Sydney Water projects. Compound sites and laydown areas may be used by more than one project. While this may reduce the need to clear vegetation or disturb ground, this has potential to prolong noise, dust and traffic impacts. Sydney Water will continue to consult with key stakeholders to coordinate projects to minimise impacts.

Safeguards

Continue to consult with key stakeholders that are constructing infrastructure in the area with a view to coordinating works where practicable.



6.2.12 General Environmental Management

Safeguards

Prepare a Construction Environmental Management Plan (CEMP) addressing the requirements of this environmental assessment. The CEMP should specify license, approval and notification requirements. Prior to the start of work, all project staff and contractors will be inducted in the CEMP.

The CEMP should be readily available on site and include a site plan which shows:

- no go areas and boundaries of the work area
- location of environmental controls (such as erosion and sediment controls, fences or other measures to protect vegetation or fauna, spill kits)
- location and full extent of any vegetation disturbance.

The pipeline alignment shown in the REF is indicative and based on latest concept design at the time of REF preparation. The final alignment may change based on activities such as detailed design and construction planning. No further environmental assessment is required provided the changed alignment:

- remains within the field assessment area for the REF and has no net additional environmental impact; or
- is outside the field assessment area for the REF but reduces the overall environmental impact of the project (as per clause 110E(a) of the Environmental Planning and Assessment Act 1979).

Changes to the Proposal outside the field assessment area will only occur:

- to reduce impacts to biodiversity, heritage or human amenity; or
- to avoid engineering (for example, geological, topographical) constraints; and
- after consultation with any potentially affected landowners and relevant agencies.

The Delivery Contractor must demonstrate in writing how the changes meet these requirements, for approval by Sydney Water's Project Manager in consultation with the environmental and communication representatives.

Sydney Water's Project Manager (after consultation with Sydney Water's environment and community representatives and affected landowners) can approve temporary ancillary construction facilities (such as compounds and access tracks), without additional environmental assessment or approval if the facilities meet the following principles:

- Limit proximity to 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 and existing access tracks
- No impacts to remnant native vegetation or key habitat features
- No disturbance to waterways
- · Potential environmental impacts can be managed using the safeguards in this REF
- No disturbance of contaminated land or acid sulphate soils



• Will be rehabilitated at the end of construction.

The Delivery Contractor must demonstrate in writing how the proposed ancillary facilities meet these principles. Any facilities that do not meet these principles will require additional environmental impact assessment.

The agreed location of these facilities must be shown on the CEMP site plan and appropriate environmental controls installed.

Prepare an Incident Management Plan (IMP) outlining actions and responsibilities during:

- onset of heavy rain during works
- spills
- unexpected heritage finds
- other potential incidents relevant to the scope of works.

All site personnel should be inducted into the IMP.

Immediately notify the Sydney Water Project Manager and Community Relations Representative of any complaints.

To ensure compliance with legislative requirements for incident notification (eg. *Protection of the Environment Operations Act 1997*), Sydney Water's employees and contractors will follow SWEMS0009.



7 Conclusion

Sydney Water has prepared this REF to assess the potential environmental impacts of construction and operation of the Prospect South to Macarthur Distribution System Link. During construction, the main potential environmental impacts of the proposal are typical construction impacts such as vegetation clearing, traffic, noise, Aboriginal heritage, erosion and sedimentation. During operation, the main impacts are associated with noise and visual impact.

The proposal is required to service growth and will also provide reliability and resilience by providing a bidirectional link between the Prospect South and Macarthur Delivery Systems.

The proposal has been considered in accordance with the principles of ecologically sustainable development (ESD) principles (**Table 2-6**). The proposal will result in positive long-term environmental improvements. In addition to servicing future growth, the bidirectional link will provide greater flexibility to balance the demand on the bulk water sources that supply the Prospect South and Macarthur systems and as a result, reduce the drought related supply risk to customers within these systems.

It is considered that, given the nature, scale and extent of impacts and implementation of the safeguards outlined in this REF, the proposed work is unlikely to have a significant impact on the environment and an environmental impact statement is not required under Division 5.1 of the EP&A Act.





8 Appendices

Appendix A – Clause 228 checklist

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Clause 228 checklist	REF finding
Any environmental impact on a community	There will be construction impacts on the community from traffic, noise and dust. The reservoir tanks at Oran Park have the potential to have a long-term visual impact. There will be environmental improvements by improving the resilience and reliability of the water service to the local community.
A transformation of a locality	The proposed work will construct two new reservoirs and three new pumping stations. These works are not expected to transform a locality.
Any environmental impact on the ecosystem of the locality	The proposed work will result in clearing of native vegetation, impacting ecosystems in the locality. Offsets will mitigate this impact.
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality	The proposed work will not result in an overall reduction of the aesthetic, recreational, scientific or other environmental quality or value of the locality.
Any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations	The proposed work will impact 12 Aboriginal heritage sites. Most of the sites have low significance. Salvage work will be undertaken at sites with higher significance to ensure that the archaeological value is recorded before impact. No more than minor impact is expected to any non-Aboriginal heritage items.
Any impact on the habitat of any protected animals (within the meaning of the Biodiversity Conservation Act 2016)	The proposed work may have any impact on the habitat of protected animals. Most of the work will be on certified land. Tests of significance were prepared for potential impact to threatened fauna species or their habitats in non-certified land. The tests concluded that the proposal will not have a significant impact. In additional offsets will minimise impacts on habitats of protected animals.
Any endangering of any species of animal or plant or other form of life, whether living on land, in water or in the air	The proposed work will not be endangering any species of animal, plant or other form of life, whether living on land, in water or in the air.



Clause 228 checklist	REF finding
Any long-term effects on the environment	The reservoir tanks at Oran Park will have a long-term visual impact. Vegetation will be planted around the tanks to minimise visual impacts. The proposal will have a positive long-term impact by improving the resilience and reliability of the drinking water supply.
Any degradation of the quality of the environment	The proposed work will not cause the degradation of the quality of the environment.
Any risk to the safety of the environment	Land slips have occurred at the Oran Park Reservoir site in the past. Construction of the tanks on the hill has potential to risk the safety of the environment. Retaining structures will be designed and constructed to eliminate the risk of land slip at the reservoir.
Any reduction in the range of beneficial uses of the environment	The proposed work will not have any reduction in the range of beneficial uses of the environment.
Any pollution of the environment	Environmental safeguards will mitigate the potential for the proposed work to pollute the environment. No pollution of the environment is expected.
Any environmental problems associated with the disposal of waste	Waste generation will be avoided where possible. Re-use opportunities will be investigated to minimise the volume of waste to be disposed.
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply	The proposed work will not increase demand on resources, that are, or are likely to become, in short supply.
Any cumulative environmental effect with other existing or likely future activities	During construction the proposed work has potential to have cumulative impacts with other road, utility and residential development in the area. Sydney Water will consult and coordinate work with key stakeholders.
Any impact on coastal processes and coastal hazards, including those under projected climate change conditions	The proposed work will not have any impact on coastal processes or hazards.



Appendix B – Consideration of ISEPP consultation

ISEPP clause	Yes	No
Clause 13, council related infrastructure or services – consultation with council		
Will the work:		
Potentially have a substantial impact on stormwater management services provided by council?		Ν
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		Ν
Involve connection to, and have a substantial impact on, the capacity of a Council owned sewerage system?		Ν
Involve connection to, and use of a substantial volume of water from a Council owned water supply system?		Ν
Involve installation of a temporary structure on, or enclosing, a public space under council's control that will cause a disruption to pedestrian or vehicular traffic that is not minor?		Ν
Involve excavation of the surface of, or a footpath adjacent to, a road for which the council is the roads authority that is not minor or inconsequential?	Y	
Clause 14, local heritage – consultation with council		
Is the work likely to affect the heritage significance of a local heritage item, or of a heritage conservation area (not also a State heritage item) more than a minor or inconsequential amount?		Ν
Clause 15, flood liable land – consultation with council		
Will the work be located on flood liable land (that is land that is susceptible to flooding by the probable maximum flood event) and will they alter flood patterns other than to a minor extent?		Ν
Clause 15AA, flood liable land – consultation with State Emergency Services		
Will the work be located on flood liable land (ie. land that is susceptible to flooding by the probable maximum flood event) and undertaken under a relevant provision*, but not the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance? * (e) Div.14 (Public admin buildings), (g) Div. 16 (Research/ monitoring stations), (i) Div. 20 (Stormwater systems)?		N
Clause 15A, development with impacts on certain land within the coastal zone– council consultation		
Is the work on land mapped as coastal vulnerability area and inconsistent with a certified coastal management program?		Ν
Clause 16 – consultation with public authorities other than councils		
Will the proposal be located on land adjacent to land reserved under the <i>National Parks and Wildlife Act</i> 1974 or to land acquired under Part 11 of that Act? <i>If so, consult with DPIE.</i>	Y	
Will the proposal be located on land in Zone E1 Nationals Parks and Nature Reserves or in a land use zone that is equivalent to that zone? <i>If so, consult with DPIE</i>		Ν
Will the proposal be adjacent to an aquatic reserve or a marine park declared under <i>Marine Estate</i> Management Act 2014? If so, consult with the Department of Industry.		Ν
Will the proposal be in the foreshore area within the meaning of the <i>Sydney Harbour Foreshore Authority Act</i> 1998? If so, consult with Sydney Harbour Foreshore Authority		Ν
Will the proposal comprise a fixed or floating structure in or over navigable waters? consult RMS		Ν





Will the proposal be located on land in a mine subsidence district within the meaning of the <i>Coal Mine</i> Subsidence Compensation Act 2017? If so, consult with Subsidence Advisory NSW.	Y	
Will the proposal involve clearing of native vegetation on land that is not subject land (ie non-certified land)? If so, notify DP&E at least 21 days prior to work commencing.	Y	







Appendix C – Ecological Assessment







Appendix D – Aboriginal Cultural Heritage Assessment Report

Aboriginal heritage information must not be made publicly available or be published in any form or by any means by Sydney Water or our contractors / joint ventures, unless where approval has been sought from <u>OEH's AHIMS Registrar</u> and provided in writing to Sydney Water.

For those REFs which are being publicly displayed, all Aboriginal heritage information which identifies individual sites must be removed.

Prospect South to Macarthur Link | Review of Environmental Factors




Appendix E – Statements of Heritage Impact





Appendix F – Construction Noise Assessment





Appendix G – Visual Impact Assessment

Prospect South to Macarthur Link | Review of Environmental Factors