Member of the Surbana Jurong Group

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Albury Regional Job Precinct

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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 Regional Job Precincts (RJP) program seeks to overcome market failure in regional settings, where intervention can help to bring together access to raw materials, transportation networks and a skilled workforce; to 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 regions, and support job growth in the Albury RJP.

The Albury RJP investigation area is a 1,190 ha area of industrial and undeveloped land in Ettamogah, north of Albury. A master plan has been prepared by Ethos Urban 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 over the next 30+ years, and sees a variety of traditional general industrial, manufacturing, food and beverage, warehousing, freight and logistics uses.

The objective of this report is to disseminate a technical assessment of the regional hydrogeology, water quality and water demand of the Albury RJP into plain English. This report integrates initial findings from the baseline assessments undertaken for the area to provide an understanding of current conditions. The report then assesses the impacts that the master plan may have on existing infrastructure within the RJP, proposing options for upgrades to support the intensification of use associated with the RJP.

Whilst there are two registered bores within the RJP investigation area and 63 within 5km of the site, groundwater is not being considered as the primary raw water source to support the industrial intensification of the RJP. Groundwater supplies in the area are unlikely to have sufficient yields to meet the delivery demand for a large primary raw water supply. As a result, water demand from industry will need to be met through potable water (and potentially raw water) from the existing Albury City Council (ACC) water entitlement.

Raw water for Albury is sourced from the Murray River and in total ACC holds ten Water Access Licences (WAL) with a total entitlement of 13,237 ML/year. Of this entitlement, 12,345 ML/year is associated with a Local Water Utility License, which is supplemented by several High Security licenses. The Albury City IWCM Issues Paper (NSW PWA, 2021) confirms that the Council’s licensed town water entitlement is expected to be sufficient to meet the town water dry year extraction until around 2054 (or 2049 if higher levels of extraction are sought due to climate change).

Ultimately, the availability of excess water allocations may limit the types of industries that can be attracted to the RJP. The Albury Regional Job Precinct Utilities Technical Report (2022) prepared by SMEC has factored demand from specific wet industries (such as beverage manufacturing and an abattoir) into the demand analysis and confirms a series of infrastructure upgrades that will be required to support growth in the RJP. . Recommendations include upgrades to the existing Waterview Waste Water Treatment Plant (WWTP), the construction of a new Northern WWTP and significant upgrades to trunk infrastructure to service the anticipated potable water demand from industries and residential development.

To manage the significant additional volume of treated effluent from the new Northern WWTP, it is recommended that a new approximately 27 ha wetland be established. A suggestion is made for the reuse of the existing Ettamogah Forest Dam, which was used for the management of process water associated with the former paper mill, as a potential site for the establishment of the new wetland.

This report also recommends the establishment of a managed aquifer recharge scheme, using community bores throughout the RJP, where collected roof water and potentially treated effluent from the new WWTP can be reinjected into the water table to supplement regional groundwater supplies and establish a local alternative non-potable source. This option algins well with the objectives of the draft Murray Regional Water Strategy (DPE, 2022) which seek to improve water security and resilience within the catchment.

This report also recommends a series of development controls be adopted through the preparation of a site specific Development Control Plan for the Albury Regional Job Precinct, including mandatory requirement for on-

site rainwater tanks and reticulation for non-potable uses. Water quality and water quantity controls should also be imposed on both subdivisions and industrial / commercial developments within the RJP, requiring a Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to be undertaken to meet established targets for the removal of gross pollutants, suspended solids, Phosphorous and Nitrogen from run off.

This report also recommends a series of funding mechanisms be established within a Section 7.11 Development Contributions Plan and Section 63 Development Servicing Plan. There may be opportunity to apply for grant funding to undertake further hydrogeological studies into the managed aquifer recharge system, given that it could potentially have positive impacts on water security and resilience across the region.

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1 Introduction

The intent of the Regional Job Precincts (RJP) program is to overcome market failure in regional settings, where intervention can help to bring together access to raw materials, transportation networks and a skilled workforce; to 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 regions, and support job growth.

The Albury RJP is a 1,190 ha area of industrial and undeveloped land in Ettamogah, north of Albury. The Albury RJP investigation area is adjacent to the Melbourne to Sydney rail corridor and the Hume Highway, which provide excellent locational attributes to drive investment in freight and logistics, and access to national and international markets.

This report provides an assessment of existing (baseline) conditions relating to hydrogeology, water demand and integrated water cycle management in the Albury RJP investigation area and considers how existing infrastructure within the region may need to be augmented to support the growth anticipated by the master plan. The recommended upgrades are provided to coincide with the anticipated sequencing and staging of development as envisaged in the master plan.

This technical report provides relevant context for industries that may have high water needs, such as food and beverage manufacturing, paper recycling/manufacture, textiles, and gas/hydrogen production. Paper manufacturing is a water intensive use, and the existing paper mill (formerly owned and operated by Norske Skog, now owned by Visy) has a bore and water reuse / recharge system in place including on-site treatment and reuse for irrigation. Excess capacity of this private bore has historically been shared with Albury City Council (ACC). There are limited additional opportunities for access to productive ground water bores to service water demand that may be created by industries in the RJP investigation area. There may be opportunity for raw water access if industry needs require it, however this may not provide the security of yield that may be required for operation during periods of low rainfall or drought.

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 Integrated Water Cycle Management (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 use
- 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.

SMEC has been engaged by DRNSW to prepare an assessment of infrastructure needs to help attract new businesses to the Albury region, and support job growth. With the existing presence of the Ettamogah Rail Hub, existing Visy-owned paper mill and early movers into the NEXUS Industrial Subdivision such as Circular Plastics, the Albury region shows enormous potential for regional growth and investment.

The focus of this report is on the Hydrogeology, water quality and water demand of the Albury RJP investigation area. This report includes an assessment of current (baseline) conditions and tests the master plan prepared by Ethos Urban 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 Albury 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.

This report should be read in conjunction with the Albury Regional Job Precinct Infrastructure Assessment – Utilities Technical Report prepared by SMEC (2022), which details the water and sewer infrastructure that will be needed to support development envisaged by the master plan.

2.3 Project Location and key features

The Albury RJP investigation area is a 1,190 ha approximately 10km north of the Albury CBD. The site surrounds the Ettamogah Rail Hub and the existing “NEXUS” industrial subdivision. Albury is located on the banks of the Murray River in the Riverina region of south-eastern NSW, approximately 300km north-east of Melbourne and 570km south-west of Sydney.

The Albury RJP investigation area is adjacent to the Melbourne to Sydney rail corridor, the Hume Highway and Albury Airport, which provide excellent locational attributes to drive investment in freight and logistics, and access to national and international markets (Figure 2-1). Proximity to productive agricultural land in the Riverina Murray region also provides a key attribute to support growth of the area for food manufacturing industries, freight and logistics.

Albury has a current population of 55,030 residents (ABS, 2021), and is forecasted to grow by another 13,074 residents by 2036 (Local Strategic Planning Statement, Albury City Council, 2020). Several new residential subdivisions are occurring south and east of the site, to accommodate the urban expansion of Albury. Land to the north and west of the Albury RJP investigation area is predominantly rural with some large lot residential development.

We understand that $32M in funding was successfully obtained for the NEXUS Industrial Precinct Stage 1 from ACC, and the NSW and Commonwealth Governments. This has been used to fund roadworks, including the $15.8M upgrade of the Davey Road interchange, gas, water and sewer augmentation, and to undertake the first stages of the NEXUS subdivision.

The location of the Albury RJP investigation area is provided in Figure 2-1, with reference to existing developed land within the region.

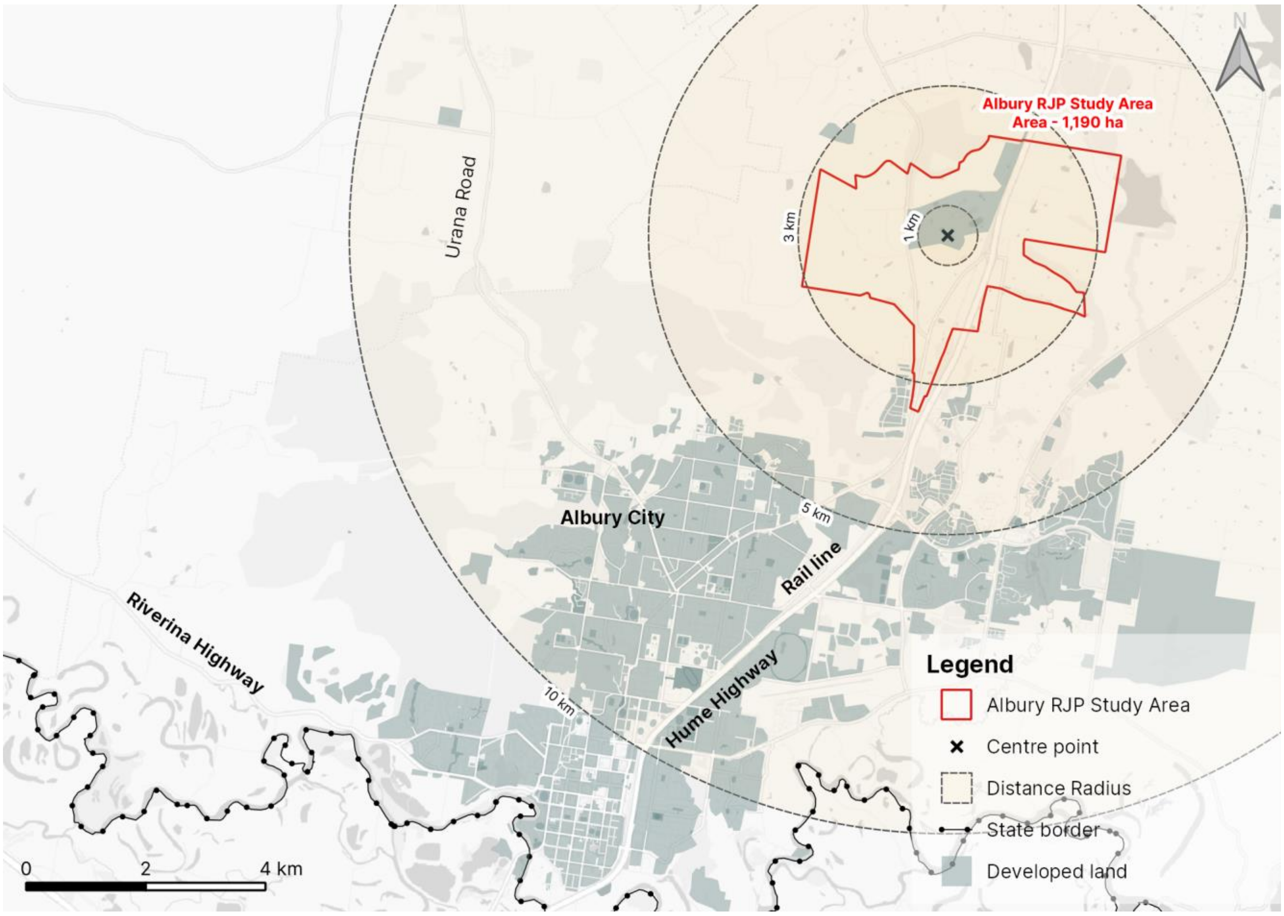

Figure 2-1 | Location diagram of study area and its proximity to Albury

The Albury RJP investigation area also contains the former Norske Skog paper mill, which is currently owned by Visy Industries. It is our understanding that the paper mill ceased operation in September 2019. The paper mill contains a rail siding and has direct vehicular access to Hume Highway via Wagga Road. Visy is a significant landowner within the RJP investigation area, as the paper mill previously operated a water reuse scheme with several fields containing centre pivots nearby, some vacant and some currently occupied by lucerne crops.

The existing presence of the paper mill and rail siding was the driving factor for the establishment of the Ettamogah Rail Hub (ERH) in 2009. The ERH primarily manages import and export of goods through the Port of Melbourne and is operated as a Common User Terminal, which allows multiple rail and trucking companies to use the siding. The ERH has a fleet of trucks including a polymer vehicle enabling the movement of raw materials to and from the region. The ERH manages a range of raw materials and transport of goods for local pet food operators and companies such as Asahi with the potential to expand into other industries including recycling and e-waste.

Overall Forge, an open die forge, occupies a site to the south of the Visy papermill with a frontage to Wagga Road. Overall Forge manufactures steel products for the Australian and South-East Asian mining and quarrying industries, and currently employs about 100 people.

Circular Plastics, a PET recycling plant developed as a joint venture partnership between Cleanaway Waste Management Ltd., Pact Group, Coca-Cola Europacific Partners and Asahi Beverages[1], recently opened within the NEXUS Industrial Precinct. The facility is anticipated to recycle approximately 1 billion PET plastic bottles each year, reducing Australia's reliance on virgin plastic, the amount of plastic waste sent overseas and the amount of recycled plastic Australia imports. The recycled plastic will be used as raw material to manufacture new bottles and food and beverage packaging in Australia. This is expected to result in a two-thirds increase in the amount of locally sourced and recycled PET produced in Australia, from around 30,000 tonnes to over 50,000 tonnes each year.

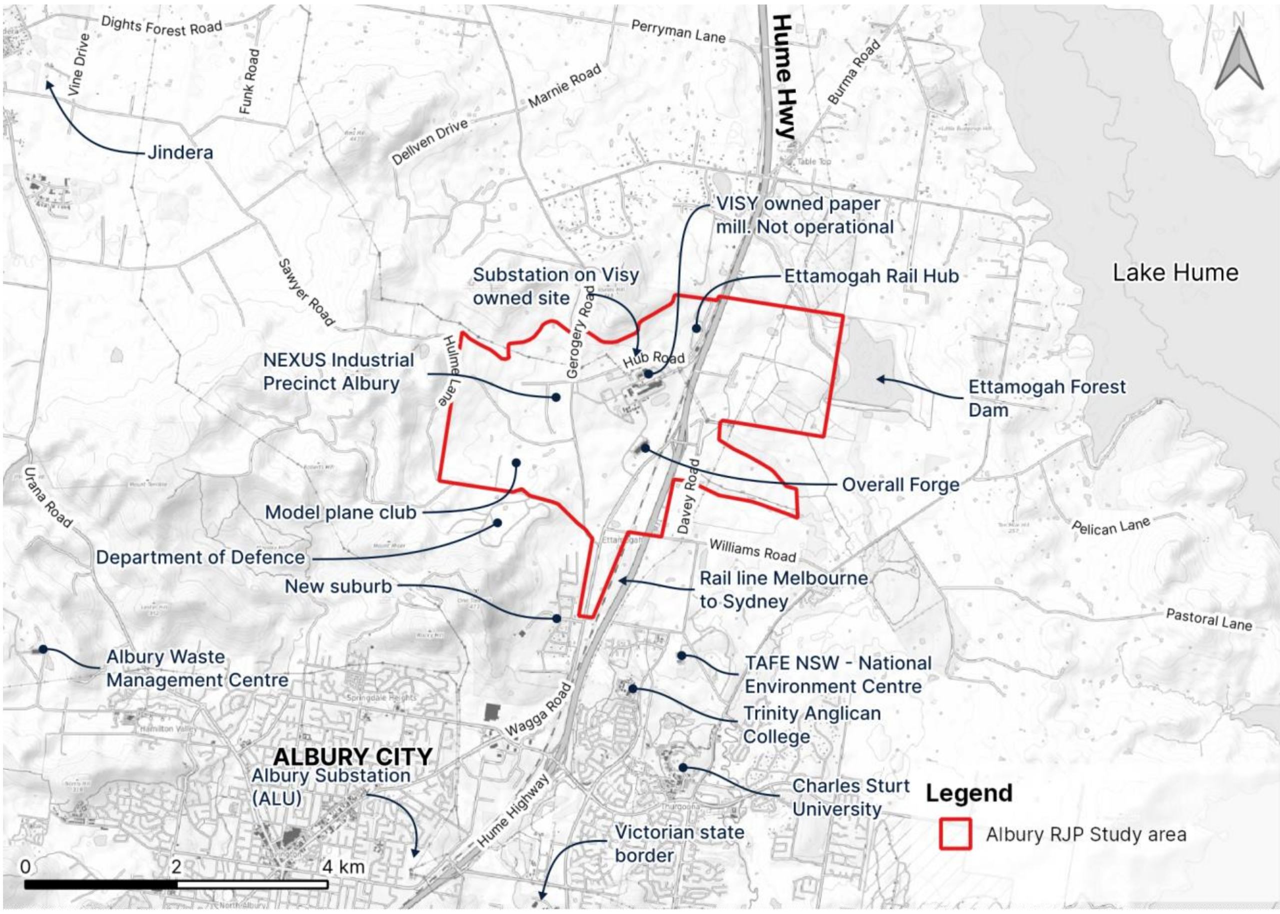

Figure 2-2 | Location diagram of study area

The Twin Cities Model Aero Club owns a large parcel of land on the southern side of the RJP investigation area and includes a club house and flying facilities for model aircraft. New residential blocks within the adjoining suburb of "Ettamogah Rise" are located to the south-west of the RJP investigation area, separated by a large parcel of Department of Defence owned land. Residential subdivision is also occurring on the eastern side of the Hume Highway in the suburb of Thurgoona. Land to the north of the RJP investigation area is predominantly rural with some large lot residential development. The Albury Local Strategic Planning Statement (2020) encourages the continuation of this rural and rural residential character.

An existing network of established roads are present within the RJP investigation area, with key collector Gerogery Road feeding into Wagga Road and onto the Hume Highway. The recent modification of the Davey Road interchange to provide a southern onramp has significantly improved efficiency of movement from the RJP

1 https://www.investregional.nsw.gov.au/news/australias-largest-pet-recycling-plant-opens-in-albury/

investigation area south. It is understood that a recent subdivision has been lodged to facilitate the construction of a truck stop / service station on the southbound side of the Davey Road interchange.

Other established roads feeding into the Albury region include the Olympic Highway, which links key agricultural areas surrounding Wagga Wagga and as far north as Bathurst; and the Riverina Highway, which provides access to the south-western agricultural food bowl.

2.4 Key Attributes and Challenges

This section provides a high-level appraisal of key attributes and challenges of the RJP:

Attributes

- Relatively low fragmentation of land ownership
- Proximity of residential development to the south. May open opportunities for shared facilities or services within walking distance
- Topography and location within a small valley which helps to reduce visual impact of development
- Topography is basin in form, raised ground protects the areas outside of the precinct to the north, south and west
- Inland rail corridor and ERH providing access to Port of Melbourne and Port of Brisbane
- Original 3km rail siding at ERH[2] which has been extended to 5km
- The site has direct access to the Hume Highway which allows movement directly from the precinct onto the highway and a connection across the highway from the East to the West
- Established existing businesses and new investment
- Existing energy network has potential for upgrades
- Visy’s private services infrastructure - substation and water supply / discharge provide opportunity to benefit the wider precinct
- Areas north, east and west are likely to be undeveloped, securing a perimeter with in-built buffers for industry to sensitive receptors
- Housing availability and affordability

Challenges

- Capacity constraints presented by the existing electricity network
- Existing road pattern and impact on efficiency of movement
- Limited ability to expand rail connectivity to the east of the rail line
- Distance to nearest commercial centre to meet the needs of employees
- Accessibility by public transport, and active travel
- Access to wastewater facilities for trade-waste intensive industries
- Competition from similar industrial precincts locally
- Riparian pathways limiting movement and development through the site
- Steeper slopes not ideal for industrial development opportunities
- Areas with valued vegetation, some of which needs protection to preserve habitats
- Heavy quarry vehicle movement paths which run through and around the site
- Residential zoned neighbourhoods are located within potential land-use conflict areas
- Much of the land needs to be considered for heritage protection, these areas centre around the Eight Mile Creek area
- Bushfire risk, shown moderate to high risk
- Odour and noise concerns
- 100-year ARI flood risk and overland flow area

[2] https://infrastructuremagazine.com.au/2021/06/04/12-2-million-ettamogah-rail-hub-upgrade-complete/

2.5 Expected Residential Growth

In 2020 Albury had a population of 55,030 residents, which is larger than the adjacent city of Wodonga (42,660 residents). Population growth in Albury over the last 20-years has been moderate, averaging +580 persons per year or 1.1% per annum (Regional Population - 2021, and the Census of Population and Housing - 2016).

The Albury Local Government Area is predicted to see a population increase of 13,074 residents by 2036 (Local Strategic Planning Statement, 2020). Land identified for urban expansion is located east of the site in Thurgoona. This area is targeted for approximately 20,000 dwellings or 50,000 residents over the next 50 years.

Infrastructure considerations for the RJP must also be considered in conjunction with the planned urban expansion in Thurgoona, to ensure sufficient capacity for both industry and residential expansion.

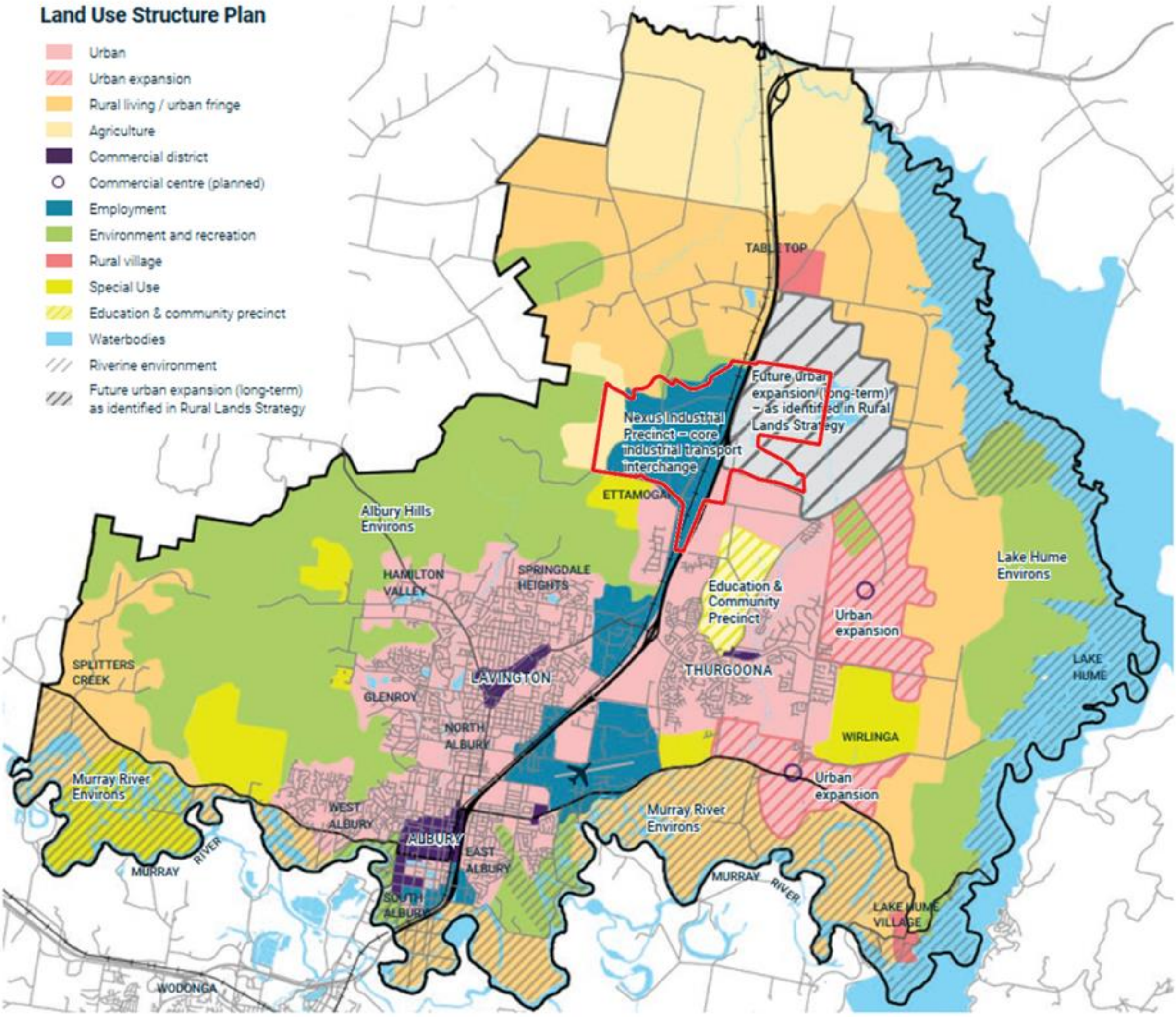

Figure 2-3 | Albury Land Use Structure Plan with the Albury RJP investigation area outlined in red

3 Site Visit Summary

3.1 Observations

Members of the SMEC team attended the Albury RJP investigation area on 7 December 2021 to undertake a site reconnaissance and familiarisation exercise. This section provides some key observations of the local area:

- Topography – the RJP study area is reasonably flat however is bounded by hills to the north and west.
- A water storage dam is located just east of the RJP investigation area. It is understood this was previously used in conjunction with the paper mill.
- A quarry is located west of the site (operated by Burgess Earthmoving).
- The ERH is located in the northern section of the site and provides a 5km rail siding off the Melbourne to Brisbane rail line. The paper mill also has a private rail siding.
- The ERH has capacity to accommodate movement of containerised freight into and out of the region.
- Access to the Hume Highway is provided by Wagga Road and Davey Road on ramps.
- Residential development is occurring to the south in the "Ettamogah Rise" development and on the eastern side of the Hume Highway in Thurgoona.
- Large centre pivots are located along the eastern and western side of the Hume Highway, some growing lucerne and others vacant. It is understood that this land is owned by Visy and provided a water reuse opportunity when the paper mill was operational.
- Council has a desire to establish a commercial precinct / local centre on Wagga Road to service employees and businesses and provide enhanced amenity.
- Large parcel of land to the west of the model aeroplane club would provide additional north-south connectivity into the first stage of the NEXUS subdivision.

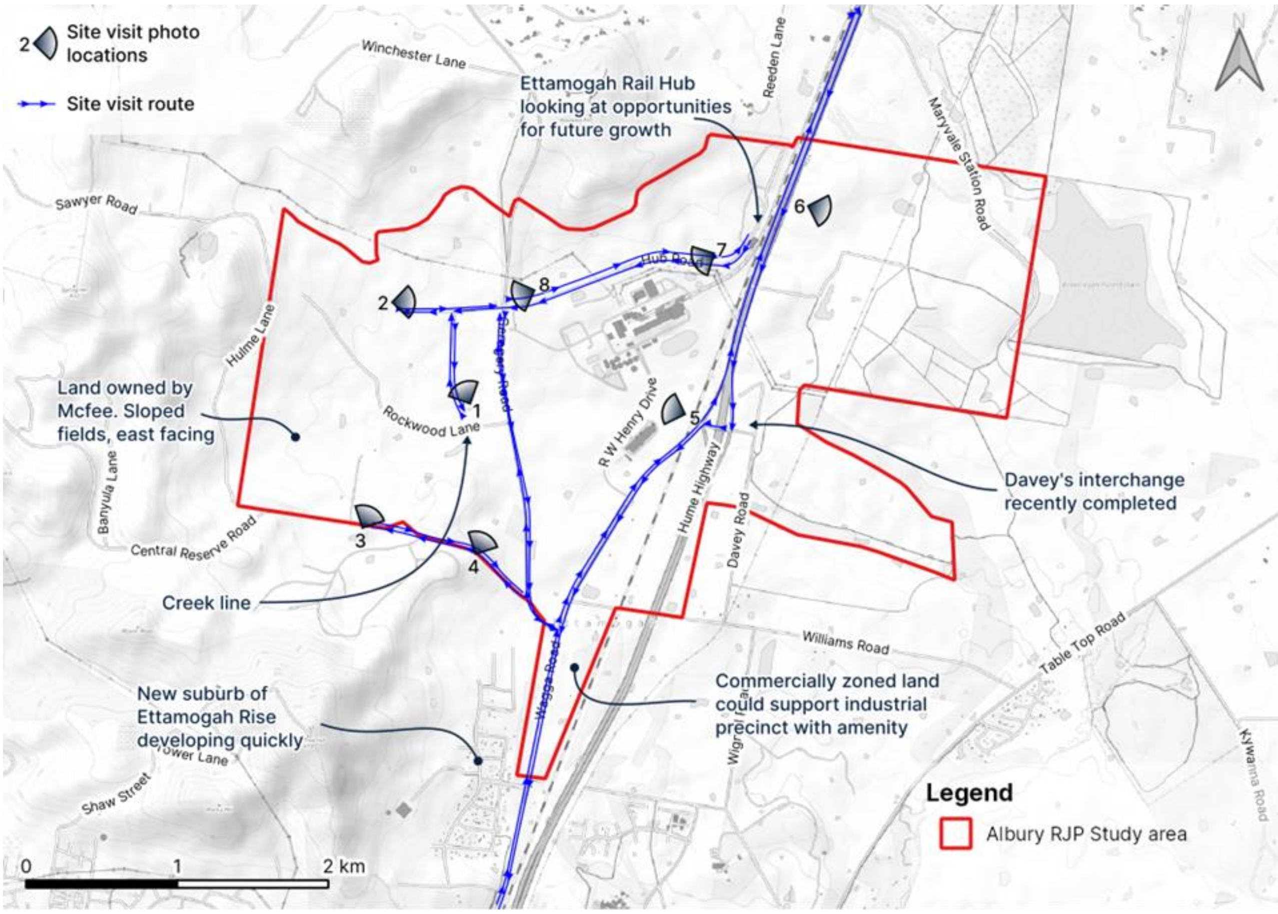

Figure 3-1 | Site visit observations

3.2 Images

Figure 3-2 | A view looking north at the new Plastic Recycling centre

Figure 3-3 | A view looking north towards the model aeroplane club headquarters

Figure 3-4 | A view looking west from the Hume Hwy

Figure 3-5 | A view looking south-west at the Visy owned site

Figure 3-6 | A view looking East at the north boundary of the study area

Figure 3-7 | A view looking north across the field to the Visy owned site.

4 Precinct Master Plan

4.1 Overview

The Albury RJP master plan draft has been developed by Ethos Urban as part of the RJP project from the Department of Regional NSW. The master plan has been developed based on site visits, preliminary technical studies, options development process and information gathered from stakeholder workshops.

4.2 Vision and Principles

The vision of the Albury RJP is to differentiate itself as an industrial hub of the future, focusing on highly sustainable production, circular economies and value-add industries. The proposed master plan has been developed and tested using the following six urban design principles:

- **Protect biodiversity and high value vegetation** – The aim of this principle is to prioritise protection and enhancement of the natural environment, the most significant of which is the Eight Mile Creek riparian corridor.
- **Protect, enhance and support sensitive receptors** – This principle aims to prioritise the protection of internal and external receptors. Internal receptors include the existing habitats, higher order creeks, water sources and valued vegetation. External receptors include existing and future residential neighbourhoods.
- **Prioritise easy connection to transport corridors and intermodal** – Prioritise connectivity to the existing transport infrastructure within and crossing the precinct - the Hume Highway, the National Rail and the Ettamogah Intermodal.
- **Maximise the potential of Eight Mile Creek** – Eight Mile Creek, which runs through the centreline of Albury RJP, west to east, has been identified as a high hazard flow during the flood study. This creek acts as potential habitat for wildlife, a location with indigenous value and potential heritage artefacts. The aim is to combine the biodiversity corridors with recreational corridors to foster and prioritise public interaction with this valuable area.
- **Design to suit existing topography** – Some areas of the site in particular are affected by existing slopes of greater than 8% or 10% which present challenges for development and in particular for typologies such as large-footprint industrial buildings or sheds. This principle aims to reduce the requirements for large-scale earth moving at industrial developments by allowing the master plan to consider alternative uses for these areas such as small-footprint light industry, small-footprint productivity areas, and conservation areas.
- **Plan with embedded flexibility, resilience and robustness** – The precinct should consider existing ownership, operations, existing property structures and infrastructure and be designed to accommodate changes to existing conditions and manage changes in ownership and operations.

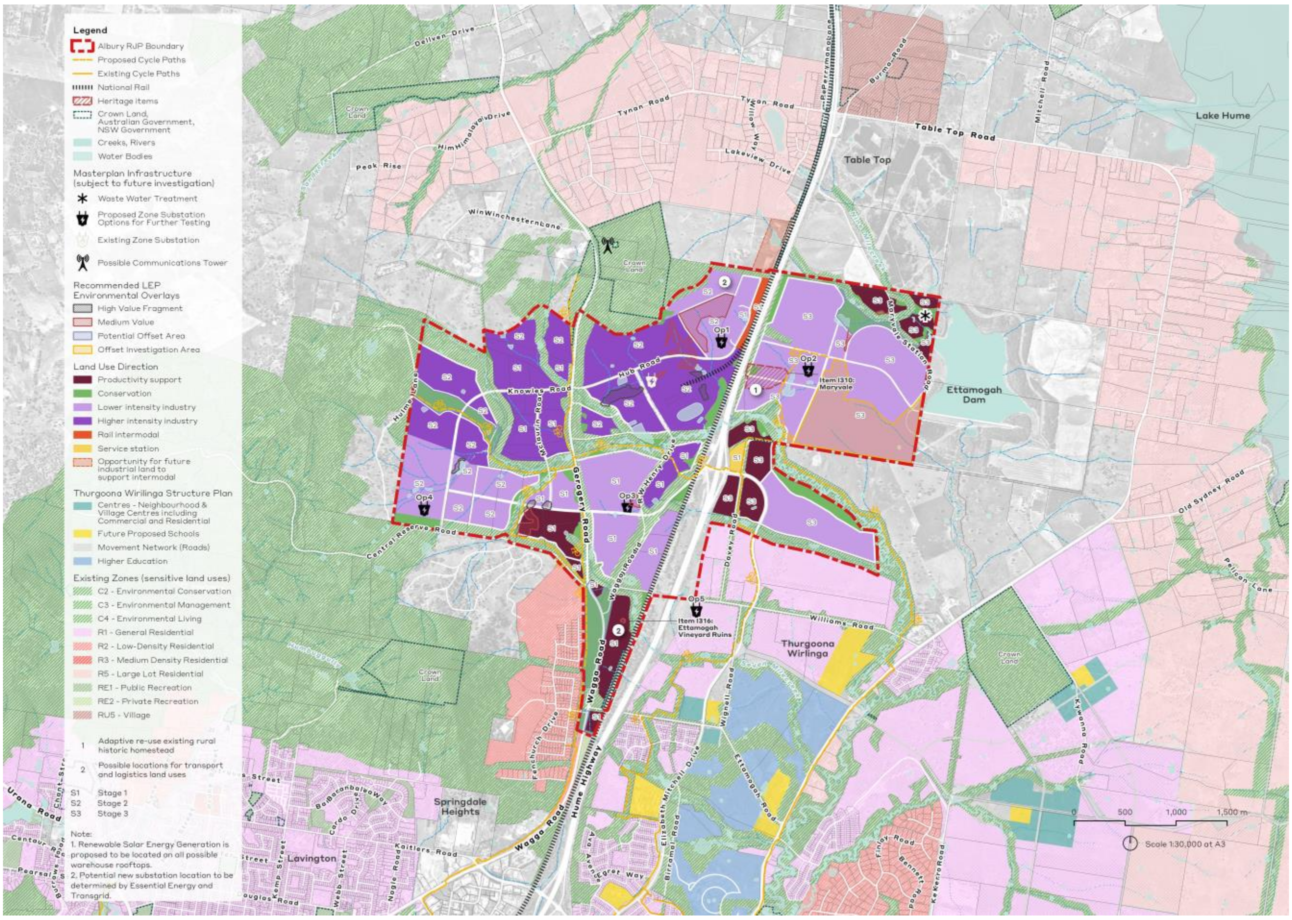

Figure 4-1 | Albury RJP Master Plan prepared by Ethos Urban 2022

4.3 Land Uses and Target Industries

A key goal of the Albury RJP and investment attraction plan is to establish a circular economy ecosystem with new operators establishing and using outputs from existing industries. Figure 4-2 provides a graphical depiction of the circular economy process and how it might apply to the Albury RJP investigation area. This concept has been a key consideration in the upgrades to utilities infrastructure that will be required to support the growth of the RJP.

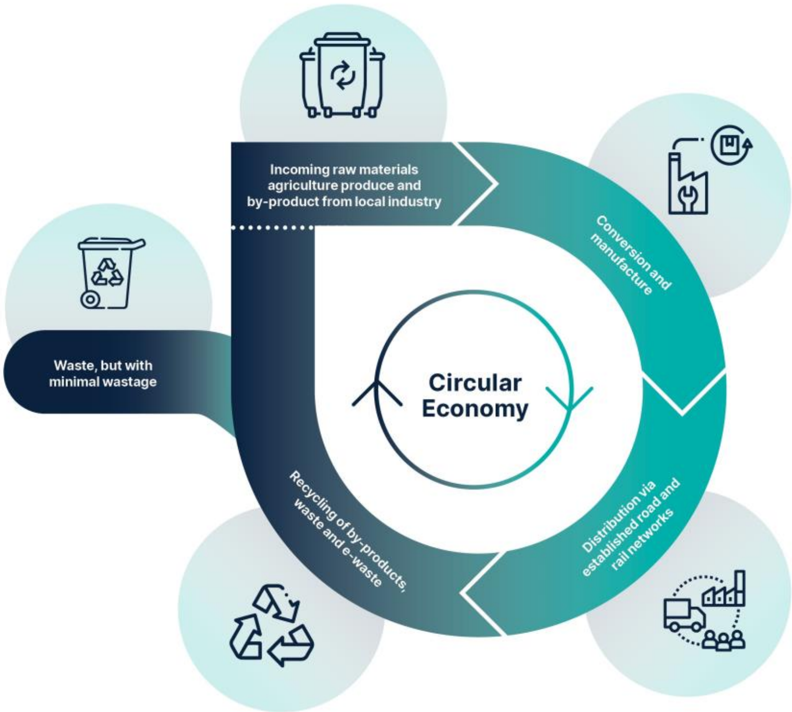

Figure 4-2 | Circular economy within the context of the Albury RJP

The Albury RJP Investment Attraction Plan, prepared by the Office of Regional Economic Development in collaboration with ACC, has been used to guide the preparation of the master plan. Based on locational attributes, existing skillsets and existing infrastructure, the following key industry groups targeted in the master plan are:

- Plastic product manufacturing (utilising PET)
- E-waste processing
- Food processing/manufacturing
- Outdoor recreational equipment metal fabrication e.g., boats, trailers, caravans

Following on from this, the master plan adopts the following eight landuse directions:

1. **Conservation** – including riparian corridors and conservation land, based on biodiversity assessments undertaken as part of the RJP project.

2. **Lower intensity industrial** – providing opportunity for industries with low or limited amenity impacts. We have assumed industries and have distributed the land use within the zone as follows:
   - Microgrids ~ 5%
   - Light industry ~ 10%
   - Freight, logistics and distribution centres ~ 15%
   - Agricultural value-add processing and manufacturing ~ 25%
   - Waste and resource recovery ~ 30%
   - Plant and parts manufacturing ~ 5%
   - Ancillary office space ~ 10%

3. **Higher intensity industrial**– providing suitable land for industries with higher noise, odour, air quality or traffic emissions such as:
    - Chemical manufacturing and mixing ~ 25%
    - Heavy manufacturing e.g., steel forge ~ 30%
    - Heavy industrial storage establishment ~ 30%
    - An abattoir ~ 5%
    - Ancillary office space ~ 10%
4. **Heritage** – for the protection of homestead heritage areas to the east of the highway with future opportunities for adaptive reuse.

5. **Intermodal** – for improved connection from Intermodal through the site with extension of Hub Road to Central Reserve Rd and facilitation of expansion of the existing ERH. Specific nature of uses considered include:
    - Intermodal terminal ~ 30%
    - Warehousing ~ 30%
    - Refrigeration storage (approx. 3,000 sqm) ~ 25%
    - Dangerous goods and chemicals storage ~ 10%
    - Ancillary office space ~ 5%
6. **Productivity** – for improved flexibility and suitability for both low-impact industrial or warehouse uses and to facilitate types of developments which support larger industrial uses, such as:
    - IT and business support services ~ 30%
    - Retail ~ 30%
    - Commercial ~ 20%
    - Low impact supporting industries ~ 15%
    - Education and childcare ~ 5%
7. **Recreation Space**
8. **Service Station**

Given the size of the Albury RJP (1,190 ha), consideration of the expected future uses, staging and delivery is critical to understanding the required infrastructure upgrades, associated costs and the trigger points to ensure infrastructure is provided 'just in time'.

Table 4–1 and Table 4–2 confirm the anticipated uptake of land by area and indicative gross floor area of buildings across the three stages. These figures have informed the demand modelling for infrastructure upgrades that will be required to support the growth of the Albury RJP.

Table 4–1 | Assumed uptake of land by industry type

Land Use	Stage 1 (ha)	Stage 2 (ha)	Stage 3 (ha)	Total
Lower intensity industrial	88	99	234	**421**
Higher intensity industrial	72	180	0	**252**
Rail intermodal	4	0	0	**4**
Productivity support	40	0	46	**86**
Service station	3	0	0	**3**
Total	**207**	**279**	**280**	**766**

Table 4–2 | Anticipated Gross Floor Area (GFA) by stage

GFA	Stage 1 (m^2)	Stage 2 (m^2)	Stage 3 (m^2)	TOTAL
Lower intensity industrial	220,000	247,500	702,000	**1,169,500**
Higher intensity industrial	180,000	450,000	0	**630,000**
Rail intermodal	10,000	0	0	**10,000**
Productivity support	100,000	0	138,000	**238,000**
Service station	2,500	0	0	**2,500**
Total	**512,500**	**697,500**	**840,000**	**2,050,000**

5 Hydrogeology and Water Quality

5.1 Baseline Context

The site is covered by Quaternary aged alluvial and colluvial sediments which overlay the Early Ordovician aged rocks of the Abercrombie Formation. The Abercrombie Formation consists of deep marine massive to laminated, thin- to thick-bedded, fine- to medium-grained quartz arenite to quartzite, interbedded with lesser cleaved grey siltstone to mudstone. It is part of the Abercrombie Group of regional geological province known as the Lachlan Fold Belt. Figure 5-1 presents the geology of the basement at the site. The Devonian aged Jindera Granite intrudes the northern part of the site. Structurally, to the south-west and north-east are north-west orientated faults associated with the Kiewa Shear Zone.

Several creeks pass through the site and around the creeks, shallow alluvial / colluvial aquifer systems may be present. These are not considered to be productive aquifers as they are anticipated to be less than 10m, though some areas may have deeper incised weathering profiles, with low potential yields due to lower porosity and the presence of more clayey material. The hydrogeology at the site is dominated by fractured rock aquifers. The depth to the water table may be variable. The Geoscience Australia Portal (www.portal.gov.au, date access 20 January 2022) regional groundwater maps show the site may have yields greater than 5 L/s with conductivity ranging from 500 to 1000 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 south-east and south to the Murray River. Eight Mile Creek is considered an ephemeral drainage line and, during wet periods or prolonged rainfall, groundwater will discharge to the creek. During periods of heavy rainfall, the creek may flow and recharge the groundwater system. The elevated hills surrounding the site provide recharge to the deeper fractured rock aquifer.

There are two water sharing plans, the Murray Alluvial Groundwater Sources (2012) and the NSW Murray-Darling Basin Fractured Rock Groundwater Sources (2020) which are applicable to the site. Extraction of groundwater for use requires a Water Access License (WAL) under the *Water Management Act 2000 (NSW).*

Groundwater is not being considered as the primary raw water source for this development, generally due to yields often being too small to meet the delivery demand of large primary raw water supply. However, groundwater may form part of the overall water supply and management strategy.

5.2 Existing Beneficial Use Arrangements

There are three registered bores within the site boundary, two are in granite in the north-eastern part of the site and the other is a monitoring bore in the alluvial/colluvial sediments. Within 5km of the site there are 63 registered bores.

The water sharing plans show the site is not in proximity to known high priority groundwater dependent ecosystems (GDE). The Bureau of Meteorology Groundwater Dependent Ecosystem Atlas (www.bom.gov.au/water/groundwater/gde/map, date accessed 20 January 2022) shows to the north of the site, on the western side of the junction of Table Top Road and the Hume Highway is a small floodplain water body classed as a high potential aquatic GDE. The site has vegetation areas, particularly in the western portion, of low potential for terrestrial GDE's. Around Eight Mile Creek there are mapped vegetation areas of high potential for terrestrial GDE's. Eight Mile Creek is considered a high potential inflow dependent aquatic ecosystem. The site also has vegetation areas considered to have low inflow dependent ecosystems.

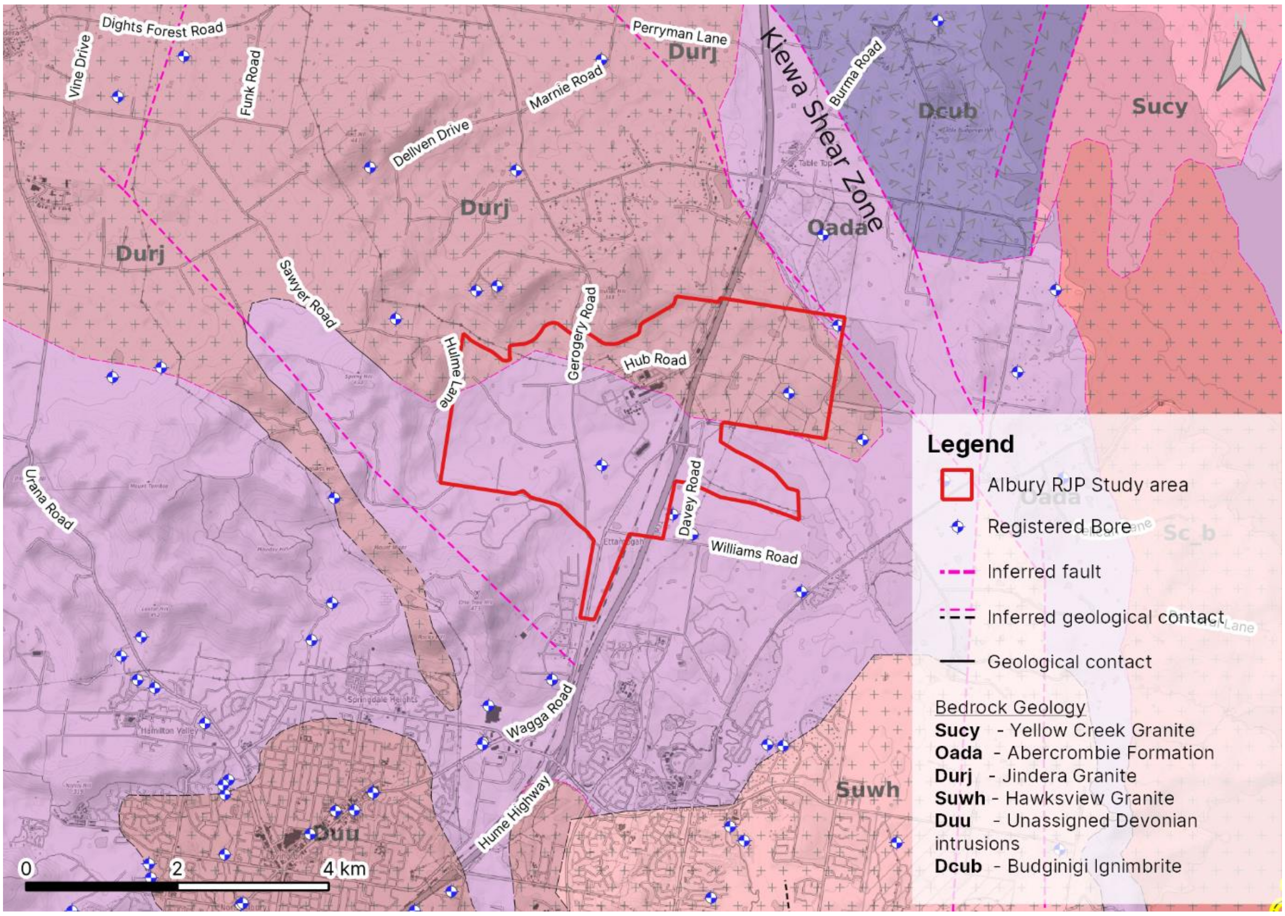

Figure 5-1 | Basement geology, structures and registered groundwater bores.

Geology sourced from www.portal.ga.gov.au and registered bores from www.bom.gov.au/water/groundwater/explorer/map

5.3 Influence on Groundwater Quality and Demand

At the site, there is a reasonable quality groundwater supply from the fractured rock aquifers with the potential for bores as a supplementary non-potable water supply source for localised or low demand uses.

The site currently has limited groundwater beneficial use associated with the registered groundwater bores. Existing industries established in the region source water offsite from surface water supplies. The former paper mill site has a 17.3 ML licensed surface water supply, whilst Albury City Council has a total licensed entitlement of 13,237 ML.

When it was operational, wastewater generated from the former paper mill was disposed of via pasture irrigation in the north-eastern portion of the site. These irrigation activities potentially increase recharge to the groundwater system and may have an impact to groundwater quality. Potential contaminants of concern from the existing land use and industries are discussed in the Contamination Study done by ERM and have the potential to reach the groundwater system and may influence quality. Background information on existing groundwater quality is unavailable. The Contamination Study considers, based on the soil type, that salinity is unlikely to be a significant issue at the Albury RJP. Offsite, several of the hills to the north-west are quarried. The activities of the quarry may increase the recharge to deeper fractured rock aquifers from the disturbed ground.

Existing land use activities within the site have the potential to impact groundwater quality via uncontrolled surface run off that may contain contaminates of concern. These contaminants of concern vary in nature and intensity and are dependent on the type of industry or activity. Poorly maintained processing equipment and linear infrastructure, such as sewer lines, also have the potential to impact groundwater quality as well as create localised mounding of the water table. It is important that any discharge of waste water to nearby waterways, such as Eight Mile Creek, does not result in water pollution unless permitted by an Environment Protection License issued under the *Protection of the Environment Operations Act 1997*.

6 Water Demand

Raw water for Albury is sourced from the Murray River and in total ACC holds ten Water Access Licences (WAL) with a total entitlement of 13,237 ML/year. Of this entitlement, 12,345 ML/year is associated with a Local Water Utility License, which is supplemented by several High Security licenses. The Albury City IWCM Issues Paper (NSW PWA, 2021) confirms that the Council's licensed town water entitlement is expected to be sufficient to meet the town water dry year extraction until around 2054 (or 2049 if higher levels of extraction are sought due to climate change).

It is important to note the distinction between water entitlements and allocations, and the different levels of reliability associated with WALs. A water entitlement is a permanent right to take water from the river system, whilst a water allocation changes depending on how wet or dry the year is and how much water is available. There are multiple license categories, which determine the prioritisation of allocations. The main license categories in NSW, in order of priority, are:

1. Domestic and stock
2. Town water supply
3. High security
4. Conveyance
5. General security

During a severe drought, high security entitlement holders can usually depend on at least a partial allocation of water, whereas general security holders may not receive any water until conditions improve. Most water entitlements in New South Wales are general security entitlements. During the millennium drought, allocations in Albury were reduced by 50%.

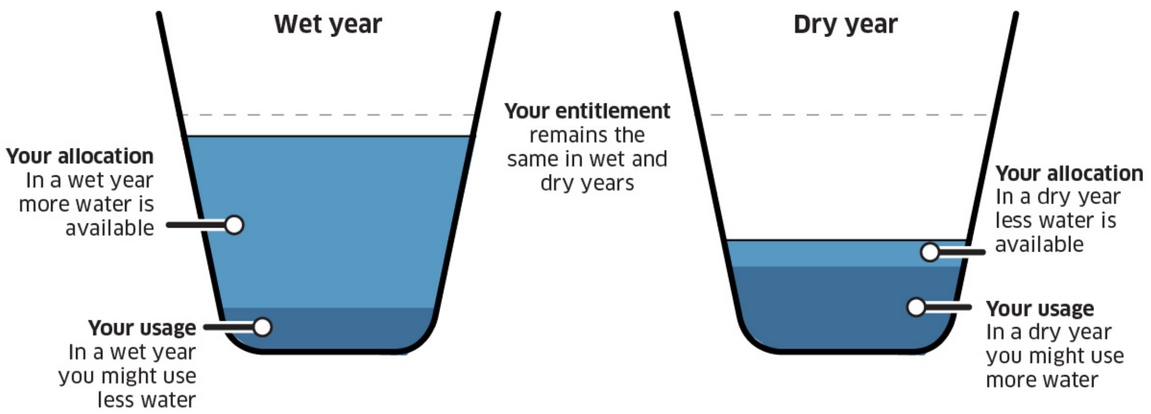

Figure 6-1 | Infographic showing the difference between water entitlements and allocations

Source: mdba.gov.au 2022

The draft Murray Regional Water Strategy was released in 2022 and provides a strategy for managing the water needs of the Murray Region over the next 20 to 40 years. The draft Strategy proposes a series of options that could be included in the final Murray Regional Water Strategy, to balance the water needs of the region with opportunities to attract regional growth and investment. Options of particular relevance to the Albury RJP include:

- Option 8 – A review of drought rules applying to the NSW Murray region, to reflect current climate data and anticipated changes due to climate change.

- Option 9 – A review of the allocation and accounting framework to consider how water allocations are made, and prioritisation.
- Option 11 – Review groundwater extraction limits based on updated understanding of groundwater processes and climate change data.
- Option 13 – Investigate the risks and benefits of increasing general security to high security access licenses, and high security to town water supply access licenses to provide increased water security and drive economic investment.
- Option 20 – Review impediments to water recycling projects which would be relevant to an expanded treated effluent scheme if a northern wastewater treatment plant is required to support the RJP.

Whilst not all of the options presented in the Draft Strategy will be taken through as final recommendations, the inclusion of the above options would have the potential to provide increased certainty of water supply for industries looking to relocate to the Albury RJP.

A summary of the licenses is provided in Table 6–1 and includes allocation, license class and purpose.

Table 6–1 | Summary of Albury City Council Water Access Licenses (WAL) - (*Albury City Council, Integrated Water Cycle Management Strategy, Draft Issues Paper 2021* (NSW PWA))

<table>
<tr><th>Water sharing plan</th><th>WAL</th><th>Licence Class</th><th>Entitlement (ML/year)</th><th>Purpose</th></tr>
<tr><td rowspan="5">New South Wales Murray Regulated River Water Source</td><td>6,470</td><td>Regulated River (High Security)</td><td>580</td><td>Albury Town Water Supply</td></tr>
<tr><td>21,515</td><td>Local Water Utility</td><td>12,345</td><td>Albury Town Water Supply</td></tr>
<tr><td>5,359</td><td>Regulated River (High Security)</td><td>100</td><td>Mill Raw Water Line</td></tr>
<tr><td>13,154</td><td>Regulated River (High Security)</td><td>70</td><td>Park Irrigation</td></tr>
<tr><td>29,615</td><td>Un-regulated River</td><td>3</td><td>Bagnell's Range Lagoon – Wonga</td></tr>
<tr><td>Murray Unregulated and Alluvial Water Sources</td><td>35,592</td><td>Aquifer</td><td>4</td><td>Quarry + Wonga Wetlands</td></tr>
<tr><td rowspan="2">Upper Murray Ground-water Source</td><td>29,927</td><td>Aquifer</td><td>35</td><td>Park Irrigation</td></tr>
<tr><td>5,359</td><td>Regulated River (High Security)</td><td>100</td><td>Mill Raw Water Line</td></tr>
</table>

In addition to the above WAL, there are also two access licenses aligned with ACC Works Approvals (i.e., river and bore pumps). The total private access allocation is approximately 7,329 ML/year and most notable is the combined 6,300 ML/year allocated to the Visy paper mill. It is understood that under the existing agreement, any unused water associated with this allowance can be used by ACC. However, this agreement was reached with the previous owner (Norske Skog), and it is understood Council are currently in negotiation with the new owners (Visy) to continue this arrangement.

A water demand analysis has been completed for Albury and is summarised in the *Albury City Council, Integrated Water Cycle Management Strategy, Draft Issues Paper 2021* (NSW PWA). A summary of water demands for the nominated growth and forecasted water demands under the nominated climate change scenario is provided in Table 6–2 and Table 6–3 respectively. It is noted that this modelling was undertaken by ACC prior to the RJP project, so does not assess additional demands from new industries that may locate to the region.

Table 6–2 | Scheme level water demand – nominated growth (Albury City Council, Integrated Water Cycle Management Strategy, Draft Issues Paper 2021:Table 11-5)

	2018	2021	2031	2041	2046	2049	2061
Average year demand (ML/yr)	8,090	8,304	9,065	9,854	10,214	10,419	11,407
Average day demand (ML/d)	22.1	22.7	24.8	27	28	28.5	31.2
Dry year demand (ML/yr)	9,079	9,319	10,169	11,053	11,456	11,688	12,797
Peak day demand (ML/d)	64.5	66.1	71.7	77.6	80.2	81.7	89

Based on the forecasted water demands outlined, above Albury City Council's current licensed town water entitlement is expected to be enough to meet the town water dry year extraction until around 2054. However, sustained drought would be likely to result in a reduced allocation, as occurred during the millennium drought. This results in a degree of vulnerability to Albury's water supply, as identified in the Integrated Water Cycle Management Strategy, Draft Issues Paper (NSW PWA, 2021). Option 9 of the Draft Regional Water Strategy (DPE, 2022) recommends that the allocation and accounting framework for surface water in the NSW Murray system should be reviewed to provide additional water security to support economic growth in regional areas.

Table 6–3 Forecast water demand under climate change scenario – nominated scenario (Albury City Council, Integrated Water Cycle Management Strategy, Draft Issues Paper 2021 - Table 11-12)

	2018	2021	2031	2041	2049	2051	2061
Average year demand (ML/yr)	8,090	8,303	9,059	9,845	10,406	10,525	11,389
Average day demand (ML/d)	20.4	20.9	22.9	25	26.4	26.8	29
Dry year demand (ML/yr)	9,079	9,318	10,163	11,041	11,672	11,806	12,775
Peak day demand (ML/d)	64.5	66.1	71.7	77.5	81.6	82.5	88.8

6.1 Opportunities and constraints

Raw water is supplied from the regulated Murray River, downstream of Lake Hume in the Murray Darling Basin. It is anticipated that opportunities to increase these existing allocations from the Murray Darling to service new industries would be limited and therefore should not be considered as a reliable option for future water demands. However, discussions on the viability of increasing existing water allocations should be undertaken given the economic benefits associated with the establishment of new industries. This would align well with the previously discussed recommendations from the Draft Regional Water Strategy (DPE, 2022).

As noted earlier, ACC currently have a small excess in water entitlement relative to current average water usage. It is anticipated that the excess water entitlement would be made available to new industries within the study area, and residential growth that is anticipated around Thurgoona. It is noted that for the most part, the anticipated industries within the RJP will be 'dry industries' with relatively low water demands. Ultimately, the availability of excess water allocations may limit the types of industries that can be attracted to the RJP. Demand from specific wet industries (such as beverage manufacturing and an abattoir) have been factored into the demand analysis undertaken by SMEC in the Albury Regional Job Precinct Utilities Technical Report (2022).

Alternative water sources to the Murray Darling may comprise onsite systems, such as roof water capture, stormwater harvesting or use of recycled water (depending on proximity to wastewater treatment). It has been noted that the paper mill processing previously produced several water streams, including the supply of treated effluent to the Ettamogah Irrigation Scheme for reuse and removal of cooling water from the site via a return water pipeline.

The opportunity to incorporate these water sources in the eventual Integrated Water Cycle Management (IWCM) for non-potable and/or process water demands within the RJP investigation area should be investigated in a site-specific Development Control Plan for the precinct. Consideration will be required on the water quality of alternative sources and viability/practicality for reuse within the RJP investigation area, as well as any existing legal or regulatory constraints, such as existing third-party agreements, discharge licenses and recycled water management plans.

6.2 Primary Anticipated Ground Water Demand

A number of assumptions have been adopted to predict future uses within the broadscale zones adopted in the Albury RJP, to provide an understanding of the potential water demand. An abattoir is considered in the assessment of uses for the higher intensity industrial zone, presenting both a high energy and high water demand. The quantity of water required by abattoirs is highly variable however the use of recycled water, ground water and treated effluent is becoming more widespread in Australia. To this effect, it is noted by the meat association that *"abattoirs in some areas of Australia are facing dramatic reductions in their historic water allocations. Without recycling or water usage reduction, the obvious response to this is reduced production, which has very substantial associated costs to any business"* (Meat and Livestock Australia, 2008)

Whilst using alternative water sources can be an option to reduce potable water demand, specific uses or export requirements, may preclude such measures. Our assessment considers the abattoir to have a water demand of 2,200kL/day. This would predominantly be potable water, however, appropriately treated alternate sources could have applications for pasture, fodder, crop irrigation, livestock drinking water, shed or stockyard wash down.

6.3 Option to integrate with Visy

The master plan ultimately envisages the former paper mill as an integrated part of the RJP, hosting higher and lower intensity industrial uses in stage 3. In addition to onsite wastewater treatment, the Visy site has a water allocation of approximately 17ML/d.

In the event that the Visy site is redeveloped, there may be opportunity to utilise excess raw water currently allocated to the former papermill. However, this approach would require negotiations with Visy or between private entities. Further discussions with Visy regarding the possibility of this as a raw water supply for the area may be considered, however this option is considered to present a higher risk alternative as it is reliant on a number of external factors.

7 Infrastructure to Support IWCM

A primary objective of the Integrated Water Cycle Management (IWCM) for the Albury RJP is ensuring the sustainability and viability of the plan to align with growth of the RJP investigation area. Once commitments are made to infrastructure funding, it is recommended that further investigations on the viability and reliability of non-potable water sources be undertaken, as these may help to target a water balance for the RJP investigation area.

This IWCM strategy is developed in line with LGA IWCM planning context, with resiliency and economic reasoning and integrates with stormwater, wastewater, recycled water, potable water, drainage system and riparian zones to be managed along Eight Mile Creek.

Further refinements will be required when detailing the design elements throughout the RJP. This information is high level in nature and provides as an indication of potential locations and land requirements for integrated water servicing infrastructure. The main objective is to provide an integrated water system to augment the sustainability principles as outlined in the master plan.

The key goals of implementing an IWCM strategy are:

- Minimising potable water demand
- Minimising net volume of effluent disposal from wastewater treatment plan
- Maximising potential for water reuse and recycling

7.1 Potable Water

The recommended potable water servicing strategy is provided in the Albury RJP Infrastructure Assessment – Utilities Technical Report (SMEC, 2022). The upgrades align with the staging of development as envisaged in the master plan.

Potable water demand from industry is inherently variable due to the differing needs of manufacturing and production uses. Ensuring efficiencies in potable water use in industries locating to the region, through investment in suitable plant and machinery will be important to the viability of the RJP and long-term water security for industry. Managing and monitoring the number of wet industries that may choose to locate to the area will be critical to ensuring there is sufficient supply for operations during various events, such as:

- Water security during drought
- To support anticipated population growth
- In the event of algal bloom in the Murray River (water supply source)

The Albury RJP Infrastructure Assessment – Utilities Technical Report (SMEC, 2022) indicates various network upgrades to the existing system will be required to support industrial growth associated with the RJP and residential growth in Thurgoona. The IWCM policy will have an important role in reducing and supplementary potable water demand through stormwater harvesting, predominantly from roof run off. Other opportunities, such as water saving devices have not been considered in the master planning stage. Those will be considered in the design during the development of the site.

7.2 Sewerage

The overall sewerage management strategy is described in the Albury RJP Infrastructure Assessment – Utilities Technical Report (SMEC, 2022). To support the growth of the RJP, the sewerage network will require a number of upgrades including trunk networks, pump station and a new Northern Wastewater Treatment Plant (WWTP).

To manage anticipated sewage inflows from both residential growth in Thurgoona and the RJP, the strategy recommends increasing the capacity of the existing Waterview WWTP and also constructing a new Northern WWTP, probably on the eastern side of the Hume Highway in the land associated with Stage 3 of the RJP.

These new and upgraded WWTPs would generate a significant additional volume of treated effluent. The SMEC strategy recommends splitting wastewater flows between the Northern WWTP and existing Waterview WWTP. It is expected that treated effluent from the Waterview WWTP could be managed within the existing adjacent Wonga Wetlands, however a use for treated effluent from the new Northern WWTP would need to be sourced.

As the proposed location of the Northern WWTP is some distance from residential or recreational areas, the establishment of a 'third pipe' distribution network for the treated sewerage effluent (TSE) would carry a significant cost and is not expected to be financially viable. Depending on the industries locating within the RJP, there may be opportunities to use TSE in the proposed industrial and commercial areas, however as demand is mostly for potable sources, it is similarly not expected that a third pipe for industry would be viable.

Therefore, it is proposed to establish a surface wetland for management of TSE before flows are discharged into receiving waters. The wetland sizing and design are based on the assumptions that the TSE flows would have the same quality as normal stormwater run off. Further confirmation of the quality and expected volumes of TSE from the new Northern WWTP is expected during the design of the new treatment plant. The presence of high organic nutrients may require additional 'sub surface' type treatments which would be determined in a further feasibility study.

The wetland has been sized based on the distribution of flows between an upgraded Waterview WWTP and the new Northern WWTP. This assumes the Northern WWTP would have an Average Dry Weather Flow (ADWF) of 6.9 ML/day (RJP only) and 13.3 ML/day (Thurgoona), or a total of 20.2 ML/day (~7,373 ML/yr), and total treated flow (i.e., including annual anticipated Peak Wet Weather Flows (PWWF)) of 3190 ML/year (RJP only) or up to 9339 ML/year if including flows from Thurgoona. The PWWF considers additional flows attributed to ground water inflow infiltration and rain dependent inflow.

A summary of the treated flow and the wetland size is provided in Table 7–1. The sizing of the wetland was undertaken using the water quality modelling tool MUSIC v6.3.

Table 7–1 | Proposed wetland for treated sewerage effluent

	AWDF (ML/day)	ADWF (ML/yr)	PWWF (ML/yr)	Total Treated Flow (ML/yr)	WQ- Wetland Sizes (ha)
Flows from RJP	6.9	2518.5	671.6	3190	9.2
Flows from Thurgoona	13.3	4854.5	1294.5	6149	17.7
Total	**20.2**	**7373**	**1966.13**	**9339**	**26.9**

It is recommended that the quality of the TSE be evaluated and further treatment options considered, such as using a floatable wetland or subsurface wetlands, during the detailed design stages of the WWTP and the wetland to present an optimised design.

If the new Northern WWTP were to be located in the Stage 3 portion of the RJP, there may be opportunity to adaptively reuse the Ettamogah Forest Dam as a wetland which has an area of approximately 68 ha and is located just east of the proposed Stage 3 of the RJP. This would require additional investigation, condition assessment and confirmation that the infrastructure is no longer in use by Visy and therefore can be decommissioned. Establishing monitoring to understand the current water quality and any contaminants within the existing dam is also recommended to support further investigation into the feasibility of this option.

Figure 7-1 | The Ettamogah Forest Dam located to the east of the RJP investigation area (Source: maps.six.nsw.gov.au)

It is expected that during operation, the flow from the wetland would be monitored in accordance with Environmental Protection License requirements to ensure the required effluent quality is met before discharging into the environment.

7.3 Other Recycled Water Opportunities

An IWCM for the project area would ideally include recycled water, however the distance to the existing Waterview WWTP creates an economic barrier to the establishment of a third pipe reuse network. Should the recommended new Northern WWTP be established as suggested toward the end of Stage 2, there may be opportunity to consider a TSE third pipe to service local industries and potentially expanded residential areas. However, low demand for such a service, and the potential cost of retrofitting the reticulation network with a third pipe, may make this unviable.

Other considerations on possible beneficial reuses for recycled water in the RJP may include:

- Managed aquifer recharge
- Environmental offsetting
- Reuse for irrigation purposes (recreation areas, plantations, agricultural land, cropping, etc.)
- Reuse as process or non-potable water for new industries

7.4 Managed Aquifer Recharge

The impact of development of the site due to land use change from farmland 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 fractured rock aquifers may be a suitable source of raw water for small demand localised applications such as the irrigation of parklands and open spaces as well as for emergency firefighting supplies. However, the groundwater table is highly vulnerable to land use change, which reduces recharge, and long-term weather conditions, which could impact the availability of groundwater particularly in times of lower rainfall. Reduction in recharge may be offset through managed aquifer recharge schemes and precinct designs that encompass more pervious surfaces for surface water / stormwater run off infiltration.

Shallow recharge schemes are constrained by the depth to the water table and the volumes of water to be infiltrated. Too much recharge occurring within a small area can lead to mounding and dry land salinity impacts. Using vegetated bio-swales for managing surface water run off, 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 contaminates of concern. There is an opportunity at this site to consider recharge in larger volumes to the deeper fractured rock aquifers, if groundwater extraction for non-potable use is considered.

Reinjection of captured water into fractured rock aquifers provides a way to offset infiltration losses from land use change and to support small scale extraction, if needed by council and or industry. If small scale site extraction is considered a viable option for specific industries, recharge (upgradient of the extraction point) may offset the extraction resulting in limited net impact to the groundwater system.

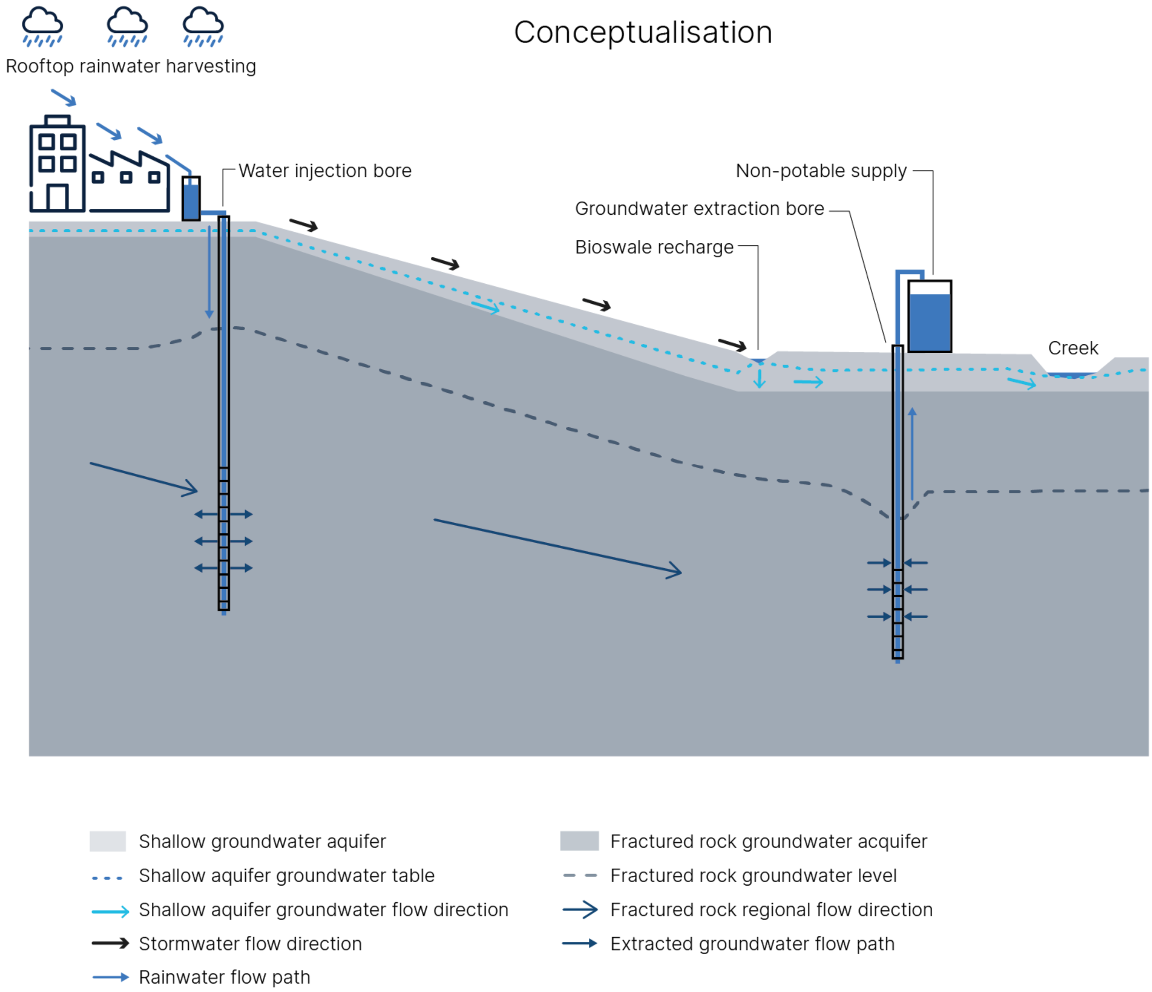

Figure 7-2 | High level conceptualisation of managed aquifer recharge and water integration in the Albury RJP

Stormwater run off collected through the site drainage system presents water quality issues, and limited opportunities for reuse unless there is a 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 7-2 provides a high-level conceptualisation of rainwater capture, aquifer recharge and potential non-potable extraction.

7.5 Stormwater Harvesting and Reuse

The proposed land use directions within the precinct consist of large impervious surfaces comprising industrial warehouse roof areas, roads, car parking, hardstand areas and landscaped open areas.

To support the IWCM objectives of the RJP, it is proposed to harvest surface run off from roof areas into on-site rainwater tanks for non-potable uses. It is expected that a requirement for on-site rainwater tanks could be included in site specific development control plan and WSUD policy for the precinct.

There are also opportunities to collect surface stormwater runoff from the hardstand areas and stored within underground storage tanks. As there are no direct uses for stormwater envisaged within the master plan, this has not been progressed in the below calculations. Should future demand arise, collection, storage and reuse of stormwater run off could be retrofitted if deemed appropriate. A summary of land use and catchments for various stages are provided below. The basis of the land use distribution is:

- Developable Area (DA)= 0.765 x Total Area (TA)
- Non Developable Area (NDA) = TA-DA
- Roof Area (RA) = 0.1x DA
- Landscape area (LA) = 0.15x DA
- Hardstand area (HA) = 0.75 x DA

Table 7–2 | Land uses and catchments (Stage 1)

Stage	Land Use Categories	Total Area (ha)	Developable Area (ha)	Non-developable area (roads, verges, constrained areas) (ha)	Roof Area (ha)	Landscape (15% of developable area)	Hardstand Area within each zone (m²) assumes 15% of the site is landscaped
Stage 1	Future highway service station	3	2.295	0.705	0.23	0.344	1.721
Stage 1	Higher intensity industrial	72	55.08	16.92	5.50854	8.26173	41.3097
Stage 1	Lower intensity industrial	88	67.32	20.68	6.7326	10.0983	50.4903
Stage 1	Productivity support	40	30.6	9.4	3.06	4.59	22.95
Stage 1	Intermodal	4	3.06	0.94	0.30612	0.45906	2.29506
Stage 1 Total		**207.0**	**158.4**	**48.6**	**15.8**	**23.8**	**118.8**

Table 7–3 | Land uses and catchments (Stage 2)

Stage	Land Use Categories	Total Area (ha)	Developable Area (ha)	Non-developable area (roads, verges, constrained areas) (ha)	Roof Area (ha)	Landscape (15% of developable area)	Hardstand Area within each zone (m²) assumes 15% of the site is landscaped
Stage 1	Future highway service station	3	2.295	0.705	0.23	0.344	1.721
Stage 1	Higher intensity industrial	72	55.08	16.92	5.50854	8.26173	41.3097
Stage 1	Lower intensity industrial	88	67.32	20.68	6.7326	10.0983	50.4903
Stage 1	Productivity support	40	30.6	9.4	3.06	4.59	22.95
Stage 1	Intermodal	4	3.06	0.94	0.30612	0.45906	2.29506
Stage 1 Total		**207.0**	**158.4**	**48.6**	**15.8**	**23.8**	**118.8**

Table 7–4 | Land uses and catchments (Stage 3)

Stage	Land Use Categories	Total Area (ha)	Developable Area (ha)	Non-developable area (roads, verges, constrained areas) (ha)	Roof Area (ha)	Landscape (15% of developable area)	Hardstand Area within each zone (m²) *assumes 15% of the site is landscaped
Stage 3	Future highway service station	-	-	-	-	-	-
Stage 3	Higher intensity industrial use	-	-	-	-	-	-
Stage 3	Lower intensity industrial	234	179.01	54.99	17.901	26.8515	134.2575
Stage 3	Productivity support	46	35.19	10.81	3.519	5.279	26.393
Stage 3	Intermodal	-	-	-	-	-	-
Stage 3 Total		**280.0**	**214.2**	**65.8**	**21.4**	**32.1**	**160.7**

7.5.1 Non-Potable Water Demand

Based on Water NSW Standard – 2019 and MUSIC modelling, non-potable water demands were estimated in commercial and industrial areas based on internal use – 0.1kL/day/ 1,000m²,and external use – 20kL/yr/1,000m².

Total internal use demand is assessed based on the total gross floor area and external use/demand is based on the pervious areas in landscape, road and the hardstand area for the master plan.

There is no established industrial target for the harvesting of rainwater; but targets as high as 80% non-potable demand for business and industrial development have been considered.

Sample water budgeting and harvesting estimates were carried on "daily rainfall data" from 1983 to 2022 (to date – Rainfall record station – Albury Airport).

The potential water yield for roof water harvesting from the various areas at various stages are presented in Table 7–5 to Table 7–7.

Table 7–5 | Water Demand (Internal and External) – Stage 1

Land Use Categories	Total Area	Total GFA	Internal use	External use
	(ha)	(m^2)	kL/day	kL/yr
Service Station (Stage 1)	3	2,295	0.23	131.48
Higher intensity industrial (Stage 1)	72	165,240	16.52	3,155.4
Lower intensity industrial (Stage 1)	88	201,960	20.20	3,856.6
Productivity (Stage 1)	40	91,800	9.18	1,753.0
Intermodal (Stage 1)	4	9,180	0.92	175.3
TOTAL	**207**	**470,475**	**47.05**	**9,071.78**

Table 7–6 | Water Demand (Internal and External) – Stage 1 + Stage 2

Land Use Categories	Total Area	Total GFA	Internal use	External use
	(ha)	(m^2)	kL/day	kL/yr
Service Station (Stage 1)	3	2,295	0.23	131.48
Higher intensity industrial (Stage 1)	72	165,240	16.52	3,155.4
Higher intensity industrial (Stage 2)	180	413,100	41.31	7,888.5
Lower intensity industrial (Stage 1)	88	201,960	20.20	3,856.6
Lower intensity Industry (Stage 2)	99	227,205	22.72	4,338.68
Productivity (Stage 1)	40	91,800	9.81	1,753.00
Intermodal (Stage 1)	4	9,180	0.92	175.30
TOTAL	**486**	**1,110,780**	**111.08**	**21,298.95**

Table 7–7 | Water Demand (Internal and External) – Stage 3 (Ultimate)

Land Use Categories	Total Area	Total GFA	Internal use	External use
	(ha)	(m^2)	kL/day	kL/yr
Service Station (Stage 1)	3	2,295	0.23	131.48
Higher intensity industry (Stage 1)	72	165,240	16.52	3,155.40
Higher intensity industry (Stage 2)	180	413,100	41.31	7,88.50
Lower intensity industry (Stage 1)	88	201,960	20.20	3,856.6
Lower intensity industry (Stage 2)	99	227,205	22.72	4,338.68

Lower intensity industry (Stage 3)	234	537,030	53.70	10,255.05
Productivity (Stage 1)	40	91,800	9.18	1,753.0
Productivity (Stage 3)	46	105,570	10.56	2,015.95
Intermodal (Stage 1)	4	9,180	0.92	175.30
TOTAL	**766**	**1,753,380**	**175.34**	**33,569.95**

7.5.2 Water Yield

A summary of the potential water yield from the site at various stages is presented below in Table 7–8 to Table 7–10. These yield estimates consider total areas at the catchment level and include developable and undevelopable area.

Table 7–8 | Potential water yield from the site for harvesting – Stage 1

	Service Station Stage 1	Heavy Industry Stage1	Light Industry Stage1	Productivity Stage 1	Intermodal Stage 1	Total
	Flow (ML/yr)					
Rain In	20.62	494.81	604.78	274.89	27.48	1422.58
ET Loss	6.42	154.11	188.36	85.61	8.57	443.07
Deep Seepage Loss	0	0	0	0	0	0
Baseflow Out	0.15	3.56	4.35	1.98	0.19	10.23
Imp. Stormflow Out	14	336.1	410.79	186.72	18.68	966.29
Perv. Stormflow Out	0.04	0.98	1.19	0.55	0.05	2.81
Total Stormflow Out	14.04	337.07	411.98	187.27	18.72	969.08
Total Outflow	**14.19**	340.63	416.33	**189.24**	18.92	979.31
Delta Soil Storage	0	0.09	0.11	0.05	0	0.25

Table 7–9 | Potential water yield from the site for harvesting – Stage 1 + Stage 2

	Service Station Stage 1	Higher intensity industrial		Lower intensity industrial Stage1	Lower intensity industrial Stage2	Productivity Stage 1	Intermodal Stage 1	Total
		Stage 1	Stage 2	Stage 1	Stage 2			
	Flow (ML/yr)							
Rain In	20.62	494.81	1237.06	604.78	680.2	274.89	27.48	3339.84
ET Loss	6.42	154.11	385.26	188.36	211.87	85.61	8.57	1040.2
Deep Seepage Loss	0	0	0	0	0	0	0	0
Baseflow Out	0.15	3.56	8.89	4.35	4.89	1.98	0.19	24.01
Imp. Stormflow Out	14	336.1	840.24	410.79	461.98	186.72	18.68	2268.51
Perv. Stormflow Out	0.04	0.98	2.45	1.19	1.35	0.55	0.05	6.61
Total Stormflow Out	14.04	337.07	842.68	411.98	463.32	187.27	18.72	2275.08
Total Outflow	**14.19**	340.63	851.57	416.33	468.2	**189.24**	18.92	2299.08

Delta Soil Storage	0	0.09	0.22	0.11	0.12	0.05	0	0.59

Table 7–10 | Potential water yield from the site for harvesting - Ultimate

	Service Station Stage 1	Higher intensity industrial		Lower intensity industrial			Productivity		Intermodal Stage 1	Total
		Stage 1	Stage 2	Stage 1	Stage 2	Stage3	Stage 1	Stage 3		
	Flow (ML/yr)									
Rain In	20.62	494.81	1237.06	604.78	680.2	1608.17	274.89	316.14	116.85	**5264.15**
ET Loss	6.42	154.11	385.26	188.36	211.87	500.85	85.61	98.46	36.39	**1639.51**
Deep Seepage Loss	0	0	0	0	0	0	0	0	0	**0**
Baseflow Out	0.15	3.56	8.89	4.35	4.89	11.55	1.98	2.27	0.84	**37.83**
Imp. Stormflow Out	14	336.1	840.24	410.79	461.98	1092.31	186.72	214.73	79.36	**3575.55**
Perv. Stormflow Out	0.04	0.98	2.45	1.19	1.35	3.17	0.55	0.63	0.23	**10.41**
Total Stormflow Out	14.04	337.07	842.68	411.98	463.32	1095.49	187.27	215.36	79.6	**3585.93**
Total Outflow	**14.19**	340.63	851.57	416.33	468.2	1107.03	**189.24**	**217.63**	**80.43**	**3623.74**
Delta Soil Storage	0	0.09	0.22	0.11	0.12	0.29	0.05	0.06	0.02	**0.94**

7.5.3 Water Harvesting Strategy

The water yield presented above may be not possible to harvest without exhausting extensive harvesting schemes and augmented further by water treatments. Therefore, the water harvesting strategy is limited to collection of potential surface run off from 100% of the roof area (maximum) in the rainwater tanks in this master plan. The potential water yield from the 100% roof area is presented below in Table 7–11 to Table 7–13.

Table 7–11 | Potential water yield from the site for harvesting – Stage 1 (Roof Area only)

	SS-Roof-Stg1	HI-Roof-Stg1	LI-Roof-Stg1	PS-Roof-Stg1	IM-Roof-Stg1	Total (Stage1) - Roof
	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	**Flow (ML/yr)**
Rain In	1.58	37.85	46.27	21.03	2.1	**108.83**
ET Loss	0.22	5.17	6.32	2.87	0.29	**14.87**
Deep Seepage Loss	0	0	0	0	0	**0**
Baseflow Out	0	0	0	0	0	**0**
Imp. Stormflow Out	1.36	32.69	39.95	18.16	1.82	**93.98**
Perv. Stormflow Out	0	0	0	0	0	**0**
Total Stormflow Out	1.36	32.69	39.95	18.16	1.82	**93.98**
Total Outflow	**1.36**	32.69	39.95	**18.16**	1.82	**93.98**
Delta Soil Storage	0	0	0	0	0	**0**

Table 7–12 | Potential water yield from the site for harvesting – Stage 1 + Stage 2 (Roof Area only)

	SS-Roof-Stg1	HI-Roof-Stg1	HI-Roof-Stg2	LI-Roof-Stg1	LI-Roof-Stg2	PS-Roof-Stg1	IM-Roof-Stg1	Total (Stg1+Stg2) - Roof
	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	**Flow (ML/yr)**
Rain In	1.58	37.85	94.63	46.27	51.87	21.03	2.1	**255.33**
ET Loss	0.22	5.17	12.92	6.32	7.08	2.87	0.29	**34.87**
Deep Seepage Loss	0	0	0	0	0	0	0	**0**
Baseflow Out	0	0	0	0	0	0	0	**0**
Imp. Stormflow Out	1.36	32.69	81.72	39.95	44.79	18.16	1.82	**220.49**
Perv. Stormflow Out	0	0	0	0	0	0	0	**0**
Total Stormflow Out	1.36	32.69	81.72	39.95	44.79	18.16	1.82	**220.49**
Total Outflow	**1.36**	32.69	81.72	39.95	44.79	**18.16**	1.82	**220.49**
Delta Soil Storage	0	0	0	0	0	0	0	**0**

Table 7–13 | Potential water yield from the site for harvesting – Stage 1 + Stage 2 + Stage 3 (Roof Area only)

	SS-Roof-Stg1	HI-Roof-Stg1	HI-Roof-Stg2	LI-Roof-Stg1	LI-Roof-Stg2	LI-Roof-Stg3	PS-Roof-Stg1	PS-Roof-Stg3	IM-Roof-Stg1	Total (Ultimate) - Roof
	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	Flow (ML/yr)	**Flow (ML/yr)**
Rain In	1.58	37.85	94.63	46.27	51.87	123.03	21.03	24.18	2.1	**402.54**
ET Loss	0.22	5.17	12.92	6.32	7.08	16.8	2.87	3.3	0.29	**54.97**
Deep Seepage Loss	0	0	0	0	0	0	0	0	0	**0**
Baseflow Out	0	0	0	0	0	0	0	0	0	**0**
Imp. Stormflow Out	1.36	32.69	81.72	39.95	44.79	106.23	18.16	20.88	1.82	**347.6**
Perv. Stormflow Out	0	0	0	0	0	0	0	0	0	**0**
Total Stormflow Out	1.36	32.69	81.72	39.95	44.79	106.23	18.16	20.88	1.82	**347.6**
Total Outflow	**1.36**	32.69	81.72	39.95	44.79	106.23	**18.16**	**20.88**	1.82	**347.6**
Delta Soil Storage	0	0	0	0	0	0	0	0	0	**0**

The yield indicates significant water is available for harvesting at various stages of development. Further modelling was carried out to harvest in rainwater tanks to provide water supply to internal and external uses for various stages of development.

Rainwater Tanks (RWT)

Various tanks sizes were considered to achieve a balanced outcome on water harvesting across the uses in the master plan. A total rainwater tank of 4,580m^3 is required across the Ultimate development, which is anticipated to provide around 82% of the anticipated non-potable water demand across the Albury RJP when fully developed. The rainwater sizing is based on the capture of the rainfall run off from 100% of expected roof area.

It is recommended that a DCP control be imposed on development within the RJP requiring onsite rainwater tanks to be provided within the capacity to collect 100% of roof water from buildings and structures, with reticulated water provided throughout all buildings for non-potable uses. This will provide an important source of potable water supplementation in the region.

Table 7–14 provides a summary of rainwater tank sizes and the service levels at various stages of the development for the master plan.

Table 7–14 | Rainwater Tank Strategy

Area	Total Area (ha)	Total GFA (m^2)	Internal use kL/day	External use kL/yr	Tank Size (m^3)	% Non-potable Water Demand Met
Service Station (Stage1)	3	2,295	0.23	131.48	10	80.94%
Higher intensity industrial (Stage 1)	72	165,240	16.52	3,155.40	400	80.28%
Higher intensity industrial (Stage 2)	180	413,100	41.31	7,888.50	1100	81.49%
Lower intensity industrial (Stage 1)	88	201,960	20.20	3,856.60	525	80.59%
Lower intensity industrial (Stage 2)	99	227,205	22.72	4,338.68	500	80.05%
Lower intensity industrial (Stage 3)	234	537,030	53.70	10,255.05	1500	81.14%
Productivity (Stage 1)	40	91,800	9.18	1,753	250	80.94%
Productivity (Stage 3)	46	105,570	10.56	2,015.95	270	80.83%
Intermodal (Stage 1)	4	9,180	0.92	173.30	25	81.20%
TOTAL	**766**	**1,753,380**	**175.34**	**33,568**	**4,580**	

7.6 Water Quality Strategy

The proposed master plan has considered conventional bio retention basins to capture and treat stormwater runoff to ensure the water quality objectives are met downstream in Eight Mile Creek and its tributaries, and more importantly, in the Lake Hume Reservoir area in Murray River. The water quality design in the master plan has been applied only for the developable area.

Typical water quality objectives considered in this master plan are typical values generally considered in the urban development. It is recommended that the following targets be adopted in a site specific DCP or WSUD policy for the RJP:

- 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 filter area of bio retention basin of 38,565 m^2 is required without rainwater tank and 36,435 m^2 if rainwater tanks are mandated. Given that rainwater tanks will also reduce demand for potable water, and are a user-pays option, it is recommended that this be mandated across the RJP through DCP controls.

A summary of optimal filter sizes of bio retention basins at each stage are provided in Table 7–15 and Table 7–16 with and without rainwater tanks.

Table 7–15 | Bio retention Strategy (without mandatory rainwater tanks)

Area	Total Area (ha)	WQ- Bioretention Basin filter area (m^2)
Service Station (Stage 1)	3	170
Higher intensity industrial (Stage 1)	72	3,675
Higher intensity industrial (Stage 2)	180	9,135
Lower intensity industrial (Stage 1)	88	4,400
Lower intensity industrial (Stage 2)	99	5,055
Lower intensity industrial (Stage 3)	234	11,400
Productivity (Stage 1)	40	2,150
Productivity (Stage 3)	46	2,350
Intermodal (Stage 1)	4	230
TOTAL	**766**	**38,565**

Table 7–16 | Bio retention Strategy (with mandatory rainwater tanks)

Area	Total Area (ha)	WQ- Bioretention Basin filter area (m^2)
Service Station (Stage 1)	3	160
Higher intensity industrial (Stage 1)	72	3,500
Higher intensity industrial (Stage 2)	180	8,700
Lower intensity industrial (Stage 1)	88	4,300
Lower intensity industrial (Stage 2)	99	4,815
Lower intensity industrial (Stage 3)	234	10,500
Productivity (Stage 1)	40	2,000
Productivity (Stage 3)	46	2,240
Intermodal (Stage 1)	4	220
TOTAL	**766**	**36,435**

These bio retention basins would need to be located appropriately based on existing terrain, preferably within the riparian areas of the creeks. These basins can be consolidated into one regional basin, or multiple smaller basins if the site terrain permits. It is recommended that the placement of GPTs (Gross Pollutant Traps) be included in public domain infrastructure and stormwater improvements.

7.6.1.1 Spill Management Strategy

Mitigation of spills and contamination of ground water from industry related pollutants (oil, chemicals) should be addressed within a site specific DCP and with appropriate conditions in development approvals. To prevent spills reaching the Murray River, it is important to ensure the bio retention systems can contain contaminated water from spills, storm or fire events.

7.6.1.2 Water Quantity Management Strategy

On-Site Detention (OSD) storage is required in the precinct for water quantity management. Estimates for the sizing of OSDs are based upon existing site conditions and anticipated developed impervious areas. The estimates are made using ILSAX method using DRAINS (Version 2022.012) for 1% AEP storm event with climatic change (20%). The OSD strategy for water quantity management for various stages of the master plan is provided in Section 7.6.1.3.

Typically, an area of 236,491 m^2 will be required to provide the required OSD storage area for the ultimate development scenario (Stage 3), with a total OSD volume of 291,308 m^3. It is envisaged that much of the OSD storage can be contained below hardstand areas at the low point of sites, however some attenuation of flows within the public domain is also likely to be required.

7.6.1.3 Flood Management Strategy

The Albury Floodplain Risk Management Study and Plan (2016) covers various catchments including the Eight Mile Creek Catchment. The RJP is located within this catchment at the upper reaches.

The overview of the geomorphic study identified some concerns over the channel stability such as:

- Bed Degradation
- Channel planform changes (considered priority A)
- Effect on existing structures
- Protection of creek reaches
- Protection of public and environmental assets threatened by bank erosion.

The flooding in the creek is contained within mainstream and limited overland flooding. The mainstream flooding is mainly affected by high level in the Murray River. There is some minor flooding south of Overall Forge/Visy and further west of Gerogery Road in the upper reaches of the catchment.

It is recommended that a further flood study be undertaken incorporating the changed land use in the RJP, grading plans for future roads and subdivisions, and the water quantity management suggested by the above OSD strategy, to confirm if further works are required to mitigate flood impacts and other issues identified in the Floodplain Risk Management Study. An extract from the 2016 Albury Floodplain Risk Management Study showing the impact of the 1 in 100 year flood event on the Eight Mile Creek and Thurgoona catchments is provided in Figure 7-3

Table 7–17 | On-Site Detention Strategy

	Catchment Area (ha)	Pre-Develop Flows	Post-Develop Flow (1%)	Bottom			slope m: 1	Water Depth	Top at water surface level			OSD Volume (m^3)
				L (m)	B (m)	A (m^2)			L (m)	B (m)	A (m^2)	
Service Station - Stage 1	3	0.90	1.46	10.2	25.2	257	4	1.20	30	15	425	419
Higher intensity industrial use - Stage 1	72	9.62	22.6	185	90	16705	4	1.20	190	95	18050	20848
Higher intensity industrial use - Stage 2	180	18.60	45.30	295	145	42863	4	1.20	300	150	45000	52712
Lower intensity industrial - Stage 1	88	11.5	26.9	225	110	24817	4	1.20	230	115	26450	30755
Lower intensity industrial - Stage 2	99	12.40	25.70	275	135	37207	4	1.20	280	140	39200	45839
Lower intensity industrial - Stage 3	234	24.4	59.2	445	220	98033	4	1.20	450	225	101250	119564
Productivity support - Stage 1	40	6.18	13.80	125	60	7537	4	1.20	130	65	8450	9587
Productivity support - Stage 3	46	6.83	15.60	135	65	8815	4	1.20	140	70	9800	11164
Intermodal - Stage 1	4	0.581	1.21	25	10	257	4	1.20	30	15	450	419
Total	**679**	**82**	**194**			**236,491**					**249,100**	**291,308**

Figure 7-3 | Eight Mile and Thurgoona Catchment Peak Flow Depths and Level Contours for a 1% AEP Event

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8 Staging and Funding Recommendations

This section provides a summary of the recommended hydrogeology, water quality and IWCM strategy for the Albury 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.

8.1 Stage 1

Stage 1 presents a readily adoptable strategy with rainwater tanks incorporated into the industrial development, providing re-use on site for non-potable uses and WSUD features incorporated into future subdivisions and public domain upgrades.

Requirements for rainwater tanks and on-site potable water substitution could be readily adopted through a Development Control Plan and presents a ‘user pays’ option with minimal infrastructure cost for Council. It is anticipated that Stage 1 of the master plan will require some development applications to be lodged for subdivision. It is recommended that Council prepare a site-specific DCP, or a WSUD policy, confirming the water quality targets and WSUD features to be installed within the precinct.

OSD and bio retention should be incorporated on-site and in public domain upgrade projects. On-site infrastructure can be required through appropriate controls in a DCP which should address water quality and quantity and require MUSIC modelling for all industrial subdivisions and future construction projects. Public infrastructure, such as linear bio retention systems, stormwater attenuation and flood mitigation work that can be linked to the redevelopment of the RJP, should be itemised and captured within a Section 7.11 Development Contributions Plan.

8.2 Stage 2

Stage 2 presents an option where roof water is captured and reused, with excess water directed into the groundwater table in a managed aquifer recharge scenario. This may work well if Council intend to use groundwater for irrigation purposes (either within the RJP or wider region) and could provide an appropriate option if an alternative recycled water source (e.g., third pipe) is not available in the area.

This option requires Council to own the bores, which could be established during construction (or prior) within open space areas. This could also provide a water source to support fire fighting supply for the area and reduce potable water demand. It would be necessary to undertake a more detailed study of the availability and quality of groundwater supplies in the region, to confirm that there is benefit in the cost of establishing bores relative to the potential for groundwater yields to offset potable water demand.

Given the recent emphasis that has been placed on regional water management in the draft Murray Regional Water Strategy (DPE, 2022), aquifer recharge within the RJP could potentially be used to improve groundwater resources in the wider catchment and build water security and resilience. Further hydrogeological investigation would be necessary to confirm the geographical extent of positive impact associated with aquifer recharge within the RJP, and whether a ‘water banking’ scheme i.e., transfer or exchange of groundwater rights, may be feasible.

As new roads are constructed, it is anticipated that there would be an increase in investment in WSUD by Council and developers, with linear WSUD features incorporated into public domain and on private properties (e.g., car parking areas associated with industrial development), to increase infiltration through bio-retention swales and ponds. This would assist in water quality and reducing urban heat island, whilst also improving the urban greening and aesthetics of the area.

It is important that a site specific DCP or WSUD policy be prepared by ACC to confirm the expected WSUD infrastructure and water quality targets that are to be met. A Development Contributions Plan should also include funding for WSUD within the public domain. If a community-based aquifer recharge and bore system is established, there may also be opportunity for Council to recover investment through a Section 64 Development Servicing Plan.

8.3 Stage 3

It is anticipated that the Northern WWTP would be operational towards the end of Stage 2 and would require an approximately 27ha wetland to assist with the polishing of treated effluent prior to discharge to receiving waters. Whilst the establishment of a wetland presents a readily adoptable option for the management of treated water from the new WWTP, there could be an opportunity to use treated water as part of the aquifer recharge scheme.

This concept would require additional hydrogeological research to confirm feasibility, however, it may present an attractive way to improve groundwater resources regionally as part of the Murray Regional Water Strategy, improve water security and resilience. If this concept is found to be viable, there may be opportunity to establish a 'water banking' scheme to offset some of new water demand from industries within the RJP.

9 Next Steps

For the Council to consider groundwater as a non-potable water supply, further assessment during the rezoning processes is recommended. The next step in assessing groundwater supply consists of a drilling program which can be part of a precinct-wide hydrogeological study. Figure 9-1 presents the locations to consider for the drilling program which take into consideration the Albury RJP master plan.

The locations focus on areas which are planned to be open space, and thus unlikely to be affected by changes in the master plan, as well as targeting potential structures assessed from the publicly available regional geophysical and geological data. The locations may be drilled progressively and it is recommended that Council consider drilling at least three locations in one program when assessing groundwater supply potential. The location on Figure 9-1 should target the bedrock groundwater with consideration of a 200 mm diameter hole to a nominal target drilling depth of at least 100 m to 150 m, with separate shallow bores in the unconsolidated material, as required. Groundwater bores should be drilled by suitably licensed water bore drillers and in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2020).

There are benefits to undertaking the drilling program during the rezoning stage. Should a groundwater supply of suitable yield be found at a site, the Council can rezone the land around it accordingly to capitalise on that location. Drilling and testing during a greenfield phase is considerably easier than once roads and infrastructure have been established. A secure and reliable groundwater supply could supplement potable water uses by reducing demand associated with firefighting supplies or other non-potable uses, and improve sharing of water allocations, ultimately allowing more industries to locate to the area and providing improved water resilience. Supplementing with groundwater use would be particularly useful if there are industries choosing to locate into the RJP that have demand for groundwater over potable water. In addition, this program may offer benefits to the wider catchment through providing data to support a managed aquifer recharge program and it aligns with the objectives of the draft Murray Regional Water Strategy (DPE, 2022).

It may not be necessary for Council to drill at all the locations proposed, however the more locations that are drilled the greater the chance of finding a suitable supply. The definition of what constitutes a suitable supply, i.e., the minimal bore yield, should be developed in consultation with Council prior to the commencement of drilling. If a suitable supply is found, consideration should be given to installing monitoring bores around the test production bore, with a minimum of one monitoring bore at least 10 m to 20 m away, for the purpose of aquifer testing and long-term monitoring of bore performance. These monitoring bores may be a smaller 125 mm diameter hole. Multiple suitable groundwater supply locations are possible. Aquifer testing, further analysis would be required to assess the final yield of the most productive bore and determine a suitable location and design of the pumping infrastructure. Testing would be undertaken in accordance with the *Minimum Requirements for pumping tests on water bores in NSW* (DPIE, 2019). Locations which do not have sufficient yield are recommended to be converted to 50mm diameter monitoring bores.

The monitoring bores and any test production bores drilled would inform a precinct wide hydrogeological study. The Contamination Study undertaken by ERM recommends sampling for groundwater quality. The shallow groundwater table monitoring locations, particularly around Eight Mile Creek, are recommended to be installed and can be used as part of the sampling program for groundwater quality. These shallow locations could be installed as part of the groundwater drilling program at the locations on Figure 9-1 where an unconsolidated shallow aquifer is found to be present. The drilling locations recommended have considered areas where there is potential for a shallow aquifer in unconsolidated material.

A precinct wide hydrogeological study provides the opportunity to assess the full spectrum of WSUD and IWCM options. The level of modelling required, and the associated time and cost of this study, will depend on the intended use of groundwater and potential impact of the development on groundwater resources. Modelling can both assess the business as usual WSUD features of integrated stormwater management and the managed aquifer recharge program.

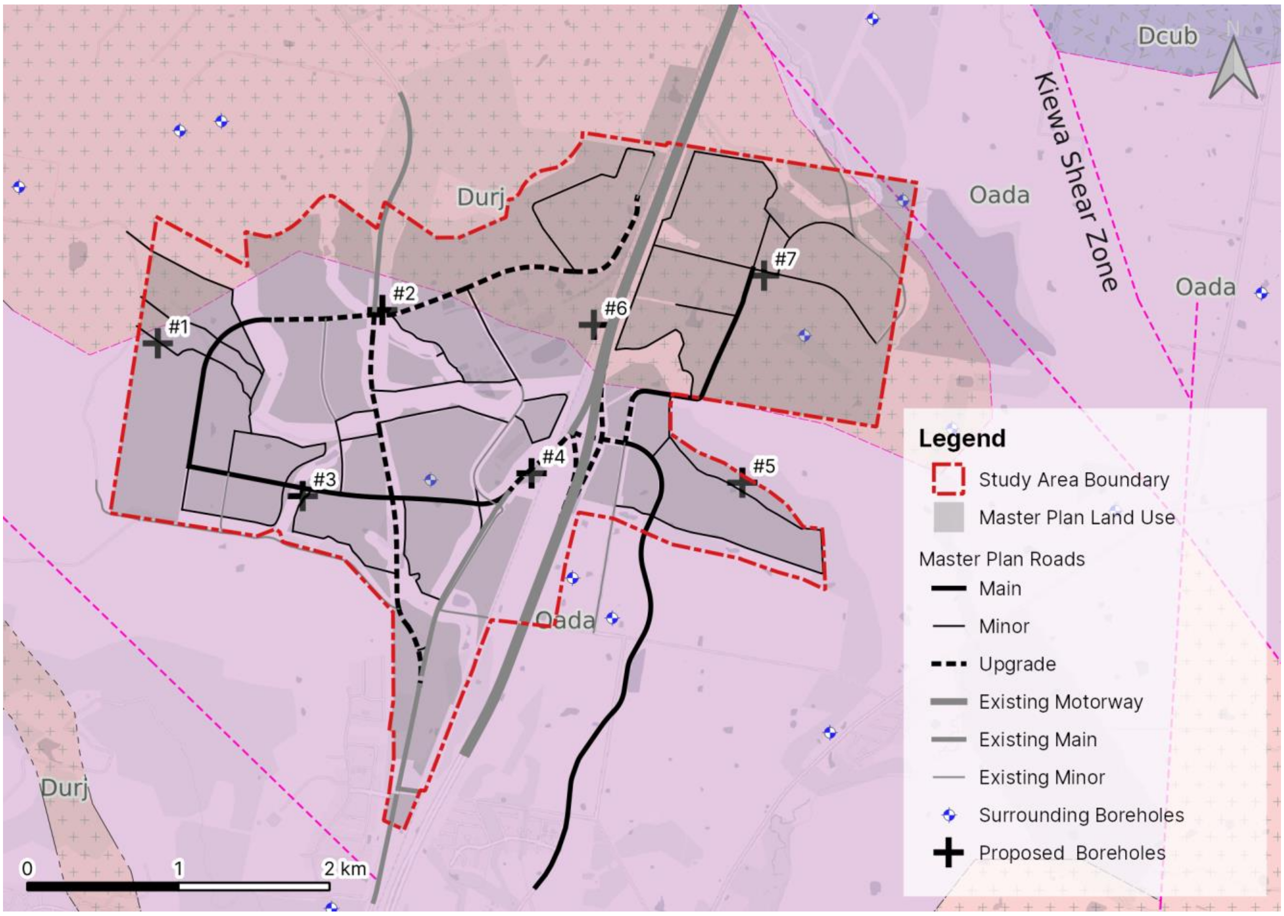

Figure 9-1 | Master Plan of the Albury RJP indicating proposed groundwater monitoring bore locations

The drilling program and any testing may be managed and adapted to fit with the Council's budget. Drilling fewer locations or to a lesser nominal depth may result in a suitable groundwater supply not being found at the site. If a suitable groundwater supply is not found, the monitoring bores that have been installed may be used for long term regional groundwater monitoring of level and quality at the Albury RJP. An ongoing monitoring program would be especially important if managed aquifer recharge is to be considered, in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2020). Existing registered bores within the precinct that are not going to be within open space zones should be decommissioned prior to earthworks in the vicinity, in accordance with the requirements of aquifer protection under the *NSW Aquifer Interference Policy* (2012).

When sufficient precinct wide hydrogeological information is obtained early on, Council has the ability to continually use the information to assess future design plans, provide advice to industries looking to locate to the region and to support the precinct staged development applications, reducing the need to drill and assess each stage of the development individually. To obtain sufficient site wide information, the seven locations provided on Figure 9-1 are recommended.

To incorporate groundwater as part of non-potable water supply, a hydrogeological study to support a water access license under the *Water Sharing Plan* (2000) may be required. The hydrogeological study would assess the monitoring bore network requirements and propose a monitoring and maintenance program. The hydrogeological study could assess the viability of managed aquifer recharge using modelling and the results of drilling and testing undertaken.

Given the alignment with the Murray Regional Water Strategy (DPE, 2022) and potential benefits to the wider catchment in terms of water security, resilience and the potential for 'water banking', it is recommended that Council consider seeking grant funding to support these additional studies.

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