11.6 Socio-economics

This section describes the existing socio-economic characteristics of Western Sydney, specifically those areas close to the project, and the potential socio-economic impacts during project construction and operation. This section provides an overview of the findings, which are reported in more detail in the detailed Socio-economic Impact Assessment (SIA) (Aurecon Arup, 2021i) included in Appendix X.

Socio-economic assessment summary

During construction, the project has the potential to impact the local community, both positively and negatively. Once operating, the overall positive impacts of improved wastewater servicing, will outweigh the largely minor negative impacts.

Positive socio-economic impacts during construction include the creation of about 400 construction jobs. However, communities close to the construction activities, may experience negative socio-economic impacts mainly relating to temporary traffic, access and noise impacts and to some personal property and open space. These can cause amenity and nuisance issues and reduce social cohesion where they disrupt people's everyday activities. With management measures, most of these negative socio-economic impacts reduce to moderate or low in significance. Construction impacts are unlikely to impact the economic or demographic profile of the suburbs directly affected, or the wider Western Sydney community. Construction impacts on land use will also be minor, with temporary impacts on landuse on portions of some properties while infrastructure is built. The exception is the impact on the AWRC facility site itself, which Sydney Water will acquire from the current landowner.

The key positive socio-economic impact of the project, once it is operational, is the provision of essential wastewater services and of recycled water which will support long-term liveability and growth in the region. However, it is important to recognise that there may be parts of the community who see this growth and the development of the region as negative. However, once operational, the project's negative socio-economic impacts will be relatively minor given the pipelines will be largely underground, the treated water release structures will have a small footprint and be relatively unobtrusive and the amenity impacts at the AWRC will be limited. Minor negative impacts at the AWRC include visual impact which will reduce as landscaping treatments are undertaken and plantings establish. Operational land use conflicts will also be minor.

Ongoing engagement with businesses, communities and local councils will be important to understand stakeholder issues and to ensure stakeholders remain adequately informed.

Sydney Water also proposes a range of management measures to minimise the scale of effects on people's everyday activities, including redirection signage on roads and around businesses and coordinating with key community and school activities.

11.6.1 Relevant Secretary's Environmental Assessment Requirements

Table 11-53 lists the Secretary's Environmental Assessment Requirements (SEARs) relevant to socio-economics and where in this section they are addressed.

Table 11-53 Project SEARs relating to socio-economic and land use impacts

SEARs	EIS section where requirement addressed
Agricultural land – including:	
27. Identify potential impacts of the proposed development on the operations of impacted agricultural industries and detail the mitigation measures to enable the agricultural industries to continue to operate. This could be detailed in a Land Use Conflict Risk Assessment (LUCRA) in consultation with DPI Agriculture	Sections 11.6.5, 11.6.6, 11.6.7, 11.6.8 and Appendix X
28. Consult with the owners / managers of affected and adjoining neighbours and agricultural operations in a timely and appropriate manner about the project, the likely impacts and suitable mitigation measures or compensation.	Chapter 6
Social – including a Social Impact Assessment, that:	This section and Appendix X
42. Identifies and assesses the potential social impacts of the project, from the points of view of the affected community/ies and other relevant stakeholders, i.e. how they expect to experience the project.	
43. Assesses the significance of positive, negative and cumulative social impacts considering likelihood, extent, duration, severity/scale, sensitivity/importance, and level of concern/interest.	Sections 11.6.5, 11.6.6, 11.6.7 and 11.6.8
44. Includes mitigation measures for likely negative social impacts and any proposed enhancement measure.	Section 11.6.9
45. Provides details of how social impacts will be adaptively monitored and managed over time.	Section 11.6.9

11.6.2 Methodology and assumptions

Appendix X contains the complete social impact assessment which assesses socio-economic impacts during construction and operation of the project. The methodology for the socio-economic assessment was based on the following guidance documents:

- Social Impact Assessment Guideline (DPE, 2017). While this provides guidance on the assessment process and information requirements for State significant mining, petroleum production and extractive industry development, it is frequently used as a guide to social impact assessment for other significant infrastructure projects.

- Social Impact Assessment Guideline for State Significant Projects (DPIE, 2021d). Although it has since been finalised, this guideline was in draft at time of writing this socio-economic assessment, which sought to be consistent with the draft guideline where possible.

In applying these guidelines, the following key steps were taken:

- Identifying socio-economic specific study areas and the sensitive receivers within those.
- Using desktop investigations, fieldwork and consultation to understand the current socio-economic conditions, and establish a baseline.
- Impact assessment involving identifying the project's potential socio-economic impacts on that baseline and developing management measures to avoid or minimise these impacts to acceptable levels.

Each of these steps is described further below.

Social impact assessment study areas

The following study areas were established for the assessment:

- Impact assessment area – this reflects the whole-of-project 'impact assessment area', aligns with the area considered in other EIS technical reports and is considered to best represent the area likely to be directly impacted by the project.
- Local influence area **–** a 25-metre buffer around the impact assessment area. This shows the area immediately adjacent to the project which is likely to be influenced by particular project impacts, particularly amenity and access impacts during the construction phase. This is specific to the socio-economic impact assessment and acknowledges the influence direct impacts may have on the neighbouring community.
- Socio-economic study area (SESA) – this represents broader communities most likely to interact and intersect with the project. It is the potential extent of broader scale, and more indirect impacts to communities from the project. It covers a total of 25 suburbs (aligned to the ABS State Suburb boundaries), including large areas of urban, rural and agricultural land.

Due to the size and diversity of the SESA, it was further divided into three sections (SESA western, central and eastern) reflecting the different land use and likely socio-economic impacts across the study area. Table 11-54 describes these study areas and they are mapped in Figure 11-35.

Table 11-54 Socio-economic study area and suburbs

Study area	Suburbs	Description	Project element
SESA-western	Greendale Mulgoa Silverdale Wallacia Warragamba	Predominantly rural and agricultural. Some key waterways and nature reserves. Includes parts of Western Sydney Aerotropolis Growth Area (WSAGA).	Treated water pipeline and environmental flows pipeline

Study area	Suburbs	Description	Project element
SESA-central	Badgerys Creek Cecil Park Erskine Park Kemps Creek Luddenham Mount Vernon Orchard Hills	Predominantly rural and agricultural. Waterways and native vegetation. Some rural residential uses, particularly around Kemps Creek and Mount Vernon. Includes parts of WSAGA. Western Sydney International Airport in this area.	AWRC, treated water pipeline and brine pipeline
SESA-eastern	Bonnyrigg Bonnyrigg Heights Cabramatta Canley Heights Canley Vale Cecil Hills Green Valley Lansvale Mount Pritchard St John's Park Cabramatta West Carramar Lansdowne	Predominantly urban and residential (low to high density). Parkland and open space along western and eastern edges.	Brine pipeline

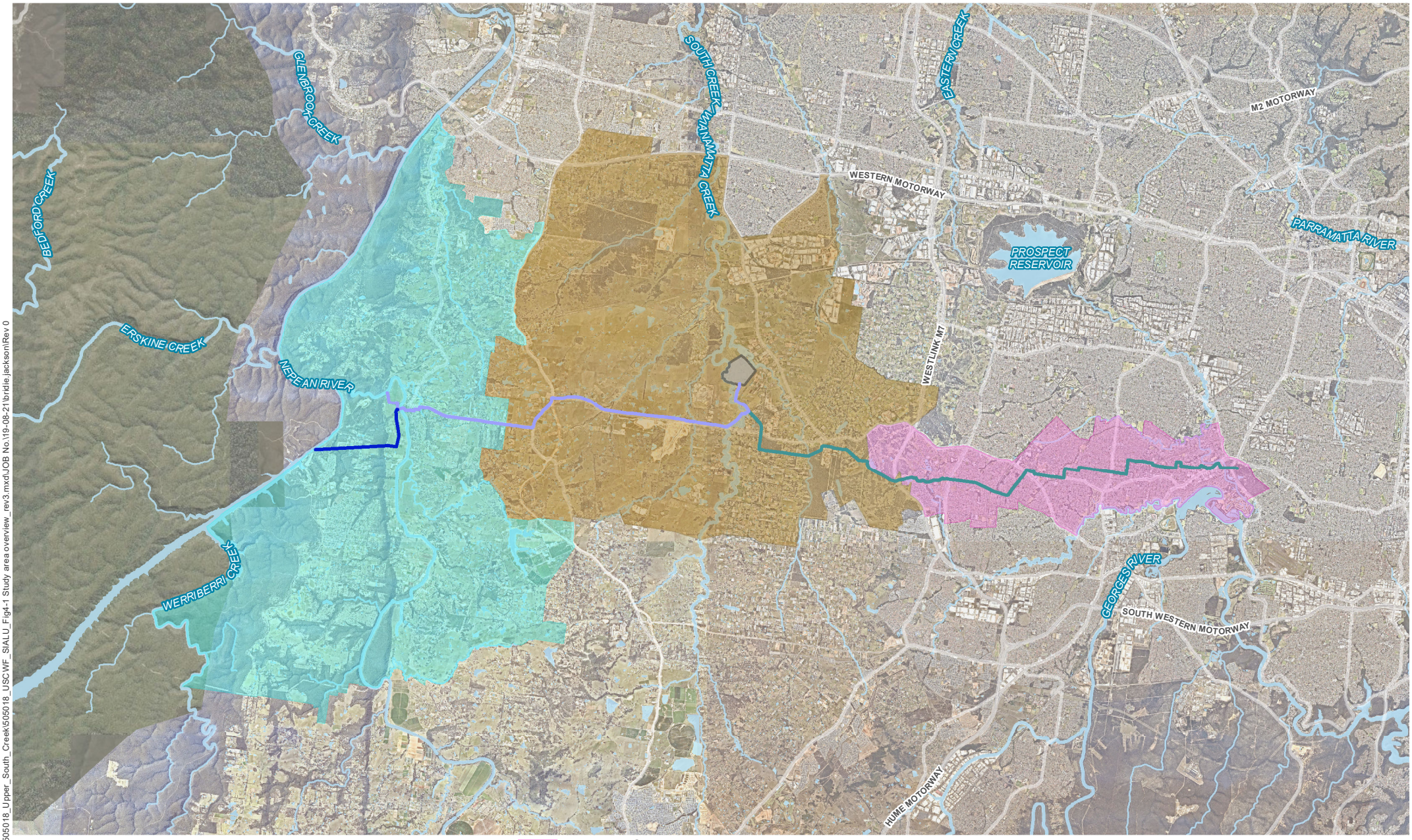

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Figure 11-35 Socio-econoic assessment study areas

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

Sensitive receivers

Based on the desktop assessment, field inspection of the impact assessment area and consultation with councils, a range of project specific sensitive receivers were considered. Section 11.6.3 summarises the sensitive receivers identified in relation to socio-economic and land use impacts.

Establishing socio-economic baseline

The socio-economic baseline was established through the following three tasks:

- Desktop assessment reviewed data sources such as the Australian Bureau of Statistics (ABS) data, economic data and community strategic plans.
- Fieldwork involving:
  - high level inspection of the entire impact assessment area and neighbouring land uses to identify key areas of sensitivity to socio-economic and land use impacts
  - detailed inspection of areas identified in the high level inspection as requiring more in-depth review. For example, reviewing social infrastructure and commercial operations that may be impacted in locations such as Wallacia, Luddenham and Cabravale.
- Consultation involving:
  - reviewing consultation undertaken for the wider project across a variety of stakeholders (as outlined in Chapter 6) and incorporating it into the assessment where relevant
  - social impact assessment specific consultation with councils in local government areas (LGAs) where the project will be located. The results of this consultation are included in Appendix X.

Social impact assessment methodology

Potential socio-economic impacts were assessed under each of the following categories:

- Way of life – impacts to how people live, work, play and interact with each other – including employment, housing, access and connectivity.
- Community – impacts to socio-demographic composition and community cohesion.
- Access and connectivity - access to and use of infrastructure, services and facilities.
- Culture – impacts to shared beliefs, customs, values and stories, including Aboriginal culture and connection to country.
- Health and wellbeing - impacts to physical and mental health.
- Surroundings – impacts to access to and use of the natural and built environment, and its aesthetic value or amenity (for example noise, air quality, landscape and visual impacts).
- Personal and property rights – impacts to property and access and the socio-economic implications.

- Decision-making systems – impacts to the extent to which communities can have a say in decisions that affect their lives.
- Fears and aspirations – impact to key community concerns and visions at present, or for the future.

A risk matrix was used to determine the potential impact in accordance with DPIE's Social Impact Assessment Guideline. Table 11-55 outlines the rating of the likelihood of a given impact and Table 11-56 outlines the consequence criteria for a given impact. These were combined to determine the socio-economic impact risk in accordance with the risk matrix in Table 11-57. Risks were assessed before and after mitigation to establish the importance of potential impacts to the sensitivity of various receivers.

Table 11-55 Likelihood of impact

Likelihood of impacts	Description
Rare	May occur only in exceptional circumstances - can be assumed not to occur during period of the project (probability <10%)
Unlikely	Event is unlikely to occur, but it is possible during period of the project (probability 10-30%)
Possible	Event could occur during period of the project (probability 30-70%)
Likely	Event likely to occur once or more during period of the project (probability 70-90%)
Almost certain	Very likely to occur as a result of the proposed proposal construction and/or operations; could occur multiple times during relevant impacting period (probability > 90%)

Table 11-56 Social consequence criteria

Consequence level	Description
Minimal	No change to the social environment. Impacts are likely to be beneath detection levels.
Minor	Impacts are noticeable but acceptable and tend to be short term, or temporary and at a local scale. The social environment is changed (decreased amenity) and people who live and work in the area (or its surrounds) may be impacted by the project. It is expected that the community can/will adapt to changes over time and that negative public perceptions of the project are easily managed.

Consequence level	Description
Moderate	Impacts tend to range from long term to short term and occur over medium scale or localised areas. The social environment is changed (decreased amenity) and people who live and work in the area (or its surrounds) may be moderately impacted by the project. It is expected that the community has some capacity to adapt and cope with change and that negative public perceptions of the project can be managed.
Major	Impacts tend to be permanent, or otherwise long to medium term and occur over large or medium scale areas. The social environment is damaged, and people no longer want to live and work in the area (or its surrounds). The community has limited capacity to adapt and cope with change and the public negativity of the project is difficult to manage.
Catastrophic/ transformational	Impacts tend to be permanent, or irreversible, or otherwise long term and occur over large scale areas. People can no longer safely live or work in the region because of impacts associated with the project. The social environment is irrevocably damaged. The community has no capacity to adapt and cope with change and there is a great level of public negativity surrounding the project.

Table 11-57 Impact evaluation matrix

Likelihood	Consequence				
	Minimal	**Minor**	**Moderate**	**Major**	**Catastrophic**
Almost certain	High	High	Extreme	Extreme	Extreme
Likely	Moderate	High	High	Extreme	Extreme
Possible	Low	Moderate	High	Extreme	Extreme
Unlikely	Low	Low	Moderate	High	High
Rare	Low	Low	Moderate	High	High

Future baseline conditions (without the project)

Section 11.6.3 describes existing baseline conditions in the SESA. As a result of the investment in Western Sydney, additional urban development and associated population growth is expected, along with a change in associated demographic and socio-economic indicators over time. Land use and character is also likely to significantly change. These changes are unrelated to the project.

The project will provide essential wastewater services to support this urban development and ensure wastewater is managed to protect human health and the environment. Section 3.2.1 provides more detail about the consequences of not proceeding with the project. From a socio-economic perspective, it would mean a continued reliance on higher risk site-based wastewater systems (such as septic tanks) which are not suitable for the scale of urban development proposed in the area. This would result in inequitable provision of quality wastewater services, compared with the rest of Sydney, and likely result in increased amenity impacts, particularly in the SESA central and western regions.

Land use conflict risk assessment methodology

The assessment of land use conflict risk was undertaken in accordance with the Land Use Conflict Risk Assessment Guideline (LUCRA Guideline) (DPI, 2011). The LUCRA Guideline establishes the following steps in the assessment process:

- Step 1 – gather information to characterise historical and current land uses on the site and adjoining lands, identify key stakeholders and compare and contrast the proposed land use for potential incompatibility and conflict issues.
- Step 2 – evaluate the risk level of each activity proposed to be undertaken as part of the project and assign a probability and consequence rating in accordance with the risk ranking matrix contained in the LUCRA Guideline.
- Step 3 – where application of the risk matrix has identified high potential for land use conflicts to occur develop risk reduction strategies and management measures to avoid, reduce of manage these risks.
- Step 4 – record the results of the LUCRA in a report. The LUCRA as summarised in this section and attached in Appendix X.

Assumptions and limitations

This assessment was based on information available at the time of writing and designed to respond to the SEARs specific to the project. The assessment assumes the following:

- Primary quantitative analysis of economic impacts is not required. In line with the DPIE Social Impact Assessment guideline, the economic assessment focuses on consideration of socio-economic factors such as employment, industry and business impacts of the project.
- Statistics, primarily sourced from the ABS, are accurate and representative for the purposes of informing this assessment.
- Chapter 2 of the EIS references Department of Planning, Industry and Environment (DPIE) population growth projections which are used to inform Sydney Water's infrastructure planning. Despite this, it is standard practice to use ABS data in SIA as it provides a wide range of data, in addition to population projections, that can be reviewed collectively to provide a holistic characterisation of the community.

- Data used in the socio-economic assessment, including Australian Bureau of Statistics 2016 Census information has been sourced from pre COVID-19 analysis. It is noted that COVID-19 may impact statistics relating to employment, travel, population and social cohesion. Despite this, the data used was the most representative available at the time of writing and COVID-19 impact, for the most part, may result in temporary short term impacts to social values but is unlikely to result in significant changes to long term trends.

11.6.3 Existing environment

This section describes the existing socio-economic environment followed by a description of the existing land use context.

Socio-economic existing environment

This section provides an overview of the socio-economic characteristics of the SESA in relation to:

- socio-demographic profile – including population, housing and household characteristics
- socio-economic profile of residents – including employment and underemployment statistics and details of employment by sector for SESA residents
- crime statistics
- economic, industry and employment profile – including existing industries in the SESA and their employment and employment growth estimates, regardless of place of residence of employee
- social infrastructure
- access and connectivity – including vehicle ownership and method of travel to work preferences
- community values – social and community cohesion, overarching community values and cultural values.

This section also identifies key issues for consideration in the assessment of socio-economic impact, based on the analysis of these existing SESA characteristics.

Population

Table 11-58 summarises the population in the western, central and eastern SESAs based on 2016 ABS Census data. The total population of the SESA is about 2.7% of the total population of Greater Sydney which is 4,823,991.

Table 11-58 Population within the SESA

	Western	Central	Eastern	Total
Number of people	8,796	14,597	107,913	131,306

The following sections summarise some of the key characteristics of the population in the western, central and eastern SESAs, compared with Greater Sydney.

Age distribution

- The residential population across the SESA is generally younger than the Greater Sydney average.
- There is generally a greater proportion of children and teenagers (people aged from 5 to 19 years old) and middle aged people (people aged 45 to 64 years old) across the SESA, when compared to the Greater Sydney average, and also a lower proportion of older people (aged 65 years and over) when compared to the Greater Sydney average.
- The SESA western has a greater proportion of children aged from 5 to 14 years old, when compared to the Greater Sydney average.
- SESA central and eastern have a higher proportion of young adults (aged 20 to 24 years old) when compared to the Greater Sydney average.

Aboriginal community

- There is a greater proportion of the population that identifies as Aboriginal in the SESA western (3%) and central (2%), when compared to the Greater Sydney average.
- SESA eastern has a similar proportion of the population (1%) identifying as Aboriginal as Greater Sydney.

Language

- A high proportion of the SESA eastern population speak a language other than English at home (72%) and of that population a high proportion (33%) speak English not very well or not at all.
- Smaller proportions of the SESA western (10%) and central (26%) speak a language other than English at home. Similarly, smaller proportions of these populations are reported as not speaking English very well or at all - 9% in the SESA western and (11%) in the SESA central.
- A higher proportion of residents were born overseas in the SESA eastern (60% of all residents) compared to Greater Sydney.
- In the SESA eastern, key languages spoken include Vietnamese, Chinese Mandarin, Cantonese, Khmer (Cambodian), Arabic and Assyrian Neo-Aramaic. For the SESA central there is a greater mix across European and other languages with key languages spoken including Arabic, Italian, Croatian and Cantonese. In the SESA western languages spoken are predominantly European languages, including Italian, Maltese, Spanish and Greek.

Need for assistance

- Needs for assistance data counts people that need help or assistance in at least one core activity area including self-care, mobility and communication due to either a disability, long term health condition or old age.

- 8% of residents in the SESA eastern are identified as needing assistance which is above the Greater Sydney average of 5%.
- SESA western and central each have 4% of the population identified as needing assistance.

Population projections

Table 11-59 documents the predicted population growth data (ABS, 2016) in the five local government areas (LGAs) in which the project is located, compared with the Western City District, Greater Sydney and NSW. Growth rates in the SESA central and western are predicted to be greater than the Greater Sydney average. The SESA eastern is expected to grow at similar rate to the rest of Greater Sydney. In summary populations of the SESA areas is described as:

- Western SESA:
  - 2016: 251,451
  - 2041: 451,759
- Central SESA:
  - 2016: 373,549
  - 2041: 690,689
- Eastern SESA:
  - 2016: 567,537
  - 2041: 779,241.

Table 11-59 Population projections

Geographical area	Study area	2016	2021	2026	2031	2036	2041	% change between 2016 and 2041
Wollondilly LGA	Western	49,854	54,140	58,482	66,381	73,477	82,513	66%
Penrith LGA	Western	201,597	230,289	248,577	292,019	350,906	369,246	83%
Liverpool LGA	Central	211,983	251,322	291,187	328,447	380,085	441,427	108%
Campbelltown LGA	Central	161,566	180,051	194,039	212,366	227,946	249,262	54%
Fairfield LGA	Eastern	205,675	209,983	216,693	232,681	254,821	264,588	29%
Canterbury-Bankstown LGA	Eastern	361,862	396,288	432,566	463,956	482,222	514,653	42%
Western City District	-	1,056,120	1,199,187	1,310,725	1,467,354	1,680,844	1,878,133	78%
Greater Sydney	-	4,688,255	5,252,611	5,746,821	6,211,970	6,661,720	7,103,091	51.5%
NSW	-	7,732,858	8,414,978	9,011,010	9,560,567	10,077,964	10,572,696	37%

Housing and households

According to 2016 ABS Census statistics, the SESA has the following housing and household characteristics:

- There are 37,140 dwellings across the SESA western (2,656), central (4,055) and eastern (30,429).
- In the SESA western and central in particular, over 95% of dwellings are separate houses, which is significantly higher than the Greater Sydney average of 57% of dwellings.
- Family households with children (couples with children and one parent families) represent 55% to 64% of all households across the SESA western, central and eastern. Across Greater Sydney, families with children represent 48% of all households.
- Household sizes are typically larger in the SESA western, central and eastern when compared to the Greater Sydney average with the greatest difference being the SESA eastern which has a higher proportion of household with six or more people (11%) compared to the Greater Sydney average (5%).
- Most households in the SESA western, central and eastern own their homes, either under full ownership or under mortgage.
- Household income in the central and SESA western is similar in distribution to Greater Sydney while the SESA eastern has a higher proportion of its population in the lowest income quartile (29%), and a lower proportion in the highest income quartile (11%), compared to Greater Sydney.

Employment and underemployment

Table 11-60 outlines the different rates of employment and unemployment across SESA and compared with Greater Sydney. There is a greater proportion of unemployment in the SESA eastern when compared to the Greater Sydney average and compared to the SESA western and central.

Table 11-60 Unemployment and workforce participation

	Western	Central	Eastern	Greater Sydney
Unemployment – percentage of population	4.2	4.4	10.8	6.0
Labour force participation – percentage of population	63.9	65.6	51.4	61.6

Industries which employ residents from the study area

The largest sectors of employment in each of the study areas by percentage of workforce are:

- SESA western: construction (18%), retail trade (9%), health care social and assistance (9%) and manufacturing (8%)

- SESA central: construction (15%), retail trade (10%), health care social and assistance (9%) and manufacturing (8%)
- SESA eastern: manufacturing (13%), retail trade (11%), construction (10%) and health care social and assistance (9%).

Crime statistics

A review of the NSW Bureau of Crime Statistics and Research (2020) indicated the following crime trends in the study area:

- Crime rates in the SESA western are generally lower than the SESA central and eastern.
- Cabramatta in the SESA eastern has the highest rate of theft incidents, having about 3,000 cases per 1,000,000 persons.
- The crime rate of drug offences across all study areas is between low and moderate levels.
- Kemps Creek in the SESA central had the highest rate of assault among all study areas, indicating about 260 to 1,160 cases per 1,000,000 persons between 2019 and 2020.
- Overall crime rates are of a low to moderate level across the SESA, with limited variation across the SESA western, central and eastern– although some pockets of higher crime rates are noted during 2019-20, around Cabramatta, Kemps Creek and Canley Vale.

Industries generating employment in the SESA

The largest sectors of employment generation (including employment from inside and outside of the study areas) by percentage of workforce are:

- health care social and assistance (12.96%)
- manufacturing (11.30%)
- retail trade (10.77%)
- education and training (9.29%).

Future industry and employment growth

Table 11-61 provides an overview of the key industries of employment growth in Western Sydney to 2046 based on Transport for NSW Travel Zone Projection 2019 (TfNSW, 2019). The projected changes in employment align with the growth anticipated across Western Sydney primarily around the WSAGA.

Table 11-61 Projected industry of employment to 2046

Industry of employment	2016 employees	2046 employees	Employment growth
Information media and telecommunications	774	3,974	3,200 (412%)
Professional, scientific and technical services	4,744	20,012	15,268 (322%)
Financial and insurance services	1,739	6,265	4,525 (260%)
Beverage and tobacco product manufacturing	90	320	231 (257%)
Arts and recreation services	1,278	4,147	2,869 (224%)
Transport, postal and warehousing	10,497	33,114	22,617 (215%)
Rental, hiring and real estate services	2,202	5,910	3,708 (168%)
Health care and social assistance	19,020	50,648	31,628 (166%)
Public administration and safety	9,027	23,612	14,585 (162%)
Accommodation and food services	9,163	21,816	12,653 (138%)

Commercial operations and businesses

Table 11-62 summarises the commercial and business characteristics of the SESA. Appendix X includes a detailed list of businesses in the impact assessment area.

Table 11-62 Commercial operations and businesses

Area	Description
SESA western	• Typified by local businesses centred around local facilities such as council chambers and educational facilities, forming small business villages/town centres within suburbs. • High streets or strips consisting of local shops and offices, such as in Wallacia and Luddenham. • No large shopping centres. • Various accommodation facilities, retreats and reception businesses throughout the SESA western. It is likely that these businesses may also cater to tourists visiting the Blue Mountains National Park.

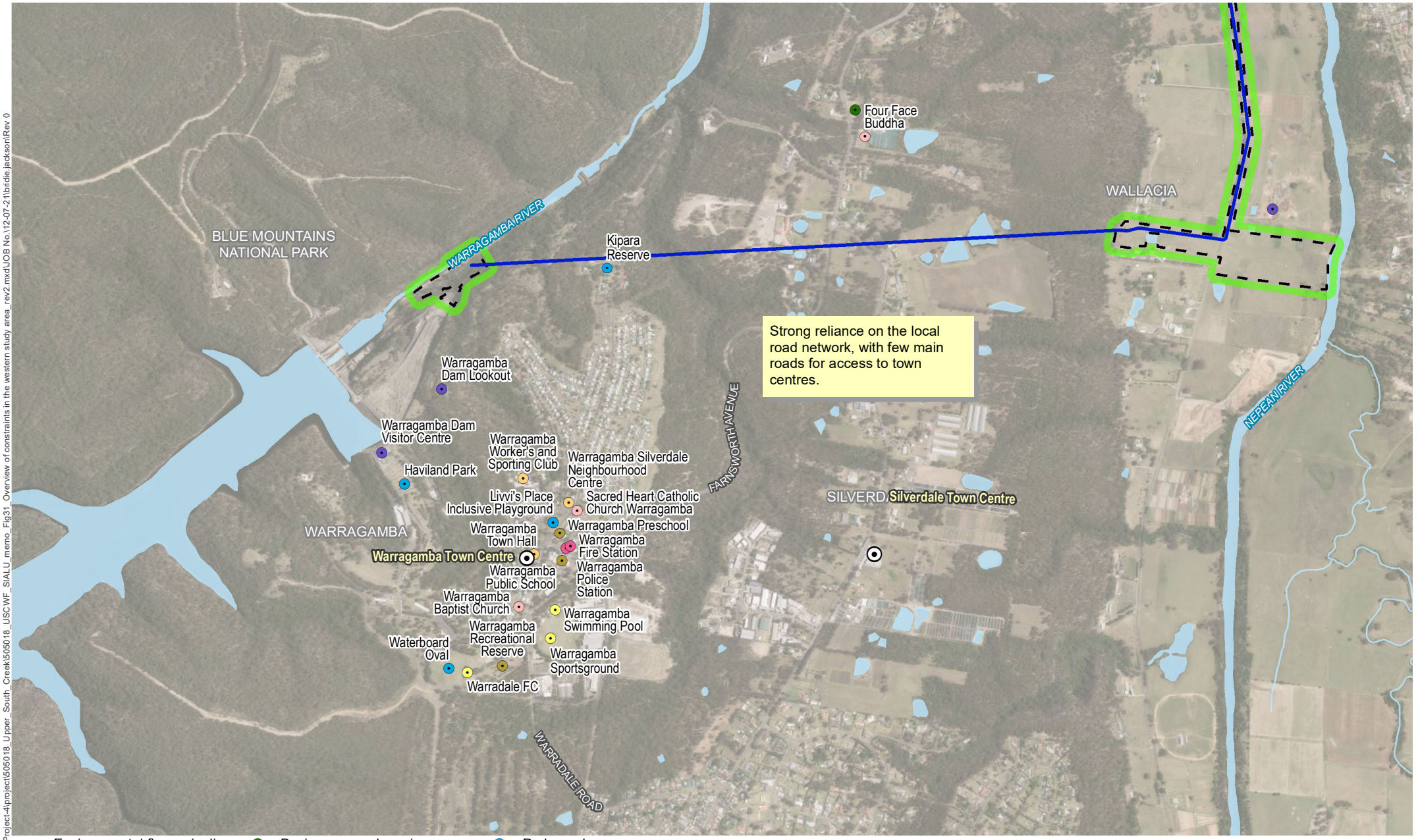
Area	Description
SESA central	• Prominent home-based business presence, with large agricultural properties and residential homes in town centres providing services from home. These include home based florists, grocers, kennel accommodation and trades. • Local businesses in small sections along local roads such as Elizabeth Drive, Kemps Creek, including an express IGA supermarket, cafes and a post office. • Along Mamre Road and Elizabeth Drive, there are a range of industrial type businesses, quarries, waste and recycling facilities, farms including livestock traders and produce sellers and nurseries. • Erskine Park Industrial Park is also located in the north eastern section of the study area. It is accessed by trucks and large freight vehicles for warehousing and storage, closely located to the M4 Motorway and M7 Motorway.
SESA eastern	• Businesses more varied given the more urbanised and developed nature of this area. • Most suburbs have strips of local businesses and shops dispersed throughout. Some areas of clustered businesses are comprised of larger commercial chains such as fast-food outlets and supermarkets. Examples of these areas throughout the study include Cecil Hills Shopping Village Green Valley Shopping Village, Brown Road shops, Bonnyrigg Plaza, Rigg Place Plaza, Canley Vale shops. • Bonnyrigg Plaza is the only large shopping centre complex. • Cabramatta has the largest town centre with facilities, shops and services clustered together. • Areas located close to public transport. • The businesses in Lansvale along the Hume Highway are large manufacturing/industrial type businesses, including car dealerships, wholesalers, mechanical, furniture and material storage premises.

Social infrastructure

Social infrastructure refers to community facilities and services which a community values for social needs and community wellbeing. Social infrastructure throughout the local influence area includes:

- primary, secondary and tertiary education facilities, including child and day care facilities
- health and emergency facilities
- recreational facilities, including sporting venues and open space
- religious and cultural facilities
- parks and reserves, including areas of passive recreation
- community facilities and spaces, including council chambers and halls.

The social infrastructure of the SESA is shown on Figure 11-36 with a full list provided in Appendix X.



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

Projection: GDA2020 MGA Zone 56

Figure 11-36a Social infrastructure in the study area

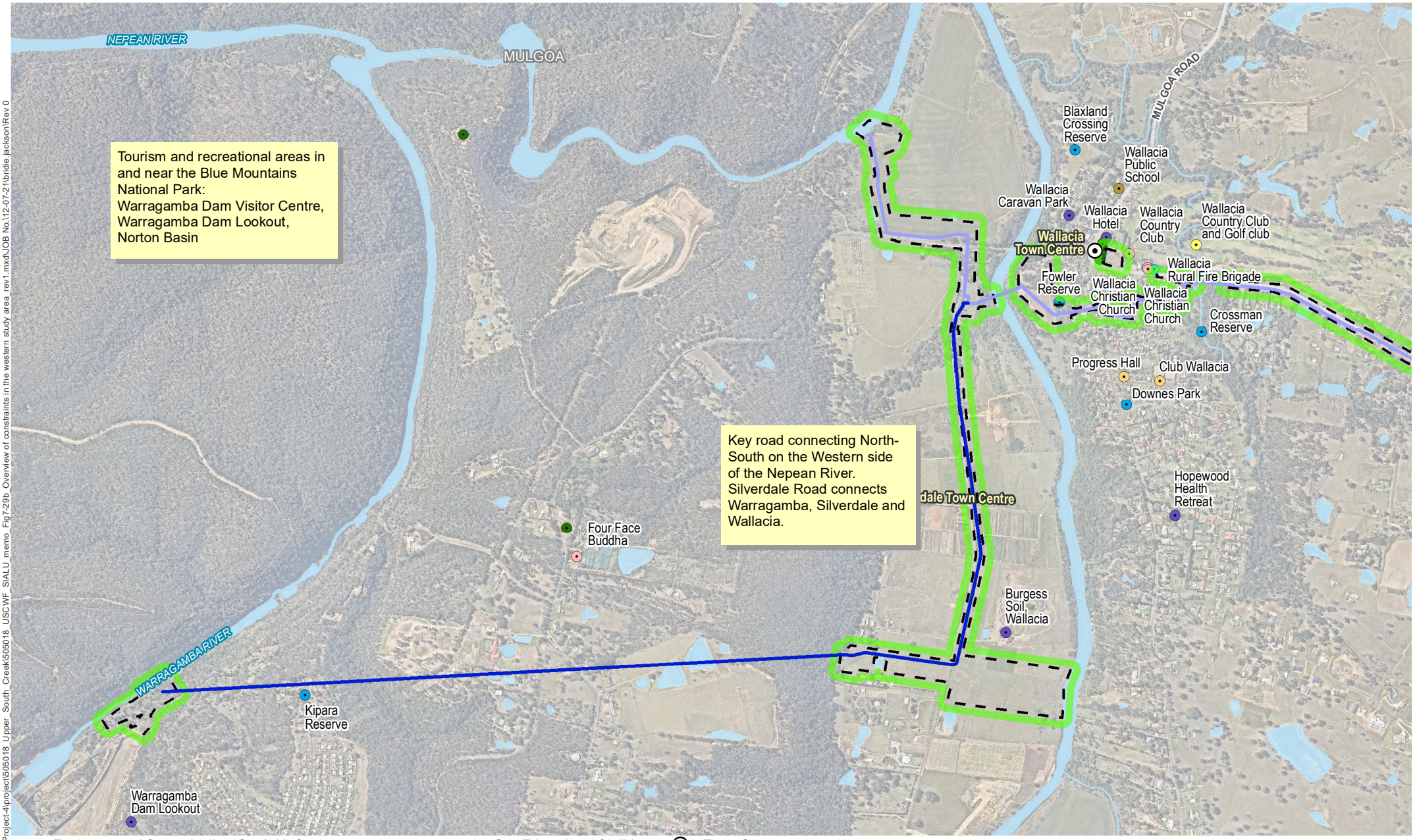


Figure 11-36b Social infrastructure in the study area

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

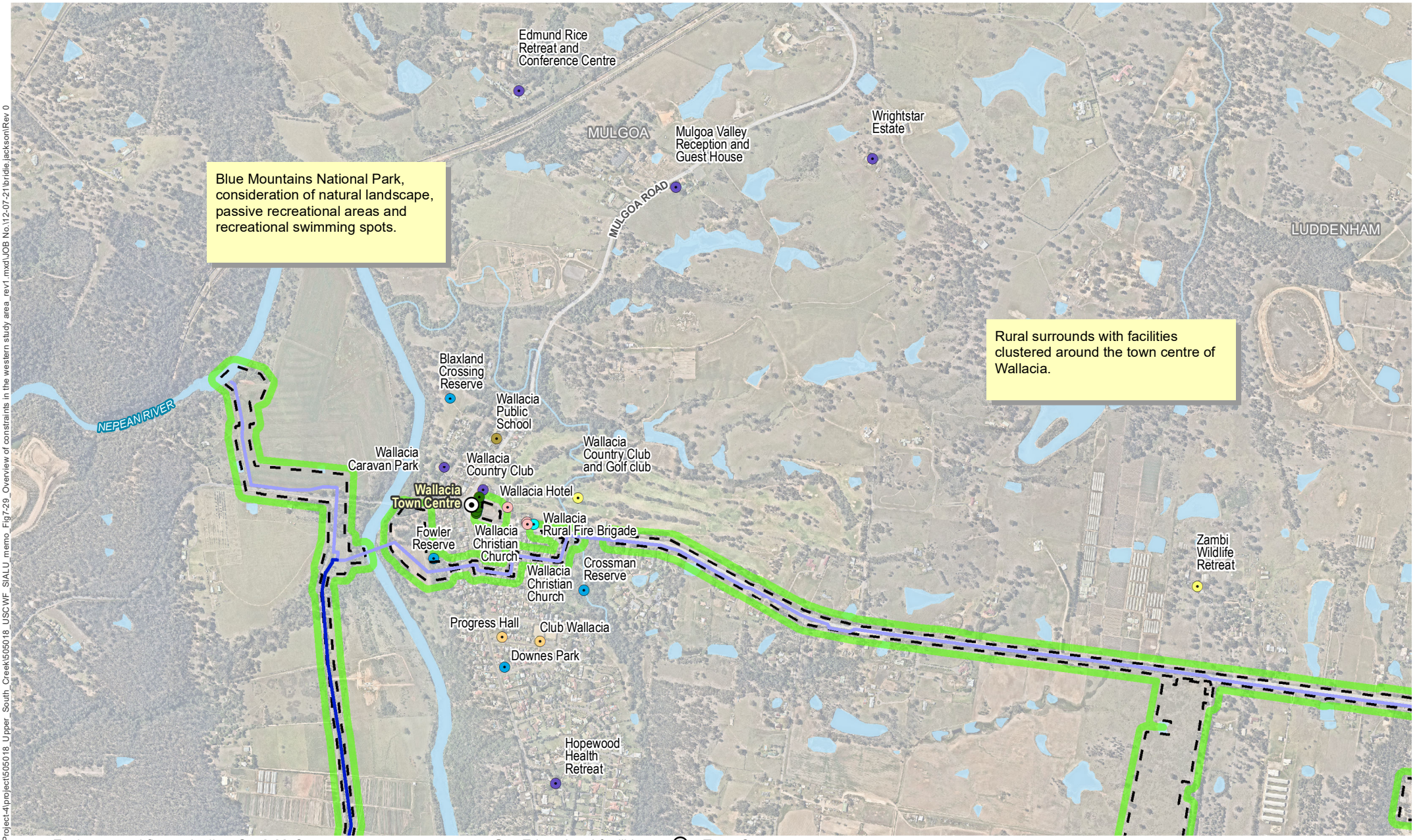


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Figure 11-36c Social infrastructure in the study area

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

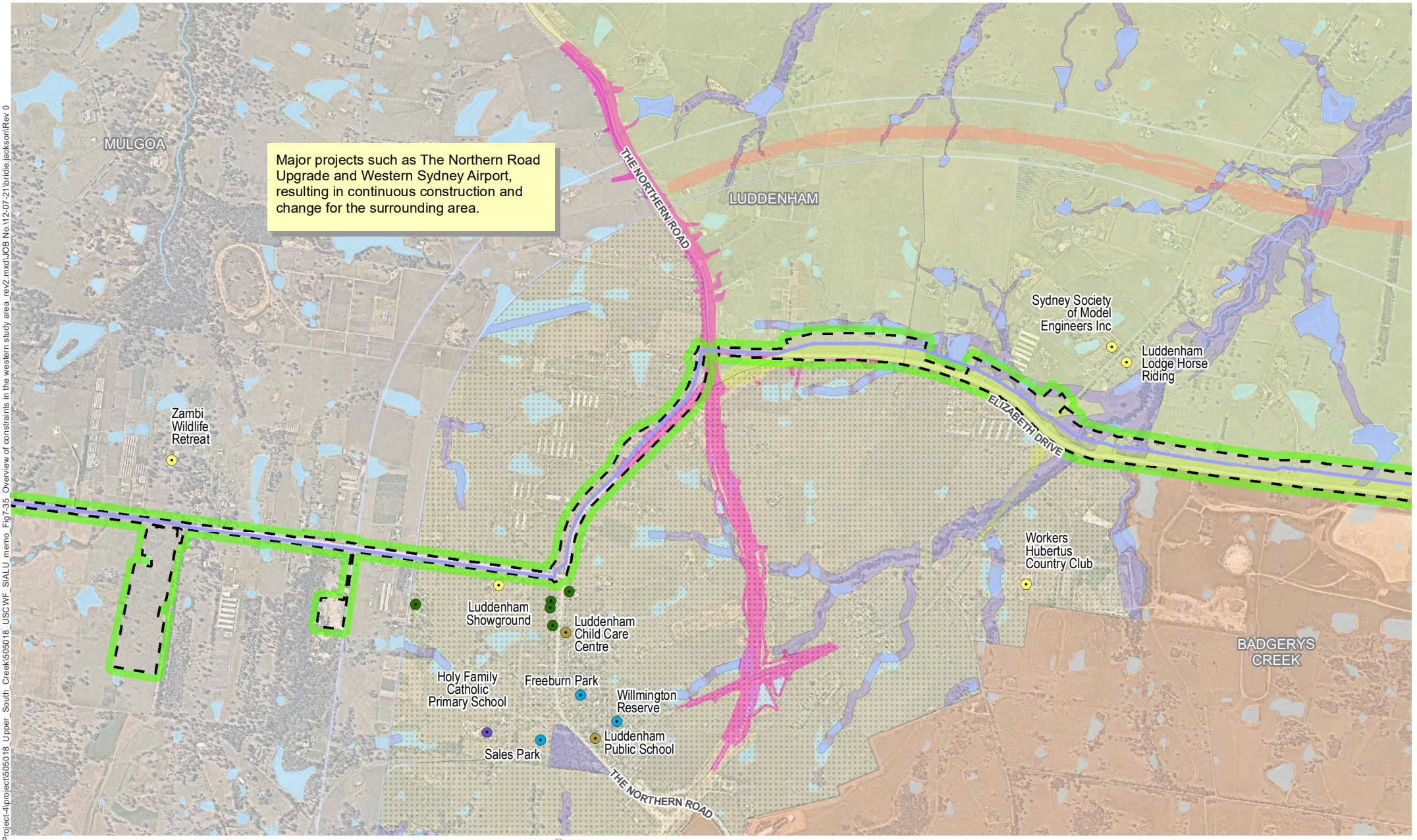

Figure 11-36d Social infrastructure in the study area

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

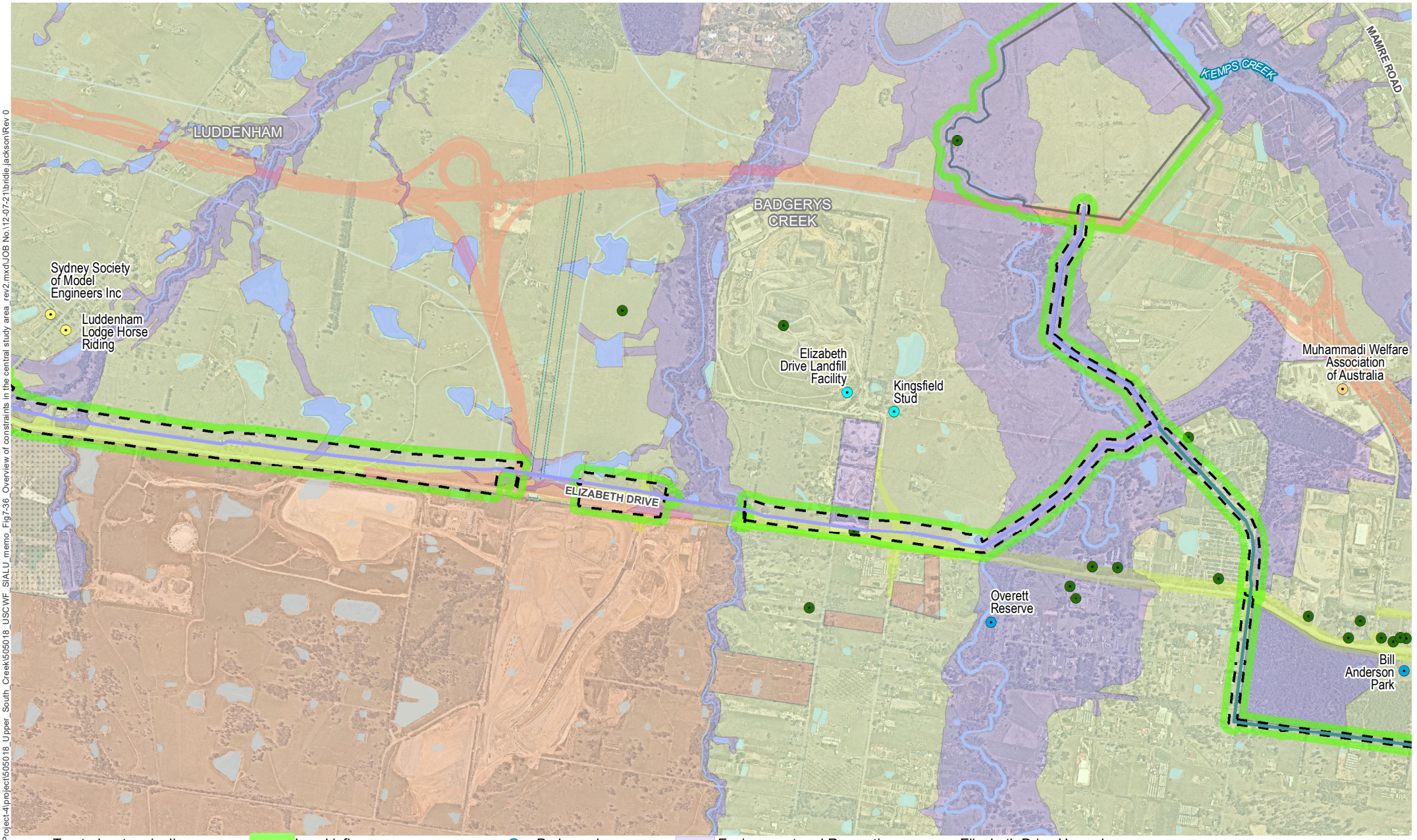

Figure 11-36e Social infrastructure in the study area

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

Projection: GDA2020 MGA Zone 56

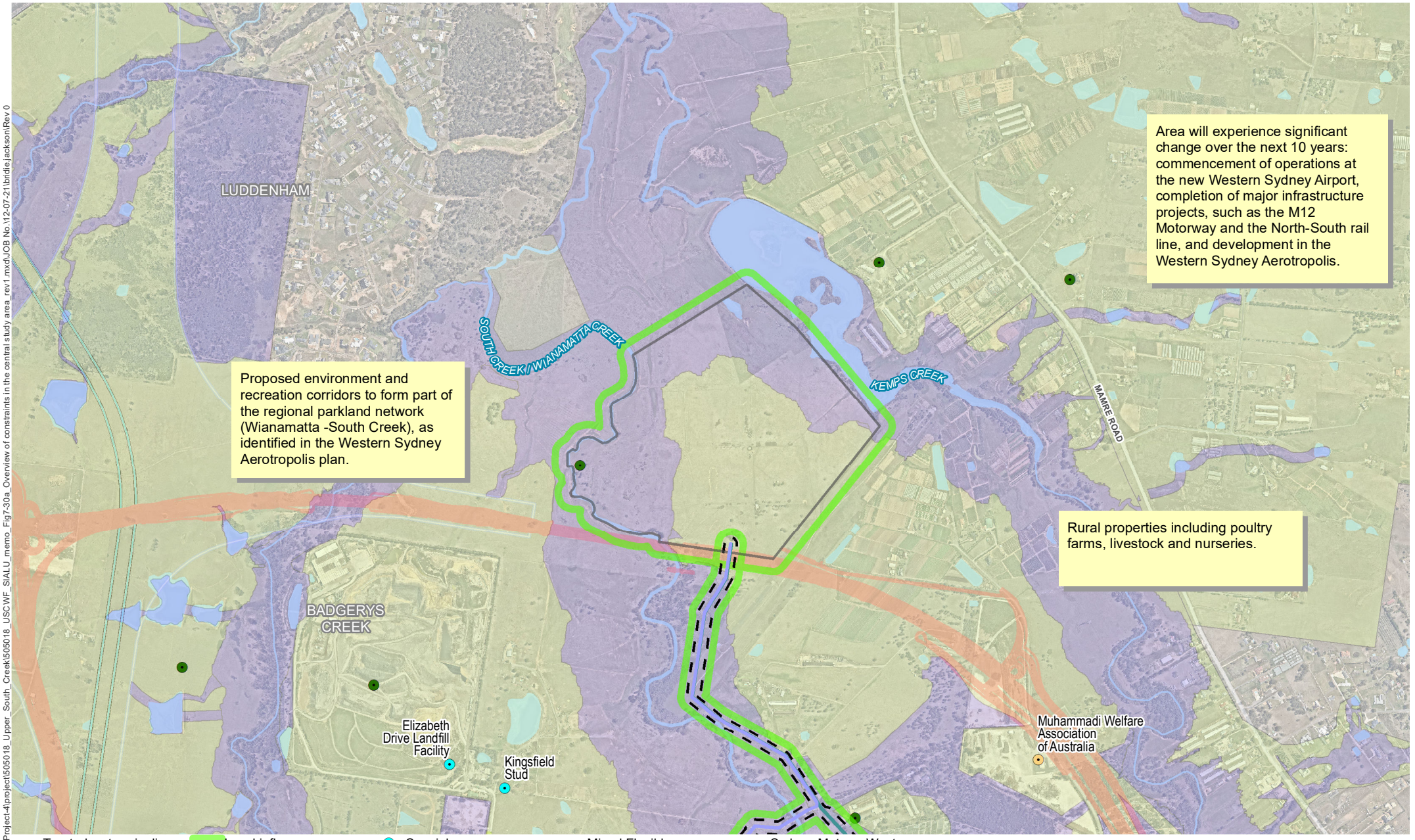

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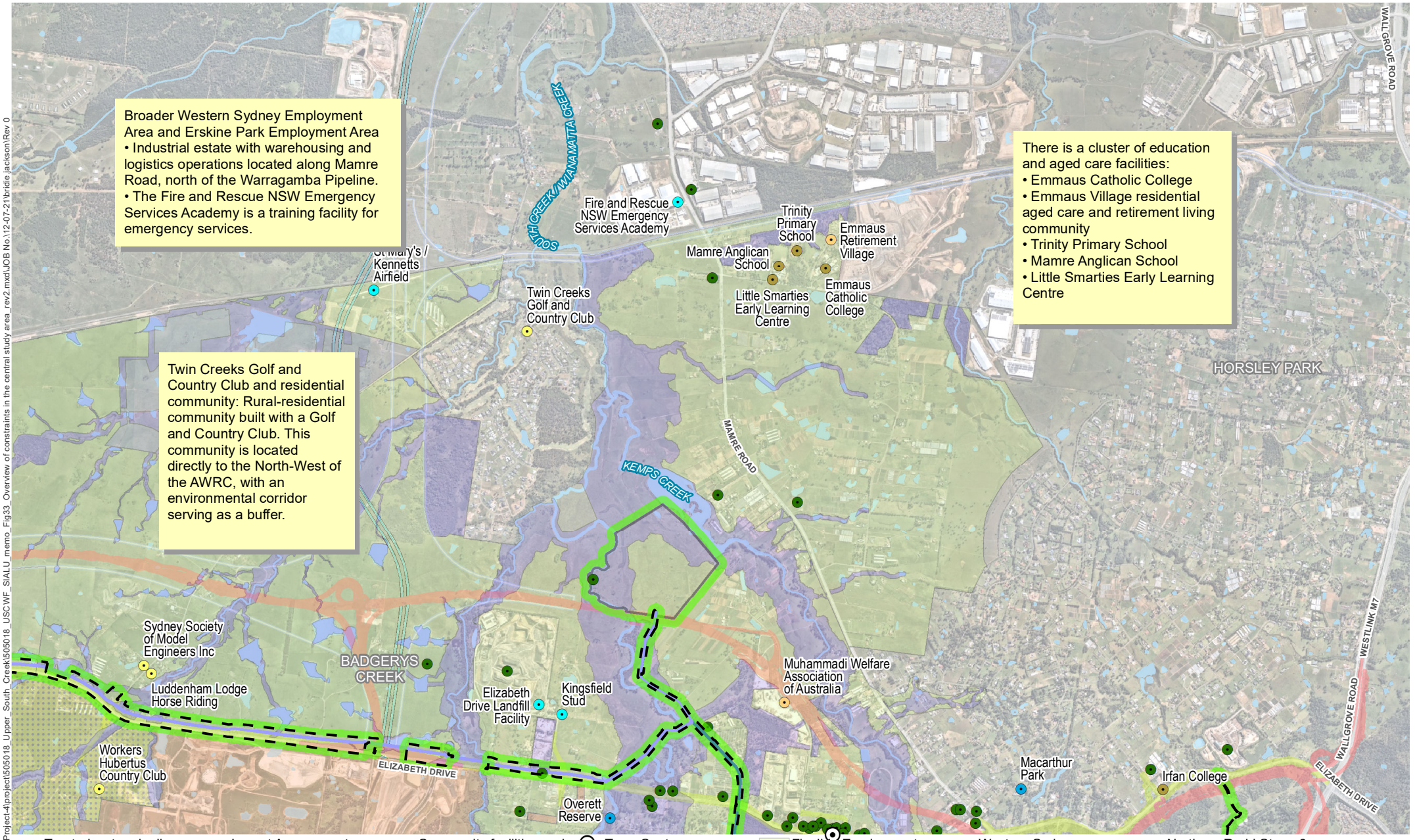
Figure 11-36f Social infrastructure in the study area

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

Projection: GDA2020 MGA Zone 56



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

Projection: GDA2020 MGA Zone 56

Figure 11-36g Social infrastructure in the study area

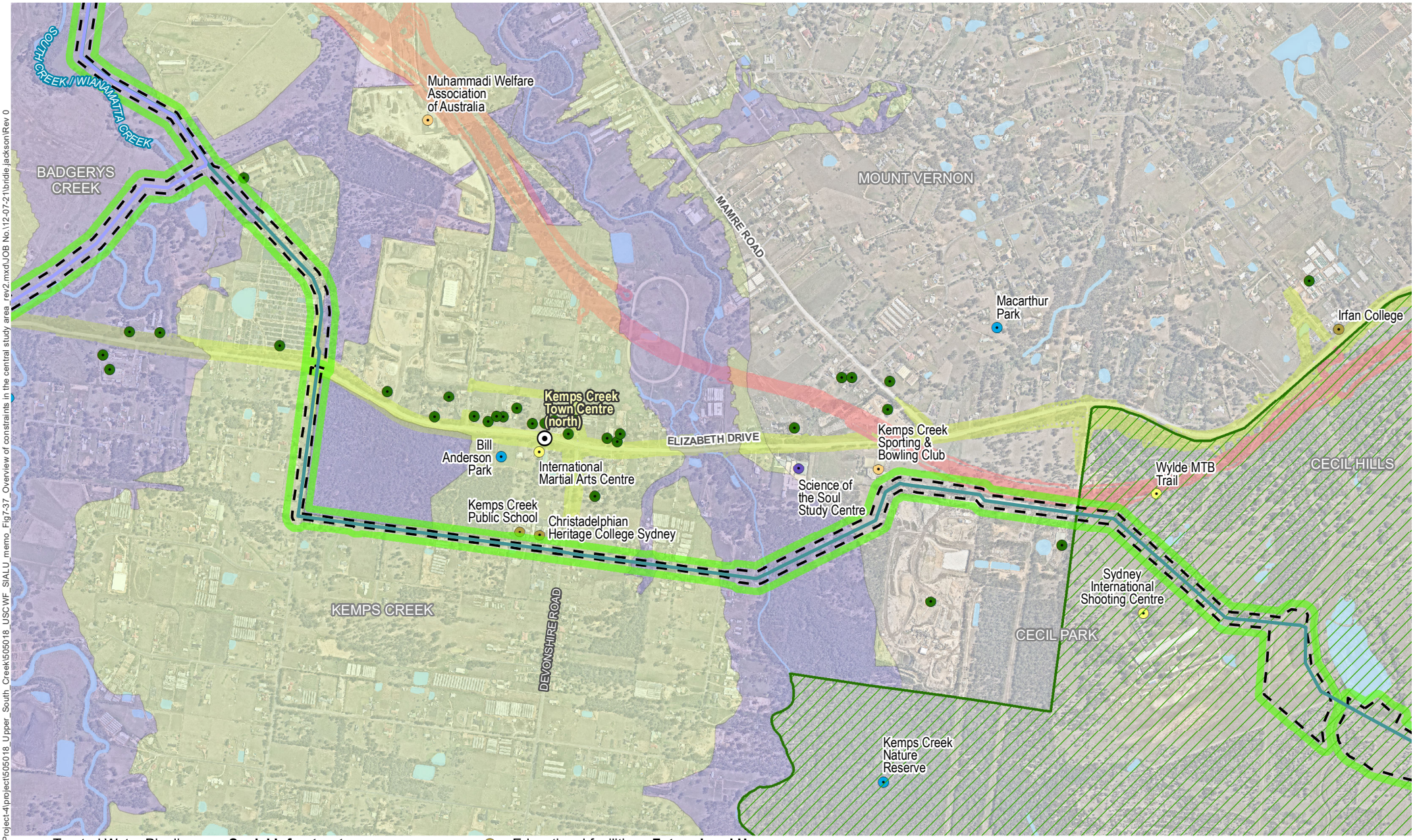


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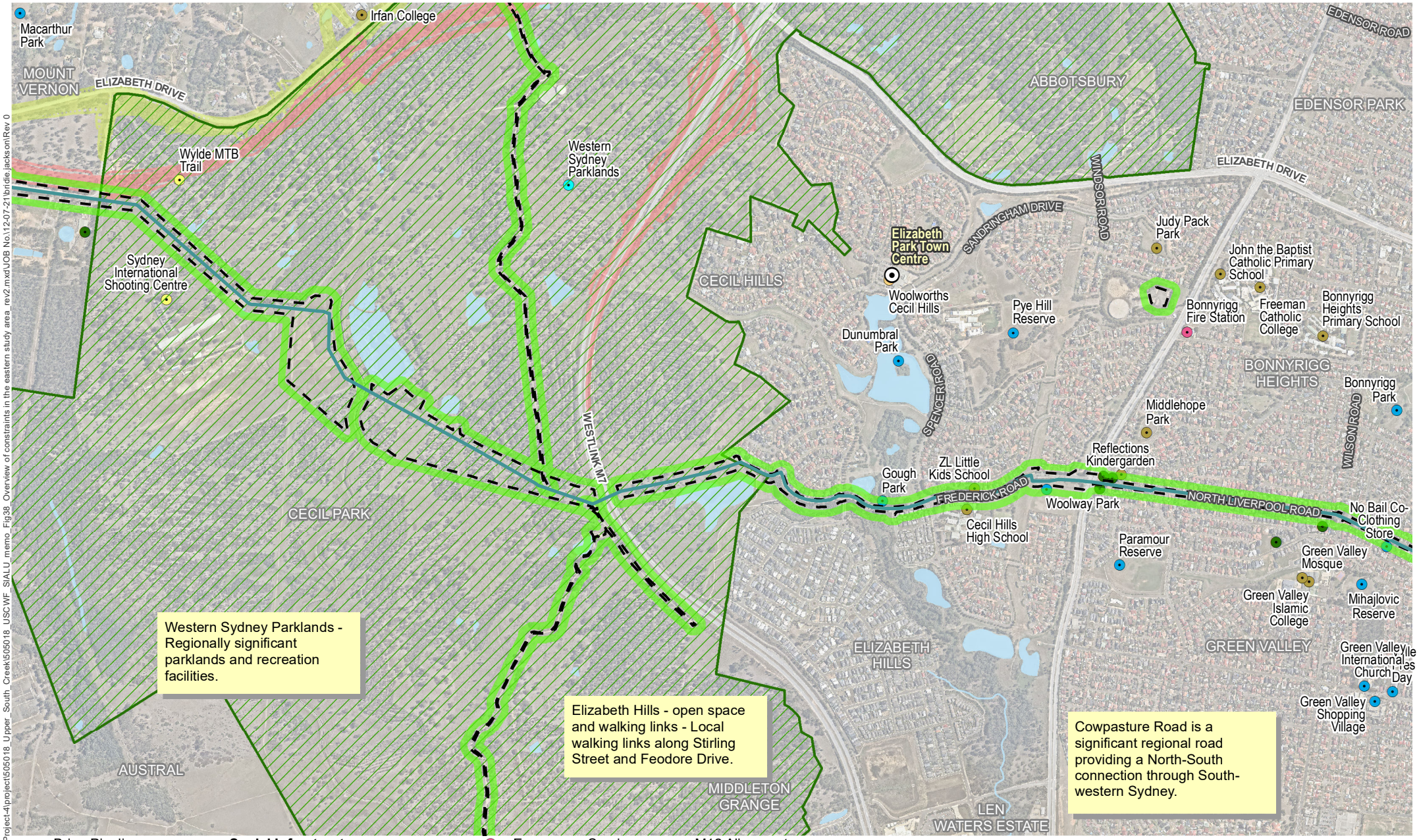
Figure 11-36h Social infrastructure in the study area

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

Projection: GDA2020 MGA Zone 56



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Brine Pipeline
Impact Assessment
Local influence area
Western Sydney Parklands

Social Infrastructure

Businesses and services
Community facilities and services
Educational facilities
Emergency Services
Parks and reserves
Recreational facilities
Special use
Town Centres

M12 Alignment
Elizabeth Drive Upgrade

1:20,000
0 250 500m

Figure 11-36i Social infrastructure in the study area

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

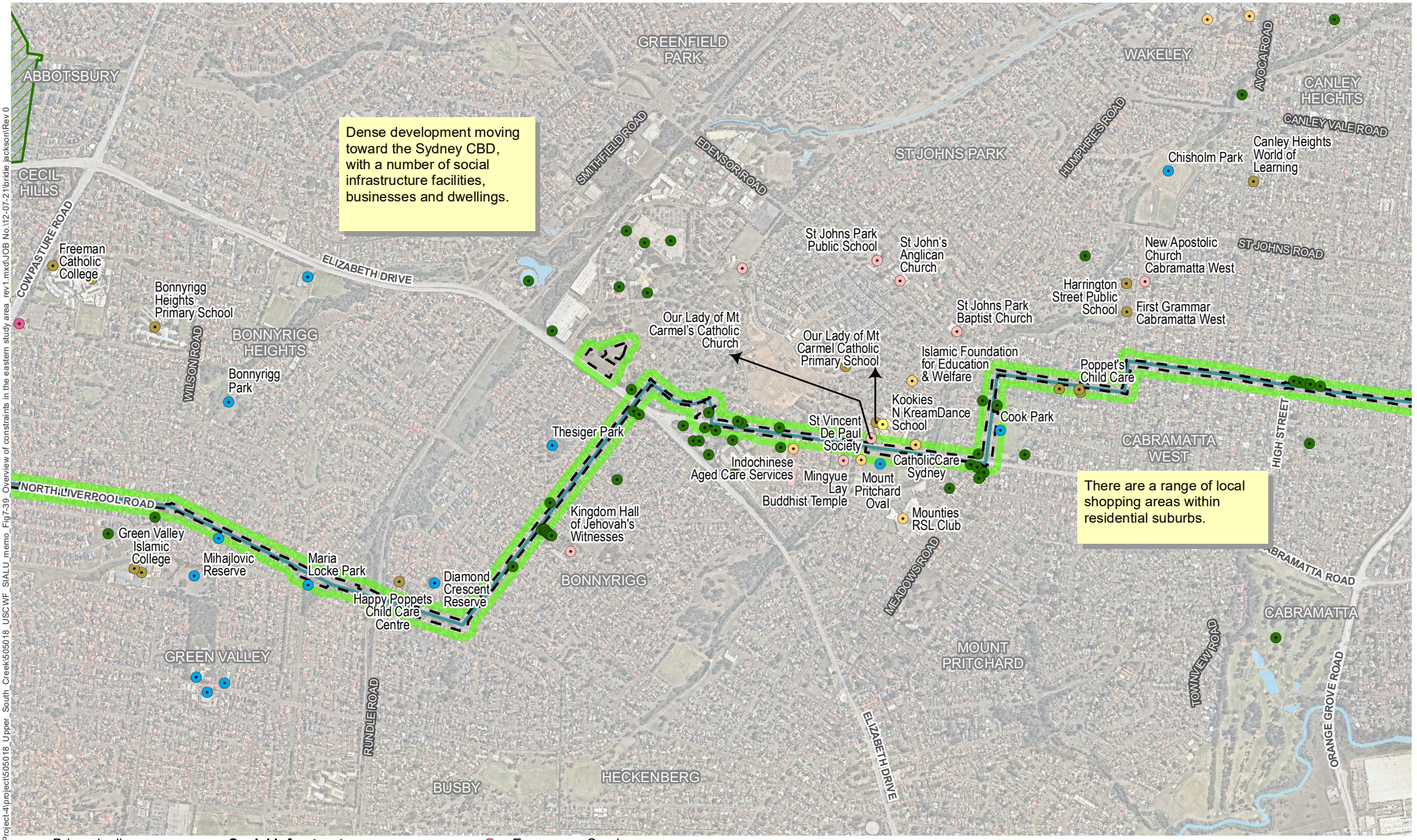

Figure 11-36j Social infrastructure in the study area

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

Projection: GDA2020 MGA Zone 56

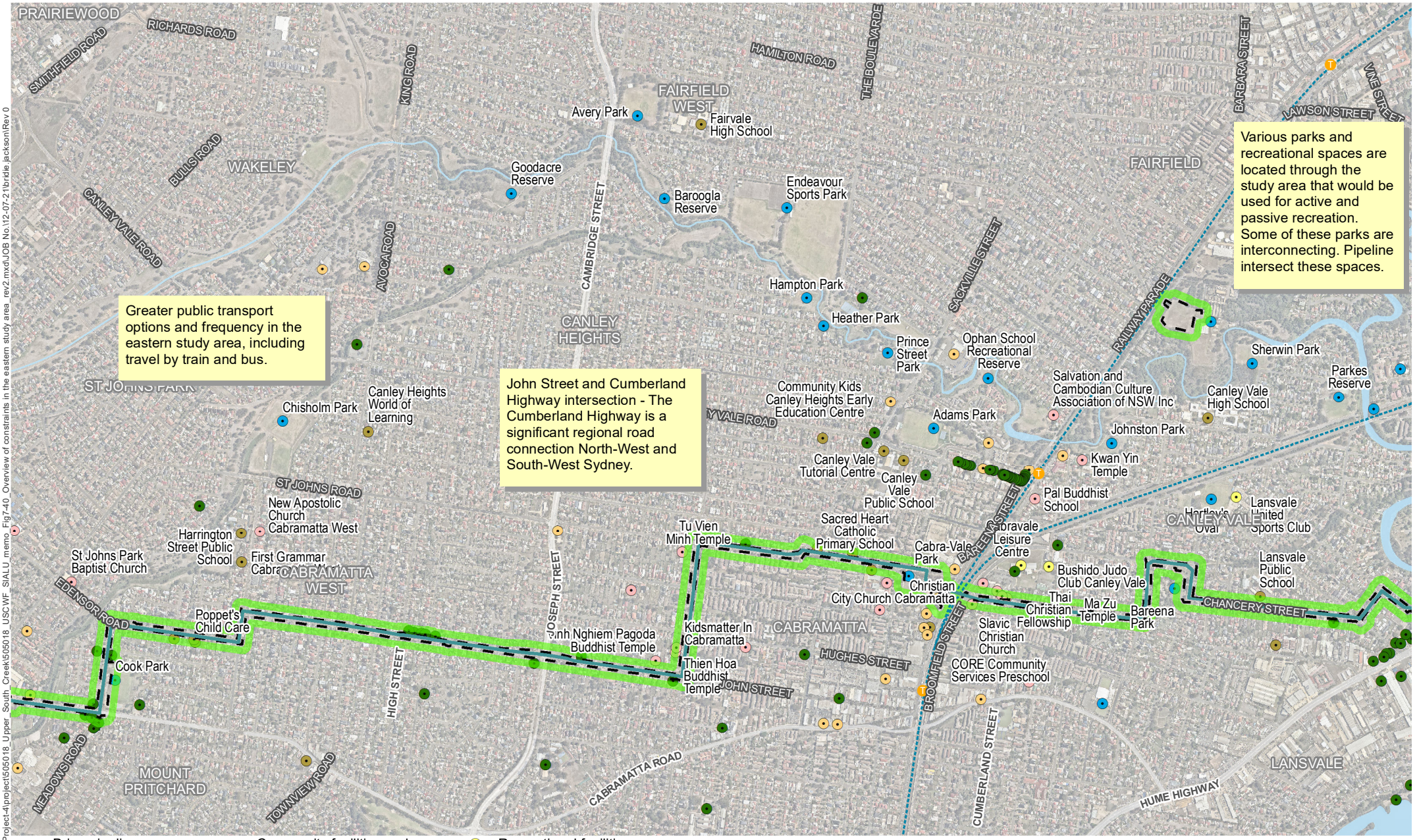

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Figure 11-36k Social infrastructure in the study area

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

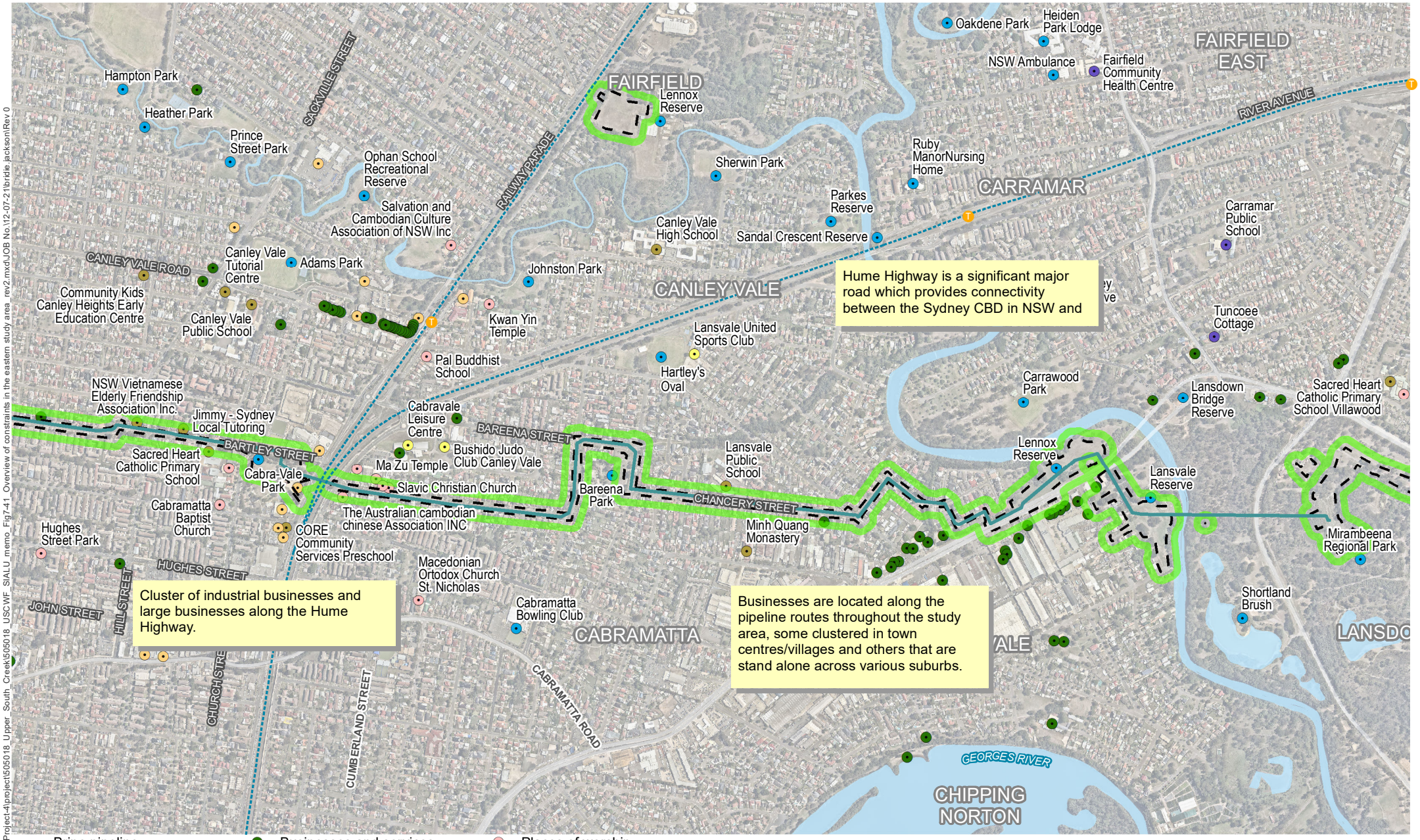


Figure 11-36l Social infrastructure in the study area

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

Projection: GDA2020 MGA Zone 56

Access and connectivity

Several local, regional and State roads traverse the SESA. Section 11.4 describes the transport infrastructure of the SESA, including public transport and active transport.

Vehicle ownership

A greater share of households in the SESA western and central own three or more vehicles (42% and 45% of all households respectively) when compared to the Greater Sydney average (16% of all households). Households in the SESA eastern typically have slightly less car ownership than the Greater Sydney average.

Method of travel to work

Method of travel to work across the SESA is highly reliant on private vehicle with individuals travelling to work as either drivers or passengers as a percentage of total trips higher than the Greater Sydney average of 57% - 75% in the SESA western, 73% in the SESA central and 70% in the SESA eastern.

Social and community cohesion

Social cohesion refers to the positive social relationships in communities. One metric used to determine community cohesion is a community's level of participation in voluntary work, which can be an indicator of community cohesion as community bonds can be strengthened and it involves giving help and provides opportunities for community engagement.

In the ABS 2016 census, about 10% of the overall SESA's local scale population reported doing voluntary work for an organisation or group. This varied between 9% in the SESA eastern, to 10% in the SESA western and 13% in the SESA central. This is lower than the participation rate in Greater Sydney more widely (17%). This suggests a lower than average level of community cohesion and participation within the SESA.

Overarching community values

A review of the community strategic plans, Local Strategic Planning Statements (LSPS), local media and consultation with councils shows that values are relatively consistent across all LGAs and represent shared ambitions for the SESA. Key themes identified include:

- supporting sustainable and balanced growth in employment through local jobs and business opportunities, alongside investment
- providing the required key facilities and services, including physical, social and digital infrastructure to support growing population and employment
- supporting active and healthy lifestyles within the direct and SESA, with a prioritisation of community health and wellbeing
- encouraging a clean and green environment, with a focus on protecting and enhancing natural assets, and increasing landscaping and tree coverage throughout the area
- supporting distinctive, liveable and diverse places, with a focus on local urban centres that are safe, high quality and welcoming

- providing a safe and connected transport network that enables ease of access for all community members, with a focus on improved public transport
- celebrating cultural values and significance, including through events and the celebration of key cultural activities
- collaborating with the community, through proactive leadership and genuine, transparent engagement.

Aboriginal heritage values

The SESA has a long association with settlement and use by the Aboriginal community. There is evidence of Aboriginal settlement across the SESA, particularly around resource areas, including waterways such as Nepean River. This is reinforced by the current day cultural importance of such landscape features to the Aboriginal community. Aboriginal heritage values are summarised in section 10.1 of the EIS including a description of how the project has minimised, or where possible avoided, impacts to Aboriginal heritage values.

Sensitive receivers

Table 11-63 describes the types of sensitive receivers identified following the review of the existing environment. This included reviewing other technical reports prepared for this project to identify receivers. For example, review of the noise and vibration impact assessment to identify noise sensitive receivers.

Table 11-63 Socio-economic assessment sensitive receivers

Sensitive receivers	Sensitivities
Agricultural properties	• Access and land use • Amenity impacts • Business and economic impacts.
Young population	• Health impacts • Amenity impacts • Access to community infrastructure.
SESA-western ageing population	• Health impacts • Amenity impacts • Access to community infrastructure • Community cohesion.
Diverse ethnicity	• Cultural impacts associated with heritage and values • Community cohesion.
Existing residential	• Access and property • Amenity impacts.

Sensitive receivers	Sensitivities
Future residential	• Perceived economic impacts • Perceived wellbeing and way of life.
Unemployed	• Economic impacts • Access to community infrastructure • Community cohesion.
Community facilities	• Access and land use • Amenity impacts.

Summary of items for consideration in the social impact assessment

Based on the review of the existing environment, key themes for consideration in the assessment of the project's impacts are the:

- changing nature of the SESA, particularly in the SESA central
- broad scale differences in the receiving communities, between the SESA western, SESA central and SESA eastern, with varying characteristics associated with location and access (for example rural in the west to urban in the east)
- significant young population representation within the whole SESA, but with a relatively large ageing population within the SESA western
- ethnic diversity of the local community, particularly in the SESA eastern, which is home to a significant Assyrian and South East Asian population in particular
- strong community connection to agricultural land uses across the SESA, particularly in the SESA western and SESA central
- anticipated growth in knowledge intensive, professional and high-tech industries
- high reliance on private motor vehicles for travel across the SESA, with more transport opportunities (active transport and cycling facilities) available in the SESA eastern
- differences in the distribution of social infrastructure facilities and businesses in the SESA, with the SESA western and SESA central having clusters of residential dwellings around town centres. The SESA eastern is densely populated, with social infrastructure facilities and businesses scattered throughout its extent. Larger precincts are also located throughout the SESA eastern, around transport corridors such as railway lines and major roads
- low-density of emergency service facilities across the whole SESA including hospitals, police stations and fire brigades with most facilities located outside of the SESA

- community values across the whole SESA with the key themes being agriculture and rural character (SESA western and central), mixed views on the scale of growth in the area (all SESAs), desire to protect and enhance the natural environment and waterways, and opportunities for reuse of water from the facility.

Land use existing environment

Current and historical land uses in Western Sydney are dominated by agricultural activities. The Sydney – South West area is important for producing livestock for consumption (particularly poultry), livestock products (such as eggs) and vegetables. The AWRC site is in the Penrith LGA, which is home to a large number of these agricultural activities, focused on intensive plant and animal production, similar to the wider Sydney South West area.

The primary commodities produced in the Sydney South West area are:

- livestock – primarily poultry (50% of total Gross Value of commodities produced in the Sydney South-West, and about 46% of all live poultry (chicken) produced in Greater Sydney)
- vegetables – lettuce, mushrooms, tomatoes and miscellaneous market garden vegetables (27% of total Gross Value of commodities produced in the Sydney South-West region)
- nurseries and cut flowers (12% of total Gross Value of commodities produced in the Sydney South-West region)
- livestock products – 24% of all livestock products produced in Greater Sydney, primarily chicken eggs (8.7 million dozen hen eggs for human consumption annually).

Penrith is a leader in egg production contributing 18% of the total egg output in NSW in 2015-2016 and producing nearly 1% of all of NSW's total agricultural output.

Agriculture in the SESA employs about 1,413 people (1.14% of all jobs), not accounting for jobs in the longer supply chain.

Although the existing land use environment is still dominated by agriculture, the region is in a transitional period towards a more urbanised land use. As a result, several major infrastructure projects are underway, including:

- Western Sydney International Airport – under construction
- Sydney Metro - Western Sydney Airport – recently received planning approval
- M12 Motorway – construction to start mid 2022
- The Northern Road Upgrade – under construction.

Although these projects are only at the construction stage it is important to include them, and the future land uses they will service, in the context of the existing environment to ensure that potential conflicts with the evolving land uses of Western Sydney are appropriately considered.

11.6.4 Legislation and guidelines

Table 11-64 lists the guidelines relevant to socio-economics and their applicability to the assessment.

Table 11-64 Socio-economic guidelines

Guidelines	Relevance to project
Social Impact Assessment Guideline (DPE, 2017)	Attachment 2 to the SEARs refers to the 2017 guideline as the primary document to inform the methodology and approach to the assessment undertaken in the SIA.
Social Impact Assessment Guideline for State Significant Projects (DPIE, 2021)	DPIE is in the process of standardising and update in the approach to social impact assessment of projects. Whilst still in draft, this guideline identifies the future direction DPIE proposes for social impact assessment. Where practical the SIA for the project has been undertaken in accordance with the draft guideline.
Land Use Conflict Risk Assessment Guideline (DPI, 2011)	The LUCRA provides DPI's guidance for the assessment of potential land use conflicts between proposed projects and established neighbouring land uses. This has been used as the basis for the land use conflict risk assessment for the project.

Although there is no specific legislation applicable to the assessment of socio-economic impacts, the assessment has reviewed and taken into consideration the following environmental planning instruments and strategic planning documents:

- State Environmental Planning Policy (Western Sydney Parklands) 2009.
- State Environmental Planning Policy (Western Sydney Aerotropolis) 2020.
- State Environmental Planning Policy (Western Sydney Employment Area) 2009.
- Wollondilly Local Environmental Plan 2011.
- Penrith Local Environmental Plan 2010.
- Liverpool Local Environmental Plan 2008.
- Fairfield Local Environmental Plan 2013.
- Canterbury Local Environmental Plan 2012 and Bankstown Local Environmental Plan 2015.
- Penrith Community Plan 2017 and Local Strategic Planning Statement – Planning a Brighter Future.
- Liverpool Community Strategic Plan 2027 and Local Strategic Planning Statement – Connected Liverpool 2040.

- Canterbury Bankstown Community Strategic Plan 2028 and Local Strategic Planning Statement –Connective City 2036.
- Fairfield Community Strategic Plan 2016 – 2026 and Local Strategic Planning Statement – Shaping a Diverse City.
- Wollondilly Community Strategic Plan 2033 and Local Strategic Planning Statement – Wollondilly 2040.

11.6.5 Construction impact assessment

Socio-economics – construction impacts

Table 11-65 summarises the potential socio-economic impacts that may occur during construction of the project.

Table 11-65 Construction socio-economic impacts

Aspect	Impact
Way of life	• **Access to housing**: the project is not expected to impact on access to housing during construction, as it will take place predominantly within existing roadways. There is potential for temporary construction impacts to residents adjacent to the project, in the SESA eastern where densities are higher, including access to properties, usual routes of travel and amenity impacts (these are considered under 'Surroundings'). • **Access to employment**: there is expected to be a moderate but temporary increase in employment opportunities of about 400 construction jobs, as a result of the project. • **Commercial operations and businesses:** the project is expected to temporarily impact businesses and some commercial operations, with most direct impacts experienced within the social influence area, and amenity impacts (noise and visual) expected along pipeline routes during trenching/tunnelling. Freight operators, delivery vehicles, patrons of local stores and staff may experience traffic delays around construction areas and impacts to parking.
Access and connectivity	• **Local road network and access:** construction is expected to require temporary partial road closures and temporary access changes to properties in the local influence area – resulting in minor social impacts. Detours may be required and disruption to traffic in some areas will occur. This may cause delays and confusion for some road users. Tunnelling construction techniques will be used to cross major roads such as the M7 Motorway. Most impacts to traffic and the local road network are expected to occur in the SESA eastern due to the higher population density. • **Parking**: Short term, minor parking impacts during trenching works and around construction areas are expected, resulting in motorists having to use alternate parking areas. Access for emergency vehicles/services will be maintained. • **Construction traffic**: Additional vehicle movements in all SESAs for workers and construction vehicles travelling to and from construction areas may result in minor impacts to surrounding receivers. • **Public and active transport**: Construction is expected to have minor impacts on bus routes, pedestrians and cyclists. Detours and construction traffic may result in longer

Aspect	Impact
	travel times. Bus stops may need to be temporarily relocated if they are impacted during the construction phase.
Community	• **Socio-demographic profile:** with 400 new jobs, there is potential for a minimal impact on the number of people living in the SESA. However, this is expected to be limited, noting most construction jobs are likely to be filled by existing residents from the Greater Sydney region. • **Physical cohesion:** the project largely follows existing roadways where possible. As such, there is potential for this to cause severance – preventing communities from accessing other services and places on the opposite side of the road. This impact will be minor and for the duration of construction in each localised area only. • **Social cohesion**: there is potential for the project to create some minor impacts on social cohesion as a result of opposing views from the community on the project.
Access to and use of infrastructure services and facilities	• **Social infrastructure**: There is expected to be a minor reduction in amenity at social infrastructure facilities and areas. There are several parks and open spaces, including Cabravale Memorial Park and Fowlers Reserve which are within the impact assessment area, and will be subject to direct impacts during construction. Some additional areas within the impact assessment area may be used for passive recreation in informal spaces. Individuals and communities can often create areas of informal place-making, which will need to be considered during construction. Although there may be impacts to social infrastructure over the 36-month construction period they will typically be for a shorter period (weeks) in any given location along the pipeline alignments. As construction work are transient and temporary impact to a given piece of social infrastructure will be limited. Where impacts may occur Sydney Water will consult with social infrastructure users to minimise impacts generally, but also identify specific times and places where construction works should be avoided. For example, avoiding disruption of ANZAC day activities in Cabravale Park. • **Educational precincts and community centres** that are comprised of community clubs, sporting/leisure centres and places of worship may experience minor changes in access, dust impacts, noise impacts and visual impacts. Delays and disruptions to the local road network could increase travel time which may also impact access to community services and facilities. • **Utilities**: temporary disruptions to utilities and services are unlikely to be required during construction.
Culture	• **Non Aboriginal heritage**: No significant impacts are anticipated. • **Aboriginal cultural heritage**: impacts are expected to 12 aboriginal archaeological sites. This is likely to have some impact on cultural value. Design changes have been implemented to minimise these impacts.
Health and wellbeing	• **Air quality/health impacts**: No significant impacts are anticipated associated with air quality emissions, odour, or human health.

Aspect	Impact
Surroundings	• **Visual impacts**: The rural amenity in the SESA is expected to be moderately impacted during construction of the AWRC. Impacts to the landscape and views may result in a sense of loss of valued character and impact on surrounding receiver's ability to enjoy the rural and vegetated areas surrounding their residences and across their suburbs. Proposed compound sites have been strategically located to minimise community and environmental impacts, however, impacts will still occur, particularly in quieter suburbs such as Warragamba, Wallacia and Cecil Hills. • **Noise impacts:** construction of the project, as well as the operation of some compound sites is expected to result in minor construction noise impacts above noise management levels (NMLs) during construction. Noisy works could potentially cause annoyance and stress, particularly if noisy works are continuous and over a period of time.
Personal and property rights	Some social impacts are anticipated as a result of property impacts from the project – impacting of way of life of residents. The requirement to allow access to their land may cause anxiety and stress for the affected residents, and result in time being spent considering options and worrying about potential impacts. Many residents have lived in the area for a long time.
Decision making systems	No significant impacts to existing decision-making systems are expected. Following the exhibition period, Sydney Water will continue to identify and manage issues of interest or concern to the community during the assessment and approval process and, if the project is approved, during its construction.
Fears and aspirations	Section 11.6.3 summarises key themes for consideration. Key fears and aspirations from that summary include: • **Biodiversity**: a review of community values shows a passion in the local community for the natural and biodiverse landscapes. The Biodiversity Development Assessment Report suggests that biodiversity impacts are of an acceptable level for a project of its scale and impacts to native vegetation and threatened flora and fauna will be somewhat mitigated through offsets. As a result, social impacts associated with perceived biodiversity impacts are expected to be minor but possible. • **Agricultural impacts**: one concern raised during consultation and engagement has been the impact of the project on neighbouring agricultural land uses. Potential conflicts include potential noise, odour, dust and air quality impacts to agricultural land uses, and direct impacts to around 3 km of Biophysical Strategic Agricultural Land (BSAL) and some easements directly on agricultural land. • There may be a concern among agricultural neighbours about the change from an established rural landscape and lifestyle, to more infrastructure focused urban development (particularly around the AWRC itself).

Evaluation of socio-economic construction impacts

Table 11-66 considers the significance of the project's socio-economic impacts during construction. A pre-mitigation impact rating was used to guide the development of mitigation measures outlined in section 11.6.9. The same risk matrix was then applied to the mitigated impacts to determine the residual impact rating. Table 11-66 only includes consideration of social aspects where it was found that the project may have a positive or negative impact. Where impacts were not applicable to the project they are not included in Table 11-66 but are addressed in Appendix X.

Table 11-66 Evaluation of construction impacts

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
		Positive / Negative	Likelihood	Consequence	Pre-mitigation impact rating	Residual impact rating
Access to employment	SESA	Positive	Almost certain	Moderate	Extreme Positive	Extreme Positive
Access to employment	Sydney	Positive	Almost certain	Minimal	High positive	High positive
Business and commercial operations – amenity, access and operation	SESA western	Negative	Likely	Moderate	High negative	Moderate negative
Business and commercial operations – amenity, access and operation	SESA central	Negative	Likely	Minor	High negative	Moderate negative
Business and commercial operations – amenity, access and operation	SESA eastern	Negative	Likely	Moderate	High negative	High negative

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
		Positive / Negative	Likelihood	Consequence	Pre-mitigation impact rating	Residual impact rating
Business and commercial operations – supply chain benefits	All scales	Positive	Possible	Minor	Moderate positive	Moderate positive
Local road network and access	SESA	Negative	Almost certain	Minor	High negative	High negative
Parking	SESA eastern	Negative	Likely	Minor	High negative	Moderate negative
Construction traffic	SESA	Negative	Likely	Minor	High negative	Moderate negative
Public and active transport	SESA	Negative	Likely	Minor	High negative	Moderate negative
Socio-demographic profile	All scales	Neutral[1]	Rare	Minimal	Low neutral	Neutral
Community cohesion – physical	Local influence area	Negative	Likely	Minor	High negative	Moderate negative
Community cohesion – social	SESA	Negative	Likely	Minor	High negative	Moderate negative

[1] It is noted that demographic change can be considered both a positive and a negative impact, dependent on the community and their individual and collective perspectives. As such, this has been recorded as neutral in impact, but a rating still applied.

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
		Positive / Negative	Likelihood	Consequence	Pre-mitigation impact rating	Residual impact rating
Natural areas, open spaces, parks and reserves	Impact assessment area	Negative	Almost certain	Moderate	Extreme negative	High negative
Natural areas, open spaces, parks and reserves	SESA	Negative	Possible	Minor	Moderate negative	Moderate negative
Community facilities	Local influence area	Negative	Likely	Minor	High negative	Moderate negative
Educational facilities	Local influence area	Negative	Likely	Minor	High negative	Moderate negative
Utilities	SESA	Negative	Possible	Minimal	Moderate negative	Low negative
Culture – non aboriginal heritage	Impact Assessment Area	Negative	Likely	Minor	High negative	Moderate negative
Human health and wellbeing	SESA	Negative	Unlikely	Minor	Low negative	Low negative
Air quality impacts	Local influence area	Negative	Likely	Minor	High negative	Low negative

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
		Positive / Negative	Likelihood	Consequence	Pre-mitigation impact rating	Residual impact rating
Visual impacts	Local influence area	Negative	Likely	Moderate	High negative	Moderate negative
Noise impacts	Local influence area	Negative	Likely	Minor	High negative	Moderate negative
Personal and property rights – impacts to way of life	Impact Assessment area	Negative	Likely	Minor	High negative	Moderate negative
Fears and aspirations – environment & biodiversity	Local influence area	Negative	Likely	Moderate	High negative	Moderate negative

Land use - construction impacts

Table 11-67 summarises the potential land use impacts that may occur during construction of the project. Appendix X includes a detailed assessment of potential construction land use conflicts.

Table 11-67 Construction land use impacts

Aspect	Assessment
Property and access	**AWRC** - Land uses impacted directly by the AWRC include about 78 hectares of land currently used for research related activities and cattle grazing by the University of Sydney. This land will be permanently acquired from the current owner Sydney University (negotiations ongoing). The project is not expected to impact on the ability of the remainder of University of Sydney's land to continue operations however is considered to have a moderate impact on this land use. **Pipelines** - The pipelines will impact parts of 60 properties during construction. This land will be temporarily unavailable for its existing use. For pipelines, construction will progressively move along the alignment so most properties will experience short-term impacts. Several of these properties are on agricultural land. Where pipelines intersect with this land, there is potential for some reduction in productive land available for agricultural uses for the period of construction. Within the eastern LUCRA study area in particular, the construction will occur in residential areas. This is likely to impact on amenity but will not prevent the existing residential land uses from continuing. The construction of the pipelines may also temporarily impact access to some properties. The project will ensure continued access to all properties during construction.
Transport and traffic	**AWRC -** About 200 construction workers are required for the proposed AWRC during peak construction periods. The Traffic and Transport Assessment predicts the highest peak traffic volumes between The Northern Road and the AWRC which will generate about 400 light vehicle movements and 302 heavy vehicle movements during standard construction hours (two-way movements). Potential impacts include increased traffic on the local road network and impacts on travel times for agricultural and rural residential properties sharing access with the AWRC. This is expected to result in some nuisance. Businesses on Clifton Avenue such as Andreasens Green Wholesale Nurseries and CR and M Ash and Sons Poultry Farm will be particularly impacted by construction traffic. This may cause nuisance and frustration and some minor impact to business activities Traffic and congestion from the AWRC are not anticipated to have significant effects beyond the immediately neighbouring properties. **Pipelines -** Up to 200 construction workers will be required to construct the pipelines for the project (noting that this will fluctuate across the construction program). Potential impacts include: • temporary road or lane closures and temporary access changes to surrounding properties. Sections of the local road network, including pedestrian pathways may be partially closed to allow for construction activities to take place. This will result in the requirement for detours and disruption to traffic in some areas

Aspect	Assessment
	• altered parking arrangements adjacent to construction activities. This may include parking restrictions along road corridors that require trenching and tunnelled pipe installations to allow for safe construction vehicle movements around construction areas and space for construction equipment and machinery These transport and access impacts may alter the way of life and routines for neighbouring properties and their activities – for example causing nuisance to neighbouring residential uses and impacting on ability of agricultural users to travel locally. This may also impact on business activities such as movement of cattle – and potential safety risks associated with this. However, it is not expected that the impacts will prevent existing land uses from occurring. Access for emergency vehicles and services will be maintained during the construction phase of the project.
Water quality	Water quality impacts resulting from construction activities such as erosion and sedimentation will be managed to avoid impact on neighbouring land uses.
Noise and vibration	**AWRC** – Construction noise is estimated to exceed noise management levels under some scenarios however works will largely be during standard hours and therefore have only minor impacts to land uses. **Pipelines** – Noise from pipeline construction activities may cause nuisance particularly where it is close to residential receivers.
Air quality	Dust and vehicles emissions will be generated from construction activities which will have minor impacts to neighbouring land uses.
Biosecurity risk	Construction activities are unlikely to represent a biosecurity risk to any land uses.
Utilities	The project has been designed to avoid conflicting with other utilities therefore impacts will be negligible.
Visual and landscape	**AWRC** – there will be a noticeable change to the landscape during construction therefore visual impacts are considered moderate. **Pipelines** – pipeline construction, whilst transient and temporary, will include locations close to sensitive receivers such as residential areas. These have the potential to be moderately impacted by construction activities.
Biodiversity	An assessment of the construction impact to biodiversity in section 9.1 found that with the proposed management measures and offsetting in place, impacts will be minor.
Employment and housing	Construction of the project will have the positive impact of generating employment. The impacts to land use are unlikely to have an impact on employment generated by any of the corresponding land uses. Most of the construction workforce is anticipated to come from the Greater Sydney region. Therefore impacts to local housing supply such as increased competition for housing is considered unlikely.

Evaluation of construction land use impacts

Appendix X contains a residual risk assessment of the land use construction impacts following the application of the management measures listed in section 11.6.9. This concludes that all residual construction land use impacts will be minor.

11.6.6 Operational impact assessment

Socio-economics – operational impacts

Table 11-68 summarises the potential socio-economic impacts that may occur during operation of the project.

Table 11-68 Operational socio-economic impacts

Aspect	Assessment
Way of life	• **Access to housing**: the project is not expected to impact on access to housing during operation. • **Access to employment:** up to 10 operational jobs will be generated by the project in addition to ongoing use of contractors for various activities. • **Commercial operations and businesses:** the project is expected to have benefits to businesses and employment areas, through producing high-quality treated water that can be used for non-drinking purposes and for agricultural use. There are likely to be perceived impacts associated with amenity impacts to agricultural businesses in particular. • **Long-term liveability:** a significant anticipated benefit in providing essential infrastructure to support transformation of the area which will in turn bring housing choice, employment, open space and significant liveability enhancements. The high-quality treated water produced also has the potential to contribute to watering open space.
Access and connectivity	• **Local road network and access:** the small amount of operational traffic generated by the project with have a minor impact on the local road network. • **Public and active transport**: the operation of the project will not impact public or active transport.
Community	• **Socio-demographic profile:** no change to population expected as a result of operational employment opportunities (up to 10 jobs) due to small scale. • **Community cohesion:** there is potential for the project to create some minor impacts on social cohesion as a result of opposing views from the community on the project. This is expected to reduce over time.
Access to and use of infrastructure services and facilities	• **Social infrastructure:** the project is not expected to have adverse impacts on social infrastructure during operation. • **Utilities:** the project will result in utility improvements through the provision of wastewater infrastructure. Other utilities and services are not expected to be impacted as a result of the operation of the project.

Aspect	Assessment
Culture	• **Non-Aboriginal heritage:** no operational impacts. • Aboriginal cultural heritage: no operational impacts. • **Positive impacts:** Aboriginal and non-Aboriginal heritage interpretation incorporated into the operational AWRC will provide an ongoing positive benefit.
Health and wellbeing	• **Air quality/health impacts:** no significant impacts are anticipated associated with air quality emissions or odour or human health. • **Liveability:** ongoing benefits from improved sanitation and also potential indirect amenity benefits associated with the use of recycled water for district cooling and greening.
Surroundings	• **Visual impacts:** with the increasing urbanisation of the surrounding area and as landscaping matures over time visual impacts will be minimal during operation. • **Noise impacts:** management measures in design are expected to ensure that noise criteria can be met surrounding the AWRC during operation. Noise from pipelines will be negligible.
Personal and property rights	No significant impacts to personal and property rights are anticipated.
Decision making systems	No significant impacts to existing decision-making systems are expected. There will be ongoing engagement with local communities.
Fears and aspirations	• **Water quality:** several stakeholders have expressed concerns around the impact of treated water outflows on water quality within the surrounding waterways. Water quality modelling undertaken as part of the project shows that there will be predominantly negligible impacts of the project upon waterways, and no significant changes in water quality, beyond temporary and localised areas. As such, no significant negative impacts to water quality, or use of the waterways for recreation are anticipated. • A recurrent theme in consultation and engagement on the project has been the future use of recycled water generated by the project, and there is generally significant support from councils and community members for the use of recycled water. • Consultation with the community undertaken for the project as a whole, and targeted council engagement undertaken for the SIA, has demonstrated a keen focus on climate change, sustainable operation, and strategies such as urban cooling and energy efficiency. • Sustainable solutions for the AWRC also include retaining water in the landscape to mitigate urban heating, circular economy approaches to waste management, installation of roof-mounted and ground mounted solar photovoltaics and adaptation measures to improve climate resilience.

Evaluation of socio-economic operational impacts

Table 11-69 summarises the potential pre-mitigation operational socio-economic impacts from the project. A pre-mitigation impact rating was used to guide the development of mitigation measures outlined in section 11.6.9. The same risk matrix was then applied to the mitigated impacts to determine the residual impact rating. Table 11-69 only includes consideration of social aspects where it was found that the project may have a positive or negative impact. Where impacts were not applicable to the project they are not included in Table 11-69 but are addressed in Appendix X.

Table 11-69 Evaluation of operational impacts

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
		Positive / Negative	Likelihood	Consequence	Pre-mitigation impact rating	Residual impact rating
Access to employment	Sydney	Positive	Rare	Minimal	Low positive	Low positive
Access to employment	Local influence area Socio-economic impact area	Positive	Almost certain	Minimal	High positive	High positive
Business and commercial operations	Local influence area – SESA central	Negative	Possible	Minor	Moderate negative	Low negative
Business and commercial operations	Local influence area Socio-economic impact area	Positive	Possible	Minor	Moderate positive	Moderate positive
Local road network and access	Local influence area	Negative	Rare	Minimal	Low negative	Low negative

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
Long-term liveability – growth and development	All scales	Positive	Likely	Transformational	Extreme positive	Extreme positive
Long-term liveability – growth and development (perceived)	SESA western and central	Negative	Likely	Minor	High negative	Moderate negative
Socio-demographic profile	All scales	Neutral	Rare	Minimal	Low neutral	Neutral
Community cohesion	SESA	Negative	Rare	Minimal	Low negative	Low negative
Social infrastructure	Local influence area – SESA western	Negative	Possible	Minor	Moderate negative	Low negative
Utilities	SESA	Positive	Almost certain	Transformational	Extreme positive	Extreme positive
Human health and wellbeing (experienced)	SESA	No impact	Possible	Minor	Moderate negative	Low negative
Human health and wellbeing (perceived)	SESA	Negative	Possible	Moderate	High Negative	Low negative
Air quality impacts	Local influence area – SESA central	Negative	Possible	Minimal	Moderate Negative	Low negative

Impact	Extent of impact	Pre-mitigation impact significance				Post-mitigation impact significance
Visual impacts	Local influence area - Central	Negative	Likely	Moderate	High Negative	
Noise impacts	Local influence area – SESA central	Negative	Possible	Minor	High Negative	Moderate negative
Perceived fears and aspirations – water quality	All scales	Negative	Possible	Minimal	Moderate negative	Low negative
Fears and aspirations – water quality	All scales	Negative	Possible	Minimal	Low negative	Low negative
Fears and aspirations – use of treated water (perceived)	All scales	Positive	Possible	Moderate	High positive	High positive
Fears and aspirations – education and sustainability	All scales	Positive	Possible	Minor	Moderate positive	Moderate positive

Land use – operational impacts

Table 11-70 summarises the potential land use impacts that may occur during operation of the project. Appendix X includes a detailed assessment of potential operational land use conflicts.

Table 11-70 Operational land use impacts

Aspect	Assessment
Property and access	**AWRC** – Acquisition will take place at the construction stage. No further impact. **Pipeline** – Some parts of the pipelines and their ancillary infrastructure will be subject to easement or acquisition. Access along pipeline easements will be required during operation for inspections and maintenance.
Transport and traffic	**AWRC** – the small amount of operational traffic generated will have a minor impact on neighbouring land uses. **Pipeline** – Access along pipeline easements for maintenance is unlikely to impact neighbouring land uses.
Water quality	**AWRC** – Water quality modelling undertaken as part of the shows that the environmental impacts on South Creek from wet weather releases around the AWRC are unlikely to be significant and unlikely to negatively affect long term ambient water quality and/or ecosystem health. Therefore any resulting impact to land uses that use water from or are adjacent to South Creek are negligible. **Pipeline** – Modelling undertaken for Nepean River and Warragamba River suggest that there will be predominantly negligible impacts of the project upon flow regime and habitat of the waterway, and no significant changes in water quality at the large river scale. At Wallacia, the treated water release area may experience localised effects, however these dissipate quickly downstream. As such, no significant negative impacts to land uses which use these waters, notably agriculture are anticipated. Similar land uses such as recreation adjacent to the waterway will not be impacted.
Noise	**AWRC** – management measures in design are expected to ensure that noise criteria can be met surrounding the AWRC during operation. Potential impacts to neighbouring land uses are considered negligible. **Pipeline** – No operational impacts.
Air quality	**AWRC** – Emissions, particularly odour will be treated through air quality systems such that neighbouring land uses may experience minor impacts. **Pipeline** – No operational impacts.
Biosecurity risk	**AWRC** – The introduction of new open waterbodies has the potential to attract birdlife and other animals which has the potential to increase the spread of disease to nearby agricultural land uses such as poultry farms. Wildlife control measures will manage this risk to minor levels. **Pipeline** – No operational impacts.

Aspect	Assessment
Utilities	**AWRC** – Positive impacts by supporting the delivery of infrastructure to support the development of more intensive land uses. **Pipeline** – No operational impacts.
Visual and landscape	**AWRC** – Some moderate impacts initially with the introduction of a new land use however this is expected to reduce over time as landscaping matures. **Pipeline** – No operational impacts.
Biodiversity	**AWRC** – No operational impacts. **Pipeline** – No operational impacts.
Employment and housing	**AWRC** – Positive impacts by supporting the delivery of infrastructure to support the development of more intensive land uses for employment land and housing. **Pipeline** – No operational impacts.

Evaluation of operational land use impacts

Appendix X contains a residual risk assessment of the land use operational impacts following the application of the management measures listed in section 11.6.9. This concludes that all residual operational land use impacts will be minor, except visual and landscape impacts which will be moderate initially and reduce to minor over time as landscaping matures.

11.6.7 Impact of future stages

The assessment of operational impact has also considered impacts which may occur from the full operational capacity of the AWRC at 100 ML/day, including from the impacts of treated water releases on social amenity and on land use. No further operational impacts from future stages are anticipated beyond those identified.

11.6.8 Cumulative impacts

Cumulative socio-economic operational impacts

It is understood that several properties impacted by the project are also part of acquisition strategies for other future development. This includes projects such as the M12 Motorway and Sydney Metro Western Sydney Airport. This means there is potential for a cumulative impact which results in greater land take from the impacted properties than just for this project. The additional cumulative impact from the project will be minor due to the relatively smaller number of properties impacted. Sydney Water is engaging early and often with impacted property owners to discuss how best to manage impacts on a property by property basis such that there is as minimal impact to property owners and occupiers as possible.

Other ongoing amenity impacts from nearby projects would include noise and vibration, traffic and air quality. These aspects have been separately assessed in respective sections of the EIS which found cumulative land uses impacts would be minor with the appropriate measures in place.

The project has engaged directly with impacted landowners, and where possible sought to understand inter-relationships with other projects. Through this, Sydney Water has been able to optimise the route and any potential acquisition and easements. This impact is expected to affect a small number of properties – particularly agricultural and rural properties in the SESA central and western. For the purposes of this project, impacts will be temporary with other projects possibly requiring longer term acquisition. Subject to acquisition agreements these impacts will be appropriately managed.

In addition, while the project alone will not result in significant long-term land use impacts, it will provide essential infrastructure to both support the local community, and future planned development and growth within the area. The project will therefore support the delivery of new homes and jobs to meet strategic growth aspirations for the region and facilitate the transformation of Western Sydney into a key hub of business, industry and residential activities.

Cumulative socio-economic construction impacts

The following potential cumulative impacts may result from the project during construction:

- Consultation fatigue as a result of multiple consultation and engagement exercises with the local community on various projects. Consultation for this project showed some confusion among the local community – with people making comments about Aerotropolis and other development.
- Concern, expressed by some stakeholders, that the Western Sydney area is being disproportionately targeted for industrial and infrastructure development that is not desired elsewhere in the city. There is potential for this to be exacerbated by the project, in the context of significant other major projects.
- Potential for the project, alongside other urban development and change, to help communities in demonstrating the benefits and opportunities of the large-scale development of the area, including greater access to services and infrastructure. In turn this might support with community acceptance and understanding of short-term impacts for long term gains.
- Amenity, traffic and transport impacts from the project are likely to be increased as a result of cumulative development.

Cumulative land use impacts

While the project alone will not result in significant land use impacts, it will support growth and development of the area which will catalyse a significant change in land use character from the rural and agricultural use to a more urban and industrial character. This is particularly the case in the SESA western and central.

While the project is just one part of this, it has the potential to contribute to this broader cumulative impact. This change will result in both positive and negative impacts – including negative impacts to agricultural economy and land use, and concerns from the local community regarding the local character that they value. Positive impacts might include the provision of greater access to employment, housing choice and other services and opportunities for local and future residents.

There is potential for a cumulative impact on the existing local community through the process of urban development and the resultant increase in land and property values. While not a direct impact of the project, in supporting ongoing urban development and growth, the project will facilitate the wholescale redevelopment of the SESA western and central. This may push existing residents out of the area to be replaced by young professionals and other typical urban dwellers.

11.6.9 Management measures

Table 11-71 outlines management measures Sydney Water proposes to manage socio-economic impacts.

Table 11-71 Land use and socio -economic management measures

ID	Impact	Mitigation measure	Timing
SELU01	Access to employment	Develop an Australian Industry Participation (AIP) Plan including consideration of the following: • Where practical training to meet minimum competency requirements. • Measures to maximise local procurement and employment. • Measures to increase employment in the long-term unemployed or underrepresented groups in the workforce. • Working with local apprenticeship programs.	Prior to construction During construction
SELU02	Negative impacts on commercial operations and businesses	Implement measures for ongoing consultation with the business community including minimum notification periods for works close to business or commercial operations and a means for receiving feedback to reduce impacts to business operation.	Prior to construction During construction
SELU03	Negative impacts on commercial operations and businesses	Where business visibility is impacted by construction activities, provide signage to maintain visibility and wayfinding of businesses and access to businesses during construction.	During construction

ID	Impact	Mitigation measure	Timing
SELU04	Interruptions to social infrastructure	Consult and work with local councils during the construction period to minimise impacts to social infrastructure and local events, such as memorials and festivals etc. This includes timing construction activities to minimise impacts to events: • at Luddenham Showground • at Cabravale Memorial Park • on public holidays and school holidays.	Prior to construction During construction
SELU05	Interruptions to social educational and community infrastructure facilities	Consult with: • Educational facilities such as child-care centres and schools to discuss timing and duration of construction. Construction activities should be timed in consideration of exam periods (i.e. NAPLAN and HSC) and school events to minimise impacts. • Community facilities and places of worship to understand potential impacts during times of worship and events/activities including amenity impacts and potential access impacts.	Prior to construction During construction
SELU06	Interruptions to social infrastructure	Investigate further ways to mitigate potential impacts associated with construction, in particular the location of construction compounds and additional construction areas at the following locations: • Fowler Reserve, Wallacia • Western Sydney Parklands, Kemps Creek and Cecil Hills • Cabravale Memorial Park, Cabramatta • Lennox Reserve, Lansvale • Lansvale Reserve, Lansvale.	Detailed design
SELU07	Interruptions to emergency services	Continue consultation with emergency services that use the local influence area to understand access requirements so that access can be maintained during construction. This includes consultation with the SES, RFS, Ambulance and Police.	Prior to construction During construction
SELU08	Severance of the community due to construction activities	Investigate opportunities for overcoming physical segregation caused by construction works with a focus on minimising impacts to commonly used active transport routes, enabling community members to access services on the other side of trenches. For example, maintaining access to Cabravale Memorial Park for nearby users.	Prior to construction During construction

ID	Impact	Mitigation measure	Timing
SELU09	Community cohesion / Health and Wellbeing / Personal and Property Rights / Fears and Aspirations / Culture	Ensure community and stakeholder management includes: • Education and information sharing around perceived impacts of the AWRC, especially regarding water quality and human health to demonstrate low impacts, as well as positive impacts associated with support for existing and future quality of life. • Targeted engagement with vulnerable groups, including families, young and ageing populations to minimise real and perceived impacts, including in languages relevant to the local community. • Publishing and display of findings from monitoring and management processes transparently for the community.	Prior to construction During operation
	Community cohesion impacts	This impact is appropriately managed by measure G08 in Chapter 15 (Project synthesis).	Prior to construction During construction
	Personal property impacts	This impact is appropriately managed by measure G05 and G08 in Chapter 15 (Project synthesis).	Prior to construction During construction Post construction
	Access, movement and connectivity	This impact is appropriately managed by measures in section 11.4 (Traffic and transport).	Prior to construction During construction

12 Sustainability and resource management impacts

This chapter assesses the project's sustainability, climate change, greenhouse gas, waste and resource management impacts.

12.1 Sustainability

This section describes how the project will implement sustainable outcomes, as well as assessing the project's greenhouse gas emissions and adaption to climate change. This section summarises the specialist report (Aurecon Arup, 2021j) in Appendix Y.

Sustainability impact summary

The project provides an essential wastewater service to Western Sydney and can also contribute to sustainable outcomes by:

- producing treated water suitable for a range of beneficial uses, contributing to Sydney's water resilience
- beneficially reusing biosolids and generating renewable energy with potential for this to expand in the future to create a centre for circular economy activity at the Advanced Water Recycling Centre (AWRC)
- providing water that could be used for greening and cooling the landscape.

In addition, sustainability is also a key consideration in the more detailed aspects of how the project is designed, constructed and operated. Sydney Water is committed to implementing a range of initiatives, ranging from ensuring materials are responsibly sourced and disposed of, through to reducing greenhouse gas emissions, which are drawn together in a commitment to achieving an Infrastructure Sustainability Council of Australia (ISCA) rating of at least Excellent or 'Gold', depending on the version of the ISCA rating tool.

Reducing greenhouse gas emissions is a key focus of the project's sustainability commitment. The main contributors to greenhouse gas emissions are materials, electricity consumption and nitrous oxide from the wastewater treatment process. At peak capacity, Stage 1 of the project will contribute about 673,986 tonnes of carbon dioxide equivalent (tCO2-e) to the atmosphere, of which two thirds is from operation and one third from construction. This represents about 0.04% of the NSW carbon budget and 0.01% of the national carbon budget. To offset these emissions, Sydney Water will generate renewable energy from solar power and co-generation facilities to reduce electricity purchase from the grid and reduce the project's greenhouse gas emissions by about 29%.

Sydney Water has also considered the project's climate change adaptability and resilience. A risk assessment has been completed for different climate change projections, with measures incorporated to address increases to temperature, extreme weather events and bushfire to ensure the infrastructure can adapt and respond to impacts from projected climate change.

The project's sustainability measures will be drawn together in a Sustainability Management Plan to outline how the project will implement and deliver the sustainability commitments and improve sustainability performance over time.

12.1.1 Relevant Secretary's Environmental Assessment Requirements

Table 12-1 summarises the project Secretary's Environmental Assessment Requirements (SEARs) relevant to sustainability, greenhouse gas and climate change Section 3.5 discusses future opportunities where the project can align with circular economy principles to address SEARs 59 and 60.

Table 12-1 Project SEARs relating to sustainability, greenhouse gas and climate change

SEARs	EIS section where requirement addressed
57. An assessment against an accredited ESD rating system or an equivalent program of ESD performance. This should include a minimum rating scheme target level.	Sections 12.1.2 and 12.1.6
58. How ESD principles (as defined in clause 7(4) of Schedule 2 of the Regulation) will be incorporated in the design and ongoing operation phases of the development.	Section 12.1.8
61. Assessment of the risk and vulnerability of the project to climate change in accordance with the current guidelines, including any Regional Water Strategy and associated climate change modelling as relevant to the project.	Sections 12.1.2 and 12.1.7
62. Quantified specific climate change risks with reference to the NSW Government's climate Projections and incorporate specific adaptation actions in the design.	Section 12.1.7
63. An assessment of potential future climate variability impacts on the operation and management of the project and associated delivery works (such as water deliver by way of river operations, or pipe infrastructure), having regard to research on groundwater recharge and surface run-off and the NSW Climate Impact Profile.	Section 12.1.7
64. Assessment of the greenhouse gas emissions from the construction and operation of the project for the life of infrastructure, including: a) documentation and justification of an appropriate methodology for estimating greenhouse gas emissions for the project	Section 12.1.2

SEARs	EIS section where requirement addressed
b) assessment of carbon dioxide, nitrous oxide and methane gas emissions	Section 12.1.9
c) quantitative assessment of Scope 1, 2 and 3 greenhouse gas emissions.	Section 12.1.9
d) an assessment of reasonable and feasible measures to minimise greenhouse gas emissions and ensure energy efficiency.	Sections 12.1.9 and 12.1.11
e) Project emissions as a proportion of NSW and Australia's greenhouse gas emissions budgets.	Section 12.1.9
f) details of all proposed mitigation, management and monitoring measures.	Section 12.1.11

12.1.2 Methodology and assumptions

Appendix Y contains the complete sustainability assessment of the project. The methodology for assessing the sustainability of the project included:

- reviewing the project reference design to identify sustainability opportunities for the Sustainability Initiatives Register
- identifying the potential Infrastructure Sustainability Council of Australia (ISCA) rating the project will aim to achieve
- identifying and assessing the potential climate change risks for the project and how these will be addressed
- assessing the project against the principles of Ecologically Sustainable Development (ESD)
- assessing the contribution of the project to greenhouse gas emissions.

Sustainability Initiatives Register

A key step in the project's sustainability assessment involved developing a project Sustainability Initiatives Register (SIR). This register identified potential sustainability initiatives and opportunities for the project by reviewing the project's reference design. It considered project design, construction and operation.

A long list of possible initiatives was developed, from which priority initiatives were identified as key commitments for the project. These initiatives are outlined in section 12.1.4 and form the minimum sustainability commitments of the project, with greatest potential to impact or influence project sustainability outcomes. Sydney Water also identified several sustainability aspirations in section 12.1.4 and will continue to develop these as detailed design and benefits realisation continues across the project lifecycle.

Infrastructure Sustainability Council of Australia target

An initial performance review of the reference design was completed against the Infrastructure Sustainability Council of Australia (ISCA) rating tool through the IS v1.2 scorecard. The preliminary scorecard used the IS v1.2 default weightings for a wastewater asset with additional input from the project design. Proposed credit levels were benchmarked with Sydney Water's Lower South Creek (LSC) project performance. Sydney Water will use the most suitable version of the ISCA rating tool for the final performance review during detailed design, construction and operation of the project.

Climate change risk assessment

The climate change risk assessment (CCRA) involved determining the potential risks future climate change will have on the project. This included identifying the relevant present and future climate scenarios based on projections using Commonwealth Scientific and Industrial Research Organisation (CSIRO) and NSW and ACT Regional Climate Modelling (NARCliM) data. For this assessment, both CSIRO and NARCliM 1.0 were used for the climate projections for completeness. This was also in response to the IS v1.2 'Cli-1' recommendation to allow the design to explore the effects of different model sensitivities. The CSIRO projections were considered representative for NSW and NARCliM for Western Sydney. Climate change modelling as part of the Greater Sydney Water strategy was not available at the time of the assessment and has not been used.

Representative Concentration Pathways (RCPs) and Special Report on Emission Scenarios (SRES) A2 were considered in line with ISCA requirements. Two time periods (2030 and 2070) were used to represent the near-term and long-term design life of the project. The RCPs used were:

- RCP 4.5 – assumes global annual GHG emissions peak around 2040, and then decline
- RCP 8.5 – assumes global annual GHG emissions continue to rise throughout the 21st century.

A preliminary risk assessment was completed using a qualitative method with local climate data to understand the likelihood and consequence of climate change risks that could affect the construction and operation of the project. Where CSIRO and NARCliM had varied projections, the most extreme projection was used.

This assessment was developed in accordance with:

- the recommendations of AS5334 Climate change adaptation for settlements and infrastructure - A risk based approach
- the requirements of the IS rating tool credits 'Cli-1' and 'Cli-2' (v1.2).

The risk assessment was verified with Sydney Water stakeholder consultation and risk validation, involving designers, engineers and climate change specialists. This analysed and evaluated the key risks and likelihood and consequences of climate change risks, using expert and local knowledge of the site and infrastructure components.

Cross dependency initiative

In addition to this risk assessment, Sydney Water also assessed the effectiveness of proposed adaptation measures for the AWRC site through its Cross Dependency Initiative (XDI) tool. Sydney Water is in the early stages of trialling this tool on major infrastructure projects. The XDI tool aims to communicate complex analysis of the impacts of extreme weather events on infrastructure assets using asset information and climate models.

Ecologically Sustainable Development

The project was assessed against the principles of Ecologically Sustainable Development (ESD) as provided in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. This included a review of the benefits of the project, and how the project aimed to avoid and minimise social, community and environmental impacts.

Greenhouse gas impact assessment

Determining the project's greenhouse gas emissions is a key consideration. As a first step to determine a greenhouse gas (GHG) emission inventory, emissions from three different zones (or scopes) were identified, in line with the project SEARs:

- Scope 1: direct emissions which occur within the site boundary from owned or controlled sources, for example emissions from site plant and equipment. This includes fuel, fugitive methane and nitrous oxide emissions from the wastewater treatment process and vegetation clearance.
- Scope 2: indirect emissions which occur outside the site boundary from the generation of purchased energy.
- Scope 3: all indirect emissions (not included in scope 2) that occur in the value chain. This includes materials, transport, waste, electricity transmission and extraction of fuels.

The quantity of each relevant emission source was estimated in its relevant units using project specific data and information. Where project estimates were not available, data from existing comparable projects was used as a proxy or to support reasonable assumptions.

Once the emissions sources and levels were estimated in their relevant units, these were converted to CO_2 equivalent units using known emission factors and industry-recognised calculation methods, to estimate the GHG emissions from the identified sources.

12.1.3 Legislation and guidelines

Table 12-2 outlines the sustainability related legislation, policies and guidelines relevant to the project. These assist in framing the project's sustainability actions and considerations. Chapter 2 provides further details on key Western Sydney policies and guidelines that influence the project.

Table 12-2 Legislation and policy context for sustainability

Legislation/ policy	Key aspects	Project relevance
Commonwealth legislation and policy		
National Greenhouse and Energy Reporting (Measurement) Determination 2008	This determination is made under sections 7B and 10 of the *National Greenhouse and Energy Reporting Act 2007*. It provides the measurement of GHG emissions arising from the operation of facilities and methods and criteria for measuring Scope 1 and 2 GHG emissions.	The project uses the method in this determination for estimating fugitive emissions from wastewater treatment as documented in section 12.1.9.
Australian National Greenhouse Accounts, National Greenhouse Accounts Factors (2019)	Draws on the National Greenhouse and Energy Reporting (Measurement) Determination 2008 to provide methods to estimate a broad range of GHG emissions, including Scope 1, 2 and 3.	The project uses the methods in this document to estimate Scope 1, 2 and 3 emissions not covered in the National Greenhouse and Energy Reporting (Measurement) Determination 2008. This is assessed in section 12.1.9.
Australian Greenhouse Office, Factors and Methods Workbook (2004)	Provides a single source of current GHG emission factors for use in the estimation of emissions and emission abatement	The project uses the methods outlined in this workbook to estimate impact of land use change as assessed in section 12.1.9.
The National Climate Resilience and Adaptation Strategy (DAWE, 2015)	The strategy articulates how Australia is managing the risks of a variable and changing climate. It identifies a set of principles to guide effective adaptation practice and resilience building and outlines the Commonwealth Government's vision for a climate-resilient future.	The project's climate risks are identified in section 12.1.7 in accordance with this strategy to enhance resilience and adaptation.
Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard (World Resources Institute, 2005)	The protocol provides internationally recognised guidelines and standards to assist companies and organisations with developing a GHG inventory. The protocol aims to provide consistency and completeness in GHG accounting.	The project uses the standard's methods and definition of the emission boundary for the GHG assessment in section 12.1.9.

Legislation/ policy	Key aspects	Project relevance
NSW legislation and policy		
Environmental Planning and Assessment Act, 1979 and Environmental Planning and Assessment Regulation 2000	The act includes a range of objectives relating to sustainability, ESD and environmental protection. The regulation includes provisions about how projects must consider ESD principles as defined in clause 7(4) of Schedule 2.	Schedule 2 of the regulation requires Environmental Impact Statements (EISs) to have regard to the principles of ESD. This is also a requirement of the SEARs.
NSW Climate Change Policy Framework 2016 (OEH, 2016)	The Framework developed by the NSW Government endorses the Paris Agreement. The framework sets policy directions to guide implementation of the framework and NSW commitments to achieving long term objectives of net zero emissions and resiliency to climate change.	Sydney Water's 2020-2030 strategy seeks to make substantial progress towards zero impact on the environment (including a focus on carbon). It also focuses on resilience to a changing climate, connecting with customers and using water in the landscape to shape liveable places. The project has made sustainability commitments in these areas to contribute to Sydney Water's corporate position on climate change.
Western Sydney Aerotropolis State Environmental Planning Policy (2020)	The SEPP aims to facilitate development in the Western Sydney Aerotropolis Growth Area (WSAGA) in accordance with the objectives and principles of the Western Sydney Aerotropolis Plan. Clause 3 outlines the aims of the SEPP.	The project aligns with the relevant aims of the SEPP through implementing sustainability initiatives and minimising impacts to biodiversity.
Western Sydney Aerotropolis Plan (2020)	The WSAP defines how the broader region's environment, waterways, strategic transport network, infrastructure and economy will combine to transform the WSAGA into a contemporary metropolitan city. Sustainability is one of four overarching objectives and principles of the plan.	Chapter 2 outlines how the project aligns with the plan's objectives.

Legislation/ policy	Key aspects	Project relevance
Western City District Plan (2018)	The plan recognises that over the next 20 years, the Western City District will transform dramatically due to extensive aviation and non-aviation infrastructure investment, increased housing supply, and a focus on commercial and industrial development supporting high-value jobs.	The plan identifies 22 planning priorities. Chapter 2 outlines how the project aligns to the relevant priorities.
Other policies and guidelines		
United Nations Sustainable Development Goals	A set of 17 Sustainable Development Goals (SDGs) developed by world leaders aimed at addressing various social, environmental and economic issues by 2030.	The project seeks to align identified benefits with corresponding SDGs. The goals have assisted the project in identifying sustainable outcomes.

Sydney Water has several internal strategies and polices that have contributed to how sustainable outcomes have been considered for the project.

Sydney Water Strategy 2020-2030

This strategy will help deliver Sydney Water's vision of 'Creating a better life with world class water services'. It will direct activities for the next decade and enable Sydney Water to respond to key challenges facing customers, business and the environment (Sydney Water, 2020b). The strategy identifies four key strategic outcomes:

- First choice of customers and partners.
- Successful and innovative business.
- High performance culture.
- Thriving, liveable and sustainable cities.

The 'Thriving, liveable and sustainable cities' outcome is most relevant to this sustainability assessment. Meeting this outcome will require delivering on the following objectives:

- Our cities waterways are clean, healthy and safe for swimming and recreation.
- Our system is resilient to shocks and disruptions (eg Sydney Water has achieved advanced system reliability and performance).
- Our water and waterways are world class and support thriving liveable and sustainable cities.
- Our environmental performance is world class.

- We are a resource recovery business with an increasing portfolio of circular economy products and services.
- We have made substantial progress towards zero impact on the environment (focus on water, waste and carbon).

Sydney Water Energy Master Plan

The vision of Sydney Water's Energy Master Plan is to ensure Sydney Water purchases, uses and generates energy in a way that delivers the best value water services to its customers (Sydney Water, 2018). This also helps reduce the environmental impact and manage the risks from a changing energy market. To achieve this, the Energy Master Plan sets a series of aspirational goals around energy resource recovery, self-generated renewable energy, energy efficiency and electricity procurement. The project's approach to these aspects is described in Appendix Y. Sydney Water is currently updating and revising the Energy Master Plan.

Sydney Water Resilience Policy

Sydney Water is committed to providing secure and reliable essential services. Building infrastructure, community and organisational resilience will ensure public health and safety, environmental outcomes, economic prosperity and social cohesion of our city (Sydney Water, 2021b).

The following elements of resilience and their scope underpin Sydney Water's policy:

- Resistance: Ability to continue service provision through withstanding and preventing reasonably foreseeable threats, hazards, shocks and stressors.
- Reliability: Capability of infrastructure and organisation to maintain service and meet obligations in a variety of conditions.
- Redundancy: Adaptability of an asset, network or group to maintain service and meet obligations with loss of individual components in a variety of expected conditions.
- Response: Preparation for and actions taken during an evolving adverse event to limit impact. Response includes monitoring conditions to guide adaptive strategies and trigger planning and investment.
- Recovery: Restoring vital functions as quickly as possible to limit damage caused by a failure. Lessons learned should be used to improve the resilience of Sydney Water's assets and systems.

The climate change risk assessment in section 12.1.7 identifies risks that can impact the resilience of the project.

Project Benefits Realisation Plan

Sydney Water has developed a Benefits Realisation Plan for the project and a pathway outlining how and when these benefits will be achieved. Relevant potential benefits include:

- Service upgrades support planned urban growth in Western Sydney.
- Waterway health and ecology is improved downstream.
- Water resilience gains through recycled water.
- Sustainability and efficiency gains through resource recovery.
- Provide better landscaping and support greening and cooling in Western Sydney.

Implementing these benefits will contribute to the sustainable outcomes of the project and further align with the internal Sydney Water strategies and external government visions for Western Sydney. They have a strong focus on social, community and environmental benefits aligning with the principles of ESD. Sydney Water has incorporated the sustainability-related benefits as part of the commitments in section 12.1.5.

12.1.4 Contribution to sustainable outcomes in Western Sydney

The project can contribute to sustainable outcomes in the Western Parkland City aligned with the NSW Government's vision for the area. In addition to providing an essential wastewater service for the South West Growth Area (SWGA) and Western Sydney Aerotropolis Growth Area (WSAGA) over the coming decades, the project also provides opportunities to:

- contribute to Sydney's water resilience by producing treated water suitable for a range of beneficial uses including industry, households, open spaces, environmental flows, agribusiness, and purified recycled water for drinking subject to future government decisions
- become a centre for circular economy activity where all resources are recovered and reused for their greatest economic value, through development of a bioenergy/circular economy hub at the AWRC to reuse waste and generate renewable energy
- contribute to the NSW Government's vision for a liveable Western Parkland City and WSAGA by providing water that could be used for greening and cooling the landscape.

12.1.5 Sustainability Initiatives Register

Table 12-3 outlines the project's key sustainability initiatives. These initiatives form the basis of the project's commitment to sustainable outcomes. The themes of the commitments cover a range of areas, with the major focus areas being energy and circular economy.

Table 12-3 also shows the alignment between these initiatives, the priority areas of Sydney Water's Strategy 2020-2030, the objectives of the Western Sydney Aerotropolis Plan, the United Nations Sustainable Development Goals and the ISCA ISv1.2 category.

Table 12-3 Summary of key project sustainability commitments

Theme	Key sustainability commitment	Relevant UNSDG	Western Sydney Aerotropolis Plan 2020	Sydney Water Strategy objectives to 2030	ISCA ISv1.2 Category
Sustainable design	**ISCA** - obtain an ISCA rating of at least 'Excellent' (or 'Gold' under v2.1) and preferably 'Leading' (or 'Platinum' under v2.1) for design and as built stages (with a minimum score of 65 points).	All	✓	✓	All
Energy	**Electricity use** - supplement 50% of Stage 1 project electricity use by: • self-generating renewable energy from installation of solar PV panels and recovered biogas to fuel cogeneration and/or • purchasing grid renewable energy.	7: Affordable and clean energy 12: Responsible consumption and production 13: Climate Action	✓	✓	Energy and Carbon Waste
Circular economy	**Beneficial reuse of biosolids** – reuse all biosolids to maximise reuse and recovery of resources. **Recycled water** - enable 100% of wastewater treated during normal dry weather conditions to be reused for the purpose of off-setting drinking water supply, including as environmental flows, recycled water for local	9. Industry innovation and infrastructure 12: Responsible consumption and production	✓	✓	Waste Water

Theme	Key sustainability commitment	Relevant UNSDG	Western Sydney Aerotropolis Plan 2020	Sydney Water Strategy objectives to 2030	ISCA ISv1.2 Category
	supply or purified recycled water for drinking in the future. Provide a source of water that can be used for green space and tree canopy irrigation to support urban cooling and greening objectives in Western Sydney.				
Water Management	**Integrated water management solution** – meet current and future changes to EPA nutrient load limits in the Yarramundi 2 subzone and maintain or improve instream water quality and macroinvertebrate diversity attributable to the project's operational waterway releases. Support customers to develop high quality integrated water management solutions that consider a range of sources including rain/stormwater and recycled water from the AWRC where appropriate.	3. Good health and wellbeing 6: Clean water and sanitation 9. Industry innovation and infrastructure 12: Responsible consumption and production 14. Life below water 15. Life on land	✓	✓	Discharges to Air, Land and Water Ecology

Theme	Key sustainability commitment	Relevant UNSDG	Western Sydney Aerotropolis Plan 2020	Sydney Water Strategy objectives to 2030	ISCA ISv1.2 Category
Sustainable communities	**Urban design/landscaping** –develop and implement a landscape-led Urban Design and Landscaping Plan for the AWRC site. **Water Sensitive Urban Design** – design stormwater management at the AWRC site with the aim of meeting waterway objectives for South Creek.	11: Sustainable cities and communities	✓	✓	Urban and Landscape Design Water
Environment	**USC AWRC Environmental Impact Statement outcomes** -manage environmental impacts arising from construction and operation of the AWRC and pipelines.	11: Sustainable cities and communities 14: Life below water 15: Life on land	✓	✓	All
Flood Management	**Flood Management –** do not contribute to existing flood management issues in the Hawkesbury Nepean or South Creek catchments.	11. Sustainable cities and communities 14. Life below water 15. Life on land	✓	✓	Lan-4

Theme	Key sustainability commitment	Relevant UNSDG	Western Sydney Aerotropolis Plan 2020	Sydney Water Strategy objectives to 2030	ISCA ISv1.2 Category
Climate Resilience	**Infrastructure resilience and opportunities for improved drought resilience in Western Sydney** - manage the impacts of a changing climate by including adaptation measures to support resilience of the AWRC and pipeline infrastructure.	11: Sustainable cities and communities 13: Climate action	✓	✓	Climate

Although not part of current project scope, in addition to these commitments, Sydney Water will continue to explore opportunities to further improve sustainability performance over the life of the project, including:

- working with the market to develop plans for energy generation and procurement, with a view to ultimately offset 100% of the project's energy draw and achieve total energy generation that is greater than that needed to run the AWRC
- working with the market to develop plans for future resource recovery at the AWRC with the aim of maximising circular economy initiatives and enabling future technologies
- working with the market to identify and implement opportunities to reduce carbon emissions during construction
- the use of recycled and recovered materials in construction and operation, and aiming for zero waste to landfill target, where alternatives exist
- maintaining 100% beneficial reuse of biosolids, with a targeted reduction in average biosolids management costs (production, handling and transport) and/or an increase in biosolids value
- opportunities to extract more biogas from wastewater with developments in technology
- opportunities for the addition of food waste as part of the circular economy hub, which will assist in diverting waste away from landfills
- creating positive commercial value for customers and partners served by the AWRC
- developing circular economy education opportunities for customers and the community
- 50% reduction in embodied carbon emissions compared to a conventional design, from 2025
- achieving net zero operational carbon emissions (Scope 1 & 2 emissions)
- 100% beneficial reuse of recycled water produced
- resource recovery contracts with customers or partners
- considering opportunities to co-design features or architectural treatment with community and stakeholders where appropriate, including traditional owners
- celebrating cultural and scientific heritage and providing future opportunities for community access.

12.1.6 ISCA benchmarking and framework

The project's sustainability performance was assessed across 15 categories using the IS v1.2 rating tool. The categories are made up of 44 credits, which assess an aspect of performance within the category. The credits may address mitigation or improvement and processes that support realisation of sustainable outcomes.

A preliminary scorecard completed for the project shows the project can achieve a minimum 'Excellent' rating. The scorecard weighting assessment suggests that the most influential categories for the project will likely be materials, energy and carbon. Other important categories that will assist in achieving a project rating of 'Excellent' include urban design, ecology and discharges to water. Urban design for the project has been a central component to achieving identified project objectives, meeting environmental standards and sustainable outcomes. It is not possible to present the preliminary ISCA scorecard now as this must be done in conjunction with ISCA. However, Sydney Water is confident in achieving an Excellent rating through analysis of the reference design and benchmarking against Sydney Water's Lower South Creek project. An official IS scorecard will be developed with ISCA during the detailed design phase of the project. Sydney Water is aiming to achieve a minimum IS rating of 'Excellent' (or 'Gold' under ISCA v2.1) for design and as built stages depending on the version of the ISCA rating tool.

Table 12-4 outlines some of the key areas where the project will have an environmental impact, and relevant indicative ISCA credit categories to demonstrate that managing impacts across environmental disciplines will contribute to achieving a higher ISCA rating.

Table 12-4 Indicative ISCA credit categories for project environmental impacts

Environmental impact	ISCA credit category
Terrestrial biodiversity	Eco-2 Habitat Connectivity
Surface water	Dis-1 Receiving Water Quality
Flooding	Lan-4 Flooding design
Groundwater	Dis-1 Receiving Water Quality
Soils and contamination	Lan-3 Contamination and remediation
Heritage	Her-1 Heritage Assessment and Management Her-2 Monitoring of heritage
Air quality	Dis-4 Air Quality
Noise and vibration	Dis-2 Noise Dis-3 Vibration
Landscape character and visual impact	Urb-1 Urban Design Dis-5 Light Pollution
Traffic and access	Dis-2 Noise
Materials	Mat-1 Material lifecycle impact measurement and reduction Mat-2 Environmentally labelled products and supply chains

Environmental impact	ISCA credit category
Energy	Ene-1 Energy and carbon monitoring and reduction Ene-2 Use of renewable energy

12.1.7 Climate change risk assessment

Climate change projections

Projected changes for each of the climate variables relevant for the project are presented in Table 12-5 for CSIRO and Table 12-6 for NARCliM.

The most contrasting projections between the two models are for annual rainfall. Both models project decreasing rainfall in winter and spring, but NARCliM predicts increased rainfall in summer and autumn resulting in annual increases in the near and far future. CSIRO projects annual decreases in rainfall in the near and far future. As a result, the risk assessment considers the impacts of increased rainfall leading to flooding and decreased rainfall leading to drought.

In response to SEARs 63, the NARCliM data includes projections for groundwater recharge and surface run-off, which were used to inform the assessment. These projections are for Metropolitan Sydney rather than Western Sydney. However, it is the most applicable dataset to use for the project area.

Table 12-5 CSIRO climate change projections for NSW

Type of Effect	Climate variable	Indicator	Projections under scenarios					Outcome
			Baseline	2030 RCP 4.5	2030 RCP 8.5	2070 RCP 4.5	2070 RCP 8.5	
Primary	Temperature	Annual mean max. temperature	24°C	+1.15°C	+1.30°C	+2.05°C	+3.82°C	Increase in average annual temperatures (minimum and maximum), and number of extreme heat days. Reduced number of extreme cold days (Very high confidence)
		Annual mean min. temperature	10.9°C	+0.92°C	+1.01°C	+1.96°C	+3.58°C	
		Number of hot days (>35 °C)	11.4	+7.21	+7.82	+10.15	+14.4	
	Precipitation	Annual rainfall	658.1 mm	-4.6%	-6.3 %	-6.9%	-6.3 %	Decrease in average annual rainfall in winter and spring. (Medium confidence)
	For 20-year period centred on 2030 (2020-2039)	Sea-level rise	-	-	0.14m	-	0.66m	Sea levels will continue to rise. (Very high confidence)

Type of Effect	Climate variable	Indicator	Projections under scenarios					Outcome
			Baseline	2030 RCP 4.5	2030 RCP 8.5	2070 RCP 4.5	2070 RCP 8.5	
Secondary	Humidity	Relative humidity change	73%	-5.7%	-2.5%	-1.7%	-1.7%	Humidity will decrease (medium confidence).
	Drought	Time spent in drought is projected, with medium confidence, to increase over the course of the century.						
	Flood	Increase in intensity of rainfall events, is likely to lead to an increase in flooding events especially in urbanised areas (with low permeability; high confidence)						
	Wind	Annual wind speed change	-	-0.6%	-0.5%	-0.8%	-1.1%	-
	Cyclones	Cyclones are very unlikely to impact Sydney. However, a greater proportion of high intensity storms is projected.						
	Bushfire	An increase in frequency of very high and extreme fire danger days is projected. This is due to harsher fire weather climate - increasing fuel dryness and hot, dry, windy conditions (high confidence).						

Table 12-6 NARCliM climate change projections for Sydney

Type of Effect	Climate variable	Indicator	Projections under scenarios			Outcome
			Baseline	2030 SRES A2	2070 SRES A2	
Primary	Temperature	Annual mean max. temperature	20-22°C	+0.7°C	+1.9°C	Increase in average annual temperatures (minimum and maximum), and number of extreme heat days. Reduced number of extreme cold nights
		Annual mean min. temperature	8-12°C	+0.64°C	+2.0°C	
		Number of hot days (>35 °C)	10-20	+5-10	+10-20	
	Precipitation	Annual rainfall	200-300 mm	+0-5%	+5-10%	Decrease in average annual rainfall in winter and spring towards 2030 but increasing in summer and autumn
Secondary	Runoff	Annual runoff	55mm	+4%	+17.6	Increase in runoff in the near and far future
	Recharge	Annual recharge	67mm	-5%	+12.5%	Decrease in recharge in the near future, increasing in the far future
	Bushfire	Average fire weather is projected to increase in spring by 2070. Severe fire weather days are projected to increase in summer and spring by 2070.				

Risk assessment

A preliminary risk assessment qualitatively rated and assessed risks as low, medium, high or extreme based on a consequence and likelihood matrix. Table 12-7 outlines the findings of the project risk assessment for medium and high climate change risks. In total, 12 medium and high risks were identified across the following categories:

- Change in annual mean air temperature.
- Increase in extreme weather events – increased days >35°C.
- Increased peak precipitation.
- Bushfires.

Of these 12 risks, two have been identified as high risks for 2070:

- More hazardous outdoor working conditions due to extreme heat which increases the health and safety risk to operational staff of the AWRC.
- Increased flooding risk from South Creek which can result in damage to AWRC infrastructure, reduced access to the AWRC site and impacting wastewater treatment performance.

Sydney Water will consider the adaptation measures in Table 12-7 during detailed design to improve the project's climate resilience. Where risks have been highlighted as 'high', adaptation measures have been implemented to reduce these risks to medium or lower. Adaptation measures have also been considered for a minimum of 50% of 'medium' risks identified, in line with ISCA requirements. Measures for further investigation during detailed design are also provided. The preliminary risk assessment did not identify any climate change risks associated with water delivery by way of river operations. The only medium risk associated with pipeline infrastructure relates to expansion and contracting of pipelines due extreme event of >49°C temperatures exceed design parameters resulting in buckling and potential failure of the infrastructure.

More information, including the risk matrix adopted for the risk assessment, is provided in Appendix Y.

Table 12-7 Project climate change risk assessment (medium and high risks) and adaptation response

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Change in annual mean air temperature									
Increased septicity in incoming wastewater mains due to higher anaerobic biological activity (higher sulfide production).	Increased odour generation at AWRC leading to impacts to surrounding residents.	Medium	Medium	Medium	No further adaptation measures proposed beyond those already in design, as impact will be minor		Likely	Minor	Medium

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Increase in extreme weather events – increased days >35°C									
More hazardous outdoor working conditions due to extreme heat.	Increased health and safety issues due to heat exposure.	Medium	Medium	High	Management plans in place to outline procedures for working in extreme weather conditions. Shading of footpaths where appropriate.	Investigate opportunities to bring equipment inside and under shelter, building ventilation and green/blue infrastructure to keep the AWRC site cool. Passive architectural design to assist with natural cooling of buildings.	Possible	Moderate	Medium

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Due to a single extreme event of >49°C temperatures exceed design parameters for expansion and contraction.	Higher temperatures cause structural damage cracking, pipe buckling.	Medium	Medium	Medium		Review maximum ambient design temperatures for infrastructure.	Likely	Moderate	Medium

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Increased peak precipitation									
Increased frequency and intensity of peak wet weather flows to AWRC.	Additional flows to cause more frequent plant bypasses or upstream overflows.	Medium	Medium	Medium		Wastewater collection network designed to minimise wet weather infiltration to reduce volume of incoming flows to the AWRC.	Possible	Minor	Low
Increased frequency of peak wet weather inflows to AWRC.	More primary treated only water discharging to waterways.	Medium	Medium	Medium		Wastewater collection network designed to minimise wet weather infiltration which will reduce the occurrence of primary treated water being released from the AWRC to South Creek.	Possible	Moderate	Medium

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Increase in wet weather wastewater flowrate.	Malabar wastewater system likely to be at capacity more frequently during wet weather reducing availability for brine release.	Medium	Medium	Medium	Up to three days storage time for brine tanks to accommodate wet weather events which will allow for the advanced treatment process to continue to operate during this time.		Possible	Minor	Low

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Increased flooding risk from South Creek.	Inundation leads to damage to infrastructure or staff cannot access site.	Medium	Medium	High	Locate critical infrastructure outside the current 1% annual exceedance probability (AEP) flood level to reduce likelihood of flooding. Raise current site levels in operational area to ensure key AWRC infrastructure is built above the 1% AEP + climate change contingency flood level.		Possible	Moderate	Medium

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Increased frequency of high intensity rainfall leading to increased stormwater runoff and flooding risk.	Increased stormwater runoff from the AWRC site exceeding capacity of stormwater detention facilities.	Medium	Medium	Medium	Design WSUD stormwater facilities at AWRC site to accept stormwater flows up to 1% AEP flood events.		Possible	Minor	Low
Increased flooding risk from South Creek.	Unsafe working conditions for AWRC operators. Restricted access to assets.	Medium	Medium	Medium	Limit staff site access during flood events and develop Flood Preparedness Plan. Additional security around low level infrastructure.		Possible	Minor	Low

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Bushfires									
Smoke and reduced visibility/air quality resulting from nearby bushfires.	Hazardous working environment for AWRC staff.	Medium	Medium	Medium	Primary offices and work areas will be air-conditioned with options to recirculate internal air. Follow existing Sydney Water policies and procedures.		Possible	Moderate	Medium

Details of risk event	Impact of risk event	Risk rating			Measures incorporated in project	Measures for investigation separate to the project	Residual risk		
		Present	2020	2070	Response to high risk (and at least 50% of 'medium' risks)		Likelihood	Consequence	Risk
Bushfire threat to infrastructure	Fire damage to infrastructure/ operational equipment, wiring and electrics and security of energy supply.	Medium	Medium	Medium	Bushfire management measures included in AWRC reference design to reduce the risk of damage to infrastructure.		Unlikely	Moderate	Medium
Bushfires restrict access to AWRC site	Restricted access during bushfire events for operational purposes - potentially causing performance risks.	Medium	High	High	Remote operation capability of site can reduce the frequency and need for staff to be present. Bushfire management on site including fire suppression and fire trail.		Possible	Moderate	Medium

XDI tool assessment of adaptation measures

Assessment of proposed adaptation measures in the XDI tool concluded:

- All adaptation measures in the climate change risk assessment to mitigate heat stress were effective to manage heat below current levels until 2060.
- Implementing controls such as a fire trail around the site will be sufficient to adequately reduce risk levels to no greater than today's levels.
- Building up the operational area of the AWRC site above the current 1% AEP flood level mitigates the risk to critical project infrastructure of more extreme floods under climate change scenarios.

Limitations of the XDI tool include:

- It focuses on risks at a point rather than across a whole site. Sydney Water has minimised this limitation by testing several points across the AWRC site.
- It is based on typical site information rather than focusing on vulnerability of specific assets or processes to specific climate risks.
- It generalises climate adaptation measures for bushfire risks and cannot provide an exact level of risk reduction.
- It does not capture measures for stormwater runoff or localised flooding and ponding.

12.1.8 Ecologically Sustainable Development (ESD)

The project has incorporated ESD principles as defined in clause 7(4) of Schedule 2 of the Environmental Planning and Assessment Regulation 2000.

Table 12-8 outlines how the project aligns with these ESD principles.

Table 12-8 Project alignment with ESD principles

ESD principle	Project alignment with ESD principles
Precautionary principle	The precautionary principle relates to the scientific uncertainty about environmental impacts during decision-making processes. It states that where there is potential for irreversible environment impact and degradation, the absence of complete scientific certainty should not be a reason to postpone management measures to prevent the potential impact. This principle has been considered throughout the options assessment and reference design processes in deciding the preferred location for the AWRC and pipeline alignments and the approach to construction and design. Multi-criteria analysis and risk assessments have been completed throughout the project to ensure serious and adverse damage to the environment is avoided. The EIS communicates and assesses the potential environmental impacts associated with the construction and operation of the project. The EIS assesses worst-case impacts and has completed detailed technical environmental assessments to minimise environmental risks and identify appropriate environmental management measures. Throughout the development of the EIS, Sydney Water has worked closely with the community and relevant government departments and agencies which has further informed the design and impact assessment process. The project also aligns with a range of Sydney Water and external policy requirements relating to sustainability, as outlined in section 12.1.3. Due to uncertainty in population growth forecasting in the servicing area of the project, multiple sizing and capacity options for the AWRC were considered, with the EIS assessing the worst-case scenario. An initial ISCA pathway assessment has been completed to assist the project in moving beyond a compliance approach to one that ensures best practice in sustainability and environmental responsibility. There has been a specific focus on ensuring that the AWRC reduces its carbon emissions as far as practicable, by minimising the reliance on energy purchased from the grid. As an alternative, the project will incorporate technologies, such as photovoltaic solar and co-generation, to generate a portion of the required energy.

ESD principle	Project alignment with ESD principles
Inter-generational equity	Inter-generational equity relates to the equal distribution of economic, social and environmental costs and benefits for current and future generations. The AWRC will be delivered in stages, meaning it can provide wastewater and recycled water services to current and future generations. The EIS and design of the project has considered intergenerational equity by considering the future ultimate capacity of the system and taking into consideration future sensitive receivers. The project's resilience to future changes in climate has been assessed, with adaptation measures incorporated into the design and operation. The AWRC will produce treated water suitable for a range of uses which can contribute to water resilience for future generations where the availability of water may reduce under future climate change scenarios. The components of the AWRC have a specified design life, however, the operation of the AWRC as a whole will be required well into the future and will support the needs of the current and future populations in Western Sydney. The project has been designed with a focus on energy efficiency and reduced carbon footprint during operation. This approach will reduce the reliance on the power grid for energy and incorporate technologies, such as solar and co-generation, to produce energy. This will reduce the greenhouse gas emissions of the project and contribute to slowing climate change. Construction and operation of the project will result the consumption of fossil fuels, including diesel, which may negatively impact future generations. The project is considered to align with the principle of inter-generational equity firstly through its consideration of the long-term needs of its stakeholders and the community and has sought to embed ESD principles throughout the design and planning process to achieve these desired outcomes. This has resulted in the implementation of sustainability initiatives that are integrated into the design and the decision-making process to ensure consistent actions towards desired outcomes through the life of the project. Sustainability initiatives and commitments will contribute to the advancing the social, environmental and economic performance of Sydney Water. The project will ensure that consumption of resources and materials during construction and operation will be significantly reduced compared to a 'business-as-usual' approach. This will be achieved through applying the rigorous standards prescribed by in the ISCA rating tool. A waste management plan will also be developed to ensure waste is reduced as far as possible and where it can't be reduced, diversion from landfill will be prioritised.
Conservation of biological diversity and	Minimising and avoiding impacts to biodiversity and maintaining ecological integrity is a fundamental component of the outcome of the project. Impacts to biodiversity are considered throughout the development of the reference design, including the options selection process for the AWRC as outlined in Chapter 3. The reference design process was completed with the aim to identify biodiversity constraints, avoid,

ESD principle	Project alignment with ESD principles
ecological integrity	minimise and manage impacts. Chapter 3 provides further details on how the project approached avoiding and minimising impacts to biodiversity when selecting pipeline alignments and the AWRC site. Management measures to avoid and minimise impacts to biodiversity include the use of tunnelling construction methodology for pipelines, especially under waterways, which avoids extensive excavation at the ground level. This can be seen in areas such as Lansdowne Reserve for the brine pipeline, and along Elizabeth Drive where the treated water pipeline will be tunnelled under several waterways. Alignment changes to avoid sensitive biodiversity, such as through Western Sydney Parklands, and along Park Road, Wallacia were also adopted to minimise the overall biodiversity impact of the project. About 13.77 hectares (ha) of native vegetation across eight plant community types (PCTs) will be cleared for the project. This includes impacts to vegetation listed under the NSW *Biodiversity and Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. The project will result in the removal of the following threatened flora individuals and habitat: • Downy Wattle – seven individuals, 0.16 ha of known habitat • Native Pear – zero individuals, 0.03 ha of known habitat • Sydney Bush-pea – zero individuals, 0.01 ha of known habitat • Spiked Rice-flower – zero individuals, 2.99 ha of expert mapped habitat The project will result in the removal of the following habitat of 'known' threatened fauna: • 1.56 ha low potential breeding habitat for the Large Bentwing-bat • 3.48 ha additional species credit forage habitat for Large –eared Pied Bat • 7.62 ha of species credit habitat for Southern Myotis • 8.95 ha of expert mapped habitat for Cumberland Plain Land Snail • 14.45 ha of expert mapped habitat for Dural Land Snail. The total impact area of the project is about 213 ha, covering over 40 km of linear area. The removal of 13.76 ha of native vegetation equates to just 6% of the total area impacted by the project. Substantial efforts have been made throughout the project to reduce and minimise impact to native vegetation habitats, and this process has resulted in the residual impacts being largely comprised of degraded, fragmented, and edge effected ecological values. Section 9.1 outlines the management measures to further minimise impacts to biodiversity, as well as the

ESD principle	Project alignment with ESD principles
	how the impacts will be offset. The project also seeks to improve biodiversity on the AWRC site as part of landscaping the green space area. This will see an increase in the biological diversity and ecological integrity of the area, that does not increase the risk of aircraft wildlife strikes on the operation of the Western Sydney International Airport. Chapter 8 considers the project's impacts on aquatic biodiversity and concludes that impacts to aquatic ecology are expected to be low, with potential for benefits in some areas. This a result of a range of factors including the high quality of treated water releases and the limited changes to flows.
Improved valuation, pricing and incentive mechanisms	To ensure the successful integration of the principles of ESD and to secure long-term sustainable development, it is important that these measures and incentives are appropriately valued and costed into the project. The project has applied the Infrastructure NSW (INSW) business case gateway template that specifically addresses the social, economic and environmental sustainability requirements of the project. This will ensure ESD is appropriately considered, valued and priced at each stage of the project lifecycle. This is an important approach to the project as it allows for more sustainable and resilient infrastructure to be identified and accounted for effectively in the INSW business case process, and recognises the long-term value for the community and the environment. Sydney Water will also provide biodiversity offsets for the project in accordance with the Biodiversity Assessment Method, which essentially places a price on biodiversity impacts.

12.1.9 Greenhouse gas impact assessment

Table 12-9 summarises the total emissions of each emissions scope across construction and operation of the project. This is a worst-case assessment based on the AWRC operating at 50 ML/day. Emissions will be lower if the project is initially built to a smaller size, and during the early years of operation when the incoming wastewater volumes are lower. The numbers are total emissions from the start of construction through to 2034 when Stage 1 will be at capacity. They are the total GHG emissions for construction and operation of the project.

Scope 1 emissions relate to the use of fuel, wastewater treatment and vegetation clearance. The largest contribution to emissions in scope 1 is the release of nitrous oxide during the wastewater treatment process. This accounts for 14.7% of the total emissions across the three scopes. No fugitive methane emissions are expected because the methane is used in co-generation, with the excess flared.

Scope 2 emissions include electricity consumption during construction and operation. During construction, electricity consumption will be very low, accounting for 0.001% of the total project emissions. During operation, the main electricity consumer is the AWRC site. This is due to wastewater treatment technologies, especially advanced level treatment, being energy-intensive.

Scope 3 emissions include those associated with materials, transport and waste for both construction and operation of the project. Materials are the largest contributor (especially chemicals used during AWRC operation and structural steel), accounting for 49% of the total emissions across the three scopes.

Table 12-9 Summary of total project GHG emissions

Emissions scope	Total emissions (tCO2-e)	% of total emissions
Scope 1	163,179	24%
Scope 2	138,732	21%
Scope 3	372,075	56%
Total	673,986	100%

The largest project emission sources are materials (about 50% of total emissions), electricity consumption (about 21% of total emissions) and nitrous oxide from wastewater treatment (about 15% of total emissions).

Operation accounts for about two thirds of all emissions from the project, and construction the remaining one third. The major contributors to the construction emissions are materials for the AWRC (of which structural steel is the largest contributor at 54%) and vegetation clearing. The major contributors to the operation emissions are chemicals used for the water treatment process and electricity purchased from the grid.

Appendix Y provides further details on the breakdown of each scope and the relative contribution to total emissions for the project.

The project has incorporated management measures into AWRC design to reduce emissions from all three scopes and these are factored in to the emissions shown in Table 12-9. These measures include:

- For emissions relating to electricity consumption, the AWRC will capture biogas/methane produced during the wastewater treatment process to generate renewable energy through a cogeneration plant. This will produce up to about 1.2 MW of energy. The AWRC site will have solar photovoltaics which will produce about 4 MW of energy. These two sources of energy generation will offset electricity that otherwise would be purchased from the grid.
- Although standard practice, direct emissions (scope 1) are also reduced by flaring any excess biogas/ methane from the treatment process where volumes exceed the capacity of cogeneration.

Had these measures not been included in the design and operation of the AWRC, the unmitigated total GHG emission inventory would increase from 673,986 to 1,074,019 tCO_2-e. Combined, these measures result in a saving of 28.6% when compared to the unmitigated GHG inventory. Further opportunities to reduce GHG emissions will be investigated throughout the detailed design, construction and operation of the AWRC.

Project emissions compared to NSW and national carbon budgets

A carbon budget is an amount of greenhouse gas that can be 'spent' (emitted) for a given level of global warming. If the budget is exceeded, then global temperatures will increase. The project's greenhouse gas emissions have considered carbon and non-CO_2 gases such as methane and nitrous oxide, as these are important greenhouse gases relevant to the project.

Table 12-10 compares the total greenhouse gas emissions of Stage 1 of the project with the NSW and national carbon budgets. Stage 1 emissions have been converted from $tCO_{2\text{-}e}$ to $MtCO_{2e}$ where 1 $tCO_{2\text{-}e}$ = 0.000001 $MtCO_{2\text{-}e}$.

The total impact of Stage 1 of the project during construction and operation is equal to the total emissions (including scope 1, 2 and 3) of about 37,450 average Australian homes for one year. The project will represent 0.04% of the total NSW carbon emissions budget, and 0.01% of the national carbon emissions budget.

Appendix Y provides further details on how the NSW and national carbon budgets have been calculated.

Table 12-10 Project emissions compared to NSW and national carbon budgets

Total estimated project emissions (MtCO2e)	Carbon Budget (MtCO2-e)		Project emissions as % of carbon budget	
	NSW	National	NSW	National
0.674	1,551	5,500	0.04%	0.01%

12.1.10 Impact of future stages

Future stages of the project will include the expansion of the AWRC to accommodate an ultimate capacity of up to 100 ML/day. The pipelines will be constructed for the ultimate capacity as part of Stage 1, therefore no future work is likely to be required.

Sustainability

Future stages of the project will have a focus on achieving sustainable outcomes. The contributing factors to the ISCA rating in Stage 1 will continue to be key areas of future project stages. This will include increase of self-generated power, and a reduced reliance on the grid. It is expected that future stages of the project will have a positive contribution to the overall sustainability of the AWRC, and the surrounding area of Western Sydney.

Climate change

Future stages of the project will consider any additional impacts from climate change. The climate change risk assessment in Table 12-7 includes potential impacts in the year 2070, at which point the project will likely be at ultimate capacity. As such, additional impacts from climate change on the project are not expected to be significantly different to those that have been assessed in this EIS.

Greenhouse gases

The additional impact of the future stages of the AWRC is estimated to be 1,043,918 tCO_2-e which is 155% of the project's Stage 1 GHG emission inventory. As the timing and number of future upgrades to the AWRC are not known, the assumptions to calculate future impacts include:

- estimated construction emissions for a 100 ML/day plant assuming the impact is equal to an additional 50 ML/day plant, excluding construction emissions attributed to the pipelines
- estimated operational emissions for a 100 ML/day plant assuming the impact is equal to an additional 50 ML/day facility for both the AWRC and pipelines and factoring for operational duration.
- emissions for future stages having the same construction duration (about three years)
- future stages operating until demand projections exceed the 100 ML/day capacity (about 20 years).

Based on these assumptions, the construction emissions for an additional 50 ML/day capacity amount to 160,223 tCO_2-e, and the operational emissions for an additional 50 ML/day capacity over 20 years amount to 883,695 tCO_2-e, resulting in the total estimated impact of 1,043,918 tCO_2-e.

12.1.11 Management measures

Table 12-11 outlines the measures Sydney Water will implement to manage the project's sustainability impacts.

Table 12-11 Management measures related to sustainability

ID	Potential impact	Management measure	Timing
SU01	Project not achieving sustainable outcomes	Develop a Sustainability Management Plan that outlines how the project will embed and continually improve sustainability throughout the project. The sustainability management plan will outline: • the IS rating process, including timeframes for achieving a project IS rating • roles and responsibilities relating to sustainability • how sustainability objectives will be embedded into the construction and operation of the project • how, and if, the future aspirations of Sydney Water can be accommodated and implemented in the project.	Detailed design During construction During operation
SU02	Project not achieving sustainable outcomes	Investigate opportunities to: • procure recycled or reused materials where the options exist, and comparable performance can be achieved • reduce material quantities, where possible, while maintaining the design performance • implement passive design measures at the AWRC such as optimum solar orientation, shading and natural ventilation to reduce demand for heating and cooling of occupied site buildings • implement alternative technologies to reduce nitrous oxide emissions from operation of the AWRC.	Detailed design During construction During operation
SU03	Project not achieving sustainable outcomes	Implement the initiatives identified in the Sustainability Initiatives Register in Table 12-3.	Detailed design During construction During operation
SU04	Energy requirements for project exceed energy generated	Supplement 50% of Stage 1 project electricity use with renewable energy generation. If this cannot be achieved through renewable energy generation, investigate other options such as purchasing large scale generation certificates (LGCs) or entering into a power purchasing agreement where electricity is sourced from off-site renewable energy.	Detailed design During operation

12.2 Waste management

This section describes the waste generated during construction and operation of the project, and the measures that will be implemented to manage that waste. This chapter provides an overview of the key findings of the detailed Waste Management Impact Assessment (Aurecon Arup, 2021k) included in Appendix Z.

Waste management summary

The project will generate waste during construction and operation, with the greatest potential for impact during construction. However, the waste related impacts of construction and operation are considered low to negligible with the implementation of management measures.

Construction waste will primarily include excavated spoil (some of which may contain small quantities of contaminated materials), green waste and surplus construction materials. Other wastes generated during construction include liquid wastes in the form of stormwater runoff and wastewater. About 181,000m^3 of excess spoil is estimated and Sydney Water plans to have commercial arrangements in place for disposal to other sites in Sydney. For any waste that cannot be immediately disposed, including excavated spoil, Sydney Water will temporarily store it at construction compounds.

Sydney Water will implement the approaches embedded in the 'avoid, minimise, reuse' waste management hierarchy to reduce the waste generated, ensure it is recycled wherever possible and carefully manage the segregation, storage and transport of any residual waste. Sydney Water will also implement a Waste Management Plan to ensure construction waste is appropriately managed.

Waste generated during operation of the AWRC will include waste chemicals, screenings and grit from the treatment process, brine and small amounts of office waste. These are relatively small volume waste streams and typical of waste generated from operation of Sydney Water's other treatment plants. Well established and tested waste management processes and contractual arrangements are in place to management these and they can often be reused. Wastes from pipeline operation are unlikely.

12.2.1 Relevant Secretary's Environmental Assessment Requirements

Table 12-12 shows the Secretary's Environmental Assessment Requirements (SEARs) relevant to waste and where in this section they are addressed.

Table 12-12 Project SEARs relating to waste impacts

SEARs	EIS section where requirement addressed
54. Details of the predicted waste generated from the project during construction and operation, including:	

SEARs	EIS section where requirement addressed
a) classification of the waste in accordance with the current guidelines.	Sections 12.2.2, 12.2.5 and 12.2.7
b) estimates / details of the quantity of each classification of waste to be generated during the construction of the project, including bulk earthworks and spoil balance	Sections 12.2.5 and 12.2.7
c) handling of waste including measures to facilitate segregation and prevent cross contamination	Section 12.2.13
d) management of waste including estimated location and volume of stockpiles	Sections 12.2.5 and 12.2.13
e) waste minimisation and reuse	Section 12.2.13
f) lawful disposal or recycling locations for each type of waste and contingencies for the above, including managing unexpected waste volumes, excessive stockpiling of material, or dirty water volumes exceeding the storage capacity available on site	Appendix Z includes a full list of lawful disposal and recycling locations. Section 12.2.4 with respect to excess spoil volumes, and 12.2.13
55. The Proponent must assess potential environmental impacts from the excavation, handling, storage on site and transport of the waste.	Sections 12.2.9 and 12.2.10
56. Details of the measures that would be implemented to ensure that the construction and operation of the project is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2014-2021.	Section 12.2.13

12.2.2 Methodology and assumptions

The key steps in completing this assessment were:

- collecting information about the potential waste types and quantities to be generated by the project
- classifying those waste types
- conducting an impact assessment to determine the impact of the waste
- identifying the management measures required to reduce any significant impacts.

Each of these is described in more detail below.

Waste types and quantities

The types and quantities of wastes generated by the project's construction and operation activities were informed by desktop reviews of the existing environment and previous land uses in the study area, review of previous studies, information from similar Sydney Water wastewater treatment plants (WWTPs) and water recycling plants (WRPs) and review of other relevant specialist studies carried out for the Environmental Impact Statement (EIS).

Waste classification

The types and quantities of waste were classified according to the NSW Environment Protection Authority (EPA) Waste Classification Guidelines, Part 1: Classifying Waste (NSW EPA, 2014a) which are summarised in Table 12-13.

Table 12-13 Summary of waste classification

Waste	Description
Special waste	Clinical and related waste Asbestos waste Waste tyres Anything classified as special waste under an EPA gazettal notice
Liquid waste	Waste that meets specific criteria such as becoming free-flowing in certain circumstances or not capable of being picked up by a spade or shovel Anything classified as liquid waste under an EPA gazettal notice
Hazardous waste	Containers, having previously contained a substance of Class 1, 3, 4, 5 or 8 within the meaning of the Transport of Dangerous Goods Code Lead-acid or nickel-cadmium batteries Lead paint waste arising otherwise than from residential premises or educational or childcare institutions
General solid waste (putrescible)	Household waste that contains putrescible organics Waste from litter bins collected by or on behalf of local councils Manure and night soil Disposable nappies, incontinence pads or sanitary napkins Food waste Animal waste Grit or screenings from sewage treatment systems that have been dewatered so that the grit or screenings do not contain free liquids

Waste	Description
General solid waste (non-putrescible)	Examples include Glass, plastic, rubber, plasterboard, ceramics, bricks, concrete or metal, paper or cardboard Household waste excluding food waste Grit, sediment, litter and gross pollutants from stormwater systems Garden waste Synthetic fibre waste (from materials such as fibreglass, polyesters and other plastics) It excludes asbestos waste, virgin excavated natural material, building and demolition waste, asphalt waste, certain biosolids and cured concrete waste from a batch plant.

The waste management hierarchy in the NSW EPA's Waste Avoidance and Resource Recovery Strategy 2014-2021 (NSW EPA, 2014b), was used to determine the waste management and disposal options for each waste classification identified for the project. Figure 12-1 shows this waste management hierarchy.

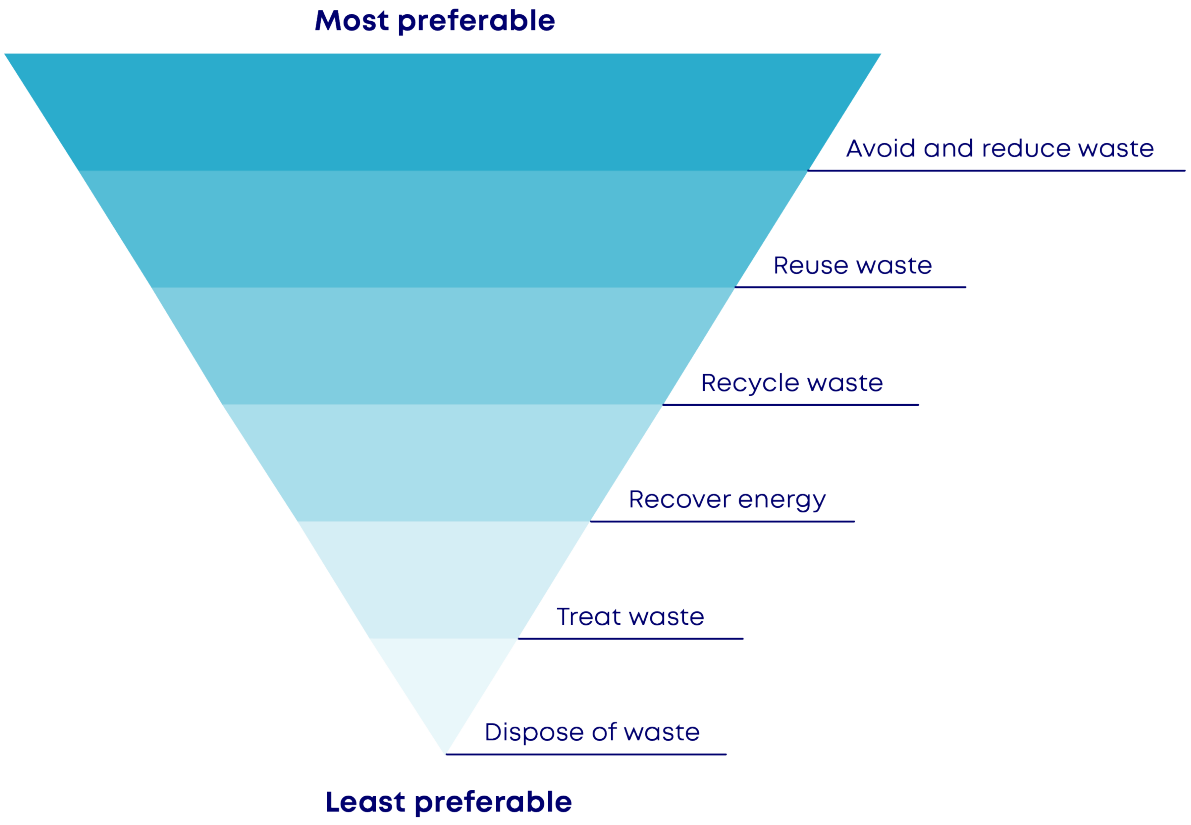


Figure 12-1 Waste hierarchy (Source: Based on EPA, 2014b)

Approach to beneficial reuse

Biosolids are a process waste generated by all WWTPs during wastewater treatment. Sydney Water has a program across its WWTPs and WRPs for the beneficial reuse of these biosolids for production of useful commodities such as agricultural fertilisers. Consistent with this, biosolids from the AWRC will also be beneficially reused.

Sydney Water has included biosolids in the assessment and tables below to give an indication of volumes and management. However, it is an example of where a waste byproduct, when treated appropriately, can be seen as a resource rather than a waste.

Impact assessment approach

After wastes were identified and classified, the impact assessment was undertaken, drawing on a risk assessment approach. This approach allowed the severity of the environmental impact of construction and operational waste to be determined. The impacts could potentially be caused by activities such as excavation, handling, storage, and transportation of wastes.

For each predicted impact, this involved considering:

- intensity (size or degree scale), which also includes the type of impact (either positive or negative)
- duration (temporal scale)
- extent (spatial scale)
- probability (likelihood).

The impacts fall into a significance category of negligible, minor, moderate or major, and the type will be either positive or negative. This methodology is described in full in Appendix Z.

12.2.3 Existing environment

The study area is located in the Penrith, Wollondilly, Liverpool, Canterbury-Bankstown and Fairfield LGAs. There are also several large infrastructure projects currently underway that contribute to the waste volumes (mainly waste soils) generated within the area. Section 12.2.12 assesses the project's cumulative impacts with these other projects.

In addition, there are 18 waste facilities (such as landfills and recycling centres) across the study area. These facilities are potential sites for treatment of waste. Appendix Z includes details of the facilities, including their distance from the AWRC.

12.2.4 Legislation and guidelines

Protection of the Environment Operations (POEO) Act 1997

The POEO Act is the principal environmental protection legislation in NSW that defines waste, establishes licensing requirements and defines offences and penalties.

The definition of waste in the POEO Act below has been used in this study to identify waste materials:

- any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment
- any discarded, rejected, unwanted, surplus or abandoned substance
- any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance
- any processed, recycled, reused or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations
- any substance prescribed by the regulations to be waste.

Section 48 of the POEO Act requires an Environment Protection Licence (EPL) for certain types of activities as outlined in Schedule 1 of the Act. The project will generate enough excess spoil that temporary storage prior to off-site disposal may be needed. If this is the case, a premises-based EPL would be needed for waste storage under section 42 of Schedule 1 of the Act. Sydney Water will confirm the project's approach to spoil management and storage during construction planning, including whether it would trigger the need for an EPL.

Protection of the Environment Operations (Waste) Regulation 2014

This regulation allows the EPA to protect human health and the environment and provides a platform for a modern and fair waste industry by setting out provisions related to the storage and transportation of waste, record-keeping, and requirements for managing special wastes such as asbestos. It also includes resource recovery orders and exemptions allowing specified reuse of waste streams, with those relevant to the project including:

- roadworks
- recovered aggregate
- reclaimed asphalt pavement
- other excavated road material
- excavated natural material
- treated drilling mud
- mulch
- stormwater.

Waste Avoidance and Resource Recovery Act 2001

This act establishes the following waste management hierarchy

- Avoidance – minimise the potential for waste generation by avoiding unnecessary consumption of resources.

- Recovery – reuse, reprocess or recycle waste products to minimise the amount of waste requiring disposal.
- Disposal – as a last resort, dispose of resources that cannot be recovered.

The waste hierarchy is the governing philosophy that drives the management methodology for the project's waste and is drawn on throughout this study.

Waste Classification Guidelines, Part 1 Classifying Waste (NSW EPA, 2014)

Part 1 of the guidelines covers the classification of wastes into groups that pose similar risks to the environment and human health. These classifications are summarised in Table 12-13 above.

Waste Avoidance and Resource Recovery Strategy 2014 - 2021 (NSW EPA, 2014)

This strategy provides a framework and targets for waste management and recycling in NSW. It supports investment in infrastructure, encourages innovation and improves recycling behaviour. It strives to help develop new markets for recycled materials and reduce litter and illegal dumping.

Targets established under this strategy and relevant to the project include

- increasing recycling rates to 70% for industrial waste and 80% for construction and demolition waste
- increasing waste diverted from landfill to 75%.

Asbestos Waste Strategy, 2019-2021 (NSW EPA, 2019b)

This strategy proposes innovative measures to reduce illegal dumping and unsafe disposal and promotes lawful and appropriate disposal of asbestos waste. It aims to make asbestos waste disposal cheaper by working with local government and industry to provide cheaper ways for householders and licensed contractors to lawfully dispose of asbestos waste under certain circumstances.

It has been used in this study to inform the most environmentally and cost-efficient method of disposing of asbestos waste.

NSW Circular Economy Policy Statement Too Good Too Waste (NSW EPA, 2019c)

This statement provides a framework for implementing initiatives throughout the product life cycle, from design, manufacturing, and retail to end-of-life-disposal. These initiatives promote long-lasting design, maintenance, repair, reuse, sharing, transforming products into services, remanufacturing, and recycling.

The principles were incorporated into the waste management methodology.

20-Year Waste Strategy for NSW (still in development)

The NSW EPA is leading the development of a 20-year Waste Strategy in partnership with Infrastructure NSW and has released an issues paper for public consultation. Its intent is to set a 20-year vision for reducing waste, driving sustainable recycling markets and identifying and improving the state and regional waste infrastructure network. It will provide industry with certainty and set goals and incentives, so the right infrastructure investments are made to meet community needs.

Although this strategy is likely to be finalised during project construction, it is unclear whether it will be applicable to the project. However, the long-term vision presented in the issues paper has been considered, including to:

- generate less waste
- improve collection and sorting
- plan for future infrastructure
- create end markets.

12.2.5 Construction waste generation

General construction waste

Table 12-14 summarises the estimated types, quantities and classification of wastes generated during project construction. This is based on a series of assumptions outlined in Appendix Z.

Table 12-14 Summary of estimated construction and demolition waste generation (not including excavated soil waste)

Waste classification AWRC	Waste stream	Waste description	Estimated quantity
Special	Tyres	Used construction plant tyres	6 tonnes
	Asbestos waste	Excavated soils contaminated with asbestos	4,960m^3
Liquid	Waste oils	Used oil from construction plant	1,050 litres
	Saline groundwater	Saline groundwater from dewatering operations	50 million litres (ML)
Hazardous	Unwashed containers that previously held Class 1, 3, 4, 5 or 8	Unwashed containers that previously contained fuels, paint, and chemicals	360 m³

Waste classification	Waste stream	Waste description	Estimated quantity
	Used batteries	Lead-acid batteries from construction plant, rechargeable Nickel-Cadmium batteries from portable handheld power tools	65 kg
General Solid Waste (non-putrescible) Excludes excavated soil waste	Green waste	From land clearing activities, tree felling	14,400 m³
	Wood waste	Timber offcuts, crates, pallets, packaging	78 tonnes
	Electrical infrastructure waste	Cables, conduits, ducts, sleeves, switches, etc	720 kg
	Piping materials	Offcuts (polyethylene (PE), steel, SCL, reinforced concrete), grindings, welding rods, gaskets	480 tonnes
	Metal wastes	Cladding/sheeting (Colorbond® etc), catwalks, handrails, gratings, beams, bars, tubes, nuts, bolts, chains, plates, frames, structural steel)	1,850 tonnes
	Demolition waste	Demolition of existing buildings (not containing asbestos)	1,000 m³
	Other construction waste	Packaging, rebar, concrete, glass, plastic, rubber, plasterboard, ceramics, bricks, grout, kerbs, conduits, asphalt	6,530 m³
	Site office waste	Paper, cardboard	20 tonnes
	Construction plant waste	Plant maintenance/ workshop waste (drained oil filters and containers, rags, grease, lubricants, etc)	90 m³
	Synthetic fibres and membranes	Geotextile offcuts (such as Bidim®), geomembrane liners, straps/slings	5 tonnes
	Dewatered grit, sediment, litter and gross pollutants	Collected in, and removed from, stormwater treatment devices and/or stormwater management systems	180 m³
General Solid Waste (putrescible)	Food waste	Generated from workers' lunches	40 tonnes
Pipelines			
Special	Asbestos waste	Excavated soils contaminated with asbestos (loose or bonded)	20 - 75 m³

Waste classification	Waste stream	Waste description	Estimated quantity
	Tyres	Used construction plant tyres	55 tonnes
Liquid	Untreated drilling muds	Untreated slurry that consists of drilling mud (mixture of rock and soil) and drilling fluid (mixture of water, bentonite, soda ash and other additives)	860 m³
	Waste oils	Used oil from construction plant	9,690 litres
	Saline groundwater	Saline water from dewatering operations	4 ML
Hazardous	Unwashed containers that previously held Class 1, 3, 4, 5 or 8	Unwashed containers that previously contained fuels, paint, and chemicals	320 m³
	Used batteries	Lead-acid batteries from construction plant, rechargeable Nickel-Cadmium batteries from portable handheld power tools	380 kg
General Solid Waste (non-putrescible) Excludes excavated soil waste	Treated drilling muds	Dewatered (drilling fluid has been removed) to create a solid	1,540 m³
	Green waste	From land clearing activities, tree felling	30,500 m³
	Pipe blanket backfill material	Excess sand/stabilised sand used as backfill material, rock	4,450 m³
	Wood waste	Timber offcuts, crates, pallets, packaging	41 tonnes
	Piping materials	Offcuts (PE, steel, SCL, reinforced concrete), grindings, welding rods	850 tonnes
	Other construction waste	Treated timber, packaging, metal, rebar, concrete, glass, plastic, rubber, plasterboard, ceramics, bricks, grout, kerbs, conduits	2,560 m³
	Site office waste	Paper, cardboard	23 tonnes
	Construction plant waste	Plant maintenance/ workshop waste (drained oil filters and containers, rags, grease, lubricants, etc)	80 m³
	Dewatered grit, sediment, litter and gross pollutants	Collected in, and removed from, stormwater treatment devices and/or stormwater management systems	160 m³
	Synthetic fibres	Geotextile offcuts (Bidim®, etc)	5 tonnes

Waste classification	Waste stream	Waste description	Estimated quantity
	Excavated pavement (m^3)	Asphalt road base	10,222m^3
General Solid Waste (putrescible)	Food waste	Generated from worker's lunches	47 tonnes

Excess spoil generation and disposal

Construction of the project will generate a substantial amount of spoil. Some of this spoil will be used on site. However, some will need to be disposed offsite to an appropriate location. Table 12-15 provides indicative volumes of spoil and other excavated material. It should be noted that these volumes are based on the current reference design. Any changes will be identified during detailed design and construction planning to ensure that the Waste Management Plan prepared as part of the CEMP is based on confirmed amounts.

Table 12-15 Indicative volumes of excavated material during construction

Activity	Topsoil volume that cannot be replaced (m^3)	Spoil and rock (m^3)	Total spoil (m^3)
AWRC construction	26,145	67,669	93,814
Brine pipeline construction	-	40,380	40,380
Treated water pipeline construction	-	47,039	47,039
Environmental flows pipeline construction	-	4,587	4,587
Sub total	26,145	159,675	185,820
Spoil reused on the AWRC site (m^3)			-4,991
Total excess spoil taken off site for reuse (m^3)			180,829

There is an estimated 10,222 m^3 of asphalt and road material that will need to be disposed of to appropriate landfill or other disposal location. This material will be generated from the pipeline construction and will be taken to a nearby compound and stored short term (likely up to several days) until it can be trucked to its disposal location. This excavated waste will be sorted and stored separately as asphalt and general solid waste before appropriate management and disposal. If commercial arrangements are in place and these long-term temporary stockpiles are not needed, this material will be transported directly to its ultimate disposal location.

The amount of total excess spoil that will need to be taken off site and either reused or disposed is estimated at about 181,000 m^3. This assessment assumes it is classified as General Solid Waste (non-putrescible). However, it is likely some or all of it could be classified as Excavated Natural Material (ENM) subject to further testing which may open further opportunities for reuse. The Soils and Contaminated Land Impact Assessment (Aurecon Arup, 2021f) has identified saline or sodic soils may be present across the project area which cannot be reused and these are included in the excess spoil volumes. Sydney Water intends securing a commercial arrangement with a disposal location to take this material. This will be confirmed at the detailed design stage. For the purposes of this EIS, the design has incorporated capacity for temporary long-term storage for all this material in the event that a disposal location is not immediately available. This includes:

- allowance for a stockpile on the AWRC site to store all excess spoil generated from that site. Sydney Water estimates a stockpile size of up to 150 m x 150 m x 4 m could be required
- storage at two of the proposed construction compounds along the brine pipeline alignment and one along the treated water pipeline for the rest of the excess spoil that will be generated in connection with the pipeline construction. Although there is enough space at these three compounds, spoil may also be stored at other compound locations.

Wastewater, grey water and stormwater

Wastewater, grey water and stormwater volumes generated during construction will vary depending on the rainfall received on the site, the types of construction activities being carried out, and the stage of construction. These liquid wastes will be generated from the following main sources:

- Wastewater from ablution (bathroom) facilities and amenities.
- Stormwater runoff collected in sediment basins.
- Grey water from construction activities such as equipment washdown.

Opportunities for reuse will be investigated and pursued where feasible and reasonable, and subject to meeting water reuse quality requirements.

Toileting and ablution facilities will be provided in portaloos and cabins at construction sites. These will be managed by the licensed provider and regularly maintained and replaced, with wastewater transported off site by the provider.

Stormwater runoff will be collected in sedimentation basins at the AWRC site. This will ensure that the water remains at a quality that means it can be reused on site for uses such as dust suppression and equipment washdown, or released to South Creek.

At other compounds, sediment and erosion controls and other stormwater management measures will be installed to manage the risk of sediment being picked up by stormwater and transported to waterways.

Vehicle and equipment washdown will be undertaken within designated and bunded areas. This will ensure any contaminants (such as oils and greases) do not enter the site stormwater systems or wash contaminants into nearby waterways. Water captured in these grey water systems will be disposed at an appropriately licensed facility.

Disposal of contaminated soil and groundwater

Other studies have been undertaken for this project including a Soil and Contamination Assessment, Surface Water Assessment and Groundwater Assessment. These studies include information about water, soil and contaminated material likely to be encountered by the project, some of which will become waste.

During construction, groundwater volumes from dewatering for each of the key project components are estimated at:

- Treated water pipeline – 3.7 ML over 331 days.
- Environmental flows pipeline – 1.3 ML over 37 days.
- Brine pipeline – 3.8 ML over 762 days.
- AWRC site – 50 ML over one year.

The AWRC site is hydraulically down-gradient of the SUEZ Kemps Creek Resource Recovery Park and any groundwater contamination from this site would flow under the AWRC site and could be intersected when excavations occur. In addition, the groundwater is potentially brackish or saline, and the extracted groundwater in some areas is likely to exceed project waterway objectives, particularly for salinity. The Groundwater Impact Assessment in section 9.4 discusses the process for testing, storage, treatment and disposal of contaminated water.

The Soil and Contamination Assessment identified the potential for asbestos contamination of soils in and around the Warragamba area of the project. There is also the potential for contaminated material to be excavated and disturbed at the AWRC site. There is potential for ACM in surface soils and in buildings that will be demolished. There is also potential it will be encountered at other localised areas across the project.

A destructive hazardous materials survey will be undertaken at the AWRC site buildings to confirm the presence of asbestos containing materials. Section 9.5 details the identification and proper management of asbestos contaminated material and other contaminated material in accordance with relevant legislation and policy.

12.2.6 Commissioning waste generation

Water will be required for hydrostatic testing of the pipelines and at the AWRC. Where possible, this water will be reused. Where it cannot, it will be disposed to appropriate locations, based on disposal protocols that will be established as part of the Waste Management Plan.

During the commissioning phase, partially treated water may be discharged from the AWRC through the brine pipeline to the Malabar wastewater network for treatment at the Malabar WWTP.

12.2.7 Operational waste generation

Table 12-16 summarises the estimated waste types, classifications and quantities generated during an average year of AWRC operation. This is based on assumptions outlined in Appendix Z. Waste will not be generated by the pipelines once operational so this information focuses on the operation of the AWRC.

Table 12-16 Summary of estimated waste generation during AWRC operation

Waste classification	Waste stream	Waste description	Estimated quantity per year (unless otherwise stated)
Special	Tyres	Used maintenance plant tyres	30 kg
Liquid	Waste oils	Used oil from maintenance plant, workshops	5 litres
	Electrical transformer oils	Used oils from electrical transformers	100 litres
	Workshop liquid wastes	Degreasers, oily water, solvents, general cleaning and washdown chemicals	440 litres
	Brine	Concentrated solution of salts and contaminants that are removed from the water during advanced treatment	8.3 ML per day
Hazardous	Unwashed containers that previously held Class 1, 3, 4, 5 or 8	Unwashed containers that previously contained fuels, paint, and chemicals	5 m^3
	Lightbulbs	Used lightbulbs	20 kg
	Water treatment chemicals	Unused or spilt chemicals: Sodium Bisulfate, Sodium Hypochlorite, Ferric Chloride, Sodium Hydroxide, Methanol, Sulfuric acid, Anti-scaleant (Phosphonic acid)	8,760 litres

Waste classification	Waste stream	Waste description	Estimated quantity per year (unless otherwise stated)
	Batteries	Lead-acid batteries from maintenance plant, rechargeable Nickel-Cadmium batteries from portable handheld power tools, backup batteries	1 kg
General Solid Waste (non-putrescible)	Green waste	Landscaping	10 tonnes
	Office waste	Paper, cardboard, plastic	1 tonne
	Maintenance waste	Drained oil filters and motor oil containers, workshop waste (containers, rags, grease and lubricants), sealants, gaskets, packaging	30 m³
	Wood waste	Crates, pallets	120 kg
	E-waste	Computers, electric monitoring components, solar panels, instrumentation and control, etc	20 kg
	Water treatment chemicals	Unused or spilt chemicals: Citric acid, Alum, Ammonia Sulfate	3,510 litres
	Odour control chemicals	Used or spilt odour control chemicals (nutrient dosing, similar to fertiliser)	30 kg
	Scrap metals	Pipes, valves, gratings, beams, bars, tubes, nuts, bolts, chains, etc	2 tonnes
	Spent filters	Spent carbon and dust filters from odour control system, air filters for blowers, RO membranes	10 m³
	Biosolids	Dewatered and digested sludge from the anaerobic digesters (transported off-site for beneficial reuse as an agricultural biosolid)	16.3 tonnes
General Solid Waste (putrescible)	Food waste	Generated from workers' lunches	2 tonnes
	Dewatered screenings	Collected in and removed from wastewater treatment devices (waste purposely flushed down the toilet)	210 tonnes
	Dewatered grits	Collected in and removed from wastewater treatment devices (sand,	110 tonnes

Waste classification	Waste stream	Waste description	Estimated quantity per year (unless otherwise stated)
		rock and gravel that has infiltrated the wastewater network)	

The volumes and types of waste are typical of Sydney Water's other WWTPs and WRPs and could be accommodated by existing metropolitan waste management facilities.

The main liquid waste types are:

- wastewater from toilets
- grey water from amenities and maintenance activities (intentional pipe scouring, hydrostatic testing, pipe leaks/bursts, equipment washdown)
- stormwater – stormwater runoff collected in site stormwater infrastructure.

Wastewater and grey water will be directed to back into the AWRC for treatment. The combined wastewater volume generated is expected to be about 480 L/d.

Section 9.2 describes how stormwater will be managed but priority will be given to reusing harvested stormwater for onsite uses such as vehicle and equipment washdown.

12.2.8 Decommissioning waste generation

As is standard Sydney Water practice, it is unlikely the project will be decommissioned. It will be repaired and upgraded throughout its design life of 40-50 years to maintain its operation. As Sydney Water has no plans for decommissioning, this assessment does not identify any decommissioning waste. However, if decommissioning ever occurs, Sydney Water will dispose of any decommissioning waste responsibly, and with minimal impact on the environment.

12.2.9 Construction impact assessment

Overall, environmental impacts associated with the generation and management of waste include:

- inefficient use of raw materials and resources due to activities such as poor handling of materials, overspecification and poor stock management
- loss of opportunities for resource reuse and recycling if the waste material is disposed
- increased transport movements and fuel use for cartage of spoil to stockpiles or to disposal
- consumption of landfill airspace from disposal of spoil to landfill
- risks to human health and safety from exposure to contaminated spoil materials due to lack of training or spills to the environment

- pollution of soil, groundwater and surface water due to inappropriate management of spoil stockpiles, handling and transportation.

Table 12-17 summarises potential environmental impacts associated with generation of waste in each waste stream. Detail on the potential environmental impacts resulting from waste streams to the surface water environment, groundwater, soils and contaminated land, and air quality are discussed in sections 9.2, 9.4, 9.5 and 11.1.

More specifically, Table 12-17 summarises the project's construction impacts associated with waste generation and the significance of these impacts. These impacts are presented without mitigation. Management measures in Table 12-19 demonstrate how Sydney Water will manage waste volumes in accordance with the waste management hierarchy and minimise impacts to the environment. All of the impacts identified in Table 12-17 will have low or negligible impact once the management measures outlined in Table 12-19 are applied.

Table 12-17 Construction impact assessment outcomes and significance

Location	Waste classification & stream	Impact description	Impact significance
Pipelines, tunnelled or trenched waterway crossings and compounds C1 to C15 including the AWRC site	General Solid Waste (non-putrescible) - spoil from excavations AWRC and pipeline	Initial cut and fill calculations have identified about 181,000 m^3 of spoil from excavations is unlikely to be reused within the project. The impact is moderate because if the spoil material cannot be beneficially reused on site, and alternative off-site reuse or recycling options are not identified there is a potential loss of raw materials and consumption of landfill airspace by disposing to landfill. The Soils and Contaminated Land Impact Assessment (Aurecon Arup, 2021f) identified saline and sodic soils across the project area that once excavated cannot be reused on this project or elsewhere. Spoil that cannot be reused on site will contribute to transport movements and fuel use for cartage of spoil to stockpiles at compounds or to disposal facilities. This then has related potential environmental impacts: • Runoff from waste stockpiles has potential to increase sedimentation of nearby waterways. • There is potential for localised dust impacts associated with poor spoil stockpile management and transportation.	**Moderate**
Pipelines, tunnelled or trenched waterway crossings and	General Solid Waste (non-putrescible) from the AWRC - excluding spoil waste	The largest volume of general waste is likely to be green waste from land clearing activities (Table 12-14 estimates 30,500 m^3 from the AWRC site and 14,400 m^3 from the pipelines). The impact is moderate because where the green waste	**Moderate**

Location	Waste classification & stream	Impact description	Impact significance
compounds C1 to C15 including the AWRC site	Green waste Wood waste Electrical infrastructure waste Piping materials Metal wastes Demolition waste Other construction waste Site office waste Construction plant waste Synthetic fibres and membranes Dewatered grit, sediment, litter and gross pollutants	cannot be reused or recycled, disposal at landfill may be required. There is a potential loss of opportunity to beneficially reuse these raw materials (for example as compost). There is then a consequent impact with a high consumption of landfill airspace by disposing to landfill. Off-site storage, reuse or disposal of green waste will lead to increased transport movements and fuel use for cartage of green waste to stockpiles at compounds or to disposal facilities. Table 12-14 indicates that all other waste materials are likely to be generated in low volumes and can be reduced through ordering and handling practices. Environmental impacts are associated with poor stockpile management leading to the potential for contaminated runoff and adverse water quality impacts to nearby waterways (i.e. South Creek).	
Soils across the AWRC site, across the pipeline impact area (including around Warragamba Dam viewing platform and Eighteenth Street)	Special Waste Asbestos waste Tyres	Contaminated soil testing has indicated the potential volumes of asbestos containing material (ACM) are very low (Table 12-14 estimates about 20-75 m^3 for the pipelines and 4,690 m^3 at the AWRC site) and most is unlikely to be a friable material. Other special wastes, such as used construction tyres, are of low volumes and can be easily transported to an appropriate disposal location as they are generated. The impact is minor because volumes of asbestos waste requiring disposal are expected to be low. Excavation and stockpiling of soils containing ACM may cause the following environmental impacts: • Hazards to construction workers and the public from exposure to contaminated soil materials through dust, handling due to lack of training or spills to the environment. • ACM containing soils can be spread across the work site contaminating other areas. • ACM containing soils can enter waterways through surface water runoff.	**Low**

Location	Waste classification & stream	Impact description	Impact significance
		• ACM containing soils may impact local communities through dust on construction transport routes.	
Pipelines, tunnelled or trenched waterway crossings and compounds C1 to C15 including the AWRC site	Liquid Waste (excluding brine) Saline groundwater Waste oils Contaminated runoff Drill muds Sewerage from worker ablutions	The largest volume of liquid waste will be saline water generated from dewatering activities (Table 12-14 indicates 4 ML for the pipelines and 50 ML at the AWRC site). Wastewater from ablutions has the potential to be moderate because of the large number of workers (peaking at 200 per day for the AWRC site and up to 200 along pipeline). The impact is moderate because of the potential volumes of saline waste generated by the project requiring management and disposal. Liquid wastes have the potential to impact the environment through: • drill muds containing chemicals adversely affecting water quality in waterways at waterway crossing worksites • spills and leaks leading to contaminated runoff which will adversely affect water quality in nearby watercourses and waterways • wastewater from ablution facilities located at compounds and worksites and greywater from construction activities, leading to pollution of soil, groundwater and surface water due to inappropriate handling and transportation • saline groundwater will adversely affect water quality of waterways if discharged to the environment.	**Moderate**
AWRC	Liquid waste (partially treated commissioning water)	Partially treated commissioning water will contain high levels of dissolved solids and nutrients which may adversely impact ocean water quality near the outfall. Chapter 4 provides more details about commissioning and discharge to the ocean via the Malabar wastewater system. Because partially treated brine commissioning water is expected to be consistent with Malabar wastewater treatment plant Environment Protection Licence, this impact is considered to be low.	**Low**

Location	Waste classification & stream	Impact description	Impact significance
Pipelines, tunnelled or trenched waterway crossings and compounds C1 to C15 including the AWRC site	Hazardous waste Unwashed containers that previously held Class 1, 3, 4, 5 or 8 (eg corrosive chemicals, oxidising chemicals, flammable substances, explosives and gases Used lead acid and cadmium nickel batteries	Low volumes of hazardous waste may be generated during the construction, the majority of which will come from within workshops or compound areas (Table 12-14 indicates about 680 m^3 of containers and 445 kg batteries). The impact is therefore minor. Storage of waste batteries has potential to cause the following impacts to the environment: • Construction workers and the public may be exposed to hazardous materials. • Leaks from unwashed containers may contaminate soil. • Hazardous waste may enter nearby waterways in surface water runoff.	**Low**
AWRC and pipelines & compounds C1-C15	Putrescible waste (food waste)	There are potentially up to 200 workers on the AWRC site each day and 200 workers on active areas of pipeline construction. This means there is potential for the project to generate large volumes of putrescible waste from workers meals (Table 12-14 indicates about 87 tonnes per year). Littering and decomposing waste has potential to adversely impact public amenity (visual and odour impacts), may encourage vermin, and decomposing food waste can enter runoff and adversely impact the quality of receiving waterways across the project area. This impact is therefore moderate.	**Moderate**

12.2.10 Operational impact assessment

Table 12-18 summarises the project's operational impacts associated with generation of waste and the significance of these impacts. As with Table 12-17, these impacts are presented without mitigation. Similarly, the management measures in Table 12-19 demonstrate how the project will minimise and manage impacts to the environment. Operational waste streams will be managed in accordance with Sydney Water's standard operating procedures and protocols. All of the impacts identified in Table 12-18 will have low or negligible impact once the management measures outlined in Table 12-19 are applied.

Table 12-18 Operational impact assessment outcomes and significance

Location	Waste classification and stream	Impact Description	Impact significance
AWRC	Special Waste Tyres	During operation, negligible special waste will be generated and is likely to be limited to used tyres from maintenance vehicles.	**Low**
AWRC	Liquid waste (excluding brine) Waste oils Electrical transformer oils Workshop liquid wastes	The volumes of liquid waste likely to be generated from workshop activities such as waste oils and general cleaning are expected to be low. Therefore, the impact is low. Spills and leaks occurring from storage of liquid waste has potential to contaminate soils and enter waterways in surface runoff,	**Low**
AWRC reverse osmosis infrastructure	Liquid waste (brine)	Table 12-16 shows the volume of brine that will be generated is about 8.3 ML per day. The brine waste stream will be managed through Sydney Water's standard operations and processes so the impact of brine on the water quality (exceeding discharge limits) within the ocean is expected to be low.	**Low**
AWRC	Hazardous waste Unwashed containers that previously held Class 1, 3, 4, 5 or 8 (eg corrosive chemicals, oxidising chemicals, flammable substances, explosives and gases Lightbulbs Water treatment chemicals Batteries	During operation moderate amounts of water treatment chemical waste will be generated (Table 12-16 indicates about 8,760 litres per year). If waste containers are not stored and handled appropriately there is potential for waste chemicals to enter South Creek in runoff from spills and leaks during handling and storage. Provided the management measures below are implemented the impact significance will reduce to low.	**Moderate**

Location	Waste classification and stream	Impact Description	Impact significance
AWRC	General solid waste (non-putrescible) Green waste Office waste Maintenance waste Wood waste E-waste Water treatment chemicals Odour control chemicals Scrap metals Spent filters Biosolids	The largest volumes of non-putrescible waste will be green waste from the landscaped areas and biosolids from the AWRC (Table 12-16 indicates about 10 tonnes per year for green waste and 16.3 tonnes per year biosolids). The volumes generated for other waste streams are generally low with some ongoing general waste such as spent filters (including RO membranes and carbon filters) and non-hazardous water treatment chemicals. There may be some larger 'one off' items of general waste such as used solar panels and e-waste. Most general waste generated during the operational phase is likely to be similar to a general office and workshop operational use. Sydney Water will implement standard operating measures to manage these waste streams and provided these are in place the impact significance will be reduced to low. Sydney Water has committed to 100% beneficial reuse of biosolids generated by the AWRC plant, which means that once waste exemptions (recovery orders) are applied biosolids do not enter the waste stream, and the impact of biosolids on the environment is negligible.	**Low**
AWRC	General Solid Waste (putrescible)	The majority of the putrescible waste will be generated from the dewatering of screenings and grit (Table 12-16 indicates about 420 tonnes per year). There is likely to be minimal food waste (Table 13-4 indicates about two tonnes per year) from a small workforce required during the operational phase.	**Low**

12.2.11 Impact of future stages

Waste derived from the construction and operation of future stages of the AWRC has not been assessed in this study. This would be assessed in future environmental impact assessments for those stages and in line with legislation and policy at the time.

Impacts from future stages are anticipated to be similar to those assessed in this section. However, given the pipelines will be built to their ultimate capacity in Stage 1, waste impacts would be limited to the AWRC.

As discussed in section 3.5 there are future opportunities for the AWRC to process additional organic waste and contribute to circular economy outcomes. However, this is outside project scope.

12.2.12 Cumulative impacts

After a literature review of other studies, infrastructure projects and plans in the region surrounding the impact assessment area, the potential cumulative impacts on the area's waste management facilities are discussed below.

Several major projects will be constructed concurrently with the project, including the M12 Motorway, Sydney Metro Western Sydney Airport, Northern Road and Warragamba Dam wall raising. In addition, urban development is likely to be occurring across the Western Sydney Aerotropolis Growth Area and South West Growth Area. Cumulatively this could lead to pressure on local waste services and facilities.

Sydney Water's approach to waste management takes this potential for over-utilisation of waste management facilities into account by providing capacity at the construction work areas for the temporary long-term storage of excess spoil, which reduces the immediate burden on waste management facilities.

In addition, Sydney Water has consulted with the local councils affected by the project with the specific intent to source information and concerns about additional pressure on waste infrastructure. During consultation with the councils, no issues or concerns were raised with respect to waste, except by Liverpool City Council. Their concern related to potential impacts to their ability to access the SUEZ Kemps Creek Resource Recovery Park where Council's waste is disposed. If there are impacts from road works or from increased traffic, there is a possibility that trucks will be inhibited from accessing the landfill and be forced to sit idle, forming a backlog that further inhibits access to their key disposal location.

Most impacts associated with the project are expected to be minor and short-term (during construction). The project is not expected to generate significant waste volumes during operation. If the proposed management measures are incorporated, the project will have a minor contribution to any foreseen cumulative impacts from other identified projects in the vicinity.

12.2.13 Management measures

Table 12-19 outlines the management measures Sydney Water will implement to avoid, minimise and manage waste.

Table 12-19 Management measures to minimise project waste impacts

ID	Potential impact	Management measure	Timing
W01	Generation and management of all construction waste streams, including liquid waste	Develop and implement a Waste Management Plan as part of the project's CEMP. This plan will include: • opportunities to minimise the generation of spoil	Detailed design During construction

ID	Potential impact	Management measure	Timing
		• targets for different waste streams with disposal being the least preferred approach (consistent with the NSW Waste Avoidance Strategy (NSW EPA, 2014), including diverting 75% of spoil from landfill (eg through offsite reuse), recycling rates of 80% for construction and demolition waste and reuse of stormwater for construction activities • classification of all waste generated by the project in accordance with the EPA waste classification guidelines • site specific measures (in accordance with the compound locations) for waste segregation, storage, handling, collection and transport according to their waste classification, including for liquid wastes • instructions on clear signage to be provided at construction compounds to encourage correct recycling and reduce contamination. • measures to ensure safe storage and transport of waste materials and avoid or minimise any risk of waste or contaminated materials creating dust or other impacts to the community or surrounding sensitive environments • regular monitoring and auditing to assess the performance of waste management activities against the determined targets • training and awareness for all construction personnel • a record keeping system on site so that waste tracking systems can be maintained. This should include the use of the NSW EPA's online waste tracking system where required. Keep records of receipts to prove that waste diversion and recycling targets have been met.	
W02	Generation and management of Special Waste	Develop and implement a procedure for managing special waste in accordance with legislative and policy requirements. This should include as a minimum: • review contaminated spoil volumes identified in the Waste Impact Assessment (Aurecon Arup 2021k). Confirm volumes of soils contaminated with ACM as detailed design develops.	During construction

ID	Potential impact	Management measure	Timing
		• identify lawful offsite storage and disposal options (including those listed in the Waste Impact Assessment (Aurecon Arup 2021k)) • if asbestos waste is transported off site, ensure appropriate containment methods are in place including, as a minimum, wrapping asbestos sheets and wetting down soil contaminated with ACM. • ensure transportation of asbestos waste by appropriately qualified personnel.	
W03	Generation and management of hazardous waste from the AWRC and pipeline construction	Store, manage and dispose of hazardous wastes in accordance with legislative and policy requirements, including disposal by a licensed contractor and at a lawful disposal facility.	During construction
W04	Generation and management of General Solid Waste (putrescible)	Investigate opportunities to divert food waste from landfill. This could include the provision of site waste facilities such as bins to separate food waste at source.	Detailed design During construction During operation
	Generation and management of operational waste streams	This impact is appropriately managed by measure G02 in Chapter 15 (Project synthesis).	During operation

13 Impacts on adjacent infrastructure

This chapter assesses the project's impact on Western Sydney International Airport operations and other utilities such as energy, roads, rail and WaterNSW infrastructure.

13.1 Airport operations

This section describes the potential impact of the project on the operation of the Western Sydney International Airport and summarises the report in Appendix AA.

Airport operations impact summary

The Advanced Water Recycling Centre (AWRC) is located about three kilometres from Western Sydney International Airport and under the future north-east flight path. The project will become operational at about the same time as Western Sydney International Airport opens. The assessment therefore focuses on impacts when both the AWRC and airport are operating.

The AWRC site has been assessed against the guidelines described in the National Airport Safeguarding Framework (NASF). This assessment has identified that the project is unlikely to have impacts related to intrusion in airspace, windshear, lighting or noise. The AWRC will, however, include components, such as bodies of water and vegetation, with the potential to attract wildlife, in particular, birds. This has the potential to contribute to the risk of wildlife strikes on aircraft and Sydney Water will develop a Wildlife Management Plan for the AWRC site to minimise any such risks.

The pipeline components of the project do not present a risk to airport operations because they will be located underground.

13.1.1 Relevant Secretary's Environmental Assessment Requirements

Table 13-1 summarises the Secretary's Environmental Assessment Requirements (SEARs) relevant to impacts on the operations of the Western Sydney International Airport and where in this section they are addressed.

Table 13-1 SEARs relating to impacts on the Western Sydney International Airport

SEARs	EIS section where requirement addressed
37. Assess the project impact on the 24-hour operations of Western Sydney International (Nancy-Bird Walton) Airport (Airport) considering the projects locations within a flight path for the future Airport and airport safety matters.	Section 13.1.4

13.1.2 Methodology and assumptions

The AWRC is located about three kilometres north east of the new Western Sydney International Airport and underneath its proposed flight path. A preliminary desktop study of design and policy constraints was completed, including:

- reviewing available legislation and policy guidance documents that guide land use and development of land near Western Sydney International Airport
- identifying project activities that could limit, impact or prevent Western Sydney International Airport operation and identifying management measures for the significant impacts.

The assessment was limited to impacts from the AWRC and only in relation to the operations because:

- construction of the project will be complete before Western Sydney International Airport is operational
- pipeline infrastructure is primarily located below ground, with some very small footprint above-ground structures. Pipeline operations are therefore considered to present no risk to airport operations.

All impacts discussed below apply to the 24-hour operations of Western Sydney International Airport.

13.1.3 Legislation and guidelines

Table 13-2 lists NSW and Commonwealth legislation and policies to ensure ongoing safe operation of airports and their relevance to the project.

Table 13-2 Legislation and policies related to safeguarding airport operations

Legislation/ policy	Relevance to the project
National Airport Safeguarding Framework (NASF), 2018	The National Airports Safeguarding Framework (NASF) is a land-use planning framework document that aims to: • improve community amenity by minimising aircraft noise-sensitive developments near airports

Legislation/ policy	Relevance to the project
	• improve safety outcomes by ensuring aviation safety requirements are recognised in land-use planning decisions. The purpose of the NASF is to enhance current and future safety, viability and growth of aviation operations, by supporting and enabling: • the implementation of best practice in relation to land use assessment and decision making in the vicinity of airports and strategic helicopter landing sites • assurance of community safety and amenity near airports and strategic helicopter landing sites • better understanding and recognition of aviation safety requirements and aircraft noise impacts in land use and related planning decisions • the provision of greater certainty and clarity for developers and landowners • improvements to regulatory certainty and efficiency • the publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports and strategic helicopter landing sites. The NASF Guidelines have formed the basis of assessing impacts of the AWRC on operations of Western Sydney International Airport.
State Environmental Planning Policy (SEPP) – Western Sydney Aerotropolis 2020	Part 3 – Development controls – Airport safeguards outlines the following objectives: a) to prevent certain noise sensitive development on land near the Airport, and b) to minimise the impact of aircraft noise for other noise sensitive development, and c) to ensure that land use and development near the Airport do not hinder or have other adverse impacts on the ongoing, safe and efficient 24 hours a day operation of the Airport. Part 3 lists development controls and the following requirements must be considered: • Aircraft noise. • Building wind shear and turbulence. • Wildlife hazards. • Wind turbines. • Lighting. • Airspace operations. • Public safety. The requirements of this SEPP are consistent with NASF Guidelines and are therefore captured by the assessment against those guidelines.

Legislation/ policy	Relevance to the project
Western Sydney Aerotropolis Development Control Plan 2020 – Phase 1	Section 4 – Risk minimisation and management details several potential risks, one of which is airport safeguarding. It also lists the following objectives: a) Safeguard the future operations of the Airport, including 24-hour operations and provide appropriate protections for the surrounding community. b) Ensure compatible development that exhibits design excellence occurs on surrounding land. c) Development does not introduce or intensify noise sensitive uses. Assessing the project against the NASF Guidelines demonstrates how the project aligns with the above objectives.

13.1.4 Operational impact assessment

The following sections assess risks of the project on the performance, safety and operation of the Western Sydney International Airport against the NASF guidelines, focusing on noise, windshear, wildlife strikes, lighting and intrusion into the airspace. They also reference State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 which includes some provisions specific to Western Sydney International Airport.

NASF Guideline A: Measures for managing impacts of aircraft noise

This guideline relates to the potential impacts of aircraft noise on land uses surrounding an airport. Inappropriate development close to an airport can result in long-term impacts on those surrounding developments and put operational constraints on the airport. It is crucial, therefore, that long term planning ensures alignment between airport development and surrounding landuses.

The guideline draws on the Australian Noise Exposure Forecast (ANEF) System and the Australian Standard AS 2021-2015 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction (AS, 2021). AS2021 provides information on what buildings are acceptable within different ANEF noise contours, as shown in Table 13-3.

Table 13-3 AS2021 building site acceptability based on ANEF contours/ zones

Building type	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEC	20 to 25 ANEC	Greater than 25 ANEC
Hotel, motel, hostel	Less than 25 ANEC	25 to 30 ANEC	Greater than 30 ANEC
School, university	Less than 20 ANEC	20 to 25 ANEC	Greater than 25 ANEC

Building type	Acceptable	Conditionally acceptable	Unacceptable
Hospital, nursing home	Less than 20 ANEC	20 to 25 ANEC	Greater than 25 ANEC
Public building	Less than 20 ANEC	20 to 25 ANEC	Greater than 30 ANEC
Commercial building	Less than 25 ANEC	25 to 35 ANEC	Greater than 35 ANEC
Light industrial	Less than 30 ANEC	30 to 40 ANEC	Greater than 40 ANEC
Other industrial	Acceptable in all ANEC zones		

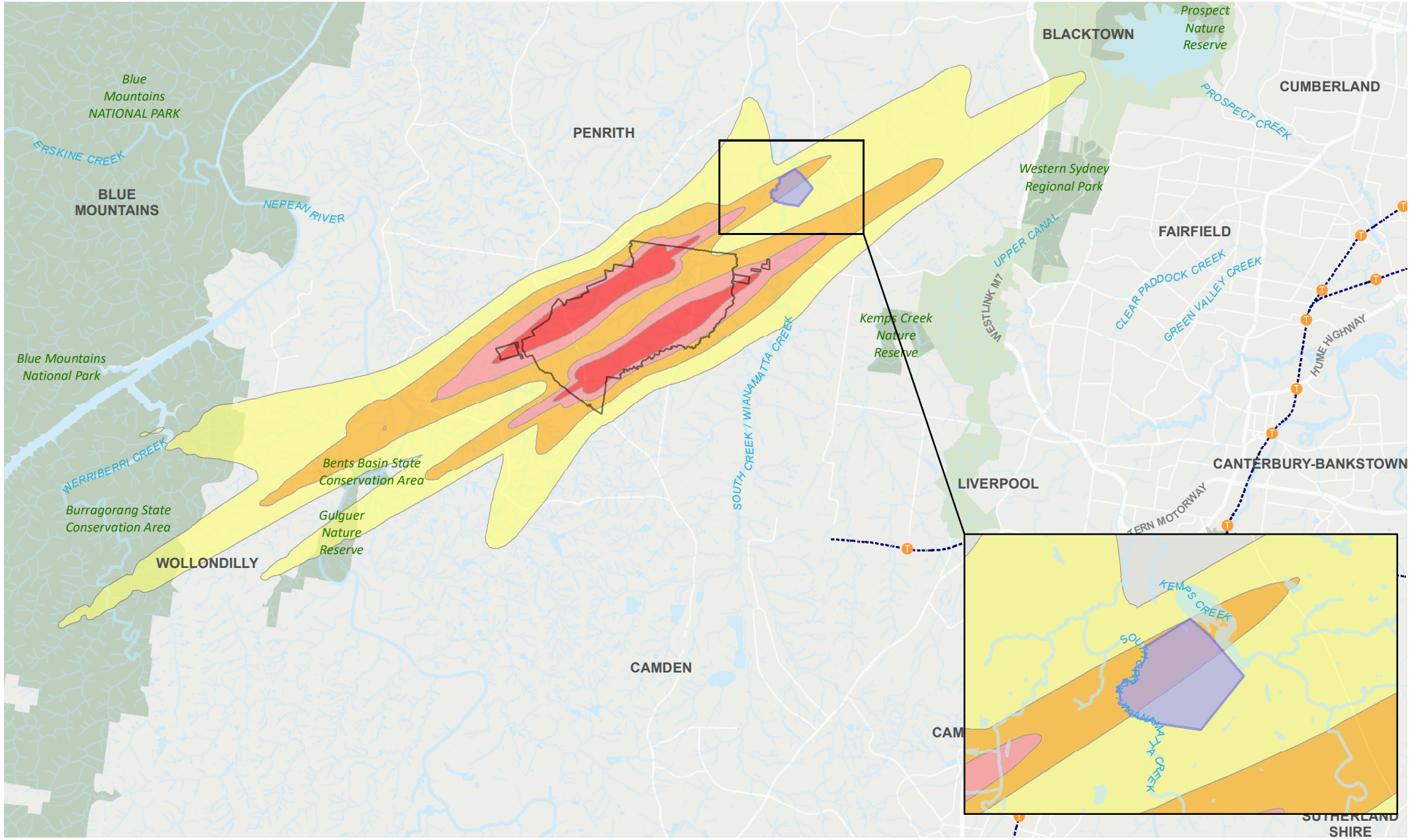
State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (WSA SEPP) provides noise contours surrounding Western Sydney International Airport in the form of Australian Noise Exposure Concept (ANEC) units. The AWRC is located in the ANEC 20-25 and ANEC 25-30 noise contours, as shown in Figure 13-1. Table 13-4 shows that activities on the AWRC site are acceptable based on the ANEC levels from the Western Sydney International Airport.

Table 13-4 Building type and acceptance within WSA SEPP ANEC

Building/ area of AWRC	Building type	WSA SEPP ANEC	Building type acceptance
Administration building	Commercial	20-25	Acceptable
Operational areas of AWRC	Light industrial	20-25	Acceptable

Although not permissible under the current zoning of the land on which the AWRC is built, there is a future opportunity for the green space area on the AWRC site to be developed into a recreation area that could include outdoor education facilities. This could form part of the Wianamatta-South Creek parkland proposed in the Western Sydney Aerotropolis Plan. The green space area is located in the ANEC 25-30 noise contour which is not suitable for permanent education facilities. Although no education buildings are proposed in the green space area, there may be future opportunities for public educational use, including accommodating visiting school or community groups. The green space area will also be subject to noise impacts from other surrounding land uses, including the AWRC and M12 Motorway, and section 11.2 considers these noise impacts in more detail. Of particular relevance is that impacts from the operation of the Western Sydney International Airport will include intermittent increases in noise levels as aircrafts fly over. These may temporarily disrupt speaking opportunities and reduce educational and recreational amenity in the area.

During detailed design, further design work will be undertaken on the administration building to reduce the impact of aircraft noise on staff at the AWRC site. This is captured in section 11.2.



Advanced Water Recycling Centre

Western Sydney International Airport

Australian Noise Exposure Concept (units)

ANEC between 20 and 25

ANEC between 25 and 30

ANEC between 30 and 35

ANEC exceeding 35

Watercourse

Waterbody

National Parks & Reserves

Western Sydney Parklands

Railway

1:150,000

0 1.5 3km

Figure 13-1 Noise contours from the operation of the Western Sydney International Airport

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

Projection: GDA2020 MGA Zone 56

NASF Guideline B: Managing the risk of building generated windshear and turbulence at airports

The AWRC site is outside the windshear envelopes of Western Sydney International Airport as mapped in the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020. This guideline is therefore not applicable for the project and has not been considered further.

NASF Guideline C: Managing risk of wildlife strikes in the vicinity of airports

The guideline relates to how a proposed development can manage the risk of wildlife strikes on aircraft, and how to reduce the potential of it occurring. Wildlife strikes on planes are more frequent when favourable habitat exists close to airports, and there is habitat connectivity that encourages wildlife to cross beneath flight paths. Guideline C provides actions for existing and proposed developments around airports based on their type of land use and the distance from the airport (or in which buffer zone category they are located).

The NASF guideline provides for buffer zones around airports and the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 identifies 3 km, 8 km and 13 km buffer zones around Western Sydney International Airport. The AWRC is in the 8 km buffer zone. The guideline and SEPP provide specific requirements for a range of development types in this buffer zone, including sewage treatment plants.

A Wildlife Hazard Assessment (WHA) identified the AWRC as having a very high risk of attracting wildlife that could contribute to the risk of wildlife strikes. This is due to the known occurrences of avian fauna in the area from 2018 surveys and potential favourable habitat created by the AWRC. The following components of the AWRC have the potential to create attractive habitats for wildlife:

- Open bodies of water, such as bioretention basins, process tanks, release structures and channels, and any water features in the green space area.
- Building eaves and other suitable locations for nesting places.
- Trees for screening, rain gardens and other water sensitive urban design elements.

The landscape around the Western Sydney International Airport is undergoing significant change as development occurs in the area. It is unknown to what extent the surrounding landscape will support wildlife once the AWRC is operational. However, it is likely that activities, infrastructure and habitat across the landscape will contribute to the risk of wildlife strike. However, as the WHA identified a very high risk of the AWRC site attracting wildlife that could contribute to risk of wildlife strike, it is important for Sydney Water to manage the project's contribution to that overall landscape risk. Section 13.1.7 outlines management measures that focus on exclusion of wildlife in the AWRC operational area and green space area. These measures will need to be adaptable over time to respond to risks that become apparent once Western Sydney International Airport is operational and as a result of changing landscapes in the area.

NASF Guideline D: Managing the risk of wind turbine farms as physical obstacles to air navigation

No wind turbine farms are proposed for the project. This guideline is therefore not applicable for the project and has not been considered.

NASF Guideline E: Managing the risk of distractions to pilots from lighting in the vicinity of airports

The guideline relates to the potential impact of lighting and reflected sunlight on distracting pilots and their ability to see runway lights and safely land an aircraft. It provides guidance on lighting lux levels around airports, to minimise any potential pilot distraction.

The State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 has zones surrounding the Western Sydney International Airport with different lighting restrictions. The AWRC site is in Zone D which has a limit of 450 candela (cd) for light intensity. The project will require lighting at the AWRC site and also proposes ground-mounted and roof mounted solar panels which have the potential to reflect sunlight. Sydney Water has not yet determined the type and extent of lighting required at the AWRC. This will be developed as part of detailed design and will meet the requirements of this guideline. As outlined in Chapter 4, design of the solar panels includes anti-glare coatings to reduce any reflectivity that may be a distraction to pilots. As the lighting requirements will be designed to comply with this guideline, the anticipated impact is considered negligible.

NASF Guideline F: Managing the risk of intrusions into the protected airspace of airports

This guideline relates to intrusion of plumes and physical objects such as buildings and cranes into the airspace above and around an airport. Intrusion into surrounding airspace can create obstacles for aircraft that can compromise safe operation of an airport. This guideline provides advice for working within and around protected airspace, including what is known as the Obstacle Limitation Surface (OLS) and Procedures for Air Navigational Services – Aircraft Operations (PANS-OPS) intrusions. The State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 contains an OLS map that ensures no structures, either permanent or temporary, protrude into the airspace.

The tallest structures on the AWRC site will be:

- Biosolids outloading building – about 25 m.
- Digesters and gas bubble storage – about 25 m.
- Brine storage tanks – about 14 m.
- Odour control discharge stack – about 15 m.
- Transfer pump stations – about 11 m.
- Advanced Water Treatment Building – about 13 m.
- Waste gas burners/flares – about eight metres.
- Cogeneration engine exhaust stack – about six metres.

- Cranes for construction of AWRC structures – about 50 m.

The tallest permanent structure at the AWRC is about 25 m high which is lower than the maximum height of 75 m specified on the OLS map. Cranes will be required during construction that are typically about 50 m and may be up to 75 m if tower cranes are required. However, these would be required before Western Sydney International Airport starts operating. The significance of the impact associated with this is therefore considered low.

The guideline also considers the potential impact of plumes rising into the airspace around the airport. The AWRC will release plumes from the odour control discharge stack, waste gas from the waste gas burner and exhaust fumes from the co-generation engines. The current design velocities at these structures are estimated to exceed the critical velocity of 6.1 m/s outlined in the Civil Aviation Safety Authority (CASA) Advisory Circular AC 139-05 v3.0 on plume rise assessments (CASA, 2019). Sydney Water has consulted with CASA and submitted a formal application for a preliminary screening assessment of the AWRC in relation to this guideline. CASA has stated that the odour treatment discharge stack, cogeneration engine exhaust stacks and the gas burner have an acceptable level of safety and no further mitigation is required. Appendix AA provides further details, including correspondence from CASA.

Guideline G: Protecting aviation facilities – communications, navigation and surveillance

Airservices Australia and Western Sydney International Airport were consulted and confirmed that the AWRC will not impact the performance of any existing aviation facilities relating to communication, navigation and surveillance. Therefore, this guideline is not applicable and has not been considered. Appendix AA provides further details, including correspondence with Airservices Australia.

Guideline H: Protecting strategically important helicopter landing sites

The AWRC will not impact any strategically important helicopter landing sites. These are mainly located at hospitals and elevated landing sites in urban areas. No strategically important helicopter landing sites are located within the proximity of the AWRC. As such, this guideline is not applicable and has not been considered.

Guideline I: Public safety areas

The public safety areas are mapped in the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 and extend from each end of the Western Sydney International Airport runways. The AWRC is located outside these public safety areas. Therefore, this guideline is not applicable and has not been considered.

The design and location of the AWRC has effectively managed any potential risks and impacts on the Western Sydney International Airport regarding protrusions in the airspace, lighting and noise impacts. As detailed design progresses, the project will continue to consider necessary safety requirements, including those defined by the guidelines and requirements described in this safeguarding assessment.

13.1.5 Impact of future stages

Future stages of the AWRC are likely to have similar operational impacts to Stage 1, given they involve extending the existing treatment processes. Future stages will be built once Western Sydney International Airport is operational so further consideration of construction impacts will be required in future environmental impact assessments for those stages, including consideration against the NASF Guidelines.

13.1.6 Cumulative impacts

The main aspect for consideration of cumulative impacts is the potential risk of wildlife strike. It is currently uncertain how development surrounding the AWRC will progress and what risks that will present to wildlife strike in the region. Sydney Water can only control how it manages its own property and section 13.1.7 includes measures for how Sydney Water will continue to monitor and manage its contribution to the regional risk during operation. For other aspects, the impacts of the AWRC on airport operations are minimal and are unlikely to result in cumulative impacts with other projects.

13.1.7 Management measures

Table 13-5 outlines the management measures Sydney Water will implement to minimise impacts on the operation of the Western Sydney International Airport.

Table 13-5 Airport operations management measures

ID	Potential impact	Management measure	Timing
AO01	Contribution of AWRC site to increased risk of wildlife strikes by aircraft	Investigate opportunities for additional design measures at the AWRC to manage potential wildlife populations. These will include: • covering large (100 m^2) open bodies of still water • exclusionary devices • enclosing waste receptacle areas • selection of landscaping plant species that are less attractive to wildlife as a food and shelter source • steepening the slopes of basins to deter wildlife.	Detailed design

ID	Potential impact	Management measure	Timing
AO02	Contribution of AWRC site to increased risk of wildlife strikes by aircraft	Prepare and implement a Wildlife Management Plan for the AWRC site. This plan will include: • wildlife monitoring surveys • regular wildlife hazard assessments • wildlife awareness and management training for AWRC operational staff • implementation of activities to reduce hazardous bird populations • adoption of wildlife deterrent technologies to reduce hazardous bird populations • performance indicators to evaluate implementation and compliance to consent conditions • a review process to regularly assess implementation against performance indicators, identify gaps, and ensure currency • roles and responsibilities for plan implementation and review.	During operation
AS03	Impact to operation of Western Sydney International Airport	Assess consistency of any changes to the location and size of structures, or plume estimations, with Western Sydney International Airport OLS and CASA plume rise assessments outlined in this EIS.	Detailed design
	AWRC lighting impacting the operation of Western Sydney International Airport	This impact is appropriately managed by measures in section 11.3 (Landscape character and visual).	Detailed design During operation

13.2 Utilities

This section describes the utility connections required for the project, and the potential for the project to impact surrounding utilities and operational land.

Utilities impact summary

The project will require new utility connections such as power, gas, water, wastewater and communications and Sydney Water has consulted with relevant government agencies and utilities about these needs. The establishment of these new services will not impact on the existing services in the area.

The project is close to a range of existing and future utilities, including council, WaterNSW and Transport for NSW (TfNSW) assets. The project has been designed to avoid and minimise impacts on these utilities. The current assessment has demonstrated that no impacts will occur, however Sydney Water will continue to consult with relevant agencies during detailed design and construction and implement management measures to ensure that remains the case.

13.2.1 Relevant Secretary's Environmental Assessment Requirements

Table 13-6 summarises the Secretary's Environmental Assessment Requirements (SEARs) relevant to the provision of services and impacts to utilities.

Table 13-6 Project SEARs relating to impacts on infrastructure and utilities.

SEARs	EIS section where requirement addressed
53. Outline how the proposal has considered WaterNSW's '*Guideline for Development Adjacent to the Upper Canal and Warragamba Pipeline'* and include all practical measures to prevent damage to WaterNSW water supply infrastructure from construction and operation of the project.	Section 13.2.3
66. Preparing an Infrastructure Management Plan in consultation with relevant agencies / authorities to: h) address the existing capacity of the site to service the proposed development and any extension or augmentation, property tenure or staging requirements for the provision of utilities, including arrangements for electrical network requirements, drinking water, wastewater and recycled water.	Section 13.2.2
i) Identify the existing infrastructure on the site or within the network which may be impacted by the construction and operation of the project and the measures to be implemented to address any impacts on this infrastructure.	Section 13.2.3

SEARs	EIS section where requirement addressed
j) demonstrates advice on the electricity infrastructure required to facilitate the proposed development (including asset relocations) has been obtained through consultation with Endeavour Energy's Network Connections Branch.	Section 13.2.2

13.2.2 Required utilities

There are no existing utilities that can adequately service the project and new utilities will therefore need to be supplied. Some minor utilities and infrastructure will be delivered as early works, to service the initial establishment of the site and are assessed outside this EIS, in separate environmental impact assessments. These include the access road and early water connections to the AWRC, as outlined in Chapter 4. This section outlines utilities that are required to construct and operate the project, in addition to those early works. No property tenure changes are expected as part of providing utilities for the project.

Power

The AWRC requires electricity to operate and Sydney Water has applied to Endeavour Energy (Network Connections Branch) for a staged power supply up to an ultimate requirement of 23.4 MVA by 2040. Endeavour Energy has issued a connection offer to cover Stage 1 requirements of 6.4 MVA by 2025 from the existing Kemps Creek Zone substation. They have indicated that by 2030 the supply will be moved to a new C3 zone substation that is proposed to cater for growth in the area.

The power supply to the AWRC, to be delivered by Endeavour Energy, will be assessed in a separate environmental impact assessment and has not been assessed in this EIS. Sydney Water will obtain any required approvals and permits from Endeavour Energy.

Low voltage power will also be required at the following pipeline locations:

- Brine pipeline connection location at Lansdowne Reserve, Lansdowne to control the actuated valve.
- Treated water flow splitter structure at Bents Basin Road, Wallacia.

Sydney Water has also consulted with Endeavour Energy about the requirements for that power supply. Whilst the capacity exists to meet this need, during detailed design Sydney Water will apply formally to Endeavour Energy for power supply to the above locations and obtain the required approvals and permits.

Gas

Gas is required for a short period during the initial operation of the AWRC, to generate biogas in the digesters. Only a limited supply is required, and no other areas of the project will require a gas supply. The reference design for the project includes a gas pipeline to the AWRC. However, due to the limited supply that is required alternative supply options are being considered. These include onsite gas and diesel storage and onsite diesel storage. The ultimate supply option will be determined during detailed design.

For the gas pipeline option, Sydney Water is consulting with Jemena for supply of gas for Stage 1 and future stages of the AWRC. Jemena has proposed a 0.15 m diameter steel main to provide gas supply to a Jemena owned meter which will be located on the AWRC site. The existing Jemena design includes a gas main approaching the AWRC site from the south and crossing under the future M12 Motorway.

Jemena and its contractors will likely install the gas main and meter set in accordance with Jemena standard requirements. It is therefore not assessed in this EIS and will be assessed under a separate environmental impact assessment. The meter set will operate on solar power and 4G communications, with 24-hour unimpeded access to the meter set through the AWRC site.

Water and wastewater

Water supply for the AWRC site will be delivered as part of a separate Sydney Water project. The pipeline will be located in the utilities corridor of the access road off Clifton Avenue and will be delivered before construction of the AWRC starts in 2022. This will provide drinking water to the AWRC for use in construction and operation.

Small amounts of water may be required during construction of the tunnelled portion of the environmental flows pipeline at Wallacia and Warragamba. This would be extracted either from the existing nearby drinking water network or Nepean River. No operational water supply will be required.

Several wastewater mains will be required to deliver the feed wastewater to the AWRC and will be sized according to their catchment area. These pipelines will form part of the wastewater collection network in the Upper South Creek Servicing Area. These are not part of the project scope and have therefore not been assessed in the EIS.

The recycled water network, which takes the high-quality treated water from the AWRC to surrounding precincts and other areas, for beneficial use, is also not part of project scope, and will therefore be assessed as part of separate approvals. These approvals are not being sought at this time because it is not clear where the pipelines will run or what their capacity will be.

Sydney Water is coordinating with Transport for NSW (TfNSW) to minimise impacts on construction and operation of the M12 Motorway, where pipelines may be required to cross this asset. Where the proposed pipelines have the potential to impact on existing services such as the M12 Motorway, the WaterNSW Upper Canal, and other sensitive areas (such as waterways), Sydney Water will design the pipelines to be maintenance free, so that future access is not required.

Communication

Communications will be required for the AWRC, the brine actuated valve at Lansdowne Reserve and the flow split structure at Wallacia. This will enable remote operating and monitoring of flows at these locations during operation. It is proposed that communications will be provided through the Telstra 4G/5G wireless network and a land line.

The access road to the AWRC will be constructed as part of a separate Sydney Water project but will accommodate fixed line data cables to the AWRC site, within the access road utilities corridor. Communications infrastructure is not part of the project scope and has not been assessed in detail in the EIS.

13.2.3 Impacted utilities

Sydney Water's preference is to design the project to avoid impacting any existing services. Design of the project to date has included a detailed assessment of existing utilities near the proposed infrastructure, including the AWRC, the pipelines or any associated infrastructure. This included a desktop ground investigation program and historical geotechnical data from NSW Government databases including Sharing and Enabling Environmental Data (SEED), ePlanning Spatial Viewer, eSPADE and MinView and records of previous ground investigation and construction works.

Sydney Water completed Dial-Before-You-Dig (DBYD) searches during project reference design to avoid impacts on existing services where possible. This included locating infrastructure to avoid impacts on surrounding utilities and ensure minimum offset distances are achieved.

There are no existing services or utilities on the AWRC site which will be impacted by the project. Potential impacts to utilities from pipelines will be limited to the construction phase of the project and may include accidental damage from construction activities. Although there are numerous existing services and utilities close to the pipelines, it is unlikely they will be impacted with the implementation of the management measures outlined in section 13.2.6. The project is unlikely to impact utilities during operation.

Sydney Water is also consulting with the following councils, utilities and government authorities where project infrastructure will be built close to their infrastructure. Sydney Water will aim to minimise impacts on existing and future infrastructure and will continue to consult with these authorities as detailed design progresses.

- WaterNSW.
- Transport for NSW (TfNSW) including Sydney Trains, Sydney Metro and Roads and Maritime. Sydney Water has also consulted Australian Rail Track Corporation.
- Impacted councils, including Penrith City, Liverpool City, Fairfield City, Wollondilly Shire, City of Canterbury-Bankstown.
- Endeavour Energy.
- Jemena.

Further information about the project's interface and impact with each of these organisations is described below.

WaterNSW infrastructure

Figure 13-2 shows where the project is located within and adjacent to WaterNSW land and assets. This includes:

- tunnelling under the Upper Canal in Western Sydney Parklands
- environmental flows release structure located on WaterNSW land adjacent to the Warragamba Dam spillway
- operational releases of treated water upstream of assets in or across waterways including Warragamba pipeline crossing of South Creek and Nepean River, Warragamba Weir, Wallacia Weir, Penrith Weir.

In addition to considering impacts of tunnelling beneath the Upper Canal, Sydney Water completed a risk assessment to assess the potential impacts of flooding, erosion and deposition on key WaterNSW infrastructure as a result of additional flows to waterways from the project.

Upper Canal

The brine pipeline will cross the WaterNSW Upper Canal in Western Sydney Parklands. Sydney Water proposes to tunnel under the Canal to avoid any above-ground disturbance to the structure. Chapter 4 outlines the tunnelling construction methodology in more detail.

Sydney Water has constructed several pipelines beneath the Upper Canal and is familiar with the requirements of WaterNSW's 'Guideline for Development Adjacent to the Upper Canal and Warragamba Pipelines' (WaterNSW, 2020b). To minimise the potential for impact on this asset during construction, Sydney Water will adopt several design measures including:

- adequate offset distances below the asset to reduce impacts from vibration
- completing survey monitoring of Upper Canal during construction
- locating launch and receival pits for tunnel construction located outside of the heritage curtilage.

A qualitative vibration assessment has also been completed for potential impacts to the Upper Canal during tunnelling construction of the brine pipeline. This assessment has identified that neither cosmetic nor structural impact is likely, due primarily to the offset distance between the proposed tunnel and the Upper Canal. The alignment has also been designed to avoid crossing beneath a water quality monitoring station located adjacent to the Upper Canal near the proposed pipeline crossing. Impacts to this structure are therefore unlikely. Further information, including vibration related management measures are provided in section 11.2.

Warragamba Dam

Sydney Water will require construction works in WaterNSW land associated with the Warragamba Dam. This includes locating the environmental flows pipeline release structure downstream of the Warragamba Dam wall, as outlined in Chapter 4. The project has been designed to be located away from sensitive WaterNSW assets, including the Warragamba Dam and its spillway. This will avoid any potential impacts during construction and avoid impeding the operation of either the Dam or the environmental flows pipeline.

Access through WaterNSW land will be required during construction of the environmental flows release structure and pipeline. This includes access via Core Park Road, Production Avenue and Valve House Road. During operation, infrequent visits for condition assessments and sampling will be required at the environmental flows release structure and will be accessed via Core Park Road. The construction and operation works near Warragamba Dam are unlikely to impact any WaterNSW infrastructure.

Operational access will be via a new permanent sealed access road off the existing sealed access road at the base of the Warragamba Dam spillway to the location of the release structure. This will be used for both construction and operational access to the release structure. A pedestrian footpath from Core Park Road will also be required for operational access. Sydney Water will continue to consult and work closely with WaterNSW to minimise any disruption the project may have on WaterNSW operational land.

Warragamba Pipeline

Sydney Water has assessed the potential impacts of the project on the Warragamba pipeline. This includes impacts from:

- AWRC operational releases of treated water into South Creek during wet weather events and potential impacts to the Warragamba Pipeline where it crosses South Creek about three kilometres downstream of the AWRC
- release of treated water into Nepean River and potential impacts to the Warragamba Pipeline where it crosses Nepean River about 275 m downstream of the release
- tunnelling construction of the environmental flows pipeline beneath the Warragamba Pipeline.

A risk assessment included in Appendix G has been completed to assess the potential impacts of project operational releases on the above assets. The assessment compared the potential risk of impact to the above listed assets, ranging from baseline flows to that of the proposed release flows from Stage 1 of the project. Releases to South Creek are expected to occur between 3-14 days per year, depending on the amount of wet weather. The contribution of the wet weather flows to South Creek during wet weather events is expected to be less than 1% of the baseline or usual flood flow rates.

For all WaterNSW assets, the additional operational flow from the project does not change the risk rating from erosion and deposition impacts compared to that of baseline flows. This is a result of the relatively minor contribution of flows to the receiving waterways which are unlikely to change the level of impact to the structural integrity of the assets.

The results of the risk assessment include:

- medium risk of impact to the Warragamba pipeline crossing of South Creek
- low risk of impact to Warragamba pipeline crossing of Nepean River.

The environmental flows pipeline will be tunnelled beneath the Warragamba Pipeline near the township of Warragamba. The pipeline will pass about 30 m beneath the Warragamba Pipeline in solid rock. It is unlikely this will impact the Warragamba Pipeline.

Weir structures

Sydney Water has assessed the potential impacts of the project on the Warragamba Weir, Wallacia Weir and Penrith Weir from operational releases of treated water, with the full assessment included in Appendix G. Flood flow conditions for Nepean River and Warragamba River are not likely to be affected by treated water releases. Any increase in flood level, extent, or flow velocity because of the proposed release is likely to be negligible and not impact the structural integrity of the assets.

The assessment did not identify any increase in risk to the potential impact to these structures from:

- flows in the waterways leading to damage to the structure through exceedance of design conditions
- flows in the river leading to erosion or deposition within the waterways or channel banks affecting the performance of the structures.

Section 13.2.6 includes management measures to minimise impact to WaterNSW assets, including the Upper Canal, Warragamba Pipeline and weir structures.

Transport for NSW infrastructure

The project will require the construction of pipelines via tunnelling beneath the following existing and proposed TfNSW assets:

- M12 Motorway.
- M7 Motorway.
- Elizabeth Drive near the intersection of The Northern Road.
- Rail line at Cabramatta, north of Cabramatta railway station.
- Proposed Sydney Metro – Western Sydney Airport.
- Hume Highway at Lansdowne.
- Henry Lawson Drive.

Sydney Water will cross these assets using tunnelling construction to reduce impacts and to maintain traffic flow. Sydney Water has consulted with TfNSW throughout the reference design process to identify potential impacts on any of their infrastructure, and has modified the design, including making pipelines beneath major roads (such as M7 Motorway) maintenance free to avoid any future impacts. Sydney Water has also moved the pipeline alignments outside of the M12 Motorway boundary to avoid impacts during construction.

There may be temporary impacts to the above listed TfNSW roads during construction, relating to traffic control, and the location of entry and exit pits for pipeline tunnelling construction. Sydney Water does not propose any permanent impacts or modifications to TfNSW assets that would result in changes to their operation.

During detailed design, Sydney Water will develop more detailed civil plans and drawings to inform consent under section 138 of the *Roads Act 1993*. Sydney Water will continue to consult with TfNSW throughout the project regarding any impacts to classified roads and rail corridors.

Section 13.2.6 includes management measures to minimise impacts to TfNSW assets.

Councils, Endeavour Energy and Jemena

The project may interface with assets owned and operated by local councils, Endeavour Energy and Jemena. This includes local council stormwater infrastructure such as pipelines and culverts, as well as local roads and parks. Impacts to Endeavour Energy infrastructure is unlikely due to locating pipelines on opposite sides of roads when overhead power lines are present. Jemena gas pipelines have been identified during the reference design process, with project pipelines located at suitable offset distances. Section 13.2.6 includes management measures to minimise impacts to these assets.

13.2.4 Impact of future stages

Given the pipelines will be built to their ultimate capacity in Stage 1, there will be no impacts to utilities in future stages.

Some utility connections to the AWRC will be staged to align with future AWRC stages, such as power connections as described in section 13.2.2. Future stages of the AWRC would also need to consider potential impact of any new infrastructure on utilities built on the AWRC site to service Stage 1.

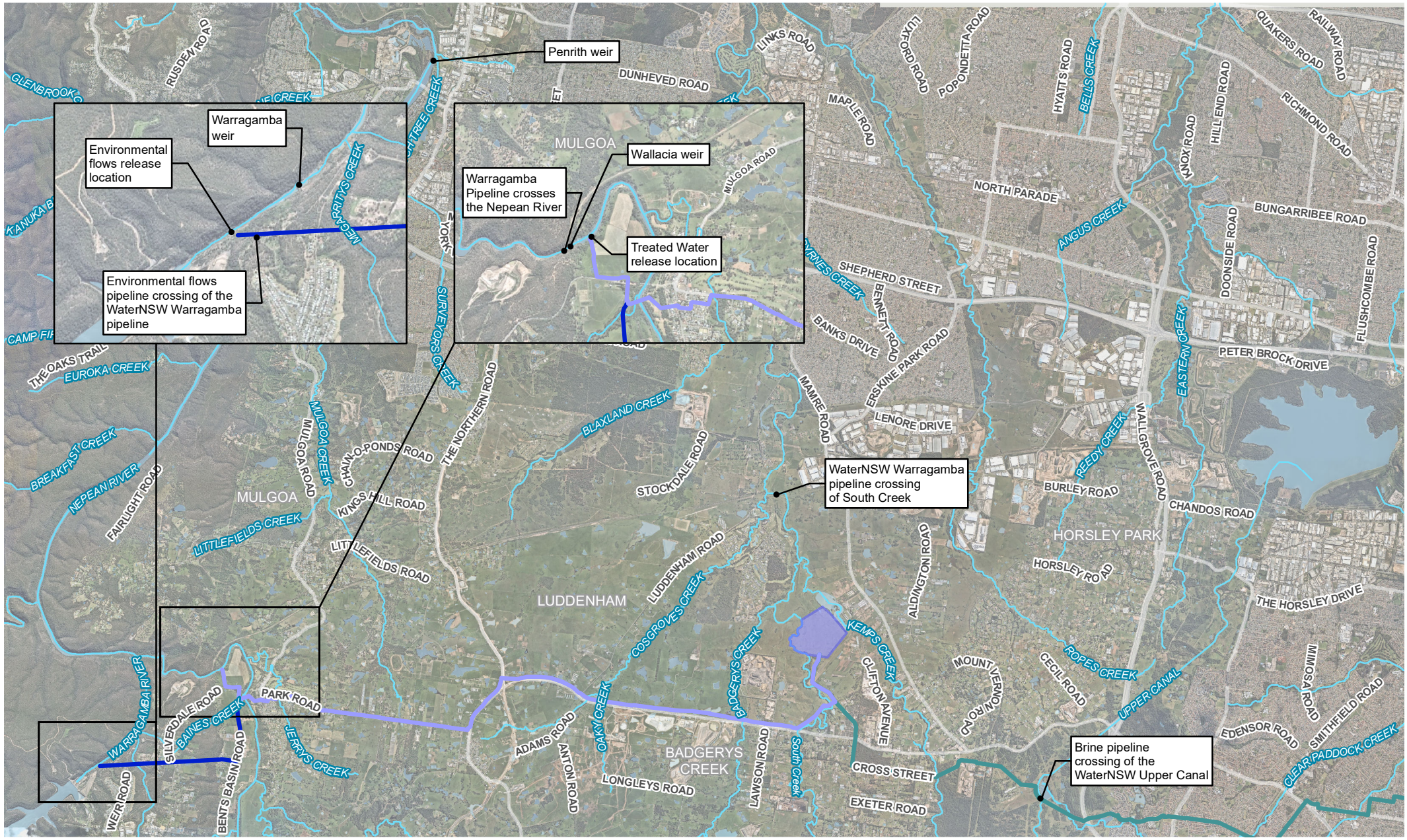


Figure 13-2 WaterNSW assets near the project

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

13.2.5 Cumulative impacts

Given the project has been designed to avoid and minimise impacts on utilities, cumulative impacts are unlikely. However, Sydney Water will continue to consult with utilities and government authorities listed in section 13.2.3 throughout the project to identify and minimise any potential cumulative impacts, particularly where construction activities for projects are likely to overlap.

13.2.6 Management measures

Table 13-7 outlines the management measures relating to utilities that Sydney Water will implement for the project.

Table 13-7 Management measures related to utilities

ID	Potential impact	Management measure	Timing
U01	Impacts to TfNSW assets during construction	Prepare and submit civil plans for road crossings to TfNSW to support any required approvals under the *Roads Act 1993*.	Detailed design
U02	Impacts to utilities and services during construction	Identify any existing utilities that may be at risk of impact from construction. Once identified, complete dilapidation surveys to establish a pre-construction condition assessment of the assets.	Detailed design Prior to construction During construction
U03	Impacts to utilities and services during construction	Repair any utilities that have been directly impacted from project construction activities.	During construction
U04	Impacts to utilities and services during construction	Complete Dial Before You Dig (DBYD) searches of existing services during detailed design and prior to construction. Where required, sensitive services or those critical to the design will be accurately located to AS5488 Quality Level A by potholing. Sydney Water will continue to consult with relevant utility agencies and organisations during detailed design and construction planning.	Detailed design Prior to construction During construction
	Impacts to WaterNSW assets during construction	This impact is appropriately managed by measures in section 10.2 (Non-Aboriginal heritage).	Prior to construction During construction During operation

ID	Potential impact	Management measure	Timing
	Impacts to WaterNSW and TfNSW assets during construction	This impact is appropriately managed by measure G10 in Chapter 15 (Project synthesis).	Detailed design Prior to construction During construction