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South Jerrabomberra Regional Job Precinct

Infrastructure Assessment – Hydrogeology, Water Quality and Water Demand Technical Report

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Important Notice

This Report considers current infrastructure network constraints and potential augmentation required to support land use intensification and master planning as it relates to hydrogeology and water demand. This report is generally qualitative in nature and design has not been undertaken to inform the study findings. Future studies will be necessary to provide a detailed demand analysis and to provide additional clarity around the infrastructure needs of the study area.

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Executive Summary

The objective of the Regional Job Precinct (RJP) program is to provide a more streamlined planning process to drive investment and development in regional NSW. The RJP program focuses specifically on targeted locations that are ready for development and will support thriving industries and job creation. SMEC has been engaged by Department of Regional NSW (DRNSW) to prepare an assessment of infrastructure needs to help attract new business to the South Jerrabomberra region, and support job growth.

The South Jerrabomberra Regional Job Precinct (RJP) is located on a 950 ha parcel of land, located adjacent to the ACT. The investigation area (the site) occurs within the Queanbeyan-Palerang Regional Local Government Area (LGA) and provides approximately 97 ha of land that is readily zoned for employment generating uses, and an additional 134 ha for potential future expansion.

A Master Plan has been prepared by Jensen Plus suggesting the structure of land uses that may be suitable for the region based on market sounding, consultation and economic assessment. The Master Plan provides an aspirational vision for the development of the region and sees a variety of defence, space, and information technology and scientific research sectors, along with light industry and high technology manufacturing.

This report provides an assessment of the regional hydrogeology, water quality and water demand of the South Jerrabomberra RJP with the following objectives:

- Assesses the potential increased demand for ground water as a result of development within the RJP
- Identifies the required water supply, water quality and hydrogeology interventions or infrastructure needed to support the preferred Master Plan, including the land required, its suggested location and capacity
- Provide recommendations for a coordinated, precinct-wide approach to water and wastewater management and improvements to water quality outcomes and wastewater treatment, including but not limited to stormwater, wastewater reclamation/re-use opportunities, trade waste and integrated water cycle management
- Provide recommendations for updates to existing infrastructure contributions plans to support the cost-effective, equitable and timely provision of key utilities infrastructure for the RJP
- Propose recommended Development Control Plan provisions, as appropriate, for consideration by the relevant local council.

Hydrogeology and Water Quality

The hydrogeology of the South Jerrabomberra RJP is dominated by fractured rock aquifers and a water table with variable depths. Groundwater recharge is currently dominated by rainfall infiltration on the surface. There are five bores within the RJP boundary registered for stock and domestic use with yields ranging from 0.3L/s to 1L/s. Due to these generally low yields, groundwater is not being considered as the primary raw water source for this development, however, could form part of the overall water supply and management strategy if there were to be appropriate land uses locating to the site. It is understood that the Regional Sports Centre is considering ground water as a potential non-potable water source to support the irrigation needs of the complex. A supply of 3L/s to 5L/s would be required, however it is noted that the assumed potable water supply for the Regional Sports Centre is reasonably high.

Recycled Water Opportunities

It is noted that the type of industries targeted for the South Jerrabomberra RJP would have a limited demand for non-potable water sources and more-over, there is a lack of existing infrastructure to supply recycled water to the Site. QPRC has confirmed they would not support the provision of infrastructure for a third pipe to the precinct.

Currently, treated effluent from the Queanbeyan Sewerage Treatment Plant (QSTP) is discharged into the Molonglo River. It is expected that the construction of infrastructure to transport treated effluent from the QSTP to the RJP would be expensive and there would be little financial incentive for QPRC to establish such a scheme.

Further consideration for recycled water opportunities may be explored if an industry moves into the RJP that has substantial demand for recycled water.

Stormwater Harvesting and Reuse

The proposed land use within the precinct will consist of large impervious surfaces, comprising industrial roof areas, car parks and hardstand areas. This presents an opportunity to harvest surface runoff from roof areas into on-site roof water tanks (RWT) for re-use in non-potable uses such as flushing toilets and washdown areas, to reduce overall demand for potable water. This report provides an estimation for non-potable water demands for commercial and industrial areas based on internal use – 0.1kL/day/ 1000 m^2, and external use – 20kL/yr/1000 m^2. As such, rainwater tanks (RWT) sized to meet a maximum of 70% of use for non-potable water demand would be required to be cost effective.

Managed Aquifer Recharge

As the RJP moves from vacant land to more impervious surfaces associated with the proposed type and scale of development, it is anticipated that there will be less opportunities for infiltration and recharge of the groundwater system. As such, a number of recommendations to offset the reduction of recharge to the groundwater system has been proposed.

The use of vegetated bio-swales for managing surface water runoff rather than concrete-lined structures will increase and distribute infiltration over a wider area. There is also an opportunity to consider recharge to the deeper rock aquifers in larger volumes via upgradient recharge. If groundwater extraction is confirmed at the Regional Sports Centre, upgradient recharge within the Environa land parcel should be considered and may offset extraction resulting in a limited net impact to the groundwater system. Further, rainwater collection systems with reinjection bores may be viable across multiple parts of the Site and tank storage could also be used as a firefighting supply for the precinct, reducing potable water demand.

Water Quality Strategy

The Master Plan considers conventional bioretention basins to treat runoff at each land use area to ensure that water quality objectives are met downstream in Jerrabomberra Creek and the Molonglo River. The Master Plan established the following values to ensure that downstream water quality is maintained:

- 95% removal of Gross Pollutants
- 85% removal of Total Suspended Solids
- 65% removal of Total Phosphorous
- 45% removal of Total Nitrogen

Based on the current Master Plan, a total bioretention basin of 7,935m^2 is required as a minimum to meet these removal targets. It is recommended that bioretention systems are located on the lowest part of the terrain and near riparian waterways where possible. A further recommendation for a detailed flood assessment is provided to build upon existing flood information and to increase the resilience of the precinct.

Staging of Upgrades and Funding Mechanisms

The South Jerrabomberra Local Infrastructure Contributions Plan 2018 levies development contributions under Section 7.11 of the EP&A Act for local infrastructure associated with previously anticipated development in Poplars, Environa, North and South Tralee, Forest, Morrison and Walsh. The contributions under the South Jerrabomberra Local Infrastructure Contributions Plan 2018 are at the maximum permitted levy, and cover planned infrastructure for the land associated with Stage 1 to 3 of the master plan, based on current zonings.

As the master plan changes land uses and increases the demand for infrastructure in the RJP, any additional infrastructure will need to be funded by levies associated with the release of additional development parcels in Stage 4, or would need to be separately funded.

Given that the growth anticipated by the RJP Master Plan is much greater than that previously contemplated in this contributions plan, it is recommended that an updated development contributions plan be prepared by QPRC to cover the growth anticipated in the area, and the change in land zonings.

Section 64 of the Local Government Act 1993 allows contributions to be levied towards the provision of water, sewerage and stormwater infrastructure, provided a Developer Servicing Plan is in place. A contributions plan can cover both Section 7.11 and Section 64 contributions. When updating the provisions of the South Jerrabomberra Local Infrastructure Contributions Plan 2018 to accommodate the increased demand associated with the new and changed land uses in the RJP, Council should also consider ensuring sufficient levying of Section 64 contributions.

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1 Introduction

The objective of the Regional Job Precinct (RJP) program is to provide a more streamlined planning process to drive investment and development in regional NSW. The RJP program focuses specifically on targeted locations that are ready for development and will support thriving industries and job creation. SMEC has been engaged by Department of Regional NSW (DRNSW) to prepare an assessment of infrastructure needs to help attract new business to the South Jerrabomberra region, and support job growth.

This report firstly provides an assessment of existing (baseline) conditions relating to hydrogeology, water quality and water demand within the South Jerrabomberra RJP investigation area and considers how planned and future infrastructure within the region may be supplemented by Integrated Water Cycle Management (IWCM).

The South Jerrabomberra RJP is accessed via Tompsitt Drive and a new north-south collector (Environa Drive) that provides access to the South Tralee residential area and the future North Tralee Light Industrial area, a future high school and a planned innovation precinct in the Poplars development. Henry Place to the north provides access to commercial land including fast food restaurants, Aldi supermarket, service station and a future planned commercial precinct.

The intent of the South Jerrabomberra RJP is to encourage an agglomeration of knowledge-based industries, focused on the proximity to Canberra Airport, access to a skilled workforce, proximity to traditional industrial lands in Hume (ACT) and Oakes Estate (NSW) and existing or planned existing utility and communication infrastructure. Planning of infrastructure to support the RJP is at varying stages, with the subdivision and first stages of the Poplars precinct already underway, the high school, regional sports precinct and North Tralee industrial area in planning approval stage and approximately 675 dwellings of 1500 constructed in South Tralee, Forest Morrison and Walsh.

This report commences with an introduction to the project site and the Master Plan, and then provides a baseline analysis of ground water and surface water quality and availability. We then consider how the type, density and staging of development in the Master Plan can support the hydrogeology of the region through recharging ground water, integrating Water Sensitive Urban Design (WSUD) and closing the water cycle through recycling, reuse and water sensitive development that respects best practice IWCM.

The technical analysis undertaken in this report includes:

- Assessment of surface water and groundwater availability and characteristics
- Current and proposed water demand from target industries
- Review of existing data to understand the hydrogeological conditions relevant to the precinct
- Review existing data to analyse the ability to use surface water and groundwater
- Consider the legislative context of water sharing plans and policies
- Prepare a high-level analysis of the expected water demand for the main target industries and land uses provided, including capacity for fire services. This should be based on best practice examples of business types of the scale that will be expected in the RJP investigation area
- Identify how the Master Plan can support the hydrogeology of the region
- Conceptually consider the integration of WSUD and IWCM into the Master Plan, and note any land that may be required to support capture, treatment and reuse of water within the region
- Provide commentary on further recommended studies, staging and funding options.

2 Project Background

2.1 Project Objectives

The RJP program provides an opportunity to assist regional areas to attract investment through facilitating upfront strategic master planning. There is also an opportunity to streamline statutory planning to further drive agglomeration and reduce barriers to investment.

The focus of this report is on the hydrogeology, water quality and water demand of the South Jerrabomberra RJP investigation area. This report includes an assessment of current (baseline) conditions and tests the Master Plan prepared by Jensen Plus to develop an understanding of infrastructure investment that may be required.

2.2 Report Objectives

The objective of this report is to disseminate a technical assessment of the regional hydrogeology, water quality and water demand of the South Jerrabomberra RJP into plain English. This report integrates initial findings from the baseline assessments undertaken for the area and assesses the impacts that the Master Plan may have on infrastructure within the RJP. This report specifically:

- Assesses the potential increased demand for ground water as a result of development within the RJP
- Identifies the required water supply, water quality and hydrogeology interventions or infrastructure needed to support the preferred Master Plan option, including the land required, its suggested location and capacity
- Provide recommendations for a coordinated, precinct-wide approach to water and wastewater management and improvements to water quality outcomes and wastewater treatment, including but not limited to stormwater, wastewater reclamation/re-use opportunities, trade waste and integrated water cycle management
- Provide recommendations for updates to existing infrastructure contributions plans to support the cost-effective, equitable and timely provision of key utilities infrastructure for the RJP
- Propose recommended Development Control Plan provisions for consideration by the relevant local council.

2.3 Project Location and Key Features

The South Jerrabomberra Regional Job Precinct (RJP) is located on a 950 ha parcel of land, adjacent to the ACT border (Figure 2–1). The vision for the South Jerrabomberra RJP is to encourage an agglomeration of knowledge-based industries specialising in Defence, space, cyber-security, information technology and scientific research.

The investigation area (the Site) lies within the Queanbeyan-Palerang Regional Local Government Area (LGA) and provides approximately 97 ha of land that is readily zoned for employment generating uses, and an additional 134 ha for potential future expansion.

The Site is predominantly vacant, however is subject to a number of Development Applications (DA's) and master plans for the Poplars Innovation Precinct (three stages of 28 lot subdivision) including a commercial centre north of Tompsitt Drive, business park and a comprehensive high school that offers STEM subjects; the North Tralee light industrial subdivision, regional sports precinct and the unzoned (deferred matter) parcel of land known as Environa. Parts of the Site, including much of Environa are within the noise contours of Canberra Airport, which is located to the north-west of the site.

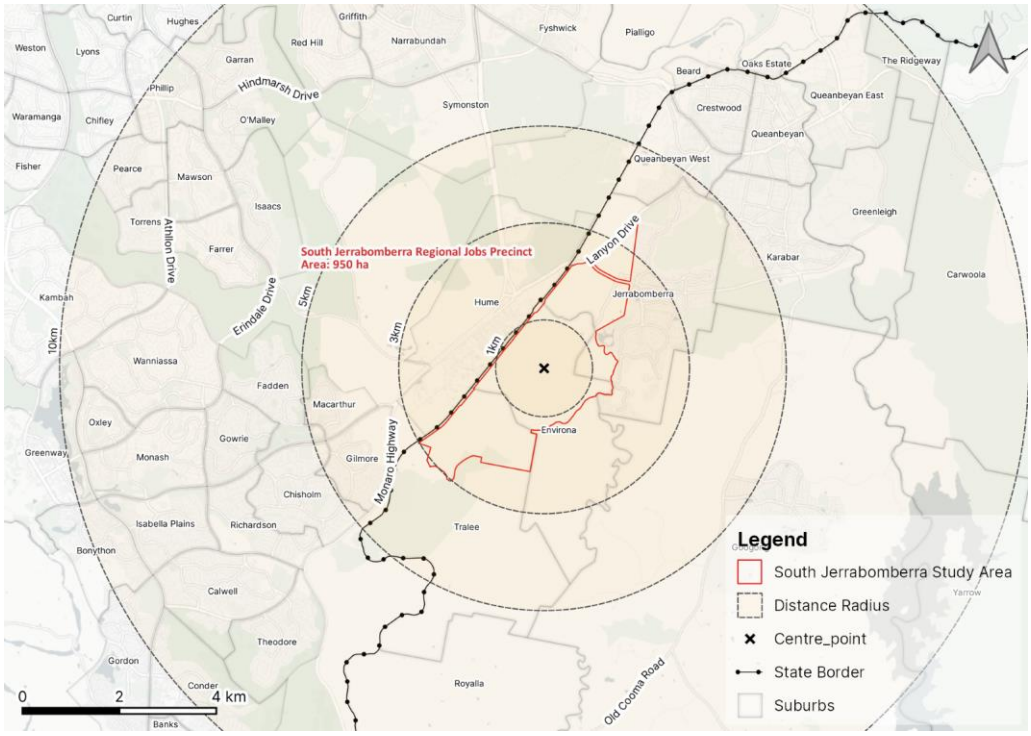

Figure 2–1 | South Jerrabomberra Location Context

Environa Drive, a newly constructed north-south collector road provides access to the Poplars Innovation Precinct, the South Tralee residential development (first stage complete) and future town centre, and the North Tralee light industrial area. Approximately 100 ha of the site is identified as the 'Poplars Grassland Reserve', a conservation area subject to a Biodiversity Stewardship Agreement, providing protection for Button Wrinklewort (*Rutidosis leptorhynchoides*) which is an endangered flora species listed under both the *Environmental Protection and Biodiversity Conservation Act 1999* and the *NSW Biodiversity Conservation Act 2016*.

The South Jerrabomberra RJP expands on the existing Poplars Innovation Precinct to consider options for the future stages of the innovation precinct, Environa lands and Tralee. These parcels of land have the potential to be better connected, activated and possibly expanded to become an employment generating precinct. Considering topography and ecological constraints will be a key driver in determining appropriate land use for Environa, whilst also ensuring there is sufficient infrastructure to support the desired mixture of future business, innovation and industrial uses.

The South Jerrabomberra RJP can complement existing industrial development within the adjacent suburb of Hume (ACT), where existing industrial land is highly sought after. It is expected that the demand for industrial land will continue to increase as housing development pressures extend to the industrial and bulky goods areas in Fyshwick (ACT).

The proximity of the area to new residential development in South Tralee, established suburbs in Jerrabomberra, the Department of Defence Headquarters Joint Operations Command (HQJOC), Brindabella Business Park, Canberra Airport, other Defence holdings within Canberra and the servicing of the Site by the secure ICON-GNS cable presents an opportunity to capitalise on the local skilled workforce to support highly skilled employment, research and development.

2.4 Key Attributes and Challenges

Error! Reference source not found. provides a high level analysis of the key attributes and challenges of the South Jerrabomberra RJP, and context of adjoining development.

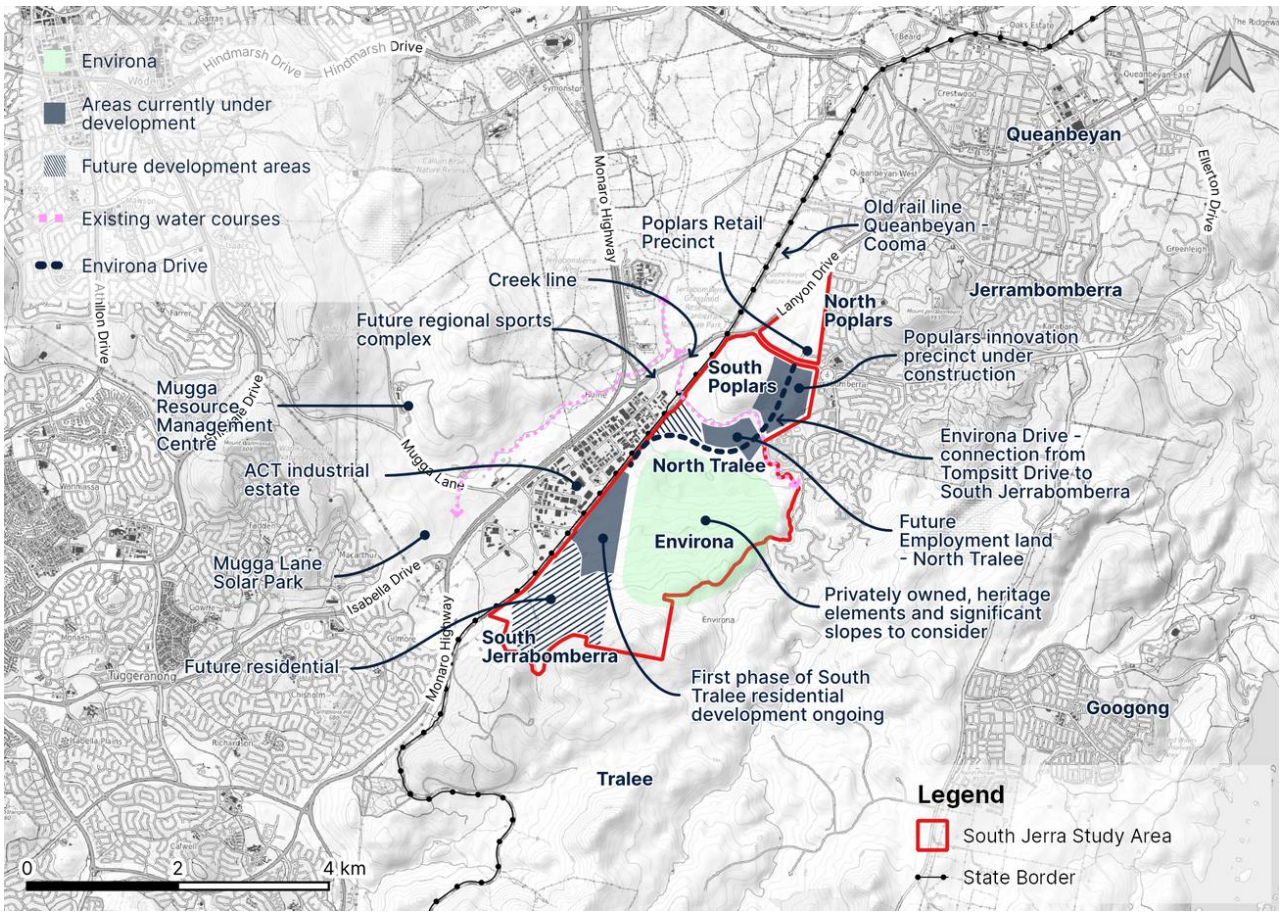

Figure 2–2 | Key attributes of South Jerrabomberra RJP

2.4.1 Future Anticipated Demand

A key intent of the South Jerrabomberra RJP is to bring together existing master planning into a single vision, to create an identity that drives business agglomeration and ultimately investor certainty. It is anticipated that the following industries will be targeted for the South Jerrabomberra RJP:

- Data centre – noting that DCI Data Centres announced plans in August 2022 to open a 20 megawatt centre in the Poplars Innovation Precinct[1] with associated electricity infrastructure augmentation currently being negotiated with Essential Energy
- Space, Defence and Technology Sub Precinct
- High-technology manufacturing and 3D printing
- Department of Defence
- A comprehensive high school with an enrollment capacity of 500 students, offering STEM subjects
- Innovation Hub
- Regional sports precinct comprising four football pitches (synthetic and grass), two hockey pitches, warm up areas, club rooms and amenities, car parking, indoor basketball courts, netball, futsal and aquatic centre[2].

[1] https://www.canberratimes.com.au/story/7845742/hunger-for-cloud-based-storage-drives-construction-of-new-data-hub-in-jerrabomberra/

[2] https://www.qprc.nsw.gov.au/Major-Works-Projects/Regional-Sports-Complex

- Planned light industrial subdivision development in North Tralee
- Residential development in South Tralee, noting 1,500 dwellings were permitted under the planning proposal which rezoned the area
- Local centre (South Tralee)

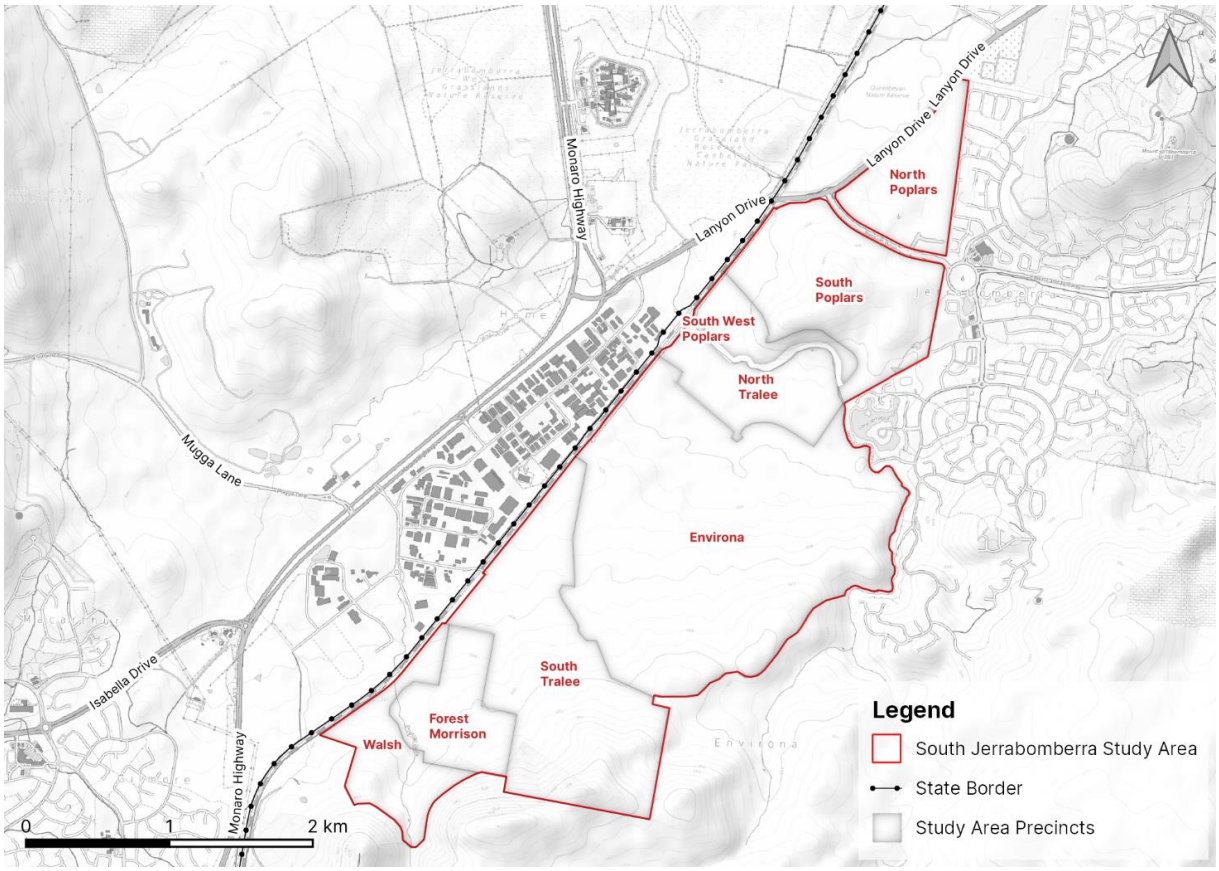

Figure 2–3 | Study Area Precincts

2.5 Observations

Members of the SMEC team attended the South Jerrabomberra RJP site on 8 December 2021 to undertake a site reconnaissance and familiarisation exercise. This section provides some key observations of the local area:

- Railway easement including missing bridge from Sheppard Street, Hume
- Flight path and Airport Noise Exposure Forecast (ANEF) contour over Environa
- Topography of innovation precinct may make large floorplate industrial or high-tech manufacturing uses difficult to accommodate
- Freight connectivity may be difficult given the disused nature of the existing railway line and missing infrastructure
- Low lying area around the Regional Sports Precinct warrants further drainage investigation
- Potential ground water bore application associated with Regional Sports Precinct
- Restricted road connectivity into the ACT

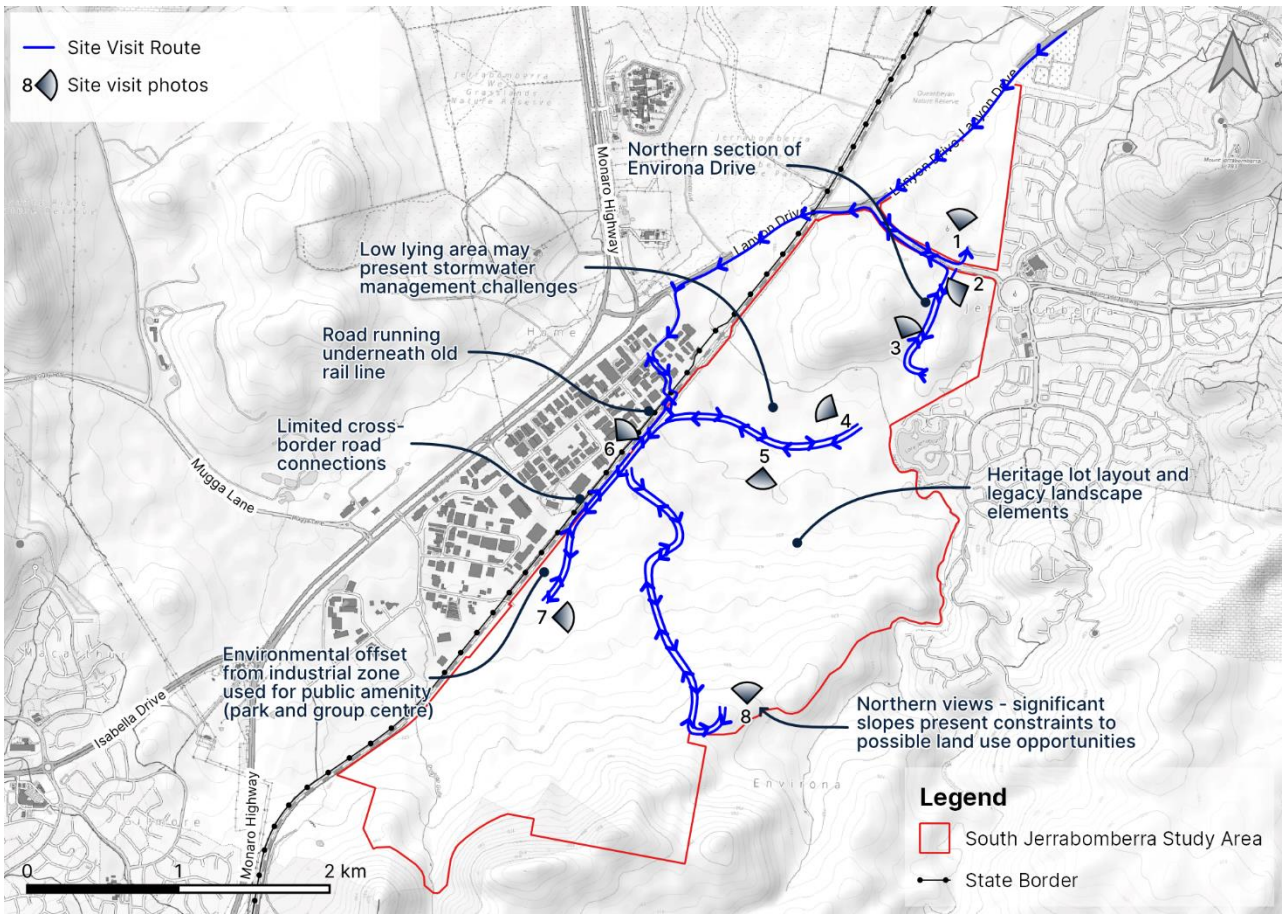

Figure 2–4 | South Jerrabomberra Site Visit

2.6 Images

The following images were captured during the site visit of 8 December 2021. The numbers correlate with the views in Figure 2–4.

Figure 2–5 |Image 1- Looking North from North Poplars Retail Precinct

Figure 2–6 | Image 2 - Looking south along Environa Drive

Figure 2–7 | Image 3 - Looking north from the site of the Innovation Hub

Figure 2–8 | Image 4- Looking across North Tralee future development area

Figure 2–9 | Image 5- Looking south across the privately owned parcels

Figure 2–10 | Image 6-Looking east toward Arnott Street and disused railway corridor

Figure 2–11 | Image 7- Looking toward South Tralee residential subdivision

Figure 2–12 | Image 8 - Elevated View from Environa toward Hume and ACT

3 Precinct Master Plan

3.1 Overview

The South Jerrabomberra RJP Master Plan has been underpinned by the Urban Design work undertaken by Jensen Plus as part of the RJP project. The Master Plan has been developed based on site visits, preliminary technical studies, an options development process and information gathered from stakeholder workshops.

3.2 Vision and Principles

The vision of the South Jerrabomberra RJP is to differentiate itself as an innovation precinct, bringing together new employment and industrial lands specialising in advanced manufacturing, space and defence related industries. The Master Plan has been developed based on the following six principles:

1. Innovative tech-jobs precinct
2. Seamless precinct and cross border connectivity
3. High quality urban design and placemaking
4. Leading sustainability outcomes
5. Be a good neighbour
6. Collaborative cluster

3.3 Land Uses and Sub-Precincts

The South Jerrabomberra RJP Master Plan integrates previous master planning activities progressed by landowners and considers how to best integrate the following areas into one precinct:

- North Poplars
- South Poplars Innovation Precinct
- Environa
- Regional Sports Precinct
- North Tralee
- South Tralee and Forest Morrison

Refer to Figure 2–3 for a delineation of each of these areas within the RJP.

The Master Plan incorporates the following sub-precinct categories:

- Activity Centres Sub Precinct
- Space, Defence and Technology Sub Precinct
- Education Sub Precinct
- Local Business and Industry Sub Precinct
- Residential Sub Precinct
- Rural Landscape Sub Precinct

The Master Plan prepared by Jensen Plus is shown in Figure 3–1

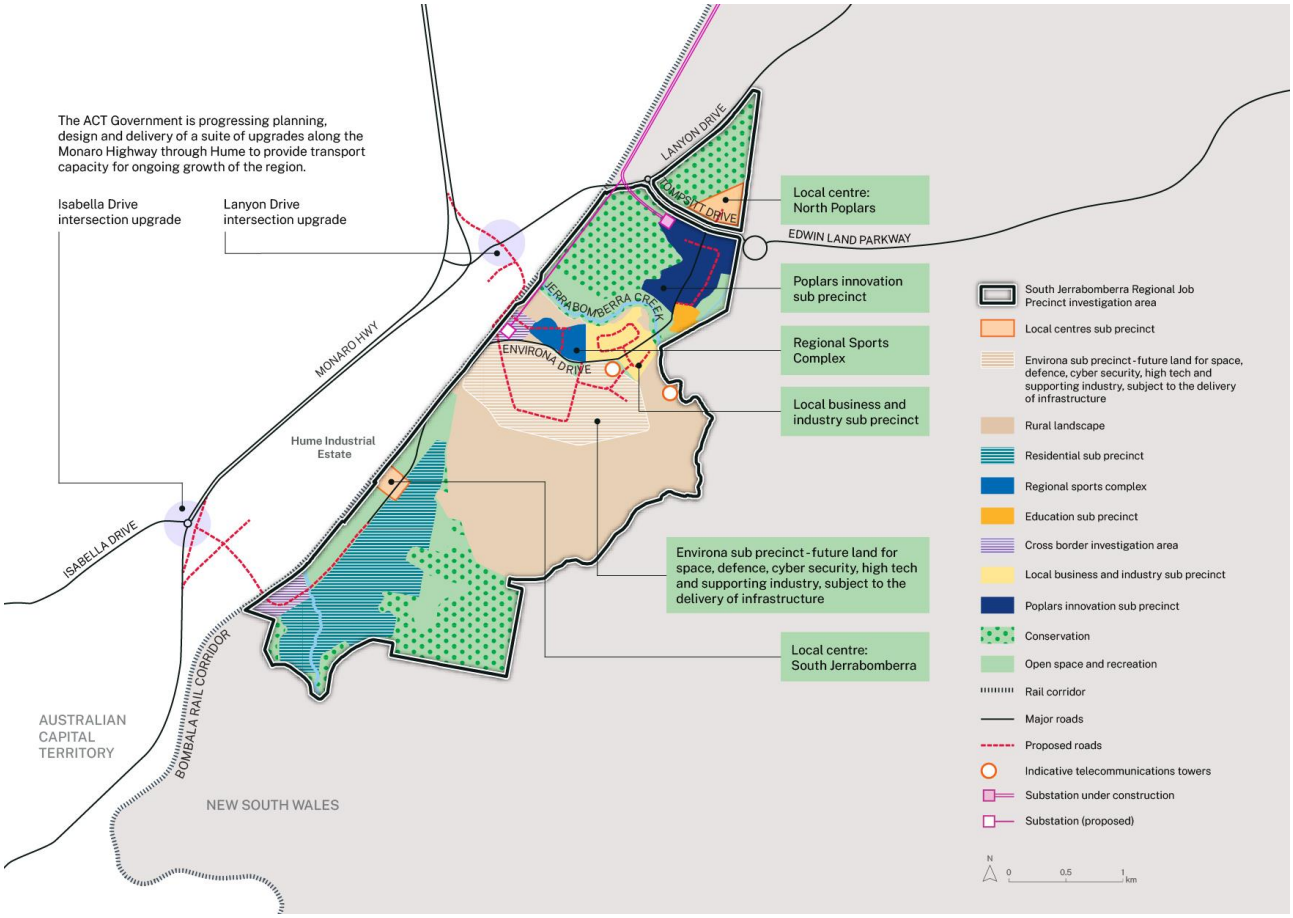

Figure 3–1 | South Jerrabomberra Master Plan (draft) (Source: Jensen Plus 2022)

3.4 Staging

Staging is a critical consideration in planning for 'just in time' delivery of infrastructure to support growth. For the purpose of this assessment, the uptake of development opportunities in the South Jerrabomberra RJP is assumed to comprise four stages. Table 3–1 provides the assumed staged increase in gross floor area as a result of uptake of development opportunities in the RJP.

Table 3–1| Assumed Staging of gross floor area by sub-precinct

Sub-Precinct	Stage 1 2026 (ha)	Stage 2 2031 (ha)	Stage 3 2041 (ha)	Stage 4 Beyond 2041 (ha)	Total (ha)
Conservation	0.66	0	0	0	0.66
Education	5.07	0	0	0	5.07
Activity Centres	3.75	20.68	24.73	13.29	62.44
Business + Industry	17.35	10.97	9.89	35.69	73.90
Open Space	13.16	8.6	0.92	2.45	25.13
Residential	16.08	40.88	35.59	21.15	113.70
Rural	0	0.00	0.00	0.00	0
Space, Defence + Technology	29.41026	9.646185	0.00	0.00	39.06
Total	85.49	90.77	71.12	72.58	319.96

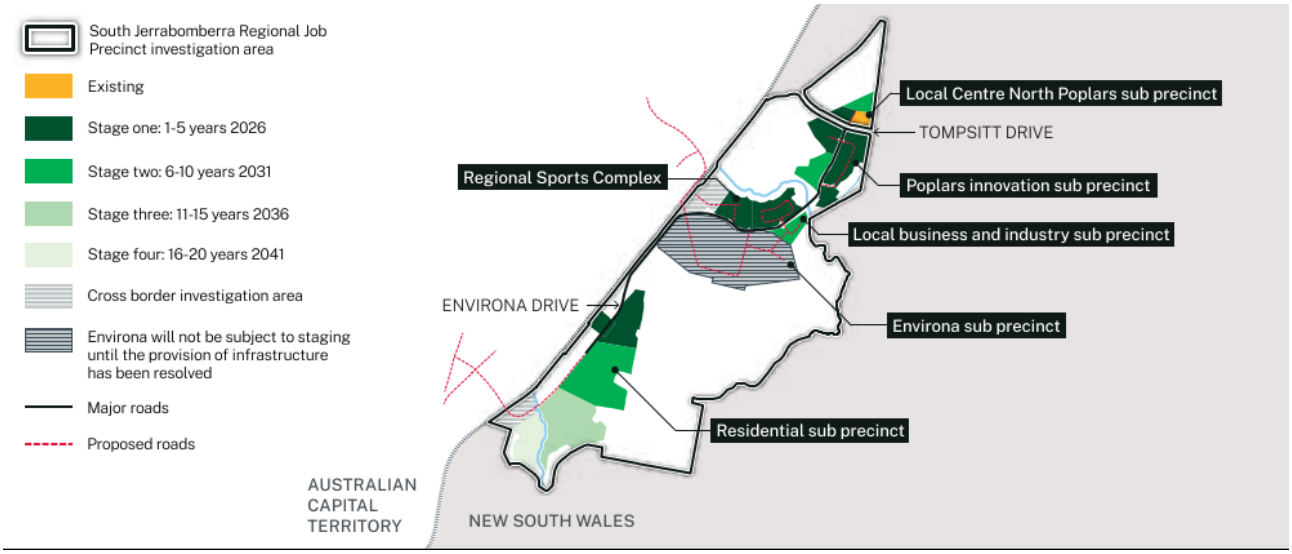

Figure 3–2 | Staging Plan

4 Hydrogeology and Water Quality

4.1 Introduction

The hydrogeology of the South Jerrabomberra RJP provides relevant context for industries that may have high water needs, irrigation needs (such as the Regional Sports Precinct and high school developments) and to understand opportunities for aquifer recharge and IWCM.

This section provides a baseline analysis of ground water and surface water quality and availability to develop an understanding of opportunities and constraints to drive investment. The analysis provides:

- Assessment of surface water and groundwater availability and characteristics
- Current and proposed water demand from target industries
- Review of existing data to understand the hydrogeological conditions relevant to the precinct
- Review of existing data to analyse the ability to use surface water and groundwater
- Consideration of the legislative context of water sharing plans and policies
- Preparation of a high-level analysis of the expected water demand for the main target industries and land uses provided, including capacity for fire services. This is based on best practice examples of business types of the scale that will be expected in the RJP.

4.2 Baseline Context

The Site is underlain by the Silurian aged rocks of the Deakin Volcanics which consist of a shallow marine rhyodacitic ignimbrite and minor volcaniclastic and argillaceous sedimentary rocks. The Mugga Mugga porphyry, a member of the Deakin Volcanics, comprises blue and mauve-grey porphyritic rhyodacite, volcaniclastic and epiclastic tuff with tuffaceous shale and sandstones. There is a small amount of Quaternary aged sediments associated with Jerrabomberra Creek. The Deakin Volcanics are part of the Douro Group which is part of the regional geological province known as the Lachlan Fold Belt.

In the most northern portion of the Site, the northwest-trending Deakin Fault separates the Deakin Volcanics from the Ordovician aged rocks of the State Circle Shale, the Canberra Formation and the Abercrombie Group. These units are regionally folded by the north trending syncline. To the southeast of the Site is the Jerrabomberra Fault and granitic intrusions associated with the Early Devonian Bega Batholith. There is the potential to encounter granite intrusions at depth at the site. To the south of the Site, a northwest-trending syncline is presented.

The hydrogeology at the Site is dominated by fractured rock aquifers. The depth of the water table may be variable. The drainage lines have numerous farm dams which may be spring fed. The Geoscience Australia Portal regional groundwater maps[3] show fractured rock at the site may have yielded greater than 5 L/s. The groundwater quality indicated on the conductivity map ranges from 500 to 1000 µS/cm in the fractured rock, and around Jerrabomberra Creek the alluvial sediments show a conductivity of 2000 µS/cm.

Recharge is dominated by direct rainfall infiltration of the surface. Shallow groundwater flow is topographically driven and flows towards drainage lines and creeks. The deeper regional groundwater flow is anticipated to be towards the north and northwest of the Queanbeyan River. Jerrabomberra is considered an ephemeral drainage line and during wet periods or prolonged rainfall, groundwater will discharge to the Jerrabomberra Creek. During periods of heavy rainfall, the Jerrabomberra Creek may flow and recharge the groundwater system. The elevated hills surrounding the Site provide recharge to the deeper fractured rock aquifer.

[3] http://www.bom.gov.au/water/groundwater/gde/ accessed 9 February 2023

The NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2020) is the only water sharing plan applicable to the Site. It indicates that the Site falls within the Murrumbidgee Region of the Murray-Darling Basin. Extraction of groundwater for use requires a Water Access License (WAL) under the *Water Management Act 2000*.

Groundwater is not being considered as the primary raw water source for this development, due to generally low yields, however groundwater may form part of the overall water supply and management strategy. SMEC understands (anecdotally) that groundwater is being considered as a potential source of non-potable use for the irrigation of sporting fields in the Regional Sports Precinct. Information regarding the potential WAL or testing of groundwater associated with the Regional Sports Precinct has been requested, however due to project timing was unable to be provided.

4.3 Beneficial Use

There are five bores within the Site boundary registered for stock and domestic use, with yields ranging from 0.3 L/s to 1 L/s. Where lithology has been recorded, porphyry or granite and porphyry are shown. The depth to water ranges from 11 m to 25 m below ground surface. Within 5 km of the site, there are 185 registered bores.

The water sharing plan shows the Site is not in proximity to known high-priority groundwater dependent ecosystems (GDE). The Bureau of Meteorology Groundwater Dependent Ecosystem Atlas also shows there are no aquatic or terrestrial groundwater dependent ecosystems at the Site and there are no mapped inflow dependent aquatic or terrestrial ecosystems.

4.4 Influence on Water Quality and Demand

At the Site, there is a potential for a reasonable quality groundwater supply from the fractured rock aquifers with potentially high-yielding bores. The Site currently has limited groundwater beneficial use associated with registered groundwater bores. The register bore reports describe the water as hard. It is noted that whilst there is limited development within the Site, there is potential that contaminants of concern may leach into the soil and shallow groundwater as a result of septic systems associated with existing farm dwellings and farming activities.

5 Water Demand

5.1 Baseline context

It is understood that most of Queanbeyan's water supply comes from sources either owned or controlled by the ACT Government. A cross border Memorandum of Understanding (MOU) on Water Resources was signed in 2006 between the Commonwealth, ACT and NSW Governments and sets out the principles and obligations for water supply and management of water resources in the Cross Border region. The MOU was superseded in 2008 by the Queanbeyan Water Supply Agreement which is a tri-partite agreement between the Commonwealth, NSW and ACT Governments.

The agreement is for a term of 150 years, unless terminated earlier by agreement or if the Googong Dam Lease ends. The agreement provides for the supply of water for the Queanbeyan existing urban area and future approved developments.

Queanbeyan water supply agreements are in place with Icon Water to provide potable water to the Queanbeyan reticulated water network. Water is sourced from the Cotter River catchment sources within the ACT and from Googong Dam, depending on operational issues. A summary of the water supply agreements between licenses is provided in Table 5–1 .

Table 5–1 | Summary of Queanbeyan water supply agreements with Icon Water

Water sharing plan	Flow Rate	Comment
Maximum Demand (Peak – 41 ML/d)		
Supply Point 1	27 ML/d	Under high consumption operating conditions (i.e. both Stromlo and Googong supplies operating), supply from Icon Water to QPRC at rates not exceeding maximum summer demand rate of 41ML/d
Supply Point 2	14 ML/d	
Maximum Demand (Peak – 50 ML/d)		
Supply Point 1	33 ML/d	In the event QPRC require in excess of 41ML/d, Icon Water may supply up to a maximum rate of 50 ML/d, pending availability of water.
Supply Point 2	17 ML/d	
Maximum Off-Peak Daily Demand		
Supply Point 1	33 ML/d	Under normal off-peak conditions (Stromlo only in operation and supply up to 250ML/d), supply from Icon Water to QPRC at a maximum rate of 20 ML/d
Supply Point 2	17 ML/d	

An estimate of the ultimate water supply flows for the South Jerrabomberra RJP Study Area was completed as part of Appendix 3 for *Review of environmental factors, South Jerrabomberra Water and Sewer Servicing Infrastructure Strategy* (Calibre, May 2017) and a summary of the anticipated demands for each development is provided in Table 5–2 below.

Table 5–2 | South Jerrabomberra Sewer Pump Station Staging Summary [Review of Environmental Factors, South Jerrabomberra Water and Sewer Servicing Infrastructure Strategy, Appendix 3 - Table 2-1 (Calibre, May 2017)]

Development	Development Stage	Local Catchment (Ha)	Local ET	Demands (L/s)		
				ADD	PDD	PHD
South Tralee	Stage 1	8.5	135.9	1	2.1	6.5
	Stage 2	23.4	245.7	2.1	4.6	14.8
	Stage 3	25.3	971	3.5	7.7	24.7
	Stage 4	3.5	55.7	0.4	0.9	2.6
	Stage 5	0	0	0	0	0
Morrison	Morrison	33.9	453.1	3.3	7.2	23.2
Forest	Forest	17.9	253.7	1.8	4	13
Walsh	Walsh	38.7	435.6	3.2	7	22.4
Total		**151.2**	**2550.7**	**15.3**	**33.5**	**107.2**

5.2 Opportunities and constraints

The existing tri-partite water supply agreement for Queanbeyan includes allowances for growth within Queanbeyan, whereby the ACT agrees to supply water for future developments in the Queanbeyan LGA under the same conditions as for existing urban areas. The availability of extra water in addition to growth already agreed to within the water supply agreement could represent a constraint on the types of industries to be included within the Master Plan. However, the potential uses identified in the Master Plan for currently un-serviced land in Environa are expected to have a relatively low demand for potable water (based on Defence, cyber security and business park type uses).

5.3 Anticipated demand

The composition of industries that have been targeted for the South Jerrabomberra RJP provide few opportunities for the use of non-potable water supplies. There is potentially an opportunity for the use of harvested rainwater (collected from roofs via rainwater tanks) by businesses for washdown areas (light industry) and flushing of toilets. Given the limited demand for non-potable sources within the precinct, and the lack of infrastructure for recycled water in the precinct, it is highly unlikely that the construction of a third pipe or treated effluent reuse scheme would be economically feasible in this area. Moreover, given that the existing Queanbeyan Sewer Treatment Plant (STP) is permitted to discharge 100% of treated effluent into the Molonglo river, there is little financial incentive for QPRC to establish such a scheme.

6 Recommended Strategy

6.1 Overview

This section provides a summary of the recommended hydrogeology, water quality and IWCM strategy to support the South Jerrabomberra RJP Master Plan. This strategy is intended to be aspirational and should be flexible to the changing needs of the RJP as development progresses and land use composition changes.

Options for IWCM are particularly tied to the demand for recycled water from industries and irrigation within the precinct. It is understood that the Regional Spots Precinct proposes to potentially utilise bore water for irrigation, and as such, it may be considered appropriate to replenish supplies through a managed aquifer recharge scheme using rainwater captured from roofs.

The spectrum of options being considered to support the Master Plan are outlined in the following sections of this report. These options are able to be staged in accordance with the Master Plan with each stage building upon infrastructure delivered in earlier stages. This overcomes the need for overcapitalisation of unnecessary infrastructure investment prior to uptake of land and operation of industries.

6.2 Integrated Water Cycle Management

6.2.1 Introduction

A primary objective of the IWCM for the South Jerrabomberra RJP is ensuring the sustainability and viability of the current planned subdivisions to align with the anticipated future growth of the RJP investigation area. There should also be further investigations on the viability and reliability of available water sources for inclusion within the eventual IWCM, with the objective of targeting a water balance for the RJP investigation area.

The IWCM strategy developed in this Master Plan has considered resiliency and economic reasoning and integrates with stormwater, wastewater, recycled water, potable water, drainage systems and riparian zones to be managed for Jerrabomberra Creek.

Further refinements will be required when considering elements in detailed engineering stages. The information provided is high level in nature and provides an indication of potential locations and land requirements for integrated water servicing infrastructure, in particular storm water elements. The main objectives are to provide an integrated water system to augment the sustainability principles.

6.2.2 Recycled Water Opportunities

There is a limited demand for non-potable water use within the precinct, and moreover there is a lack of infrastructure to supply recycled water in the precinct. This would require the construction of a third pipe or treated effluent reuse scheme. We raise concern with the economic feasibility of introducing a third pipe in this area. Additionally, given that the existing Queanbeyan STP is permitted to discharge 100% of treated effluent into the Molonglo river, there is little financial incentive for QPRC to establish such a scheme. This can be considered as a potential effluent water source for reuse if an industry moves into the RJP with substantial demand for recycled water, however, would be coupled with considerable infrastructure investment.

6.2.3 Stormwater Harvesting and Reuse

The proposed land use within the precinct consist of large impervious surfaces, comprising industrial roof areas, car park and hardstand areas. There is a potential to collect and store surface runoff from these impervious areas for on-site reuse.

As part of the IWCM, it is proposed to harvest surface runoff from all roof areas into on-site roof water tank (RWT), for reuse within properties for non-potable uses such as wash down and toilet flushing. There is also a potential

for reuse of the harvested water to augment water supply for the industrial use. The strategies of such use shall be developed by individual industries.

It is recommended that Council update their Development Control Plan for the precinct to make on-site rainwater tanks, and reuse of the collected water for non-potable uses, a mandatory requirement for all new developments.

Our assessment of potential bulk stormwater harvesting volumes is broadly based on the land uses and zones adopted in the Master Plan, making assumptions around warehouse building footprints. This should be considered and modelled further in the future once there is more certainty around subdivision lot layouts and building scales.

6.2.3.1 Non-Potable Water Demand for Stormwater reuse

Non-potable water demands were estimated for the commercial and industrial areas of the Master Plan based on internal use – 0.1kL/day/ 1000 m^2, and external use – 20kL/yr/1000 m^2 (Source: Using Water NSW Standard- 2019 June, Model for Urban Stormwater Improvement Conceptualisation (MUSIC) in Sydney Drinking Water Catchment). There is no established industrial target for the harvesting of rainwater; but targets can be as high as 80% non-potable demand for business and industrial development. The water harvest for stormwater reuse is based on the ultimate development scenario.

The typical non-potable water demands based on internal and external typical demands and the Master Plan land uses are provided in Table 6–1.

Table 6–1 | Land Use and Water Demands

Land use	Roof Area (ha)	Road Area (ha)	Total Pervious area (ha)	Internal use (kL/day)	External Use (kL/yr)
SP-STG 1	5.001	2.667	1.96	5.001	392.284
SP-STG 2	8.062	4.300	3.16	8.062	632.444
SP-STG 3	3.768	2.010	1.48	3.768	295.593
EV	17.718	9.450	6.95	17.718	1389.876
NT+IP	4.540	5.448	9.40	4.540	1879.560
EB/IP	10.573	12.687	21.89	10.573	4377.067
ST/LBH	0.788	0.946	1.63	0.788	326.232
RS	8.427	5.556	5.98	8.427	1195.466
RS 2031	18.792	12.390	13.33	18.792	2665.915
RS 2036	17.199	11.340	12.20	17.199	2439.990
RS 2041	7.735	5.100	5.49	7.735	1097.350

Sample water budgeting and harvesting estimates were carried on “6 mins rainfall data” from a representative year – 1991 (Canberra). Note that the results from this 6 min rainfall data are similar to the result from daily rainfall record data from the Queanbeyan Bowling Club (Station 070072 – year 1870 – year 2019). The total water yield from the entire land use and the roof area (assumed collection from 100% roof area) are shown in Table 6–2.

Table 6–2 | Potential total water yield using representative rainfall data

Land use	Total Stormwater Yield (ML/yr)	Potential storm water yield from Roof Collection (ML/yr)
SP-STG 1	33.34	24.45
SP-STG 2	53.7	39.42
SP-STG 3	25.06	18.42
EV	118	86.63
NT+IP	45.58	22.2
EB/IP	105.93	51.69
ST/LBH	7.92	3.85

Land use	Total Stormwater Yield (ML/yr)	Potential storm water yield from Roof Collection (ML/yr)
RS	61.44	41.2
RS 2031	136.87	91.87
RS 2036	125.58	84.09
RS 2041	56.66	37.82

6.2.3.2 Storm Water Harvesting Strategy

The proposed storm water harvesting strategy is limited to collection of rainwater from roofed area (assumes 100% of roof), which will be used for various non-potable uses as required. Based on non-potable water for internal and external uses, rainwater tanks (RWT) sized to meet a maximum of 70% of demand would be required to be cost effective. The following sizing of the water tanks are proposed along with their serviceability for the Master Plan.

Table 6–3 | Proposed rainwater tank sizing to support stormwater harvesting strategy

Land use	RWT size (m3)	Water used demand (kL/yr)	Water reuse (kL/yr)	% Demand met
SP-STG 1	60	5.001	392.284	74.74
SP-STG 2	100	8.062	632.444	76.21
SP-STG 3	50	3.768	295.593	78.55
EV	220	17.718	1389.876	76.54
NT+IP	120	4.540	1879.560	75.03
EB/IP	300	10.573	4377.067	77.57
ST/LBH	20	0.788	326.232	73.53
RS	130	8.427	1195.466	77.39
RS 2031	300	18.792	2665.915	78.81
RS 2036	250	17.199	2439.990	75.68
RS 2041	100	7.735	1097.350	70.95

6.2.3.3 Water Quality Strategy

The proposed Master Plan has considered conventional bioretention basins to treat runoff at each land use area to ensure the water quality objectives are met downstream in Jerrabomberra Creek which discharges into Molonglo River.

The Water Quality objectives considered in this Master Plan are typical values generally considered in urban development. The following values are adopted to ensure the water quality in the tributaries and the downstream waterways is maintained:

- 95% removal of Gross Pollutants
- 85% removal of Total Suspended Solids
- 65% removal of Total Phosphorous
- 45% removal of Total Nitrogen

Based on the current Master Plan, a total bioretention basin of 7,935m^2 of filter area is required as a minimum to meet the removal targets. The bioretention strategy is provided in Table 6–4. The bioretention systems should be located on the lowest part of the terrain and near riparian areas where possible.

Table 6–4| Bioretention Basin Strategy

Land use	Roof Area (ha)	Road Area (ha)	Total Pervious area (ha)	Total Area (ha)	Bioretention (m^2)
SP-STG 1	5.001	2.667	1.96	8.89	680
SP-STG 2	8.062	4.300	3.16	14.33	1360
SP-STG 3	3.768	2.010	1.48	6.70	680
EV	17.718	9.450	6.95	31.50	1530.00
NT+IP	4.540	5.448	9.40	18.16	680.00
EB/IP	10.573	12.687	21.89	42.29	1275.00
ST/LBH	0.788	0.946	1.63	3.15	102.00
RS	8.427	5.556	5.98	18.52	765.00
RS 2031	18.792	12.390	13.33	41.30	1870.00
RS 2036	17.199	11.340	12.20	37.80	1700.00
RS 2041	7.735	5.100	5.49	17.00	850.00

6.2.3.4 Spill Management Strategy

Mitigation of spills and contamination of ground water from industry related pollutants (oil, chemicals) shall be considered separately during the later design stages of development approvals. Water quality systems shall be designed to include containment of contaminated water from various storm events and fire events in adherence to environmental policies and guidelines.

6.2.3.5 Water Quantity Management Strategy

The Water Quantity Management Strategy uses Onsite Detention (OSD) Storages distributed at various land use zones. A total storage 58,664m^3 has been proposed, considering the Master Planned area.

The OSD estimates are based on DRAINS model for the 1%AEP storm event.

Table 6–5 | Hydraulic Design for Proposed Onsite Detention strategy for the RJP Master Plan

Land use	Roof Area (ha)	Road Area (ha)	Total Pervious area (ha)	Total Area (ha)	Imperviousness	OSD Vol Proposed (m^3)	OSD Volume Required (m^3)	Outlet Pipe Size (mm)	No of Identical parallel pipes
SP-STG 1	5.001	2.667	1.96	8.89	0.779	1987	1701	900	1
SP-STG 2	8.062	4.300	3.16	14.33	0.779	4586	3039	1050	2
SP-STG 3	3.768	2.010	1.48	6.70	0.779	1361	1113	825	1
EV	17.718	9.450	6.95	31.50	0.779	6919	6885	1050	2
NT+IP	4.540	5.448	9.40	18.16	0.483	4586	3288	1050	2
EB/IP	10.573	12.687	21.89	42.29	0.483	9732	8131	1200	3
ST/LBH	0.788	0.946	1.63	3.15	0.483	854	401	825	1
RS	8.427	5.556	5.98	18.52	0.667	4586	3525	1050	2
RS 2031	18.792	12.390	13.33	41.30	0.667	9732	7892	1050	4
RS 2036	17.199	11.340	12.20	37.80	0.667	9732	7388	1050	4
RS 2041	7.735	5.100	5.49	17.00	0.667	4586	3299	1050	2

Table 6–6 | Civil Design for Proposed Onsite Detention strategy for the RJP Master Plan

Land use	Total Area (ha)	Length (m)	Width (m)	Height (m)	Surface Land Area (m^2)	OSD Volume Proposed (m^3)
SP-STG 1	8.89	70	2.667	1.5	3150	3300
SP-STG 2	14.33	100	4.300	1.5	6000	6900
SP-STG 3	6.70	60	2.010	1.5	2400	2400
EV	31.50	120	9.450	1.5	8400	10050
NT+IP	18.16	100	5.448	1.5	6000	6900
EB/IP	42.29	140	12.687	1.5	11200	13800
ST/LBH	3.15	50	0.946	1.5	1750	1650
RS	18.52	100	5.556	1.5	6000	6900
RS 2031	41.30	140	12.390	1.5	11200	13800
RS 2036	37.80	140	11.340	1.5	11200	13800
RS 2041	17.00	100	5.100	1.5	6000	6900

OSD basins should be designed into the Master Plan at the lowest part of the terrain for drainage and overland flow management, and preferably near the riparian fringes.

6.2.3.6 Flood Management Strategy

There is no comprehensive flood management study for the entire RJP site as such. A flood study and riparian corridor assessment Jerrabomberra Creek was prepared by Brown Consulting (now Calibre Consulting) in January 2010 to undertake an investigation of the flood behaviour of Jerrabomberra Creek at Tralee for the proposed Tralee North and The Poplars development areas. The additional flood modelling was undertaken in 2016 by Calibre to assist with the re-zoning application for the site, which incorporated the recommendations of a peer review of the Brown Consulting 2010 study by WMA Water (December 2015).

Furthermore, WMA water reviewed the Calibre Study (2016) in September 2016 by on behalf of Queanbeyan-Palerang Regional Council. The review suggested hydraulic model have several issues and not suitable for determining finished floor levels for residential properties and does not meet the NSW Floodplain Management Program. A flood map is shown in Figure 6-1 as a 1% AEP flood planning level with 0.5 m freeboard.

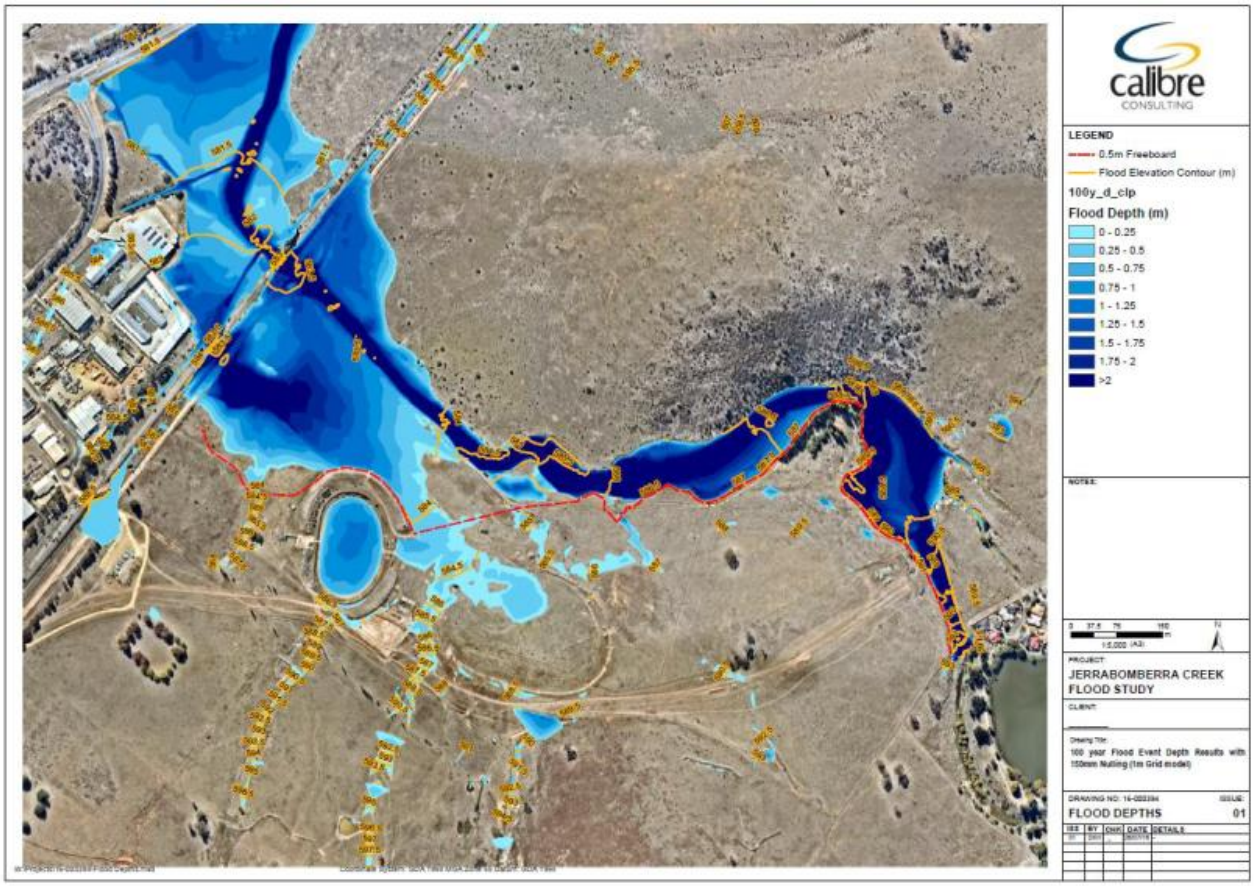

Figure 6–1 | Calibre Study (2016) FPA – 100 year ARI Event plus 0.5 m

The results of the flood mapping are shown on Figure 6–1 have been marked with a red line indicating the area of main channel flooding. Areas to the north (creek side) are recommended to be zoned as drainage area, with areas to the south of the red lines to be zoned for land development, with flows to be managed by the trunk drainage network once developed. It is recommended that for further studies, a more detailed hydraulic model be derived that addresses the issues, and the model should be re-calibrated if possible.

The information in the flood study is inadequate and further detailed flood assessment is recommended to consider the current hydrology and particularly addressing resilience in design for the ultimate Master Plan and determining the flood planning levels. The flood study shall provide a flood management plan along with the flood hazards and emergency management for the proposed RJP development.

The study should include hydrologic assessment using the ARR 2019 method. The 2019 approach uses a revised rainfall and ensembled method as opposed to that used in the 2010 and 2015 studies, and which accounts for climatic changes expected in the future.

6.3 Managed Aquifer Recharge

The impact of development of the Site, due to land use change from vacant land to more impervious surfaces, will reduce recharge to the groundwater system. In accordance with the NSW Aquifer Interference Policy (2012), the Site's impact to groundwater will need to be assessed for whether the planned activities are likely to have greater than minimal impact.

The deeper fractured rock aquifers may be a suitable source of raw water for small demand applications such as the irrigation of playing fields and open spaces as well as for supplementing emergency firefighting supplies. The groundwater table is vulnerable to land use change which reduces recharge opportunities, and changes to long-term weather conditions. Reduction in recharge may be offset through managed aquifer recharge schemes and precinct designs (such as undertaken in the nearby Googong Township) that encompass more pervious surfaces for surface water and stormwater runoff infiltration.

It is understood that a non-potable water supply, from groundwater extraction, is being explored for the Regional Sports Precinct in the low-lying land around Jerrabomberra Creek. A drought proof supply would require targeting of the deeper fractured rock aquifer rather than the shallow groundwater table. It is understood that a non-potable groundwater supply of around 3 L/s to 5 L/s would be needed for the Regional Sports Precinct to use for irrigation purposes. If desired, an on-site storage tank could be provided for groundwater to be used as part of the firefighting supply for the RJP.

Shallow recharge schemes are constrained by the depth to the water table and the volumes of water to be infiltrated. Excessive recharge in a small area can lead to mounding, potentially around the low-lying land of Jerrabomberra Creek, and dryland salinity impacts. Using vegetated bio-swales for managing surface water runoff, rather than concrete-lined structures to a retention basin, increases the available area for infiltration and distributes the infiltration over a wider area. Bio-swales are also beneficial in managing some contaminants of concern.

There is an opportunity at this site to consider recharge in larger volumes to the deeper fractured rock aquifers. Reinjection of captured water into the deeper fractured rock aquifers provides offset to losses from land-use change and supports small-scale extraction down-gradient. With extraction planned at the Regional Sports Precinct, up-gradient recharge within the Environa land parcel should be considered. Recharge up-gradient may offset the extraction resulting in a limited net impact to the groundwater system.

The elevated areas of the Environa parcel of the Site could be a potential recharge location, providing a driving head towards the extraction point. Stormwater runoff collected through the Site drainage system presents water quality issues, and limited opportunities for reuse unless there is a wastewater treatment plant (WTP) to improve its quality. However, rainwater collected from rooftops is likely to have fewer quality issues and require less treatment prior to reuse. Rainwater collection systems with a reinjection bore may be viable across multiple parts of the Site. Tank storage of groundwater could be used as a firefighting supply for the precinct, reducing potable water demand. Figure 6–2 provides a high-level conceptualisation of rainwater capture, aquifer recharge and potential non-potable extraction.

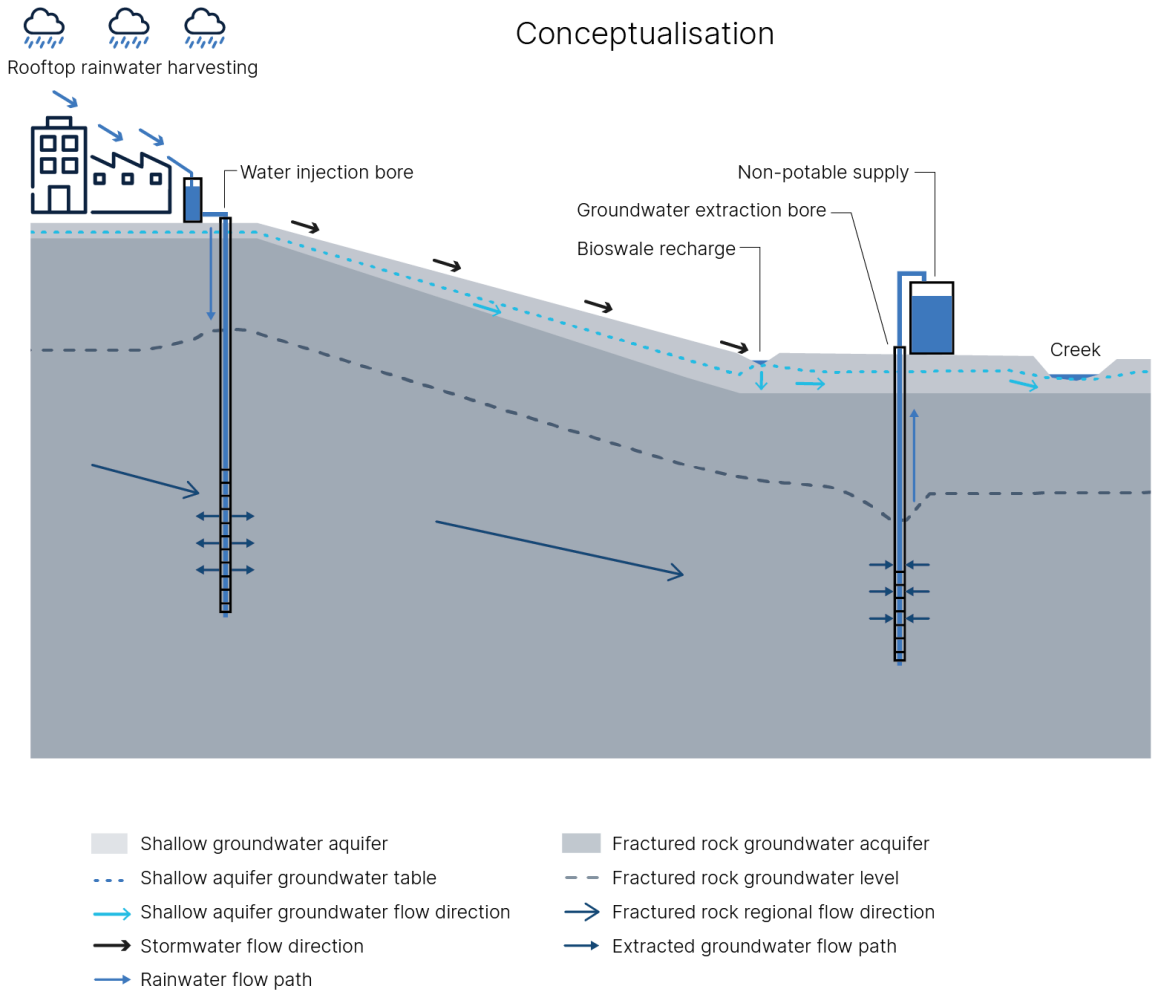

Figure 6–2 | High level conceptualisation of managed aquifer recharge and water integration in the South Jerrabomberra RJP

7 Funding Recommendations

There are various funding mechanisms to support the cost effective, equitable and timely delivery of public infrastructure associated with growth. This section considers the potential to update the existing infrastructure contributions plans and other mechanisms such as Special Infrastructure Contribution (SIC) levies and Voluntary Planning Agreements (VPAs).

Development contributions are payments made by developers to help fund public infrastructure that is needed as a result of development. Development contributions are a key source of funding for NSW councils and state agencies.

Figure 7–1 | Types of infrastructure funded through development contributions in NSW (source DPIE, 2021)

Sections 7.11 and 7.12 of the Environmental Planning and Assessment Act 1979 (EP&A Act) permit the collection of local development contributions by councils, in accordance with local infrastructure plans. These plans cover the construction of public infrastructure that will ultimately be owned by the local council such as open space, community facilities and stormwater upgrades. Funding for State infrastructure is levied through Special Infrastructure Contributions (under Clause 7.24 of the EP&A Act) or through planning agreements. In addition, Section 64 of the Local Government Act 1993 allows a Council to levy fees for water, sewer and stormwater infrastructure where the Council has a Development Servicing Plan. Section 64 contributions only apply where the Council is the water supply authority.

The South Jerrabomberra Local Infrastructure Contributions Plan 2018 levies development contributions under Section 7.11 of the EP&A Act for local infrastructure associated with previously anticipated development in Poplars, Environa, North and South Tralee, Forest Morrison and Walsh. The Jerrabomberra Innovation Precinct Infrastructure Planning Agreement 2020 is also active, and is a Voluntary Planning Agreement which was reached between QPRC, Village Building Company and Poplars Development. The South Tralee Essential Infrastructure Planning Agreement is a historical agreement that supported the provision of sewer and water infrastructure to initially service the region.

Given that the growth anticipated by the RJP Master Plan is much greater than that previously contemplated in the South Jerrabomberra Local Infrastructure Contributions Plan, it is recommended that an updated development contributions plan be prepared by QPRC. This would cover regional WSUD features, with onsite WSUD features (e.g., bioretention swales within carparks) funded by developers and maintained by landowners through

development provisions such as a Section 88B Restrictions (Positive Covenants) that can be required as a condition of development consents.

In order to ensure future developments in the precinct prioritise rainwater reuse, and reduce potable demand for non-potable uses, it is recommended that a Development Control Plan (DCP) clause be developed to require:

> *Future development must include on-site provision of a rainwater tank collecting 100% of runoff from roofed area. The rainwater tank must be plumbed and connected to washdown facilities, any landscape irrigation and toilets within the development.*

The DCP controls should also be updated to require WSUD across all scales of industrial development. This will ensure that the desired water quality values of receiving waterways are met, as follows:

- 95% removal of Gross Pollutants
- 85% removal of Total Suspended Solids
- 65% removal of Total Phosphorous
- 45% removal of Total Nitrogen

Development controls should be drafted into Council's DCP requiring future commercial and industrial subdivisions to be accompanied by MUSIC modelling and WSUD strategies, to meet the above targets through appropriately designed WSUD features (such as bioretention basins or raingardens) within the future development footprint. This will share the responsibility of developing and maintaining water quality between future tenants/owners of the precinct and Council.

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