Ordinary Meeting of Council

18 January 2023

UNDER SEPARATE COVER ATTACHMENTS

ITEMS 9.1 AND 9.2

QUEANBEYAN-PALERANG REGIONAL COUNCIL

Council Meeting Attachment

18 JANUARY 2023

ITEM 9.1 MAIN STREET GRANT APPLICATIONS 2022/23

ATTACHMENT 2 MAIN STREET UPGRADE FUND 2022-23 GUIDELINES

QPRC

MAIN STREET UPGRADE FUND

Guidelines

2022-23

ECM 1699107

qprc.nsw.gov.au

Main Street Upgrade Fund Guidelines 2022-23

Background

In March 2021 Council established this fund to assist owners of commercial buildings or businesses located within the Central Business District, Queanbeyan (Map 1), along Wallace Street, Braidwood (Map 2) or located in Gibraltar Street, Bungendore (Map 3) and zoned Business, to improve the external appearance of their buildings. However, excluded from licenced hotels and clubs are excluded from the fund.

These guidelines are included to assist you with your application. It is essential that you prepare and submit the best application possible as this is a competitive grant with limited available funding.

Available Funding

For the 2022-2023 financial year a total of $150,000 has been allocated by Council to this fund.

This program provides financial assistance on a dollar for dollar basis (excluding GST) for a variety of improvements to eligible buildings located within the areas outlined in Maps 1-3. The maximum amount allocated for any one fund application will generally be $10,000 on a $1: $1 basis. Only one application for each building/business will be accepted in any one financial year.

Aim of The Fund

The aim of the fund is to encourage a positive improvement in the overall appearance of the Queanbeyan CBD as well as the commercial areas of Gibraltar Street, Bungendore and Wallace Street, Braidwood.

In the longer term it is hoped that this process will encourage greater interest in, and concern for, the appearance of buildings located in the previously outlined areas and that this will encourage owners to contribute to an overall improvement in the appearance and amenity of these areas into the future.

Timing of the Program

Applications are to be received by 11 November 2022.

Successful applicants will be required to complete their relevant projects by 30 June 2023.

Applications for Funding

Owners of commercial buildings within the outlined areas of Queanbeyan, Bungendore and Braidwood (Maps 1-3) are invited to apply for assistance under this fund.

Application forms can be downloaded from Council's website www.qprc.nsw.gov.au or by phoning the Land-Use Planning Branch on 6285 6276.

Please note that in all instances written applications with appropriate details must be made and approval given by Council prior to any work being undertaken. **In some cases, this will involve the submission and approval of a development application**. Further information can be found on Council's website at https://www.qprc.nsw.gov.au/Building-Development/Building-and-Development-Forms-and-Checklists

You will receive a letter of advice regarding the success or otherwise of your application for funding. We anticipate this will occur in early December 2022.

Matters to Consider and comply with when completing your application

It will assist your application if you can properly demonstrate why the work you propose is appropriate and how it will improve the appearance of the existing building. Consequently, Council strongly encourages you to review and comply with the following matters:

1) Decide in detail what work you want to carry out. This can include the proposed colour scheme for the painting of the façade of a building. For external painting exact details of proposed colours are to be submitted with your application.
2) Discuss the proposed work with Council's Development Assessment Branch on 1300 735 025 to find out if a Development Consent is required. If development consent is required, please indicate this as part of your application for funding.
3) For any other questions that you may have, you can discuss with staff of the Land-Use Planning Branch contactable on 6285 6276.
4) For improvement to older buildings or buildings that are heritage items, it is recommended that you contact Council's Heritage Advisor to discuss the eligibility of your project. Appointments can be made through Council's Land-Use Planning Branch on 6285 6276. The Heritage Advisor can also provide advice on appropriate colour schemes for buildings. This service is provided free of charge to property owners. If the project is too large, the Heritage Advisor may suggest that you obtain the services of an Architect for carrying out the project. Depending on the scale of the project a development application or a "Minor Heritage" application may need to be lodged. Further information on Minor Heritage applications can be found on Council's website at https://www.qprc.nsw.gov.au/Building-Development/Heritage
5) If work is proposed over the footpath, a Section 138 Approval for Work over footpath is required. The relevant form can be found on Council's website at https://www.qprc.nsw.gov.au/Building-Development/Building-and-Development-Forms-and-Checklists#section-8 . A Traffic Control Plan (TCP) is required to be prepared to accompany a Section 138 application.
6) Costs associated with any Council approvals required to be obtained will be added to the grant money offered.
7) Depending on the size of the project you may need to attach plans and sketches to your application for funding.
8) Obtain a minimum of two written quotes from different licensed contractors. If you are intending to undertake all or part of the work yourself, reimbursement of up to 50% of materials you use (excluding GST) will be considered as part of the grant. This is subject to details of materials required and their prices being provided to Council prior to work being undertaken. A claim for reimbursement must be supported by receipts for materials used on the project.

9) Photograph(s) of the setting of the building, each elevation, and close-ups of all jobs to be done is to be provided with the application form. At the time of claiming the allocated fund monies, a photographic record of the completed work must be supplied.
10) Where structural, electrical, or other alterations are to take place, applicants need to comply with relevant development control plans for the area available from Council's website. Further information can also be obtained from Council's duty planner on 1300 735 025.

Eligible Projects

Eligible projects are those which involve the applicant's own property, or another property with appropriate consent, and includes repairs, replacement, painting, and the reinstatement of original architectural features to the façade of buildings located in the outlined areas.

A list of eligible projects is identified below. Please note that this is not an exhaustive list and each application will be considered on merit.

Examples of projects that funding may be provided for include:

- Removal and/or replacement of external unused signs.
- Painting and shop front decorations.
- Application of anti-graffiti treatments.
- External repairs, replacement, or refurbishment of building façade.
- External reinstatement of original architectural features to building façade.
- Lighting where it makes a substantial contribution to the streetscape.

Joint applications are encouraged where improvements are proposed for two (2) or more adjoining properties. In this case multiple funds may be approved, and the funded amount will be in proportion to the number of successful applicants.

Applications involving sites listed as heritage items under the current Local Environment Plan are also strongly encouraged.

Ineligible Projects

Ineligible projects include works that are considered not to achieve the aim of these guidelines.

Examples of ineligible projects include the following, although the list is not exhaustive:	
Security devices or grills.	Handwritten signs or posters.
New additions or extensions.	Works not architecturally sympathetic with the heritage or surrounding property.
Works fully or partially completed (retrospective funding will not be considered).	Any work/repairs to the interior of a building.
The provision or upkeep of advertising material.	Any work/repairs to the exterior of a building where that work is not visible from a public road.
Any work/repair requiring development consent that has not been obtained prior to undertaking that work or repair.	Funding will also not be provided for licenced hotels and clubs.

Assessment Criteria

Successful applications will be those that meet the aim of this Fund program by contributing to a positive improvement in the overall streetscape. These proposed projects must be eligible and have complied with other requirements of these guidelines as well as any development or heritage approval processes applicable to the property.

The following matters will be considered in assessing the eligibility of your application:

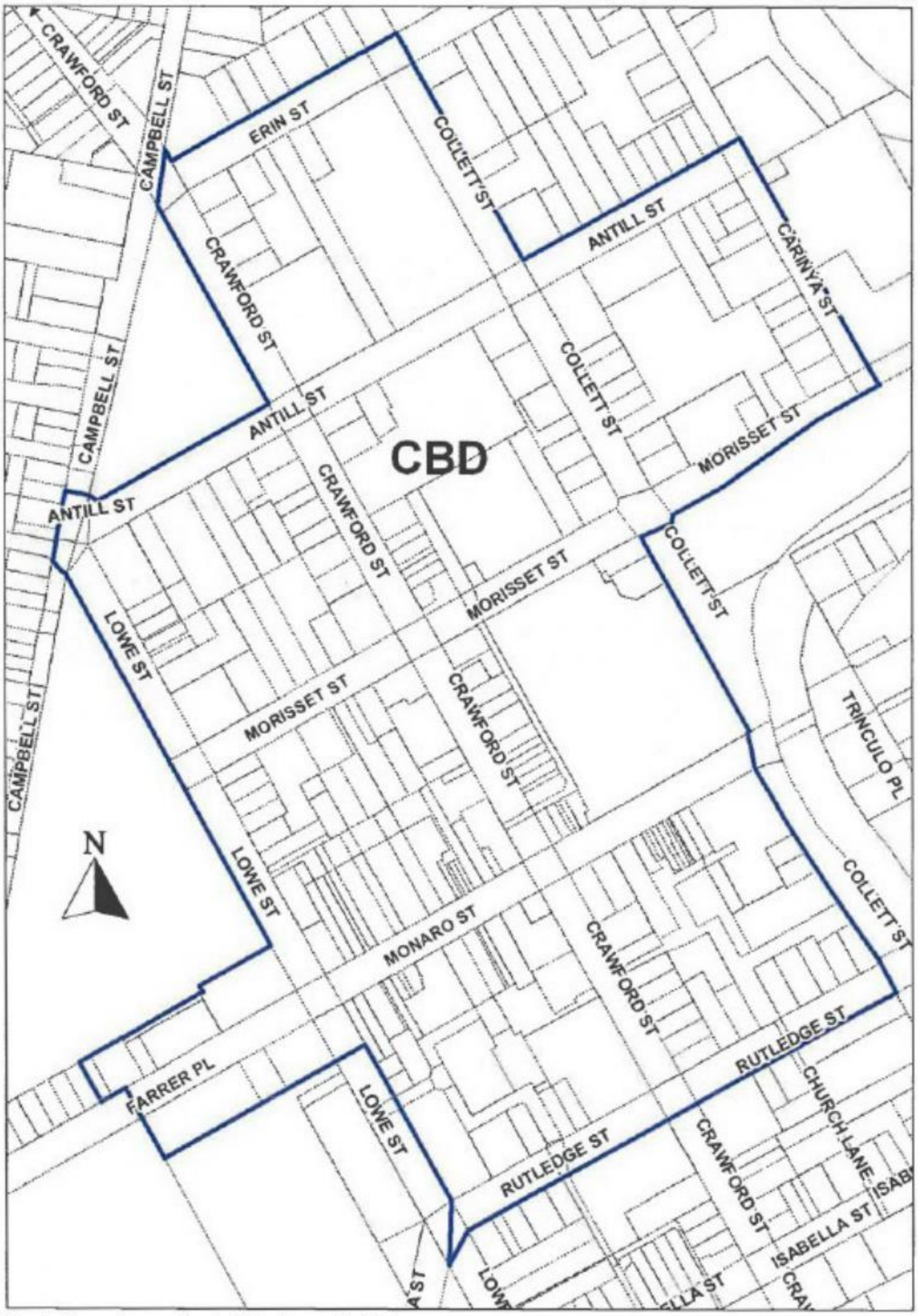
- Whether the project is eligible or ineligible.
- The extent to which the project achieves or fails to achieve the aim of the Fund and clearly provides improvements to the appearance of the local streetscape.
- Whether the project is part of a joint project or not.
- Whether the project involves a listed heritage item or not
- The applicant's demonstrated ability to complete the project within 6 months of the Fund being approved by Council in writing.
- The applicant's demonstrated consideration of and compliance with the matters listed when completing an application.
- Whether or not the application form has been completed in full and **paid invoices** and **images of completed works** can be provided.
- The degree to which the applicant is financially contributing to the project.

Favourable consideration will be given to applications involving sites listed as heritage items under the appropriate current Local Environment Plan although non listed buildings are not excluded.

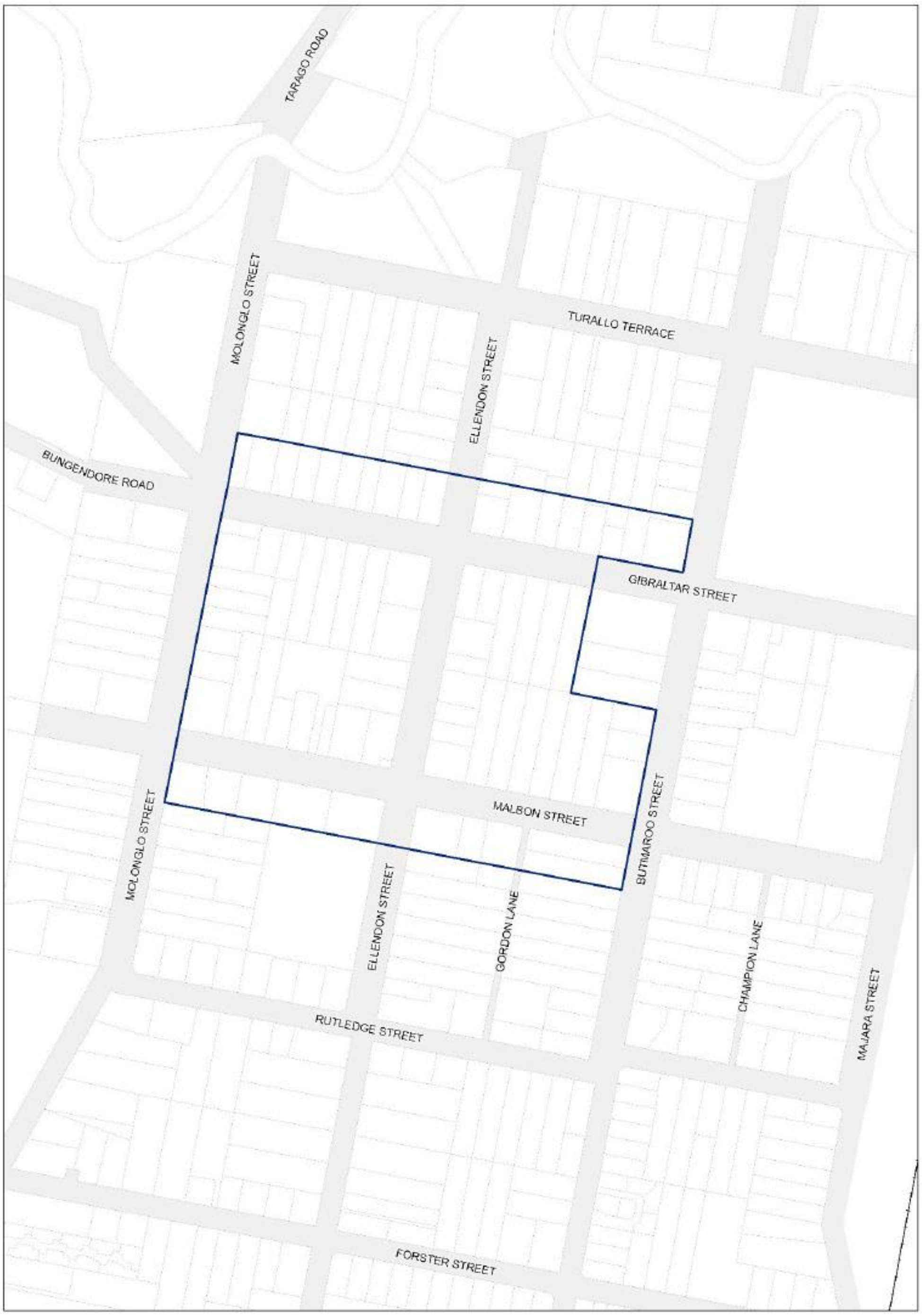
Favourable consideration will also be given to joint applications where improvements are proposed for two (2) or more adjoining properties. In this case multiple funds may be approved, and the funded amount will be in proportion to the number of successful applicants.

Payment of Fund

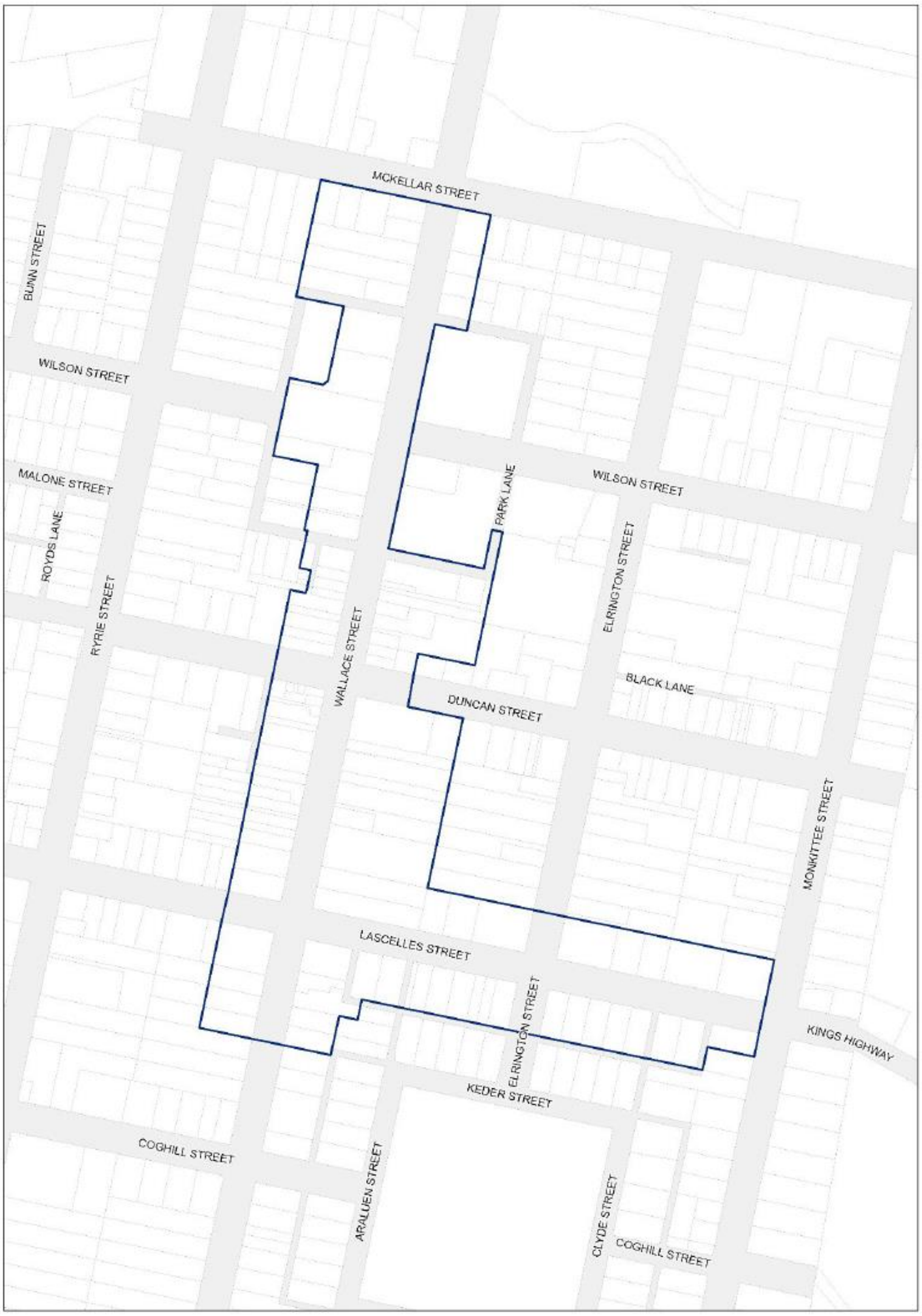
Funds will only be paid on satisfactory completion of the work specified and when **paid invoices** and **images of completed works** have be provided. From approval of the fund, you have 6 months to complete the project. Where development consent is required, this time will be from the date that a construction certificate is issued. When the work is completed for successful applicants, the fund will be paid according to the amount of funding approved.



Map 1: Queanbeyan Central Business District



Map 2: Commercial District Gibraltar Street, Bungendore



Map 3: Commercial District Wallace Street, Braidwood

MAIN STREETS IMPROVEMENTS FUNDS APPLICATION FORM

Please find the application form on Council's website or contact the Land-Use Planning Branch on 6285 6276.

QUEANBEYAN-PALERANG REGIONAL COUNCIL

Council Meeting Attachment

18 JANUARY 2023

ITEM 9.2 QUEANBEYAN INTEGRATED WATER CYCLE MANAGEMENT (IWCM) REPORT

ATTACHMENT 1 IWCM ISSUES PAPER

Queanbeyan Integrated Water Cycle Management Strategy
Queanbeyan Palerang Regional Council D R A F T**FINAL DRAFT**
18-Nov-2019

Issues Paper

Queanbeyan Integrated Water Cycle Management Strategy

FINAL DRAFT

Issues Paper

Queanbeyan Integrated Water Cycle Management Strategy

Client: Queanbeyan Palerang Regional Council

ABN: 95 933 070 982

Prepared by

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AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

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Quality Information

Document Issues Paper

Ref 60548525

Date 18-Nov-2019

Prepared by Shane Wickramasinghe and Sukru Ozger

Reviewed by Mark Wilton and Hayden Seear

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	17-Apr-2018	1st Draft - issued for QPRC & DPI Water review	Ryan Signor Project Director	Refer Rev A
B	24-Sept-2019	2nd Draft - issued for QPRC review	Hayden Seear Project Manager	
C	18-Nov-2019	Final Draft - issued for QPRC & DPIE Water review (as preparation for PRG Workshop)	Hayden Seear Project Manager	

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Executive Summary

Queanbeyan is a city located in the south-eastern region of NSW within the Southern Tablelands, adjacent to the ACT. In May 2016, Queanbeyan City Council (QCC) amalgamated with Palerang Regional Council (PRC) to form Queanbeyan-Palerang Regional Council (QPRC).

QPRC has commissioned a review of water, sewer and stormwater infrastructure within the former Queanbeyan Local Government Area (LGA), as part of a process to develop and implement a suitable 30-year Integrated Water Cycle Management (IWCM) Strategy. The commissioning of this IWCM strategy follows the initiation of an IWCM strategy for the former Palerang LGA in 2017 and the completion of an IWCM focused master plan for Googong Township (located within the Queanbeyan LGA) in 2016.

The Queanbeyan IWCM Strategy is therefore comprised of the former QCC LGA including the suburbs of Queanbeyan, Queanbeyan East, Queanbeyan West, Greenleigh, The Ridgeway, Crestwood, Jerrabomberra, Karabar, Tralee-Environa and parts of the rural localities of Carwoola, Googong, Royalla and Burra. It excludes the former Palerang LGA localities that are encompassed within the Palerang Community IWCM Strategy and Googong Township is not featured due to a number of factors including its independence from Queanbeyan City water related services; completion of a separate IWCM focused 25-year master plan, and distinctive pricing policy considerations surrounding the provision of reticulated recycled water.

Population and Demographic Projections

Queanbeyan's housing is made up of older traditional housing stock in suburbs closer to the City Centre and relatively new housing stock in areas such as Jerrabomberra. Queanbeyan is also characterised by the significant rural living opportunities that are provided within the rural parts of the former QCC LGA. The permanent residential population across the study area at 2016 is in the order of 42,000. This is projected to grow by 12% into the future with an additional 5,000 population projected by 2050 based on a number of new Greenfield developments as well as distributed infill development. A summary of the residential population projection is provided in Table E1 below.

Employment across the study area is also projected to increase into the future based on local employment growth being boosted by external population growth pressures, including the traditional flow of population from Canberra and the surrounding rural areas and small towns. Employment growth of 74% to 2050 (+120 Ha) is represented by the non-residential projection provided in **Table E1**. An additional 26 Ha of recreational land is also projected out to 2050.

Table E1 Residential and Non-Residential Projections (Cumulative)

Queanbeyan IWCM	Forecast Year					
	2016	2021	2026	2031	2036	2050[2]
Residential Population	41,952	42,584	43,874	45,690	46,931	46,931
Residential Dwellings[1]	17,374	17,985	18,650	19,443	20,094	20,094
Non-residential (employment) Area, Ha	163	200	211	231	245	283
Non-residential (recreational) Area, Ha [3, 4]	UNK	3	13	26	26	26

Notes:

1. Dwellings assumed to represent low, medium and high density from private and non-private dwellings
2. There are no projections available for development areas beyond 2036 hence for the 2050 planning horizon there is no further growth assumed (as agreed with QPRC)
3. Existing (2016) recreational land area unknown (data not available)
4. Additional future recreational development (2021-2050) assumed to represent Public Open Space

Water Demand Analysis

Treated water is supplied in bulk from Icon Water in the ACT to Queanbeyan under a Service Level Agreement via two bulk water supply offtakes, namely Offtake 1 (East Queanbeyan) and Offtake 2

(Jerrabomberra). Queanbeyan's water supply network downstream of Offtake 1 and Offtake 2 consists of seven water supply zones (WSZs) including associated reservoirs, pump stations and several pressure managed areas.

Historical bulk water supply data from Icon Water and historical metered customer consumption data provided by QPRC were used to analyse the current baseline water demand and derive future water demand projections. Key messages surrounding the water demand analysis are summarised as follows:

- An annual average baseline water consumption unit rate of 233 L/cap/day (climate adjusted) was derived. This unit rate was used to project future residential water demand out to 2050.
- Equivalent Population (EP) for the water network projected out to 2050 is estimated at 46,931 residential EP. Non-residential demand was projected based on future development area (Net Ha) as shown in **Table E1**.
- Non-Revenue Water (NRW) component was calculated at 18% of the total network demand based on comparing historical bulk supply data (Icon Water) with historical metered customer consumption data (QPRC) at the system level on an annual basis.
- A ratio of Peak Day Demand (PDD) to daily Average Day Demand (ADD) was derived as 2.3 when referencing historical bulk supply data. This ratio was adopted as a scaling factor to forecast future PDD.
- The current and future water demand forecast for the study area, inclusive of Average Day Demand (ADD) and Peak Day Demand (PDD), is shown in **Table E2**. The increase in ADD and PDD from 2016 to 2050 is estimated at 22% and 33% respectively. It is also noted that the projected future water demand out to 2050 remains below the maximum allocation limit as stipulated in the existing Service Level Agreement with Icon Water.

Table E2 Projected Water Demand

Queanbeyan IWCM [1, 2]	2016	2021	2026	2031	2036	2050
Average Day Demand (ADD)						
Total ADD (ML/day)	11.0	11.9	11.5	12.4	12.6	13.4
Peak Day Demand (PDD)						
Total PDD (ML/day)	24.1	26.1	27.2	29.2	30.4	32.1
Maximum Allocation from Icon Water (ML/d)[3]	41-50	41-50	41-50	41-50	41-50	41-50

Notes:

1. Current baseline (2016) water demand is related to the number of properties currently connected to Queanbeyan's water network, which excludes some rural properties in Carwoola, Tralee–Environa and Royalla–Burra
2. Future water demand projections (2021 to 2050) include future development in the areas of Carwoola, Tralee–Environa and Royalla–Burra as a conservative assumption. Plans for extending service to cover these areas in the future remains unconfirmed however the potential to extend the water network into these areas in the future needs to be considered as part of developing the IWCM strategy
3. The maximum allocation from Icon Water represents a range across Offtake 1 and Offtake 2 and is related to the existing Service Level Agreement with QPRC.

Sewer Load Analysis

The majority of Queanbeyan is serviced by the Queanbeyan Sewerage Treatment Plant (STP), which is located within the ACT and is subject to ACT environmental legislation. The STP also currently services a small number of properties from the Oaks Estate development located in the ACT. Some smaller and more remote areas located throughout the study area are currently serviced by on-site sewage management systems i.e. septic tanks. Queanbeyan's sewerage scheme consists of 20 'supra' catchments made up of 15 pumped and 5 gravity sub-systems.

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Historical STP inflows, rainfall data and customer connection data provided by QPRC was used to analyse the current baseline sewer loading and derive future sewer load projections. Key messages surrounding the sewer load analysis are summarised as follows:

- An annual average baseline sewer load unit rate of 264 L/EP/day (climate adjusted) was derived. This unit rate was used to project future residential and non-residential sewer load out to 2050.
- Equivalent Population (EP) for the sewer network projected out to 2050 is estimated at 60,389, broken down as 49,473 residential EP and 10,916 non-residential EP.
- A ratio of Peak Dry Weather Flow (PDWF) to daily Average Dry Weather Flow (ADWF) was adopted as 1.78 referencing the WSAA Sewerage Code of Australia (WSA-02) due to insufficient historical diurnal inflow data being available for Queanbeyan STP. This ratio was adopted as a peaking factor ('r') to forecast future PDWF.
- A ratio of Peak Wet Weather Flow (PWWF) to daily Average Dry Weather Flow (ADWF) was adopted as 9.4 referencing the WSAA Sewerage Code of Australia (WSA-02) due to insufficient historical evidence based data. This ratio was adopted as a scaling factor to forecast future PWWF.
- The current and future sewer loading forecast for the study area, inclusive of ADWF, PDWF and PWWF, is shown in **Table E3** at a whole-of-catchment level and aggregated to the Queanbeyan STP. The increase in ADWF, PDWF and PWWF from 2016 to 2050 is estimated at approximately 68%.

Table E3 Projected Sewer Loading

Queanbeyan IWCM [1, 2]	Item	2016	2021	2026	2031	2036	2050
Queanbeyan STP Scheme	ADWF (kL/d)	9,480	12,745	13,397	14,325	15,051	15,959
	PDWF (L/s)	195	262	275	294	309	328
	PWWF (L/s)	1,031	1,385	1,456	1,557	1,636	1,735

Note:

1. Current baseline (2016) sewer load is related to the number of properties currently connected to Queanbeyan's sewer network, which includes 78 residential lots and industrial properties from the Oaks Estate in the ACT, however excludes some properties in The Ridgeway, Carwoola, Tralee–Environa and Royalla–Burra.
2. Future sewer load projections (2021 to 2050) include future development areas in the areas of The Ridgeway, Carwoola and Tralee–Environa, however excludes future development in Royalla–Burra (more remote location) as a conservative assumption. Plans for extending services to cover these areas in the future remains unconfirmed however the potential to extend the sewer network into these areas in the future needs to be considered as part of developing the IWCM strategy.

Stormwater Analysis

Queanbeyan's stormwater drainage network represents a gravity system encompassing the Queanbeyan River, Jerrabomberra Creek and Molonglo River catchments that in turn drain to Lake Burley Griffin in the ACT. The existing stormwater network comprises natural assets, drainage assets and stormwater quality and quantity assets.

The annual average stormwater volumes and nutrient pollutant loads from the study area were estimated using existing condition data and the future development forecast. Key messages surrounding the stormwater analysis are summarised as follows:

- Stormwater volumes and nutrients were estimated using an average annual rainfall depth of 655 mm and 1116 mm of evapotranspiration.
- No marked increase in pollutant loads to Lake Jerrabomberra is expected as a result of forecast development; hence there is no associated increase or worsening in algal bloom risk.

The increased pollutant loads to Lake Burley Griffin however may increase the cumulative impact on the lake water quality.

- The projected future land use area (Ha) and associated stormwater volume (GL/year) and nutrient loading (Tonne/year) at 2050 is shown in **Table E4**. There is up to 2 GL/annum of extra stormwater discharge that could be captured (under average rainfall) as potable water offset when considering the projected future water demand. There is also a large nutrient contribution from stormwater which could be managed to offset wastewater loads. These opportunities are recommended to be explored further in subsequent phases.

Table E4 Projected Stormwater Discharge (2050)

Future Land Use (2050)	2050 Area (Ha)	Stormwater (GL/yr)	Total Suspended Solids (Tonne/yr)	Total Phosphorus (Tonne/yr)	Total Nitrogen (Tonne/yr)
Industrial	207	1.1	89	0.2	1.2
Commercial	95	0.5	76	0.1	1.2
Residential	3,190	9.6	1,297	2.3	17.7
Parkland and Open Space	88	0.2	17	<0.1	0.3
Forest	2,460	<0.1	23	<0.1	1.1
Rural residential	13,461	8.5	742	1.3	14.0
Total Study Area	**19,500**	**19.8**	**2,245**	**4.0**	**35.4**

Notes:

1. No stormwater discharge is expected from the existing local quarry (55 Ha) therefore it is not featured in Table E4.

IWCM Issues

A consolidated summary of the water, sewerage, stormwater and more general related issues for the Queanbeyan IWCM is outlined below in **Table E5**, **Table E6**, **Table E7** and **Table E8**.

Table E5 General System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Operating Performance	• Levels of Service (LOS) specified are preliminary and yet to be formally adopted. There are also a number of gaps identified within the preliminary LOS which would need to be resolved prior to adopting. • The majority of data required to report on annual operating performance against LOS has not been collected to date. • Preliminary LOS are specific for customers within the former QCC LGA and differ from the LOS adopted for the former PRC LGA. The adoption of a single LOS should be considered by QPRC. • The Drinking Water Management System (DWQMS) reporting has not yet been finalised by QPRC. • There is no formal procedure currently documented in QPRC's business management system to cover emergency situations (i.e. sewer overflows, contaminated water etc.).

Table E6 Water Supply System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Bulk Supply Service Level Agreement (Icon Water)	• Service level agreement with Icon Water is not reflective of the current supply arrangements (i.e. agreed service levels for Offtake 3 - Googong remain undefined). • The specified water quality targets do not match QPRC's NSW water quality guidelines or Queanbeyan's water quality plan • Currently the bulk supply agreement states that QPRC will comply with ACT water restrictions. This should be mandated via a QPRC ruling made under the Local Government Act.
	Water Quality	• Bulk water is typically supplied from the Mt Stromlo WTP, which is located on the opposite side of Canberra and this represents a risk to maintaining adequate chlorine residual – based on the information received there is no re-chlorination point at Offtake 1 (Jerrabomberra) hence this presents an increased water quality risk. • Water quality parameters i.e. chlorine residual, are not currently featured in the Icon Water Service Level Agreement. • The DWMS Annual Report (2017) has identified a taste and odour issue believed to be due to the presence of Geosmin. • There is inadequate visibility/advance notice from Icon Water to inform/manage customers in the event of a bulk supply water quality incident. • The DWMS Annual Report (2017) has documented repeated free chlorine failures in Queanbeyan which represent a water quality management issue.
	Water Supply Security	• Appropriate level of service criteria for water supply security in Queanbeyan needs to be defined (with reference to the bulk supply from Icon Water). • The impact of climate variability, whilst considered to be a long-term water security risk for Queanbeyan, should continue to be monitored into the future as the impacts of climate change become more visible.
	Reliability	• There is insufficient data available to verify and report on performance against water main breaks. • Jerrabomberra Reservoir lacks a suitable by-pass arrangement and therefore cannot be taken off-line during planned or unplanned events without triggering extensive service continuity (reliability) risks. Jerrabomberra Reservoir represents a critical network asset. • Upper Thornton Reservoir, Thornton Pump Station, Jerrabomberra Reservoir, Greenleigh Reservoir, Greenleigh Pump Station and East Queanbeyan Reservoir are situation near bushland areas and this represents a higher risk of bushfire threat and service continuity (reliability) risk i.e. these assets are more vulnerable to bushfires.
	Sustainability	• The performance against sustainability in the context on Non-Revenue Water (NRW) is observed to be relatively poor with NRW estimated at 18% of total system demand. This is above the target LoS of 11%. NRW averaged at 114 L/connection/day over a five year historical period and this is considered high. The high NRW observed may be representative of a lack of maintenance and renewal on the

Issue Type	Target for Compliance	Issue
		water network and therefore a higher rate of leakage.
Performance	Water Consumption Behaviour	• Time lag in the metered consumption data when compared to the bulk supply meter data may be due to the customer billing period, which occurs in the quarter following the meter-reads, hence impacting the way the data is labelled for billing purposes. This may represent a business process improvement. • A check in the rolling number of residential property meters per quarter highlighted a drop of around 500 property meters in the first quarter of FY16/17, followed by an increase of 690 property meters in Q2 of FY16/17. This may indicate a change in metering during this quarter and is subject to confirmation. • Analysis of the historical water consumption dataset has identified that high-density related consumption has been evenly distributed from the parent property to its child properties. An even distribution may not be representative of the individual child property consumption trends. • Bulk meter readings recorded as zero on particular days for one offtake and provide a positive reading for the second offtake. It is difficult to determine if this is due to one of the offtakes being shut down, zero draw from that offtake on that particular day, or bulk flow meter failure. Also there is unusually high bulk supply readings observed on several occasions and the reason for this remains unclear. • It remains unclear if permanent water conservation measures have been implemented by Council post-millennium drought and the extent to which water conservation measures may be influencing recent water consumption trends and behaviours remains unclear.
	Asset Capacity	• Given the extent of data gaps highlighted it is difficult to assess the current and future capacity of the existing water network assets at a quantitative or more granular level. This includes for water reservoirs, pump stations and trunk mains. As a result, a 'first principles' qualitative approach has been adopted for the Issues Paper. This is considered suitable as an initial indicator of asset capacity issues and will need greater rigour / improved confidence applied in subsequent phases of the IWCM to verify the 'first principles' outcomes before a commitment to investment is made. This will be reliant on further asset data and field data (i.e. telemetry data, drawdown tests etc.) being made available for the sewer network assets to verify the indicative capacity assessment. • Given the extent of growth forecast for Queanbeyan over the next 30 years it is expected that new drinking water network infrastructure will be required to extend service to the major Greenfield developments proposed at Tralee, Environa and South Jerrabomberra, including trunk lead-in assets and reticulation networks. • No material water network capacity related issues have been flagged following the 'first principles' analysis. However, more robust capacity assessment should be completed once a number of asset data and telemetry data gaps have been resolved. Pump drawdown tests etc. are an alternative approach to confirm and verify the indicative high-level water network capacity assessment. • The existing water model requires validation of the trunk network and

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Issue Type	Target for Compliance	Issue
		controls to better align the interaction of the bulk supply offtakes, reservoirs and pump stations within the network before it can used with confidence for reporting on asset capacity related performance.

Table E7 Sewerage System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Sewer Agreement 1905	• The agreement covers discharges from Oaks Estate in the ACT however there are gaps in this agreement, including the absence of any mandate on Oaks Estate customers to pay QPRC for their sewerage service.
	Health and Safety (overflows)	• The performance against the number of sewage overflows per year remains unverified due to the limited data available. The existing sewer model is not fit for modelling surcharges in the system.
	Health and Safety (WHS)	• The performance in regard to the latest WHS audit remains unverified due to the limited data available. • Queanbeyan STP - changes in legislative WHS for operator safety represents an issue in regards to the continuing operation of the existing Queanbeyan STP, which is an old plant reaching the end of its design life.
	Reliability	• There is insufficient data available to verify and report on overflows due to sewer chokes. The existing sewer model is not suitable for modelling surcharges in the system. • Queanbeyan STP - quantitative analysis of the existing STP performance against reliability is difficult given the lack of data however anecdotal evidence suggests that it is an old plant reaching the end of its design life and the condition of various assets within the plant is making operation and maintenance of the STP difficult and expensive. Ultimately this represents an increasing service continuity (reliability) risk.
	Sustainability	• Targets needs to be defined for benchmarking sustainability performance of the system. • There is no specific LOS target defined for sustainability however the derived unit rate for sewer at 264 L/EP/day is higher than the derived unit rate for water (233 L/cap/day). This indicates a potential performance issue within the sewer network (i.e. high baseline infiltration & inflow) that requires further discussion and investigation
Trade Waste	Trade Waste	• The annual trade waste performance report is currently not provided.
Best Practice	Section 60 Approvals	• There is no effluent re-use currently in place at Queanbeyan STP.
Performance	Asset Capacity - Queanbeyan STP	• Some discrepancy is noted for the future EP projections between the STP Master Plan and the IWCM Issues Paper investigations and this may represent a risk to the outcomes of each project if key inputs and assumptions are not considered compatible. • EPA Licence Compliance – there is insufficient data available to benchmark the existing STP performance against environmental

Issue Type	Target for Compliance	Issue
		licence conditions. • Based on anecdotal evidence and historical sewer inflow data the Queanbeyan STP is very close to exceeding its existing design capacity, however the precise status remains unverified as evidence-based data was not available at the time. Regardless, the anecdotal evidence and projected growth forecast represents a capacity issue for Queanbeyan STP in the very near future.
	Asset Capacity - Sewer Network	• There is conflicting data pertaining to the number of sewer connections per sewer catchment. However, the QPRC customer billing dataset has been used to derive the number of sewer connections as it is considered more reliable than the number of connections historically reported as part of annual DPI performance data. • Given the extent of data gaps highlighted it is difficult to assess the current and future capacity of the existing sewer network assets at a quantitative or more granular level. This includes for sewer pump stations, trunk rising mains and gravity carriers. As a result, a 'first principles' qualitative approach has been adopted for the Issues Paper. This is considered suitable as an initial indicator of asset capacity issues and will need greater rigour / improved confidence applied in subsequent phases of the IWCM to verify the 'first principles' outcomes before a commitment to investment is made. This will be reliant on further asset data and field data (i.e. telemetry data, drawdown tests etc.) being made available for the sewer network assets to verify the indicative capacity assessment. • Based on the outcomes of the 'first principles' asset capacity analysis the following sewer network capacity related issues have been flagged as an indicator for further consideration: - Morriset St SPS: the cumulative current and future PWWF upstream of the SPS is indicated to exceed the duty flow. This is reinforced by the Morriset St catchment flows indicated to exceed the duty flow from 2021 onwards. - Banyalla Cl – Pump 11 and Kathleen St – Pump 7: current and future PWWF is indicated to exceed the duty flow. - Bayside Ct – Pump 9: the pump station data including duty flow was not available and therefore pump performance was not able to be assessed. However, there is significant growth forecast to 2050 in the Bayside Ct catchment, which is conducive to a potential future capacity issue. The rising main associated with Bayside Ct – Pump 9 is indicated to exceed 2 m/s velocity in 2050 due to the significant growth allocated to this catchment. Further investigation should be undertaken to validate this capacity issue when sufficient data is made available. - SPS emergency storage: 7 x SPSs are indicated to have less than 4 hours of emergency storage (as a minimum requirement) under both current and future planning horizons. - South Jerrabomberra Trunk Sewer Main - future development will likely trigger a need for the Jerrabomberra Trunk Sewer Main capacity to be upgraded to accommodate the increase in growth and sewer loading.

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Issue Type	Target for Compliance	Issue
		• The 2015 Sewer Asset Management Plan has identified a number of key assets within the sewer network with deficiencies and these are scheduled for future upgrade and/or renewal. This includes the South Jerrabomberra Trunk Main and nine (9) sewer pump stations including associated rising mains. • A sewer inspection and relining program has been undertaken for the Queanbeyan scheme with the aim of reducing inflow and infiltration. Internal analysis undertaken by QPRC in 2018 did not identify any material improvement in inflow or infiltration as a result of the program (noting that relining/refitting of manholes was not undertaken as part of the program). • Given the extent of growth forecast for Queanbeyan over the next 30 years it is expected that new sewer network infrastructure will be required to extend service to the major Greenfield developments proposed at Tralee, Environa and South Jerrabomberra, including trunk lead-in assets and reticulation networks. • The existing sewer model requires extensive update and validation before it can used with confidence for reporting on asset capacity related performance.

Table E8 Stormwater System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Performance Measures – Customer/ Technical	• Remain undefined. Targets yet to be established. • Development Design Specifications for Stormwater Drainage Design and Erosion Control and Stormwater Management do not specifically address waterway stability or refer to best practice stormwater management for waterway health.
System Performance	Quality	• Periodic blooms of toxic blue green algae in Lake Jerrabomberra and Lake Burley Griffin, posing public safety, amenity and environmental concern.
	Waterway Erosion	• Waterway erosion upstream of Lake Jerrabomberra due to high flows and vegetation loss
	Nuisance Flooding	• Letchworth Regional Park prone to surcharging due to high stormwater flows lifting off the stormwater pit lids. • Stormwater drainage networks within some of the older areas (Crestwood, Queanbeyan, etc.) are prone to nuisance flooding and surcharging
	Asset condition	• Stormwater asset valuation may contain some elements from other systems which cannot be easily identified from the asset database.
	Overland and Mainstream Flooding	• Potential for flooding in Queanbeyan CBD, impacting up to 50 residential properties and extensive areas of commercial development based on the Queanbeyan Floodplain Risk Management Plan. • The existing stormwater model requires extensive update and validation before it can used with confidence for reporting on asset capacity and flooding related performance.

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1.0 Introduction

1.1 Integrated Water Cycle Management in New South Wales

The New South Wales (NSW) Government's Best Practice Management of Water Supply and Sewerage Framework [1] mandates local water utilities prepare and implement a sound 30-year Integrated Water Cycle Management (IWCM) strategy. The 30-year strategy must consider both the complex inter-relationship between the urban water cycle (water supply, sewage and stormwater) and community expectations. The IWCM strategy should be developed using a transparent, evidenced based analysis.

The NSW Department of Planning, Industry and Environment (DPIE) – Water, under the best practice management approach, oversees the preparation of the IWCM strategy, on behalf of the NSW Government. DPIE Water has developed an IWCM Checklist [2], which is used to guide the process.

1.2 This report

The initial phase of the IWCM process is development of an Issues Paper. The Issues Paper comprises a review of the current water system and documents identified water system issues related to regulatory and contractual compliance, levels of service, capacity to meet current and future demands and loads, system performance and utilisation, appropriateness and effectiveness of existing total asset management plans to address all Issues.

An 'Issue' in the context of the Issues Paper is defined as an unacceptable risk of failure to meet statutory requirements or the adopted Levels of Service now or within the 30-year planning horizon and needs to be supported by evidence-based data/analysis.

The Project Reference Group (PRG) Workshop was held on the 26th of November 2019 to familiarise the PRG with the IWCM process and highlight the key findings and issues from this study. It was also an opportunity to receive PRG feedback on the key findings/issues and gain consensus on the outcomes. It is acknowledged that there are some actions that remain outstanding following the PRG workshop (refer to Appendix E for the PRG Workshop Minutes). These outstanding actions require further consideration in the next stage of the IWCM strategy development.

1.3 Study area

In May 2016 Queanbeyan City Council (QCC) amalgamated with Palerang Council (PRC) to form Queanbeyan-Palerang Regional Council (QPRC). Located in south-eastern region of New South Wales (NSW) in the Southern Tablelands, the QPRC Local Government Area (LGA) is adjacent to the Australian Capital Territory (ACT). The QPRC area is 5,300 km^2 and predominantly rural, with growing residential and rural-residential areas. Rural land is used mainly for sheep and cattle grazing, with smaller amounts of land dedicated to orchards, nurseries, crop growing, honey production, and vineyards. Tourism is also an important industry for economic growth in the area [3]. The largest employment industries include construction, retail trade, and public administration and safety [3].

Queanbeyan City and immediate surrounding townships, with a population of *ca*. 40,000, is the largest city in the LGA. The Queanbeyan IWCM Strategy is comprised of the former QCC areas within Queanbeyan City including Greenleigh, Ridgeway, Crestwood, Jerrabomberra, Karabar, Queanbeyan, Queanbeyan East, Queanbeyan West and Tralee-Environa. The study area also includes portions of Carwoola, Burra, Googong and Royalla, which are localities that all fall within both the former QCC and Palerang Council LGAs (see Figure 1-1**)**. These areas are collectively referred to as Queanbeyan and Jerrabomberra in this report.

Exclusions: *the study area excludes areas serviced by the former PRC as these have been reviewed separately and reported under a separate IWCM strategy [4]. Googong Township is a relatively new urban area commencing in 2012 and is projected to fully develop over 25-years. Googong Township has also been excluded from the study due to a number of factors:*

- *Represents an independent system with water, sewer, recycled water and stormwater services that do not impact on the Queanbeyan City services.*

- *Has a separate 25-year integrated water cycle management strategy and master plan, which is being implemented in-line with the staging of the development.*
- *Incorporates different pricing policies surrounding the provision of reticulated recycled water and these policies need to consider the role and responsibility of Googong Township Pty Ltd.*

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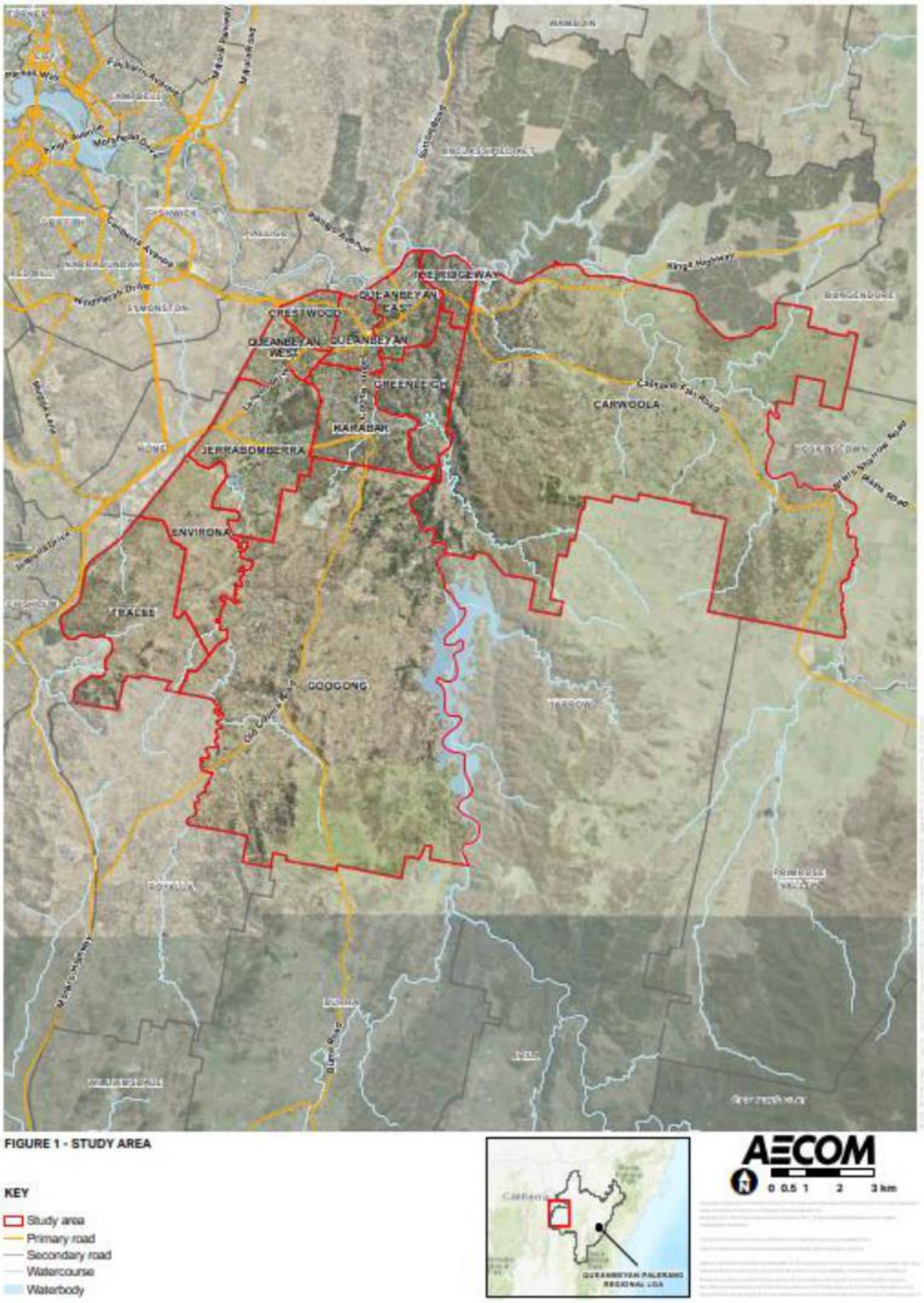

Figure 1-1 Study Area Locality Plan

1.4 Urban centres - nature of services

The population of the study area is concentrated within the urban centres of Queanbeyan and Jerrabomberra. The most recent population census data, together with a summary of the water supply, sewerage and recycled water service for each urban centre, is summarised below and in more detail in **Section 1.0**.

1.4.1 Water supply

Treated bulk water is supplied to Queanbeyan by Icon Water, which is the water service provider responsible for providing potable water supply to the ACT). Treated bulk water is transferred to Queanbeyan from Icon Water's Mt Stromlo Water Treatment Plant (located in the ACT) and Googong Water Treatment Plant (located in NSW) via two bulk supply 'offtakes' to end users in Queanbeyan. Water supply in the study area is discussed in greater detail in **Section 4.2**.

1.4.2 Sewerage

The sewerage system in the study area is predominantly a gravity reticulation system, comprising over 282 km of pipelines and 15 pumping stations. The reticulated network services the majority of Queanbeyan and Jerrabomberra, with the exception of some semi-rural outer suburbs (e.g. The Ridgeway) where decentralised septic systems are used instead. The reticulated sewerage network transfers sewerage to the Queanbeyan Sewage Treatment Plant (STP), located to the north of Queanbeyan, within the ACT, on the south bank of the Queanbeyan River. The Queanbeyan STP is operated by QPRC. The treatment plant discharges to Molonglo River in accordance with ACT Environment Protection Authority (EPA) licence conditions. Downstream of the STP the Molonglo River drains into Lake Burley-Griffin. The sewerage system in the study area is discussed in greater detail in **Section 4.3**.

Table 1-1 Water supply and sewerage services

<table>
<tr><th>Urban centre</th><th>Water supply</th><th>Sewerage service</th></tr>
<tr><td>Queanbeyan</td><td>▪ Source: Icon Water Offtake No. 2
▪ Treatment: Treated water received from Icon Water via Googong WTP and Mount Stromlo WTP
▪ Distribution: 4 reservoirs, 2 pumping stations</td><td rowspan="2">▪ Catchment: Queanbeyan STP
▪ Treatment: Inlet works, biological secondary treatment, tertiary treatment and chemical and utility areas
▪ Discharge: Molonglo River</td></tr>
<tr><td>Jerrabomberra</td><td>▪ Source: Icon Water Offtake No. 1
▪ Treatment: Treated water received from Icon Water via Googong WTP and Mount Stromlo WTP. Re-chlorination dosing station located at Offtake No. 1
▪ Distribution: 4 reservoirs, 2 pumping stations</td></tr>
</table>

1.4.3 Recycled water

There are no existing recycled water systems or any future plans to instigate water recycling schemes for Queanbeyan or Jerrabomberra.

It is acknowledged that a non-potable water recycling scheme (dual reticulation) is being implemented for Googong Township in-line with the staging of the development as part of a separate 25-year IWCM focused master plan. However this scheme is independent from other water infrastructure in Queanbeyan and is not featured as part of the Issues Paper. Formal references for Googong Township related studies including IWCM plans are provided in **Section 12.0**.

Table 1-2 Recycled water services

Urban Centre	Recycled water service
Queanbeyan	None
Jerrabomberra	None

1.4.4 Stormwater

The stormwater system in the former Queanbeyan City LGA comprises a reticulated system that drains via gravity into the Queanbeyan River, which in turn flows into Lake Burley-Griffin. Stormwater from Jerrabomberra and future development areas to the south of the city drain into Jerrabomberra Creek, which feeds the Jerrabomberra Wetlands and Lake Burley-Griffin. The stormwater system in the study area is discussed in greater detail in **Section 4.4.**

1.5 Current IWCM strategy measures and outcomes

QPRC has an adopted IWCM strategy that covers the former Palerang LGA (Palerang Communities IWCM Strategy). However there is no existing IWCM strategy or plan in place for the former QCC LGA, with the exception of Googong Township which is being delivered separately under IWCM principles (i.e. 25-year IWCM focused master plan), including water sensitive urban design and the inclusion of a water recycling plant and network to deliver treated wastewater to households for non-potable residential uses.

Completion of the Queanbeyan IWCM Strategy will close out the initial IWCM strategy development for QPRC's merged area of operations, in the first instance as a suite of stand-alone IWCM strategies. As part of future review, it is envisaged that these discrete IWCM strategies will be merged into a single IWCM strategy that covers the entire QPRC LGA.

A separate project is being undertaken by QPRC to augment the existing Queanbeyan STP. A master plan has been prepared and approved by QPRC and DPIE Water. The master plan presents the need for the augmentation as well as the indicative timeframe for the project. The augmentation represents the replacement of the existing Queanbeyan STP with a new treatment facility, which is expected to be commissioned by 2022/23. Once the new STP is commissioned the existing treatment facility will be taken off-line and made redundant.

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2.0 Operating environment compliance

The delivery of urban water services including water supply, sewerage, and stormwater services is subject to various legislative and regulatory requirements, guidelines, and contractual obligations collectively referred to as the operating environment.

Due to its connectivity with the ACT for services, particularly water supply (with bulk water delivered from the ACT entity Icon Water) and sewerage (i.e. the Queanbeyan STP sits on ACT land), the study area is subject to several ACT legislative and regulatory requirements in addition to NSW requirements. A summary is presented in **Table 2-1.**

There are several key contracts applicable to the supply of water and sewage services in the study area, these are summarised in **Table 2-2**.

It is to be noted that QPRC do not need to comply with the NSW Fluoridation of Public Water Supplies Act (1957) as this is performed by Icon Water who sit outside of NSW legislation.

QPRC do not have a direct responsibility to work with the Murray Darling Basin Authority (MDBA) as Icon Water is responsible for extractions. However, QPRC provides Icon Water with outflows from Queanbeyan STP for water balancing requirements to allow Icon Water to report to MDBA through the ACT Government.

Table 2-1 Legislative and regulatory requirements relevant to the study area

Legislation	Relevancy for the Queanbeyan IWCM Strategy
NSW Local Government Act (1993)	• Section 60 – water and sewage treatment works construction and modification - Requirement for QPRC to obtain approval from the NSW government for the construction or modification to water or sewage treatment works. • Section 64 – determining developer charges - Source of funding for water and sewer infrastructure required for new urban development • Section 68 – council approvals - Mechanism for council to regulate the discharge of trade waste into the council sewer network - QPRC has developed a draft trade waste policy • Section 406 – integrated planning and reporting guidelines - Requirement for QPRC to comply with 'guidelines' established by the NSW Department, which can impose requirements in connection with the preparation, development and review of, and the contents of, the community strategic plan, resourcing strategy, delivery program, operational plan, community engagement strategy, annual report and state of the environment report of a council.
NSW Environmental Planning and Assessment Act (1979) including the EPA Regulation 2000	• Section 53 – Local Environmental Plans - Mechanism for the NSW government to make environmental planning instruments specific to QPRC LGA • Section 93F – Planning Agreements - Mechanism for council to enter into planning agreements with developers. • Section 94 – Developer contributions towards provision or improvement of amenities or services - Mechanism for council to impose a levy on land development the funds from which are used for construction of infrastructure including stormwater assets.

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Legislation	Relevancy for the Queanbeyan IWCM Strategy
NSW Water Management Act (2000)	• Section 310 – Authority to levy service charges and impose fees and other charges - Mechanism for a water authority to levy service charges on land within is area of operations for water service, sewer service, drainage service, flood mitigation service, river management service. • Section 56 – Water access licences; Section 85 – Water allocations - Approval to take water from groundwater and surface water resources.
NSW Public Health Act 2010	• Section 15 – Drinking water quality - Requirement for council to ensure water supplied by means of a reticulated system is fit for human consumption
Public Health Act 2010 & Public Health Regulation 2012	• Require drinking water suppliers to develop and adhere to a 'quality assurance program' or Drinking Water Management System (DWMS)
NSW Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011	• Section 20 – Duty to ensure the workplace, the means of entering and exiting this workplace and anything arising from the workplace are without risks to health and safety of any person. - Requirement for council to ensure water service facilities it operates (including the Queanbeyan STP) is without risk to the health and safety of any person.
NSW Protection of the Environment Operations Act 1997	• Chapter 4 - Mechanism for NSW government to issue clean-up notices to QPRC specific to QPRC assets • Schedule 1 - Defines QPRC activities for which an environment protection licence is required.
ACT Environment Protection Act 1997 and ACT Environment Protection Regulations 2005	• Section 49(1) – Grants - Mechanism for the ACT government to grant environmental authorisation in relation to a specified activity - specifically to the conditions for discharging treated effluent from the Queanbeyan STP.
ACT Utilities Act 2000	• Applicable to the Queanbeyan STP as the facility is situated within the ACT border. Any asset that resides within the ACT border is required to comply with the Act regardless of the jurisdiction and ownership of the asset.
Commonwealth Water Act and Regulations 2007	• Established the Murray-Darling Basin Authority. • Empowers the Murray-Darling Basin Authority as the government body responsible for overseeing water resource planning in the Basin.
Council Local Environment Plans	• Sewer Agreement 1905 – covers discharges to Queanbeyan STP from Oaks Estate (residential and industrial land use) located in the ACT.

Table 2-2 Water service contractual requirements relevant to the study area

Contract	Relevancy for the Queanbeyan IWCM Strategy
Supply of Potable Water to the City of Queanbeyan (2009) – *Actew Corporation Ltd and QCC* (Service Level Agreement) [6]	• Defines the location, quantity, pressure and quality • Commits to providing the same level of water security for Queanbeyan as provided to Canberra • Commits to providing water to future developments within the study area, providing the developments are approved by the NSW Government or QCC (now QPRC), as appropriate and the consent authority determines that each future development is consistent with the Sydney-Canberra Regional Strategy and the Memorandum of Understanding on ACT and NSW Cross Border Region Settlement. • Defines the contact limits between ACTEW (now Icon Water) and QCC (now QPRC) supplied, operated and maintained assets.

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Contract	Relevancy for the Queanbeyan IWCM Strategy
Letter of Agreement – Supply of Water to Googong Township (2009) – *ACTEW and QCC* *(Side letter to the Service Level Agreement)*	• Documents that new water supply infrastructure to be constructed within the ACT to service Googong Township will be owned and maintained by ACTEW (now Icon Water), however construction costs will be borne by Googong Township Pty Ltd. • Documents that QCC (now QPRC) will pay all costs incurred by ACTEW (now Icon Water) for the operation and maintenance of new Googong Township water supply infrastructure located within the ACT. • Documents that QCC (now QPRC) will pay ACTEW (Icon Water) for all water supplied by ACTEW (now Icon Water) to Googong Township.

3.0 Levels of Service

Formal obligations relevant to the delivery of water and sewerage services are set out in the legislation, regulations, and requirements that comprise the operating environment. Levels of Service (LOS) are the targets set for the provision of water and sewerage services by the local water authorities that have been set to drive system and asset planning and management in line with community needs and expectations. The provision of an agreed LOS is subject to efficient operation of the water supply and sewerage systems; the intent is that service providers are guided to deliver a program of works and appropriate operation and maintenance procedures to meet agreed LOS. Provided below is a discussion of LOS and their applications by QPRC in the study area.

3.1 Supply of water to Queanbeyan

Potable water is supplied by Icon Water (formerly ACTEW Water) to Queanbeyan via two bulk supply offtakes, namely Offtake No. 1 and Offtake No. 2. A service level agreement exists between Icon Water and QPRC for the provision of potable water supply to Queanbeyan [6] and this is summarised in **Table 3-1** below. It is incumbent on Icon Water to deliver on these service levels up to the identified boundary point of supply to Queanbeyan, after which the potable water service provision becomes QPRC's responsibility.

Table 3-1 Service level agreement parameters between Icon Water and QPRC

Description	Unit	Level of Service
Quantity and pressure		
Maximum demand - Under high consumption with both Stromlo and Googong WTPs operating - Maximum Summer demand not exceeding 41 ML/d	Quantity – ML/d Pressure – mAHD head	Offtake 1: 27 ML/d @ 698.8m AHD head Offtake 2: 14 ML/d @ 699.3m AHD head
Maximum demand - Under conditions of QPRC requiring supply greater than 41 ML/d and Icon Water to have capacity to supply up to a maximum of 50 ML/d	Quantity – ML/d Pressure – mAHD head	Offtake 1: 33 ML/d @ 698.8m AHD head Offtake 2: 17 ML/d @ 699.1m AHD head
Maximum off peak daily demand - Under normal off peak conditions (defined as April to October in the Icon Water Agreement with Stromlo WTP only in operation and Icon Water to have capacity to supply a maximum of 20 ML/d to QPRC	Quantity – ML/d Pressure – mAHD head	Offtake 1: 13 ML/d @ 686.2m AHD head Offtake 2: 7 ML/d @ 675m AHD head
Water Quality		
Water quality compliance - Maintain treated water quality to the relevant prescribed potable water standards	N/A	Icon Water to supply potable water complying with the standards under the Utilities Act 2000 (ACT) and the ACT Drinking Water Code of Practice 2007. *(Icon Water cannot guarantee the water quality beyond the identified boundary point and QPRC is responsible for taking any corrective action beyond this boundary if water quality is outside the quality specification.)*

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Description	Unit	Level of Service

Indicative Queanbeyan water quality specification at Offtake 1 and Offtake 2.

Indicator	*Units*	*Specification*
E. Coli *	MPN/ 100mL	<1
Total coliforms *	MPN/100mL	<1
Free chlorine (Supply Point 1)**	mg/L	0.7-1.2
Free chlorine (Supply Point 2)**	mg/L	0.7-1.2 when Googong WTP operating, other times <1.2
Fluoride	mg/L	0.6-1.1
pH	pH units	6.5-8.5
Turbidity	NTU	<2
Colour	Co-Pt Units	<15
Aluminium	mg/L	<0.2
Iron	mg/L	<0.3
Manganese	mg/L	<0.1
Copper	mg/L	<1.0

* The specification for these parameters cannot be guaranteed if the draw-off from a Supply Point (offtake) is less than 2 ML/d averaged over five or more days.

** Icon Water cannot guarantee the level of chlorine in the water supplied, given the distance over which the water is being provided.

3.2 Water supply and sewerage services

3.2.1 Services overview

Services are detailed in Section 4, in summary:

- QPRC operates and maintains the water distribution network from the boundary point of the Icon Water bulk supply offtakes to the QPRC end users. QPRC is also responsible for the maintenance of chlorine concentration in the water supply and operates and maintains a re-chlorination plant accordingly.
- QPRC owns, maintains and operates its own sewerage systems including collection, transmission and treatment facilities.

3.2.2 Service level commitments

QPRC currently does not have a formally adopted LOS for water supply and sewerage services.

The first set of asset management plans for water and sewer developed in 2015 describe the preliminary LOS proposed for QPRC's water and sewer systems. The preliminary LOS has been distinguished into Community LOS and Technical LOS respectively:

- Community LOS covers quality, function and capacity/utilisation of the asset - community expectations on the desired LOS were captured from customer surveys in 2013 as well as informal feedback from stakeholders and analysis of customer service requests and complaints.
- Technical LOS covers operations, maintenance, renewals and upgrades, and is linked to annual budgets - the 2015 Asset Management Plan [13 & 14] describes the performance against preliminary LOS at the time of its development in 2015.

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As these preliminary LOS are still to be formally adopted by QPRC there was no further LOS performance analysis data available to comment on beyond 2015.

The preliminary LOS for water supply and sewerage services described in the tables below have been extracted from the 2015 Asset Management Plans for Water and Sewer [13 & 14].

Table 3-2 Preliminary LOS – water services

Customer value	LOS	Customer Performance Measure	Technical Performance Measures	Performance against LOS in 2015 [13]		Comments for Issues Paper
				CPM	TPM	
Accessibility	Water Connections available	Number of service requests per 1000 customers **Target <15**	100% of rate payers serviced by the network	13	N/A	-
Affordability	Services are affordable	85% of customers are satisfied over fair and reasonable water charges	Operating cost per connection **Target - <$200/annum**	N/A	$178 / annum	*The CPM will be tested in Phase 2 of the IWCM strategy development*
Community Involvement	Provide opportunities for community involvement	Asset management plan accessible to customer upon request	Public comments are considered during Asset Management Plan reviews	No	No	-
Health and Safety	Water is safe to drink	No illness from management of water supply	E.coli compliance with ADWG **Target – 100%** *Note: this indicator is annually reported - DPI Performance Monitoring*	N/A	100%	*QPRC's Drinking Water Quality Management System is the primary instrument for documenting water quality controls (noting that QPRC's DWQMS is yet to be finalised)*
Quality / Quantity	Pleasant tasting and looking drinking water is provided	X% of customers satisfied with quality of drinking water **Target – 90%**	x% of reservoirs cleaned every 4 years **Target – 50%**	90.6%	100%	-
Reliability / Responsiveness	Reliable water supply is provided	X% of customers satisfied with reliability of water supply **Target – 90%**	Number of main breaks per km – **Target 0.0**	91%	0.01	*In defining LOS for reliability there should also be consideration of other asset classes i.e. pump stations etc.*

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Customer value	LOS	Customer Performance Measure	Technical Performance Measures	Performance against LOS in 2015 [13]		*Comments for Issues Paper*
Sustainability	Efficient and sustainable use of water resources	Per capita peak water consumption remains constant or **reduces by 1%**	Less than x% of water loss in pipe network **Target – 11%**	N/A	11%	*Non-revenue water (NRW) has been specifically investigated in the Issues Paper - **Section 6.3** (noting that QPRC's broader water supply security is reliant on Icon Water meeting its obligations under the Bulk Supply Service Level Agreement)*

Table 3-3 Preliminary LOS - sewerage services

Customer value	LOS	Customer Performance Measure	Technical Performance Measures	Performance against LOS in 2015 [14]		*Comments for Issues Paper*
				CPM	TPM	
Accessibility	Wastewater connections available	Number of service requests per 1000 customers **Target <25**	x% of rate payers serviced by the network **Target >95%**	20	100%	-
Affordability	Services are affordable	x% of customers are satisfied over fair and reasonable wastewater charges **Target >90%**	1) Operating cost per sewer main connection **Target - <$300 / annum** 2) Operating cost per connection to STP **Target - $100 / connection**	N/A N/A	$294 / annum 140	*No metrics available to assess customer satisfaction on service affordability. Phase 2 of the IWCM strategy development will respond to this gap.* *STP target defined without units and requires clarification.*
Community Involvement	Provide opportunities for community involvement	Asset Management Plan accessible to customer upon request	Public comments are considered during Asset Management Plan reviews	No	No	-

Customer value	LOS	Customer Performance Measure	Technical Performance Measures	Performance against LOS in 2015 [14]		*Comments for Issues Paper*
Health and Safety	Sewage is managed without risk to public health	No sewage overflows into habitable buildings due to network faults	Less than (X) sewage overflows each year **Target – 16**	N/A	13	*Consider the potential to adopt 'effects based' targets and metrics for sewage overflow performance.*
Reliability/ Responsiveness	Reliable service is provided	X% of customers satisfied with reliability of wastewater services **Target >90%**	Sewerage overflows due to blockages addressed within – **Target 0.5 hrs** **95% success**	84.6% *(data based on results of customer survey data)*	97% *(data based on results of customer survey data)*	*In defining LOS for reliability there should also be consideration of the STP performance and other asset classes i.e. pump stations etc.*
Sustainability	Efficient and sustainable use of sewer resources	Max average (volume) of treated wastewater generated per property per year – **Target – undefined**	Less than x (m3) of sewage overflow from wastewater network per year **Target – undefined**	N/A	N/A	*Undefined LOS target that requires resolution during Phase 2 of the IWCM strategy development.*

3.2.3 Compliance monitoring and reporting

QPRC collects and analyses data that is required by NSW DPIE Water in order to report on annual performance against NSW Performance Monitoring measures. As part of this annual reporting process, DPIE Water benchmarks across all local water utilities in NSW. The NSW Performance Monitoring measures are not directly related or transferrable to the preliminary LOS developed by QPRC (Section 3.2.2).

The following compliance related monitoring and reporting is currently undertaken by QPRC:

- NSW DPIE Water – annual performance reporting and benchmarking
- EPA – network asset related reporting
- Department of Health (DoH) – water quality reporting

QPRC developed a Drinking Water Management System (DWQMS) in 2017 following their application for funding approval via NSW Department of Health [29]. The DWQMS provides a quality assurance program for QPRC for drinking water service management along with other registers, procedures and policies [29].

It is noted that the DWQMS reporting has not yet been finalised by QPRC and this therefore represents a potential future improvement.

There is also observed to be no formal procedure documented in QPRC's business management system to cover emergency situations (i.e. sewer overflows, contaminated water etc.). This also represents a potential future improvement.

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3.3 Stormwater drainage and flooding

New development in QPRC must meet the drainage and stormwater quality targets established in the Development Design Specifications for South Jerrabomberra and Queanbeyan [7] which were authorised in 2013.

Existing and older areas of Queanbeyan and Jerrabomberra have been developed to less stringent standards of drainage and known areas of stormwater management issues are summarised in **Table 3-4**.

Table 3-4 Stormwater and drainage issues

Item	Location	Issue description
Stormwater quality issues	Lake Jerrabomberra	This lake periodically experiences toxic blue green algae blooms which are likely to be due to a combination of long residence times, poor flushing, high nutrient inflows and thermal stratification. This becomes a public safety, amenity and environmental concern. The most recent bloom was in 2017 (QPRC pers comm, 2017).
	Lake Burley-Griffin	This lake is in the ACT however a large portion of its catchment coincides with the study area and the QPRC STP has been implicated as a cause of water quality issues in the past, though the situation is improving [8] also prone to toxic blue green algae blooms which are likely to be due to a combination of long residence times, poor flushing, high nutrient inflows and thermal stratification.
	Watercourse upstream of Jerrabomberra Parkway	Erosion in watercourse from high flows and loss of vegetation – this is a source of high sediment loads to downstream waterways. (QPRC pers comm, 2017). Development Design Specifications for Stormwater Drainage Design and Erosion Control and Stormwater Management do not specifically address waterway stability or refer to best practice stormwater management for waterway health. This is a gap in the guidelines which may lead to future erosion issues in developing areas as well as in developed catchments.
Nuisance flooding	Letchworth Regional Park	Stormwater pit lids and grates have been lifted by high flows surcharging from stormwater system. These events create safety issues for the general public using this area and requires ongoing maintenance by Council staff. (QPRC pers comm, 2017).
Overland and mainstream flooding	Queanbeyan CBD to the east of Stornaway Road	The Queanbeyan Floodplain Risk Management Plan shows the Queanbeyan CBD to the east of Stornaway Road is affected by overland flooding in a 5% annual exceedance probability (AEP) flood event. Areas of residential development (up to 50 properties) are affected by flooding up to 1.5m deep in a 1% AEP event. Extensive areas of commercial development are flooded up to 2m deep in a 1% AEP event.

4.0 Existing urban water services

4.1 Water catchments and treatment

4.1.1 Surface water

Icon Water is responsible for supplying potable water to the study area. Water is sourced from the Queanbeyan River / Burra Creek and Cotter River catchments, where it is stored in several dams then treated at Icon Water's Mt Stromlo WTP and Googong WTP, before being transferred to Queanbeyan via Icon Water's trunk distribution network. (see Figure 4-1).

Icon Water manages source water quality and treated water quality by applying its own Drinking Water Quality Management System based on the Australian Drinking Water Guidelines and that has been certified as a Hazard Assessment Critical Control Point (HACCP) compliant system – which indicates adherence to modern good practice in water and public health management [9].

4.1.1.1 Cotter River catchment

Raw water from the Cotter River is stored in three sequential dams positioned along the Cotter River (Corin Dam, Bendora Dam and Cotter Dam). The majority of the Cotter River catchment is within the Namadgi National Park and is protected from human and domestic animal activities, as well as other pollutants associated with urban development.

Raw water received via Corin Dam, Bendora Dam and/or Cotter Dam is treated at the Mt Stromlo WTP by coagulation & flocculation, dissolved air flotation, filtration, disinfection by chlorine and ultra-violet processes, and fluoridation. Treated water from the Mt Stromlo WTP represents the primary source of potable water for the ACT and Queanbeyan.

4.1.1.2 Queanbeyan River catchment

Googong Dam is supplied with raw water from the Queanbeyan River and Burra Creek catchments. The Googong Dam Catchment Area Act 1975 (an agreement between the Commonwealth and State of New South Wales) and set of subsequent regulations restricts the activities and development permitted in the catchment area, particularly livestock and domestic animals. However the Act guarantees water supply for the ACT.

Raw water from Googong Dam is treated in the Googong WTP by powdered activated carbon, flocculation, clarification, dissolved air flotation, filtration, chlorination and fluoridation. Treated water from the Googong WTP represents a secondary source of potable water for the ACT and Queanbeyan and typically operates less frequently than Mt Stromlo WTP.

In response to the millennium drought during the 2000s, Icon Water installed the Murrumbidgee to Googong pipeline that enables raw water to be transferred from the Murrumbidgee River at Angles Crossing pump station to Googong Dam via Burra Creek. The Murrumbidgee River is one of Australia's major rivers and many communities use it as their source of water. Major towns up and downstream of Queanbeyan, such as Cooma and Wagga Wagga, have been drawing water from the Murrumbidgee River for decades.

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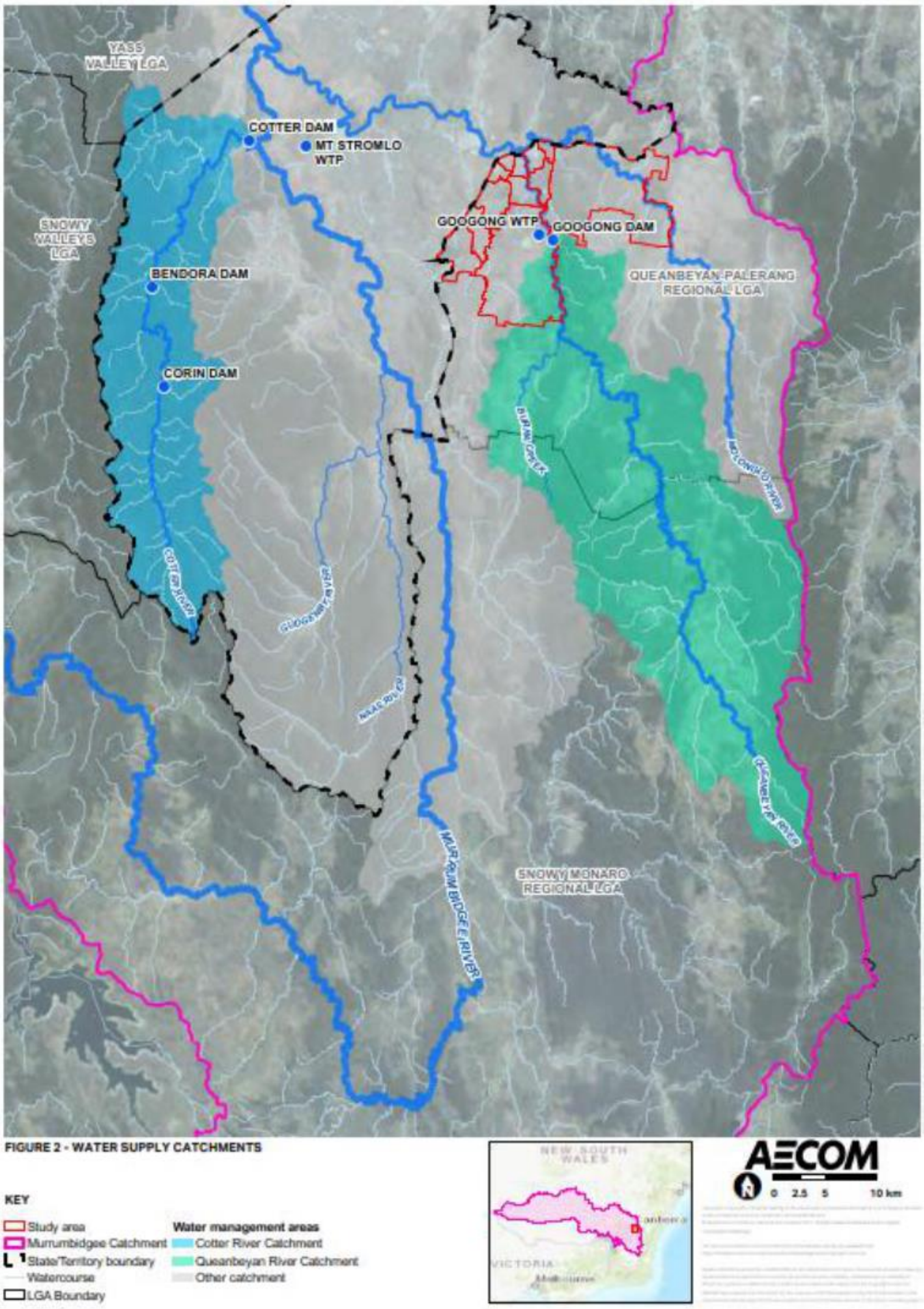

Figure 4-1 Water Supply Catchments

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4.1.2 Water licensing

QPRC holds the Water Access Licences (WAL) issued under the Water Management Act 2000 described in **Table 4-1**. Key messages related to the WAL's are summarised as follows:

- The showground water access licence (WAL28587) relates to a council water bore installed at the showground. Groundwater from the bore feeds a travelling irrigator that waters the main area to soften the ground prior to events (e.g. rodeos, dressage, etc.). Areas exterior to the main arena could be irrigated if a permanent irrigation system was installed, but demand is not currently present and there are insufficient QPRC Park resources to facilitate additional watering.
- The Queanbeyan Park water access licence (WAL29209) relates to a council water bore installed in the park. The bore is not currently tied into the irrigation system and the park is currently irrigated with town water. Council could investigate whether using groundwater is a more efficient way to irrigate the park.
- Three bores are installed around the exterior of Seiffert Oval, used to lower the water table to prevent boggy ground conditions at the oval.
- There is also a decommissioned pumping station on Morisett St that was previously used to pump town water to irrigate Campese Oval and Wright Park. The pumping station has been decommissioned due to problems with silting.
- Queen Elizabeth II Park is irrigated using water from the Queanbeyan River, extracted from a wet well that is connected to the river via a buried pipe. Council states there is a 120 ML/year water access licence associated with this service; however records pertaining to the water access licence was not able to be located.

Table 4-1 Water Access Licences

Licence number	Water supply scheme	Location	Bore construction detail	Average extraction (2010- 2015)	Licence details
WAL28587	Queanbeyan	Showground	Installed: 2007 Screened Aquifer: Fractured Rock (screened: 36 – 42 m and 68-74 m) Inner diameter: 143 mm Estimated yield: 1.4 L/s	0.1 ML/year	Maximum take of 4.5 ML/year from the Murray Darling Basin Fractured Rock Groundwater Source
WAL29209	Queanbeyan	Queanbeyan Park	Installed: 2008 Screened Aquifer: Fractured Rock (screened: 15 – 60 m) Inner diameter: 163 mm Estimated yield: 11 L/s	0.4 ML/year	Maximum take of 6 ML/year from the Murray Darling Basin Fractured Rock Groundwater Source
Water Access Licence Unknown	Queanbeyan	Seiffert Oval	Bore: GW047855 Installed: 1981 Screened Aquifer: Fractured Rock (screened: 3 – 24 m) Outer diameter: 150 mm Estimated yield: 0.7 L/s	Not metered	Dewatering bore, lowers water table to protect oval playing surface
			Bore: GW047856 Installed: 1981 Screened Aquifer: Fractured Rock (screened: 3 – 27 m) Outer diameter: 150 mm Estimated yield: 12.6 L/s	Not metered	

Licence number	Water supply scheme	Location	Bore construction detail	Average extraction (2010- 2015)	Licence details
			Bore: GW047857 Installed: 1981 Screened Aquifer: Fractured Rock (screened: 3 – 16 m) Outer diameter: 150 mm Estimated yield: 2 L/s	Not metered	
Water Access Licence Unknown	Queanbeyan River	Multiple locations including Queen Elizabeth II Park	Not applicable	Not metered	Maximum take of120 ML/year from the Queanbeyan River

4.2 Water supply assets and facilities

4.2.1 Water transfer from Icon Water to Queanbeyan

Potable water is supplied in bulk to Queanbeyan by Icon Water. Bulk treated water is transferred by Icon Water via the trunk distribution network from the Mt Stromlo WTP (in the ACT) and Googong WTP (in NSW) to the QPRC supply points. QPRC manages the transfer of potable water from Icon Water at two bulk supply point locations ('offtakes') in order to service Queanbeyan customers (see **Figure 3**):

- Offtake No. 1 (Jerrabomberra) - supplies treated water to the Jerrabomberra reservoir, Crest reservoirs (via gravity from Jerrabomberra reservoir, Thornton reservoir (via Thornton water pumping station (WPS)) and Homestead reservoir (via Homestead WPS)
- Offtake No. 2 (East Queanbeyan) - supplies treated water to the East Queanbeyan and Greenleigh reservoirs (via Greenleigh WPS) and Ridgeway and Weetalabah reservoirs (via Carawoola WPS)

Potable water supplied through the Icon Water trunk system is more frequently sourced from the Mt Stromlo WTP but can also be supplied from Googong WTP if Mt Stromlo WTP is offline [9]. Offtakes 1 and 2 are both connected to Icon Water's DN1800 trunk delivery main.

A schematic of Queanbeyan's water supply system, which includes the capacity of the service reservoirs, is presented in **Figure 4-3**.

The DWQMS [29] documents the Queanbeyan operational water quality monitoring locations. These are summarised in **Table 4-2**.

Table 4-2 Queanbeyan Operational Performance Monitoring

Location	Parameter	Frequency
Queanbeyan Distribution:	Free Chlorine	Weekly
- **QCC Offtake #1**	Total Chlorine	
- **QCC Offtake #2**	pH	
Reticulation network (various)	Temperature	

4.2.2 Water treatment

QPRC operates a re-chlorination dosing point at Offtake No. 2 in order to maintain residual chlorine in the downstream reticulation network. There is currently no re-chlorination dosing in place at Offtake No. 1.

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4.2.3 Water supply network

There are seven water supply zones (WSZs) within the Jerrabomberra (Offtake 1) and East Queanbeyan (Offtake 2) water distribution systems. Figure 4-2 illustrates the spatial location of the seven WSZs including a number of sub-zones (some pressure managed) across the entire study area. A summary of each WSZ is provided in Table 4-3.

- Jerrabomberra (Offtake 1) – Jerrabomberra reservoir functions as a primary service reservoir to parts of Queanbeyan and Jerrabomberra as well as providing onward supply to other service reservoirs located at Crest, Homestead and Thornton.
- East Queanbeyan (Offtake 2) – East Queanbeyan functions as a primary service reservoir in supplying parts of Queanbeyan, including the East Queanbeyan Industrial Area, as well as providing onward supply to other service reservoirs located at Greenleigh and Ridgeway (servicing rural residential areas at Ridgeway, Greenleigh, Kingsway and Weetalabah).

4.2.4 Recycled water systems

There is no existing supply of recycled water within Queanbeyan. As outlined in **Section 1.4.2**, there are currently no future plans to initiate recycled water supply services in Queanbeyan or Jerrabomberra. Queanbeyan STP uses reclaimed water within the plant for operational purposes. A NSW Local Government Act Section 60 approval is not required for this activity within the plant.

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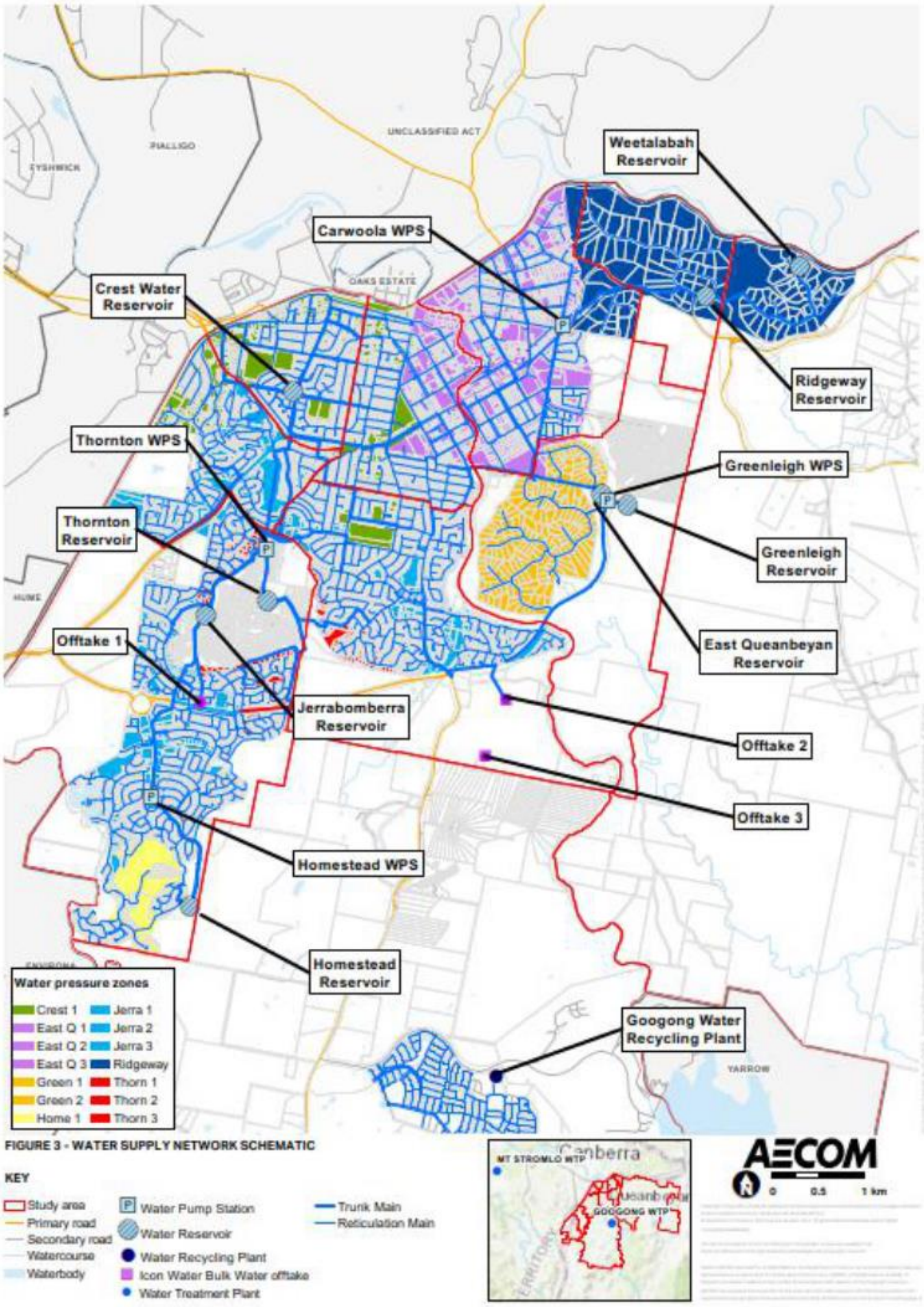

Figure 4-2 Water supply network layout

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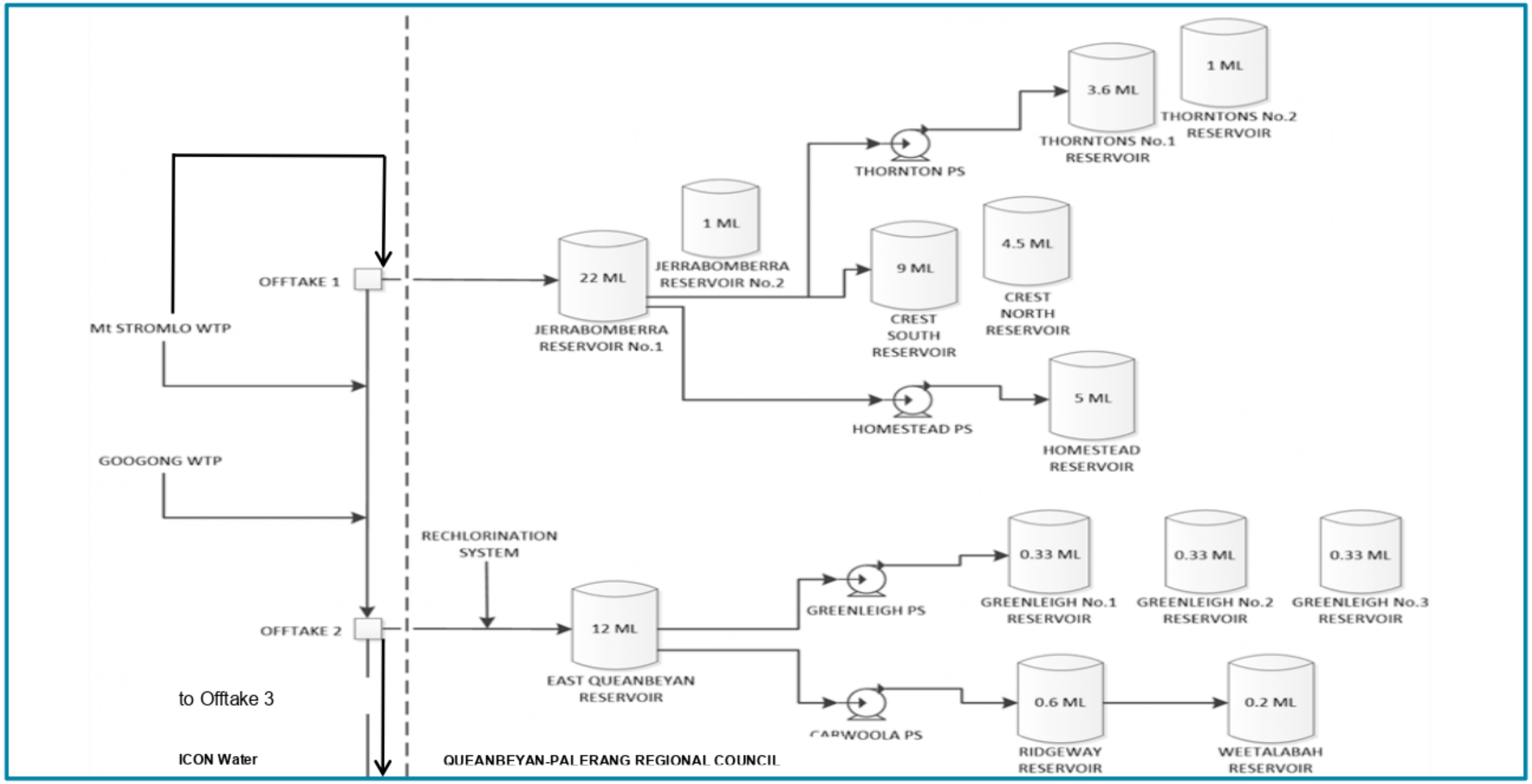
Figure 4-3 Water supply system schematic



Source: Adapted from QPRC Drinking Water Management System – Queanbeyan sub plan, Viridis Consultants, 2017

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Table 4-3 Water Supply Zones

Water Supply Zone[1]	Locality	OFFTAKE	Supply	Water Pump Stations	Water Reservoirs	Reservoir Capacities (ML)	Total Reservoir Capacities (ML)
Crest 1	Karabar, Queanbeyan West, Crestwood, Queanbeyan	OFFTAKE 1	Mt Stromlo WTP > Offtake 1 > Jerrabomberra Res > Gravity to Crest Reservoirs > Supply Zone	-	Crest South Water Reservoir (9ML)	9	13.5
					Crest North Water Reservoir (4.5ML)	4.5	
East Q 1	Greenleigh, Queanbeyan East	OFFTAKE 2	Mt Stomlo/Googong WTP > Offtake 2 > East Queanbeyan Res > Supply Zones	-	East Queanbeyan Reservoir (12ML)	12	12
East Q 2	Greenleigh, Queanbeyan, Queanbeyan East						
East Q 3	Karabar, Queanbeyan						
Green 1	Greenleigh	OFFTAKE 2	Mt Stromlo/Googong WTP > Offtake 2 > East Queanbeyan Res > Pumped to Greenleigh Reservoirs via Greeleigh WPS > Supply Zones	Greenleigh WPS	Greenleigh Reservoir (Reservoir #1 – 0.33ML, Reservoir #2 – 0.33ML, Reservoir #3 – 0.33ML)	0.33	0.99
						0.33	
Green 2	Greenleigh					0.33	
Home 1	Jerrabomberra	OFFTAKE 1	Mt Stromlo WTP > Offtake 1 > Jerrabomberra Res > Pumped to Homestead Reservoir via Homestead WPS > Supply Zone	Homestead WPS	Homestead Reservoir (5ML)	5	5
Jerra 1	Jerrabomberra, Karabar, Queanbeyan West, Crestwood, Queanbeyan	OFFTAKE 1	Mt Stromlo WTP > Offtake 1 > Jerrabomberra Reservoirs > Supply Zones	-	Jerrabomberra Reservoir (Reservoir #1 - 22ML, Reservoir #2 – 1ML)	22	23
Jerra 2	Jerrabomberra					1	
Jerra 3	Karabar						
Ridgeway	Queanbeyan East, The Ridgeway, Carwoola	OFFTAKE 2	Mt Stromlo/Googong WTP > Offtake 2 > East Queanbeyan Res > Pumped to Ridgeway Reservoirs via Carwoola WPS > Supply Zone > Gravity to Weetalabah Res > Supply Zone	Carwoola WPS	Ridgeway Reservoir (0.6ML)	0.6	0.8
					Weetalabah Reservoir (0.2ML)	0.2	

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Water Supply Zone[1]	Locality	OFFTAKE	Supply	Water Pump Stations	Water Reservoirs	Reservoir Capacities (ML)	Total Reservoir Capacities (ML)
Thorn 1	Jerrabomberra	OFFTAKE 1	Mt Stomlo WTP > Offtake 1 > Jerrabomberra Res > Pumped to Thornton Reservoirs via Thornton WPS > Supply Zones	Thornton WPS	Thornton Reservoir (Reservoir #1 – 3.6ML, Reservoir #2 – 1ML)	3.6	4.6
Thorn 2	Karabar					1	
Thorn 3	Jerrabomberra						

Note:

1. WSZ colour corresponds to legend in Figure 4-2

4.3 Sewerage assets and facilities

4.3.1 Sewerage treatment – Queanbeyan STP

Effluent from the study area is treated by the Queanbeyan STP before it is discharged into the Molonglo River. The Queanbeyan STP was built in the 1930s and services urban localities within the catchment including Queanbeyan, Queanbeyan East, Queanbeyan West, Crestwood, Jerrabomberra, Karabar and sections of rural residential properties in Rural East. The Queanbeyan STP has a treatment design capacity of approximately 34,500 equivalent population (EP) [11] based on the existing treatment processes [10]. Sewage inflows are received from various pump stations in the network via two independent trunk gravity main carriers that converge at the headworks of the plant. The treated effluent is discharged into the Molonglo River.

There have been multiple upgrades to the Queanbeyan STP since its construction, most recently in the 1980s. Since commissioning in 1937, three treatment trains have been added as upgrades. The Queanbeyan STP treatment train comprises an assortment of technological processes that have been added in a piecemeal fashion over time to resolve capacity issues, rather than a systematic approach to meet water quality objectives [10]. The Queanbeyan sewage treatment plant flow diagram is shown below in **Figure 4-6**.

More recently a Queanbeyan STP masterplan was completed in 2016 and the broader outcomes of the masterplan outline the foundation for future augmentation of the STP based on the following key risk drivers, which ultimately exacerbate the risk of QPRC not complying with licence conditions [10]:

- The STP undergoes regular maintenance however this is becoming less effective due to increasing asset age which is nearing the end of design life. Despite regular maintenance the poor condition of the existing plant continues to deteriorate. This adds to the risk of failure of one or more of the critical assets within the treatment plant.
- A number of WHS issues are associated with the existing STP that impact operational and maintenance activities and add to the risk of failure of one or more of the critical assets within the treatment plant.
- Projected growth and development within Queanbeyan is expected to exceed the current STP treatment capacity in the near future – proposed residential development areas within South Tralee, Forrest, Morrison, and Walsh as well as future industrial and commercial development areas within Poplars, Environa, and North Tralee are expected to become part of the existing STP scheme.

The existing effluent licence conditions and sewage treatment process is briefly described below.

4.3.1.1 Existing effluent licence conditions

The ACT EPA has prescribed licence conditions on the Queanbeyan STP [12], in accordance with the ACT Environment Protection Act 1997 (Environmental Authorisation 0417). The EPA licence conditions states the concentration and loading objectives for the treated effluent as shown in and .

Table 4-4 Concentration and loading conditions for the treated effluent

Parameter	Concentration (mg/L) 50th percentile	Concentration (mg/L) 90th percentile	Average daily load limit (kg/d)	Average performance period
Biochemical oxygen demand (5 day)	5	10	50	90 days
Suspended solids	8	20	90	90 days
Total dissolved solids	600	650	6000	12 months
Total nitrogen	30	35	300	12 months
Total phosphorus	0.2	0.3	6	90 days

Note - The pH of the effluent should be between pH of 6.5 – 8.5.

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Table 4-5 Thermotolerant coliforms licence parameters

Parameter	50th percentile	80th percentile	Performance period
Thermotolerant coliforms (cfu/100 mL)	200	1000	35 days

4.3.1.2 Inlet works

Two 12 mm screens function on a flow-based method comprises the STP inlet works. These screens can be used in bypass or duty and standby mode. Only larger material is filtered at this stage due to the coarse mesh size of the screens. A vortex grit chamber is present and in reasonable condition, but the primary grit chamber is not used, hence there is no grit removal at this stage.

4.3.1.3 Flow Splitting

Downstream of the inlet works, the screened and de-gritted flows converge to a common channel [11]. Flumes are used to split the flows into five flow measurement channels [11]. The three smaller channels have a nominal capacity of 200 L/s each whilst the two larger channels have a nominal capacity of 400 L/s each [11]. The operation of the flumes are as follows [11]:

- Flume 1 flows to Aeration Tanks 1 & 2
- Flume 2 flows to the rectangular sedimentation tank and Trickling Filters 1 & 2
- Flume 3 flows to the round primary sedimentation tank and Trickling Filters 3 & 4
- Flume 4 flows to Aeration Tank 3
- Flume 5 is generally isolated with a manual stop board. This flume is only opened to bypass high storm flows (greater than 685 L/s)

4.3.1.4 Trickling filters

Downstream of the inlet works are four rock-media trickling filters. These trickling filters receive the influent from the rotating distribution arms which are hydraulically driven by the influents pressure. The effluent from the trickling filter is then pumped to the secondary biological treatment zone.

4.3.1.5 Aeration tanks

Downstream of the trickling filters, air (i.e. oxygen) is pumped into the tank, which allows for microbial growth in the wastewater. Flocs are formed in this stage due to the mixing and aeration of the bacteria as the microbes feed on the organic material. It has been noted that the Dissolved Oxygen (DO) levels are not being controlled as efficiently as they could be in the aerator at the Queanbeyan STP.

4.3.1.6 Anaerobic digestion

Anaerobic digestion involves an oxygen free environment where organic matter is decomposed. Carbon dioxide and methane are produced as a result of the anaerobic microorganisms decomposing the organic matter [10]. There is apparent poor nitrogen removal at the Queanbeyan STP as air entrapment occurs resulting in a reduction in the usefulness of the anoxic nature of this system.

4.3.1.7 Clarifiers

The clarifier is utilised for removal of suspended solids and flocs from the liquid. There are three clarifiers at the Queanbeyan STP. It has been noted that due to high levels of sludge in the aeration tank, this sludge moves through into the clarifiers and through to the Maturation Ponds which ultimately reduces the water quality of the effluent.

4.3.1.8 Maturation ponds

Maturation ponds allow ultraviolet light infiltration and disinfection which assists with improving the quality of the effluent. The maturation ponds at the Queanbeyan STP contain algae activity within the ponds which ultimately affect the effluent water quality [10].

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4.3.1.9 Sludge handling system

There are two sludge lagoons located at the Queanbeyan STP. Sludge formed in the previously described process is flowed to one of the lagoons, where it is held for stabilisation before it is dried on the sludge drying beds. One of the sludge beds is fed (over a period of 6-12 months) whilst the other is on standby. Over this time period of 6-12 months, the sludge is allowed to settle and partial dewatering occurs. This sludge is then placed onto drying beds.

4.3.1.10 Wet Weather Bypass Arrangement

The ACT EPA licence conditions applicable to the Queanbeyan STP include a mechanism to divert untreated or partially treated wastewater to the maturation lagoons, if the situation is unavoidable. The licence places conditions on wastewater diversions, which include:

- In the event of diversion of untreated or partially treated wastewater to the maturation lagoons, the Authorisation holder shall take all steps necessary to ensure that the pollution of receiving waters is reduced to the lowest practicable level.
- Under no circumstances shall untreated or partially treated wastewater be discharged from the plant directly to the Molonglo River. Where the treatment plant capacity is exceeded, waste water shall be diverted through the system of maturation lagoons prior to discharge to the Molonglo River.
- In the event of untreated or partially treated wastewater being diverted to the maturation lagoons, the Authorisation holder shall immediately contact the ACT Government oand request the operator to inform the Environment Protection Authority of the diversion.
- Establishment of a program to monitoring the water quality parameters of the wastewater entering the maturation lagoons and water flowing from the lagoons into the Molonglo River. Results of the monitoring program are to be provided to the ACT EPA.

4.3.2 Sewerage network – Queanbeyan scheme

The Queanbeyan sewer network operated and maintained by QPRC as part of the Queanbeyan STP scheme is presented in **Figure 5**. Queanbeyan has one sewerage scheme. There are smaller rural areas and existing residential areas within the study area that are serviced by on-site sewage management systems.

Queanbeyan's system uses gravity collection, incorporating a series of sewage pumping stations serving districts within the catchment. Sewage from the south of the study area (Jerrabomberra) drains via an independent 600mm diameter trunk main to the Queanbeyan STP. Sewage from the north drain is pumped via a series of pumping stations which collectively drain to a 900mm diameter trunk main. The two independent trunk mains transfer the flows to the Queanbeyan STP. Sewage from the locality of Oaks Estate, located in the ACT also drains to the Queanbeyan STP.

A skeletonised sewer schematic has been developed for the purposes of the Issues Paper and this is presented in Figure 4-5**,** which has been developed from interpretation of the GIS layers provided by QPRC. The schematic shows the general operation of the sewer network including the gravity sub-catchments and pumped sub-catchments along the two independent trunk mains which drain to the Queanbeyan STP.

4.3.2.1 Sewerage network sub-catchments

Queanbeyan has a gravity reticulation system comprised of approximately 20 sewer sub-catchments ('supra-catchments') that incorporate 280 km of sewer pipeline and 15 sewage pumping stations. Two of the significant items of infrastructure in the sewerage collection system include the Morisset St Sewer Pump Station (SPS) and rising main and the Jerrabomberra trunk sewer gravity main.

A summary of the available asset data (including rising mains, pump stations etc.) per sewer sub-catchment was compiled based on available GIS and QPRC asset data and is shown in Table 4-6. The following is also noted based on anecdotal evidence:

- Operational issues have been identified at the Morriset St SPS. Major ragging occurs at this site which requires the frequent removal of pump sets for clearing. The pump station configuration allows for only 2 pumps to run in parallel and there is no auto changeover process to switch duty pump pairs. The operational issues associated with the Morriset St SPS increase the risk of sewer overflows occurring.

- There is an overflow point located on the east side of the Queanbeyan River adjacent to the Morriset Street Low Level Bridge. Overflows have occurred from this location previously due to failure of the Morriset St SPS and sewer chokes in the system.
- The operating philosophy for the sewer pump stations is to bring in a portable generator if power fails, except for Morisset St SPS which has a dedicated generator. QPRC has noted that there are several generators in its fleet available to be mobilised for emergency events.
- Future land development will likely trigger a need for the Jerrabomberra trunk sewer main to be upgraded to accommodate growth within future developments [10].

4.3.2.2 Sewerage network age and condition

Around half of the sewerage collection network is greater than 30 years old. Urban infill is set to increase sewage flows within the existing network, increasing pressure on parts of the system that are already approaching the design capacity [10].

Between 2010 and 2015, a sewer inspection and relining program was undertaken with an aim of reducing inflow and infiltration. During the program, significant sections of the following catchments were relined:

- Morriset SPS Catchment 32%
- Gravity CA.2 Catchment 28%
- Kathleen SPS Catchment 22%

Relining/refitting of manholes was not undertaken as part of the program and an internal analysis undertaken by QPRC in 2018 did not identify material improvements in inflow or infiltration as a result of the program.

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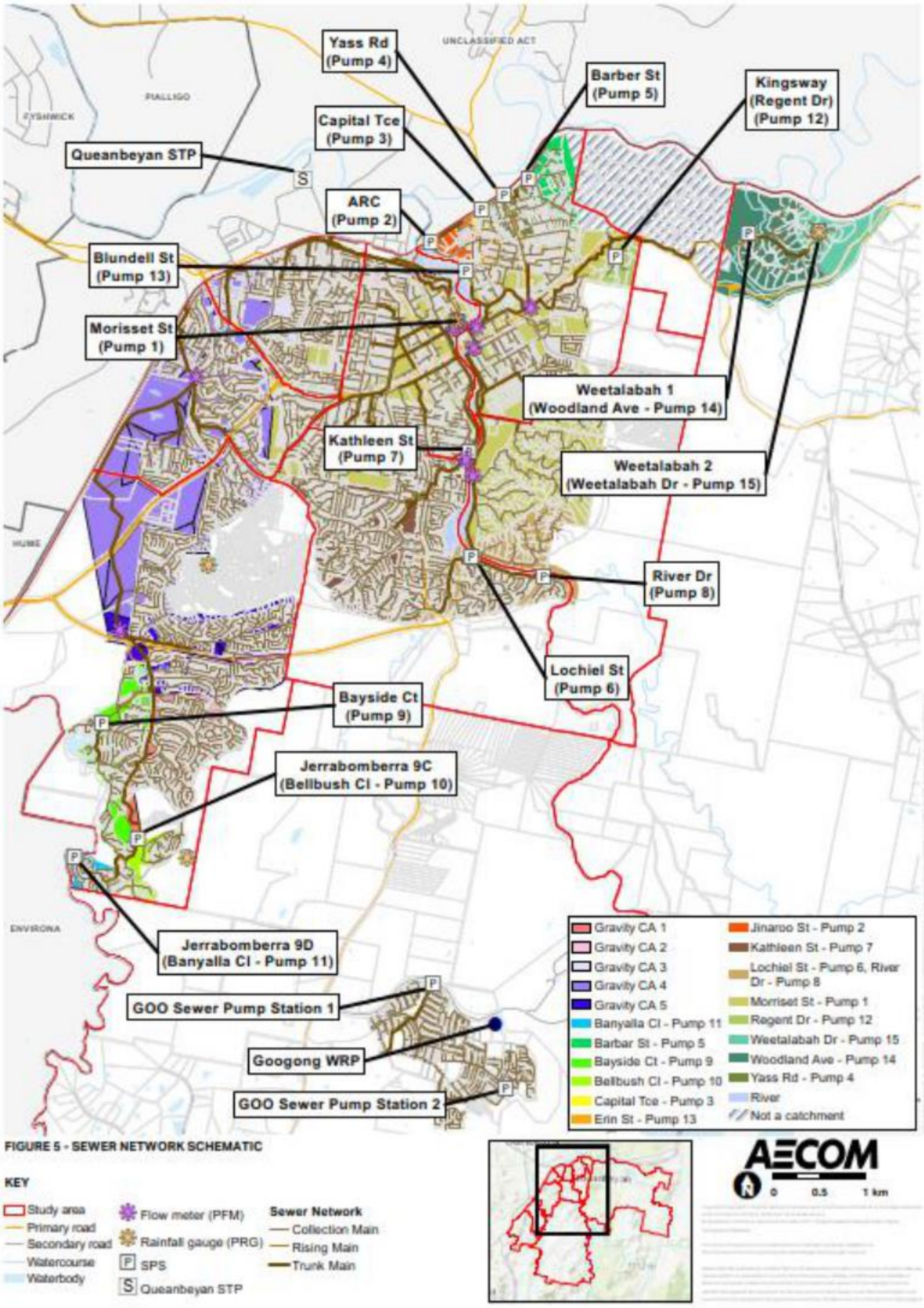

Figure 4-4 Sewer network layout

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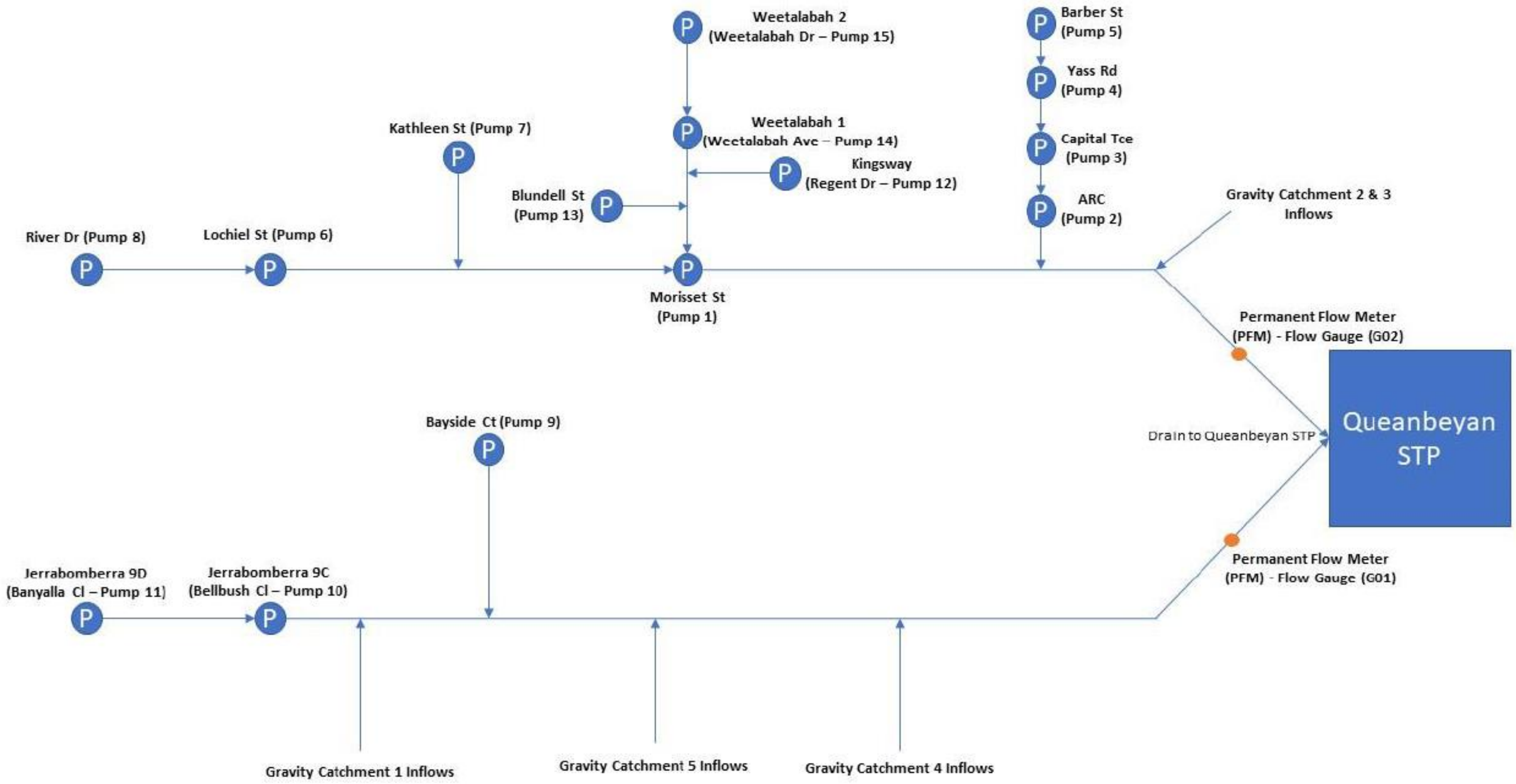

Figure 4-5 Sewer System Schematic

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Table 4-6 Sewer Sub-Catchments

Sewer Sub-Catchments	Locality	Sewer Pump Stations	Rising Mains	SPS Data (info. from 'SPS details.xlsx')		
				General Info	Pump Data	Dry/Wet Well
Gravity CA 1	Jerrabomberra	N/A - gravity		-	-	-
Gravity CA 2	Crestwood / Queanbeyan	N/A - gravity		-	-	-
Gravity CA 3	Crestwood	N/A - gravity		-	-	-
Gravity CA 4	Jerrabomberra / Queanbeyan West	N/A - gravity		-	-	-
Gravity CA 5	Jerrabomberra	N/A - gravity		-	-	-
Banyalla Cl – Pump 11	Jerrabomberra	Jerrabomberra 9D (Banyalla Cl – Pump 11)	DN100 DICL (382.1m)	Pump Station install date: May 2002 Drawings: C109648	Capacity: 9.36L/s Power: 17 kW Type: Submersible Number of pumps: 2	**Wet Well 1** Internal diameter: 2700mm Floor level: 626.95 Overflow level: 630.402 **Emergency Storage** Internal diameter: 2700mm Floor level: 628.52 Overflow level: 630.02
Barbar St – Pump 5	Queanbeyan East	Barber St (Pump 5)	DN225 AC (164.3m)	Emergency Storage Drawings: C0942041		**Wet Well** Max depth: 2.5m **Emergency Storage** Internal diameter: 1800mm Max depth: 1174mm
Bayside Ct – Pump 9	Jerrabomberra	Bayside Ct (Pump 9)	DN225 DICL (620.4m)	Approved plans: C0951647 Jerrabomberra Park Stage 3B/1 Pump	Pump model 1&2: Flyt 3171.181 4511IMP 22KW 39A 1455 RPM (from 2017 pump maintenance report)	Internal Diameter: 1800mm Floor level: 587.42m Top level: 594.85m High Water Level Alarm:

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Sewer Sub-Catchments	Locality	Sewer Pump Stations	Rising Mains	SPS Data (info. from 'SPS details.xlsx')		
				General Info	Pump Data	Dry/Wet Well
				station build: 1992?	No. of pumps: 2	589.63m
Bellbush Cl – Pump 10	Jerrabomberra	Jerrabomberra 9C (Bullbush Cl – Pump 10)	DN150 DICL (177.6m)	Pump Station built: 2002 WAE: C0943005, C0943006, C0943004 Estimated ET at the time of construction: 240	Duty point: 32 L/s Duty head: 50m Power: 30 kW Type: Submersible Pump Number of pumps: 2 (1 duty and 1 standby) Pump 1 replaced: 42290 Pump 2 replaced: 42291	**Wet Well 1** Internal diameter: 3800mm Floor level: 628.037 Overflow level: 637.057 **Emergency Storage/Wet Well 2** Internal diameter: 3800mm Floor level: 629.257 Top water level: 632.057
Capital Tce - Pump 3	Queanbeyan East	Capital Tce (Pump 3)	DN225 VC (238.7m)	Drawings: C0942040 (additional storage)	Number of pumps: 2 One pump replaced on: 17/12/2013 (NP 3127 HT Flygt pump – pump curve code 0487) Pump model: Flygt 3127.180-487 IMP-5.9 KW-1445 RPM-11AMP (from 2017 pump maintenance)	**Wet Well** Max depth: 3.3 **Emergency Storage** Max depth: 2.4m
Erin St – Pump 13	Queanbeyan East	Blundell St (Pump 13)	DN100 (material unknown) (135.2m)	Information put together from the operating manual – WAE of wet will is in the operating manual	Duty flow: 22 L/s Duty head: 9.3m Power: 3.1 kW Type: Submersible Pump number: 2 (alternating duty pumps) Pump replaced: 08/01/2016	Internal diameter: 3m Maximum depth: 3.5m
Jinaroo St – Pump 2	Queanbeyan East	ARC (Pump 2)	DN300 AC (336.9m)	Install date: 20/01/1998	Number of pumps: 2 Pump 1 & 2 model: FLYGT 3152.191 – 450 IMP-13.5 KW-1450 RPM – 26 AMP	**Wet Well** Internal diameter: 1800mm Maximum depth: 4m **Emergency Storage 1** Internal Diameter: 1800mm

FINAL DRAFT

Sewer Sub-Catchments	Locality	Sewer Pump Stations	Rising Mains	SPS Data (info. from 'SPS details.xlsx')		
				General Info	**Pump Data**	**Dry/Wet Well**
					(from 2017 pump maintenance report)	Maximum depth: 2.5m **Emergency Storage Tank 2** Internal Diameter: 1800mm Maximum Depth: 2.5m
Kathleen St – Pump 7	Karabar	Kathleen St (Pump 7)	DN225 HDPE (160.0m)	Install date: 12/11/1999 WAE: C0948063, C0948061	Duty flow: 95 L/s Duty head: 7.5m Power: 13.5 kW Type: Submersible Number of pumps: 2 (1 duty and 1 standby)	**Wet Well 1** Internal diameter: 2250mm Floor level: 569.25 Top level: 575.75 No emergency storage
Lochiel St – Pump 6, River Dr – Pump 8	Karabar/Greenleigh	Lochiel St (Pump 6)	DN300 AC (113.64m)	Install date: 20/02/1976 Drawings: C0945891, C0945893 Pump 1 & 2 Flygt 3153.180 (information from 2017 pump maintenance report)	Number of pumps: 3 (2 duty pump and 1 standby)	**Wet Well 1 (1 pump)** Internal Diameter: 1824 mm Maximum depth: 6m **Wet Well 2 (2 pumps)** Internal diameter: 1824mm Maximum depth: 6m
		River Dr (Pump 8)	DN150 DICL (13.0m)	Install date: 11/08/1999 (Fairlane estate Stage 10A-1) WAE: C0941935 – certified plan	Duty flow: 7.66 L/s Duty head: 26.18m Type: Submersible	Internal dia: 1050mm (assumed) Maximum depth: 3.179m
Morriset St – Pump 1	Greenleigh / Queanbeyan East / Queanbeyan	Morriset St (Pump 1)	DN600 DICL (398.3m)	Install date: 09/12/2008 WAE: C1322943	Duty point: 460 L/s Duty head: 31.5m Power: 250 kW Type: Submersible VSD – high flow/high head No. of pumps: 4 (2 duty pumps and 2 standby)	Internal diameter: 11300mm Floor level: 559 Roof level top: 572.2 Overflow level: 570.2
Regent Dr – Pump 12	Queanbeyan East	Kingsway (Regent Dr) – Pump 12	DN150 AC – (114.2m)	Install date: 12/11/95 Drawings: C0946645 (Carwoola Heights) Pump 1 & 2 Flygt	Number of pumps: 2 (1 duty pump and 1 standby) No information on pump	Wet Well 1 Internal diameter: 1800 Bottom RL: 640.17 Top RL: 643.67

FINAL DRAFT

Sewer Sub-Catchments	Locality	Sewer Pump Stations	Rising Mains	SPS Data (info. from 'SPS details.xlsx')		
				General Info	**Pump Data**	**Dry/Wet Well**
				3085.172-253 IMP-2.4 KW-4.5 AMP (from 2017 pump maintenance report)	replacements	High Level Alarm: 641.51
Weetalabah Dr – Pump 15	Carwoola	East Weetalabah 2 (Weetalabah Dr – Pump 15)	DN75 UPVC (264.2m)	Install date: 2002 WAE: C0948479	No. of Pumps: 2 Pump 1 replaced: 09/10/2013 Duty flow: 3.7 L/s Duty Head: 23m Power: 2.4 kW Type: Submersible	Nominal diameter: 1800mm Floor level: 680.25m Roof Level: 683.2m
Woodland Ave – Pump 14	Carwoola	West Weetalabah 1 (Woodland Ave – Pump 14)	DN75 UPVC (783.6m)	Install date: 2002 WAE: C0948479	64m head requirement 2 stage pumping (duty pump and booster pump run in parallel) The two pumps in the dry well were replaced in 2015 & 2016 One pump in the wet well replaced in 2013 Wet Well Pump 1 and 2 Model: Flygt 3127.170-252 imp-7.4 KW-2895 RPM-13 AMP	**Wet Well** Internal Diameter: 2250mm Floor level: 664.42m Roof level: 669.25m
Yass Rd – Pump 4	Queanbeyan East	Yass Rd (Pump 4)	DN200 VC (195.2m)	Pump 1 replaced: 21-1-2010 NP 3127 HT Flygt pump Pump 2 replaced: 19/02/2010 NP 3127 HT Flygt pump		**Emergency Storage 1** Internal diameter: 2700mm Max depth: 1460mm Internal diameter: 2700mm Max depth: 1460mm

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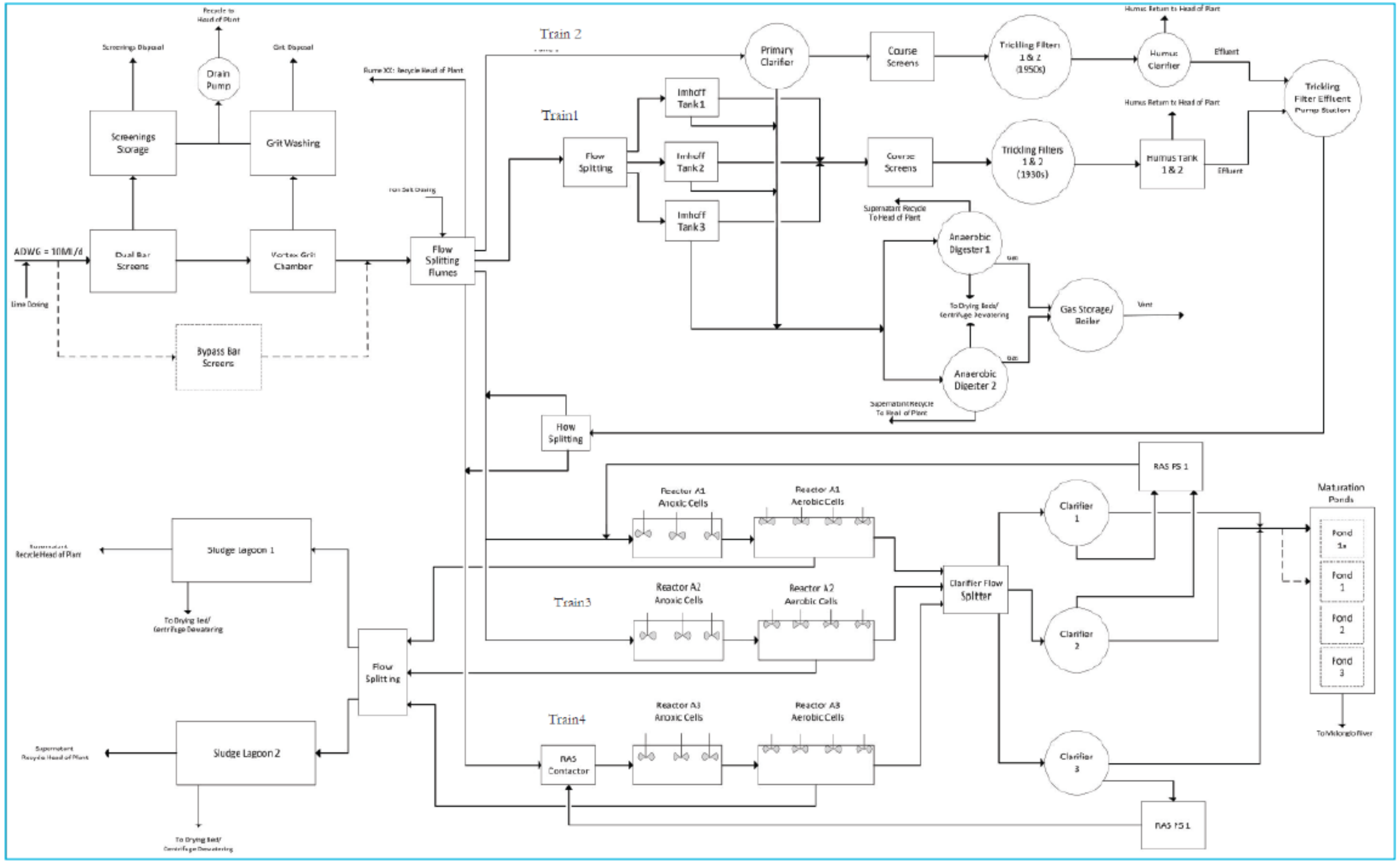

Figure 4-6 Queanbeyan Sewage Treatment Plant Flow Diagram [25]

4.4 Urban stormwater

4.4.1 Stormwater drainage scheme – Queanbeyan

QPRC is responsible for drainage assets in the study area which falls within several waterway catchments that in turn drain to Lake Burley Griffin as follows:

- Crestwood, Queanbeyan, Queanbeyan West – Molonglo River;
- Queanbeyan East, Karabar – Queanbeyan River;
- Jerrabomberra, Tralee, Environa, Royalla – Jerrabomberra Creek; and
- Burra–Burra Creek / Googong Dam.

The existing stormwater drainage network comprises:

- Natural stormwater assets – man-made open waterbodies, creeks and open channels;
- Stormwater drainage assets - pipes, pits, manholes, culverts and headwalls; and
- Stormwater quality and quantity assets - stormwater detention basins and gross pollutant traps.

A schematic plan of the urban area illustrating the urban stormwater sub-catchments is presented in Figure 4-7. **Table 4-7** summarises mean annual stormwater runoff volumes for the various land use types in the study area.

A limited MUSIC model was developed using local rainfall data and stormwater pollutant export loads based on published values for common land uses. The MUSIC model was used to determine the annual average loads of pollutants from existing and proposed land uses for a climate period with average rainfall of 655mm. Stormwater and pollutant reductions associated with WSUD were applied to stormwater estimates from new areas of development occurring after 2018.

The model was used to estimate the order of magnitude increase in stormwater volumes and pollutant loads to local waterways.

Table 4-7 Land use types and contribution to stormwater runoff and pollutant loads

Land Use	2050 Area (Ha)	Stormwater (GL/yr)	Total Susp.Solids (Tonne/yr)	Total Phosphorus (Tonne/yr)	Total Nitrogen (Tonne/yr)
Industrial	131.00	0.67	89.31	0.15	1.20
Commercial	144.00	0.74	76.06	0.14	1.19
Residential*	3,189.61	9.60	1,297.16	2.34	17.68
Parkland and Open Space	87.46	0.15	17.39	0.03	0.27
Forest	2,460.40	0.01	22.86	0.06	1.05
Quarry (no discharge)	55.00	-	-	-	-
Rural residential	13,460.78	8.48	741.76	1.31	14.04
Total Study Area	19,528.25	19.65	2,244.53	4.03	35.43

4.4.2 Stormwater conveyance network

The level of service provided by stormwater drainage networks within older areas (Crestwood, Queanbeyan, etc.) is unknown. QPRC records show that some areas are prone to nuisance flooding and surcharging.

QPRC has commenced building a drainage model using computer modelling software but the models reviewed as part of this study are not complete and do not contain sufficient data to determine the level of drainage service provided.

The Draft Queanbeyan Floodplain Management Plan shows that the Queanbeyan CBD is prone to overland flooding in a 5% AEP storm event. Current design standards would minor drainage networks with capacity for rain events up to the 5% AEP event.

Within older regions of the study area, QPRC is monitoring the condition of drainage assets by using pipe CCTV surveys. Pipe renewal programs are also in place.

Stormwater drainage networks within newer areas have been designed to modern standards of minor and major drainage. In these areas, properties have been designed to accommodate flows from rain events up to and exceeding the 1% AEP storm.

4.4.3 Stormwater quality and quantity assets

QPRC currently controls sixteen Gross Pollutant Traps (GPTs) in the study area which are cleaned out on an ongoing six monthly basis. Several GPTs require more frequent cleaning (approximately 3 monthly). The ACT Government has recently funded the construction of two stormwater quality devices in Morisset Street and Kenneth Place to reduce stormwater pollutant loads to Lake Burley-Griffin as part of the *Healthy Waterways* initiative. An estimate of the stormwater pollutant loads from the study area has been developed using MUSIC software and based on the types of land uses in the area (see **Table 4-7** for the outputs).

QPRC does not operate a stormwater harvesting scheme, however does (indirectly) extract stormwater via a wet well installed into the Queanbeyan River for irrigation of Queen Elizabeth II Park. Council maintains several stormwater detention basins which have unknown levels of service but are listed below for reference:

- Halloran Drive Oval – 14,650 m^2, depth unknown
- Brad Haddin Oval - up to 41,500 m^2, depth unknown
- 81 Brudenell Dr – 8,600 m^2, depth unknown
- Jerrabomberra Community Centre lake – 13,860 m^2, depth unknown
- Lake Jerrabomberra – 95,090 m^2, depth unknown
- Waterfall Drive South – 1,350 m^2, depth unknown
- Waterfall Drive North – 5,500 m^2, depth unknown
- 43 Candlebark Road – 2,680 m^2, depth unknown
- Googong Basin – 22,250 m^2, depth unknown.

4.4.4 Natural stormwater assets

Several urban waterways traverse through the Jerrabomberra development area and feed open water bodies as follows:

- 81 Brudenell Dr – 8,600 m^2, depth unknown
- Lake Jerrabomberra – 95,090 m^2, depth unknown
- Jerrabomberra Community Centre lake – 13,860 m^2depth unknown
- Waterfall Drive South – 1,350 m^2, depth unknown
- Waterfall Drive North – 5,500 m^2, depth unknown.

Lake Jerrabomberra periodically experiences toxic blue green algae blooms which are likely to be due a result of a combination of long residence times, poor flushing, high nutrient inflows and thermal stratification. This becomes a public safety, amenity and environmental concern. The most recent bloom was in 2017. Controlling or reducing the frequency of algal blooms in established urban waterways is difficult and costly. It is likely that these issues will be periodic but persistent.

Some erosion has been noted within the waterway feeding the lake behind the Jerrabomberra Community Centre. Erosion control works are relatively simple to design.

Lake Jerrabomberra is a constructed sediment basin and is not a wetland under SEPP58, otherwise a Pollution Reduction Plan (PRP) could be applied.

4.4.5 Stormwater funding mechanisms

QPRC collects stormwater levies for stormwater improvement works, which are separate funds to maintenance of stormwater pipes and pits. These funds could support future stormwater pollution control or stormwater harvesting measures to improve downstream water quality impacts in Lake Jerrabomberra or waterways within developing areas.

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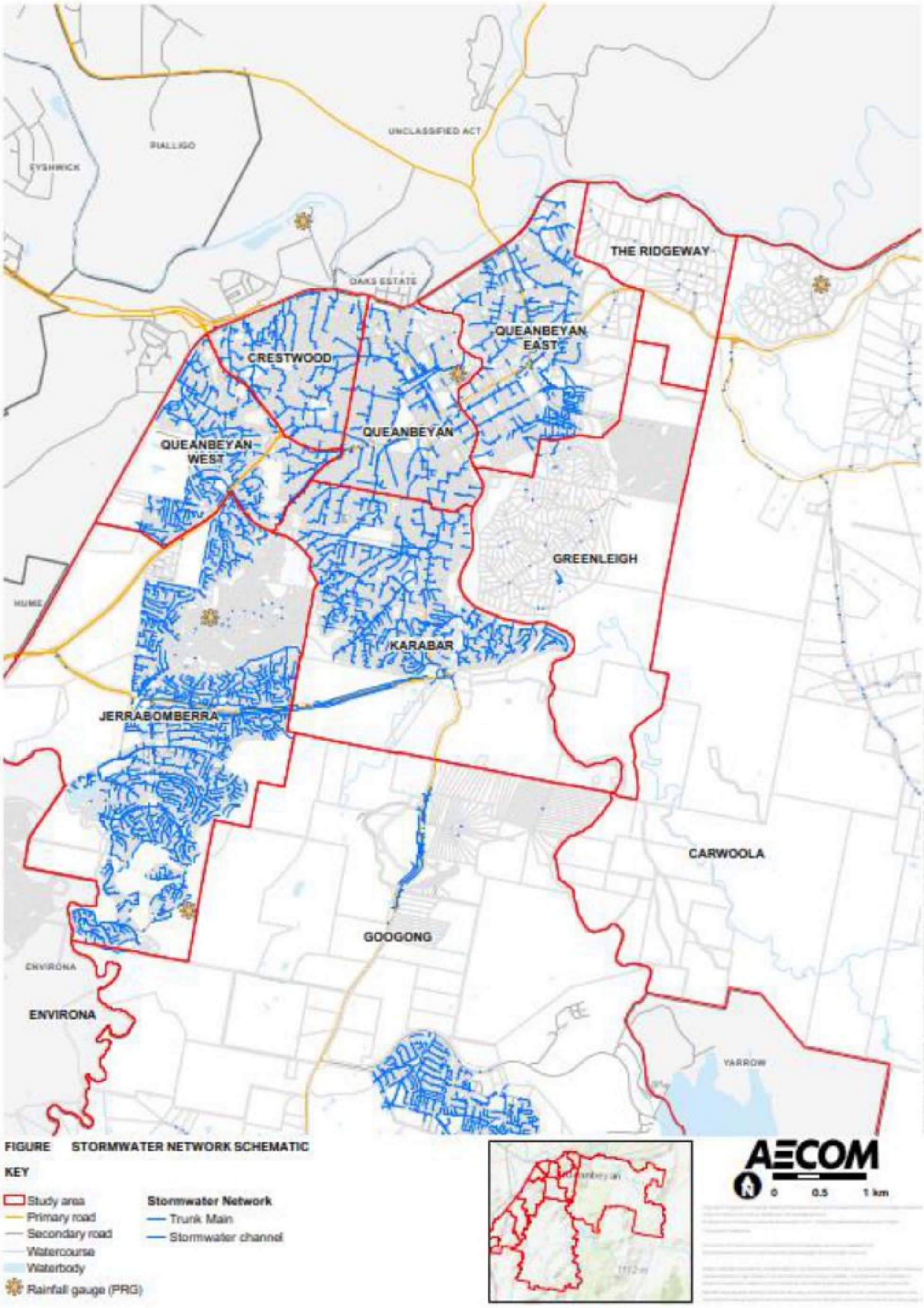

Figure 4-7 Stormwater network layout

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4.5 Asset condition and replacement costs

The condition and replacement costs for Queanbeyan's water supply, sewerage and stormwater schemes have been obtained from QPRC's asset register. Land and building values are stored in a separate asset register which was difficult to source for the Issues Paper and therefore these values are excluded from the table below.

A revaluation of assets was undertaken in 2016 as part of the Council merger process. Condition data is based on visual observation, asset age and/or QPRC experience.

QPRC is currently not able to provide an accurate breakdown of condition assessment based on water supply and sewerage schemes. However, this information is currently being updated and reviewed as part of the preparation for the renewed Asset Management Plans. The condition information for QPRCs' entire water and sewerage assets is shown in Figure 4-8 and Figure 4-9. Overall, the reported water and sewerage backlog is approximately 5.6%. QPRC has committed to reducing backlog to 2% as part of the merger process.

Table 4-8 Asset replacement costs and written down value

System	Asset Replacement Cost	Written Down Value
Queanbeyan Water	$101,780,508	$62,315,770
Queanbeyan Sewerage	$141,454,650	$70,821,118
Queanbeyan Stormwater*	$112,885,327	$63,446,071
Total Value	$356,120,485	$196,582,959

Note: * Queanbeyan Stormwater valuation may contain some elements from other systems which cannot be easily identified from the asset database.

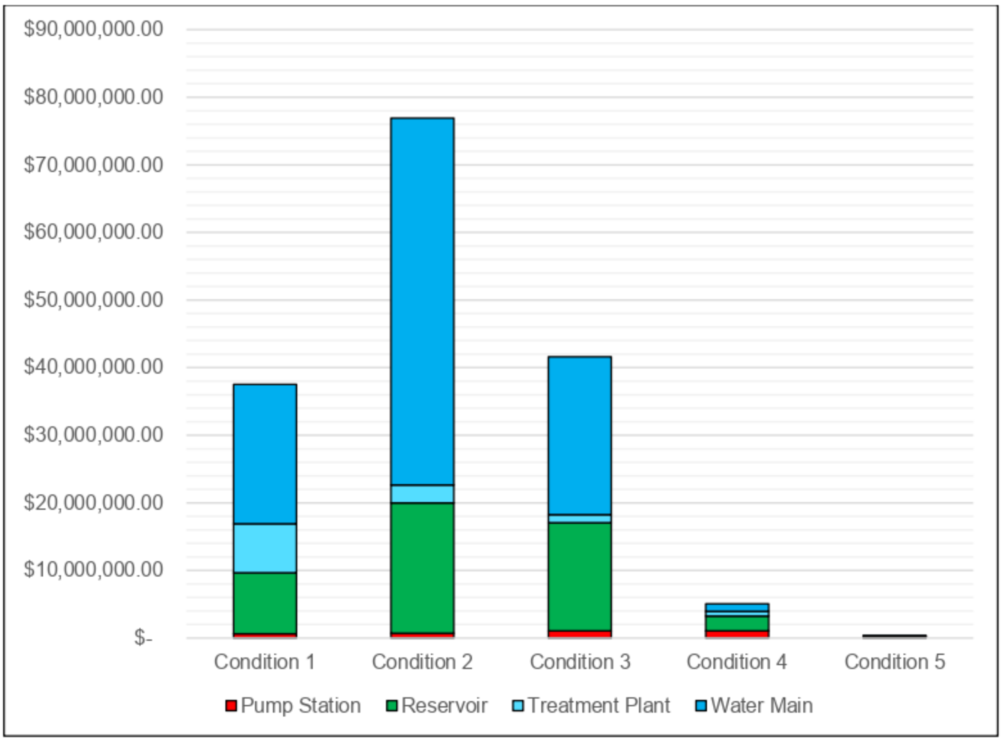

Figure 4-8 QPRC total water infrastructure asset condition replacement costs

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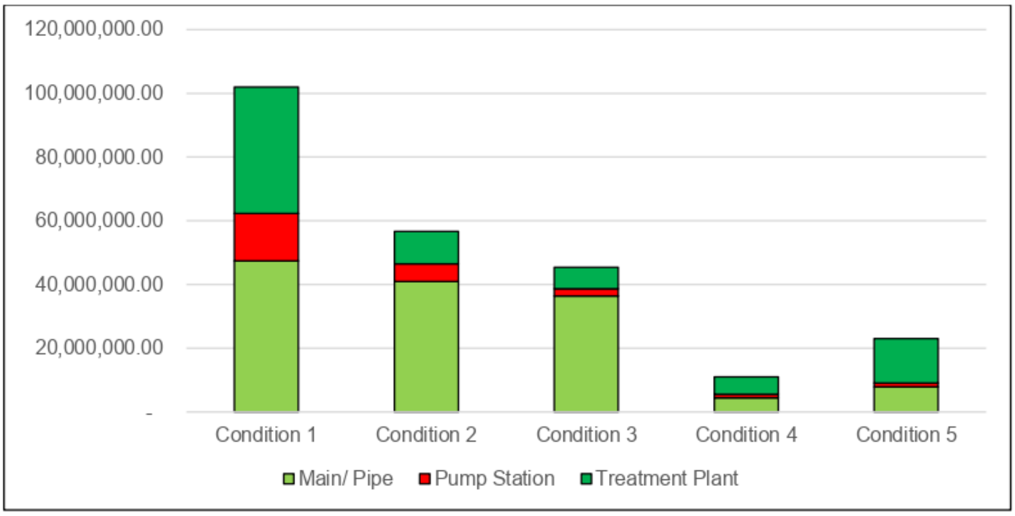

Figure 4-9 QPRC total sewerage infrastructure asset condition replacement costs

4.6 Current price signals

The current price signals have been extracted from the NSW Department of Primary Industry (DPI) Queanbeyan City Council Historical Data from 1994-95 to 2015-16 and the QPRC 2017-18 Revenue Policy [16]. This has been extracted and summarised in **Table 4-9**.

Table 4-9 Current Price Signals

Current Price Signals	2013/14	2014/15	2015/16	2016/17	2017-18
Water Supply					
Consumption Charge per kl (Single Tier) ($/kL) - former QCC	-	-	-	3.72	3.80
Usage Charge for Step 1 (c/kL)	250	274	297	-	-
Usage Charge for Step 2 (c/kL)	367	402	456	-	-
Annual Water Access Charge (20 mm Meter Size) ($) - former QCC	-	-	-	251	257
Typical Developer Charge (next reporting year) ($/ET)	8,290	8,500	8,610	-	-
Typical Residential Bill ($/assmt)	815	871	930	-	-
Operating Cost (OMA) ($/Property) – including water purchase	589	577	-	-	-
Operating Cost (OMA) ($/Property) – excluding water purchase	589	301	-	-	-
Residential Revenue (% of rates and charges total)	90	90	-	-	-

Current Price Signals	2013/14	2014/15	2015/16	2016/17	2017-18
Sewerage					
Annual Sewerage Access Charge for Residential Properties ($) - former QCC	-	-	-	643	657
Residential Sewer Usage Charge (c/kL)	0	-	-	-	-
Non-residential Sewer Usage Charge (Not including SDF) (c/kL)	83	94	107	-	-
Non-Residential Access Charge ($) (20mm water service) –	-	-	-	643	657
Non-Residential Usage Charge ($/kL) - former QCC	-	-	-	-	1.14
Typical Residential Bill ($/assmt)	414	470	533	-	-
Trade Waste Charges (c/kL)	180	204	232	-	-
Operating Cost (OMA) ($/Property)	372	377	-	-	-
Revenue Total (excl. Capital Works Grants) ($'000)	12,605	11,702	9,781	-	-
Typical Developer Charge (next reporting year) ($/ET)	1,330	1,390	1,390	-	-

Source: NSW DPI Queanbeyan City Council Historical Data & QPRC 2017-18 Revenue Policy [16])

4.7 Trade waste policy, approvals and pricing

QPRC has adopted a Liquid Trade Waste Policy [27] in 2018 and this policy is available on the QPRC website. However, the annual trade waste performance report is not yet available.

The annual charges and usage charges for liquid trade waste for the former QCC LGA is documented in the QPRC 2017-18 Revenue Policy which is shown in **Table 4-10**.

Table 4-10 Liquid Trade Waste Charges

Trade Waste Category	Annual Trade Waste Charge 2016-17	Annual Trade Waste Charge 2017-18	No or Assess	Projected income 2017-18	Liquid Trade Waste Usage Rate 2016-17	Liquid Trade Waste Usage Rate 2017-18	% Change
Category 1 – complying	$120	$120	53	$6,360	N/A	N/A	N/A
Category 1 – non-complying					$2.32 per kl	$2.35 per kl	1.5%
Category 2 – complying	$120	$120	114	$13,680	$2.32 per kl	$2.35 per kl	1.5%
Category 2 – non-complying					$19.71 per kl	$19.71 per kl	0%
Category 3	$780	$780	6	$4,680	As stated in LTW Excess Mass charges	As stated in LTW Excess Mass Charges	0%
Totals	**-**	**-**	**173**	**$24,720**	**-**	**-**	**-**

Note: These represent annual charges and usage charges from the former QCC LGA (pre-merger)

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5.0 Population and Development

5.1 Current Population and Housing

Queanbeyan's housing is made up of older traditional housing stock in suburbs closer to the City Centre and relatively new housing stock in areas such as Jerrabomberra. Queanbeyan is also characterised by the significant rural living opportunities that are provided within the rural parts of the former Queanbeyan City Council (QCC) local government area (LGA).

The number of connected properties (both residential and non-residential) for water and sewer, historically between 1995/96 to 2014/15, as obtained using reported DPI Performance Data is presented in **Table 5-1.** For the purposes of the Queanbeyan IWCM the existing population has been adopted from the ABS 2016 Census QuickStats data as shown in **Table 5-2**, which provides a breakdown of existing population, number of private dwellings and average people per household.

Existing dwellings in Burra, Royalla, Carwoola and parts of Tralee, Environa and Ridgeway are not currently connected to Queanbeyan's existing water and sewer services. Therefore, the two sets of data found in **Table 5-1** and **Table 5-2** do not fully align and should not be directly compared.

Table 5-1 Historically Serviced Properties (based on DPI performance data)

Serviced Properties	1995/96	2000/01	2005/06	2010/11[1]	2014/15
Water					
Residential Connected Properties	No data	No data	14,390	14,930	16,417
Non-Residential Connected Properties	No data	No data	1,000	1,000	933
Total Connected Properties	9,550	13,900	15,390	15,930	17,350
Serviced Population (Permanent)	**28,000**	**29,700**	**35,700**	**40,000**	**39,200**
Sewer					
Residential Connected Properties	No data	No data	14,400	15,165	16,100
Non-Residential Connected Properties	No data	No data	1,030	993	1,180
Total Connected Properties	12,950	13,800	15,430	16,158	17,280
Serviced Population (Permanent)	**28,000**	**29,700**	**35,600**	**40,000**	**39,000**

Notes:

1. The reported permanent serviced population increases over time however between 2010/11 and 2011/12 there was a significant reported reduction in serviced population of approximately 4,500. This appears to be an anomaly in the historical data or may have represented a change in reporting definitions or requirements at the time (which remains unclear). Regardless, the total serviced population at 2014/15 appears to correlate reasonably well with the ABS 2016 Census QuickStats Data as a sanity check.

Table 5-2 Existing population (based on ABS 2016 Census QuickStats Data)

Locality	Number of Private Dwellings*	Average People Per Household	Population
Carwoola	520	2.9	1,453
Greenleigh	245	3	694
The Ridgeway	62	2.7	168
Crestwood	2,439	2.2	5,132
Jerrabomberra	3,284	3.0	9,656
Karabar	3,483	2.6	8,899
Queanbeyan	3,221	2.1	6,678
Queanbeyan East	2,176	2.0	4,264

FINAL DRAFT

Locality	Number of Private Dwellings*	Average People Per Household	Population
Queanbeyan West	1,323	2.5	3,235
Royalla	312	3.0	969
Burra	301	3.0	784
Tralee	7	2.9	20
Environa	-	-	-
TOTAL	**17,374**	**2.6**	**41,952**

Notes: * It is assumed that the total number of private dwellings is representative of residential low, medium and high density. The dwelling type breakdown provided in the ABS Census QuickStats data is difficult to reconcile and therefore no further breakdown is provided.

5.2 Unoccupied and Seasonally Occupied Dwellings

The estimated unoccupied and seasonally occupied dwellings are presented in **Table 5-3**. The breakdown is presented based on data obtained from the 2016 Census.

Table 5-3 Estimated Unoccupied and Seasonally Occupied

Area[2]	Unoccupied Dwellings	Seasonally Occupied Dwellings (Hotel, motel, bed and breakfast)
Karabar	282	0
Queanbeyan[1]	1,215	16
Total	**1,497**[3]	**16**

Notes:

1. This includes Queanbeyan, Queanbeyan East and Queanbeyan West/Jerrabomberra.
2. There are values for unoccupied and seasonally occupied dwellings reported against the Queanbeyan Region in the 2016 Census data; however this includes areas outside the Queanbeyan IWCM study area and therefore is not reported in this paper.
3. The number of unoccupied dwellings seems to be approximately 8% of the total number of dwellings. This is considered not to have a major impact and the demand sensitivity could be further investigated in the next phase of developing the IWCM.

The total number of seasonally occupied dwellings equates to a low transient population. Therefore, it is assumed that there is no major impact on any future demand and flow projections.

5.3 Tourist Connections

The number of rooms/units based on different types of tourist accommodations is shown in **Table 5-4**. This data was gathered through website research for Queanbeyan. In total there are approximately 19 tourist accommodations in Queanbeyan, which comprise a total of approximately 550 rooms or units.

Table 5-4 Tourist Connections in Queanbeyan

Urban Centre	Type of Accommodation	Number of Accommodation Type	Total Number of Rooms/Units
Queanbeyan	Inn	6	202
	Motel	9	235
	Hotel	2	22
	Villa	1	19
	Tourist Park	1	76
Total		**19**	**554**

5.4 Properties with On-Site Sewerage Collection Systems

There are a number of properties within the study area that contain on-site sewerage collection systems (i.e. septic tanks etc.). The majority of these properties are located at the fringes of the network away from the urban and suburban centres.

Table 5-5 Properties with On-Site Sewerage Collection Systems

Locality Area	Number of Connections not on Sewer
Urban	
The Ridgeway	50
Queanbeyan	1*
Crestwood	1*
Jerrabomberra	2*
Karabar	1*
Sub-total	**55**
Rural	
Royalla	112
Carwoola	146
Sub-total	**258**
TOTAL	**313**
Notes: *Single connections recorded for these urban areas may potentially be a data error.	

5.5 Vacant Lots

An estimate of the vacant lots could not be readily determined as there was insufficient data available.

5.6 Non-Residential Connections

The number of non-residential connections has been developed from the customer billing database based on the number of properties and equivalent number of water connections (water meters), shown in **Table 5-6** (i.e. some properties appear to have more than one connection). Land zoning of the study area including spatial distribution of non-residential connections is presented in Figure 5-1.

Table 5-6 Non-Residential Connections

Non-Residential Category	Number of Properties	Number of Connections (Water Meters)
Hospital/Medical Facility	3	5
School/Education Facility	9	11
Council Premise	2	5
Park or Garden (Park/Sports field/Picnic Area)	35	37
Public Swimming Pool	1	1
Hotel/Motel	12	11
Businesses[1,3]	901	901[2]
TOTAL	**963**	**971**

Notes:

1. Assuming that Businesses includes both Commercial and Industrial.
2. Assuming that for each property there is an associated connection.
3. It should be noted that the number of properties and connections for businesses have been estimated based on a different dataset to the other non-residential categories.

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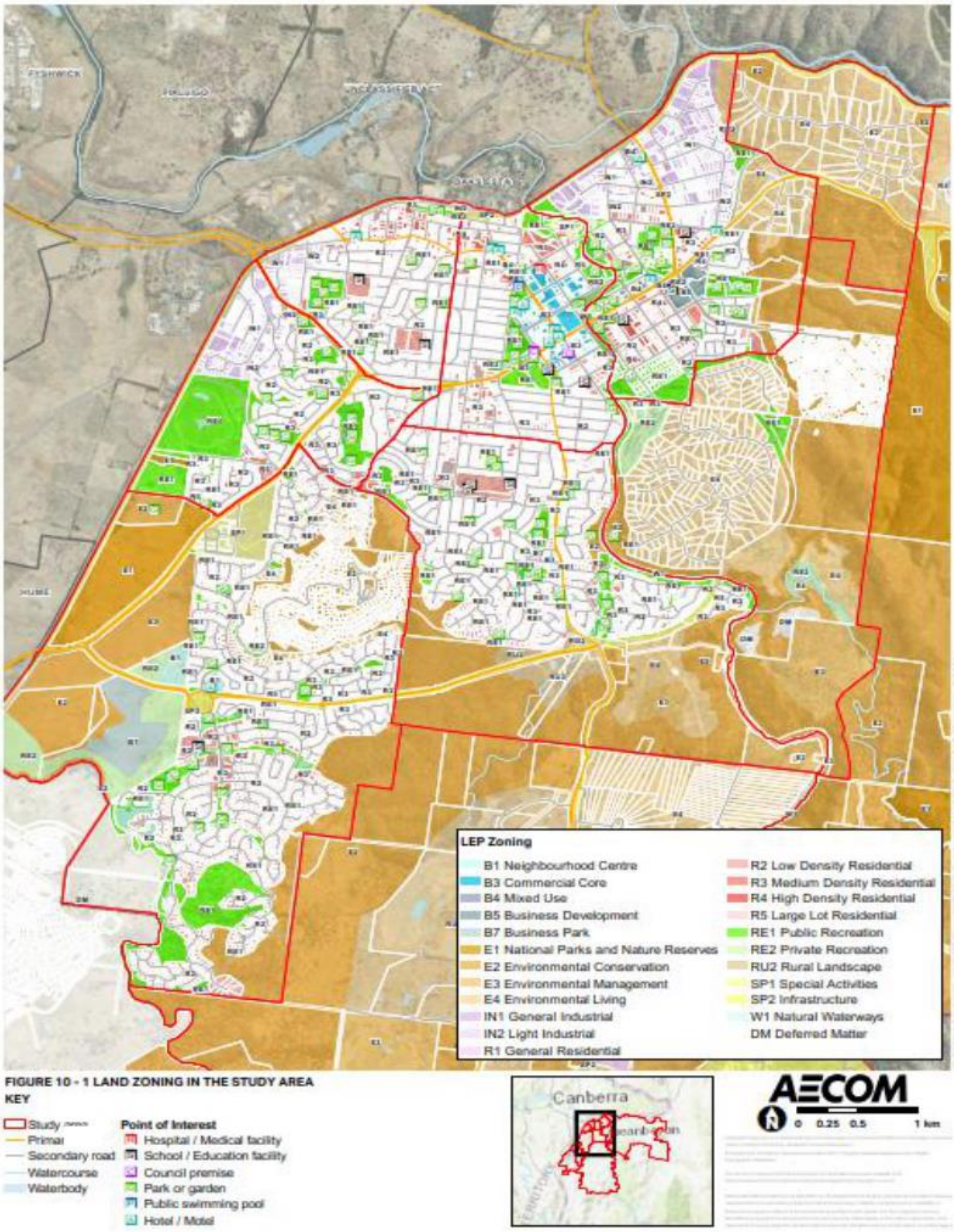

FIGURE 10 - 1 LAND ZONING IN THE STUDY AREA

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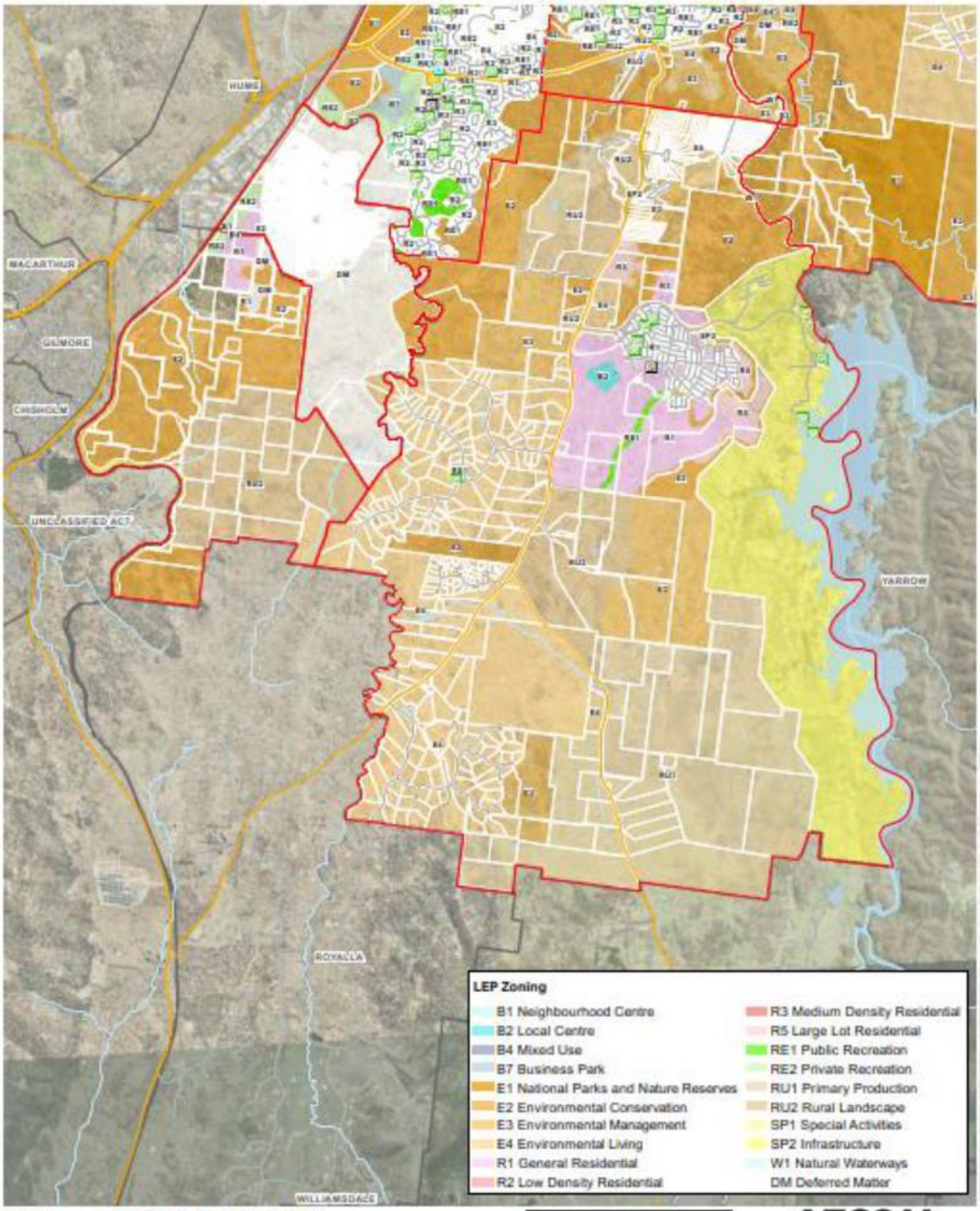

FIGURE LAND ZONING IN THE STUDY AREA

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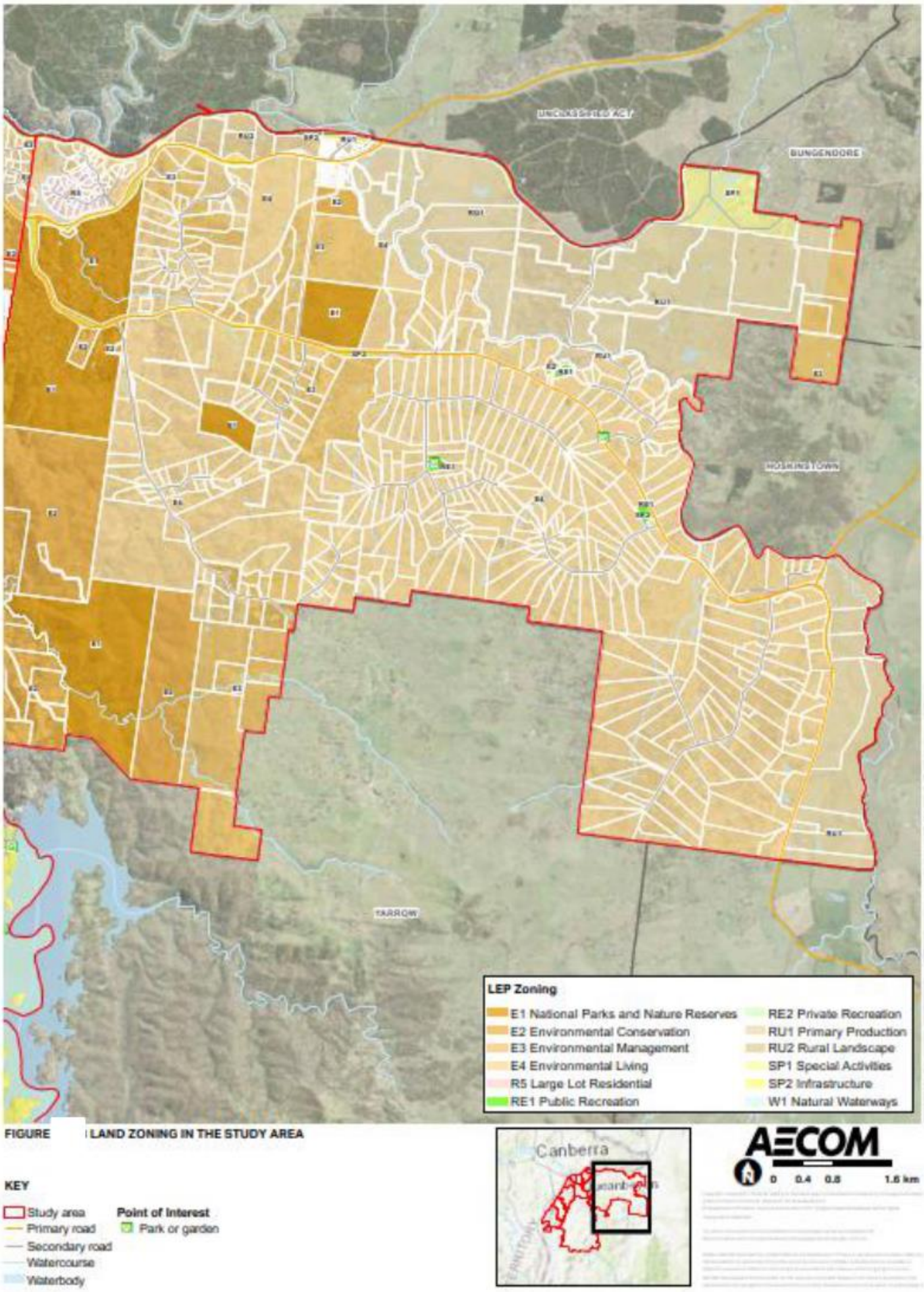

Figure 5-1 Land Zoning in the Study Area

5.7 Population and Housing Projection

Based on the growth projections provided by Council for the IWCM Issues Paper, including recent adjustments for South Tralee, the number of residential dwellings in the study area (former QCC LGA, excluding Googong Township) is forecast to grow from 17,374 in 2016 to 20,094 in 2036 (2,720 new dwellings over 20 years), with the average residential household size decreasing from 2.48 in 2016 to 2.38 by 2036. It is noted that there were no projections available for development areas beyond 2036 at the time of developing the IWCM Issues Paper, hence there is no further growth assumed out to the 2050 planning horizon as agreed with QPRC.

A summary of key messages related to population growth is as follows:

- Population growth in Queanbeyan has been around 2% per annum over the last 25 years. This population growth has been most heavily concentrated in Jerrabomberra, Karabar and Queanbeyan West since 1991, although these areas are now ageing. Future population growth will predominantly be focused on major fronts across Tralee-Environa.
- Approximately 65% of the residential housing stock in Queanbeyan is traditional detached housing (low density). The remaining 35% is made up of medium density (25%) and high density (10%) housing. This proportion has been relatively stable since 1991 and emphasises the relatively high proportion of medium to high density housing in Queanbeyan.
- Within the rural parts of the former QCC LGA approximately one third of the land is zoned as Environmental Living (E4). Further Environmental Living opportunities are likely to be restricted by environmental constraints as most of the land without constraints has already been subdivided. Consequently, environmental living will make a negligent contribution to the overall supply of new dwellings into the future.
- The future Queanbeyan growth targets set by the original Queanbeyan Residential and Economic Strategy 2031 (QCC) in 2008 have been revised down as part of a review of the Strategy in 2015, due to a number of key changes and actions including:
  - Major rezoning and Gateway determinations of Planning Proposals since 2008
  - Constraints with respect to Future Investigation Areas
  - Key infrastructure issues regarding land release areas

The forecast below was reviewed with QPRC Planners. The forecast is deemed conservative and suitable for the purposes of this study.

Table 5-7 Residential Population and Dwelling Projection (Cumulative)

Queanbeyan IWCM Study Area	Forecast Year					
	2016	2021	2026	2031	2036	2050[3]
Total Population	**41,952**	**42,584**	**43,874**	**45,690**	**46,931**	**46,931**
Average household size	2.48	2.42	2.40	2.40	2.38	2.38
Total Dwellings[2]	**17,374**	**17,985**	**18,650**	**19,443**	**20,094**	**20,094**
Dwelling Increase (no. per 5 years)	-	611	665	793	651	N/A
Dwelling Increase (no. per annum)	-	122	133	159	130	N/A
Dwelling Increase (% per annum)	-	0.7%	0.7%	0.8%	0.6%	N/A

Notes:

5. Dwellings assumed to represent low, medium and high density from private and non-private dwellings
6. There are no projections available for development areas beyond 2036 hence for the 2050 planning horizon there is no further growth assumed (as agreed with QPRC)

Key Source: http://forecast.id.com.au/queanbeyan-palerang/population-households-dwellings

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A detailed breakdown of the future residential population and dwelling projection for each locality area is provided in **Table 5-8**. Key messages on the assumptions for servicing of future growth are as follows:

- Tralee-Environa - it is assumed that the existing water and sewer networks will be extended to service this major growth front including key urban release areas.
- For the remaining growth areas it is assumed that the existing water and sewer networks will be extended to service them as required.
- Where there is negative growth/population decrease into the future for some areas, it is assumed that medium/higher density development is replacing existing low density dwellings (i.e. lower occupancy ratio as it is projected to decrease into the future particularly within the areas that are subjected to future infill growth)

Refer to **Appendix C** for a map showing the spatial reference for the future growth areas and sites.

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Table 5-8 Breakdown of Residential Population and Dwelling Projection (Cumulative)

Population and Housing		Forecast year (Cumulative)						% Δ (30 Years)	New Dwelling Type(s)[1]	Incl. Urban Release Area(s)
By Locality / Area		2016[2]	2021	2026	2031	2036	2050			
Carwoola - Greenleigh - The Ridgeway	Population	2,315	2,330	2,528	2,721	3,012	3,012	28%	Greenfield - Low Density	Jumping Creek
	Dwellings	827	844	907	980	1,055	1,055			
Crestwood	Population	5,132	5,433	5,524	5,558	5,596	5,596	10%	Infill - Med/High Density	N/A
	Dwellings	2,439	2,556	2,608	2,642	2,672	2,672			
Jerrabomberra	Population	9,656	9,217	8,839	8,587	8,453	8,453	1%	Infill - Med/High Density	N/A
	Dwellings	3,284	3,292	3,299	3,306	3,312	3,312			
Karabar	Population	8,899	8,700	8,644	8,619	8,648	8,648	3%	Infill - Med/High Density	N/A
	Dwellings	3,483	3,495	3,525	3,547	3,572	3,572			
Queanbeyan	Population	6,678	7,081	7,138	7,161	7,187	7,187	10%	Infill - Med/High Density	N/A
	Dwellings	3,221	3,399	3,449	3,489	3,529	3,529			
Queanbeyan East	Population	4,264	4,585	4,682	4,725	4,733	4,733	11%	Greenfield - Low Density	N/A
	Dwellings	2,176	2,332	2,368	2,395	2,420	2,420			
Queanbeyan West	Population	3,235	3,190	3,197	3,195	3,210	3,210	4%	Infill - Med/High Density	N/A
	Dwellings	1,323	1,333	1,345	1,360	1,375	1,375			
Royalla - Burra	Population	1,753	1,750	1,769	1,799	1,817	1,817	7%	Greenfield - Low Density	N/A
	Dwellings	614	629	639	649	659	659			
Tralee - Environa	Population	20	298	1,553	3,325	4,275	4,275	21329%	Greenfield - Low Density	South Tralee, South Jerra, Melrose Valley
	Dwellings	7	105	510	1,075	1,500	1,500			

Notes:

1. Assumed new dwelling type(s) based on location of development i.e. Greenfield versus infill and urban versus rural locations
2. Year 2016 assumed to represent existing population/dwellings

Table 5-9 Residential Dwelling Projection by Type (Cumulative)

Queanbeyan IWCM		Forecast year - Growth (∆)						% Proportion of Growth
New Dwelling Type		2016	2021	2026	2031	2036	2050	
Low Density	Dwellings	-	130	608	1,256	1,766	1,766	65%
Med-High Density	Dwellings	-	481	668	813	954	954	35%

5.8 Employment Projection

A summary of key messages related to employment growth is provided as follows:

- Local employment growth in secondary industries and services has been boosted by external population growth pressures. They include the traditional flow of population from Canberra and the surrounding rural areas and small towns. This is a result of people seeking new housing opportunities from Canberra and it is assumed that these patterns will generally continue into the future.

Based on the latest growth projections provided by Council for the IWCM Issues Paper, the employment land area (Net Ha) in the study area is forecast to grow from 163 Ha in 2016 to 282 Ha in 2050 (120 Ha additional employment area over approx. 35 years). This represents employment growth of 74% to 2050. An additional 26 Ha of recreational land is also identified as part of the South Tralee urban release area. Employment projection summary tables are provided below.

Table 5-10 Employment Projection (Cumulative)

Queanbeyan IWCM	Forecast year (Net Ha)						Total Growth (Net Ha)	Total Growth % Proportion
Summary	2016	2021	2026	2031	2036	2050		
Total Non-Residential	163	202	224	256	270	309	146	-
Commercial / Business / Mixed Use	10	22	34	49	56	75	65	45%
Industrial (General / Light)	152	177	177	182	188	207	55	38%
Recreational	UNK	3	13	26	26	26	26	18%
Take-up Rate (Ha/5yrs)	-	40	22	33	14	14	-	-
Take-up Rate (Ha/Year)	-	7.9	4.4	6.5	2.7	2.7	-	-
Non-Residential Increase (% per annum)	-	3.9%	2.0%	2.5%	1.0%	0.9%	-	-

Notes:
- UNK: existing Recreational land area unknown / not confirmed
- Recreational development: assumed to represent Public Open Space (irrigation from non-potable water sources)
- Year 2016 assumed to represent existing employment land area
- Higher up-take rates over the next 10-15 years and slowing down over the longer term

Table 5-11 Breakdown of Employment Projection (Cumulative)

Queanbeyan IWCM		Forecast year (Net Ha)						Total Growth (Net Ha)	Incl. Urban Release Area(s)
By Precinct / Area		2016	2021	2026	2031	2036	2050		
Jerrabomberra	Commercial	-	8	20	31	31	31	31	Poplars
Tralee - Environa	Commercial	-	4	4	8	15	34	34	South Tralee, Environa
	Industrial	-	25	25	29	36	55	55	North Tralee, Environa
	Recreational	-	3	13	26	26	26	26	South Tralee
Total Growth (Net Ha)		**-**	**40**	**62**	**94**	**108**	**146**	**146**	
Notes: - No. of Jobs: assume 100m2 GFA/Worker									

5.9 Population Predictions

5.9.1 Predicted Population for Water

Details of the projected residential population over the next 30 years, in the context of geographical area and the existing water system configuration (Bulk Supply Offtakes 1 and 2) are presented below. For the context of the Issues Paper it has been assumed that the future population in the study area will continue to be supplied from Offtake 1 and Offtake 2 as a baseline to understand future performance issues for the existing network (noting that Offtake 3 provides treated water supply to Googong Township). The preferred servicing outcome will form part of the subsequent phases of the Queanbeyan IWCM.

Table 5-12 Population for Water

Queanbeyan IWCM – Offtakes 1 & 2	Population[1, 2]					
	2016	2021	2026	2031	2036	2050
Population	40,179	42,584	43,874	45,690	46,931	46,931

Notes:

1. Population projections shown here include future populations from the areas of Carwoola, Tralee- Environa and Royalla – Burra, which are outside the current extent of QPRC's water network. Plans for extending service to cover these areas in the future remain unconfirmed however the future potential to extend the water network to some of these areas needs to be considered as part of developing the IWCM Strategy.
2. 2016 population shown here is related to the number of properties currently connected to QPRC's water network. This excludes areas in Carwoola, Tralee -Environa and Royalla –Burra that are not currently connected to QPRC's water network.

5.9.2 Predicted Population for Sewer

5.9.2.1 Current and Projected Equivalent Tenements

Two sets of data were reviewed to derive the existing sewer connections/equivalent tenements (ET), namely the DPI performance data and the wastewater connections per sewer sub-catchment (supra-catchment) dataset provided by QPRC (dated 2018). The QPRC dataset revealed a large number of duplicate entries referencing the same address details.

The total number of sewer connections, after filtering the dataset and discounting all the duplicate entries, is presented below in Table **5-13**. This represents a total of 14,408 existing sewer connections. It is estimated that there are around 78 lots/connections that drain to the Queanbeyan STP from Oaks Estate in the ACT.

The number of sewer connections reported annually in the DPI performance data (see **Table 5-1**) could not be reconciled with the latest dataset provided by QPRC and was therefore ignored for the purposes of the Issues Paper.

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As a further sanity check, the existing number of sewer connections (14,407), plus the 313 properties that currently have on-site sewerage collection (Section 5.4) represents approximately 14,720 properties, which is reasonably close to the total number of existing water connections as a sanity check. The sewer and water connections were also compared spatially as part of GIS mapping to ensure reasonable correlation.

Table 5-13 Current Sewer Connections by Locality

Locality/Area[1]	Number of Sewer Connections/Properties
Carwoola	48
Crestwood	1,956
Greenleigh	226
Jerrabomberra	3,023
Karabar	3,017
Queanbeyan	2,597
Queanbeyan East	2,106
Queanbeyan West	1,356
Oaks Estate[2]	78
Total	**14,407**

Notes:

1. The lots in Ridgeway are not connected to the Queanbeyan sewer system, however they have on-site sewerage collection as noted in Section 5.4
2. Estimate of 78 lots/connections that drain to the Queanbeyan STP from Oaks Estate development located in the ACT

5.9.2.2 Projected Equivalent Population for Queanbeyan Scheme

Table 5-14 shows the projected equivalent tenements for the Queanbeyan Sewerage Scheme. The number of existing connected properties was derived from the QPRC sewer catchment/property dataset (see **Table 5-13**). For the purpose of this report, each active connected residential property was assumed to represent one equivalent tenement (ET). The increase in residential population growth and non-residential employment growth has been used to derive the increase in Equivalent Population (EP) for future sewerage scheme projections using a 'first principles' analysis.

Equivalent Population (EP) was derived by converting the ET's to EP's using an average household size (2.49) as derived from the Census data (see **Table 5-7**). It is noted that the Queanbeyan STP currently receives a small volume of wastewater from the Oaks Estate development, which is located in the ACT. There are approximately 78 lots in Oaks Estate draining to the Queanbeyan STP and Oaks Estate is very unlikely to expand in the future as it is constrained by a Flood Plain (therefore assumed there is no Oaks Estate growth into the future).

It is noted that the derived EP projection represents an estimate due to uncertainties in the land use breakdown of the population dataset. That is, the dataset for the sewerage scheme does not easily distinguish between residential and non-residential land use categories. The data lacks sufficient granularity to develop Non-Residential ET based on expected sewage loading rates.

Table 5-14 Equivalent Population (EP) Projections for Queanbeyan Sewerage Scheme

Sewerage Scheme[4,5]	Units	2016[1]	2021	2026	2031	2036	2050
Queanbeyan STP Catchment	Sewer connected properties	14,407	17,434	18,089	18,872	19,513	19,513
	ET - Total	14,407	17,434	18,089	18,872	19,513	19,513
	EP - Residential	35,873	44,507	46,075	47,952	49,473	49,473
	EP - Non Residential [2,3]	0	3,720	4,618	6,252	7,480	10,916
	EP - Total	**35,873**	**48,227**	**50,693**	**54,204**	**56,953**	**60,389**
	EP (STP Master Plan)[6]	*45,737*	*NA*	*53,885*	*NA*	*NA*	*76,972*

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Notes:

1. Total connections in 2016 references Section 5.9.2.1.
2. For 2016, the Non-Residential EP is included in the number of connected properties.
3. For future years, the increase in Non-Residential land area (Net Ha) is used for estimating the increase in Non-Residential EP.
4. Future Residential EP has been calculated based on an adopted global occupancy ratio of 2.49.
5. Projections for Queanbeyan STP exclude the Royalla-Burra rural region as this is located well beyond the existing sewer network.
6. The EP projections adopted for the Queanbeyan STP Masterplan [10] differs from the EP projections derived for the Issues Paper. It is noted that the Queanbeyan STP Masterplan adopted a higher household occupancy ratio which is assumed to have contributed to the projected EP discrepancy as shown in Table 5-14

5.9.2.3 Predicted Equivalent Population per Sewer Catchment

A breakdown of the EP projection at the sewer sub-catchment (supra-catchment) level was undertaken using the 2018 dataset provided by QPRC which assigned sewer supra catchments to individual properties. The dataset was initially filtered to remove duplicate entries.

Table 5-15 shows the predicted ET and EP per sewer supra-catchment. The projected EP has been estimated using an average occupancy ratio of 2.49.

Table 5-15 Predicted Equivalent Population per Sewer Catchment

Supra Catchment	Equivalent Tenements (ET)[1]	Equivalent Population (EP)					
	2016	2016	2021	2026	2031	2036	2050
Banyalla Cl - Pump 11	88	219	265	265	266	266	266
Barbar St - Pump 5	74	184	313	321	328	334	334
Bayside Ct - Pump 9	336	837	4517	5736	8089	10377	13813
Bellbush Cl - Pump 10	116	289	368	369	370	370	370
Capital Tce - Pump 3	49	122	148	150	151	153	153
Erin St - Pump 13	147	366	407	410	412	414	414
Gravity CA 1	831	2069	2318	2321	2324	2326	2326
Gravity CA 2	471	1173	1404	1422	1435	1447	1447
Gravity CA 3	857	2134	2589	2632	2661	2686	2686
Gravity CA 4	1761	4385	5677	5736	5792	5844	5844
Gravity CA 5	1158	2883	3758	4453	5147	5151	5151
Jinaroo St - Pump 2	32	80	158	163	167	171	171
Kathleen St - Pump 7	1775	4420	5292	5335	5366	5401	5401
Lochiel St - Pump 6, River Dr – Pump 8	639	1591	2040	2074	2105	2139	2139
Morriset St - Pump 1	5862	14596	18196	18487	18727	18963	18963
Regent Dr - Pump 12	7	17	69	73	75	78	78
Weetalabah Dr - Pump 15	18	45	68	77	88	99	99
Woodland Ave - Pump 14	31	77	134	157	183	209	209
Yass Rd - Pump 4	77	192	311	319	325	331	331
Oaks Estate[2]	78	194	194	194	194	194	194
TOTAL	**14,407**	**35,873**	**48,227**	**50,693**	**54,204**	**56,953**	**60,389**

Note:

1. ET are based on the sewer connection analysis within the QPRC 2018 dataset
2. Estimated 78 lots/connections in Oaks Estate draining to the Queanbeyan STP. It is assumed there is to be no growth into the future and therefore remains consistent until 2050.

6.0 Water Demand

6.1 Regional Water Consumption

Historical bulk potable water supply meter data from Icon Water and historical QPRC customer metered consumption datasets were reviewed at a total system scale to understand historical regional water consumption. The historical bulk supply flow data was provided for the period spanning from 2008/09 to 2015/16, representing approximately 7 years of data. Additional bulk supply flow data was subsequently provided for 2016/17 and 2017/18 during the development of the Issues Paper.

The customer metered consumption data was cleaned, screened and consolidated into a single dataset that represented a 7 year period from 2009/10 to 2016/17. Review of the quarterly consumption data revealed a significant step change from 2012/13 onwards (approx. 3 x the bulk water supply flow data provided by Icon Water over the same period). Scrutiny of customer meter readings identified anomalies in the manner of reporting the strata units in the customer billing database.

As a work-around to the anomalies initially identified in the customer billing database, QPRC provided a new dataset spanning a 5 year period of customer water meter readings from 2013/14 to 2017/18 (FY13-FY17). The initial dataset spanning from 2009/10 to 2016/17 was subsequently disregarded as the anomalies could not be resolved. The new 5 year dataset was adopted for the Issues Paper and subjected to interrogation and screening to eliminate anomalies and appropriately aggregate historical consumption for strata units.

The 5 year customer consumption dataset spanning FY13-FY17 has provided the following resolution:

- Resolved the major discrepancies initially flagged between the customer consumption data and the bulk water supply flow data.
- Resolved the initial anomalies flagged in terms of discrepancies in the number of customer connections (i.e. 4,000 missing connections were flagged in the initial dataset and these have now been resolved via the new 5 year dataset).

When comparing both sources of regional based water consumption there appears to be a time lag issue between the data:

- Bulk water supply flow data – date stamp is observed to follow the financial year (i.e. Quarter 1 referring to July, August and September).
- Customer metered consumption data – date stamp is not specified. If assumed to follow the financial year then the data trend does not align with the bulk water supply flow data, suggesting a time based offset is required to be applied.

In order for the two data sets to be appropriately compared, the metered consumption data was shifted backwards by one quarter (approx. 3 months) to align with the bulk water supply flow trend (i.e. alignment of quarterly peaks and troughs). The time lag in the metered consumption data may be due to the billing period, which occurs in the quarter following the meter-reads, hence impacting the way the data is labelled for billing purposes. This would require further review and may represent a business process improvement.

The resultant bulk water supply and metered customer consumption data trends and the derived Non-Revenue Water (NRW) component are shown as a time series chart in **Figure 6-1** (FY2013 to FY2017). The metered customer consumption closely follows the bulk water supply flow trend over the five years.

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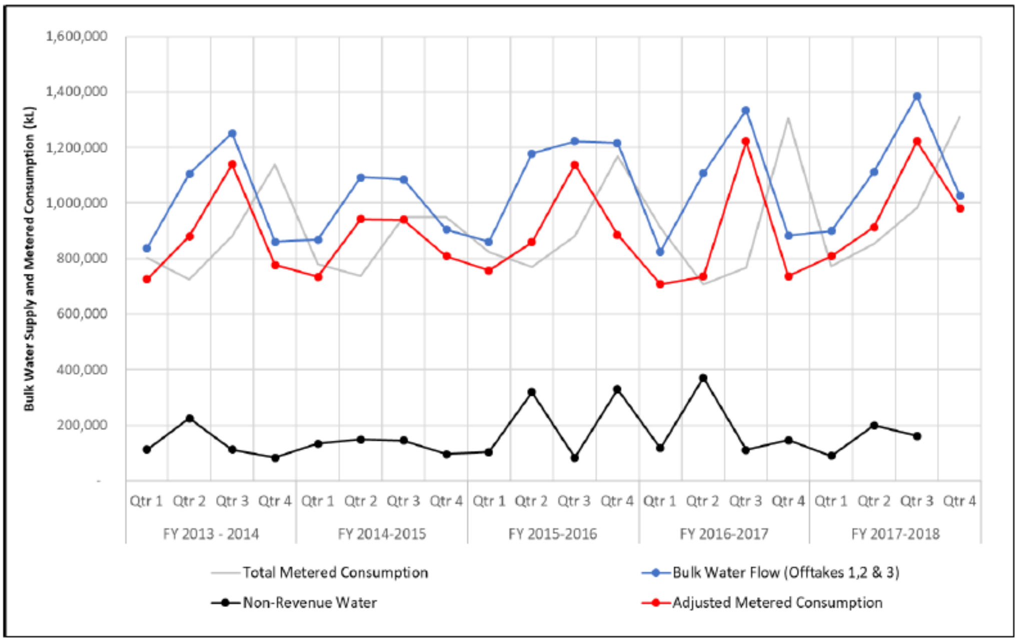

Figure 6-1 Quarterly Historical Production and Metered Consumption Time Series

The resultant annual trends for the bulk water supply and time adjusted metered consumption, versus permanent population and number of connected properties is shown in Figure 6-2. In general, there is a reasonable correlation between the regional based datasets. The permanent population from 2015/16 is noted as the population receiving water supply services for the merged QPRC, whilst the prior period represents pre-Council amalgamation. The number of uniquely identified connected properties in each quarter was averaged over the year to develop an annual average number of connected properties for the analysis.

There is an increase in the number of properties from quarter to quarter, with the exception of an observed decrease of around 500 properties in Q1 of FY16/17. However this is immediately followed by an increase of approximately 690 properties in Q2 of FY16/17 which may indicate a change in the meter reading or reporting process during this quarter.

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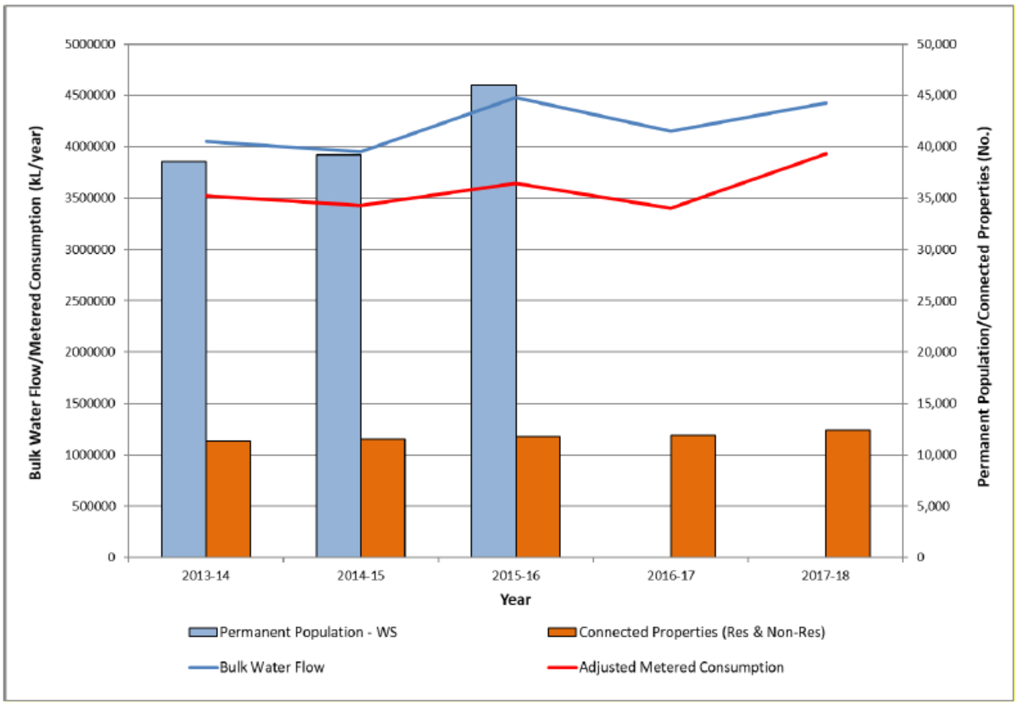

Figure 6-2 Annual Historical Bulk Flow, Metered Consumption, Population and Connection Time Series

6.2 Metered Demand Assessment

6.2.1 Residential Metered Water Use

The consolidated meter consumption data was separated into residential and non-residential properties based on the Local Government Code provided in the dataset. **Table 6-1** reports the residential demands for the Queanbeyan potable water system

Table 6-1 Queanbeyan Residential Demands Summary

Residential Demand	Units	2013/14[1]	2014/15[1]	2015/16[1]	2016/17[1]	2017/18[2]
Residential Connected Properties	Properties	13,760	13,936	14,041	14,141	14,222
Annual Consumption	ML/yr	2,913	2,850	2,986	2,849	3,263
Average Daily Consumption	ML/day	8.0	7.8	8.2	7.8	8.9
Annual Consumption per Connection	kL/meter/yr	212	205	213	201	229
Average Daily Consumption per Connection	L/meter/day	581	560	584	552	626

Notes:

1. 2013/14 to 2016/17 – residential meter data referenced from the customer metered consumption data as an average of the connections over each quarter as agreed to disregard DPI historical data
2. 2017/18 connections based on an average of the last three 17/18 Quarters (Q2,Q3 & Q4) as the following quarter data was unavailable

The analysis of the water consumption data has identified an even distribution of consumption across the child properties that sit against each parent property. This approach may not be capturing the individual child property consumption correctly.

An average household size/occupancy ratio of 2.49 was used to determine the annual unit residential water consumption rate (L/cap/day) for Queanbeyan. The derived unit water consumption rates between 2013/14 to 2017/18 are shown in **Table 6-2**.

An average or median residential unit consumption rate of 233 L/cap/day was adopted for the future water demand projections over the period spanning 2013/14 to 2017/18 (5 years). The adopted value of 233 L/cap/day is observed to be relatively high when comparing to current industry trends regarding urban residential water consumption behaviour.

A trend of the residential connected properties against the unit consumption rates is found in Figure 6-3.

Table 6-2 Residential Unit Water Consumption Rates

Residential Water Usage	2013/14	2014/15	2015/16	2016/17	2017/18[1]
Unit Consumption Rate (L/cap/day)	233	225	233	222	252

Notes:

1. The consumption data for the first three quarters of 2017/18 was only available due to the time shift of the consumption data to match the bulk water data. Therefore, the last quarter was estimated to be an average of the first three quarters.

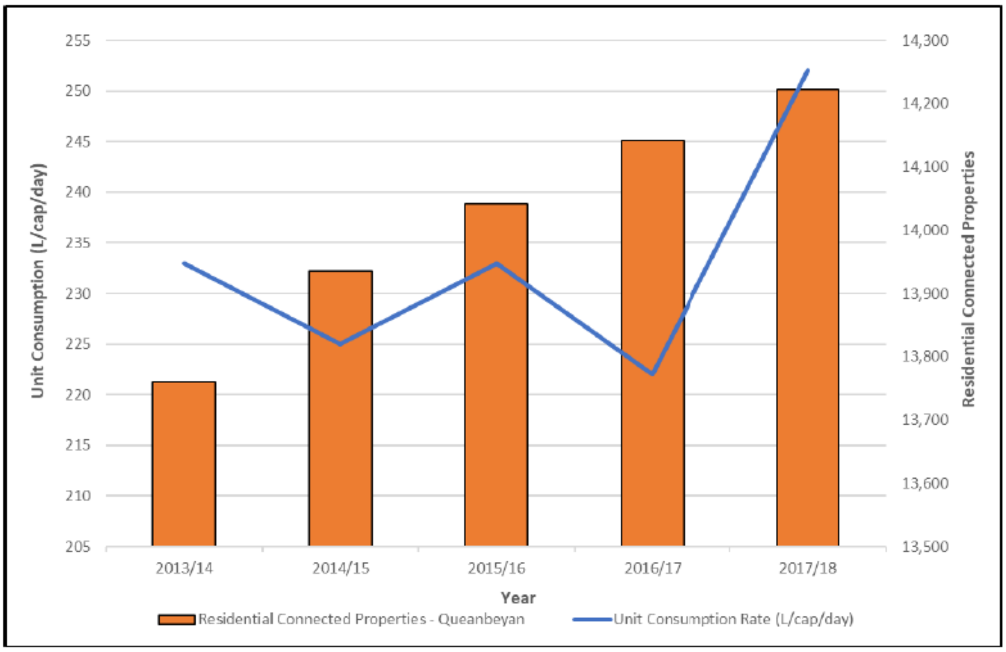

Figure 6-3 Residential Unit Consumption Rate Analysis

6.2.2 Non-Residential Metered Water Use

Similar to the residential water use reported in **Section 6.2.1**, **Table 6-3** reports the non-residential demands and derived unit consumption rates for the Queanbeyan system.

Table 6-3 Queanbeyan Non-Residential Demands Summary

Non-Residential Demand	Units	2013/14[1]	2014/15[1]	2015/16[1]	2016/17[1]	2017/18[2]
Non-Residential Connected Properties	Properties	992	998	1016	1021	1018
Annual Consumption	ML/yr	609	576	654	555	664
Average Daily Consumption	ML/day	1.7	1.6	1.8	1.5	1.8
Annual Consumption per Connection	kL/meter/yr	614	577	644	544	652
Average Daily Consumption per Connection	L/meter/day	1682	1581	1759	1489	1787

Notes:

1. 2013/14 to 2016/17 – non-residential meter data referenced from the customer metered consumption data as an average of the connections over each quarter as agreed to disregard DPI historical data
2. 2017/18 connections based on an average of the last three 17/18 Quarters (Q2,Q3 & Q4) as the following quarter data was unavailable

Figure 6-4 shows the annual water consumption trend for different non-residential demand categories for the Queanbeyan system. The following land use types fall within each non-residential category:

- **Commercial:** Queanbeyan CBD Businesses, General Businesses, Regional Businesses and all other types of businesses
- **Industrial:** All industrial businesses
- **Hospital:** All hospitals
- **Education:** Schools
- **Parks:** Gardens and Community: Reserves, Recreation and Community
- **Other Non-Residential:** Retirement village, Strata, Hall, Council, Crown, Church, Utilities, Farmland

As a summary from **Figure 6-4** the following is noted:

- Commercial and Industrial – commercial businesses within Queanbeyan make up the largest component of non-residential water consumption followed by Industrial. The trend shows that the Commercial and Industrial water usage closely follow the same trend and decreases in 2016/17 which aligns with the overall water consumption trend. The last quarter of the 2017/18 data was estimated as the average of the first three quarters as the data was shifted to match the bulk water supply and therefore may affect the overall annual consumption and may not be representative of the actual consumption.
- Hospitals – the metered consumption data between 2013/14 and 2017/18 did not report hospitals as its own category and therefore it was difficult to determine the consumption attributed to hospitals on its own. The hospital consumption may be recorded under the other non-residential category as this category reports the third highest non-residential annual consumption each year. It is generally expected that hospitals are high water users and therefore the data should be reporting high annual water consumption for hospitals.
- Parks, Gardens and Community – the metered consumption data shows a peak in 2015/16, however is relatively consistent over the other four years of data available.

Unit consumption rates for each of these non-residential categories was not derived as there is currently insufficient data to normalise the types of businesses within each category i.e. the variability of non-residential water usage within each category was high and it was not considered suitable to adopt a uniform consumption rate for projecting future non-residential water demands. Instead, standard design unit rates have been adopted and applied to future non-residential growth in order to derive future water demand projections.

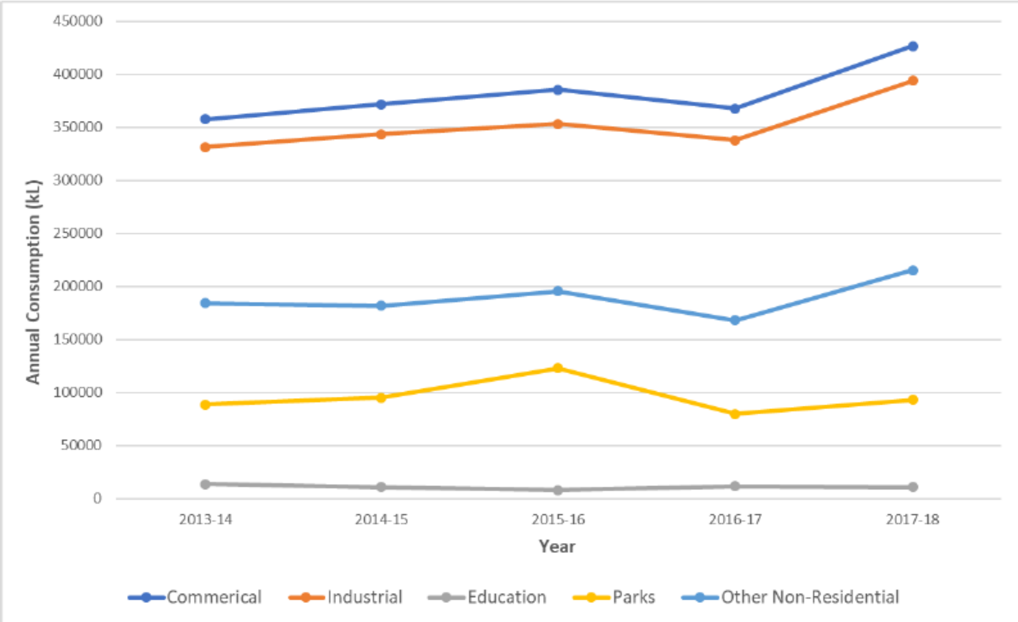

Figure 6-4 Non-Residential Historical Consumption Trends

6.2.3 Major Water Using Industries

The major water users have been collated based on the most recent historical metered consumption data for 2016/17 and this is presented in Figure 6-5. This provides an indication of potentially high draws on the water network if a number of the higher water users are displaying similar water usage behaviour patterns. However, further flow monitoring data would be required to understand the usage patterns of the top water users in the most predominant categories.

As reported in **Section 6.2.2**:

- Hospitals are typically expected to represent major users, however based on the metered consumption data received it is difficult to delineate hospital water usage. Hospitals are likely represented as part of the 'Other Non-residential' land use category and this would need to be further investigated if a further breakdown is required.
- Recreational reserves, sportsgrounds and ovals are represented within the 'Parks, Gardens and Community' demand category and most of these end users rely on potable water for irrigation purposes (in the absence of water reuse schemes). This is noted as a potential long-term sustainability (water security) issue and an opportunity for future water conservation.

The hierarchy of major water users by demand category, as sourced from the metered consumption data, is illustrated in Figure 6-5 and the top ten non-residential water users based on historical consumption are shown geographically in Figure 6-6 below.

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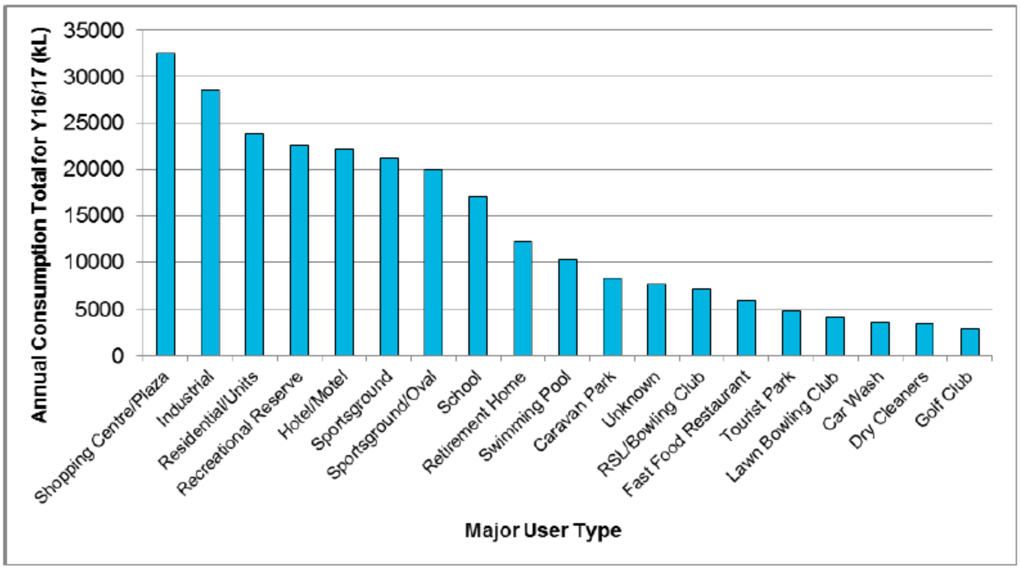

Figure 6-5 Major Water Using Industries

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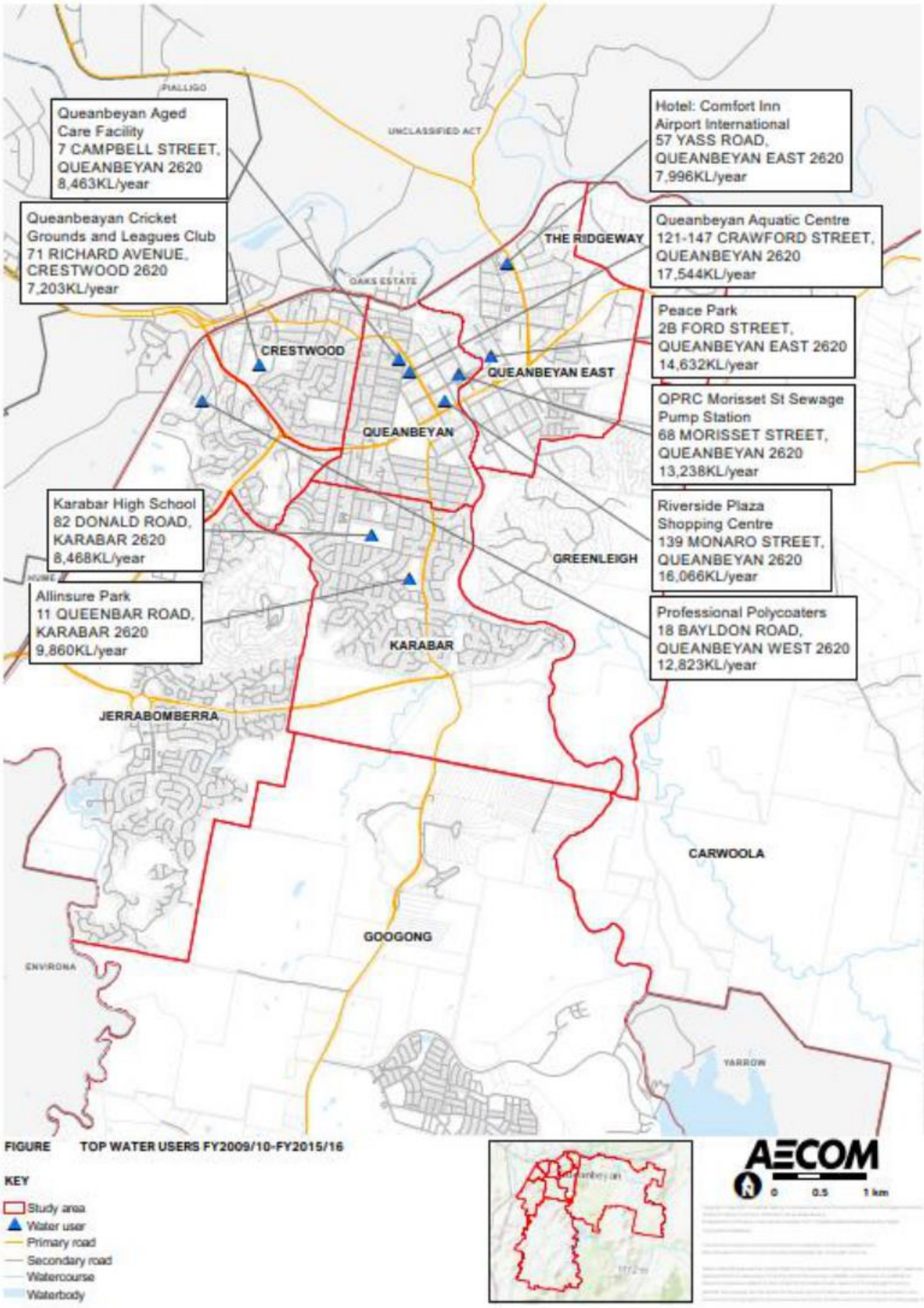

Figure 6-6 Top 10 Non-Residential Water Users

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6.3 Non-Revenue Water

The Non-Revenue Water (NRW) for Queanbeyan was derived on a per annum basis by calculating the difference in the historical bulk water supply and (time adjusted) customer metered consumption data. NRW accounts for the overall potable water losses in the system and is typically made up of the following components:

- Network leakage
- Unmetered connections/water usage
- Illegal connections/water usage
- Meter inaccuracies (frequency of calibration and/or meter reads) – in this case the bulk supply flow data (daily) is being compared to quarterly metered consumption data

The resultant historical annual trends for the bulk water supply, time adjusted metered consumption and resultant derived NRW are shown in Figure 6-7, which illustrates a good annual trend correlation over the 5 years including relatively consistent annual NRW volume at a regional scale during this period. The observed correlation adds confidence to the data inputs and adopted assumptions for deriving NRW.

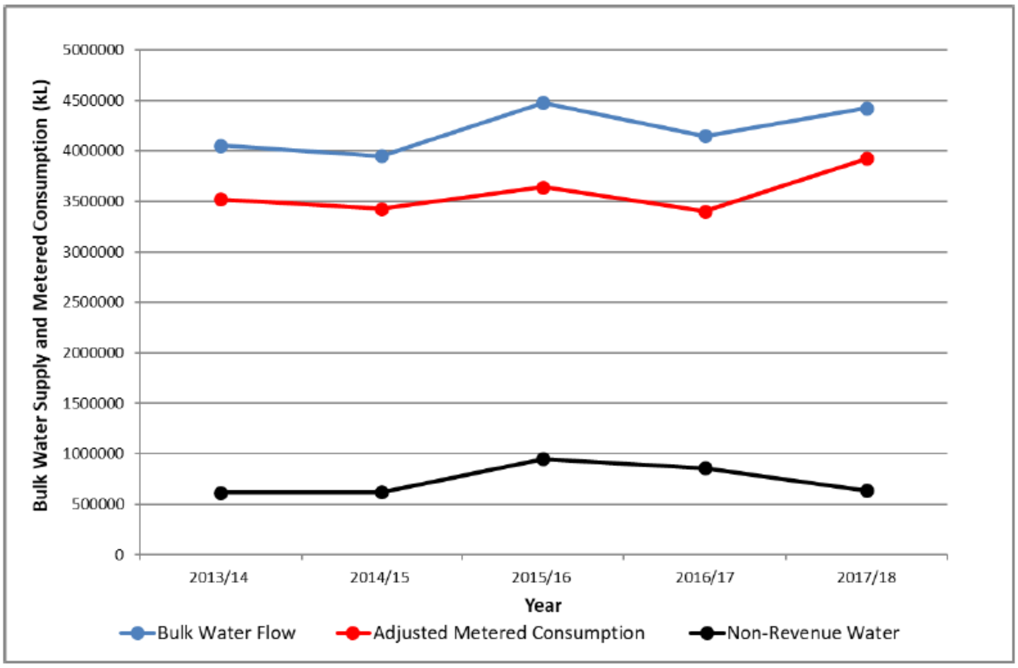

Figure 6-7 Historical Bulk Supply Volume, Metered Consumption and NRW

As a further observation, the derived annual NRW volume exhibits a downward trend following 2015/16. This downward trend aligns with the timing of increased capital and operational grants during 2016/17 and 2017/18 (as referenced in QPRC's annual Water and Sewer Income records), which indicates the additional funding may have helped to reduce NRW as an outcome over this period.

Historical capital and operational grant information provided by QPRC is plotted against the corresponding NRW level (%) as shown in Figure 6-8.

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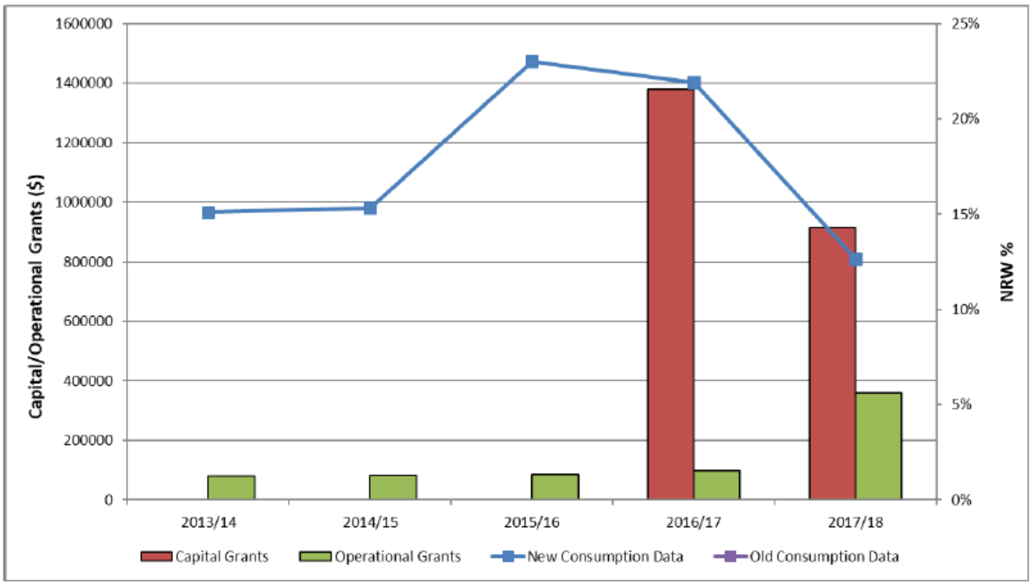

Figure 6-8 Historical Capital and Operational Grants versus NRW levels

The historical annual NRW volume for Queanbeyan are summarised below in **Table 6-4.** A household size/occupancy ratio of 2.49 was used to estimate the per capita rate for NRW, which provides a benchmark for industry comparison. In summary, the following key messages are noted when considering the five year NRW analysis trend:

- NRW as a component of total system demand is averaged at 18% over 5 years
- NRW is observed to have been marginally reduced from 15% (2013/14) to 13% (2017/18), including a response to the sharp rise in NRW observed during 2015/16 and 2016/17

Table 6-4 Non-Revenue Water for Queanbeyan

Queanbeyan System	2013/14	2014/15	2015/16	2016/17	2017/18
Annual Metered Consumption (kL/year)	3,521,411	3,425,925	3,640,022	3,404,269	3,927,185[2]
Annual NRW (kL/year)	532,039	525,075	837,918	745,811	497,195
NRW Proportion (%) of Annual Consumption	15%	15%	23%	22%	13%
Daily NRW (kL/day)	1,458	1,439	2,289	2,043	1,362
Total Number of Connections[1]	14,752	14,934	15,057	15,162	15,240
NRW per property connection (L/connection/day)	99	96	152	135	89
NRW per capita (L/cap/day)	40	39	61	54	36

Notes:
1. Residential and non-residential connections
2. The last quarter (Q4) of 2017/18 has been taken as the average of the prior three quarters as there is no data reported for Q4 due to the backward shift in the data to match the bulk water supply trend

6.4 Baseline Water Demand Analysis

A baseline water demand analysis was undertaken to understand current water demand patterns and behaviour including for Average Day, Peak Day and Peak Week demands. The baseline demand analysis was based on the available historical bulk water supply flow data and the existing number of water connections as presented in **Table 5-1**. **Figure 6-9** shows the total daily bulk supply flows for the Queanbeyan water network between 2009 and 2016, which represents the combined supply through Offtake 1 and Offtake 2 from Icon Water.

The Peak Day and Peak Week were identified from the historical data after filtering anomalies and outliers and represent 24.4 Ml/d and 17.0 Ml/d respectively as shown on **Figure 6-9** and **Figure 6-10**. The Peak Day Demand, Peak Week Demand and Average Day Demand outcomes are tabulated in **Table 6-5**.

The bulk supply flow data exhibited several anomalies and outliers which were ignored after further interrogation, including:

- Bulk meter readings recorded as zero on particular days for one offtake and provide a positive reading for the second offtake. It is difficult to determine if this is due to one of the offtakes being shut down, zero draw from that offtake on that particular day, or bulk flow meter failure.
- Unusually high bulk meter readings were recorded in several instances which may be the result of an unusually high reservoir draw, major network burst/leakage or bulk flow meter failure.

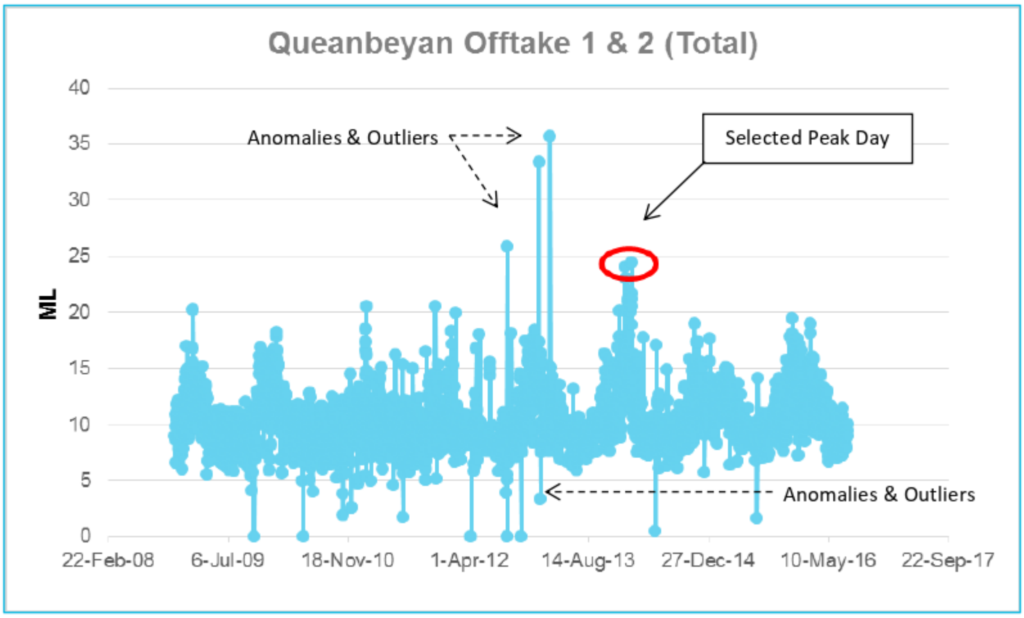

Figure 6-9 Bulk Supply Flow for Queanbeyan System (Offtakes 1 & 2)

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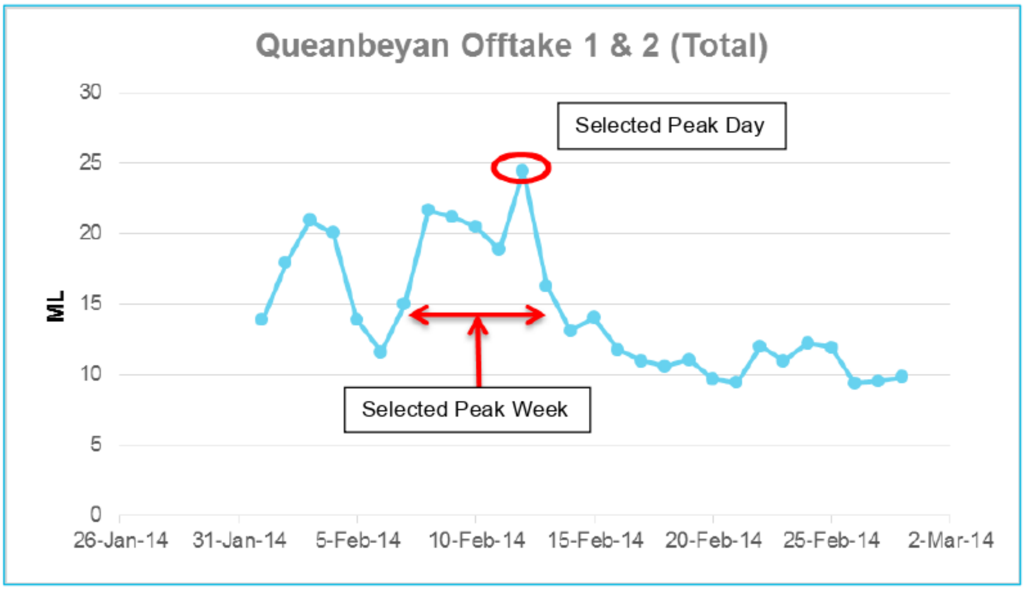

Figure 6-10 Peak Week Trend for Queanbeyan System (Offtakes 1 & 2)

Table 6-5 Evidenced Based Demand Summary

Offtake 1 + Offtake 2	Date	Volume (ML)	Daily Demand (ML/d)
PEAK DAY DEMAND	12-Feb-2014	24.4	24.4
PEAK WEEK DEMAND	10-16 Feb 2014	118.9	17.0
AVERAGE DAY DEMAND	2009-2016	-	10.5

The average daily bulk supply volume transferred to Queanbeyan via Offtake 1 and Offtake 2 is estimated to be 10.5 ML based on the historical bulk supply meter records. The following is noted based on the analysis:

- Ratio of the Peak Day to Average Day = 2.3
- Ratio of the Peak Day to Peak Week (7-day average) = 1.4

These ratios can be used as scaling factors to derive 'evidence based' future peak day and peak week demand projections for the Queanbeyan water supply network, assuming the factors remain constant into the future (which is common practise as a rule of thumb and is considered suitable for the purposes of the Issues Paper).

Note: these ratios or evidence based scaling factors are inclusive of non-revenue water (NRW) which is historically observed to be 18% on average as a component of the total system demand. Therefore the true peaking factors representing the customer metered consumption behaviour may be marginally lower however this was not considered material for the purposes of the Issues Paper.

6.5 Future Water Demand Forecast

The future water demand forecast for the Queanbeyan water supply network is summarised in **Table 6-6,** including a breakdown between residential and non-residential demands. The future demand forecast references the population and employment forecasts detailed in **Section 5.7** and **Section 5.8**. The future water demand forecast for both Average Day Demand (ADD) and Peak Day Demand (PDD) by Water Supply Zones (WSZs) is found in Table 6-7 and Table 6-8. Other key messages to note from the analysis:

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- Peak Day to Average Day scaling factor – the same scaling factor has been applied to both residential and non-residential development for the purposes of the Issues Paper
- Non-Revenue Water (NRW) – is assumed to remain consistent at 18% of ADD when projecting into the future (refer **Section 6.3**) i.e. NRW as a percentage remains constant into the future
- Infill growth - the residential population forecast was spatially analysed using GIS mapping to proportionally allocate or distribute the infill growth into the respective WSZs. It is noted that the future growth projections from the ABS/Census database do not align neatly with the WSZ boundaries, hence the need to spatially distribute the infill growth.
- Greenfield growth areas (refer to Appendix C for the future growth areas) have been allocated to the nearest WSZ based on the spatial analysis of each Greenfield growth polygon, in particular:
  - Residential growth in Tralee-Environa (including South Tralee, South Jerra and Melrose Valley urban release areas) has been allocated to Jerra 2 WSZ due to its proximity as well as the zone being supplied by the Jerrabomberra Reservoir which has a greater storage compared to the more closely located Homestead Reservoir.
  - Non-residential growth in Jerrabomberra (Poplars) and Tralee-Environa (South Tralee, North Tralee and Environa) has also been allocated to Jerra 2 WSZ due to proximity and storage size of Jerrabomberra Reservoir.

In summary, the future water demand is projected to increase by approximately 2.3 ML/d at ADD and approximately 8.0 ML/d at PDD by 2050 based on the growth forecast for Queanbeyan. It is noted that the future ADD and PDD projections do not exceed the maximum allocation limit from Icon Water when projected out to 2050.

Table 6-6 Future Water Demand Forecast – Queanbeyan

Queanbeyan System	2016[1]	2021	2026	2031	2036	2050
Serviced Population	41,952	42,584	43,874	45,690	46,931	46,931
Serviced Employment (net Ha)	163	200	225	257	271	309
Average Day Demand (ADD)						
Residential Demand (ML/day)	7.81	7.96	8.25	8.67	8.95	8.95
Non-Residential Demand (ML/day)[2]	1.52	2.14	1.49	1.82	1.71	2.36
Non-Revenue Water Demand (ML/day)	1.68	1.82	1.75	1.89	1.92	2.04
Total ADD (ML/day)	**11.01**	**11.92**	**11.49**	**12.38**	**12.59**	**13.35**
Peak Day Demand (PDD)						
Residential Demand (ML/day)	18.74	19.09	19.81	20.80	21.49	21.49
Non-Residential Demand (ML/day)[2]	3.65	5.14	5.66	6.46	7.02	8.56
Non-Revenue Water Demand (ML/day)	1.68	1.82	1.75	1.89	1.92	2.04
Total PDD (ML/day)	**24.07**	**26.05**	**27.22**	**29.15**	**30.43**	**32.09**
Maximum Allocation from Icon Water (ML/day)	41-50	41-50	41-50	41-50	41-50	41-50

Notes:

1. 2016 baseline demand is based on the metered customer consumption and has been broken down into residential and non-residential components based on the local government code field found in the metered consumption data
2. The unit rates (kL/ha/day) for Commercial and Industrial development were adopted from the WSA-03 code to project the future non-residential demand.

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Table 6-7 ADD Forecast by WSZs

Average Day Demand (ADD) Forecast							
Water Supply Zones	**Demand Category**	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
Crest 1	Residential	1.91	2.02	2.05	2.06	2.07	2.07
	Non-Residential	0.67	0.67	0.67	0.67	0.67	0.67
East Q1	Residential	0.30	0.33	0.34	0.35	0.35	0.35
	Non-Residential	0.15	0.15	0.15	0.15	0.15	0.15
East Q2	Residential	1.03	1.11	1.13	1.14	1.14	1.14
	Non-Residential	0.70	0.70	0.70	0.70	0.70	0.70
East Q3	Residential	0.40	0.42	0.42	0.42	0.42	0.42
	Non-Residential	0.01	0.01	0.01	0.01	0.01	0.01
Green 1	Residential	0.04	0.05	0.05	0.05	0.06	0.06
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Green 2	Residential	0.17	0.17	0.18	0.20	0.23	0.23
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Home 1	Residential	0.61	0.57	0.55	0.53	0.52	0.52
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Jerra 1	Residential	1.79	1.77	1.77	1.76	1.77	1.77
	Non-Residential	0.17	0.17	0.17	0.17	0.17	0.17
Jerra 2	Residential	1.35	1.37	1.66	2.11	2.36	2.36
	Non-Residential	0.05	0.78	0.01	0.41	0.28	1.04
Jerra 3	Residential	0.54	0.52	0.52	0.52	0.52	0.52
	Non-Residential	0.04	0.04	0.04	0.04	0.04	0.04
Ridgeway	Residential	0.12	0.13	0.17	0.20	0.25	0.25
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Thorn 1	Residential	0.14	0.13	0.12	0.12	0.12	0.12
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Thorn 2	Residential	0.37	0.36	0.36	0.36	0.36	0.36
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Thorn 3	Residential	0.46	0.45	0.43	0.42	0.42	0.42
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00

Table 6-8 PDD Forecast by WSZ

Peak Day Demand (PDD) Forecast (ML/d)							
Water Supply Zones	**Demand Category**	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
Crest 1	Residential	4.58	4.85	4.91	4.94	4.97	4.97
	Non-Residential	1.61	1.61	1.61	1.61	1.61	1.61
East Q1	Residential	0.71	0.79	0.82	0.83	0.84	0.84
	Non-Residential	0.37	0.37	0.37	0.37	0.37	0.37
East Q2	Residential	2.47	2.66	2.71	2.73	2.74	2.74
	Non-Residential	1.69	1.69	1.69	1.69	1.69	1.69
East Q3	Residential	0.96	1.00	1.00	1.00	1.00	1.00
	Non-Residential	0.01	0.01	0.01	0.01	0.01	0.01
Green 1	Residential	0.11	0.11	0.12	0.12	0.14	0.14
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Green 2	Residential	0.40	0.40	0.44	0.48	0.54	0.54
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00

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Peak Day Demand (PDD) Forecast (ML/d)							
Water Supply Zones	**Demand Category**	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
Home 1	Residential	1.46	1.38	1.31	1.27	1.24	1.24
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Jerra 1	Residential	4.30	4.25	4.24	4.23	4.24	4.24
	Non-Residential	0.40	0.40	0.40	0.40	0.40	0.40
Jerra 2	Residential	3.24	3.28	3.99	5.07	5.66	5.66
	Non-Residential	0.12	1.88	2.49	3.43	4.10	5.92
Jerra 3	Residential	1.29	1.25	1.24	1.24	1.24	1.24
	Non-Residential	0.10	0.10	0.10	0.10	0.10	0.10
Ridgeway	Residential	0.28	0.32	0.40	0.49	0.60	0.60
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Thorn 1	Residential	0.33	0.31	0.29	0.29	0.28	0.28
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Thorn 2	Residential	0.89	0.86	0.86	0.85	0.86	0.86
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00
Thorn 3	Residential	1.11	1.07	1.04	1.01	1.00	1.00
	Non-Residential	0.00	0.00	0.00	0.00	0.00	0.00

6.6 Water Demand Sensitivity

6.6.1 Historical Rainfall – Dry and Wet Years

The annual rainfall versus annual water consumption is shown in **Figure 6-11** and **Table 6-9** below. A high level analysis was undertaken to determine a typical wet and dry year in relation to water consumption rates based on the rainfall data available from a nearby Bureau of Meteorology (BOM) rain gauge at Canberra Airport (in close proximity to Queanbeyan). The annual rainfall totals are reported on a financial year basis (i.e. 01st July – 30th June).

- Wet year analysis - the year 2013/14 shows that there was relatively high annual rainfall (95th percentile of the annual rainfall dataset), hence was considered to represent a wet year in comparison to the other years included in the dataset. This year shows reasonable correlation as there was relatively lower water consumption when comparing to 2017/18 in particular.
- Dry year analysis - the year 2017/18 shows the lowest relative annual rainfall (5th percentile of the annual rainfall dataset) and is therefore considered to represent a dry year. There is a strong correlation with the water consumption for that year as the water consumption is high.

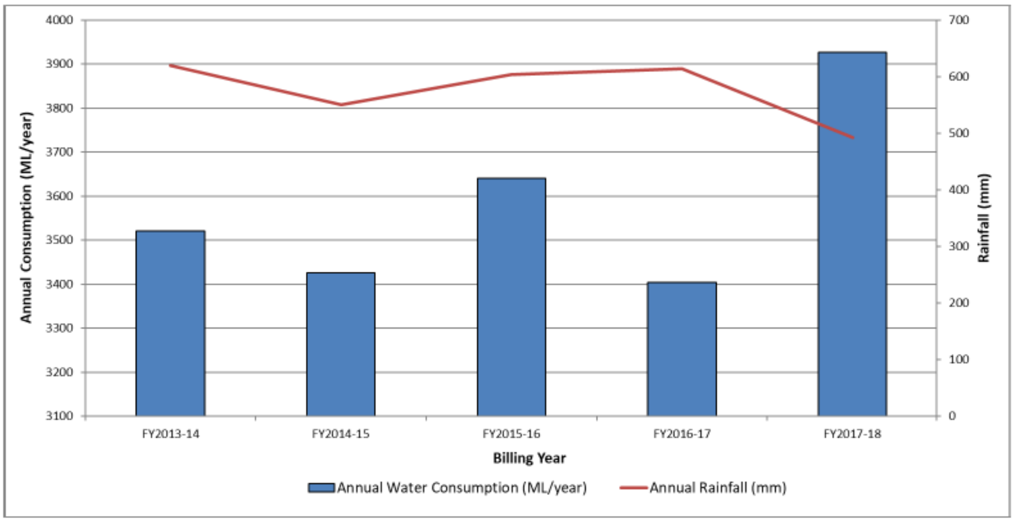

Figure 6-11 Annual Rainfall and Water Consumption

Table 6-9 Rainfall Trends – Dry and Wet Years

Year	Annual Water Consumption (ML/year)	Annual Rainfall (mm)	Comment
FY2013-2014	3,521	620	Wet Year – approx. 95%ile
FY2014-2015	3,426	550	Median
FY2015-2016	3,640	604	Median
FY2016-2017	3,404	614	Median
FY2017-2018	3,927	493	Dry Year – approx. 5%ile

It is acknowledged that the impacts of temperature have not been considered as part of the historical analysis and the timeline for deducing the trend and correlation is short as it is limited to five years of available data. However, for the purposes of the Issues Paper an indication of the per capita demand rate sensitivity due to rainfall is provided in Table 6-10. This provides an indicative per capita water usage range for the purposes of demand sensitivity testing. This is reported in the context of annual average demand as annual rainfall may not necessarily impact on peak day demand:

- Wet year – adopted as 2013/14 as an indicator (high rainfall combined with median consumption)
- Dry year – adopted as 2017/18 as an indicator (lower rainfall combined with high consumption)

Table 6-10 Demand Sensitivity for Rainfall

Water Demand Sensitivity	'Wet Year' Indicator	Adopted Average*	'Dry Year' Indicator
	2013/14	2013/14-2017/18	2017/18
Unit Consumption Rate (L/cap/day)	233	233	252

- Notes: * Adopted average as per Section 6.2

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6.6.2 Water Conservation and Efficiency

The requirement for BASIX in new residential properties (low density) involves a 40% reduction on the annual average water consumption with reference to the NSW benchmark of 247 L/cap/day (2006). The adopted average daily per capita rate (233 L/cap/day) as shown in Table 6-9 is lower than the NSW benchmark from 2006 and this may suggest a slight reduction in residential water consumption behaviour since the introduction of BASIX requirements. However, this downward consumption trend is likely to be the result of several influencing factors:

- BASIX 40 requirement for new residential dwellings
- Change in consumer behaviour post-millennium drought – greater education and awareness
- Permanent water conservation measures if this has been introduced by Council post- millennium drought – the implementation of any measures remains unknown and requires confirmation by Council

The most recent water consumption data indicates a potential bounce back in water usage behaviour however there is not enough data to be conclusive on whether this bounce back is temporary or permanent. In any case there remains opportunity to improve on the current adopted per capita rate of 233 L/cap/day or at the very least maintain this rate into the future when considering the predicted adversity of climate change and drought. This will be explored further in the next phase of the IWCM strategy development including the investigation of demand management options, which may encompass the following as examples:

- Reduction in NRW
- Smart metering
- Moving beyond BASIX 40
- Expanding on the use of recycled water including stormwater harvesting
- Increased customer education and awareness (including incentivised targets).

6.6.3 Water Pricing

The QPRC Revenue Policy 2017/18 states the water usage charges (potable water) for the former Queanbeyan City Council (QCC). The single tier consumption charge per kl for 2016/17 and 2017/18 is shown in **Table 6-11**.

There is a small increase in the consumption charge at +$0.08 from 2016/17 to 2017/18. This represents a percentage change of +2.20%, which is reflective of a Consumer Price Index (CPI) increase and therefore is unlikely to drive behaviour change. Given the limited available historical water usage charge data it is difficult to draw conclusions on the historical impact of water pricing changes and evidence of any related impacts should continue to be monitored as more data becomes available.

Table 6-11 Water Usage Charges and Water Consumption

Water Pricing	2016/17	2017/18
Single Tier Consumption Charge per kL	$3.72	$3.80
Water Consumption (kL/year)	3,404,269	3,927,185

7.0 Sewer Loading

7.1 Regional Sewage Flow

The historical daily inflows to the Queanbeyan STP were analysed in conjunction with the daily rainfall data recorded at the STP. The provided dataset covered a 16 month period from 14th Nov 2015 to 14th March 2017. Two permanent flows gauges ('PFM_G01' and 'PFM_G02') are installed at the STP inlet works.

Figure 7-1 and **Figure 7-2** show the recorded inflows (daily and monthly averages) to the STP and the corresponding daily rainfall measured at the STP inlet works. **Table 7-1** summarises the daily inflow analysis as measured from the permanent gauges.

The average daily flow to the plant during this period is 9.8 ML/d, whilst the average daily flow when filtering only for dry days is observed to be 9.2 ML/d. **Section 7.2** presents the estimation of catchment flow during dry days in more detail.

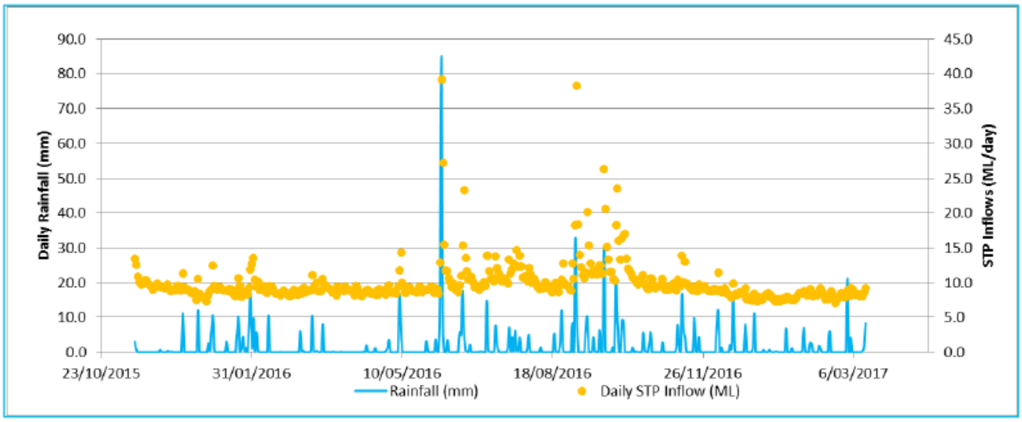

Figure 7-1 Daily STP Inflow and Rainfall for Queanbeyan STP

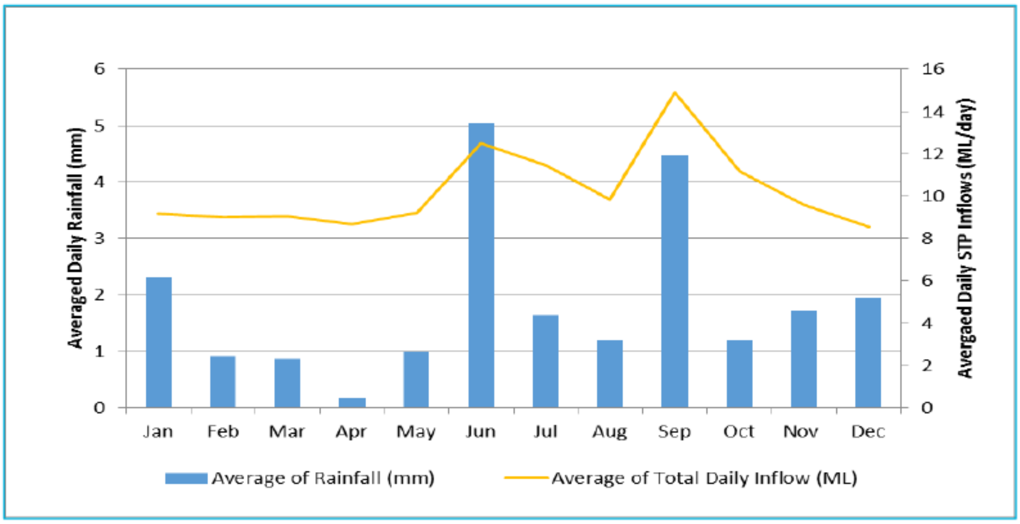

Figure 7-2 Average Daily STP Inflow and Rainfall by Month

Table 7-1 Daily Inflow Analysis

Daily Inflow Analysis for Queanbeyan STP				
Permanent Gauges	**Rain (mm)**	**PFM_G01 (ML)**	**PFM_G02 (ML)**	**Combined Flow (G01 + G02) (ML)**
Maximum	85.0	9.1	30.8	39.2
Minimum	0.0	2.0	4.6	7.0
Average	1.6	2.8	7.0	9.8
Mode	0.0	2.8	6.5	9.4
Average daily flows to STP (dry days only) – 9.2 ML/d				
Averaged daily flow – 9.8 ML/d				

A second dataset was provided by Council for the Queanbeyan STP inlet works and contained daily inflows, rainfall and peak flows from 1st Sep 2009 to 31st July 2016. However, this dataset contained several gaps and anomalies:

- No measurement of flows or rainfall from 25th Feb 2009 to 30th Sept 2009 (approximately 6 month period).
- Recorded daily inflows and daily rainfall could not be reconciled with the data recorded by the permanent flow gauges PFM_G01 and PFM_G02 for the period 15th Nov 2015 to 31st July 2016 (approximately 9 months). Typically the gauged daily inflow was found to be consistently lower than the flow dataset provided for the inlet works. For peak flows, the discrepancy was typically in the range of 3-11 ML/d.
- Lack of flow gauging data for period prior to Nov 2015 and after July 2016 makes it difficult to ascertain if the discrepancy in daily inflows persisted over the entire timeframe from 1st Sept 2009 to 31st July 2016.

Figure 7-3 illustrates the above data gaps. As a result the confidence in this second dataset was reduced, particularly as the source of the data is unconfirmed.

Further investigation of the differences between the two datasets (i.e. bypasses near STP etc.) will be considered in the next phase of the IWCM strategy development. For the purposes of the Issues Paper the dataset sourced from permanent flow gauges 'PFM_G01' and 'PFM_G02' is considered suitable for deriving an evidenced based calculation of Average Dry Weather Flow (ADWF) for the Queanbeyan scheme. This initial evidenced based ADWF calculation will be reviewed and refined during subsequent phase of the IWCM strategy development as further data is made available.

It is noted that concurrent analysis of the Queanbeyan catchment sewer loading is being undertaken as part of the ongoing Queanbeyan STP Upgrade project. This concurrent analysis will inform the design capacity of the treatment plant upgrade.

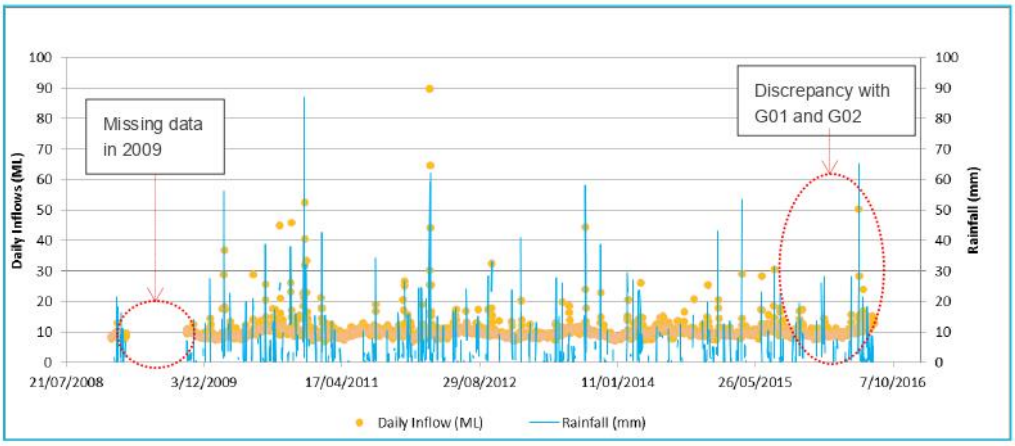

Figure 7-3 STP Inlet Works - Daily Flows and Rainfall (second dataset)

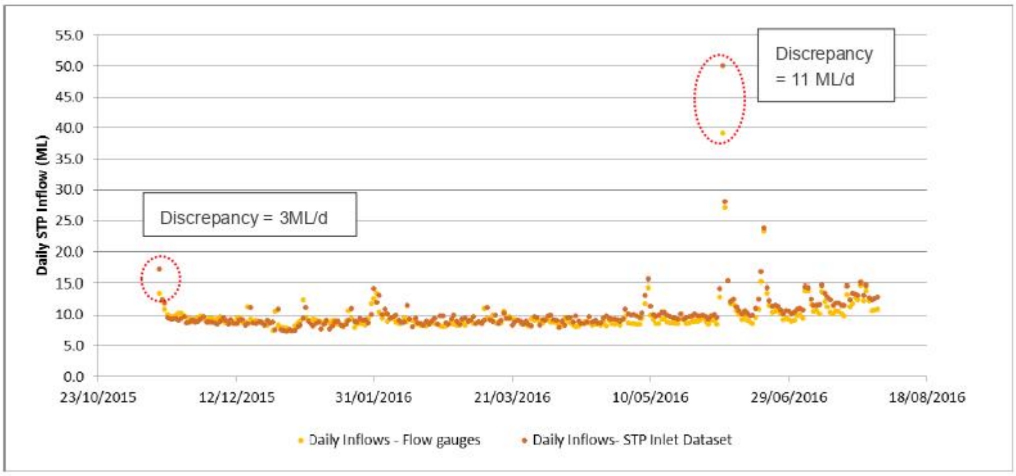

Figure 7-4 Daily STP Inflows - Dataset Discrepancies (2015/16)

7.2 Average Dry Weather Flow (ADWF)

The available permanent flow gauging data ('PFM_G01' and 'PFM_G02') was the primary source of data adopted for the Average Dry Weather Flow (ADWF) analysis. The second dataset for the inlet works (lower confidence in the dataset) was used as a means of sanity checking the primary calculations. To derive the historical evidence based ADWF the following industry 'rule of thumb' approach was applied:

- Days with a daily rainfall over 8mm were identified as a 'wet day' and ignored for the analysis. In addition:
  - Days where there was greater than 10mm of rainfall, the next day was also considered wet
  - Days where there was greater than 15mm of rainfall, the next two days was also considered wet
- Selection of dry days - days with a daily rainfall of less than 8mm as it is unlikely for a material wet weather response in the sewer

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- Manual screening of the inflows against the dry/wet days above was undertaken to filter out any anomalies (i.e. lag in recorded inflows due to preceding rainfall events resulting in being labelled under a 'dry' day etc.)

Based on the above rule of thumb approach the following is noted:

- Intermittent data anomalies identified will have no material impact on the analysis outcomes.
- It is important to consider the location of the rain gauges in comparison to the catchment boundary as variable weather patterns may affect the sewer loading as rain is not uniform across all catchments and can be disparate and dynamic.
- Based on the limitations of the second inlet works dataset, there is limited confidence in the historical records pre-dating November 2015, however the historical ADWF trend from this second dataset has been reported as a sanity check.

The historical evidence based ADWF referencing the adopted permanent flow gauge data for 2015, 2016 and 2017, and the comparative ADWF estimated using the second inlet works dataset (2009-2016) is presented in **Table 7-2**.

The baseline (2016) ADWF and associated unit loading rate adopted for the Issues Paper is 9,480 kL/d and 264 L/EP/day as presented in **Table 7-3**. This is considered conservative when cross-checking against the unit loading rate adopted for the concurrent Queanbeyan STP Upgrade project (230 L/EP/day) and the typical unit loading rate applied in the ACT (200 L/EP/day). However a conservative approach is considered reasonable for the Issues Paper as there remains opportunity to refine the unit loading rate and/or undertake sensitivity analysis during subsequent phases of the IWCM strategy development.

Table 7-2 Historical ADWF Analysis - Queanbeyan

Sewer Scheme	2009	2010	2011	2012	2013	2014	2015	2016	2015 (2 mths data)	2016 (12 mths data)	2017 (3 mths data)
Units		kL/d	kL/d	kL/d	kL/d	kL/d	kL/d		kL/d	kL/d	kL/d
Sewer Load	N/A	9,608	9,374	9,496	9,254	9,545	9,660	N/A	N/A	9,480	N/A
Unit ADWF (L/EP/d)[1]		314	301	299	285	288	286		-	264	
Comments	Inlet works dataset gaps (lower confidence)	Inlet Works dataset – complete year (low confidence in data)						Inlet works data gaps (lower confidence)	Permanent flow meter data - not adopted as gaps in data	Permanent flow meter data – full data set & adopted for ADWF analysis	Permanent flow meter data - not adopted as gaps in data

Notes:

1. Historical EP was estimated based on the population growth in Queanbeyan historically being around 2% per annum over the last 25 years. This was back calculated from the existing EP of 35,679 to estimate the ADWF for the preceding years as an indicator to inform the analysis.
2. The comparative ADWF estimated from the second inlet works dataset is included as a sanity check for the years where there was a complete dataset

Table 7-3 Adopted ADWF and Unit Loading Rate - Queanbeyan

Sewerage Scheme	Adopted ADWF (kL/d)	2016 EP	Adopted Unit Loading Rate (L/EP/day)
Queanbeyan STP	9,480	35,873	264

The adopted unit loading rate of 264 L/EP/day for sewer is higher than the adopted per capita water consumption rate of 233 L/capita/day. The higher sewer loading rate may be influenced by high base flows in the sewer system. Anecdotal evidence provided by QPRC suggests high inflow-infiltration issues exist in the catchment, which could potentially be a result of the following:

- Declining condition of sewer network assets over time, including tree root penetration.
- Higher rates of groundwater infiltration, particularly in lower lying parts of the system that are close to the water table.
- NRW (leakage) from the potable water system potentially infiltrating the sewer system.

Typically, the return-to-sewer rate for urban residential areas is in the range of 80-85% of the potable water consumption. A comparison between the adopted potable water per capita rate and the sewer unit loading rate including the potential scale of inflow and infiltration is shown in Table 7-4.

Table 7-4 Sewer Unit Loading Rate Comparison Check

Adopted Sewer Unit Loading Rate (L/EP/day)	264
Adopted Potable Water Per Capita Rate (L/capita/day)	233
Comparative Sewer Unit Loading Rate - Return to Sewer method (80-85%) (L/EP/day)	186 to 198
Potential infiltration and inflow (L/EP/day)	66 to 78
Potential infiltration and inflow as % of the adopted sewer unit loading rate	25 to 29%

Figure 7-5 shows the historical trend comparing the annual bulk water supply and derived ADWF from 2013/14 to 2015/16 (second inlet works dataset) and 2016/17 (permanent inflow gauge dataset). The comparative trend appears reasonable with the exception of 2014/15, which appears to represent an anomaly. If ignoring 2014/15, the comparative trend between annual bulk water supply and ADWF provides improved confidence in the adopted baseline (2016) ADWF for the Issues Paper.

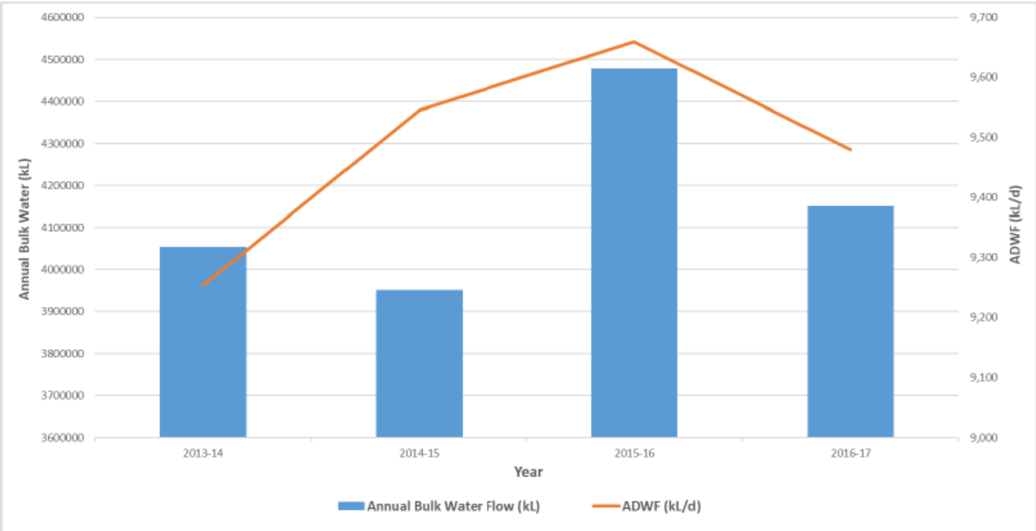

Figure 7-5 Annual Bulk Water Supply and ADWF Comparative Trend

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7.3 Peak Dry Weather Flow (PDWF)

The adopted PDWF for Queanbeyan is based on sewer design rates within the WSAA Sewerage Code of Australia (WSA-02) due to a lack of historical influent diurnal flow data at the STP i.e. diurnal inflow data for the STP was not available at the level of granularity required. As such, the peaking factor 'r' required to calculate the PDWF was estimated using WSA-02.

As a sanity check, the peaking factor was also estimated based on ET by referencing the Public Works – Sewerage Branch Manual of Practice, Sewer Design method. The outcome of both methods is closely comparable as shown in Table 7-5.

The adopted peaking factor 'r', ADWF and estimated PDWF for the Queanbeyan sewerage scheme is shown in Table 7-6. The peaking factor 'r' is assumed to remain relatively consistent into the future given the total catchment area is not projected to change at a material level.

Table 7-5 PDWF - Peaking Factor Comparison

Sewerage Scheme	Catchment Size	Peaking Factor	Method
Queanbeyan STP	2,617 Ha	1.78	WSAA Sewerage Code (based on catchment area)
	14,329 ET	1.72	Public Works – Sewerage Branch Manual of Practice (Sewer Design) (based on ET)

Table 7-6 Adopted PDWF - Queanbeyan

Sewerage Scheme	Derived Peaking Factor 'r'	Adopted ADWF (kL/d)	Adopted ADWF (L/s)	Adopted PDWF (L/s)
Queanbeyan STP	1.78	9,480	109.7	195.3

In comparison to the estimated PDWF, the highest daily inflow event observed at the Queanbeyan STP during dry weather, based on the available historical data and filtering out wet weather periods and anomalies:

- 170.2 L/s on 12th December 2010 (second inlet works dataset) – low confidence in data
- 155.9 L/s on 14th November 2015 (permanent flow gauge dataset) – limited data series

The peaking factors for each supra-catchment were individually calculated based on the catchment area approach from the WSAA Sewerage Code (WSA-02). The supra-catchment peaking factors were assumed to remain constant into the future with the exception of supra catchment 'Bayside Ct – Pump 9', as significant growth is allocated to this supra catchment.

The incremental increase in catchment area per horizon for Bayside Ct – Pump 9 was estimated using the projected growth in order to calculate the associated peaking factor for each planning horizon. The derived peaking factors per supra catchment are shown in Table 7-7.

Table 7-7 PDWF Peaking Factors per Supra Catchment

Supra-Catchment	2016	2021	2026	2031	2036	2050
Banyalla Cl - Pump 11	3.5	3.5	3.5	3.5	3.5	3.5
Barbar St - Pump 5	3.1	3.1	3.1	3.1	3.1	3.1
Bayside Ct - Pump 9[1]	2.6	2.3	2.3	2.2	2.2	2.1
Bellbush Cl - Pump 10	3.1	3.1	3.1	3.1	3.1	3.1
Capital Tce - Pump 3	4.6	4.6	4.6	4.6	4.6	4.6
Erin St - Pump 13	4.1	4.1	4.1	4.1	4.1	4.1
Gravity CA 1	2.5	2.5	2.5	2.5	2.5	2.5

Supra-Catchment	2016	2021	2026	2031	2036	2050
Gravity CA 2	3.1	3.1	3.1	3.1	3.1	3.1
Gravity CA 3	2.7	2.7	2.7	2.7	2.7	2.7
Gravity CA 4	2.0	2.0	2.0	2.0	2.0	2.0
Gravity CA 5	2.3	2.3	2.3	2.3	2.3	2.3
Jinaroo St - Pump 2	3.5	3.5	3.5	3.5	3.5	3.5
Kathleen St - Pump 7	2.2	2.2	2.2	2.2	2.2	2.2
Lochiel St - Pump 6, River Dr - Pump 8	2.3	2.3	2.3	2.3	2.3	2.3
Morriset St - Pump 1	1.9	1.9	1.9	1.9	1.9	1.9
Regent Dr - Pump 12	3.8	3.8	3.8	3.8	3.8	3.8
Weetalabah Dr - Pump 15	3.0	3.0	3.0	3.0	3.0	3.0
Woodland Ave - Pump 14	2.5	2.5	2.5	2.5	2.5	2.5
Yass Rd - Pump 4	3.2	3.2	3.2	3.2	3.2	3.2
Oaks Estate	3.0	3.0	3.0	3.0	3.0	3.0

Note:

1. The larger the catchment area the smaller the peaking factor, hence the decrease in the peaking factor through to 2050 as the catchment area increases.

7.3.1 Peak Wet Weather Flow (PWWF)

The three highest daily inflow events measured at the Queanbeyan STP between 14th Nov 2015 and 13th March 2017 was observed on the following dates:

- 39.2 ML/d on 5th June 2016 (equivalent daily flow rate of 454 L/s)
- 27.2 ML/d on 6th June 2016 (equivalent daily flow rate of 315 L/s)
- 38.3 ML/d on 3rd Sept 2016 (equivalent daily flow rate of 443 L/s)

These dates correspond to key wet weather events where the rainfall recorded equates to approximately a 1-in-5 year event over 48 hours. This results in an equivalent daily PWWF factor of 4.1 when comparing the highest daily inflow event (39.2 ML/d) to the adopted ADWF of 9,480 kL/d (109.7 L/s).

The instantaneous PWWF was estimated using design rates from the WSAA Sewerage Code (WSA-02) and is presented in **Table 7-8** below. An instantaneous PWWF factor of 9.4 has been adopted as a conservative estimate for the Issues Paper. However this should be reviewed when further hydrological data is made available.

Table 7-8 Adopted PWWF - Queanbeyan

Sewerage Scheme	Storm Allowance (L/s)	Adopted PWWF- Instantaneous (L/s)	Instantaneous PWWF / ADWF	Equivalent Daily PWWF / ADWF[1]
Queanbeyan STP	836	1,031	9.4	4.1

Note:

1. Based on the highest historical daily inflow event of 39.2 ML/d (454 L/s), referencing the adopted permanent flow gauge dataset and the adopted ADWF of 9,480 kL/d (109.7 L/s)

The PWWF/ADWF peaking factors at the supra catchment level have been individually calculated for the 'Bayside Ct – Pump 9', 'Gravity CA 5' and 'Morriset St – Pump 1' supra catchments as there is a higher level of growth allocated to these catchments when compared to the other supra catchments. The PWWF/ADWF peaking factors for each supra catchment is shown in Table 7-9. It is assumed that the PWWF/ADWF peaking factor remains constant into the future for all remaining supra catchments that exhibit relatively lower levels of growth (refer **Table 7-8**).

Table 7-9 PWWF Peaking Factors per Supra Catchment

PWWF/ADWF Peaking Factors						
Supra Catchment	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
Bayside Ct - Pump 9	8.1	9.4	9.5	9.5	9.5	9.5
Gravity CA 5	8.7	9.0	9.1	9.2	9.2	9.2
Morriset St - Pump 1	9.9	9.8	9.8	9.8	9.8	9.8

Note:

1. PWWF calculated based on; SA = 0.058 x ET and PWWF = PDWF + SA

7.4 Future Sewer Flow Projection

7.4.1 Projected STP Flows

The Queanbeyan sewer flow projections are presented at the regional level for the whole of the catchment and aggregating to the Queanbeyan STP. The future ADWF, PDWF and PWWF projections have been derived using the projected population growth, adopted unit loading rate (264 L/EP/day) and peaking factors as documented in the sections above. The sewer flow projection is summarised in **Table 7-10** below. The projected ADWF for 2050 is 15,959 kL/d or 16.0 ML/d which represents an increase of 69% on the baseline ADWF in 2016.

Table 7-10 Projected STP flows - Queanbeyan

Sewerage Scheme	Units	2016	2021	2026	2031	2036	2050
Queanbeyan STP	EP	35,873	48,227	50,693	54,204	56,953	60,389
	ADWF (kL/d)	9,480	12,745	13,397	14,325	15,051	15,959
	'r' - for PDWF[1]	1.78	1.78	1.78	1.78	1.78	1.78
	PDWF (L/s)	195	262	275	294	309	328
	PWWF (L/s)	1,031	1,385	1,456	1,557	1,636	1,735

Notes:

1. The adopted peaking factor 'r' at the catchment level is 1.78 as per Table 7-6

7.4.2 Projected Flows for Sewer Catchments

Flow projections at a more granular sewer supra catchment level was developed for the future planning horizons up to 2050 as shown in Table 7-11. The following assumptions were adopted when developing the projected flows for the supra catchments:

- Infill growth - the residential population forecast was spatially analysed using GIS mapping to proportionally allocate or distribute the infill growth into the respective supra catchments. It is noted that the future growth projections from the ABS/Census database do not align neatly with the supra catchment boundaries, hence the need to spatially distribute the infill growth.
- Greenfield growth areas (refer to Appendix C for the future growth areas) have been allocated to the nearest supra catchment based on the spatial analysis of each Greenfield growth polygon:
  - Residential growth in Tralee-Environa (Sth Tralee, Sth Jerra, Melrose Valley urban release areas) has been allocated to Bayside Court-Pump 9 based on locality and ground levels.
  - Non-residential growth in Jerrabomberra (Poplars) was allocated to Gravity Catchment 5 based on locality. Non-residential growth in Tralee-Environa was allocated to Bayside Ct – Pump 9 based on locality and ground levels.
  - The Oak Estate SPS flow meter shows an ADWF of 1.5 to 2 L/s, increasing to approximately 12 L/s during observed PWWF events. The Oaks Estate flows are relatively immaterial at the whole of catchment level and therefore it has been assumed that the flow transfer from Oaks Estate to the Queanbeyan scheme will remain constant into the future.

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Table 7-11 Projected Flows for Sewer Supra Catchments

Projected Catchment Flows	ADWF (kL/d)						PDWF (L/s)						PWWF (L/s)					
Supra Catchment	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
Banyalla Cl - Pump 11	87	99	99	99	99	99	4	4	4	4	4	4	9	10	10	10	10	10
Barbar St - Pump 5	44	77	79	81	83	83	2	3	3	3	3	3	6	10	11	11	11	11
Bayside Ct - Pump 9	305	1277	1599	2221	2825	3733	9	35	42	56	71	90	29	140	176	245	312	411
Bellbush Cl - Pump 10	113	134	134	134	134	134	4	5	5	5	5	5	11	13	13	13	13	13
Capital Tce - Pump 3	15	22	23	23	23	23	1	1	1	1	1	1	4	5	5	5	6	6
Erin St - Pump 13	78	89	89	90	90	90	4	4	4	4	4	4	12	14	14	14	14	14
Gravity CA 1	671	735	736	737	737	737	19	21	21	21	21	21	68	74	74	74	74	74
Gravity CA 2	170	230	235	238	242	242	6	8	9	9	9	9	33	45	46	46	47	47
Gravity CA 3	379	497	509	516	523	523	12	16	16	16	16	16	62	81	83	84	85	85
Gravity CA 4	1212	1545	1561	1575	1589	1589	28	36	36	36	37	37	130	166	168	169	171	171
Gravity CA 5	904	1133	1316	1500	1501	1501	24	30	35	40	40	40	91	117	139	160	160	160
Jinaroo St - Pump 2	26	46	47	48	49	49	1	2	2	2	2	2	3	5	5	5	6	6
Kathleen St - Pump 7	1240	1465	1476	1485	1494	1494	32	38	38	38	38	38	134	158	160	161	162	162
Lochiel St - Pump 6, River Dr - Pump 8	439	555	564	572	581	581	12	15	15	15	16	16	44	55	56	57	58	58
Morriset St - Pump 1	3653	4585	4662	4726	4788	4788	80	101	102	104	105	105	417	520	528	535	542	542
Regent Dr - Pump 12	10	23	24	25	26	26	0	1	1	1	1	1	1	2	2	2	2	2
Weetalabah Dr - Pump 15	17	23	25	28	31	31	1	1	1	1	1	1	2	2	2	3	3	3
Woodland Ave - Pump 14	26	40	46	53	60	60	1	1	1	2	2	2	3	4	5	5	6	6
Yass Rd - Pump 4	91	122	124	126	127	127	3	4	5	5	5	5	8	10	11	11	11	11
TOTAL[1]	**9480**	**12698**	**13349**	**14277**	**15004**	**15912**	**242**	**325**	**341**	**364**	**381**	**400**	**1064**	**1432**	**1506**	**1610**	**1691**	**1791**

Note:

1. The total summation of supra catchment sewer loading may exhibit some minor discrepancy when compared to the whole-of-catchment sewer load forecast that has been derived at a regional scale for the Queanbeyan STP. In practise there is expected to be some attenuation of sewer flow within network storages prior to reaching the STP i.e. reducing the peak flows experienced by the STP.

7.4.3 Projected Flows for Un-serviced Areas

Currently there are 313 properties within the study area that are not connected to the Queanbeyan sewer network and thus represent on-site sewerage collection systems. The existing ADWF for these properties has been estimated using the typical wastewater design flows for on-site roof water tank supply (AS1547) adopting a unit loading rate of 120 L/EP/day for non-reticulated areas and is summarised in **Table 7-12**.

For the purposes of the Issues Paper it is assumed that these 313 properties will remain on private collection systems into the future i.e. will remain un-serviced. The assumption for all future growth and new dwellings is that they will be connected to the sewer network and this represents the projected STP flows as presented in **Section 7.4.1**.

Table 7-12 ADWF for Un-serviced Areas

Area	Number of Properties with On-Site Systems (i.e. Septic Tanks etc.)	Average Person Per Household	EP	ADWF (kL/d)
		Urban		
Queanbeyan*	1	2	2	0.2
Crestwood*	1	2.1	2	0.3
Jerrabomberra*	2	3.1	6	0.7
Karabar*	1	2.6	3	0.3
The Ridgeway	50	2.4	120	14.4
Sub-total	**55**			**16.0**
		Rural		
Royalla	112	3.4	381	45.7
Carwoola	146	2.9	423	50.8
Sub-total	**258**			**96.5**
TOTAL	**313**			**112.5**
Notes: *Single connections recorded for these urban areas may potentially be a data error.				

7.5 Biological and Nutrient Loading Analysis

Historical data for influent biological (biological oxygen demand (BOD)) and nutrient (Nitrogen (N) and Phosphorus (P)) loads measured at the Queanbeyan STP inlet was examined to derive an average loading. Data was received for the period from 1st Jan 2009 to 31st July 2016. The average loading is presented in **Table 7-13** below.

Biological and nutrient loadings are being collected and analysed as part of the Queanbeyan STP Upgrade project. This information will be used to benchmark the required performance requirements of the upgraded treatment plant.

Table 7-13 Biological and Nutrient Loading – Queanbeyan STP

Parameter	Units	Current Loading
Biological Oxygen Demand (BOD_5)	g/EP/d	49.0
Total Nitrogen (N)	g/EP/d	18.2
Total Phosphorous (P)	g/EP/d	2.2

8.0 Stormwater Quality and Quantity Projection

8.1 Regional Stormwater Volume and Quality

Current annual average stormwater volumes and nutrient pollutant loads for the study area have been estimated based upon GIS mapping of existing land use.

Existing stormwater volumes and nutrients were estimated using an average annual rainfall depth of 655mm and 1116mm of evapo-transpiration based on historical data. The pollutant export parameters adopted are default values prescribed by MUSIC modelling software as there was insufficient data available to calibrate the model to local conditions.

Table 8-1 Current Annual Stormwater Volumes and Land Use

Existing Land Use	Existing Area (Ha)	Stormwater (ML/yr)	Total Suspended Solids (kg/yr)	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)
Industrial	152	0.78	161.12	0.24	1.72
Commercial	10	0.05	10.60	0.02	0.11
Residential	2,378	7.16	1,233.94	2.09	14.88
Parkland and Open Space	61	0.10	16.35	0.03	0.22
Forest	2,460	0.01	22.86	0.06	1.05
Quarry (no discharge)	55	0.00	0.00	0.00	0.00
Rural residential	14,439	9.10	749.38	1.34	14.58
Total Study Area	**19,528**	**17.20**	**2,194.24**	**3.77**	**32.57**

8.2 Future Stormwater Volume and Quality Projection

The future annual average stormwater volumes and nutrient pollutant loads projected out to 2050 have been estimated based upon the future land use projections as featured in Section 5. These projections assume that rainwater tanks and Water Sensitive Urban Design (WSUD) are applied as discussed below. An estimate of the future housing extents was based on the average lot size:

- Carwoola - Greenleigh - The Ridgeway: 750 m^2
- Crestwood: 450m^2
- Jerrabomberra: 450 m^2
- Karabar: 450 m^2
- Queanbeyan: 450 m^2
- Queanbeyan East: 600 m^2
- Queanbeyan West: 450 m^2
- Royalla – Burra: 750 m^2
- Tralee – Environa: 750 m^2

Table 8-2 Projected Annual Stormwater Volumes and Land Use (2050)

Future Land Use (2050)	2050 Area (Ha)	Stormwater (ML/yr)	Total Suspended Solids (kg/yr)	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)
Industrial	207	1.06	89.31	0.15	1.20
Commercial	95	0.49	76.06	0.14	1.19
Residential	3,190	9.60	1,297.16	2.34	17.68
Parkland and Open Space	87	0.15	17.39	0.03	0.27
Forest	2,460	0.01	22.86	0.06	1.05
Quarry (no discharge)	55	0.00	0.00	0.00	0.00
Rural residential	13,461	8.48	741.76	1.31	14.04
Total Study Area	**19,555**	**19.79**	**2,244.53**	**4.03**	**35.43**

Stormwater quality and quantity mitigation measures to control the increase of stormwater pollutant loads are prescribed in Council's development control plans for new growth areas. Prescribed pollutant load limits would be achieved through the application of water sensitive urban design (WSUD) which commonly comprises:

- Rainwater tanks
- Gross pollutant traps
- Vegetated systems such as bio-filtration basins or wetlands.

These treatment devices will reduce the volume of stormwater runoff by a small amount (notionally up to 15%). Other key points of discussion are summarised as follows:

- The future volume and load projections above forecast the greatest incremental contribution of stormwater pollutants will result from new residential development in growth precincts. This reflects the residual increase in loads after the application of WSUD in the catchment to reduce pollutant loads by 85%, 65% and 45% for total suspended solids (TSS), total phosphorous (TP) and total nitrogen (TN) respectively. However, the greatest source of stormwater pollutants to local waterways will be from untreated stormwater runoff from existing development.
- It is important to note that no significant increase in pollutant loads to Lake Jerrabomberra is expected, and there is expected to be no associated increase or worsening in algal bloom risk as a result of the forecast development.
- The projected increase in pollutant loads cascading downstream to Queanbeyan River and Lake Burley Griffin may contribute to the cumulative impact on the water quality within the lake. Conversely, improving the quality of stormwater discharges may be considered as a strategy to offset nutrient loads from the treatment plant.
- The increased stormwater volume from future development (2.6 GL/yr) has the potential to cause noticeable impacts on the health and structure of local ephemeral waterways. Without flow management or stormwater retention measures, erosion impacts of development within a catchment can persist for decades after development. Rainwater tanks have the greatest potential to impact on urban runoff but these will be most effective when stormwater is captured on a regional basis and is reticulated to the highest residential water end uses;
  - Hot water tanks
  - Laundry
  - Toilet flushing

- Rainwater tanks that are sized to comply with BASIX and supply roof water for irrigation and toilet flushing are unlikely to have sufficient impact on stormwater volumes to have a benefit on stream erosion.
- Infill development forecast within Crestwood, Queanbeyan and Queanbeyan West may require flow management controls such as on-site stormwater detention or stormwater retention to preserve or improve existing flooding on downstream properties, particularly within the CBD area.

9.0 Water System Capacity and Performance Assessment

9.1 Regional Water Security

Water security related information provided by Icon Water for the Issues Paper (Figure 9-1) shows the projected annual average water consumption for the ACT and Queanbeyan (including Googong) and the associated increase in the probability of water restrictions. The level of service for Icon Water is projected to be exceeded in 2059, which corresponds to an average annual supply rate of 75 GL/year.

This projection is based on a dry climate scenario and therefore indicates a high level of water security and surety of bulk supply from Icon Water to Queanbeyan and Googong over the next 30 years. This is not surprising given the significant investment in water security related projects by Icon Water over the past 10-15 years i.e. enlargement of Cotter Dam (+75GL), Murrumbidgee to Googong transfer (+100ML/d) and the Tantangara transfer scheme (emergency releases). As a result, the future regional water security for Queanbeyan is considered to be robust.

More detailed water security related information provided by Icon Water is included in **Appendix D**.

Note: in developing their projection, Icon Water has made assumptions regarding the Queanbeyan growth rate and per capita consumption, however the assumptions are reasonably consistent with the growth and per capita rate developed for the Issues Paper and is therefore not problematic.

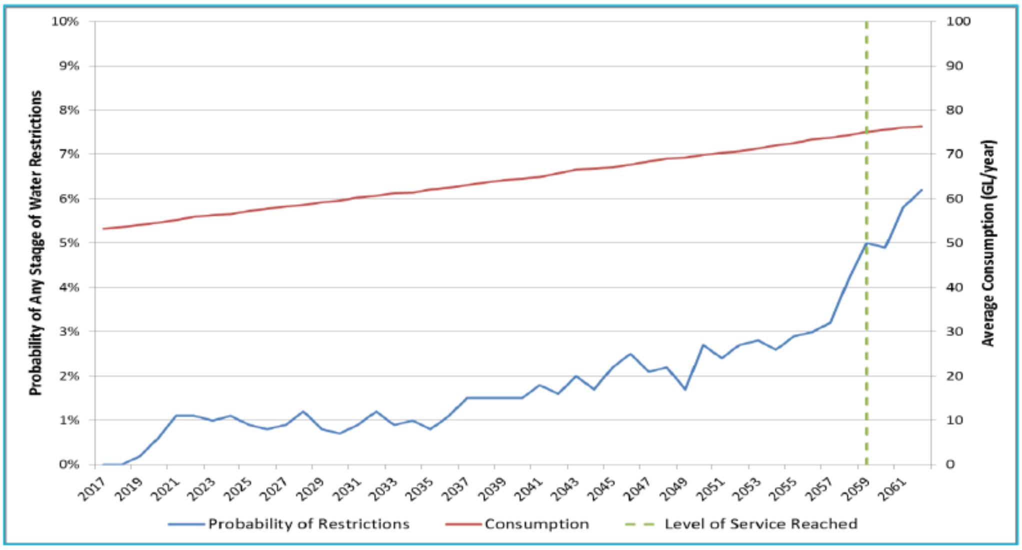

Figure 9-1 Projected Probability of Water Restrictions and Annual Average Water Consumption *(Icon Water)*

9.2 Bulk Supply Service Agreement

Figure 9-2 presents the peak day and average day demand forecast derived for Queanbeyan (Offtakes 1 and 2) out to 2050 versus the following parameters from the existing bulk supply service level agreement with Icon Water:

- Maximum off peak (i.e. outside summer months) daily demand – 20 ML/d (Stromlo WTP operating)
- Maximum summer daily demand – 41 ML/d (Stromlo and Googong WTP's operating)
- Maximum demand – 50 ML/d (under conditions requiring greater supply and Icon Water having capacity to supply)

Based on the projected forecast for Queanbeyan (Offtakes 1 and 2) the following observations are noted:

- Average day demand for Queanbeyan is not forecast to breach the off-peak daily allocation by 2050
- Peak day demand for Queanbeyan is approaching the maximum summer daily demand but does not breach the allocation by 2050

This implies that the allocations set out within the existing service level agreement with Icon Water will be adequate until 2050 based on the projected demands for Queanbeyan. However, the agreed allocations will need to be re-negotiated with Icon Water in the future (post 2050) if the upward demand trend continues for Queanbeyan past 2050.

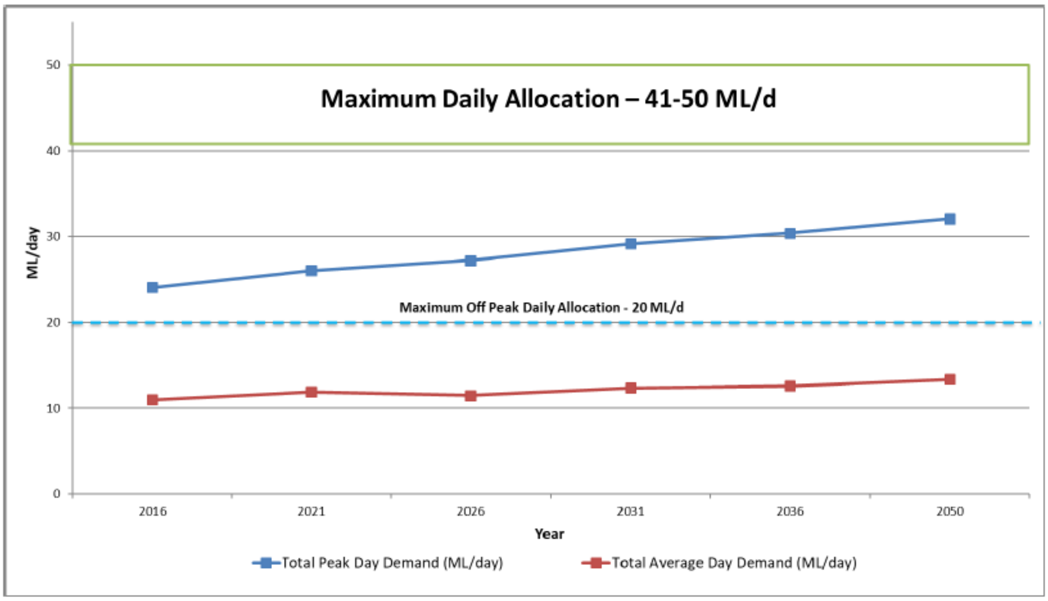

Figure 9-2 Icon Water Service Agreement and Total Peak Day and Average Day Demands

9.3 Impact of Climate Variability

In the future, Icon Water's service area may include additional areas in NSW, such as Yass, Murrumbateman and extended parts of the Queanbeyan-Palerang Regional Council area that are not currently supplied by Icon Water. This possibility has been raised in the past, particularly during the previous drought, and is included in an ACT, NSW and Commonwealth inter-governmental Memorandum of Understanding (MoU) covering the supply of ACT water to NSW. The MoU formalises the existing arrangements to supply Queanbeyan and provides a framework for extending supply to nearby regional towns in NSW over the next 30 years.

If the impacts of climate change become more severe or accelerated in the future, particularly in regards to triggering long-term drought conditions, it is possible that the framework for extending supply to nearby regional towns will be taken up via the inter-governmental MoU and this may in turn increase annual water consumption and accelerate the probability of water restrictions. The implications of this could see Icon Water's regional level of service breached sooner than 2059, which may then impact the availability of bulk water supply to Queanbeyan i.e. increasing regional water security related risks.

The impact of climate variability is therefore considered to be a long-term water security risk for Queanbeyan. There is considered to be time available to appropriately plan and react should climate variability begin to increase the risk. Water security should continue to be monitored into the future as the impacts of climate change become more visible.

9.4 Level of Service Performance

9.4.1 Accessibility and Affordability

The performance against accessibility (water connections available) and affordability (affordable services) remains unverified due to the limited data available. However, it is noted that the affordability of services will be tested in Phase 2 of the IWCM strategy development.

9.4.2 Reliability and Responsiveness

The performance against reliability (number of water main breaks and satisfied customers) remains unverified due to the limited data available.

9.4.3 Sustainability

The performance against sustainability in the context on non-revenue water (NRW) is observed to be poor with NRW estimated at 18% of total system demand based on the Issues Paper investigation. This is above the target LoS of 11%. This indicates a performance issue that requires further discussion and investigation.

The per capita water consumption has remained reasonably consistent over the past few years where measurable (and in the context of annual rainfall). However, the data limitations prevent a thorough analysis so it is difficult to be conclusive on this indicator.

9.4.4 Water Quality

Water quality compliance is reported annually by QPRC against the 2011 ADWG in terms of E.coli and Chemical Compliance as part of the DPI Performance Monitoring [18, 19, 20, 21 & 22], which is shown in **Table 9-1**. This illustrates E.Coli Compliance and Chemical Compliance has been achieved from 2011/12 to 2015/16. The 2015/16 performance data represents the amalgamated performance for Queanbeyan and Palerang and therefore it is difficult to deduce the performance within Queanbeyan during 2015/16.

Table 9-1 Reported Water Quality Compliance

E.coli Compliance (% Population)				Chemical Compliance Achieved?			
2011/12	2013/14	2014/15	2015/16*	2011/12	2013/14	2014/15	2015/16
100%	100%	100%	100%	Yes	Yes	Yes	Yes

Notes: * 2015/16 data represents the amalgamated performance for Queanbeyan and Palerang

The 2017 Annual Drinking Water Management System (DWMS) report [29] documents 2017 water quality monitoring results and water quality customer complaints, from which a summary has been extracted as shown below in Table 9-2 and Table 9-3. Key messages related to the 2017 annual report include:

- Water Quality Monitoring – there were repeated (x36) free chlorine failures in Queanbeyan during 2017 which is considered to represent a sustained water quality issue that requires further consideration.
- Water Quality Complaints – there was a taste and odour issue reported in 2017 and this was believed to be due to the presence of Geosmin. There is also considered to be inadequate advance notice / visibility provided by Icon Water to inform and manage Queanbeyan customers in response to water quality related incidents and events.

Table 9-2 Summary of 2017 Water Quality Monitoring Results

Parameter	Location	Min	Max	Mean	Median	5th %ile	95th %ile	Count	ADWG Limit	Number of exceedances
pH	All	6.34	9.23	7.70	7.68	6.86	8.67	358	6.5-8.5	25
Free Chlorine		0	2.06	0.72	0.70	0.1	1.33	383	0.2-5mg/L	36
Total		0.03	5.5	0.89	0.83	0.19	1.55	383	5mg/L	2

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Parameter	Location	Min	Max	Mean	Median	5th %ile	95th %ile	Count	ADWG Limit	Number of exceedances
Chlorine										
Turbidity		0	7.62	0.04	0.00	0	0	370	5 NTU	1
E. coli	Googong	0	3	0.01	0.00	0	0	384	0 mpn/100mL	1
Total Coliforms		0	70	0.24	0.00	0	0	384	0/mpn/100mL	6

Table 9-3 Summary of 2017 Water Quality Complaints

Month during 2017	Monthly Sum of Complaints			Comments[1]
	T&O	Dirty water	Other	
January				-
February		1	1	-
March				-
April		2		Flushing
May		1		-
June				-
July	1	1		-
August	1	5	1	Mains flushing undertaken until water clear. Works undertaken on mains in areas of Queanbeyan.
September		2	1	-
October		2		-
November		2		-
December	1	1	1	One taste and odour referred to EHO for chemical testing, results returned in normal range. One request for pesticide analysis, results returned no detections.

Based on anecdotal evidence captured from stakeholder interviews there are a number of existing operational risks and/or constraints in relation to network water quality which are summarised as follows:

- Bulk supply from Icon Water's trunk network via Offtake 1 and Offtake 2 is typically supplied from the Mt Stromlo WTP, which is located on the opposite side of Canberra and therefore Offtake 1 and 2 are normally at the extremity of Icon Water's supply network. This represents a risk to maintaining adequate chlorine residual.
- There is a re-chlorination point at Offtake 2 (East Queanbeyan) to manage chlorine residual and reduce water quality risks. Based on the information received there is no re-chlorination point at Offtake 1 (Jerrabomberra) hence this presents an increased water quality risk.
- Homestead Reservoir is normally operated at lower levels between 60-70% due to water quality (low turnover) issues.
- Bushfires represent a threat to Queanbeyan every year and this represents a water quality risk. Further, the fire brigade regularly draws from the network during bushfire events, potentially reducing supply reliability in the network as bushfires coincide with maximum demands.

It is noted that there was no historical information available regarding QPRC's reservoir cleaning schedule.

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The existing water network hydraulic model was reviewed and considered not suitable for undertaking water quality (water age) modelling analysis. Improvement to the currency and accuracy of the water model is required before it can be used with confidence in undertaking water quality modelling.

9.4.5 Health and Safety

There are no historical records or audits available for workplace health and safety (WHS) therefore the performance in regards to the latest WHS audit data could not be reported.

9.5 Asset Capacity Performance

9.5.1 Approach and key assumptions

The existing water network hydraulic model was reviewed and considered not suitable for undertaking asset capacity performance analysis until a number of updates are made to improve the currency and accuracy of the model, including the development of future growth scenarios. An improvement plan for the water model has been recommended concurrently with the Issues Paper.

Therefore the current and future water capacity analysis for the Issues Paper was informed by an agreed ‘first principles’ approach and leveraging the available asset data, telemetry data and anecdotal evidence provided by QPRC stakeholders. Due to limitations in available data the ‘first principles’ analysis was focused on key water network assets, including reservoirs, pump stations and key trunk mains (i.e. Offtakes 1 and 2). Analysis of water reticulation network capacity will be addressed by future modelling that is proposed to be undertaken by QPRC.

A ‘first principles’ analysis approach is considered suitable for the Issues Paper in regards to highlighting likely or potential network performance issues and risks as an indicator and pre-cursor to the subsequent phases of the IWCM strategy development. The ‘first principles’ approach was discussed, developed and agreed with QPRC and DPIE Water prior to undertaking the analysis and with acknowledgment regarding the lack of historical evidenced based data.

It is noted that the recent Council amalgamation has resulted in material data and knowledge loss and therefore represents a legacy issue. This legacy issue cannot be resolved for the Issues Paper and represents a longer-term goal to be resolved over time.

The following data has been leveraged for the water asset capacity performance analysis:

- Asset data – GIS database
- Reservoirs – storage capacity based on water network schematic data provided by QPRC
- Pump stations – pump curves extracted from the existing water network hydraulic model (unverified and accuracy unknown), however the pump curve data in the model has been used due to a lack of more reliable information)
- Offtakes 1 and 2 (Icon Water) – historical bulk water supply flow data

A traffic light approach has been used to highlight potential asset capacity issues as an indicator:

- Green – existing capacity appears sufficient and no further action required
- Yellow – existing capacity appears ‘fair’ or ‘borderline’ and represents a potential issue that requires further investigation
- Red – existing capacity appears insufficient and represents a likely or more prominent issue that requires investigation

9.5.2 Water Reservoirs

Reservoir capacity has been assessed based on the need to maintain a minimum of 2/3 Peak Day Demand (PDD) storage volume as a ‘first principles’ and industry ‘rule of thumb’. This rule of thumb implies that each reservoir should be sized at a minimum 2/3 PDD of the respective Water Supply Zone(s), broken down as follows:

- 1/3 PDD for normal operational storage and day-to-day cycling;
- 1/3 PDD for reserve/emergency storage

The 2/3 PDD volume was calculated for each water supply zone up to 2050 and was compared against the existing capacity of the appropriately supplying reservoir. The reservoir assessment outcome is shown in Table 9-4 and indicates there is sufficient storage available to service customers across all water supply zones up to 2050.

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Table 9-4 Water Reservoir Capacity Assessment

Water Supply Zone	Reservoir Capacity (ML)[1]	Adopted 2/3 PDD Criterion (ML/d)						RESERVOIR CAPACITY CHECK					
		2016	2021	2026	2031	2036	2050	2016	2021	2026	2031	2036	2050
Crest 1	13.5	4.1	4.3	4.4	4.4	4.4	4.4	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
East Q1	12	4.1	4.4	4.4	4.4	4.4	4.4	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
East Q2													
East Q3													
Green 1	1.0	0.3	0.3	0.4	0.4	0.5	0.5	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Green 2													
Home 1	5	1.0	0.9	0.9	0.8	0.8	0.8	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Jerra 1	23	6.3	7.4	8.3	9.7	10.5	11.7	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Jerra 2													
Jerra 3													
Ridgeway	0.8	0.2	0.2	0.3	0.3	0.4	0.4	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Thorn 1	4.6	1.6	1.5	1.5	1.4	1.4	1.4	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Thorn 2													
Thorn 3													

Note:

1. Total reservoir storage volume – assumed to include dead storage and does not account for any unavailable/inaccessible storage volumes

9.5.3 Water Pump Stations

Water pump station capacity has been assessed based on the following 'first principles' rules of thumb:

- High level comparison between the pump station duty flow (extracted from the hydraulic model pump curves) and the PDD for the pump stations downstream supply zone(s). If the pump station duty flow is less than the relevant downstream PDD, then the pump station may be undersized as an indicator.
- Pump duty flow and head - adopted as the middle value in the pump curve data extracted from the hydraulic model.

Table 9-5 Pump Duty Flows

Adopted Pump Data – extracted from the hydraulic model[1]							
Pump 1 – Homestead		Pump 3 - Thornton Tank		Pump 8 - Ridgeway/Carwoola		Greenleigh	
Flow (L/s)	Head (m)	Flow (L/s)	Head (m)	Flow (L/s)	Head (m)	Flow (L/s)	Head (m)
33.3	102	86	72	27.8	170	26.7	34

The pump station capacity assessment outcome is shown in Table 9-6 and indicates there is sufficient pump capacity available to service customers across all water supply zones up to 2050.

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Table 9-6 Water Pump Station Capacity Assessment

Water Supply Zone	Pump Station	PDD Forecast (L/s)						PUMP CAPACITY CHECK					
		2016	2021	2026	2031	2036	2050	2016	2021	2026	2031	2036	2050
Green 1 Green 2	Greenleigh PS	5.9	5.9	6.5	7.1	7.9	7.9	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Home 1	Homestead PS	16.9	15.9	15.2	14.6	14.4	14.4	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Ridgeway	Ridgeway / Carwoola PS	3.3	3.7	4.7	5.7	7	7	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
Thorn 1 Thorn 2 Thorn 3	Thornton PS	26.9	26	25.3	24.9	24.8	24.8	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient

9.5.4 Offtake Trunk Mains

The trunk mains associated with Offtake 1 and Offtake 2 were assessed based on the following 'first principles' rules of thumb:

- If velocity > 2m/s then the trunk main may be undersized as an indicator (acknowledging a velocity higher than 2 m/s may be acceptable in varying situations, therefore any indicative capacity issues should be treated with caution and investigated further during the next phase of the IWCM strategy development)
- Current performance – historical bulk supply flow data was used to derive maximum velocity and headloss per unit distance based on the historical maximum flows observed at Offtake 1 and Offtake 2. The top three historical maximum flows observed from the data available are shown in Table 9-8.
- Future performance - the downstream supply area for Offtakes 1 and 2 was taken to represent the summation of future peak day demand (PDD) in the relevant water supply zones as an indicator (shown in Table 9-9) i.e. balancing of reservoir storages has not been incorporated and should be noted when interpreting the assessment results

The current performance results are shown in Table 9-8 and the results imply that the offtake trunk main capacity currently appears to be sufficient as an indicator. The high velocity and headloss per unit distance experienced by Offtake 2 on 7th March 2013 is an outlier as a flow of this magnitude is seldom experienced based on the historical data.

The future performance results are shown in Table 9-10 and the results imply that the offtake trunk main capacity will remain sufficient into the future as an indicator when subject to projected growth and future demand.

Table 9-7 Offtake Trunk Mains

OFFTAKE	Trunk Main	Length (m)	Notes
OFFTAKE 1	DN750	1,090	Trunk supply to Jerrabomberra Reservoir
OFFTAKE 2	DN375	1,790	Trunk supply to East Queanbeyan Reservoir

Table 9-8 Offtake Trunk Mains – Current Performance Results

OFFTAKE 1				
Bulk Flow Data	Date	Max Flow (ML/d)	Velocity (m/s)	Headloss per unit distance (m/km)
2008 to 2016	20-Jan-13	30.2	0.8	0.72
	11-Sep-12	23.67	0.6	0.45
2016-17	06-Feb-17	19.76	0.5	0.32
OFFTAKE 2				
Bulk Flow Data	Date	Max Flow (ML/d)	Velocity (m/s)	Headloss per unit distance (m/km)
2008 to 2016	7-Mar-13	25.92	2.7	19.01
2016-17	12-Feb-17	5.29	0.6	0.85
2017-18	02-Jul- 17	11.43	1.2	3.78

Note:

1. Calculated using InfoWorks calculator; K = 0.3 (Colebrook White)

Table 9-9 Offtake Trunk Mains – Future Demand Loading (PDD)

OFFTAKE	Demand Loading – PDD (L/s)					
	2016	**2021**	**2026**	**2031**	**2036**	**2050**
OFFTAKE 1	224.8	245.9	260.2	282.9	297.5	318.6

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OFFTAKE 2	81.0	85.1	87.6	89.5	91.9	91.9

Table 9-10 Offtake Trunk Main – Future Performance Results

VELOCITY (m/s)	2016	2021	2026	2031	2036	2050
OFFTAKE 1	0.51	0.56	0.59	0.64	0.67	0.72
OFFTAKE 2	0.73	0.77	0.79	0.81	0.83	0.83

9.5.5 Summary

The existing and future capacity assessment for the key water network assets indicates the following:

- Existing reservoir capacity is currently adequate and appears sufficient to cater for future growth and demand up to 2050
- Existing water pump station capacity is currently adequate and appears sufficient to cater for future growth and demand up to 2050
- Existing trunk main capacity associated with Offtake 1 and Offtake 2 is currently adequate and appears sufficient to cater for future growth and demand up to 2050

Therefore, no material water network capacity related issues have been flagged following the 'first principles' analysis. It is acknowledged that this represents a high level indicative outcome and more robust capacity assessment should be completed to verify these outcomes when the identified data gaps have been resolved. Pump drawdown tests etc. are an alternative approach to verify the initial 'first principles' assessment.

Based on anecdotal evidence captured from stakeholder interviews there does not appear to be any known asset capacity issues in the water network. This is supported by the indicative outcomes of the first principles capacity assessment.

The exception to these indicative outcomes is the consideration of asset criticality, including network capacity related risks associated with critical assets in the event of planned or unplanned events. In particular this includes the following:

- Jerrabomberra Reservoir – considered as a critical asset in terms of the reservoir being the major network storage location for Queanbeyan and Jerrabomberra. Despite the importance and critical nature of this reservoir, it currently lacks a suitable by-pass arrangement and therefore cannot be taken off-line without triggering extensive service continuity risks. The lack of a suitable alternative supply arrangement for Jerrabomberra Reservoir is considered to represent an existing performance issue. This issue is exacerbated by the poor condition of the reservoir including the need to take it off-line for an extended maintenance period. This cannot occur until a suitable by-pass arrangement is implemented.
- Upper Thornton Reservoir, Thornton Pump, Jerrabomberra Reservoir, Greenleigh Reservoir, Greenleigh Pump and East Queanbeyan Reservoir are situation near bushland and have a higher risk of bushfire threat

Future infrastructure required to service Greenfield growth in Tralee and Environa (allocated to Jerra 2 water supply zone for the capacity assessment) is being developed as part of the South Jerrabomberra Development Strategy. This strategy will identify the need for any new trunk infrastructure requirements to service these new development areas in the future, which may be related to more localised risk drivers and should continue to be monitored.

10.0 Sewerage Scheme Capacity and Performance Assessment

10.1 Queanbeyan STP

Quantitative evaluation of the Queanbeyan STP is difficult given the lack of data available for the plant. A brief qualitative discussion of the STP performance is included in **Section 4.3**, which references the recently completed (2016) Queanbeyan STP Masterplan in terms of outlining the need for augmenting the Queanbeyan STP in the future. With reference to the STP Masterplan the key performance issues at the STP are summarised below, which ultimately exacerbate the risk of QPRC not complying with licence conditions:

- The STP undergoes regular maintenance however this is becoming less effective due to increasing asset age which is nearing the end of design life. Despite regular maintenance the poor condition of the existing plant continues to deteriorate. This adds to the risk of failure of one or more of the critical assets within the treatment plant.
- A number of WHS issues are associated with the existing STP that impact operational and maintenance activities and add to the risk of failure of one or more of the critical assets within the treatment plant. As an example it is noted that an operational decision was made several years ago to shut down the anaerobic digesters at the plant for safety reasons.
- Projected growth and development within Queanbeyan is expected to exceed the current STP treatment capacity in the near future. Table 10-1 compares the existing and future forecast EP against the existing STP design capacity. This indicates that the existing STP design capacity (based on EP) is estimated to be exceeded in the short-term. Proposed residential development areas within South Tralee, Forrest, Morrison, and Walsh as well as future industrial and commercial development areas within Poplars, Environa, and North Tralee are expected to become part of the existing STP scheme.

Table 10-1 Existing STP Capacity Performance

	2016	2021	2026	2031	2036	2050
Projected EP	35,873	48,227	50,693	54,204	56,953	60,389
Existing STP Capacity (EP)[1]	34,500	34,500	34,500	34,500	34,500	34,500

Note:

1. Existing STP EP capacity as stated in the MWH Queanbeyan Sewerage Treatment Plant Future Needs Study Final Report [11]

Augmentation of the existing STP is concurrently progressing as part of the Queanbeyan STP Upgrade project given the criticality and high priority placed on the above performance issues. The key drivers outlined in the Queanbeyan STP Upgrade Project Business Case [26] include:

- Improve effluent quality to meet current and expected future licence conditions
- Increase hydraulic/treatment capacity to meet current and expected future growth
- Upgrade and/or replace infrastructure to provide adequate service life (≥ 40 years)
- Improve the robustness, operability and reliability of the treatment plant

10.2 Level of Service Performance

10.2.1 Accessibility and Affordability

The performance against accessibility (sewer connections available) and affordability (affordable services) remains unverified due to the limited data available. However it is noted that the affordability of services will be tested in Phase 2 of the IWCM strategy development.

10.2.2 Reliability and Responsiveness

The performance against reliability (number of sewer overflows due to blockages and satisfied customers) remains unverified due to the limited data available.

10.2.3 Sustainability

The performance against sustainability in the context of sewage overflow volume remains unverified due to the limited data available.

The performance against sustainability in the context of 'treated wastewater generated' is considered poor based on the derived sewer unit loading rate of 264 L/EP/day. There is no specific LOS target defined for 'treated wastewater generated' however the derived sewer unit loading rate is higher than the derived water consumption unit rate (233 L/cap/day). This indicates a performance issue within the sewer network that requires further discussion and investigation. The higher sewer loading rate may be influenced by high base flows in the sewer system. Anecdotal evidence provided by QPRC suggests high inflow-infiltration issues exist in the catchment, which could potentially be a result of the following:

- Declining condition of sewer network assets over time, including tree root penetration.
- Higher rates of groundwater infiltration, particularly in lower lying parts of the system that are close to the water table.
- NRW (leakage) from the potable water system potentially infiltrating the sewer system.

10.2.4 Overflows

The performance against the number of sewage overflows per year remains unverified due to the limited data available.

10.2.5 Health and Safety

There are no historical records or audits available for workplace health and safety (WHS) therefore the performance in regard to the latest WHS audit data could not be reported.

A number of WHS issues are associated with the existing STP that impact operational and maintenance activities and this is discussed further in Section 10.1.

10.3 Asset Capacity Performance

10.3.1 Approach and key assumptions

The existing sewer network hydraulic model was reviewed and considered not suitable for undertaking asset capacity performance analysis until a number of updates are made to improve the currency and accuracy of the model, including the development of a wet weather component and future growth scenarios. An improvement plan for the sewer model has been recommended concurrently with the Issues Paper.

Therefore the current and future sewer capacity analysis for the Issues Paper was informed by an agreed 'first principles' approach and leveraging the available asset data, telemetry data and anecdotal evidence provided by QPRC stakeholders. Due to limitations in available data the 'first principles' analysis was focused on key sewer network assets, including pump stations, trunk rising mains and gravity carriers. Analysis of sewer reticulation network capacity will be addressed by future modelling that is proposed to be undertaken by QPRC.

A 'first principles' analysis approach is considered suitable for the Issues Paper in regards to highlighting likely or potential network performance issues and risks as an indicator and pre-cursor to the subsequent phases of the IWCM strategy development. The 'first principles' approach was discussed, developed and agreed with QPRC and DPIE Water prior to undertaking the analysis and with acknowledgment regarding the lack of historical evidenced based data.

It is noted that the recent Council amalgamation has resulted in material data and knowledge loss and therefore represents a legacy issue. This legacy issue cannot be resolved for the Issues Paper and represents a longer-term goal to be resolved over time.

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The following data has been leveraged for the water asset capacity performance analysis:

- Asset data – GIS database
- Pump stations – QPRC SPS summary details spreadsheet, Morisset St SPS Pump Runtimes (March 2012 to July 2019), Queanbeyan SPS Run times (collated runtimes for the remaining SPS's for varied lengths of time), SPS 9C (January 2019 to July 2019) and SPS 9D flows (September 2018 to July 2019),
- Rising mains and gravity carriers – historical bulk water supply flow data

A traffic light approach has been used to highlight potential asset capacity issues as an indicator:

- Green – existing capacity appears sufficient and no further action required
- Yellow – existing capacity appears 'fair' or 'borderline' and represents a potential issue that requires further investigation
- Red – existing capacity appears insufficient and represents a likely or more prominent issue that requires investigation

10.3.2 Sewer Pump Stations

The sewer pump stations were assessed based on the following 'first principles' rules of thumb:

- Assessment of dry weather periods: if pump is running for greater than 3.5 hours per day it is considered to be running at capacity
- Assessment of wet weather periods: if the pump is running for 24 hours per day then it is considered to be running at capacity
- If the dry weather, peak dry weather or peak wet weather exceed the duty flow/design capacity of the pump then it is considered to be at capacity

The pump run times were provided for the Queanbeyan pumping stations for varied lengths of time.

10.3.2.1 Morisset St SPS

The Morisset St SPS is the largest pump station in the network and therefore has been assessed separately. A summary of the Morisset St SPS performance based on available run times is found in Table 10-2. Based on the existing Morisset St SPS runtimes, the four pumps (2 duty and 2 standby) have not been running for greater than 24 hours on any given day. The percentage of days that the pump runs for greater than 3.5 hours on a dry day is negligible and therefore is considered acceptable as an indicator.

Table 10-2 Morisset St SPS Performance – based on run times

	Morisset St SPS			
	Pump 1 (standby)	Pump 2 (standby)	Pump 3 (duty)	Pump 4 (duty)
Maximum Run Time	17 hrs	7 hrs	21 hrs	21 hrs
% of time pump is off	60%	60%	37%	36%
Wet Days > 24 hour run time[1]	0	0	0	0
Dry Days >3.5 hrs run time[2]	62	36	102	80
% of dry days > 3.5 hours[1]	2%	1%	4%	3%

Note:

1. Based on dataset length from March 2012 to July 2019
2. Number of days where the pump has been running for 24 hours on a day labelled "wet"
3. Number of days where the pump has been running for greater than 3.5 hours on a day labelled "dry"

The Morisset St SPS performance was also assessed referencing the pump station duty point (460 L/s) and is shown in Table 10-3. The duty flow was assessed against the Morisset St catchment flows and the total upstream catchment flows that drain to the Morisset St SPS.

The assessment indicates that future PWWF loading is likely to exceed the duty flow of the SPS from approximately 2021 onwards. This highlights the large PWWF generated from the Morisset St catchment.

Table 10-3 Morisset St SPS Performance – based on Duty Flow

Morriset St SPS						
Morriset St Catchment Flows	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
ADWF (L/s)	42	53	54	55	55	55
PDWF(L/s)	80	101	102	104	105	105
PWWF (L/s)	417	520	528	535	542	542
Total Upstream Catchment Flows[1]	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
ADWF (L/s)	63	79	80	81	82	82
PDWF(L/s)	129	161	164	166	168	168
PWWF (L/s)	612	759	771	780	790	790

Note:

1. Upstream catchments based on interpretation of the sewer schematic developed by AECOM – summation of Erin St (Pump 13), Kathleen St (Pump 7), Lochiel St (Pump 6) & River Dr (Pump 8), Morisset St (Pump 1), Regent Dr (Pump 12), Weetalabah Dr (Pump 15) & Woodland Ave (Pump 14) flows

10.3.2.2 Remaining SPS

The known duty flows for the remaining sewer pump stations have been assessed against the current and future projected ADWF, PDWF, PWWF based on the total upstream catchment flows that drain to each respective pump station. The outcome of this assessment is shown in Table 10-4 and indicates the following potential performance issues:

- Banyalla Cl – Pump 11: current and future PWWF loading is indicated to exceed the duty flow
- Kathleen St – Pump 7: current and future PWWF loading is indicated to exceed the duty flow

In addition, it is noted that future performance issues may be experienced at Bayside Ct – Pump 9 as there is significant growth forecast by 2050 in the Bayside Ct catchment. The pump station duty flow data was not available for Bayside Ct – Pump 9 and therefore capacity performance was not able to be assessed. However, given the scale of growth in the catchment, further investigation should be undertaken to verify the future performance issue indicated at Bayside Ct – Pump 9.

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Table 10-4 SPS Duty Flow Assessment

Supra Catchments	Duty Flow (L/s)	ADWF (L/s)[1]						PDWF (L/s)[1]						PWWF (L/s)[1]					
		2016	2021	2026	2031	2036	2050	2016	2021	2026	2031	2036	2050	2016	2021	2026	2031	2036	2050
Jerrabomberra 9D (Banyalla Cl – Pump 11)	9.4	1.0	1.1	1.2	1.2	1.2	1.2	3.6	4.1	4.1	4.1	4.1	4.1	8.7	9.9	9.9	9.9	9.9	9.9
Jerrabomberra 9C (Bellbush Cl – Pump 10)	32.0	2.3	2.7	2.7	2.7	2.7	2.7	7.7	8.9	9.0	9.0	9.0	9.0	19.5	22.7	22.8	22.8	22.8	22.8
Blundell St (Pump 13)	22.0	0.8	1.3	1.4	1.5	1.6	1.6	2.6	4.2	4.5	4.8	5.2	5.2	8.6	13.6	14.6	15.7	16.8	16.8
Kathleen St (Pump 7)	95.0	14.4	17.0	17.2	17.3	17.4	17.4	31.8	37.8	38.1	38.3	38.5	38.5	134.1	159.2	160.4	161.3	162.3	162.3
Morisset St (Pump 1)	460.0	63.2	78.9	80.1	81.2	82.3	82.3	129.4	161.3	163.9	166.1	168.3	168.3	612.2	759.0	770.6	780.4	790.3	790.3
East Weetalabah 2 (Weetalabah Dr – Pump 15)	3.7	0.2	0.3	0.3	0.3	0.4	0.4	0.6	0.8	0.9	1.0	1.1	1.1	1.6	2.2	2.4	2.7	3.0	3.0

Note:

1. Based on total upstream catchment flows draining to the respective SPS. The attenuation of the flow due to the upstream pumps is not considered which would affect the flows received at each SPS respectively, however this has not been considered in this analysis due to the lack of telemetry data.

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Assessment of historical runtimes for wet and dry days for the remaining SPSs is shown in Table 10-5 as a further performance indicator. There are eight SPSs which have experienced day(s) where the pump has run for 24 hours, although these do not appear to occur on wet days. All pump stations exhibit runtimes over 3.5 hours on multiple dry days, however this is relatively insignificant compared to the total number of times the pumps have been run as recorded in the dataset and is therefore considered to be immaterial and acceptable.

Table 10-5 SPS Runtime Assessment

			Pump 1		Pump 2		
SPS	**No. of Pumps**	**Max Runtime (hrs)**	**Wet Days > 24 hour run time[1]**	**Dry Days >3.5 hrs run time[2]**	**Wet Days > 24 hour run time[1]**	**Dry Days >3.5 hrs run time[2]**	**Total no. of pump runtimes[3]**
Arc	2	24	0	11	0	10	2064
Barber St	2	20	0	14	0	14	2095
Bayside Ct	2	24	0	36	0	55	2061
Blundell St	2	24	0	4	0	6	2085
Captial Tce	2	12	0	4	0	6	2014
Jerra 9C	2	22	0	3	0	29	1908
Jerra 9D	2	24	0	350	0	84	1655
Kathleen St	2	24	0	136	0	142	2028
Kingsway	2	24	0	7	0	3	2088
Lochiel St	2	24	0	3	0	25	2074
River Dr	2	14	0	4	0	4	2117
Weetalabah SPS 1	2	24	0	46	0	38	2041
Weetalabah SPS 2	2	24	0	218	0	165	1913
Yass Road	2	15	0	24	0	3	1994

Note:

1. Number of days where the pump has been running for 24 hours on a day labelled "wet"
2. Number of days where the pump has been running for greater than 3.5 hours on a day labelled "dry"
3. Total number of runtimes in the dataset for each respective pump

Daily inflows for SPS 9C and SPS 9D have been analysed over a period of 8 months and 11 months respectively, based on the data available. There is uncertainty on the appropriate flow units associated with the inflows i.e. average daily inflow or instantaneous peak flow during the day. Regardless of this uncertainty, the maximum flow value recorded in the datasets is noted in Table 10-6 and appears to be well below the duty flow of each pump station.

Table 10-6 SPS 9D and SPS 9C performance – based on daily inflows

	Max Recorded Flow Value	Duty Point (L/s)
SPS 11 (9D)	1.0	9.36
SPS 9C	1.9	32

10.3.2.3 SPS Criticality

In terms of asset criticality, the following risks have been identified for critical SPS assets in the event of planned or unplanned events:

- River Dr (Pump 8), Lochiel St (Pump 6), Kathleen St (Pump 7), Morisset St (Pump 1), Blundell St (Pump 13), ARC (Pump 2) SPS's are all situated near Queanbeyan River and therefore have a higher flooding risk.
- Kingsway (Regent Dr) (Pump 12), Weetalabah 1 (Woodland Ave – Pump 14), Weetalabah 2 (Weetalabah Dr – Pump 15) SPS's are situated near bushland and have a higher risk of bushfire threat.

10.3.3 SPS Emergency Storage

SPS emergency storages, including wet wells, were assessed based on the following assumptions and rules of thumb:

- Minimum of 4 hours of storage required under ADWF conditions
- The volumes of the wet wells/emergency storages have been calculated based on the assumption that they are cylindrical in shape.
- The dimensions provided by QPRC for the different wet wells/emergency storage have been used in the calculations. Where there are no emergency storages or dimensions for the emergency storages, the wet well dimensions have been used to assess the hours of storage as an indicator.
- The hours of storage are based on the ADWF loading of the relevant supra catchment (i.e. not an accumulation of ADWF from upstream catchments that ultimately drain to the SPS)

The assessment of SPS storages is found in Table 10-7. There are seven SPS's that are observed to exhibit less than 4 hours of storage over current and future horizons as an indicator, with the exception of Jinaroo St – Pump 2 which begins to exhibit less than 4 hours storage from 2021 onwards.

Table 10-7 SPS Storage Assessment

Supra Catchment	Volume (L)	SPS Storage	Hours of Storage					
			2016	2021	2026	2031	2036	2050
Banyalla Cl – Pump 11	8588	Emergency Storage	2.4	2.1	2.1	2.1	2.1	2.1
Barbar St – Pump 5	2987	Emergency Storage	1.6	0.9	0.9	0.9	0.9	0.9
Bayside Ct – Pump 9	18907	Wet Well	1.5	0.4	0.3	0.2	0.2	0.1
Bellbush Cl – Pump 10	31755	Emergency Storage	6.7	5.7	5.7	5.7	5.6	5.6
Capital Tce - Pump 3	Dimensions not provided	Wet Well	-	-	-	-	-	-
Erin St – Pump 13	24740	Wet Well	7.6	6.7	6.6	6.6	6.5	6.5
Jinaroo St – Pump 2	6362	Emergency Storage	6.0	3.3	3.2	3.1	3.1	3.1
Kathleen St – Pump 7	25845	Wet Well (no emergency storage)	0.5	0.4	0.4	0.4	0.4	0.4
Lochiel St – Pump 6, River Dr – Pump 8	15678	Wet Well	0.9	0.7	0.7	0.7	0.6	0.6
Morriset St – Pump 1	1123220	Wet Well	7.4	5.8	5.8	5.7	5.6	5.6

Supra Catchment	Volume (L)	SPS Storage	Hours of Storage					
Regent Dr – Pump 12	8906	Wet Well	21.9	9.1	8.7	8.5	8.3	8.3
Weetalabah Dr – Pump 15	7507	Wet Well	10.8	7.9	7.1	6.4	5.8	5.8
Woodland Ave – Pump 14	19204	Wet Well	18.0	11.3	9.9	8.6	7.6	7.6
Yass Rd – Pump 4	8359	Emergency Storage	2.2	1.6	1.6	1.6	1.6	1.6

10.3.4 Sewer Rising Mains

Sewer rising mains have been assessed based on the following assumptions and rules of thumb:

- Rising mains experiencing greater than 2m/s velocity is considered to be undersized and are suggested to be upsized. This may in theory be acceptable in varying situations, however this has been used to baseline our assessment to highlight potential issues to be considered in the next phase of the project.
- The historical run time records for the pump stations were used to convert into a flow rate using the duty flow for the pump station to calculate the velocity. This was completed for the pumps where duty flow information was available.

Current performance for each of the pump station rising mains has been assessed based on historical runtime data as shown in Table 10-8. Based on the assessment, Blundell St (Pump 13) rising main and Kathleen St (Pump 7) rising main are indicated to experience maximum velocities greater than 2m/s, although this velocity is not experienced frequently and is therefore considered to be a low performance risk as an indicator.

Future performance for each of the pump station rising mains has been assessed based on the future forecast PDWF loading as shown in Table 10-9. With the exception of Bayside Ct - Pump 9 rising main, there are no performance issues noted for the future as an indicator. Bayside Ct - Pump 9 rising main represents a longer term consideration due to the significant growth allocated to this catchment and should be further explored in the next phase of the project.

Table 10-8 Current Rising Main Performance

Supra Catchment	Duty Flow (L/s)	Rising Main Diameter (mm)	Length (m)	Max Run Time	Max Flow Rate (L/s)	Max Velocity (m/s)
Jerrabomberra 9D (Banyalla Cl – Pump 11)	9.4	100	382.1	24	9.4	1.19
Jerrabomberra 9C (Bellbush Cl – Pump 10)	32.0	150	177.6	22	29.3	1.66
Blundell St (Pump 13)	22.0	100	135.2	24	22.0	2.80
Kathleen St (Pump 7)	95.0	225	160	24	95.0	2.39
Morriset St (Pump 1)	460.0	600	398.3	21	408	1.44
East Weetalabah 2 (Weetalabah Dr – Pump 15)	3.7	75	783.6	24	3.7	0.84

Table 10-9 Future Rising Main Performance

Supra Catchment	Rising Main Diameter (mm)	Rising Main Length (m)	Velocity (m/s)					
			2016	2021	2026	2031	2036	2050
Banyalla Cl - Pump 11	100	382.1	0.5	0.5	0.5	0.5	0.5	0.5

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Supra Catchment	Rising Main Diameter (mm)	Rising Main Length (m)	Velocity (m/s) 2016	2021	2026	2031	2036	2050
Barbar St - Pump 5	225	164.3	0.0	0.1	0.1	0.1	0.1	0.1
Bayside Ct - Pump 9	225	620.4	0.2	0.9	1.1	1.4	1.8	2.3
Bellbush Cl - Pump 10	150	177.6	0.2	0.3	0.3	0.3	0.3	0.3
Capital Tce - Pump 3	225	238.7	0.0	0.0	0.0	0.0	0.0	0.0
Erin St - Pump 13	100	135.2	0.5	0.5	0.5	0.5	0.5	0.5
Jinaroo St - Pump 2	300	336.9	0.0	0.0	0.0	0.0	0.0	0.0
Kathleen St - Pump 7	225	160.0	0.8	1.0	1.0	1.0	1.0	1.0
Lochiel St - Pump 6; River Dr - Pump 8	300	113.6	0.2	0.2	0.2	0.2	0.2	0.2
Morriset St - Pump 1	600	398.3	0.3	0.4	0.4	0.4	0.4	0.4
Regent Dr - Pump 12	150	114.2	0.0	0.1	0.1	0.1	0.1	0.1
Weetalabah Dr - Pump 15	75	264.2	0.1	0.2	0.2	0.2	0.2	0.2
Woodland Ave - Pump 14	75	783.6	0.2	0.3	0.3	0.3	0.4	0.4
Yass Rd - Pump 4	200	195.2	0.1	0.1	0.1	0.1	0.1	0.1

10.3.5 Summary

The existing and future capacity assessment for the key sewer network assets shows that:

- Morriset St SPS - the cumulative current and future PWWF loading upstream of the SPS is indicated to exceed the pump station duty flow from 2021 onwards.
- Banyalla Cl – Pump 11 - current and future PWWF loading is indicated to exceed the pump station duty flow
- Kathleen St – Pump 7 - current and future PWWF loading is indicated to exceed the pump station duty flow
- Bayside Ct – Pump 9 – the pump station duty flow data was not available and therefore the capacity performance of the pump station was not able to be assessed. However, there is significant growth projected in the Bayside Ct catchment by 2050 and this in itself represents a future performance risk, including for the associated rising main. Further investigation should be undertaken when further data is available to verify this potential future performance issue.
- SPS storage - seven SPS's exhibit less than 4 hours storage as an indicator, which is below the minimum requirement as a rule of thumb. This performance issue is indicated at both the current and future planning horizons, with the exception of Jinaroo St – Pump 2 which appears to exhibit less than 4 hours storage from 2021 onwards
- Blundell St (Pump 13) rising main - exhibits maximum velocity greater than 2m/s as an indicator, although this is not experienced frequently based on historical data and is therefore considered to represent a low performance risk as an indicator.
- Kathleen St (Pump 7) rising main - exhibits maximum velocity greater than 2m/s as an indicator, although this is not experienced frequently based on historical data and is therefore considered to represent a low performance risk as an indicator.

Current and future capacity performance risks have been highlighted as an indicator for sewer pump stations and associated storages and rising mains. Further assessment should be undertaken when more data becomes available in order to verify the initial high-level 'first principles' analysis outcomes.

In support of the 'first principles' analysis, the 2015 Sewer Asset Management Plan has identified deficiencies associated with a number of key assets in the sewer network. These assets are scheduled for upgrade and/or renewal as listed in Table 10-10 below.

Table 10-10 List of Identified Sewer Asset Upgrades and/or Renewal (2015 Sewer AMP)

Sewer Pump Stations (SPS)	Sewer Trunk Mains
Barber St SPS	South Jerrabomberra Trunk Main
Capital Terrace SPS	Sewer rising mains – for each of the identified SPS's
Lochiel St SPS	-
River Drive SPS	-
Kingsway SPS	-
Bayside Court SPS	-
Kathleen St SPS	-
ARC SPS	-
Blundell St SPS	-

Future infrastructure required to service Greenfield growth in Tralee and Environa is being developed as part of the South Jerrabomberra Development Strategy. This strategy will identify the need for any new trunk sewer infrastructure requirements to service these new development areas in the future, which may be related to more localised risk drivers and the outcomes of this strategy should continue to be monitored.

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11.0 IWCM Issues

The IWCM Issues tables for Water, Sewerage and Stormwater are found in **Table 11-1**, **Table 11-2**, **Table 11-3** and **Table 11-4**. Refer to **Appendix B** for a full listing of highlighted data gaps against the IWCM checklist.

11.1 General IWCM Issues

Table 11-1 General IWCM System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Operating Performance	• Levels of Service (LOS) specified are preliminary and yet to be formally adopted. There are also a number of gaps identified within the preliminary LOS which would need to be resolved prior to adopting. • The majority of data required to report on annual operating performance against LOS has not been collected to date. • Preliminary LOS are specific for customers within the former Queanbeyan LGA and differ from the LOS adopted for the former Palerang LGA. The adoption of a single LOS should be considered by QPRC. • The Drinking Water Management System (DWMS) reporting has not yet been finalised by QPRC. • There is no formal procedure currently documented in QPRC's business management system to cover emergency situations (i.e. sewer overflows, contaminated water etc.).

11.2 Water Supply Issues

Table 11-2 Water Supply System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Bulk Supply Service Level Agreement (Icon Water)	• Service level agreement with Icon Water is not reflective of the current supply arrangements (i.e. agreed service levels for Offtake 3 - Googong remain undefined). • The specified water quality targets do not match QPRC's NSW water quality guidelines or Queanbeyan's water quality plan • Currently the bulk supply agreement states that QPRC will comply with ACT water restrictions. This should be mandated via a QPRC ruling made under the Local Government Act.

Issue Type	Target for Compliance	Issue
	Water Quality	• Bulk water is typically supplied from the Mt Stromlo WTP, which is located on the opposite side of Canberra and this represents a risk to maintaining adequate chlorine residual – based on the information received there is no re-chlorination point at Offtake 1 (Jerrabomberra) hence this presents an increased water quality risk. • Water quality parameters i.e. chlorine residual, are not currently featured in the Icon Water Service Level Agreement. • The DWMS Annual Report (2017) has identified a taste and odour issue believed to be due to the presence of Geosmin. • There is inadequate visibility/advance notice from Icon Water to inform/manage customers in the event of a bulk supply water quality incident. • The DWMS Annual Report (2017) has documented repeated free chlorine failures in Queanbeyan which represent a water quality management issue.
	Water Supply Security	• Appropriate level of service criteria for water supply security in Queanbeyan needs to be defined (with reference to the bulk supply from Icon Water). • The impact of climate variability, whilst considered to be a long-term water security risk for Queanbeyan, should continue to be monitored into the future as the impacts of climate change become more visible.
	Reliability	• There is insufficient data available to verify and report on performance against water main breaks. • Jerrabomberra Reservoir lacks a suitable by-pass arrangement and therefore cannot be taken off-line during planned or unplanned events without triggering extensive service continuity (reliability) risks. Jerrabomberra Reservoir represents a critical network asset. • Upper Thornton Reservoir, Thornton Pump Station, Jerrabomberra Reservoir, Greenleigh Reservoir, Greenleigh Pump Station and East Queanbeyan Reservoir are situation near bushland areas and this represents a higher risk of bushfire threat and service continuity (reliability) risk i.e. these assets are considered to be more vulnerable to bushfires.
	Sustainability	• The performance against sustainability in the context on Non-Revenue Water (NRW) is observed to be relatively poor with NRW estimated at 18% of total system demand. This is above the target LoS of 11%. NRW averaged at 114 L/connection/day over a five year historical period and this is considered high. The high NRW observed may be representative of a lack of maintenance and renewal on the water network and therefore a higher rate of leakage.

Issue Type	Target for Compliance	Issue
Performance	Water Consumption Behaviour	• Time lag in the metered consumption data when compared to the bulk supply meter data may be due to the customer billing period, which occurs in the quarter following the meter-reads, hence impacting the way the data is labelled for billing purposes. This may represent a business process improvement. • A check in the rolling number of residential property meters per quarter highlighted a drop of around 500 property meters in the first quarter of FY16/17, followed by an increase of 690 property meters in Q2 of FY16/17. This may indicate a change in metering during this quarter and is subject to confirmation. • Analysis of the historical water consumption dataset has identified that high-density related consumption has been evenly distributed from the parent property to its child properties. An even distribution may not be representative of the individual child property consumption trends. • Bulk meter readings recorded as zero on particular days for one offtake and provide a positive reading for the second offtake. It is difficult to determine if this is due to one of the offtakes being shut down, zero draw from that offtake on that particular day, or bulk flow meter failure. Also there is unusually high bulk supply readings observed on several occasions and the reason for this remains unclear. • It remains unclear if permanent water conservation measures have been implemented by Council post-millennium drought and the extent to which water conservation measures may be influencing recent water consumption trends and behaviours remains unclear.
	Asset Capacity	• Given the extent of data gaps highlighted it is difficult to assess the current and future capacity of the existing water network assets at a quantitative or more granular level. This includes for water reservoirs, pump stations and trunk mains. As a result, a 'first principles' qualitative approach has been adopted for the Issues Paper. This is considered suitable as an initial indicator of asset capacity issues and will need greater rigour / improved confidence applied in subsequent phases of the IWCM to verify the 'first principles' outcomes before a commitment to investment is made. This will be reliant on further asset data and field data (i.e. telemetry data, drawdown tests etc.) being made available for the sewer network assets to verify the indicative capacity assessment. • Given the extent of growth forecast for Queanbeyan over the next 30 years it is expected that new drinking water network infrastructure will be required to extend service to the major Greenfield developments proposed at Tralee, Environa and South Jerrabomberra, including trunk lead-in assets and reticulation networks. • No material water network capacity related issues have been flagged following the 'first principles' analysis. However, more robust capacity assessment should be completed once a number of asset data and telemetry data gaps have been resolved. Pump drawdown tests etc. are an alternative approach to confirm and verify the indicative high-level water network capacity assessment.

Issue Type	Target for Compliance	Issue
		• The existing water model requires validation of the trunk network and controls to better align the interaction of the bulk supply offtakes, reservoirs and pump stations within the network (before it can used with confidence for reporting on asset capacity related performance)

11.3 Sewerage System Issues

Table 11-3 Sewerage System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Sewer Agreement 1905	• The agreement covers discharges from Oaks Estate in the ACT however there are gaps in this agreement, including the absence of any mandate on Oaks Estate customers to pay QPRC for their sewerage service.
	Health and Safety (overflows)	• The performance against the number of sewage overflows per year remains unverified due to the limited data available. The existing sewer model is not fit for modelling surcharges in the system.
	Health and Safety (WHS)	• The performance in regard to the latest WHS audit remains unverified due to the limited data available. • Queanbeyan STP - changes in legislative WHS for operator safety represents an issue in regards to the continuing operation of the existing Queanbeyan STP, which is an old plant reaching the end of its design life.
	Reliability	• There is insufficient data available to verify and report on overflows due to sewer chokes. The existing sewer model is not suitable for modelling surcharges in the system. • Queanbeyan STP - quantitative analysis of the existing STP performance against reliability is difficult given the lack of data however anecdotal evidence suggests that it is an old plant reaching the end of its design life and the condition of various assets within the plant is making operation and maintenance of the STP difficult and expensive. Ultimately this represents an increasing service continuity (reliability) risk.
	Sustainability	• Targets needs to be defined for benchmarking sustainability performance of the system. • There is no specific LOS target defined for sustainability however the derived unit rate for sewer at 264 L/EP/day is higher than the derived unit rate for water (233 L/cap/day). This indicates a potential performance issue within the sewer network (i.e. high baseline infiltration & inflow) that requires further discussion and investigation
Trade Waste	Trade Waste	• The annual trade waste performance report is currently not provided.
Best Practice	Section 60 Approvals	• There is no effluent re-use currently in place at Queanbeyan STP.

Issue Type	Target for Compliance	Issue
Performance	Asset Capacity - Queanbeyan STP	• Some discrepancy is noted for the future EP projections between the STP Master Plan and the IWCM Issues Paper investigations and this may represent a risk to the outcomes of each project if key inputs and assumptions are not considered compatible. • EPA Licence Compliance – there is insufficient data available to benchmark the existing STP performance against environmental licence conditions. • Based on anecdotal evidence and historical sewer inflow data the Queanbeyan STP is very close to exceeding its existing design capacity, however the precise status remains unverified as evidence-based data was not available at the time. Regardless, the anecdotal evidence and projected growth forecast represents a capacity issue for Queanbeyan STP in the very near future.
	Asset Capacity - Sewer Network	• There is conflicting data pertaining to the number of sewer connections per sewer catchment. However, the QPRC customer billing dataset has been used to derive the number of sewer connections as it is considered more reliable than the number of connections historically reported as part of annual DPI performance data. • Given the extent of data gaps highlighted it is difficult to assess the current and future capacity of the existing sewer network assets at a quantitative or more granular level. This includes for sewer pump stations, trunk rising mains and gravity carriers. As a result, a 'first principles' qualitative approach has been adopted for the Issues Paper. This is considered suitable as an initial indicator of asset capacity issues and will need greater rigour / improved confidence applied in subsequent phases of the IWCM to verify the 'first principles' outcomes before a commitment to investment is made. This will be reliant on further asset data and field data (i.e. telemetry data, drawdown tests etc.) being made available for the sewer network assets to verify the indicative capacity assessment. • Based on the outcomes of the 'first principles' asset capacity analysis the following sewer network capacity related issues have been flagged as an indicator for further consideration: - Morriset St SPS: the cumulative current and future PWWF upstream of the SPS is indicated to exceed the duty flow. This is reinforced by the Morriset St catchment flows indicated to exceed the duty flow from 2021 onwards. - Banyalla Cl – Pump 11 and Kathleen St – Pump 7: current and future PWWF is indicated to exceed the duty flow. - Bayside Ct – Pump 9: the pump station data including duty flow was not available and therefore pump performance was not able to be assessed. However, there is significant growth forecast to 2050 in the Bayside Ct catchment, which is conducive to a potential future capacity issue. The rising main associated with Bayside Ct – Pump 9 is indicated to exceed 2 m/s velocity in 2050 due to the significant growth allocated to this catchment. Further investigation should be undertaken to validate this capacity issue when sufficient data is made available. - SPS emergency storage: 7 x SPSs are indicated to have less than 4 hours of emergency storage (as a minimum

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Issue Type	Target for Compliance	Issue
		requirement) under both current and future planning horizons. - South Jerrabomberra Trunk Sewer Main - future development will likely trigger a need for the Jerrabomberra Trunk Sewer Main capacity to be upgraded to accommodate the increase in growth and sewer loading. • The 2015 Sewer Asset Management Plan has identified a number of key assets within the sewer network with deficiencies and these are scheduled for future upgrade and/or renewal. This includes the South Jerrabomberra Trunk Main and nine (9) sewer pump stations including associated rising mains. • A sewer inspection and relining program has been undertaken for the Queanbeyan scheme with the aim of reducing inflow and infiltration. Internal analysis undertaken by QPRC in 2018 did not identify any material improvement in inflow or infiltration as a result of the program (noting that relining/refitting of manholes was not undertaken as part of the program). • Given the extent of growth forecast for Queanbeyan over the next 30 years it is expected that new sewer network infrastructure will be required to extend service to the major Greenfield developments proposed at Tralee, Environa and South Jerrabomberra, including trunk lead-in assets and reticulation networks. • The existing sewer model requires extensive update and validation before it can used with confidence for reporting on asset capacity related performance.

11.4 Stormwater System Issues

Table 11-4 Stormwater System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Performance Measures – Customer/ Technical	• Remain undefined. Targets yet to be established. • Development Design Specifications for Stormwater Drainage Design and Erosion Control and Stormwater Management do not specifically address waterway stability or refer to best practice stormwater management for waterway health.
System Performance	Quality	• Periodic blooms of toxic blue green algae in Lake Jerrabomberra and Lake Burley Griffin, posing public safety, amenity and environmental concern.
	Waterway Erosion	• Waterway erosion upstream of Lake Jerrabomberra due to high flows and vegetation loss
	Nuisance Flooding	• Letchworth Regional Park prone to surcharging due to high stormwater flows lifting off the stormwater pit lids. • Stormwater drainage networks within some of the older areas (Crestwood, Queanbeyan, etc.) are prone to nuisance

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Issue Type	Target for Compliance	Issue
		flooding and surcharging
	Asset condition	• Stormwater asset valuation may contain some elements from other systems which cannot be easily identified from the asset database.
	Overland and Mainstream Flooding	• Potential for flooding in Queanbeyan CBD, impacting up to 50 residential properties and extensive areas of commercial development based on the Queanbeyan Floodplain Risk Management Plan. • The existing stormwater model requires extensive update and validation before it can used with confidence for reporting on asset capacity and flooding related performance.

12.0 References

1. **NSW DPI Water,** New South Wales (NSW) Government's Best Practice Management of Water Supply and Sewerage Framework, (2016) http://www.water.nsw.gov.au/__data/assets/pdf_file/0005/549608/BPMF.pdf
2. **NSW DPI Water,** Integrated Water Cycle Management Checklist, 2014 http://www.water.nsw.gov.au/__data/assets/pdf_file/0008/549566/utilities_cycle_iwcm_checklist.pdf
3. **Destination Marketing Store/QPRC**, Queanbeyan-Palerang Regional Council – Tourism Plan 2017-2025: Supporting the Visitor Economy (2017)
4. **QPRC,** Palerang Community – Integrated Water Cycle Management Issues Paper (2017)
5. **RPS,** Water Management Plan – Googong Township Integrated Water Cycle Project (2015)
6. **Queanbeyan City Council/ACTEW Corporation,** Supply of Potable Water to the City of Queanbeyan – Service Level Agreement (SLA) (2009)
7. **QCC**, Queanbeyan Design Specifications (2013), https://www.qprc.nsw.gov.au/Building-Development/Engineering-design-and-construction-specifications
8. **Office of the Commissioner for Sustainability and the Environment**, Report on the state of water courses and catchments for Lake Burley Griffin, 2012
9. **Icon Water**, Annual Drinking Water Quality Report 2016-17 https://www.iconwater.com.au//~/media/Files/Icon%20Water/Annual%20Reports%20and%20SCI/2017/Icon%20Water%20Annual%20Report%202016-17%20Web%20small.ashx?dl=true
10. **GHD**, Queanbeyan Sewage Treatment Plant Upgrade Project – Masterplan for Sewage Treatment Plant Upgrade (2016)
11. **MWH,** Queanbeyan Sewage Treatment Plant Future Needs Study (2008)
12. **Environment ACT & Urban Services,** Environmental Authorisation Under the Environment Protection Act 1997 (2004)
13. **Opus International Consultants**, QCC Asset Management Plan – Water – 2015 -2019 (2015)
14. **Opus International Consultants,** QCC Asset Management Plan – Sewerage – 2015 – 2019 (2015)
15. **Queanbeyan City Council**, General Purpose Financial Statements for the period 1 July 2015 to 12 May 2016 (2016)
16. **QPRC**, Revenue Policy 2017-18
17. **QCC,** Residential Economic Strategy Review 2015-2031 (2015)
18. **NSW DPI Water,** 2011-12 NSW Water Supply and Sewerage – Performance Monitoring Report (2013)
19. **NSW DPI Water,** 2012-13 NSW Water Supply and Sewerage – Performance Monitoring Report (2014)
20. **NSW DPI Water,** 2013-14 NSW Water Supply and Sewerage – Performance Monitoring Report (2013)
21. **NSW DPI Water,** 2014-15 NSW Water Supply and Sewerage – Performance Monitoring Report (2014)

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22. **NSW DPI Water,** 2015-16 NSW Water Supply and Sewerage – Performance Monitoring Report (2014)
23. **QPRC,** Googong Township – Water Balance Memorandum (2017)
24. **Standards Australia Limited/Standards New Zealand,** On-site domestic wastewater management, AS/NZS 1547:2012 (2012)
25. **Hunter Water Australia,** Queanbeyan STP – Upgrade Options Assessment Summary Report
26. **QCC,** Queanbeyan Sewage Treatment Plant Upgrade Project – Business Case (2013)
27. **QPRC,** QPRC Liquid Trade Waste Policy (2018)
28. **MWH,** Googong Integrated Water Cycle Water and Wastewater Concept Design, Volume 1 – Main Report (2010)
29. **QPRC, Annual Drinking Water Quality Report (2017)**

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Appendix A

IWCM Checklist and Identified Data Gaps

Appendix A IWCM Checklist and Identified Data Gaps

IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
2A	Introduction	Includes the study area context (e.g. map of the local government area (LGA) showing the cities, towns and villages, etc.).	Section 1.1	Complete. No gaps		
2B	Introduction	Includes a table of all the urban centres/areas (i.e. towns and villages) within the study area indicating the nature of the water supply and sewerage service provision.	Section 1.2	Complete. No gaps		
2C	Introduction	Includes a summary table of current IWCM strategy measures and the status of outcomes.	Section 1.3	No gaps as QPRC does not have a current IWCM strategy	Palerang has an Issues Paper; IWCM yet to be developed. Googong IWCM referenced.	
2D	Introduction	Includes with evidence any changes to the assumptions underpinning the current IWCM strategy, the outstanding issues, the new and emerging issues, etc. with respect to the urban water services.	Section 1.4 and Section 1.5	No gaps	QPRC does not have a current IWCM strategy. This Issues Paper will form the basis of development on IWCM	
3.1A&B	Operating Environment Compliance	The regulatory and contractual compliance requirements are clearly defined. Document ISSUES identified relating to the operating environment compliance.	Table 2.1	No data gap		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
3.2A	Levels of Service (LOS)	Target LOS are clearly defined and have taken account of your existing SBP. Document ISSUES identified relating to the operating environment compliance.	Section 3	LOS are preliminary	LOS metrics are undefined for water & sewer. No LOS for stormwater	Yes
3.2B	Levels of Service (LOS)	Includes all issues from the LOS situation analysis (Item 1 of Figure 2 on page 4).	Section 3	Data Gaps: - Asset Management data beyond 2015 for water , sewer & stormwater - Asset condition data not available for water, sewer and stormwater - DWMS – Water Quality monitoring data at reference sites	Water Supply and Sewerage LOS – preliminary. Data to benchmark current performance against LOS is not available	Yes
3.2C	Levels of Service (LOS)	Any warranted changes to the Target LOS are identified and explained.	Section 3	Data Gaps – Refer above	LOS are preliminary Current performance against LOS cannot be completed without addressing data gaps.	Yes
3.2D	Levels of Service (LOS)	Community consultation is essential on the proposed levels of service* (LOS) in order to negotiate an appropriate balance between LOS and the required Typical Residential Bill (section 12.4 on page 85 of Reference 1).	Section 3	No data gap	Level of Community engagement and inputs towards defining current LOS remains unclear. Refer to outcomes of current community consultation outcomes	Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
4A	Description of Existing Urban Water Services Systems	A map or aerial image of each urban centre (i.e. city, town or village).	Figure 1.1	No data gap		
4B	Description of Existing Urban Water Services Systems	A schematic plan of each water supply system showing the headworks, treatment and pumping facilities, service reservoirs, trunk mains and reticulation and their capacities.	Figure 4-2 and Figure 4-3	No data gap	Schematic does not include capacities of pumping facilities	
4C	Description of Existing Urban Water Services Systems	A brief description of the catchment characteristics (e.g., average annual runoff volume, land use, annual usage by all users, significant industries, etc.) from which water is drawn. Include as an appendix the relevant publicly available water catchment maps, score cards, etc.	Section 4.8 and Figure 4.7	No data gap		
4D	Description of Existing Urban Water Services Systems	A brief description of each of the water supply assets/facilities including their characteristics, capacities, purpose, standby/emergency arrangements, water extraction/operating licence conditions (include licence conditions as an appendix) and the overall scheme control philosophy.	Section 4.2 and Figure 4-2	Data Gaps - Water Pumping Station details including asset condition, renewals/ upgrades - Reservoir details including total volume, operating levels, asset condition, renewals/upgrades - Reticulation – age and condition, renewals	Not sighted Work as Executed drawings to verify water model. Asset Management data is limited	

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
4E	Description of Existing Urban Water Services Systems	A schematic and a brief description of each water treatment process including the sludge and wastewater management practices.	Section 4.2 and Figure 4-2	No data gap	Water treatment (except re-chlorination) is by Icon Water), this is noted in Section 4.2	
4F	Description of Existing Urban Water Services Systems	A summary outline of your Category 3 trade waste discharges.	Section 4.3	No data gap	Category C discharges are still under review	Yes
4G	Description of Existing Urban Water Services Systems	A schematic plan of each sewerage system showing the hierarchy of the sewer pumping facilities, gravity catchments, treatment facilities, water recycling systems and their capacities.	Section 4.4 and Figure 4-4	No data gap		
4H	Description of Existing Urban Water Services Systems	A brief description of each of the sewerage system assets/facilities including their characteristics, capacities, purpose, standby/emergency arrangements, overall scheme control philosophy, discharge/operating licence conditions (include licence conditions as an appendix) and the receiving environment.	Section 4.5	Data Gaps - Complete Sewer Pumping Station details including pumping capacity, arrangement, asset condition - Emergency arrangements - Sewer Rising Main – age, capacity and condition - Reticulation – age and condition - Data on asset condition, renewals/ upgrades is limited	Sewer schematic and summary of sewer asset details has been tabulated. Not sighted Work as Executed drawings to verify information contained in the model. Asset Management Plan lists known deficiencies in the system	

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
4I	Description of Existing Urban Water Services Systems	A schematic and a brief description of each sewage treatment process including the grit and biosolids management practices.	Section 4.6 and accompanying figure	Data Gaps - Hydraulic and process capacity information is limited to previous feasibility studies - Previous planning reports missing critical information (missing appendices) - Limited information on design capacity/ current capacity of various process units - Data on asset condition, renewals/ upgrades is limited	Details of STP design capacity vs the current performance at each process unit level is not available	Yes
4J	Description of Existing Urban Water Services Systems	A schematic and a brief description of each water recycling system, the types of end use of water within the enterprises and the associated management practices and agreements.	Section 4.7	No data gap		
4K	Description of Existing Urban Water Services Systems	A schematic plan of the urban area showing the urban stormwater sub-catchments including the urban stormwater harvesting and use systems, common detention/retention systems.	Section 4.8 and associated figure.	Data gaps - Retention basin depths unknown; WAE drawings not		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
4L	Description of Existing Urban Water Services Systems	A brief description of the stormwater sub-catchments (i.e., land-use characteristics), the assets/facilities including their capacities, purpose, the overall scheme control philosophy, discharge/operating licence conditions and the receiving environment.		sighted to confirm asset details		
4M	Description of Existing Urban Water Services Systems	A summary of the current replacement costs of the water supply, sewerage and stormwater assets from the latest Valuation Report (e.g. Special Schedules 4 and 6 of your LWU's annual financial statements).	Section 4.9	No data gap	Referenced from Percy Allen Report	
4N	Description of Existing Urban Water Services Systems	Includes a summary of the current price signals such as typical residential bill (TRB), developer charges (DC), water usage charge per kL, the percentage of residential water supply revenue from usage charges, non-residential sewerage charge per kL, etc.	Section 4.10	No data gap		
4O	Description of Existing Urban Water Services Systems	Reports whether trade waste policy, approvals and pricing, in accordance with Reference 5 on page 21, are in place.	Section 4.11	Liquid Trade Waste Policy exists.		Yes
5A	30-Year Population and Demographic Projection - **WATER**	The number of existing connected properties (residential and non-residential) and assessments (since 1996) obtained using your LWU's water customer billing database and reservoir zone layers (linked to Geographic Information Systems (GIS) where practicable).	Section 5.1-5.3	No data gap		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
5B	30-Year Population and Demographic Projection - WATER	An estimate of the existing **unoccupied** and seasonally occupied (e.g. holiday dwellings) connected residential properties obtained from sources such as the local real estate agent or Council staff or tourist information services or customer billing database or Australian Bureau of Statistics (ABS) C-data.	Section 5.2	No data gap		
5C	30-Year Population and Demographic Projection - WATER	An estimate of the connected permanent residential population including household size using ABS C-data.	Section 5.1-5.3	No data gap		
5D	30-Year Population and Demographic Projection - WATER	For the non-residential sector the number of existing commercial, industrial, rural, and institutional, hospital, school, hotel/motel, public swimming pools, council premises, and urban public parks and gardens connections.	Section 5.5	No data gap		
5E	30-Year Population and Demographic Projection - WATER	Nature of major water using and/or discharging industries.	Section 6.3	No data gap		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
5F	30-Year Population and Demographic Projection - WATER	An estimate of the total number of existing and new beds in connected tourist premises (e.g. motels/hotels, cabins/caravans, etc.) obtained from sources such as the local real estate agent or Council staff or customer billing database or premise operators or ABS data.	Section 5.6	No data gap		
5G	30-Year Population and Demographic Projection - WATER	An estimate of the vacant lots, lot yield from larger lots that are likely to be subdivided within the existing zoned urban areas, lot yield from redevelopment areas, and lot yield from the new release area(s) that are to be serviced by each reservoir {establish using the reservoir zone, cadastre and Local Environment Plan (LEP) zone layers (linked to GIS where practicable} and their timing and take-up rate. Provide a map and table summarising the development type with details in an appendix.	5.4	Data not available		Yes
5H	30-Year Population and Demographic Projection - WATER	The number of existing (since 1996) and new connected residential and non-residential properties and assessments, and the permanent and peak population to be served by each reservoir for the next 30 years	Section 5.8	Data gap - Information in model is not current	The properties have been assigned to their respective WSZ through GIS.	Yes
5I	30-Year Population and Demographic Projection - WATER	The number of existing (since 1996) and new connected residential and non-residential properties and assessments, and the permanent and peak population to be served by each scheme's headworks for the next 30 years.	Section 5.8, Table 5.9	Data gaps – refer above	Reported as total population being serviced by the Offtakes	Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
5J	30-Year Population and Demographic Projection - SEWER	The number of existing connected properties (residential and non-residential) and assessments (since 1996) obtained using the LWU's sewer/water customer billing database, ABS C-data and sewer catchment layers.	Section 5.1	Data Gaps - Customer billing data not available - Data provided on total Sewer connections contained duplicates - Mismatch between number of connections reported to DPI and Council provided dataset on existing sewer connections (over 3700 missing connections)	QPRC sewer property/catchment dataset has been adopted instead of the DPI performance data.	Yes
5K	30-Year Population and Demographic Projection - SEWER	An estimate of the existing unoccupied and seasonally occupied (e.g. holiday dwellings) connected residential properties obtained from sources such as the local real estate agent or Council staff or tourist information services or customer billing database or ABS C-data.	Section 5.2	No data gap	Assumed all hotels/holiday dwellings etc. are connected to sewer i.e. same as water connections	
5L	30-Year Population and Demographic Projection - SEWER	The number of existing dwellings that are serviced with town water supply but not with town sewer system (i.e. on-site systems).	Section 5.4	No data gap		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
5M	30-Year Population and Demographic Projection - SEWER	For the non-residential sector the number of commercial, industrial, rural, institutional, hospital, school, hotel/motel, public swimming pools, council premises and public toilet connections and an estimate of the equivalent tenements (ETs) involved.	Section 5.6	Data gap - Refer above. Mismatch in number of connections reported	ET estimates were based on non-residential connections reported to DPI	Yes
5N	30-Year Population and Demographic Projection - SEWER	The vacant lots, lot yield from larger lots that are likely to be subdivided within the existing zoned urban areas, lot yield from redevelopment areas, and lot yield from the new release area(s) that are to be serviced by individual sewer catchments and their timing and take-up rate.	Section 5.4	Data not available		
5O	30-Year Population and Demographic Projection - SEWER	The number of existing (since 1996) and new connected residential and non-residential properties and assessments, and the permanent and peak equivalent population (EP) and equivalent tenement (ET) to be served by each catchment for the next 30 years.	Section 5.6	Data Gap - Data in sewer model remains unverified - Mismatch in datasets documenting total number of existing sewer connections	Breakdown of ETs per SPS catchment has been estimated through GIS analysis.	Yes
5P	30-Year Population and Demographic Projection - SEWER	The number of existing (since 1996) and new connected residential and non-residential properties and assessments, and the permanent and peak equivalent population (EP) and equivalent tenement (ET) to be served by each scheme's sewage treatment works for the next 30 years. A reliable measurement of existing EP from measured sewer flows may be used.	Section 5.6	Data gaps - Refer above	Total EP discharging to Queanbeyan STP reported. EPs derived from DPI data	Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
5Q	30-Year Population and Demographic Projection - SEWER	For each unserviced urban centre/area provide existing and projected 30-year permanent and peak population and occupied properties.	Section 5.3	Data gaps - Data on future areas outside existing sewer service boundary is not available.	Assumed all future properties will be serviced by the STP	Yes
6A	30-Year Water Cycle Analysis and Projection - Water	A time series graph showing the actual and corrected historical daily, monthly and annual production as well as annual consumption of potable and non-potable (if present) water.	Section 6.1 and 6.2	Data gaps - Anomalies noted in bulk flow meter data - Metered consumption data does not contain information on meter reading dates; difficult to assign consumption to the correct quarter	Metered consumption manually adjusted to match bulk supply trends	Yes
6B	30-Year Water Cycle Analysis and Projection - Water	The factors/trends (such as demographic, climatic, economic, lot size, water efficiency, restriction impacts, pricing, etc.) that have affected historic water production and consumption.	Section 6.4	Data gaps - Anomalies noted in the permanent population and connections reported for each year - Yearly increase in total number of connections serviced is not available	Trend analysis only undertaken on metered consumption data. Limited correlation noted in the annual metered consumption and rainfall data	Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6C	30-Year Water Cycle Analysis and Projection - Water	The volume of non-revenue water (NRW) [represented as L/connection/d]. This comprises real losses (mostly leakage), apparent losses (under-registration of customers' meters and illegal use) and authorised unbilled water (e.g. mains flushing and firefighting).	Section 6.6	No data gap		
6D	30-Year Water Cycle Analysis and Projection - Water	The climatic and other factors/trends corrected unrestricted annual dry year demand per connected residential property.	Section 6.2	No data gap		Yes
6E	30-Year Water Cycle Analysis and Projection - Water	The climatic and other factors/trends corrected unrestricted average annual residential water supplied per connected property.				
6F	30-Year Water Cycle Analysis and Projection - Water	The climatic and other factors/trends (e.g. reservoir effect, etc.) corrected unrestricted peak day demand per connected property.				
6G	30-Year Water Cycle Analysis and Projection - Water	The historical persistence of daily demand leading up to and after the peak day demand event.	Section 6.1	No data gap		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6H	30-Year Water Cycle Analysis and Projection - Water	The unrestricted annual and peak day water demands of each non-residential connection type with climatic and other factors/trend correction if possible. For the non-residential sector, the total water supplied should be recorded for each of commercial, industrial, rural, institutional, public parks and gardens and non-revenue water (NRW).	Section 6.2	No data gap		
6I	30-Year Water Cycle Analysis and Projection - Demand	Total unrestricted **annual dry year demand** aggregated from the residential and non-residential connections for sizing of headworks infrastructure such as a dam, etc.;	Section 6.2	No data gap		Yes
6J	30-Year Water Cycle Analysis and Projection - Demand	Total unrestricted **annual average year demand** aggregated from residential and non-residential connections for licensing and revenue requirements prediction; and	Section 6.2	No data gap		
6K	30-Year Water Cycle Analysis and Projection - Demand	Total unrestricted **peak day demand** aggregated from residential and non-residential connections for sizing of water treatment works, pumping facility, etc.	Section 6.2	Anomalies noted in consumption		
6L	30-Year Water Cycle Analysis and Projection - Demand	The unit demands of connected residential property and of each non-residential connection type and NRW using the bulk flow meter/ pumping records and consumer meter records.	Section 6.2 -6.6	No data gap		Yes
6M	30-Year Water Cycle Analysis and Projection - Demand	The total current peak and average day demands aggregated from the residential and non-residential connections for each reservoir zone.		No data gap		Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6N	30-Year Water Cycle Analysis and Projection - Demand	The 30-year total unrestricted peak day demand aggregated from the residential and non-residential connections for each reservoir zone for sizing of reservoirs, distribution mains, booster pumping facility, etc.		No data gap		Yes
6O	30-Year Water Cycle Analysis and Projection - Demand	Check that the water savings due to implementation of best-practice pricing (refer to Circular LWU11 of March 2011) and BASIX requirements have been accounted for in the annual and peak day demand projections.	Section 6.8	No data gap		
6P	30-Year Water Cycle Analysis and Projection - Demand	Includes brief analysis of the impact of climate variability on the unrestricted annual and peak day demand projections.	Section 6.8	No data gap		
6Q	30-Year Water Cycle Analysis and Projection - Demand	Lists all the unserviced urban centres/areas within the local government area or LWU's area of operation and includes for each unserviced urban centre/area the projected 30-year peak day and annual demands aggregated from the residential and non-residential occupied properties.		Data gaps - Data on future areas that remain disconnected from current water network is not available	Assumed that all new growth will be serviced	

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6R	30-Year Water Cycle Analysis and Projection - Sewer Catchments	The actual and designed average dry and peak wet weather flows per ET and per EP using the consumer water meter records, SPS telemetry data and the sewer design manual. Include the dates, daily rainfall and the estimated ARI the actual per ET and EP flows were based on.	Section 8.1 -8.2	Data gaps - ET/EP breakdown is not available at each sewer catchment level. - Telemetry information on SPS is not available - Sewer Pumping Station details including pumping capacity, arrangement, asset condition - Gaps noted in daily STP inflow datasets provided - ADWF value in the sewer model is higher than the ADWF estimated for 2016 based on inlet flow data	Flow estimates (ADWF & PWWF) are based on daily flow gauge data located at STP inlet works Actual current per ET &EP flow reported for the total catchment draining to STP	Yes
6S	30-Year Water Cycle Analysis and Projection - Sewer Catchments	The current actual and design ADWF, PDWF and PWWF for each catchment aggregated from the residential and non-residential connections.	Section 8.1 -8.2	Data gaps – refer above	Flows not reported at each sewer catchment	Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6T	30-Year Water Cycle Analysis and Projection - Sewer Catchments	The 30-year projection of actual and designed ADWF, PDWF and PWWF for each catchment taking into account the impact from natural propagation of water efficiency, BASIX, water pricing and other current Council water efficiency and sewer flow management measures.	Section 8.2	Data gaps – refer above	Flow projections to the STP reported. Projections per catchment is not reported due to lack of data	Yes
6U	30-Year Water Cycle Analysis and Projection - Sewage treatment works	A time series graph showing the historical daily, monthly and annual sewage and effluent flows in conjunction with daily rainfall records.	Section 8.1 -8.2	Data gaps - Daily effluent flow record not available - Effluent quality data not available	Daily inflow flow and rainfall data graphed	Yes
6V	30-Year Water Cycle Analysis and Projection - Sewage treatment works	The actual current per EP and ET average dry weather flow. A reliable measurement of existing EP from measured sewer flows may be used.	Section 8.1 -8.2	Completed using the flow gauging data recorded from Nov 2015 to Mar 2017		
6W	30-Year Water Cycle Analysis and Projection - Sewage treatment works	The actual ADWF, PDWF and PWWF over time (since 1996) using the historic flow analysis and data.	Section 8.1 -8.2	Not completed. Data gaps - Gaps in the dataset dating prior to Nov 2015 - Daily influent flows values show considerable variation in the two sets of data supplied by QPRC		Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6X	30-Year Water Cycle Analysis and Projection - Sewage treatment works	The 30-year projection of actual and design ADWF, PDWF, PWWF and annual effluent volume as a time series taking account of the catchment level analysis information, pumping capacities and the impact of natural propagation of water efficiency, BASIX, water pricing and other current and planned LWU water efficiency and sewer management measures.	Section 8.2	Not completed. Data gaps - Gaps in the dataset dating prior to Nov 2015 - Daily influent flows values show considerable variation in the two sets of data supplied by QPRC - Catchment level information analysis not completed		Yes
6Y	30-Year Water Cycle Analysis and Projection - Sewage treatment works	The actual current per EP biological and nutrient loads.	Section 8.4	No data gap	Adopted from STP inlet characteristics data supplied by Council	
6Z	30-Year Water Cycle Analysis and Projection - Sewage treatment works	The 30-year projection of biological and nutrient loads as a time series.		Not complete - Design capacity of process units not available		Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6AA	30-Year Water Cycle Analysis and Projection - Sewage treatment works	Include a brief analysis of the impact of climate variability on peak wet weather flows using the location-specific intensity, frequency and duration of rainfall analysis available on the Bureau of Meteorology (BOM) website.		Not completed as derived ADWF, PWWF require confirmation - Available model not set up for running wet weather analysis		
6AB	30-Year Water Cycle Analysis and Projection - Sewage treatment works	Lists all the unserviced urban centres/areas within the local government area or LWU's area of operation and for each unserviced urban centres/areas includes the projected 30-year ADWF.		Not completed - Data on future areas that will be on private connections not available		Yes
6AC	30-Year Water Cycle Analysis and Projection - Water Recycling	A time series graph (since 1996) showing the historical daily, monthly and annual usage in conjunction with daily rainfall records for each of the discharge or reuse pathways (urban use, reclaimed water, industrial, agricultural or discharge).		Not applicable - Googong water recycling system is yet to be commissioned, hence has no historical data	Not applicable	
6AD	30-Year Water Cycle Analysis and Projection - Water Recycling	The average per connected property and peak daily per connected property usage when used as reclaimed water for urban customers.		Not applicable - Googong water recycling system is yet to be commissioned, hence has no historical data	Not applicable	
6AE	30-Year Water Cycle Analysis and Projection - Water Recycling	The estimated 30-year daily and annual projection for each of the discharge and/or reuse pathway as a time series.		Not applicable - Googong water recycling system is yet to be commissioned, hence has no historical data	Not applicable	

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
6AF	30-Year Water Cycle Analysis and Projection - Urban Stormwater	The current and 30-year projection of annual stormwater volumes for each of the discharge and/or urban stormwater harvesting and use pathways as a time series.	Section 7.1	No data gap		
6AG	30-Year Water Cycle Analysis and Projection - Urban Stormwater	The current and 30-year projection of annual biological and nutrient loads as a time series.	Section 7.1	No data gap		
7A	Existing Urban Water System Capacity and Performance Assessment - Water	Secure yield of existing headworks system undertaken in accordance with draft NSW Guidelines on Assuring Future Urban Water Security – Assessment and Adaption Guidelines for NSW Local Water Utilities (Reference 17 on page 21).	Section 10.2	Secure yield of existing headworks system based on Icon Water provided data.		
7B	Existing Urban Water System Capacity and Performance Assessment - Water	Sustainable yield of groundwater sources that form part of the headworks system.	Section 4.1.1	Groundwater does not form part of the headworks, is used only for the irrigation of some council assets.		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
7C	Existing Urban Water System Capacity and Performance Assessment - Water	A time series graph showing the historical and projected annual unrestricted dry year demand super-imposed with the assessed secure yield or sustainable yield (if groundwater source) of the existing headworks system and licensed annual extraction volume. Includes commentary on the headworks ability to meet current and future demands and LOS.	Section 10.1	No data gap		
7D	Existing Urban Water System Capacity and Performance Assessment - Water	A table summarising the historical raw water quality data of each supply source including a discussion on the variables that has an influence on the effective performance of the water treatment process to meet the LOS.		Not complete. QPRC water quality data from Offtakes not available.		Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
7E	Existing Urban Water System Capacity and Performance Assessment - Water	A table summarising the historical reticulated water quality data of each scheme including a comparison to the LOS target. Also include a brief discussion on the effectiveness of the treatment process, barriers and management systems in meeting the LOS target.		QPRC water quality data from Offtakes not available.		Yes
7F	Existing Urban Water System Capacity and Performance Assessment - Water	A time series graph showing the historical and projected peak day unrestricted demand super-imposed with the design/assessed capacity of the existing treatment works (including raw and treated water pumping facilities) and licensed daily extraction volume (if applicable). Includes commentary on the ability of the treatment works to meet current and future demands and LOS.	Section 10.1	No data gap		
7G	Existing Urban Water System Capacity and Performance Assessment - Water	A summary showing the performance of the distribution system against the LOS targets under current and future demand scenarios. The details of the analysis may be included as an Attachment.		Data gaps - Current system performance vs LOS not available		Yes
7H	Existing Urban Water System Capacity and Performance Assessment - Water	A summary of the asset condition from the latest Valuation Report.		No data gap		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
7I	Existing Urban Water System Capacity and Performance Assessment - Sewer	A table showing the performance of each sewer catchment with respect to inflow/infiltration, pumping capacity, pump run time in dry and wet weather conditions, available storage at 4 hours of ADWF and odour/septicity potential assessed using the historical sewer pumping/bulk flow meter records obtained via Telemetry including a brief commentary on the potential performance with the future loads/flows and LOS targets.		- Completed based on available telemetry data and asset data available		
7J	Existing Urban Water System Capacity and Performance Assessment - Sewer	A table summarising the historical effluent quality data of each scheme including a comparison to the LOS target and discharge limits for the licence. Also include a brief discussion on the effectiveness of the treatment process, barriers and management systems in meeting the LOS target and discharge limits for current and future scenario.		Not completed Lack of data on effluent quality and LOS		Yes
7K	Existing Urban Water System Capacity and Performance Assessment - Sewer	A time series graph showing the historical and projected biological and hydraulic loads super-imposed with the design/assessed capacity of the existing treatment works and licensed daily discharge volume (if applicable) including commentary on the ability of the treatment works to meet current and future loads and LOS targets.		As above		Yes

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
7L	Existing Urban Water System Capacity and Performance Assessment - Sewer	A summary of the asset condition from the latest Valuation Report.		Complete		
7M	Existing Urban Water System Capacity and Performance Assessment - Sewer	A table summarising the historical data and showing the existing sustainability performance (e.g. nutrient, salt and hydraulic, etc.) against the compliance and/or LOS targets and a brief commentary on the potential performance with the future loads and flows.		Googong only. However limited discussion possible as only potable water is currently being circulated (pending Section 60 approval)		
7O	Existing Urban Water System Capacity and Performance Assessment - Stormwater	A table showing its performance against the objectives and LOS targets.		Not applicable, there are no stormwater harvesting in study area.		
7P	Existing Urban Water System Capacity and Performance Assessment - Unserviced Areas	Assessment of performance of the existing water supply relating to environmental sustainability, public health and availability of supply (estimated and actual observed) during extended **dry periods** and **during average rainfall years**.		Not complete - data not available.		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
7Q	Existing Urban Water System Capacity and Performance Assessment - Unserviced Areas	Assessment of performance of the existing on-site sewage management systems based on LGA clause 68 inspections relating to environmental sustainability and public health.		Not complete - data not available.		
7R	Existing Urban Water System Capacity and Performance Assessment - Unserviced Areas	A review with respect to the requirements in the Environment and Health Protection Guidelines: On-Site Sewage Management for Single Households and any other relevant guidelines, standards or policies including local geology and topography.		Not complete - data not available.		
8A	IWCM Issues Paper	Summary of all the outcomes from items 2 to 7 on pages 5 to 12		No data gap		
8B	IWCM Issues Paper	A summary table of the information and data gaps relating to regulatory compliance and LOS targets based on a review of all the reference documents and operational monitoring data.		Not complete to extent required in Checklist due to data gaps		
8C	IWCM Issues Paper	A table capturing all (existing unresolved, new and emerging) issues in each water service system that have been identified through the analysis, site inspection and from community consultation, and clearly showing whether the issue is one of regulatory compliance, LOS or capacity.		Not complete to extent required in Checklist due to data gaps		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
8D	IWCM Issues Paper	Known recurrent and non-recurrent issues from a review of maintenance logs, incident reports, annual Action Plan and TBL Reports, customer complaints, EPA22 Public register licence breaches and NOW23 system inspections (section 61 of Local Government Act 1993).		Not complete to extent required in Checklist due to data gaps		
8E	IWCM Issues Paper	All items requiring a capital works resolution (refer to Item 1 of SBP Check List for your LWU's business compliance and LOS assessment).		Not complete to extent required in Checklist due to data gaps		
8F	IWCM Issues Paper	Includes a brief review to identify issues to support your city, town or village water-sensitive urban design (WSUD) and the broader 'liveable towns and cities' objectives as per paragraph 92 of the National Water Initiative.		Not complete to extent required in Checklist due to data gaps		
8G	IWCM Issues Paper	Includes a summary of the existing TAMP measures and their current status. Check whether any of the identified issues are being addressed through the measures in the TAMP that are at an advanced stage of implementation.		Not complete to extent required in Checklist due to data gaps		
8H	IWCM Issues Paper	Includes item 6.7 on page 10 of the SBP Check List relating to your Drinking Water Management System.		Not complete to extent required in Checklist due to data gaps		
8I	IWCM Issues Paper	The current program measures in the non-build water conservation and inflow/infiltration measures need to be reviewed based on current performance data, new knowledge and technology, regulation, community acceptance, possible new integration, etc.		Not complete to extent required in Checklist due to data gaps		

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IWCM CHECKLIST TOPIC		IWCM CHECKLIST OUTCOME ACHIEVED	LOCATION IN ISSUES PAPER	DATA GAPS (Limiting the analysis for Issues Paper)	Comments	Flagged as ISSUE
8J	IWCM Issues Paper	The capital works program review to consider whether the issues (existing, new or emerging) could be more cost-effectively addressed using an alternative solution path.		Not complete to extent required in Checklist due to data gaps		
8K	IWCM Issues Paper	Provide Issues Paper to NSW Office of Water for review and concurrence.		Not complete to extent required in Checklist due to data gaps		

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Appendix B

Future Growth Areas and Sites

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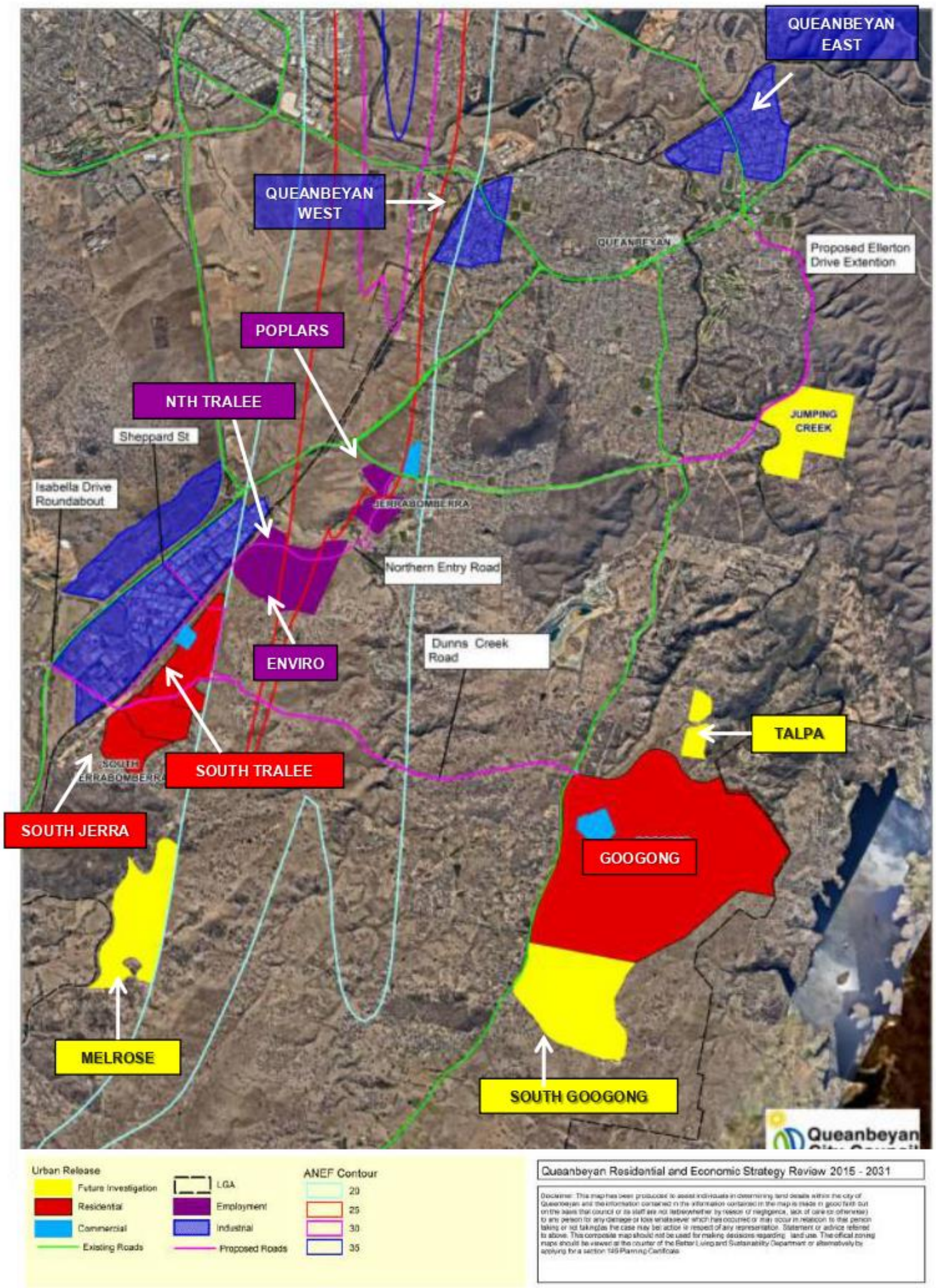
Appendix B Future Growth Areas and Sites

Map 15: ***Revised Residential and Economic Strategy 2031***



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Appendix C

Climate Variability and Headworks capacity – Icon Water Extracts

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Appendix C Icon Water Extracts on Climate Variability and Headworks Capacity

D1. Impact of Climate Variability

In response to a Request for Information to support the IWCM for the study area, Icon Water prepared the following discussion regarding how climate variability has been incorporated into future demand projections.

D1.1. Climate Variability

Icon Water has used stochastic data to determine water security in all studies since 2004. Stochastic data are large amounts of data that are developed to reproduce the statistical properties of the observed data (e.g. average rainfall, rainfall variability, number of rain days, relationship between rainfall at different sites). Stochastic data should be able to approximately reproduce these relationships on all timescales from daily through to multi-year. Stochastic data has a number of advantages over historical record data, including:

- It provides better resolution around extreme events and can therefore provide a better estimation of the probability of water restrictions.
- Because there is much more data than the historical record, it contains far worse droughts than observed and can therefore be used to evaluate the risk of running out of water altogether.
- It enables probabilistic analysis by examining the outcomes that could occur in many different weather scenarios that could occur during the planning horizon.

The stochastic climate data provide 1000 equally likely versions of the next 50 years known as replicates. Rainfall-runoff and demand models are used to generate inflow and demand time series for each replicate, which are then processed by a water resources model to generate time series outputs of variables including dam storage and water restriction level.

D1.2 Climate Change

Icon Water has also included climate change planning in all water security studies since 2004. Four climate change scenarios were adopted in the 2014 *Climate Update* to consider the full range of possible future climates:

- Dry climate change, stochastic data produced using outputs from the second driest of the 15 global climate models included in the South-East Australian Climate Initiative (SEACI) project.
- Medium climate change, stochastic data produced using outputs from the median global climate model included in the SEACI project.
- Wet climate change, stochastic data produced using outputs from the second wettest of the 15 global climate models included in the SEACI project.
- Last 20 Years, stochastic data produced so that the seasonal means of rainfall in each catchment and evaporation are adjusted to match the means observed in the past 20 years from June 1993 to May 2013.

These four scenarios will provide different yield estimates for Icon Water's water supply system. In this paper the dry climate change scenario has been used to estimate system yield.

D2. Headworks Capacity

In response to a Request for Information to support the IWCM for the study area, Icon Water prepared the following discussion regarding Headworks Capacity.

The ACT region is predominantly a residential and commercial region; it does not have any significant water use intensive industries. As such, future water demand is largely driven by:

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- climate (in Canberra, water consumption can vary from 90 ML/day during a wet winter to approximately 300 ML/day during a dry summer)
- future population
- the level of individual water consumption (i.e. the per capita demand).

The current service area covers Canberra and Queanbeyan in NSW. Icon Water considers Canberra and Queanbeyan as one and applies the same growth assumptions to each. Comparison of the two shows the Queanbeyan population has remained approximately 10% of Canberra's population throughout the last 10 years.

In the future the service area may include additional areas in NSW, such as Yass, Murrumbateman and parts of Queanbeyan-Palerang Regional Council that are not currently supplied by Icon Water. This possibility has been raised in the past, particularly during the recent drought, and is included in an ACT, NSW and Commonwealth inter-governmental Memorandum of Understanding (MoU) covering the supply of ACT water to NSW. The MoU formalises the existing arrangements to supply Queanbeyan City Council and provides a framework for supply to NSW regions close to ACT over the next 30 years.

Based on the possible additional NSW population, Icon Water makes an allowance of 1.5% of the combined Canberra / Queanbeyan population

Note: the population growth rate used by Icon Water, 1.5%, is less than the 2% 30 year population growth rate estimated for the study area by QPRC. This is not considered problematic as the QPRC growth rate is skewed by the growth rate of the Googong new development. Additional population growth in the study area is anticipated to be offset by a smaller growth rate in the balance (~90%) of the Icon Water supplied region (i.e. Canberra).

D2.1. Current Yield Estimate

The assumptions discussed above have been used to project the probability of water restrictions and volumes of water supplied over the next 50 years. Icon Water's REALM water resources model has been used to make this projection by running the 1000 stochastic data replicates and averaging these results.

Figure D1 shows the projected increase in the probability of water restrictions and average water consumption. The level of service is exceeded in 2059, which corresponds to a serviced population of approximately 808,000 and an average annual supply rate of 75 GL/year.

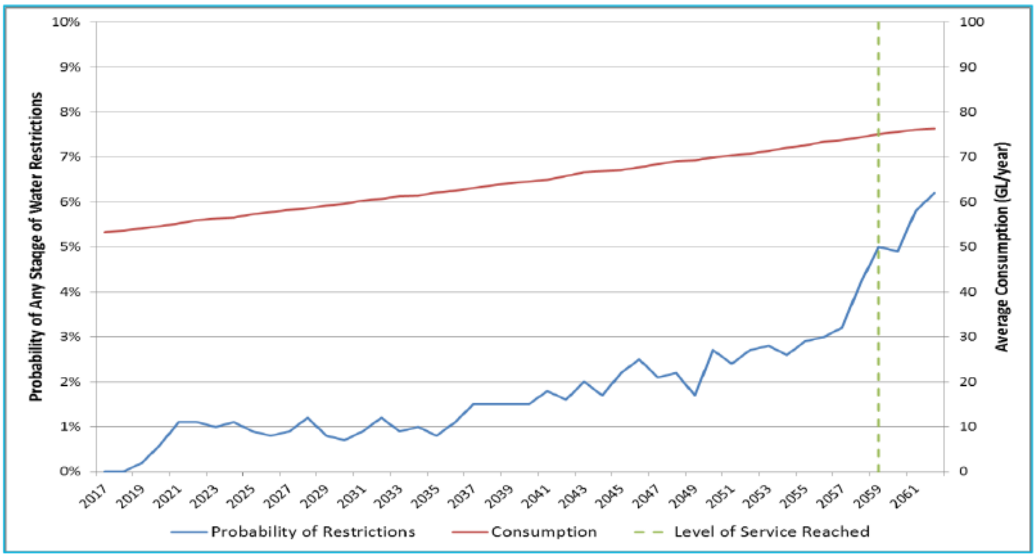

Figure D1 Projected Probability of Water Restrictions and Annual Average Water Consumption *(Icon Water)*

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It is not possible to express this system yield in a way that provides a meaningful indication of yield from the individual sources. However, the average amount of water supplied from each source at the point where the level of service is exceeded is shown below in **Table D-1**. These average volumes are not indicative of how much water can be supplied from each individual source or how much water is supplied during a drought.

Table D-1 Statistics when Level of Service is Exceeded *(Icon Water)*

Probability of Water Restrictions	5%
Year	2059
Serviced Population	808,355
Consumption (GL/year)	75.1

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Appendix D

Hydraulic Model Review Memorandums

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Appendix D Hydraulic Model Review Memorandums

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Memorandum

To	QPRC – Andrew Grant	Page	1
CC			
Subject	QPRC – Queanbeyan Water Model Review – **DRAFT FOR REVIEW**		
From	Hayden Seear		
File/Ref No.	60548525/ 4.3 Hydraulic Model Reviews	Date	13-Feb-2018

1.0 Introduction

This technical memorandum summarises a high level review of the Queanbeyan water system hydraulic model to assist in the development of the Issues Paper for the Integrated Water Cycle Management Strategy (IWCMS).

It is noted that the existing water model was reviewed for completeness and quality by AECOM as part of the planning for the Jerrabomberra Reservoir Rehabilitation works (Feb 2015). As a result, the model review for the IWCMS has built on the findings from the 2015 model review.

2.0 System Overview

The Queanbeyan water network is supplied by two bulk water offtakes (Offtakes 1 & 2) from Icon Water's trunk distribution network, which is supplied by Mt. Stromlo and Googong Water Treatment Plants (WTP). There are two primary service reservoirs which receive the transfer of supply from Icon Water:

- Jerrabomberra Reservoir – receives bulk supply from Offtake 1 and services customers in Queanbeyan and Jerrabomberra as well as providing onward supply to downstream secondary reservoirs at Crest, Homestead and Thorntons.
- East Queanbeyan Reservoir – receives bulk supply from Offtake 2 and services customers in Queanbeyan, including the East Queanbeyan Industrial Area, as well as providing onward supply to downstream secondary reservoirs at Greenleigh, Ridgeway and Weetalabah.

The nearby Googong Township is serviced by a third offtake (Offtake 3) from Icon Water and is not connected to the remainder of the Queanbeyan water network. The Googong scheme is represented by a separate hydraulic model and does not form part of this model review.

A schematic of the Queanbeyan water network is shown in Figure 1. The extent of the Queanbeyan water network as represented in the hydraulic model is shown in Figure 2.

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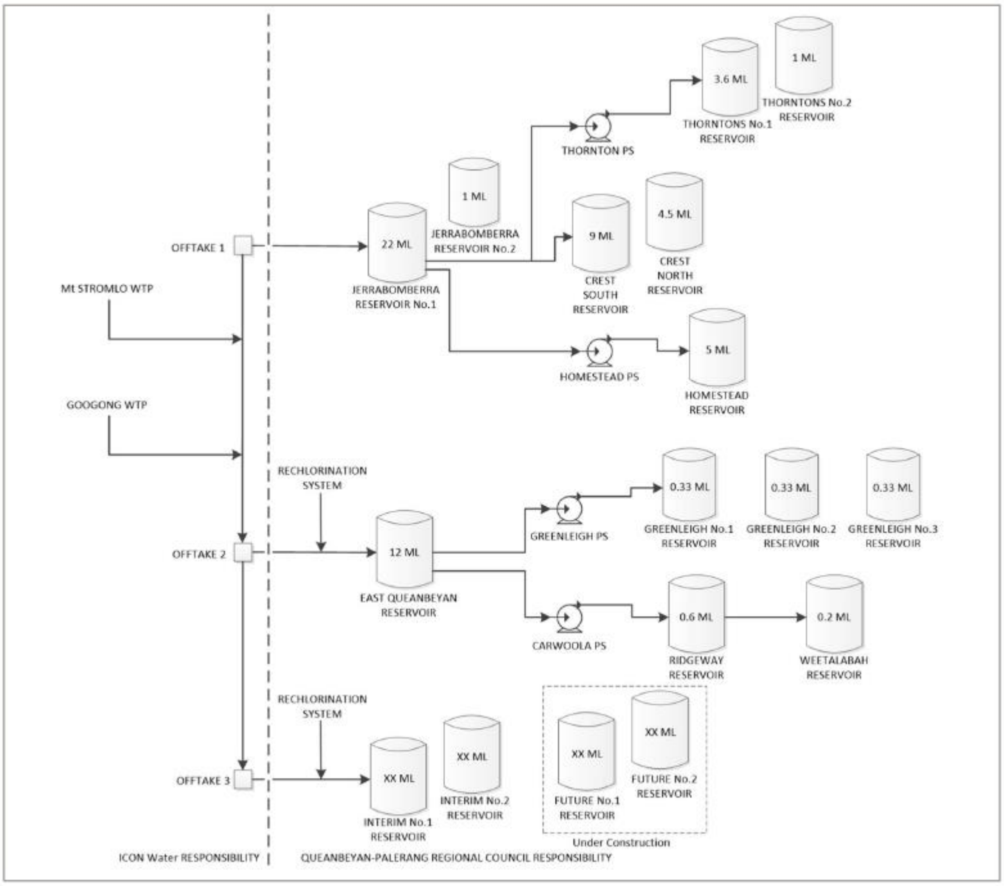

Figure 1 Queanbeyan Water Network Schematic

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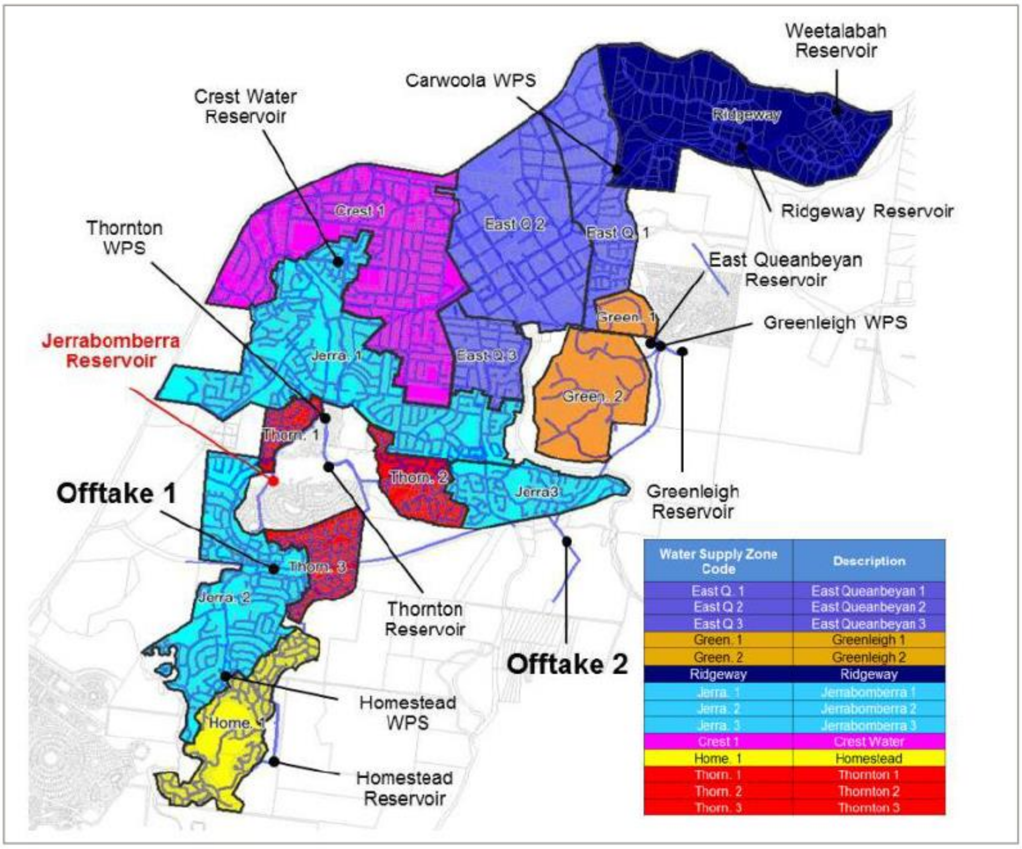

Water Supply Zone Code	Description
East Q. 1	East Queanbeyan 1
East Q 2	East Queanbeyan 2
East Q 3	East Queanbeyan 3
Green. 1	Greenleigh 1
Green. 2	Greenleigh 2
Ridgeway	Ridgeway
Jerra. 1	Jerrabomberra 1
Jerra. 2	Jerrabomberra 2
Jerra. 3	Jerrabomberra 3
Crest 1	Crest Water
Home. 1	Homestead
Thorn. 1	Thornton 1
Thorn. 2	Thornton 2
Thorn. 3	Thornton 3

Figure 2 | Queanbeyan Water Network Extents

3.0 Water Model Review

AECOM was provided a copy of the existing Queanbeyan water model in WaterGEMS (Bentley software). Based on information provided by QPRC during stakeholder interviews the water model is generally considered to be better maintained than the sewer and stormwater models and is subject to informal updates as and when the model is required to be used for planning purposes. This generally implies greater confidence in the currency and accuracy of the water model. Based on the information received the water model is understood to have been last updated circa 2013-14.

3.1 Extent of Model C overage

AECOM was provided access to the QPRC GIS asset dataset to sanity check the latest network coverage to the existing model extents. A manual spot check of the model against the GIS data indicates that all trunk assets in the Queanbeyan network appear to be represented hence trunk network coverage and connectivity appears to be reasonable. However it is noted that the configuration of pipework at reservoir sites and pump station sites is skeletonised and only represented schematically.

A detailed comparison of the reticulation pipe layouts was not undertaken as part of the high level review, however a number of spot checks were carried out as summarised in the following sections.

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3.2 Asset Attribute data

Pipe Data

A review of the pipe data revealed all pipes contain a nominal diameter and length. Gaps observed in pipe data are summarised below:

- Pipe material data is missing for 156 pipes out of 6,873 pipes modelled.
- Pipe roughness co-efficient, Hazen-Williams “C” is assumed as “90” for pipes with ‘unknown’ material type.
- There are pipes that have an install date of 2006, no material type allocated and a “C” factor of 80. This roughness value is normally associated with old pipes in very poor condition.
- Closed pipes are noted on the outlet mains from Crest South Reservoir therefore network connectivity at reservoir sites should be comprehensively investigated.
- A detailed spot check was performed on East Queanbeyan 2 water pressure zone and uncovered some missing pipework, incorrect diameters, incorrect connectivity logic and missing cross-connections within the small area investigated.

Based on the above the model may benefit from a thorough network review to identify all pipe data anomalies and confirm pipe connectivity including valve status and logic.

Water Pumping Stations

The water network comprises of four water pump stations, however the model currently incorporates five pump stations. PMP-19 in the model has been setup as a constant speed pump with no pump curve definition. The intended function of this additional pump station remains unclear. A summary of the pump station findings is provided as follows:

- Pump curves - pump curves exist for four pumps, and appear reasonable except for PMP-19. No notes or background information for the pump curves are available in the model hence they remain unverified.
- Nine (9) pump curves are included in the model. Incorrect or redundant pump curve information should be removed from the model for clarity.
- Pump station layout - not all pump station layouts/configurations in the model are representative of typical layouts and designs. Bypass lines appear to be isolated or not connected and non-return valves are not functioning correctly or have been ‘closed’ etc.
- Pump control settings - some pump settings (i.e. Homestead and Thornton) have not been updated to reflect the pump requirements in the model i.e. missing control links to reservoir levels etc.

Table 1 | Water Pump Stations in Model

ID	Label	Elevation (m)	Pump Definition
13374	PMP-6, Greenleigh	640	Greenleigh
13376	PMP-8, Ridgeway/Carwoola	598.09	Pump 8
13377	PMP-1, Homestead	615.5	Pump 1
13378	PMP-3, Thornton tank	668	Pump 3
27630	PMP-19	0	-

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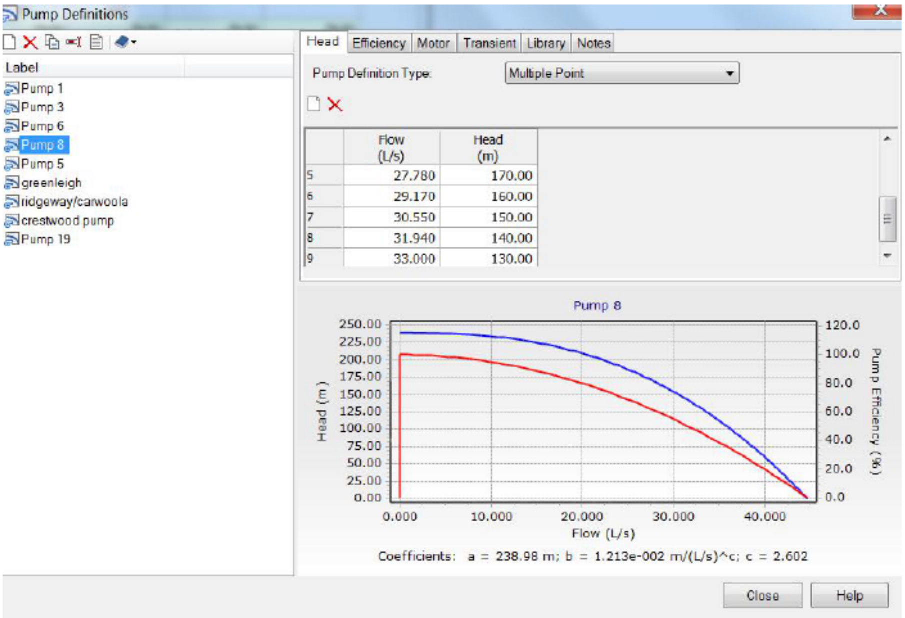

Figure 3 | Pump Curves in Model

Reservoirs and Tanks

The Icon Water bulk supply offtakes are modelled as fixed head reservoirs, whilst the service reservoirs (13) in the network are represented as tanks in the model. Observations regarding the reservoir and tank setup are summarised as follows:

- Offtakes 1 & 2 – R1 and R2 fixed head reservoirs represent the incoming supply points however the R1 and R2 fixed head elevations are noted as incorrect.
- R1 HGL in model (720 mAHD) does not align with Icon Water historical trend data (2013/14) under both average and peak demand conditions
- R2 HGL in model (683.5 mAHD) does not align with Icon Water historical trend data (2013/14) under both average and peak demand conditions
- A number of tanks (representing service reservoirs) are 'inactive' or not connected to the network within the model, including Jerrabomberra 1, Crest North, Greenleigh 2 & 3 and Thorntons 1 tanks. This is representative of a skeletonised reservoir setup within the model. The active tanks in the model will need adjustment if incorporating the currently inactive, isolated or missing tanks into the model.
- Tank operational settings – spot check on East Queanbeyan Reservoir shows that the operating window and cycling pattern does not emulate the historical telemetry data for the reservoir. This is likely to be reflective of all reservoirs setup in the model.
- Tank operational settings – detailed investigation of Jerrabomberra Reservoir operating window and cycling pattern shows the model operating between 80% and 98%. However historical telemetry data for the reservoir shows its operation between 48% and 100% i.e. a much larger operating window.

Further investigation of all reservoirs and tanks is recommended to clarify the model control settings versus historical operational data and the need for adjustments to match average demand and peak demand conditions where required.

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Zone Valves and Control Valves

The existing model generally aligns with the GIS "DMALAT" layer and a boundary trace in the model confirms that the water supply zones are tight i.e. no open boundary valves. Other observations noted are summarised below:

- Several closed valves are identified within water supply zones in the model including Crest and East Queanbeyan 2. The reason and purpose of these closed valves is unknown and should be confirmed.
- Four non-return valves (NRVs) are included in the model however they are all observed to be 'inactive' or not connected to the surrounding network. The implications of not having the NRV's correctly setup is considered to represent a risk to the model outputs and the importance of these NRV's for the model accuracy should be confirmed.
- Eight (8) Pressure Reducing Valves (PRVs) are included in the model however the status and function of the PRVs remains unverified. Some of the PRV's remain inactive or isolated in the model however the reason for this is unclear.
- Flow control valves for the controlled filling of reservoirs do not appear to be established in the model i.e. the tanks exhibit rapid filling without observed flow control

It is also noted that the results of previous field investigations to confirm zone valve status for the Jerrabomberra Reservoir Rehabilitation works should be fed back into the hydraulic model as a formal update of the water supply zone boundaries.

3.3 Model Design Input Parameters

Model Scenarios

- The existing model is setup as a dynamic model with the ability to run extended period simulations over 24 hours
- The existing model is setup to simulate average and peak demand conditions with separate scenarios available to assess average and peak demand performance, particularly in the context of residual pressure including fire flow analysis.
- The existing model contains nodes, pipes and pumps that are currently inactive or isolated in the model i.e. these components are currently excluded from the model runs and resultant performance results
- There does not appear to be any future scenarios available to understand future performance in relation to growth or other strategic drivers such as renewal and reliability.
- There is no evidence of the model having previously been utilised for water quality related purposes. The model could be utilised for a coarse indication of network water age if required.

Model Demands

Model demands are based on 2010 data with reference to the previous model review undertaken. Other observations noted are summarised below:

- Node demands – 86% of nodes in the model have demands allocated to them. This is considered to represent a reasonably detailed distribution of demand.
- Major customers – discrepancies are noted in regards to major water users as the highest demand in the model has been assigned to a residential customer. Further checks on large node demands should be performed to verify if this anomaly is repeated elsewhere.
- Diurnal demand curves – the model includes three demand curves which are labelled as Hydraulic Pattern 1, 2 and 3. Hydraulic Pattern 1 (residential) is currently used for all customer demands in the model with no differentiation between residential and non-residential customers i.e. no commercial or industrial patterns.

- Average day demand (15 ML/d) in the model appears higher than the annual average inflow data from Icon Water via Offtake 1 and 2. This means the model is likely to be conservative in terms of the system performance outputs.
- Peak day demand (26 ML/d) in the model is reasonably comparable to the peak day identified for the IWCMS via Offtake 1 and 2 i.e. 24.5 ML/d (February 2014).

4.0 Discussion

4.1 Model fitness for Strategic planning

The existing water model as it stands can be utilised for strategic planning purposes in the context of current demand conditions and the existing operating environment. However the accuracy of the performance results should be treated with caution as the gaps and anomalies observed are considered to reduce the accuracy of the model outputs (i.e. considered conservative at best). As a minimum, the interaction between the bulk supply offtakes (fixed head reservoirs), reservoirs (tanks) and pump stations should be verified and updated to reflect current operation (as best as possible) where required.

There does not appear to be any future planning scenarios available in the scenario manager within the model. The model is therefore not currently setup to assess future system performance (which is considered fundamental for strategic planning purposes i.e. growth).

There is no evidence of the model having previously been utilised for water quality related purposes however the existing model could be utilised for a coarse indication of water age for strategic planning purposes if required.

4.2 Model Fitness for Operations and Maintenance

The existing hydraulic model is considered suitable for limited operations and maintenance purposes however the performance results should be treated with caution as they are considered coarse at best – this may be considered inadequate in some instances depending on the level of detail required for the investigation purposes. To improve the accuracy of the model for O&M purposes (which will also have a positive flow-on effect for strategic planning purposes) it is recommended to resolve gaps, issues and anomalies associated with the following as a minimum:

- Operational status of reservoirs and pump stations including surrounding pipework and connectivity (currently skeletonised)
- Status of zone valves, flow control valves, PRVs and NRVs (unverified)
- Verify the diurnal demand patterns in the model including for residential non-residential demand nodes

5.0 Recommendations

There are a number of recommended water model improvements to improve the currency and accuracy of the model for strategic planning and O&M related purposes. These are summarised in the sections below.

In terms of using the model to inform the IWCMS the more immediate model update needs are focused at the trunk network level, including validating the interaction between the bulk supply offtakes (fixed head reservoirs), reservoirs (tanks) and pump stations, plus the development of an appropriate future growth scenario.

5.1 Asset Data Updates

- Undertake detailed verification of all trunk pipe assets with reference to the latest GIS data and/or works-as-executed drawings, including pipework configurations at reservoirs and pump station sites

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- Undertake further review of reticulation pipe assets with reference to the latest GIS data, in the context of pipe coverage, configuration and connectivity, with particular focus on more recent development areas
- Include date/year of installation for all assets
- Verify pipe material based on age and works-as-executed drawings (where possible) and update pipe roughness based on age and material type
- Incorporate or 'activate' Jerrabomberra 1, Crest North, Thorntons 1 and Greenleigh 2 & 3 Reservoirs in the model (including required pipework connections) and subsequently adjust Crest South, Thorntons 2 and Greenleigh 1 tank volume/dimensions when adding the outstanding tanks
- Update zone boundary valve locations and status based on results of previous field investigations.
- Update status of closed valves in Crestwood and East Queanbeyan 2 water supply zones following field survey clarifications.
- Verify status and settings for flow control valves (tanks), PRVs and NRVs and update in model
- Remaining 'inactive' or closed assets in the model - clarify as to the inclusion or deletion of this infrastructure to improve model currency and accuracy
- Update asset information for any recent asset renewals or replacements with a particular focus on trunk assets

5.2 Model Validation

- Further investigation with Icon Water to confirm and/or refine HGL profiles at Offtake 1 and Offtake 2 (fixed head reservoirs R1 and R2) for average day and peak day scenarios under both Mt Stromlo and Googong bulk supply conditions
- Further evaluation of remaining reservoirs (tanks) is recommended to clarify model controls versus operational data and set points i.e. inflow control settings and operating windows
- Validation of pump configurations, control settings and pump curves to improve accuracy of model
- Update customer demands in model particularly for any recent development areas i.e. improved demand allocation and distribution
- Update model diurnal demand pattern for residential customers (to suit more recent consumption behaviour) and include an appropriate diurnal demand pattern for assigning to non-residential customers
- Confirm high water users and appropriately update in the model, including identification of specific large user customers where required.

5.3 Scenario Planning

- Include additional growth scenarios for future planning horizons
- Include additional bulk supply scenarios for strategic planning purposes i.e. supply from Mt Stromlo versus Googong WTP's

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Memorandum

To	QPRC - Andrew Grant	Page	1
CC			
Subject	QPRC - Queanbeyan Sewer Model Review – **DRAFT FOR REVIEW**		
From	Hayden Seear		
File/Ref No.	60548525/ 4.3 Hydraulic Model Reviews	Date	13-Feb-2018

1.0 Introduction

This technical memorandum summarises a high level review of the Queanbeyan sewer system hydraulic model to assist in the development of the Issues Paper for the Integrated Water Cycle Management Strategy (IWCMS).

2.0 System Overview

Queanbeyan has one sewerage scheme servicing the township of Queanbeyan, with wastewater flows draining to the Queanbeyan Sewerage Treatment Plant (STP). There are known unserviced areas within the township which are not covered by the existing scheme. The nearby Googong Township is serviced by its own water recycling plant and is not connected to the Queanbeyan sewerage scheme. The Googong scheme is represented by a separate hydraulic model and does not form part of this model review.

Refer to Figure 1 for an overview of the existing sewer system as represented spatially in the GIS database.

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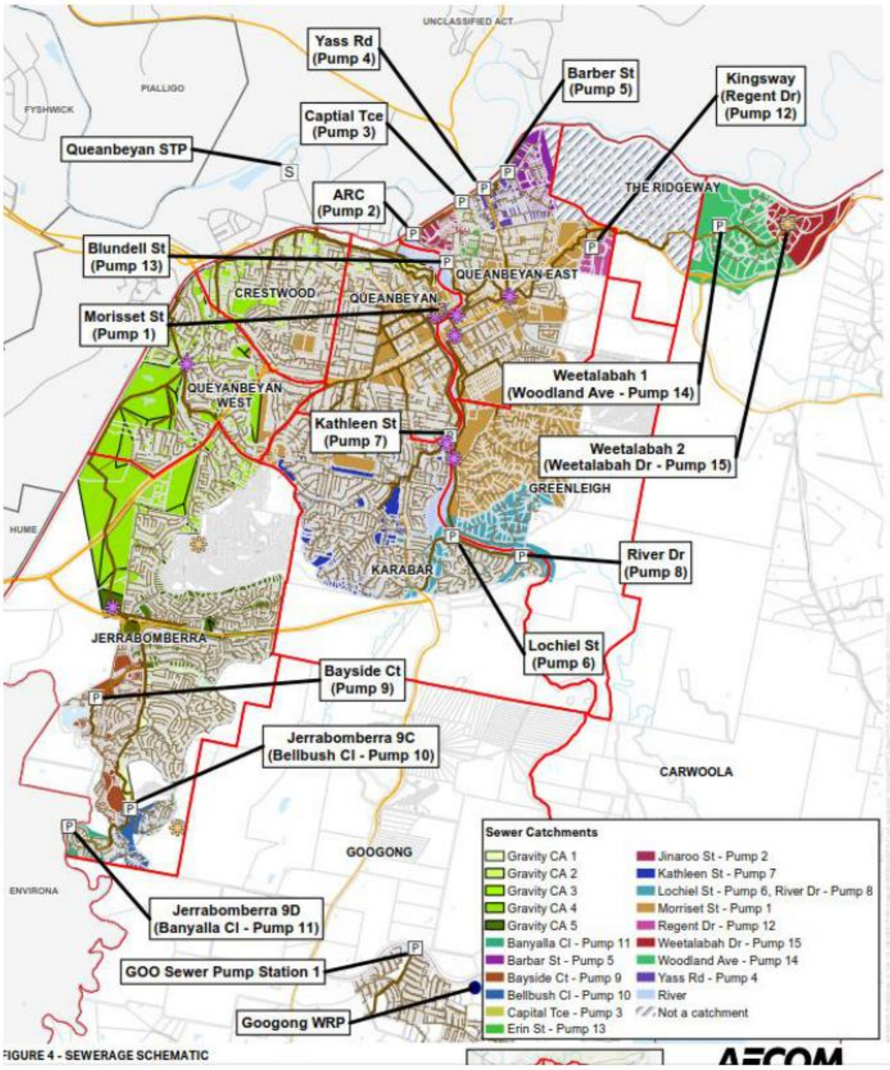

Figure 1 | Queanbeyan and Googong Sewer System Extents (GIS)

3.0 Sewer Model Review

AECOM was provided the existing Queanbeyan sewer model in XPSWMM. Based on information provided by QPRC during stakeholder interviews the sewer model was initially built in 2007 and has never been formally validated or calibrated. QPRC also confirmed the model has not been formally updated since the initial build in 2007. An extract showing the modelled sewer pipes and pump stations can be found in Figure 2.

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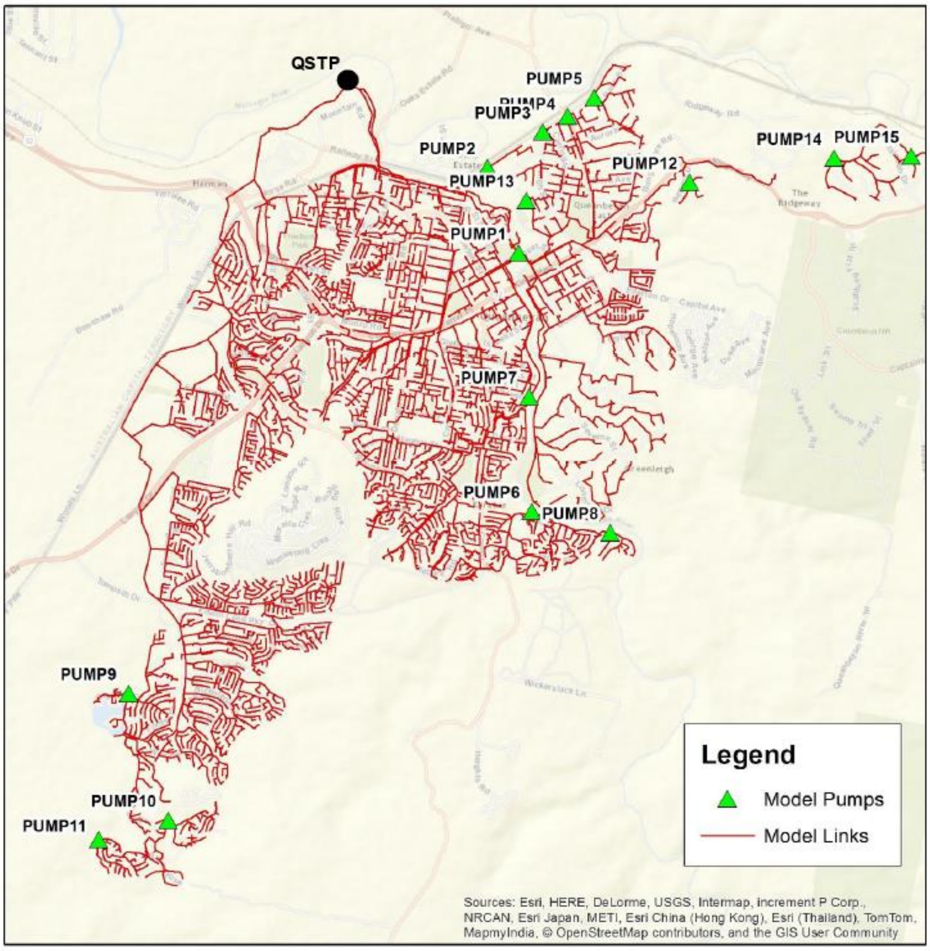

Figure 2. Extent of Queanbeyan Sewer Model

3.1 Extent of Model Coverage

AECOM was provided access to the QPRC GIS asset dataset to sanity check the latest network coverage to the existing model extents. A manual spot check of the model against the GIS data indicates that all trunk sewer catchments in the Queanbeyan scheme appear to be represented hence trunk network coverage and connectivity appears to be reasonable. A detailed comparison of the reticulation pipe layouts was not undertaken as part of the high level review.

The hydraulic model contains 7,588 nodes and 7,636 links. Fifteen (15) pump stations are modelled and are shown in Figure 2. However the corresponding sewer rising mains are not represented, which limits the assessment of the sewer pump and rising main performance i.e. the model is currently set-up to assess sewer gravity performance only. The Queanbeyan STP is modelled as an outflow.

3.2 Asset Attribute Data

Fifteen pump stations are coded into the model and their locations are represented in Figure 2. The name of the pump stations is not available in the model which limits identification and traceability. Characteristics of the pump stations are provided in Table 1. The pump curve associated with each pump is provided as an attachment to this memo in Appendix 1.

Existing pump station asset and operational data was not available to spot check the accuracy of the pump data in the model. The pump stations therefore remain unverified.

Table 1 | Sewer Pump Stations

Pump	Number of Pumps	Pump Description	Initial Depth (m)	Pump On	Pump Off	Curve
1	PUMP1A	FLYGT 3312-53-830	0.50	561.45	560.65	PUMP1A
	PUMP1B	FLYGT 3312-53-830	0.50	561.45	560.65	PUMP1B
	PUMP1C	FLYGT 3312-53-830	0.65	561.60	560.80	PUMP1C
	PUMP1D	FLYGT 3312-53-830	0.65	561.60	560.80	PUMP1D
2	PUMP2A	FLYGT 3152-181-450 CURVE	0.80	571.90	570.50	PUMP2A
	PUMP2B	FLYGT 3152-181-450 CURVE	1.00	572.10	570.70	PUMP2B
3	PUMP3A	FLYGT 3127-180-481 CURVE	0.40	578.10	577.20	PUMP3A
	PUMP3B	FLYGT 3127-180-481 CURVE	0.55	578.25	577.35	PUMP3B
4	PUMP4A	FLYGT 3127-180-481 CURVE	0.55	574.39	573.64	PUMP4A
	PUMP4B	FLYGT 3127-180-481 CURVE	0.70	574.54	573.79	PUMP4B
5	PUMP5A	FLYGT 3127-180-481 CURVE	0.41	574.62	573.87	PUMP5A
	PUMP5B	FLYGT 3127-180-481 CURVE	0.56	574.77	574.02	PUMP5B
6	PUMP6A	FLYGT 3153-180-432 CURVE	0.35	570.35	569.35	PUMP6A
	PUMP6B	FLYGT 3153-180-432 CURVE	0.60	570.60	569.60	PUMP6B
7	PUMP7A	FLYGT 3152-181-430 CURVE	1.00	572.20	570.40	PUMP7A
	PUMP7B	FLYGT 3152-181-430 CURVE	1.30	572.50	570.70	PUMP7B
8	PUMP8A	FLYGT 3127-180-430 CURVE	0.70	575.53	575.13	PUMP8A
	PUMP8B	FLYGT 3127-180-430 CURVE	0.80	575.63	575.23	PUMP8B
9	PUMP9A	FLYGT 3127-180-481 CURVE	0.37	590.80	590.30	PUMP9A
	PUMP9B	FLYGT 3127-180-481 CURVE	0.57	591.00	590.50	PUMP9B
10	PUMP10A	FLYGT 3201-180	0.65	628.88	628.58	PUMP10A
	PUMP10B	FLYGT 3201-180	0.80	629.03	628.73	PUMP10B
11	PIMP11A	FLYGT 3152-181-263 CURVE	0.35	628.25	627.65	PUMP11A
	PUMP11B	FLYGT 3152-181-263 CURVE	0.50	628.40	627.80	PUMP11B
12	PUMP12A	FLYGT 3085-171-253 CURVE	0.06	640.47	640.23	PUMP12A
	PUMP12B	FLYGT 3085-171-253 CURVE	0.12	640.53	640.29	PUMP12B
13	PUMP13A	FLYGT 3102-180-430 CURVE	0.50	567.29	566.89	PUMP13A
	PUMP13B	FLYGT 3102-180-430 CURVE	0.60	567.39	566.99	PUMP13B
14	PUMP14A	FLYGT 3127-170-210 CURVE	0.50	665.60	665.20	PUMP14A
	PUMP14B	FLYGT 3127-170-210 CURVE	0.60	665.70	665.30	PUMP14B
15	PUMP15A	FLYGT 3068-170-210 CURVE	0.45	681.55	681.15	PUMP15A
	PUMP15B	FLYGT 3068-170-210 CURVE	0.55	681.65	681.25	PUMP15B

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A total of 7,621 sewer pipes are represented in the model. A summary of pipe diameters and respective cumulative lengths can be found in Table 2. The pipe roughness for all conduits was set at 0.014, which indicates that pipe material and age was not considered when coding sewer pipes into the model.

All pipes in the model contain invert levels but this information was not available in the GIS asset database so a spot check comparison of invert accuracy in the model could not be conducted. A spot check of pipe profiles or gradients indicates that inverts seem reasonable with no obvious gradient anomalies observed.

Table 2 | Summary of Model Pipes

Diameter (mm)	Count	Total Length (km)
150	6,891	277.1
225	342	17.5
300	104	505.5
375	93	589.7
450	42	300.3
525	17	133.9
600	94	798.6
750	38	254.8

3.3 Model Flow Parameters

Average Dry Weather Flows

The sewer model contains only dry weather flow, coded as a constant inflow at nodes across the system. A total of 7,154 l/m or 10.3 ML/d is input into the model as dry weather flow with no data field distinguishing residential versus non-residential flows.

The modelled ADWF of 10.3 ML/d appears to match the ADWF used in the Queanbeyan STP Masterplan report. However, the modelled flow appears to be higher than the gauged flow data for 2016 which shows an ADWF of 9.3 ML/d. This represents a discrepancy of approximately 11%.

Diurnal Patterns

A single 24 hour diurnal pattern is used to represent all customers within the model. This provides the ability for a dynamic simulation over 24 hours. A graph of the diurnal pattern can be found in Figure 3. Additional diurnal patterns are available for selection but no documentation is available to describe their source or purpose. No hourly inflow data measured at the STP inlet was available to verify the diurnal pattern incorporated into the model.

Diurnal patterns derived from a flow monitoring program conducted over 31 days in 2008 (to elucidate flows and loads into STP as a part of STP future needs study feasibility report), were compared with the existing diurnal pattern in the model. The diurnal pattern in the model appears to differ from the diurnal pattern derived from the hourly flow gauging data. This lowers the confidence in the accuracy of the existing model.

Wet Weather Flows

No rainfall dependent inflow or infiltration parameters are coded into the model. Therefore, the model does not simulate the expected increase in flow due to rainfall events.

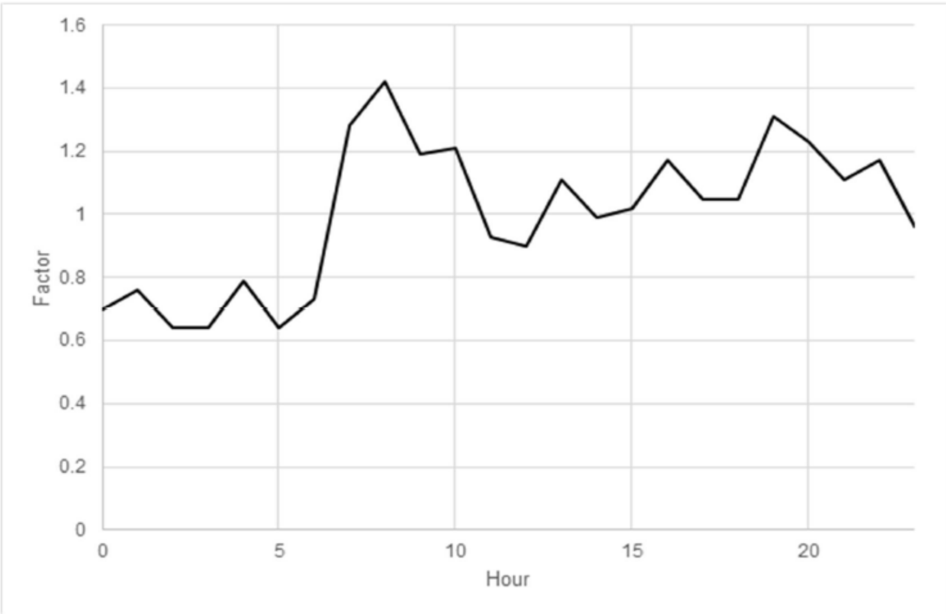

Figure 3. Diurnal Pattern used in Model

4.0 Discussion

4.1 Model Fitness for Strategic Planning

The existing hydraulic model as it stands is significantly limited in its use for strategic planning purposes. The absence of a wet-weather response in the model means only dry weather performance can be simulated. There is no ability to understand wet-weather performance or identify potential wet weather capacity related issues which is a key planning and design related function.

In addition, there does not appear to be any future planning scenarios available in the scenario manager within the model. The model is therefore not setup to assess future system performance (which is considered fundamental for strategic planning purposes).

Both of these critical gaps should be addressed before using the model for strategic planning purposes, particularly in the context of trunk network assets and associated scenarios.

For wet weather events, a peaking factor could be applied to the dry weather flow, however this is a theoretical or rule of thumb technique and would not be representative of evidence based rainfall dependent infiltration & inflow, which would continue to limit the accuracy of the model outputs.

4.2 Model Fitness for Operations and Maintenance

The existing hydraulic model may be suitable for limited operations and maintenance purposes however only for scenarios involving dry weather flow and gravity sewers. However, modelled flows should be compared to actual flows (gauge data) to validate the accuracy of the model load inputs and performance outputs before it is used with confidence for dry weather related O&M purposes, in addition to the inclusion of any known operational issues in the area of the network that is the focus of the O&M investigations.

If there is found to be a material dry weather flow discrepancy then there may be an update required for O&M purposes, including adjustment of the diurnal pattern currently used in the model, or further validation of the existing network configuration, pump station data and/or controls may be required.

5.0 Conclusions

In summary, there is low confidence in the accuracy of the existing sewer model for both strategic planning and O&M purposes, including its use on the IWCMS. This conclusion is based on the following:

- A number of key gaps identified – including the absence of wet weather data, future scenarios, and sewer rising mains
- Lack of historical model updates (since the original build in 2007) – particularly when considering model coverage, connectivity and configuration at the reticulation level (especially in new development areas post-2007)
- Limited operational data available to verify key assets within the model - including the sewer pump stations.

6.0 Recommendations

There are a number of recommended sewer model improvements to enable the model for strategic planning and/or O&M related purposes. These are summarised in the sections below.

In terms of using the model to inform the IWCMS the more immediate model update needs are focused at the trunk network level, including the inclusion of a wet weather event and future growth scenario.

6.1 General

- Consider upgrading from XPSWMM software to another sewer modelling package – XPSWMM is not as widely used or supported as other software packages and this may hinder the ability to outsource, check models and/or innovate within the model. XP Software has also recently been purchased by Innovyze and there is uncertainty as to the future of the product i.e. it may be phased out and eventually replaced by Innovyze at some point in the future.

6.2 Asset Data Updates

- Undertake detailed comparison and update of all network pipe assets with reference to the latest GIS data, with particular focus on recent development areas post-2007
- Include date/year of installation for all assets
- Include information on pipe material based on works-as-executed drawings and update pipe roughness based on material type. Also reference historical sewer rehabilitation works to inform pipe condition, internal diameter and roughness changes
- Update pipe and manhole invert data based on works-as-executed drawings
- Include pump station names in the model for ease of reference
- Include information on any pump replacements and update flow curves for renewed pumps

6.3 Model Validation

- Verify and update dry-weather flows and diurnal patterns in the model based on flow gauging information.
- Update diurnal patterns based on land-use type to differentiate between residential and non-residential flows
- Diurnal patterns should also be updated to reflect the differences between weekday and weekend profiles based on flow gauging – if executing extended period simulations ≥ 1 week
- Verify and update pump curves based on telemetry data
- Input wet-weather or rainfall dependent inflow-infiltration information into the model

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6.4 Scenario Planning

- Modelled flows to be updated to reflect the current population and measured ADWF and PDWF flows measured at the STP inlet
- Include additional growth scenarios for future planning horizons

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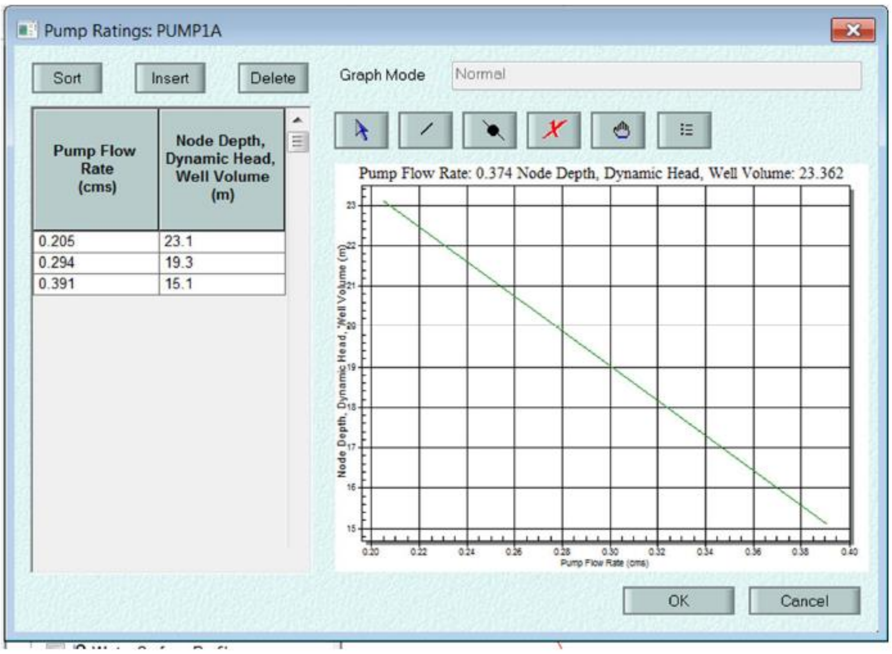
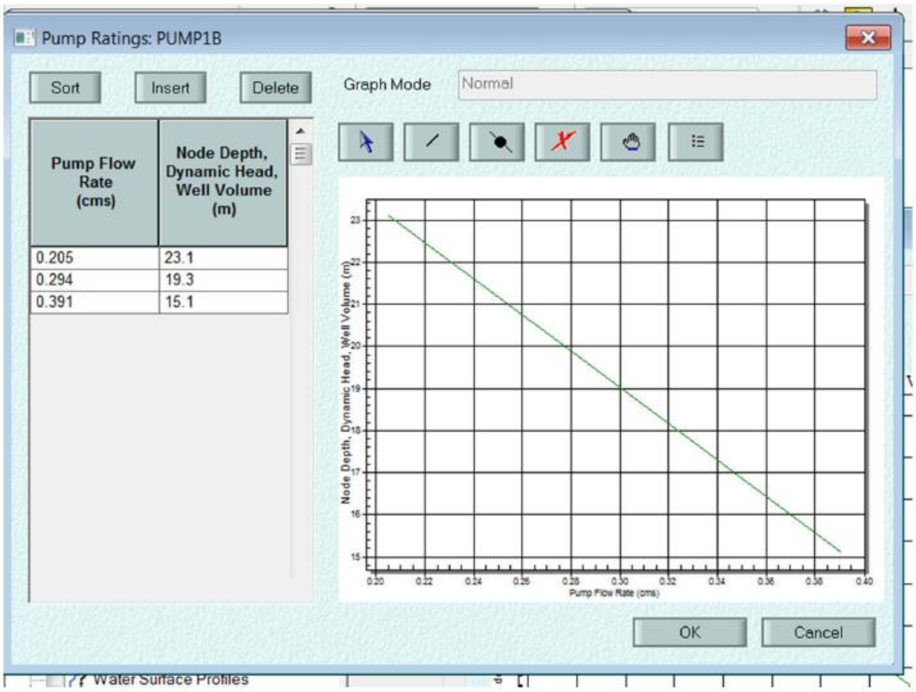
Appendix A: Model Pump Curves

SPS1 – Morisset St SPS





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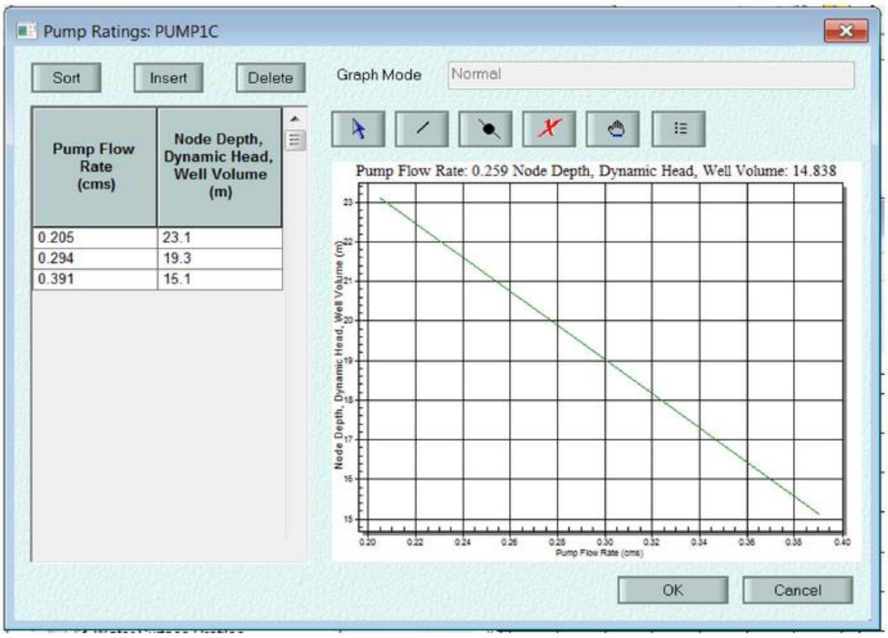
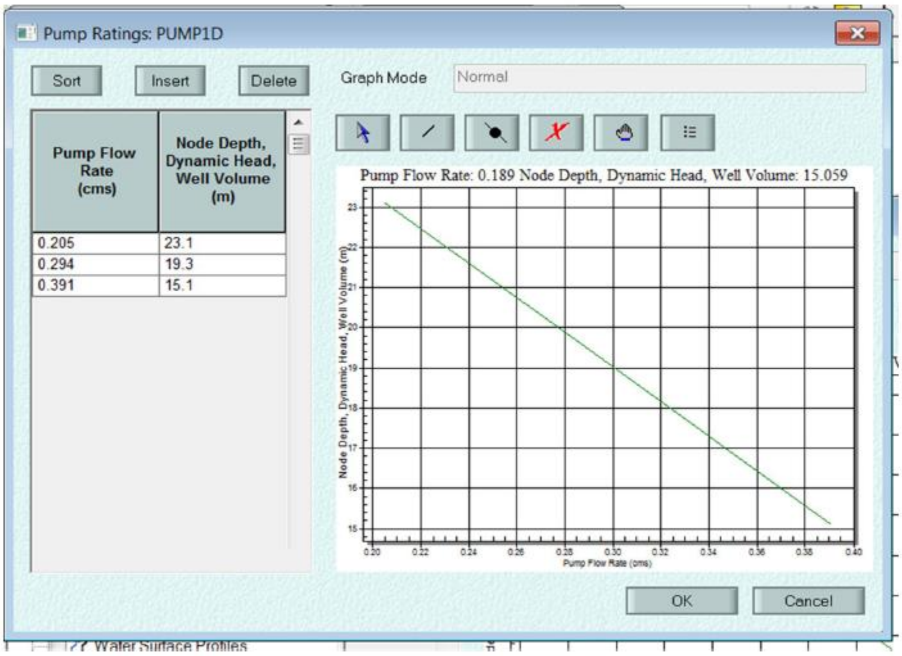

Pump Ratings: PUMP1C
Sort
Insert
Delete
Graph Mode
Normal
Pump Flow Rate (cms)
Node Depth, Dynamic Head, Well Volume (m)
0.205
23.1
0.294
19.3
0.391
15.1
Pump Flow Rate: 0.259 Node Depth, Dynamic Head, Well Volume: 14.838
OK
Cancel


Pump Ratings: PUMP1D
Sort
Insert
Delete
Graph Mode
Normal
Pump Flow Rate (cms)
Node Depth, Dynamic Head, Well Volume (m)
0.205
23.1
0.294
19.3
0.391
15.1
Pump Flow Rate: 0.189 Node Depth, Dynamic Head, Well Volume: 15.059
OK
Cancel

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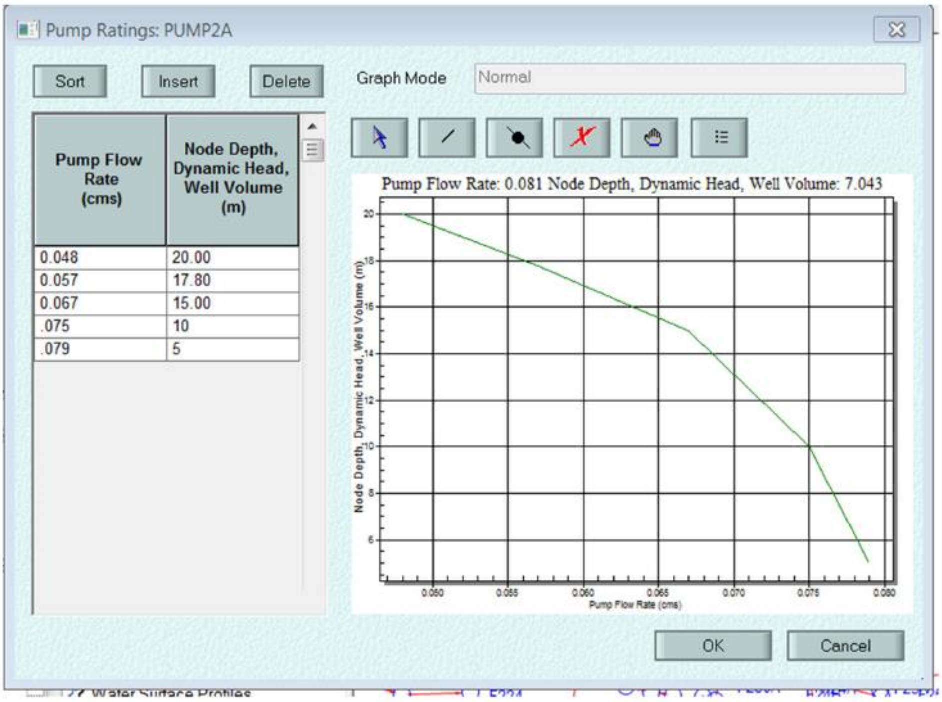
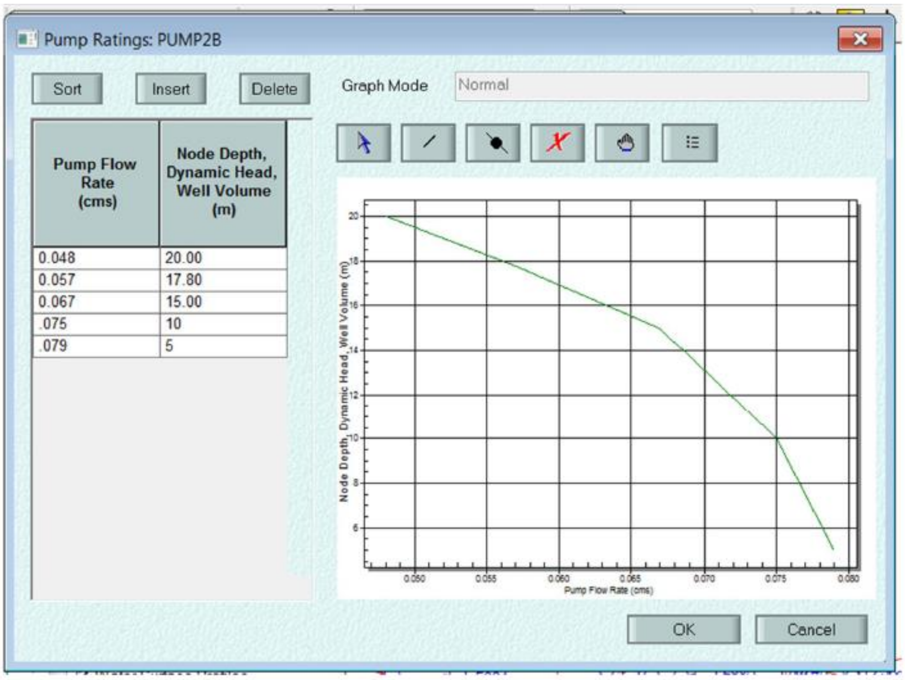
SPS2 – ARC Pump





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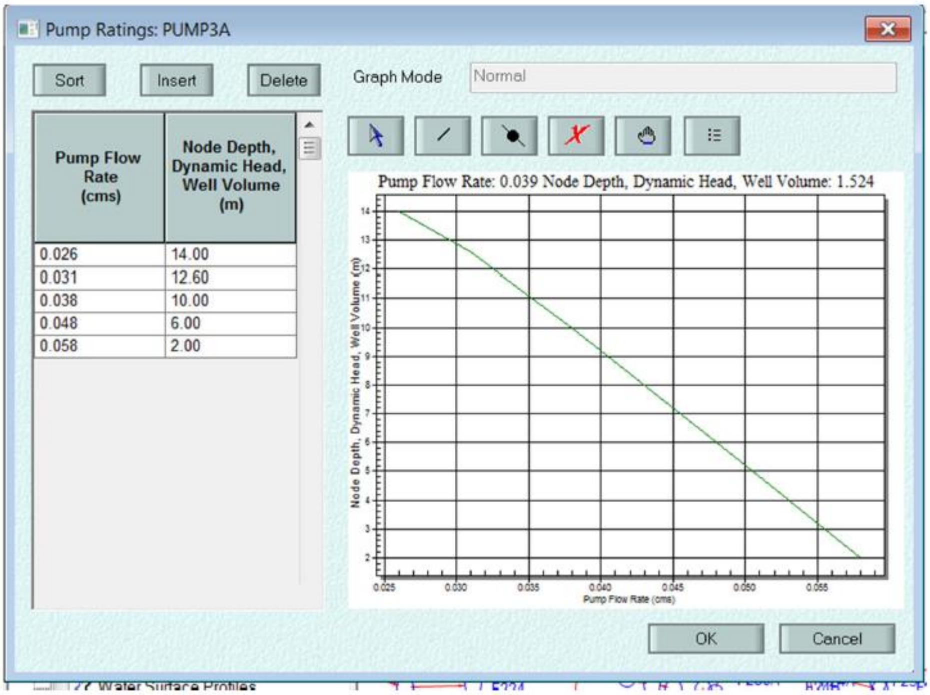
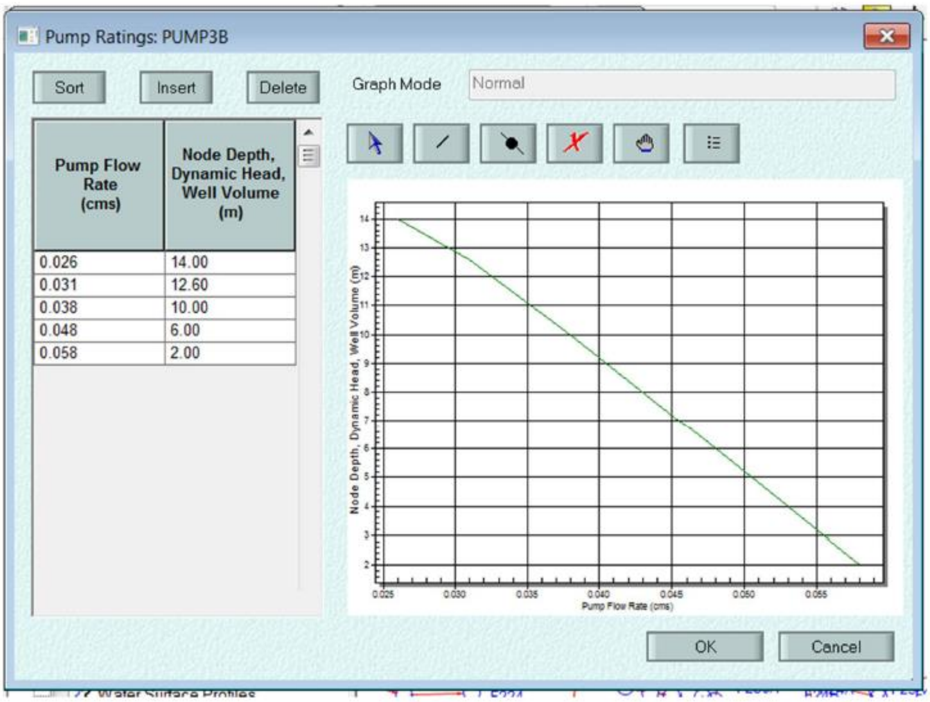
SPS3 – Capital Terrace





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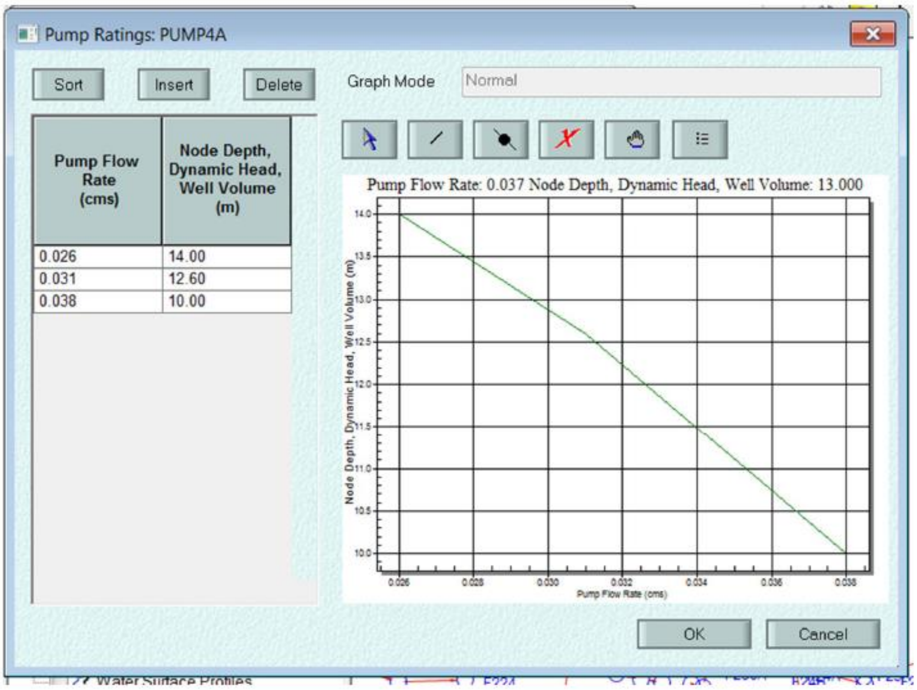
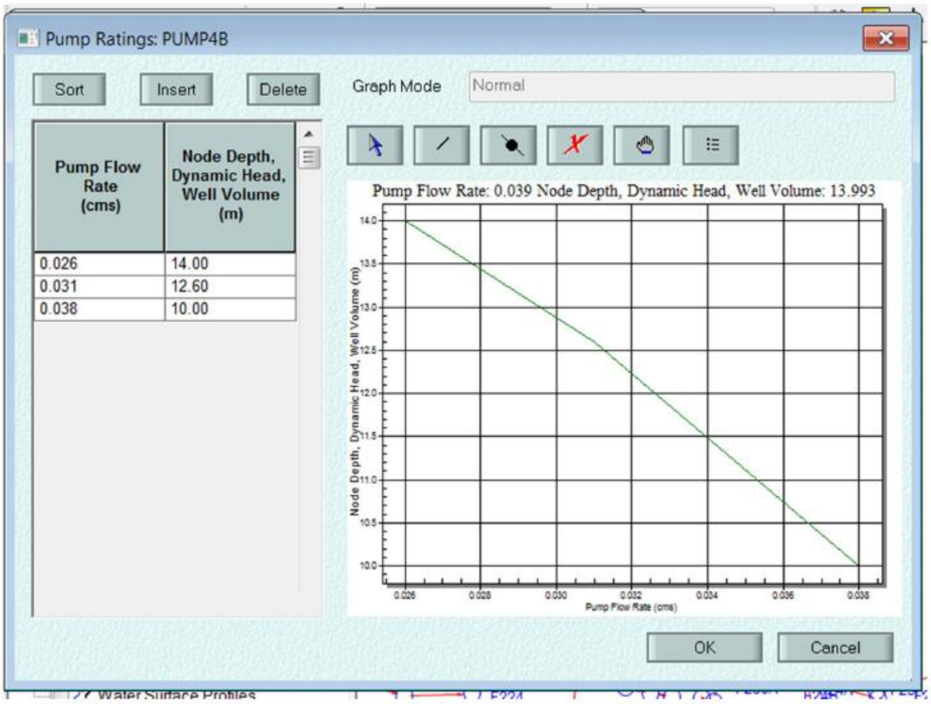
SPS4 – Yass Road





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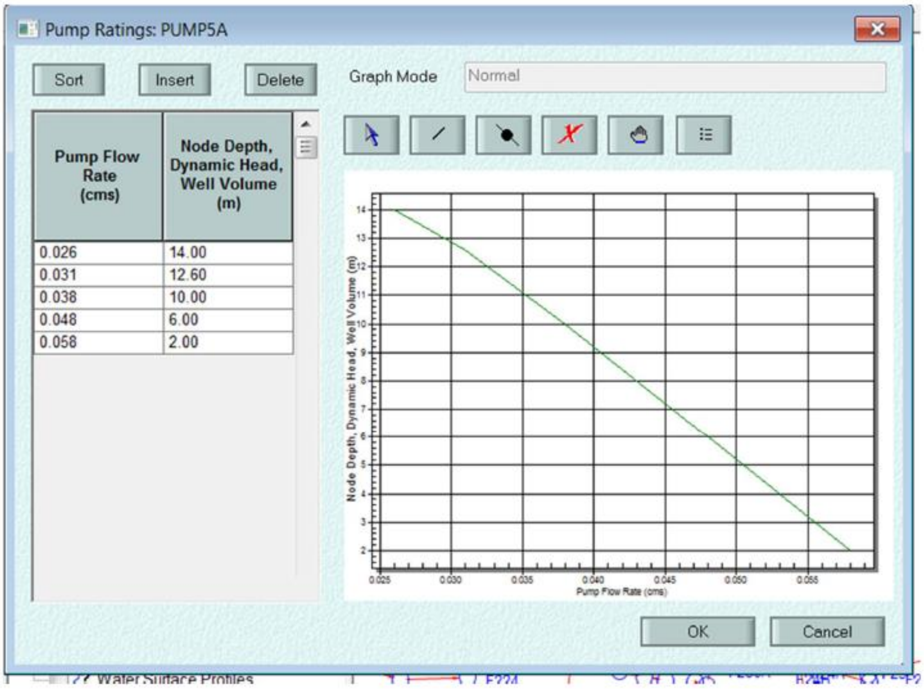
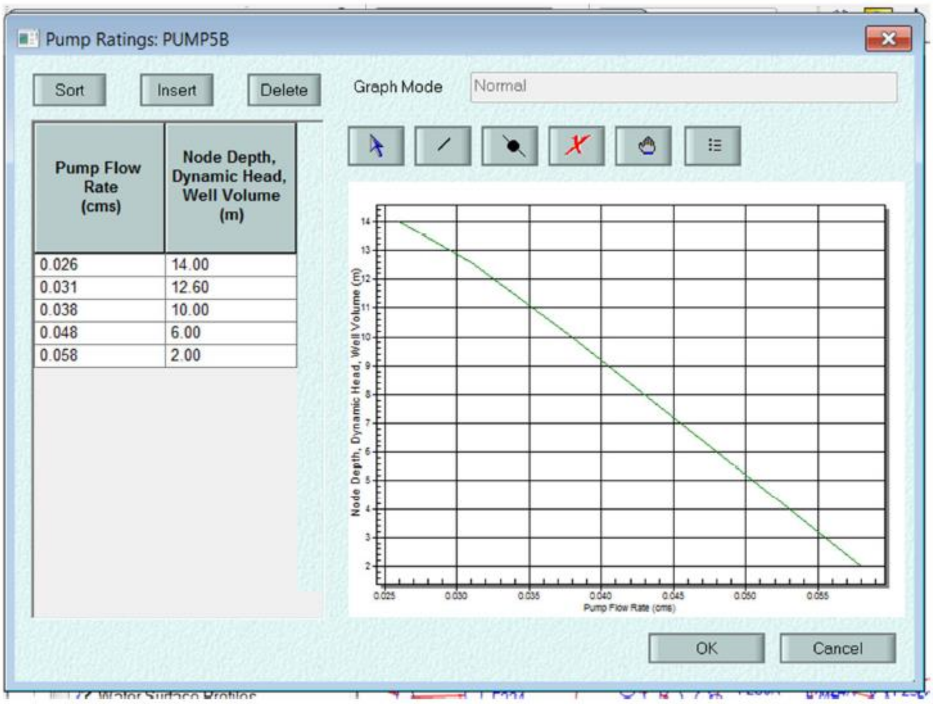
SPS5 – Barber St





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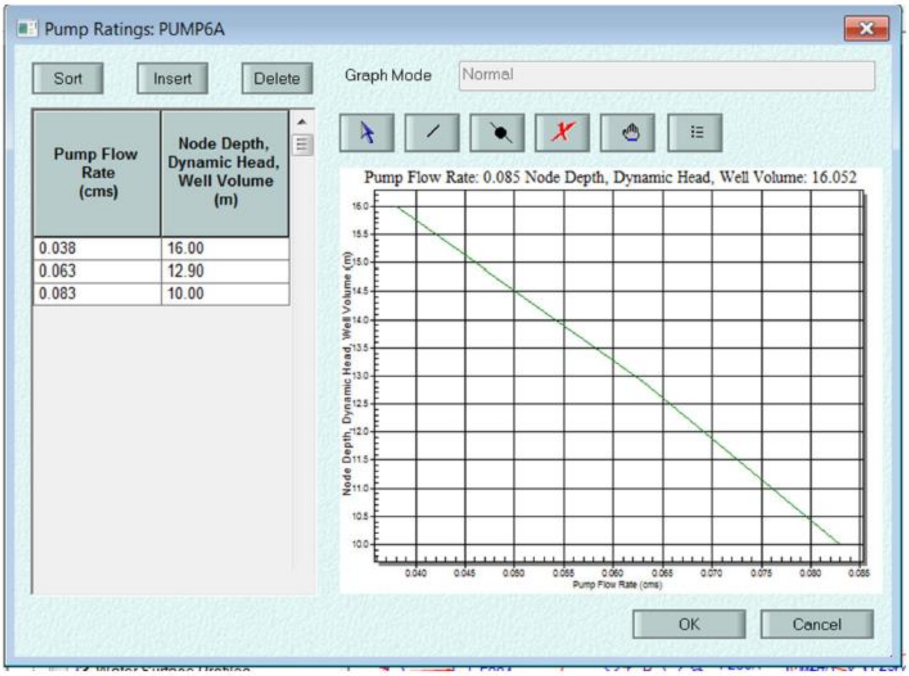
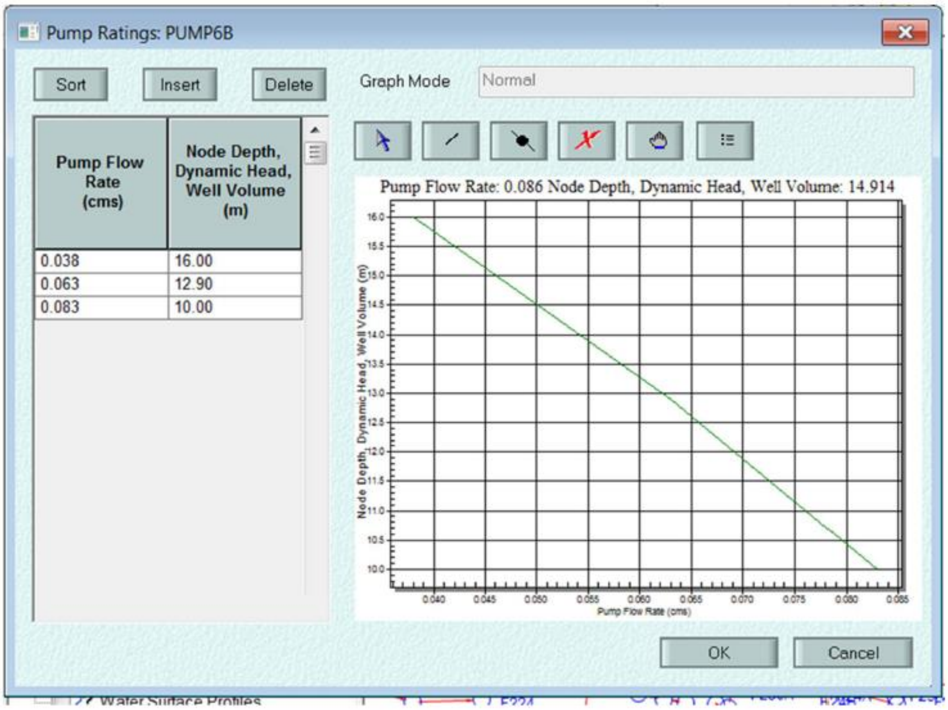
SPS6 – Lochiel Street





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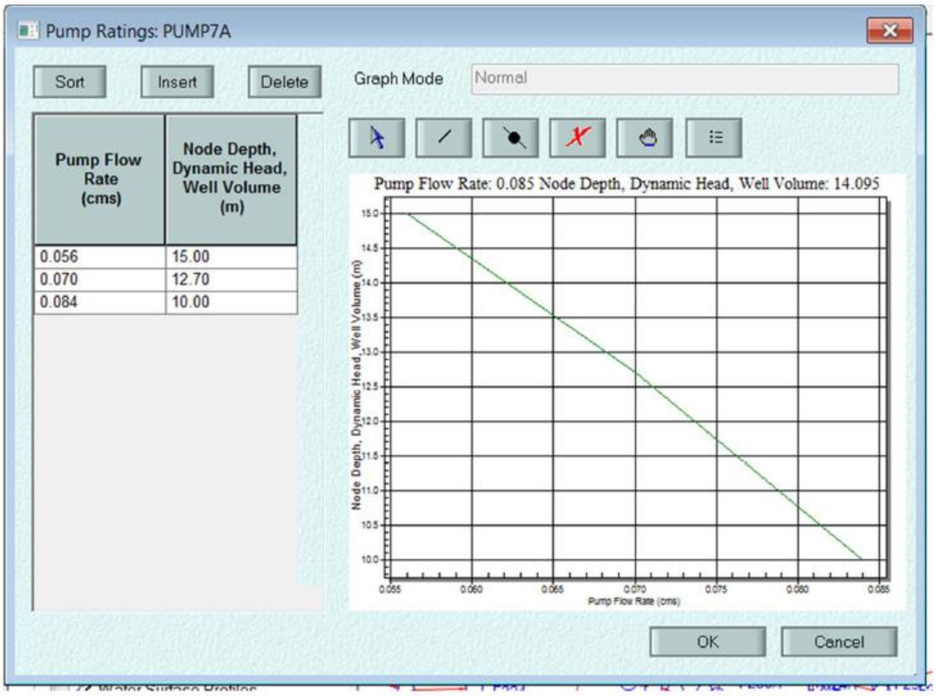
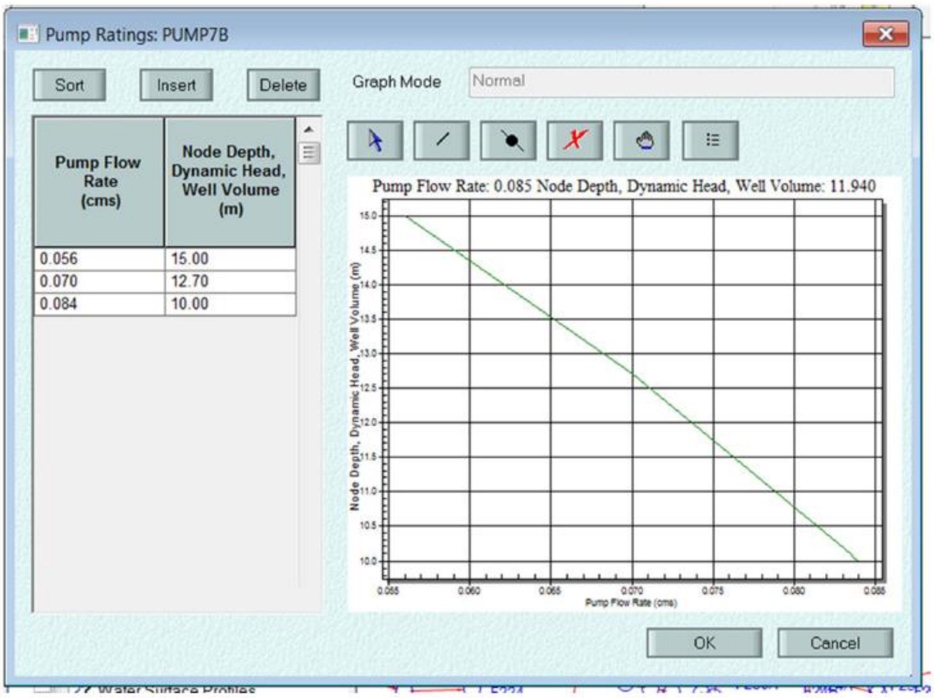
SPS7 – Kathleen Street





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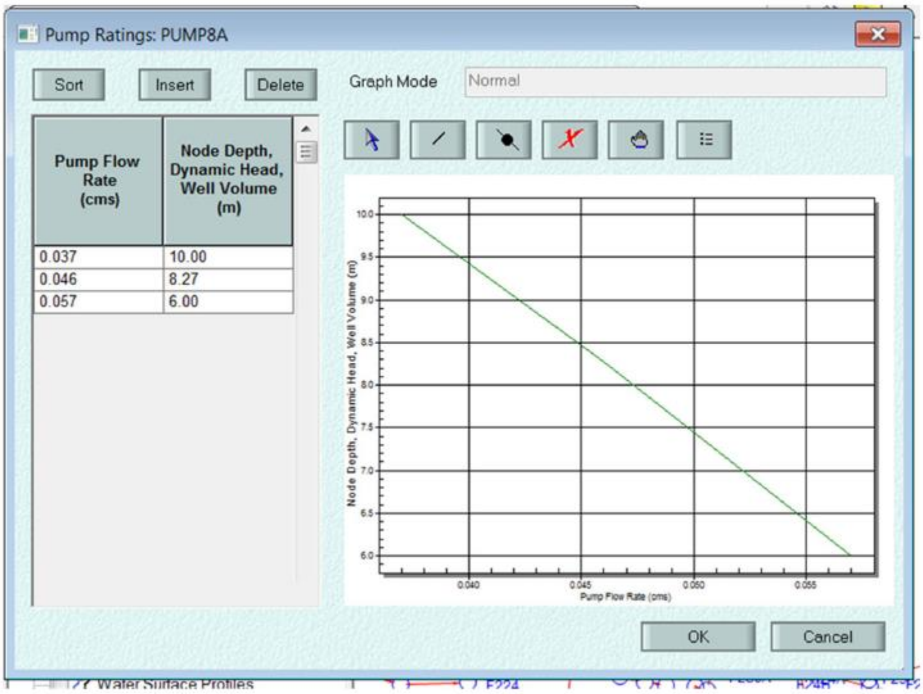
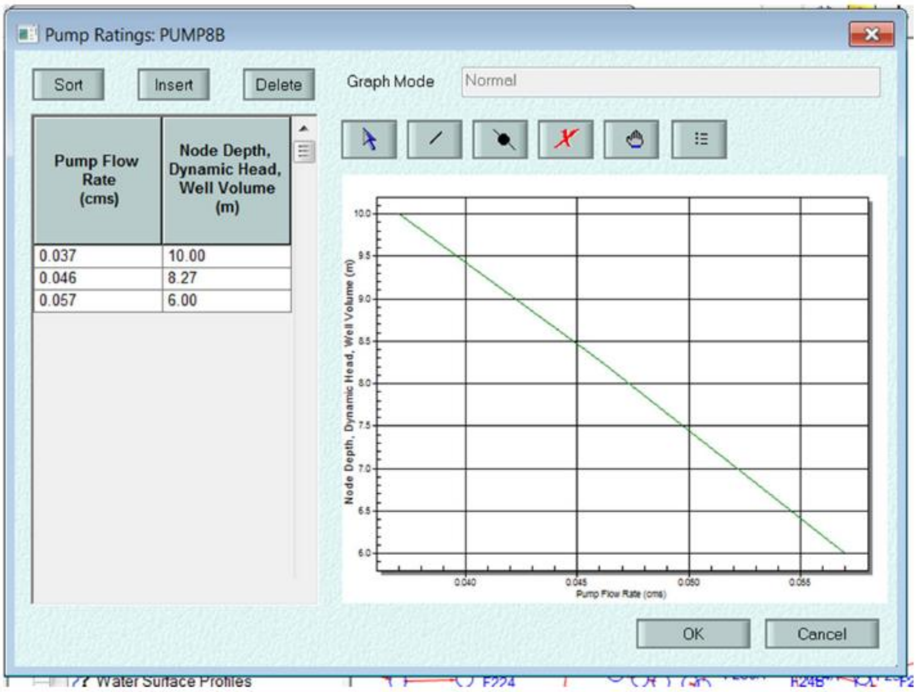
SPS8 – River Drive





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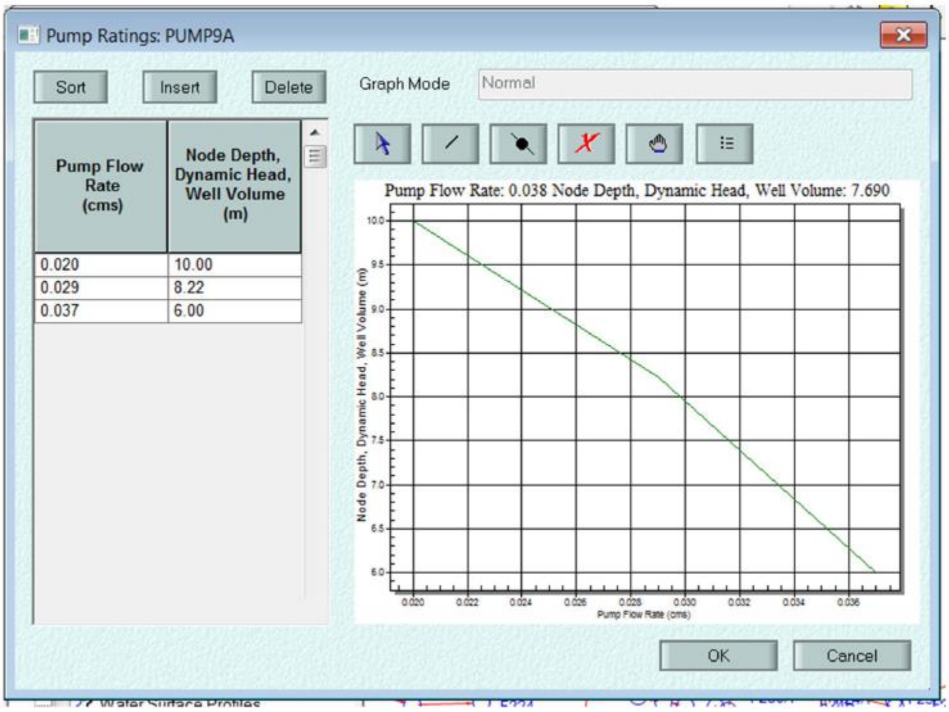
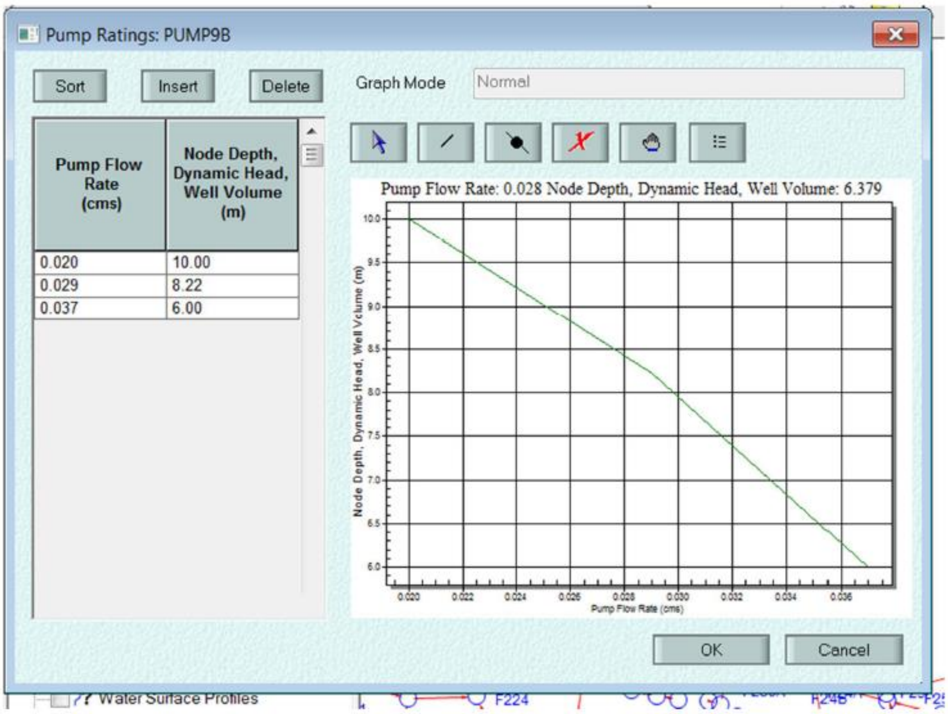
SPS9 – Bayside Circuit





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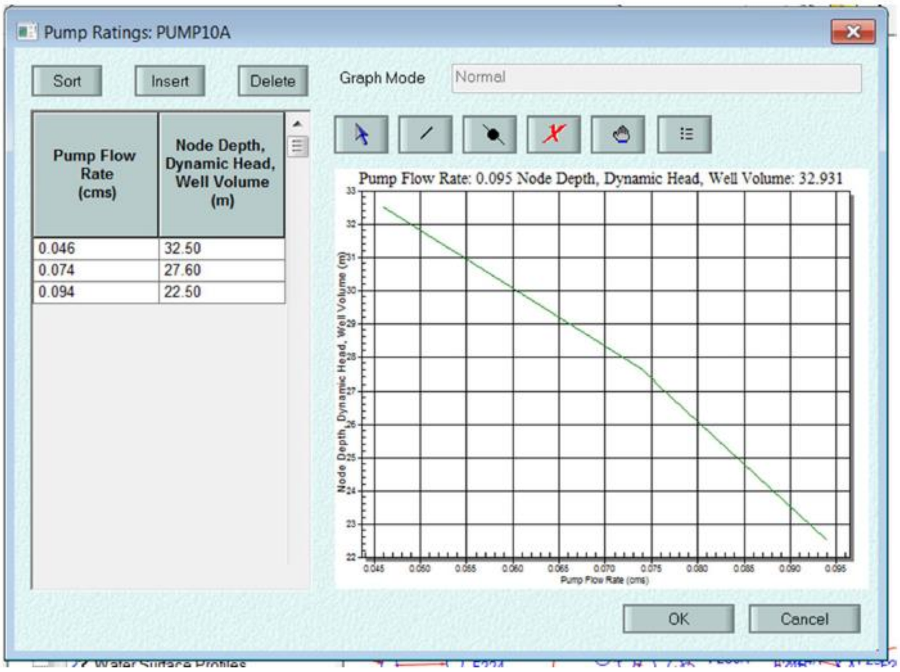
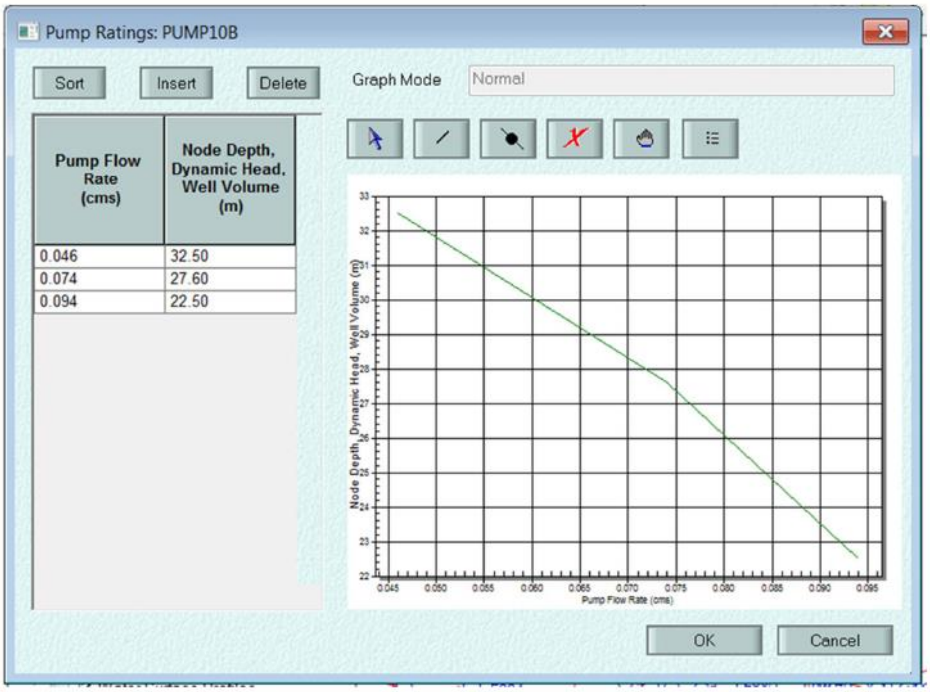
SPS10 – Bellbush Close – Jerrabomberra 9C





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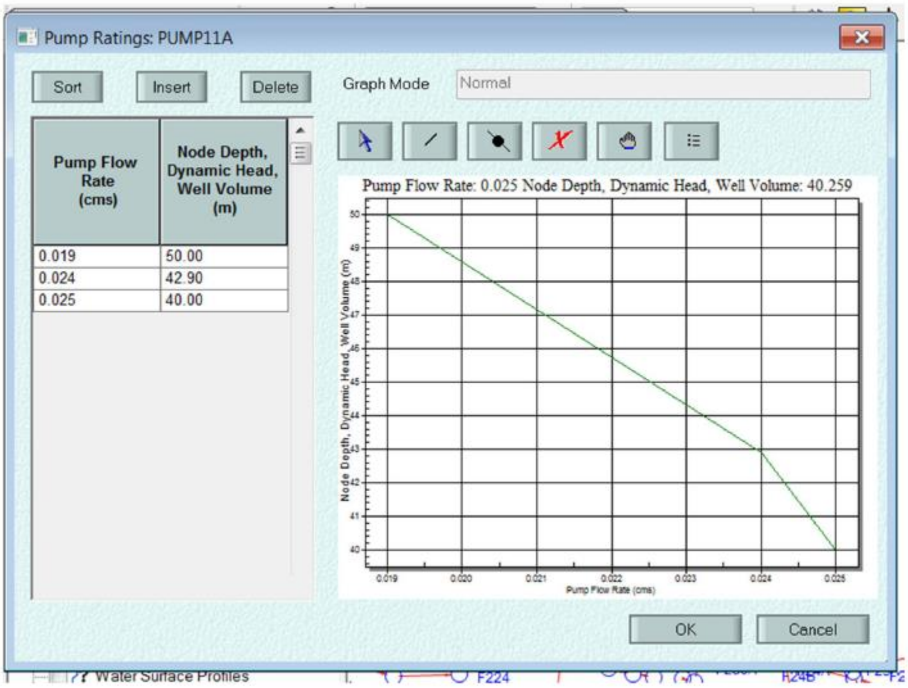
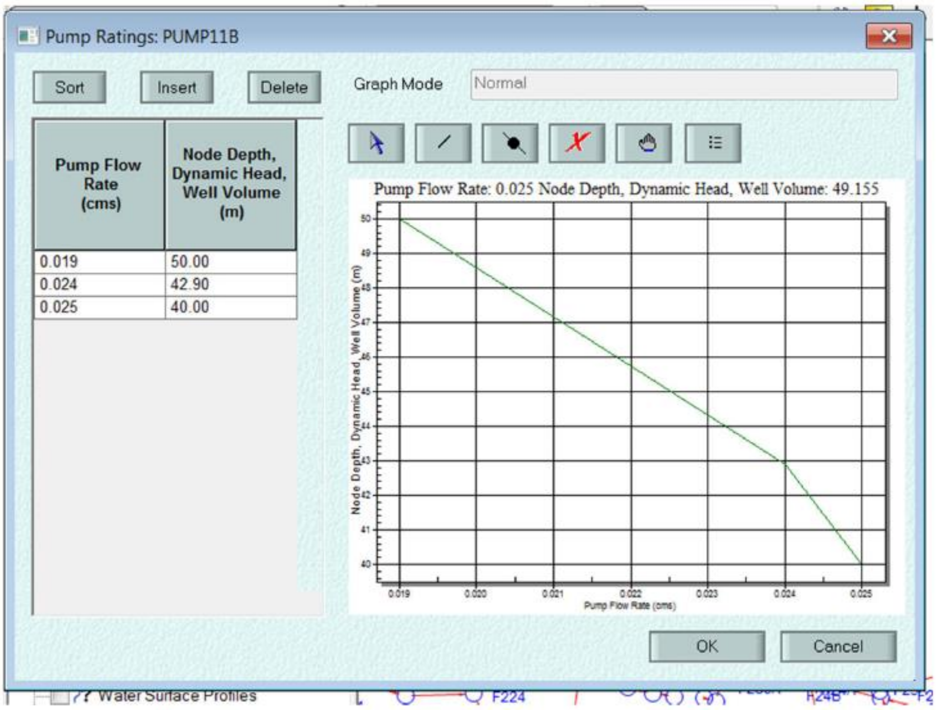
SPS11 – Banyalla Cl – Jerrabomberra 9 D





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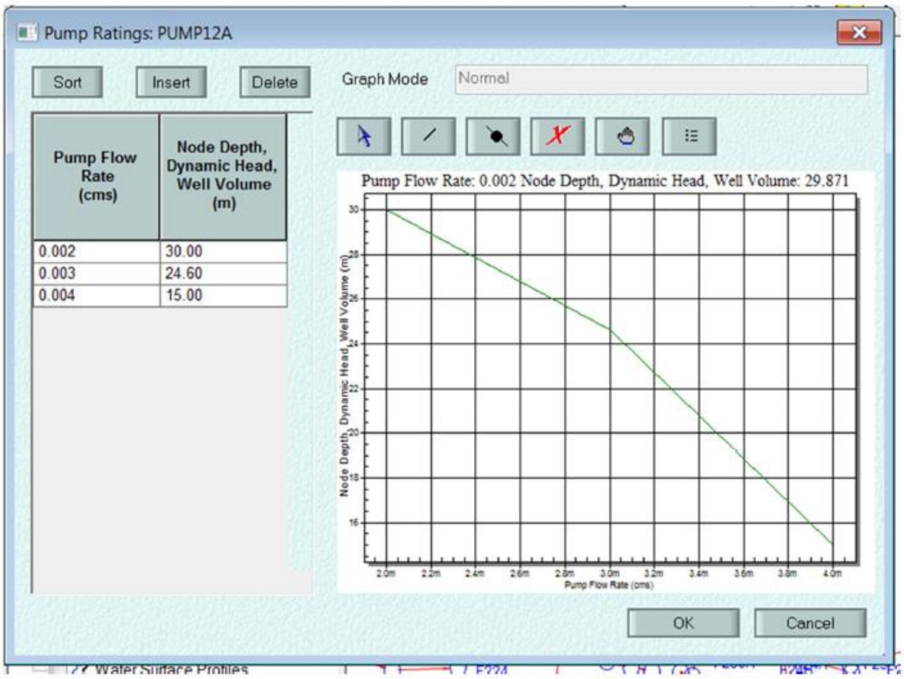
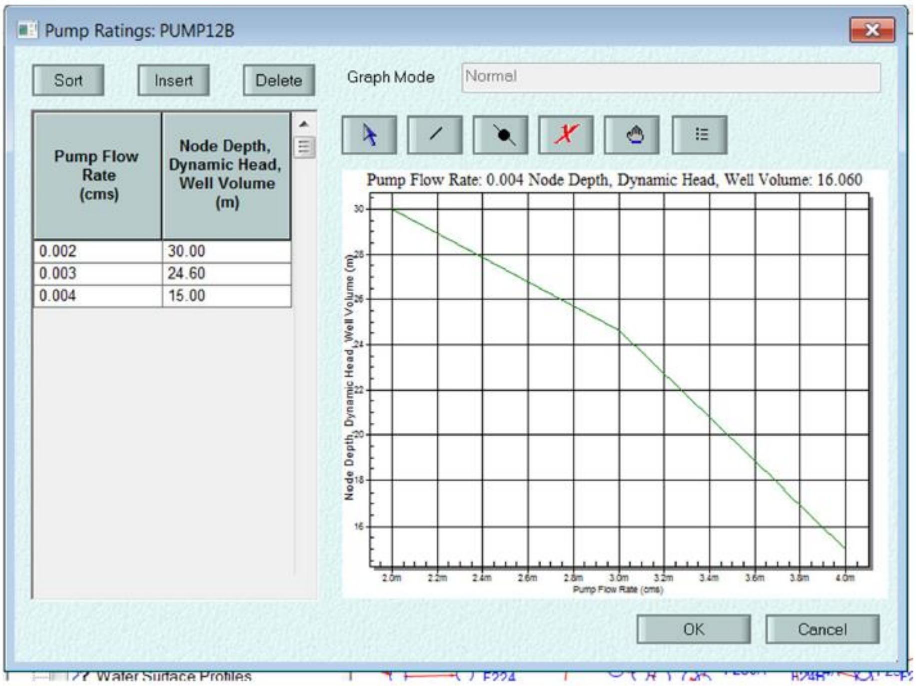
SPS12 – Regent Drive – Kingsway





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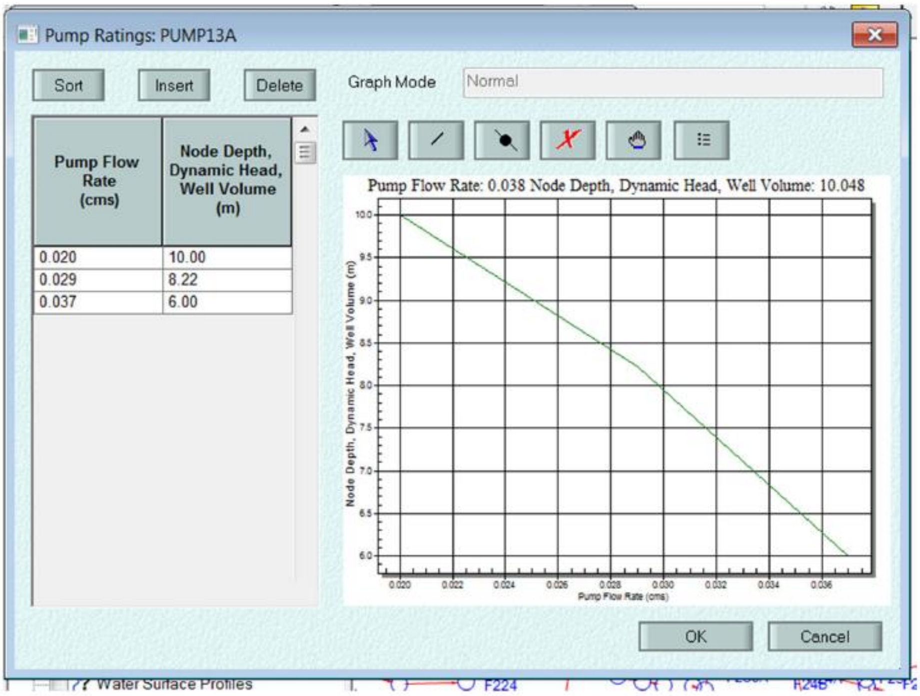
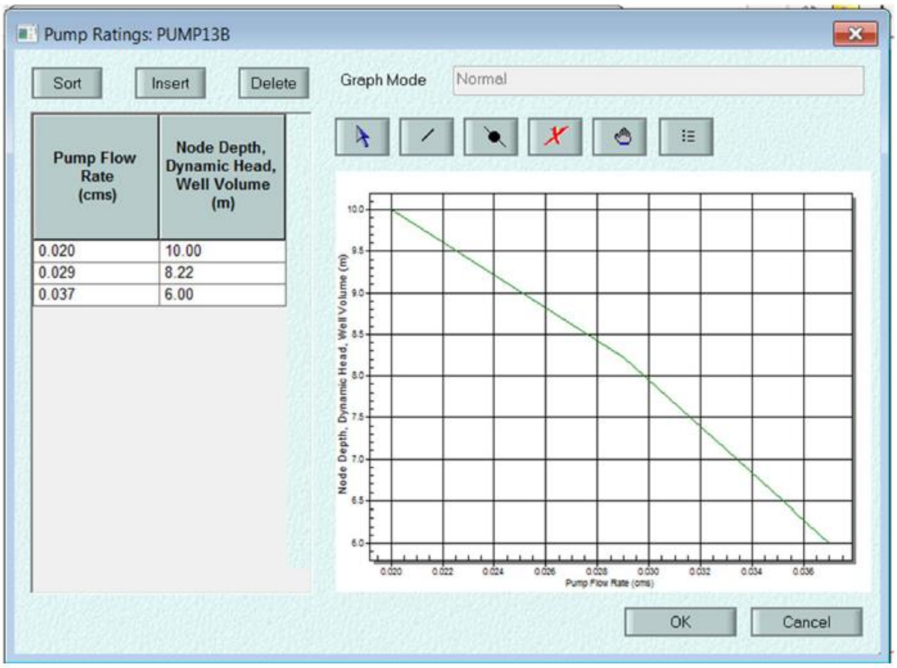
SPS13 – Blundell Street





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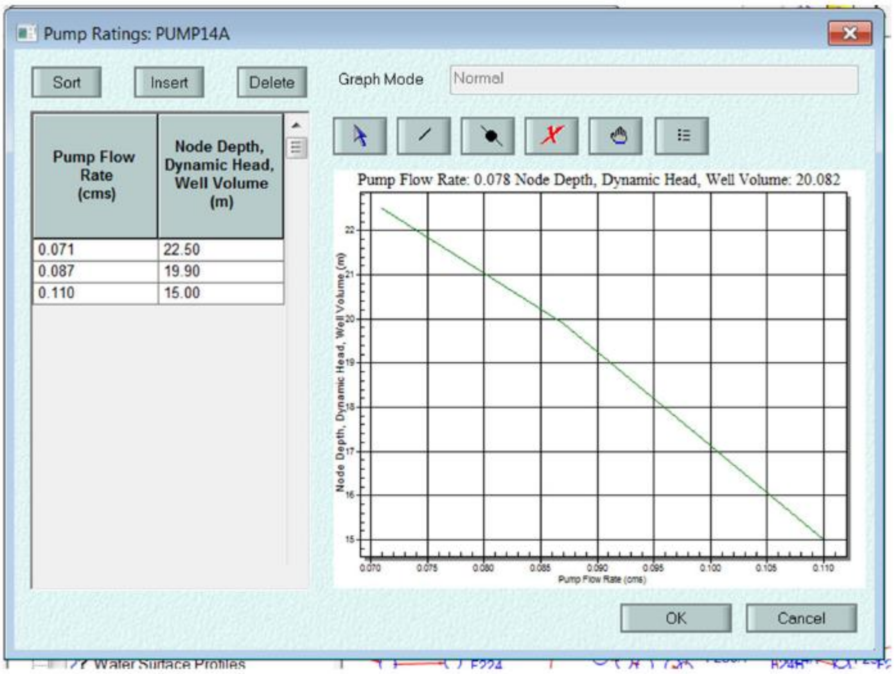
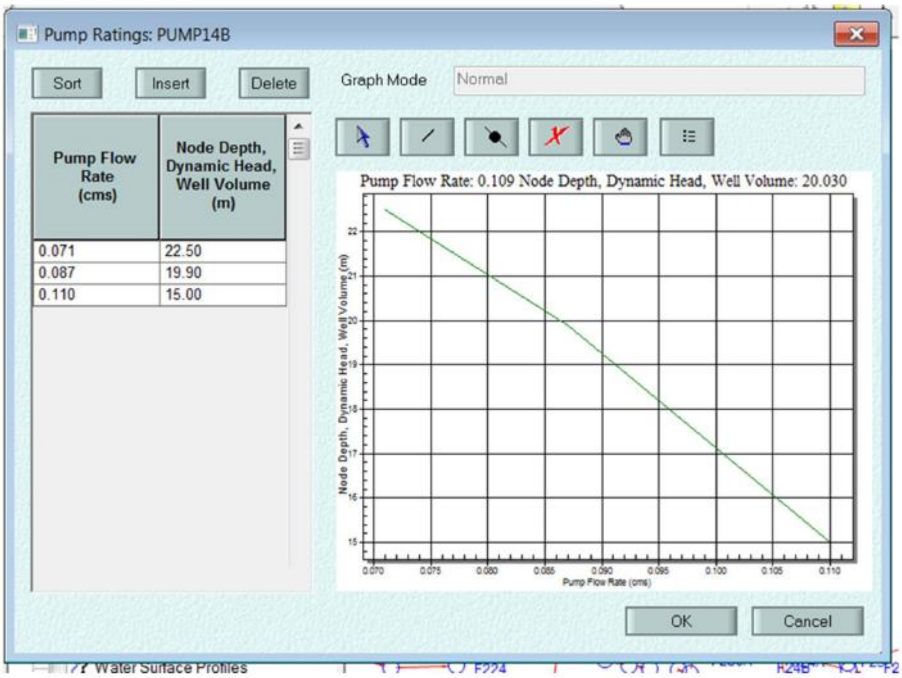
SPS14 – Woodland Avenue- Weetalabah1





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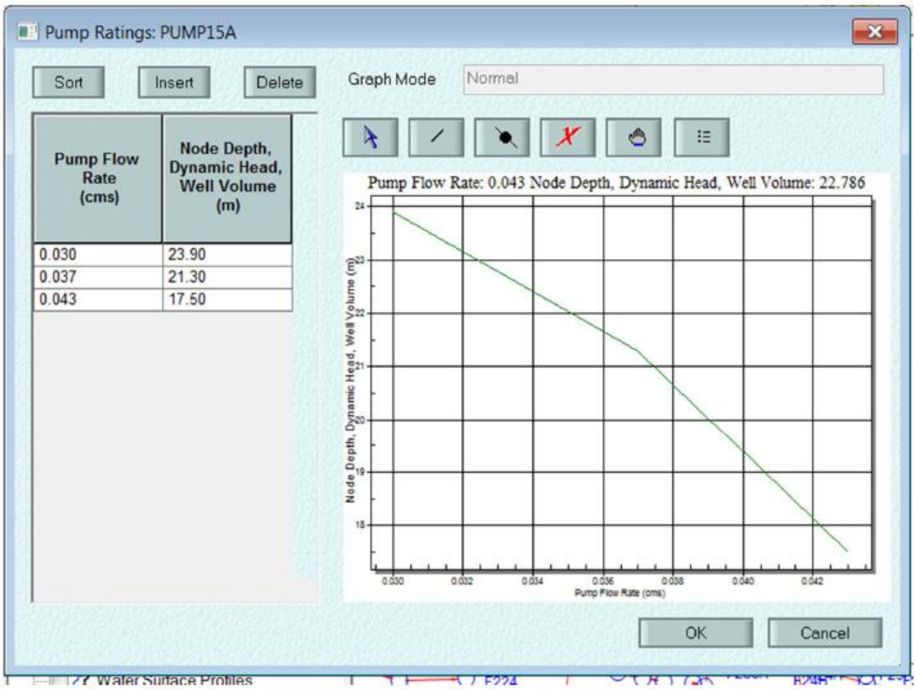
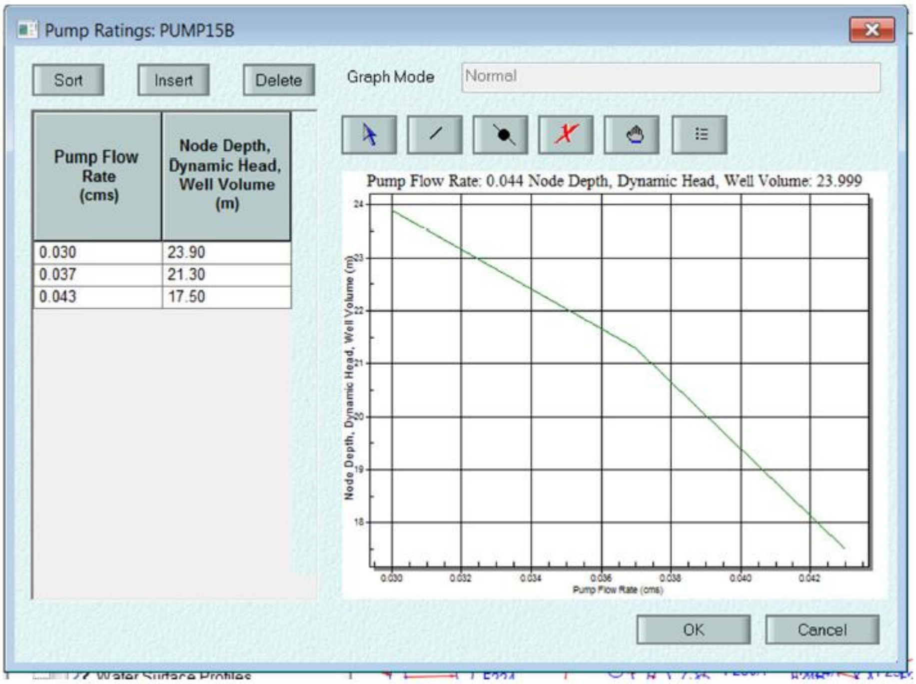
SPS15 – Weetalabah Drive – Weetalabah 2





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Memorandum

To	QPRC – Andrew Grant	Page	1
CC			
Subject	QPRC – Queanbeyan Stormwater Model Review **– DRAFT FOR REVIEW**		
From	Hayden Seear		
File/Ref No.	60548525/ 4.3 Hydraulic Model Reviews	Date	13-Feb-2018

1.0 Introduction

This technical memorandum summarises a high level review of the Queanbeyan stormwater system hydraulic model to assist in the development of the Issues Paper for the Integrated Water Cycle Management Strategy (IWCMS).

2.0 System Overview

The stormwater collection system in Queanbeyan represents a gravity drainage network, with stormwater flows predominantly draining to the Queanbeyan River and in turn the Molonglo River. The nearby Googong Township is serviced by its own stormwater collection system and is not connected to the Queanbeyan stormwater scheme. The Googong scheme is represented by a separate model and does not form part of this model review. Refer to Figure 1 for an overview of the existing stormwater system as represented spatially by sub-catchments within the existing model.

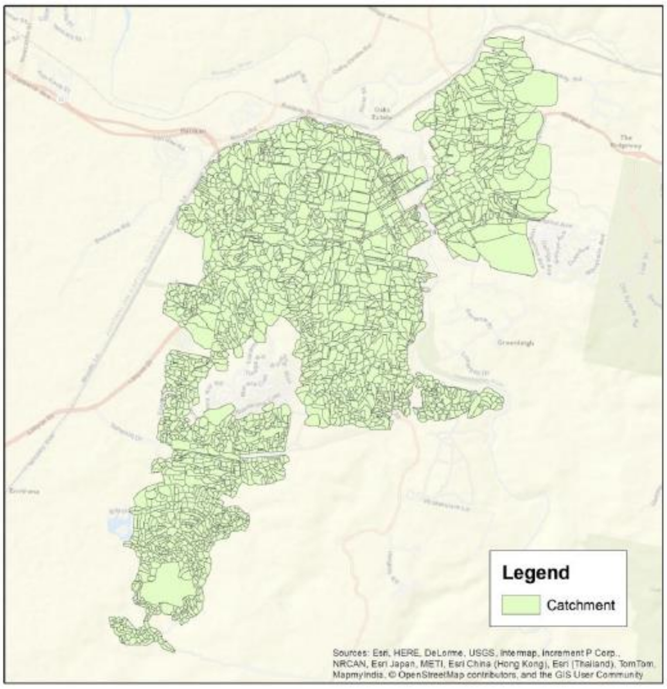

Figure 1. Existing Stormwater System - Modelled Sub-catchments

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3.0 Stormwater Model Review

AECOM was provided the existing Queanbeyan stormwater model in XPSWMM. Based on information provided by QPRC during stakeholder interviews the stormwater model was initially built in 2010 and has never been formally validated or calibrated. QPRC also confirmed the model has not been formally updated since the initial build in 2010. An extract showing the modelled stormwater pipes can be found in Figure 2.

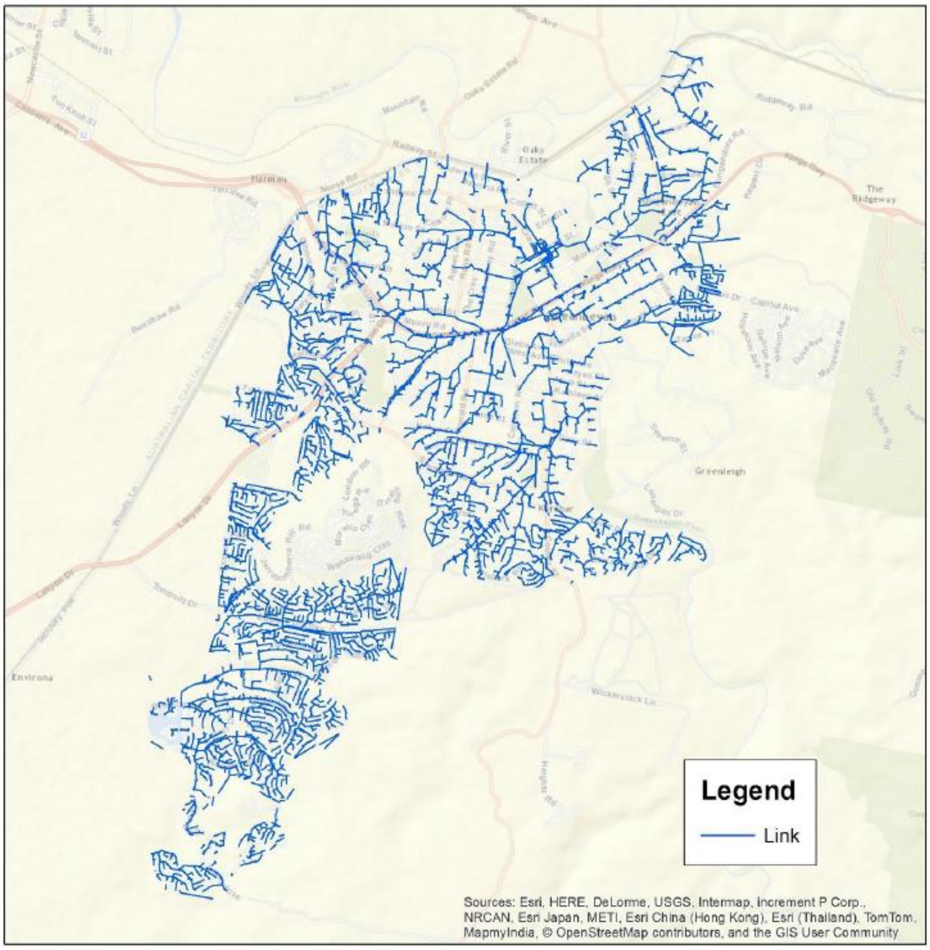

Figure 2. Extent of Queanbeyan Stormwater Model

3.1 Extent of Model Coverage

AECOM was provided access to the QPRC GIS asset dataset to sanity check the latest network coverage to the existing model extents. The existing stormwater model contains 9,261 nodes and 9,084 links. A manual spot check of the model against the GIS data indicates that the older trunk stormwater catchments appear to be reasonably represented, with reference to the older areas of Queanbeyan.

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In regards to the more recent development in areas such as The Ridgeway and Greenleigh there appears to be a gap in model pipe coverage. This reduces the confidence in the accuracy of the model. A detailed comparison of the reticulation pipe layouts was not undertaken as part of the high level review.

3.2 Design Storms and Losses

The existing model is setup to simulate three storm durations with a 5 year average recurrence interval using design rainfall events from the 1987 version of Australian Rainfall and Runoff. These are shown below in Figure 3.

A fourth storm is specified at the sub-catchment level in the model. This storm represents 21.2 mm, which corresponds to a 5 year, 30 minute event according to the global storms table, however uses the Zone 2, 30 minute, <30 year rainfall distribution curve. This storm event is currently coded into the model as the existing scenario. A graph showing rainfall intensity versus time for this storm event can be found in Figure 4.

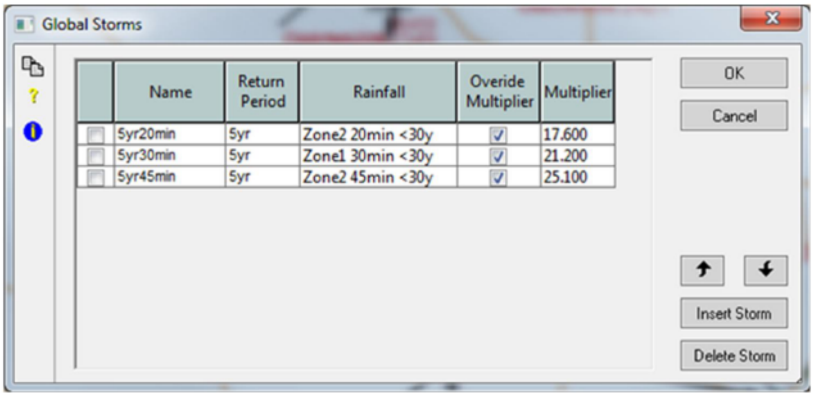

Figure 3. Global Design Storms in Stormwater Model

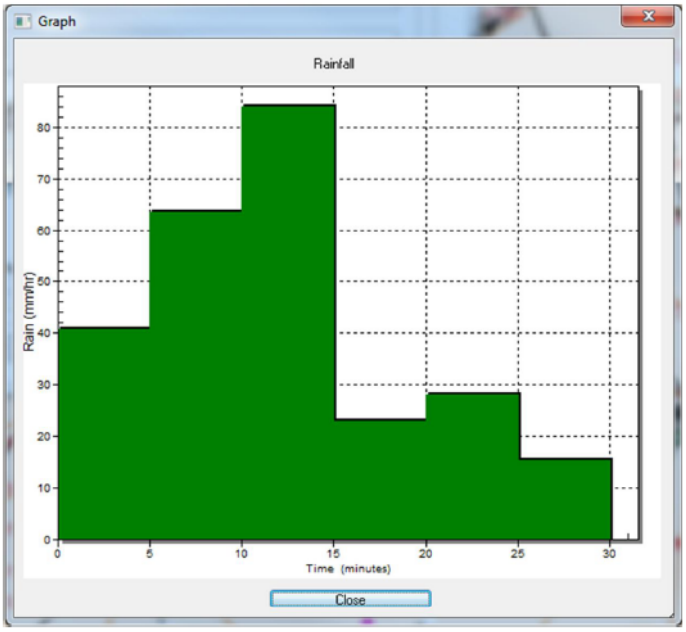

Figure 4. Existing Storm Scenario in Model (rainfall intensity versus time)

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3.3 Catchment Review

There are 2,992 sub-catchments within the existing stormwater model. All sub-catchments use the Laurenson routing method and have a constant imperviousness of 50%. A constant Laurenson shape factor of -0.285 is used in the model. The constant imperviousness and shape factor supports the assumption that the existing model is likely not calibrated.

The sub-catchment delineation is highly detailed and gives a catchment for most stormwater pits. Due to the sheer number of sub-catchments, a detailed review was not undertaken for this high level review.

The sub-catchment definition is likely to be complete and suitable for modelling the level of service performance for the entire pipe network, however the delineation should be reviewed and confirmed if any particular branches are the subject of a detailed planning and/or O&M investigation. Similar review will be required for pit and side entry/inlet characteristics prior to using the model at a more detailed granularity with confidence.

3.4 Asset Attribute Data

A spot check comparison of the modelled pipes versus the GIS indicates that all elements within the stormwater model are represented as circular pipes, including some locations that are designated as open channels in the GIS data. A further review of actual circular pipes within the network indicates that the correct pipe diameters have been coded into the model, however pipe inverts appear to be estimated or inferred from ground elevations. This is considered to reduce the accuracy of the model and aligns with QPRC's stated low confidence regarding the invert levels.

As an example, Figure 5 shows a sample pipe profile from the model. Pipe inverts follow the ground elevation very closely, even for locations where the ground level causes an adverse slope or gradient in the pipe. This is considered to represent a significant issue that reduces the usefulness of the model. The pipe roughness for all pipes was set at 0.014, which indicates that pipe material and age was not considered when coding stormwater pipes into the model.

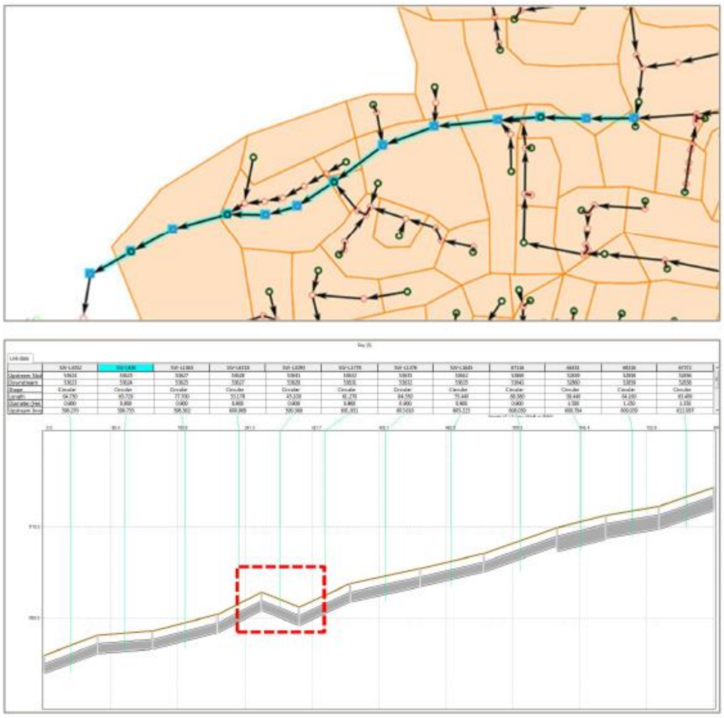

Figure 5. Example Profile from Stormwater Model (showing adverse gradients)

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3.5 Overland Flow Paths

No secondary/overland flow paths are coded into the model and this remains a gap.

3.6 Model Performance Results

The model does not currently run due to a number of missing pipe inverts. This places greater importance on resolving the pipe invert anomalies within the model. This information would need to be populated as a minimum before evaluating model results and is therefore considered a critical data gap.

4.0 Conclusions

In summary, there is low confidence in the accuracy of the existing stormwater model for both strategic planning and O&M purposes, including its use on the IWCMS. This conclusion is based on the following:

- A number of key gaps identified – including the absence of pipe inverts and overland flow paths and adverse pipe gradients.
- Lack of historical model updates (since the original build in 2010) – particularly when considering model coverage, connectivity and configuration (especially in new development areas post-2010).
- Inability to run the model in its current state due to the above data gaps.

5.0 Recommendations

There are a number of recommended stormwater model improvements required to enable the model for strategic planning and/or O&M related purposes. These are summarised in the sections below.

In terms of using the model to inform the IWCMS, the required updates in the model to resolve the above issues is considered to be a time intensive task and therefore a staged approach may be more suitable in regards to initially focusing on perceived problem areas or hot spots.

5.1 General

- Consider upgrading from XPSWMM software to another modelling package – XPSWMM is not as widely used or supported as other software packages and this may hinder the ability to outsource, check models and/or innovate within the model. XP Software has also recently been purchased by Innovyze and there is uncertainty as to the future of the product i.e. it may be phased out and eventually replaced by Innovyze at some point in the future.
- Missing pipe inverts to be populated as a priority to enable the model to run.
- Upgrade the hydrology model data to the latest Australian Rainfall and Runoff 2016.
- Adopt a staged approach to updating the model by improving the model data on a single branch at a time, starting with the problem areas or drainage hot spots and progressively improving the model accuracy as the need arises.

5.2 System Wide Updates

- To determine the approximate level of service offered by the entire network, adverse pipe grades should be corrected with reference to design drawings or work-as-executed surveys
- Where the above can't be done, adverse pipe slopes should be smoothed by applying a minimum pipe grade to ensure no water is trapped in the model.
- When assessing the capacity of the pipe network, pit capacity is less important but should be modelled accurately if localised drainage issues are known.
- Undertake spot checks with reference to the design drawings or work-as-executed surveys to ensure that the pipe diameters entered into the model are accurate.

- Include additional growth scenarios for future planning horizons.

5.3 Detailed Updates

- Where a detailed assessment is required, pipe inverts along an entire branch should be revised with reference to design drawings or work-as-executed surveys.
- Where this can't be done, survey should be undertaken to determine pipe invert levels and pit details.
- Pit characteristics should be accurately surveyed and pit losses calculated.
- Overland flow paths should be represented in the model to ensure no loss of stormwater from the model.

FINAL DRAFT

Appendix E

PRG Workshop Slides & Minutes

FINAL DRAFT

Appendix E PRG Workshop Slides & Minutes

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Queanbeyan Integrated Water Cycle Management (IWCM) Strategy

Project Reference Group (PRG) Workshop

26 November 2019

Agenda

- Welcome/Introductions
- Safety Moment
- Project & Workshop Objectives
- Project Journey (Roadmap)
- Project Team & Key Stakeholders
- Study Area
- Existing Urban Water Services
- Data Gap Analysis
- Population and Development
- Drinking Water Gap Analysis and Findings
- **Lunch Break (12.00)**
- Sewer Gap Analysis and Findings
- Stormwater Gap Analysis and Findings
- Wrap-up - Workshop Outcomes & Actions
- Next Steps

Introductions

Safety Moment – Bush Fire Survival Plan

There are four simple steps to get ready for a bush fire:

DISCUSS

STEP 1

DISCUSS WHAT TO DO IF A BUSH FIRE THREATENS YOUR HOME

Many households find that having a discussion over dinner works best as everybody is together and focussed.

Download the Step 1 discussion guide (PDF, 985.3 KB).

PREPARE

STEP 2

PREPARE YOUR HOME AND GET IT READY FOR BUSH FIRE SEASON

There are simple things you can do around your home to prepare it for a bush fire, like keeping the grass low and having a cleared area around your home.

Download the Step 2 checklist (PDF, 595.5 KB).

KNOW

STEP 3

KNOW THE BUSH FIRE ALERT LEVELS

If there is a fire in your area you will find its alert level on the NSW RFS website and in the 'Fires Near Me' app. You need to keep track of the alert level so you know what you should do.

Download Step 3 (PDF, 146.4 KB).

KEEP

STEP 4

KEEP ALL THE BUSH FIRE INFORMATION NUMBERS, WEBSITES AND THE SMARTPHONE APP

In a bush fire, it's important that you stay up to date on conditions in your area.

Download Step 4 (PDF, 219.1 KB).

It's a fact. If you and your home are well prepared, you stand a better chance of surviving a bush fire. Download the four simple steps today.

https://www.rfs.nsw.gov.au/plan-and-prepare/bush-fire-survival-plan

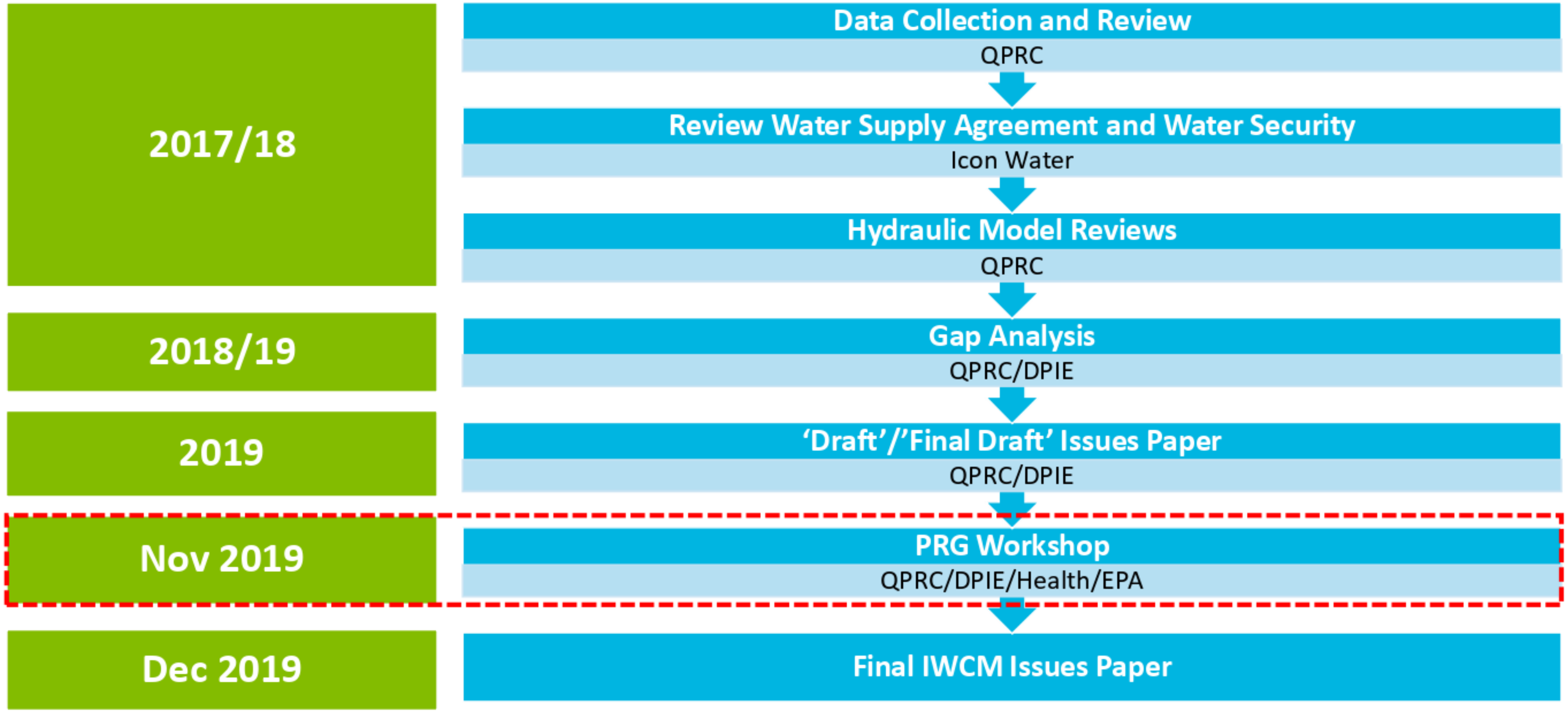
Project Objectives

- Develop a 30-year Integrated Water Cycle Management Strategy (IWCMS) for the water, sewer and stormwater infrastructure within the former Queanbeyan Local Government Area (LGA)
- Aligned to the NSW Best-Practice Management of Water and Sewerage Framework (DPIE Water) – "IWCM Checklist"
- Develop the 30-year IWCM strategy using transparent, evidence based analysis that considers both the complex inter-relationship between the urban water cycle (water supply, sewerage and stormwater) and community expectations
- **Part 1: IWCM Issues Paper**
  Part 2: IWCM Strategy
  Part 3: Strategic Business Plan
  Part 4: Financial Plan

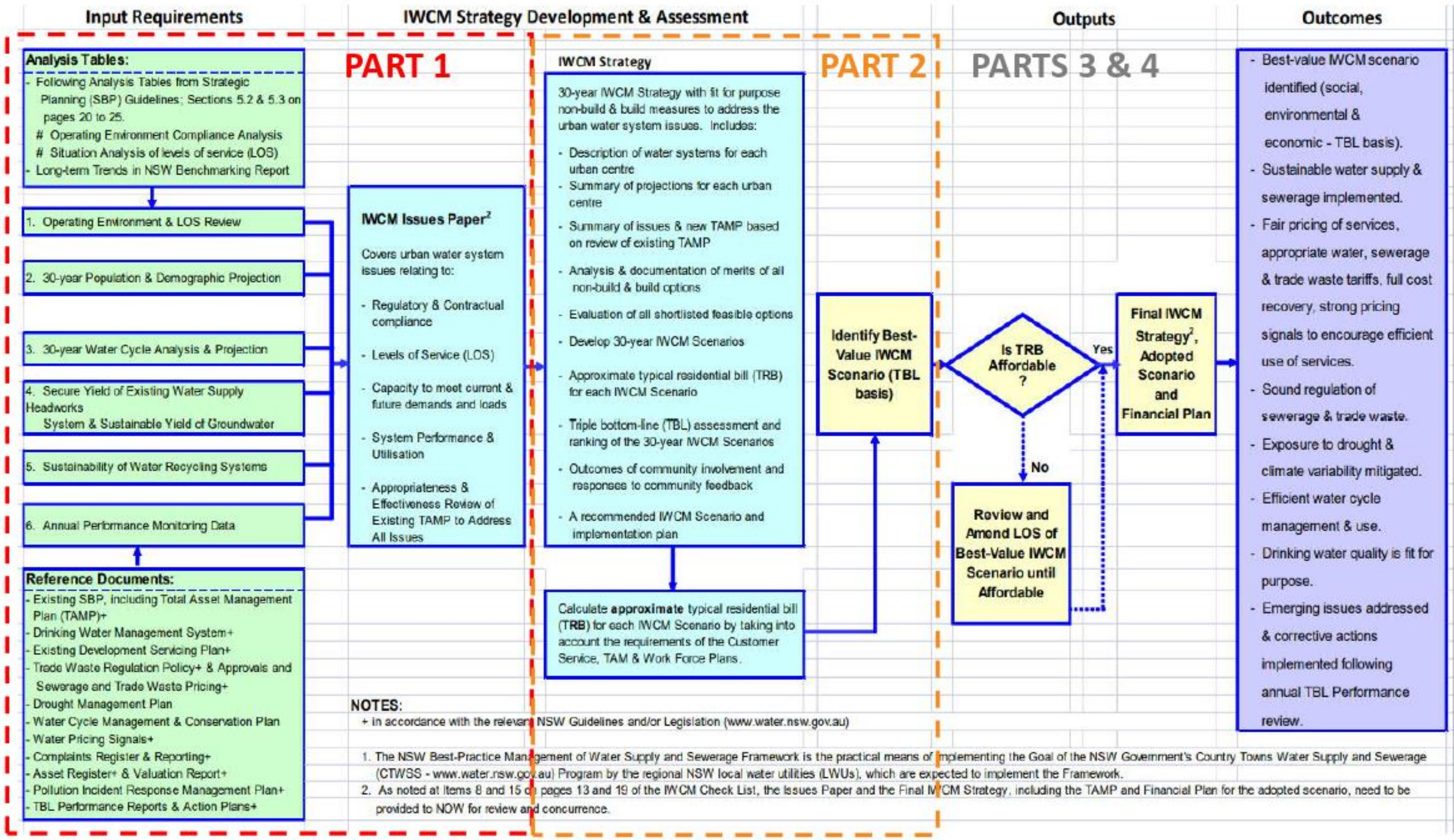
Workshop Objectives

- Familiarise the Project Reference Group (PRG) with the IWCM process and highlight the key findings and issues from Part 1 that may limit the successful completion of the IWCM Strategy
- Receive PRG feedback on the key findings/issues and gain consensus on the outcomes in order to finalise the IWCM Issues Paper for endorsement, and close out Part 1
- Part 1 aims to define “what the problems are” with respect to IWCM, prioritise strategic gaps and associated problems and document the key findings in order to progress the development of the IWCM Strategy in Part 2

Part 1 - Project Road Map



IWCM Strategy – DPIE Flowchart



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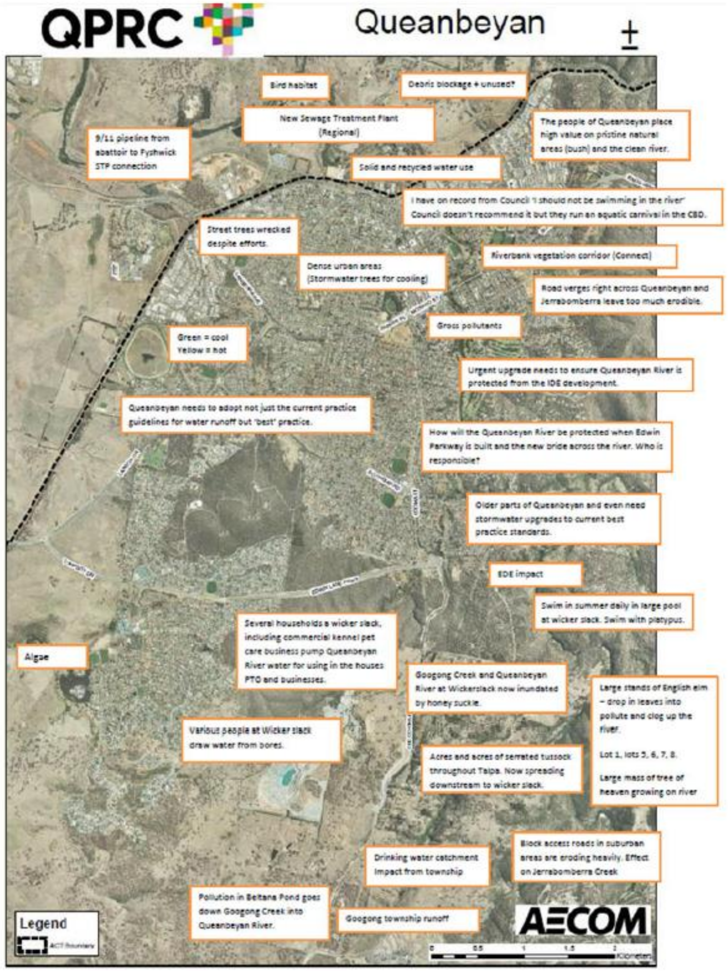
Project Team & Key Stakeholders

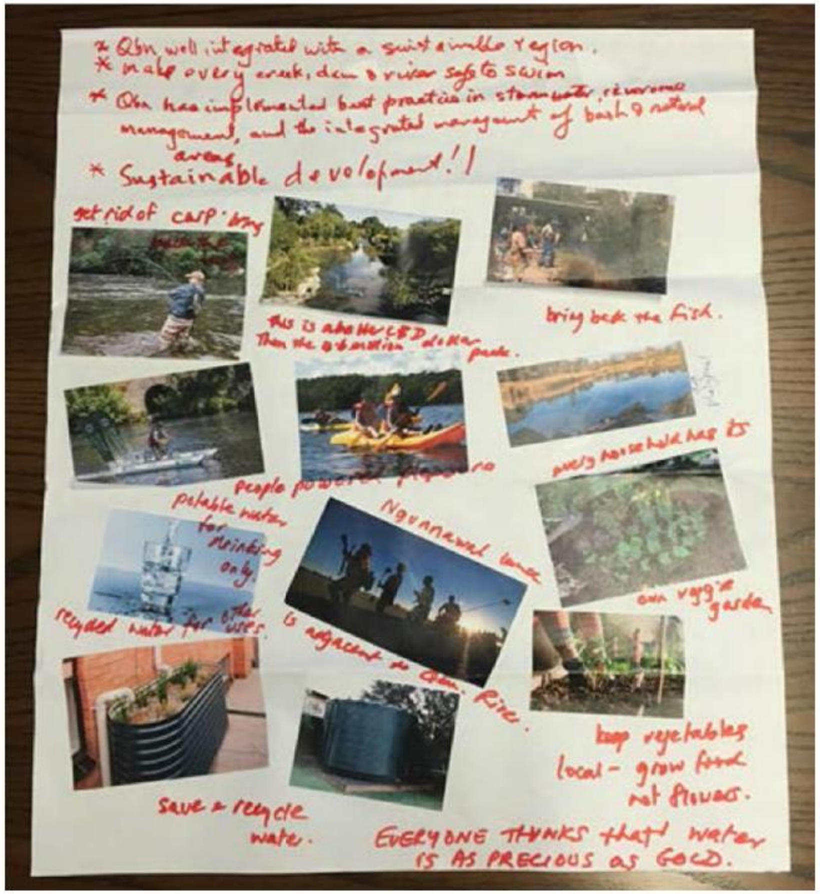
- **AECOM**
  - Project Manager: Hayden Seear
  - Technical Lead: Mark Wilton
  - Planner: Shane Wickramasinghe
- **QPRC**
  - Project Manager: Andrew Grant
  - Project Sponsor: Gordon Cunningham

Project Team & Key Stakeholders

Stakeholders Consulted

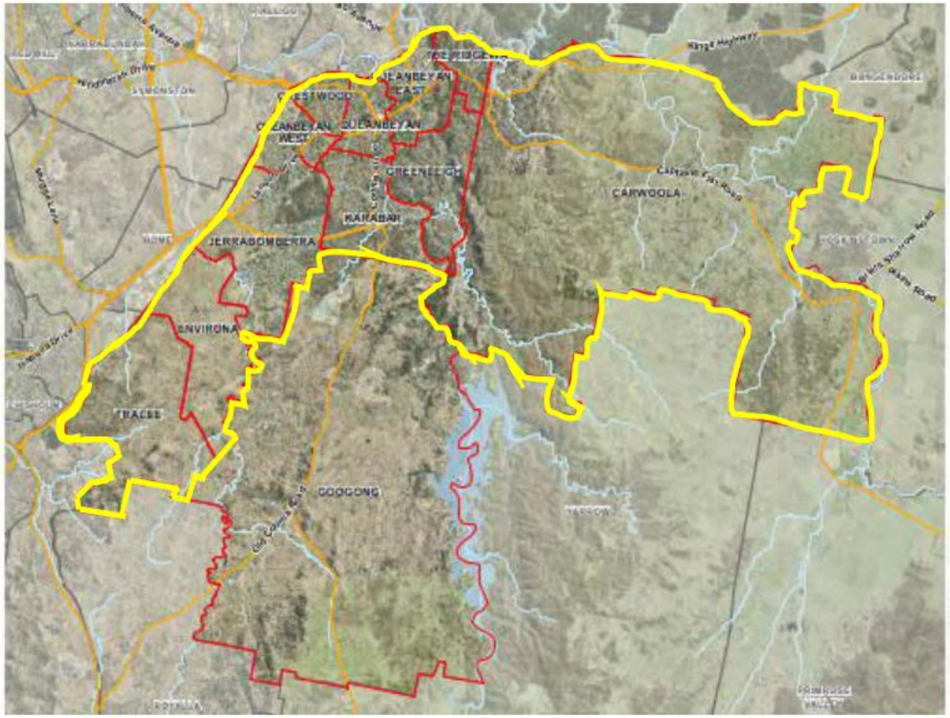
- QPRC Internal Stakeholders:
  - QPRC Operators and Maintenance Staff (STP and Stormwater Network)
  - QPRC Asset Management
  - QPRC Utilities
  - QPRC Strategic Planning, Land Use Planning
  - QPRC Health
  - QPRC Parks
- DPIE Water
- ACT Government – Environment Planning and Sustainable Development Directorate
- Icon Water
- Community Groups:
  - Upper Murrumbidgee Catchment Group
  - Wickerslack Area Group
  - Queanbeyan Residents and Ratepayers Association
- PRG Workshop (<u>today</u>):
  - QPRC
  - DPIE Water
  - Icon Water
  - NSW EPA
  - NSW Health


QPRC
Queanbeyan
Bird habitat
Debris blockage + unused?
New Sewage Treatment Plant (Regional)
9/11 pipeline from abattoir to Fyshwick STP connection
The people of Queanbeyan place high value on pristine natural areas (bush) and the clean river.
Solid and recycled water use
I have on record from Council 'I should not be swimming in the river' Council doesn't recommend it but they run an aquatic carnival in the CBD.
Street trees wrecked despite efforts.
Dense urban areas (Stormwater trees for cooling)
Riverbank vegetation corridor (Connect)
Road verges right across Queanbeyan and Jerrabomberra leave too much erodible.
Gross pollutants
Green = cool
Yellow = hot
Urgent upgrade needs to ensure Queanbeyan River is protected from the IDE development.
Queanbeyan needs to adopt not just the current practice guidelines for water runoff but 'best' practice.
How will the Queanbeyan River be protected when Edwin Parkway is built and the new bride across the river. Who is responsible?
Older parts of Queanbeyan and even need stormwater upgrades to current best practice standards.
EDE impact
Swim in summer daily in large pool at wicker slack. Swim with platypus.
Algae
Several households a wicker slack, including commercial kennel pet care business pump Queanbeyan River water for using in the houses PTO and businesses.
Googong Creek and Queanbeyan River at Wickerslack now inundated by honey suckle.
Large stands of English elm – drop in leaves into pollute and clog up the river.
Lot 1, lots 5, 6, 7, 8.
Large mass of tree of heaven growing on river
Various people at Wicker slack draw water from bores.
Acres and acres of serrated tussock throughout Talpa. Now spreading downstream to wicker slack.
Drinking water catchment Impact from township
Block access roads in suburban areas are eroding heavily. Effect on Jerrabomberra Creek
Pollution in Beltana Pond goes down Googong Creek into Queanbeyan River.
Googong township runoff
Legend
AECOM


Sustainable development!!
get rid of carp
bring back the fish.
Potable water for drinking only.
recycled water for other uses
own veggie garden
keep vegetables local - grow food not flowers.
save & recycle water.
EVERYONE THINKS that water IS AS PRECIOUS as GOLD.

Study Area

- Queanbeyan City – largest urban centre in the LGA with approx. population of 40,000
- Queanbeyan IWCMS is comprised of the former QCC LGA localities, excluding:
  - Googong Township/ Scheme
  - Former PRC LGA



Legislative & Regulatory Requirements

- NSW Local Government Act (1993)
- NSW Environmental Planning and Assessment Act (1979) including the EPA Regulation 2000
- NSW Water Management Act (2000)
- NSW Public Health Act 2010
- Public Health Act 2010 & Public Health Regulation 2012
- NSW Work Health and Safety Act 2011 and Work Health and Safety Regulation 2011
- NSW Protection of the Environment Operations Act 1997
- ACT Environment Protection Act 1997 and ACT Environment Protection Regulations 2005
- ACT Utilities Act 2000
- Commonwealth Water Act and Regulations 2007
- Council Local Environment Plans

Contractual Requirements

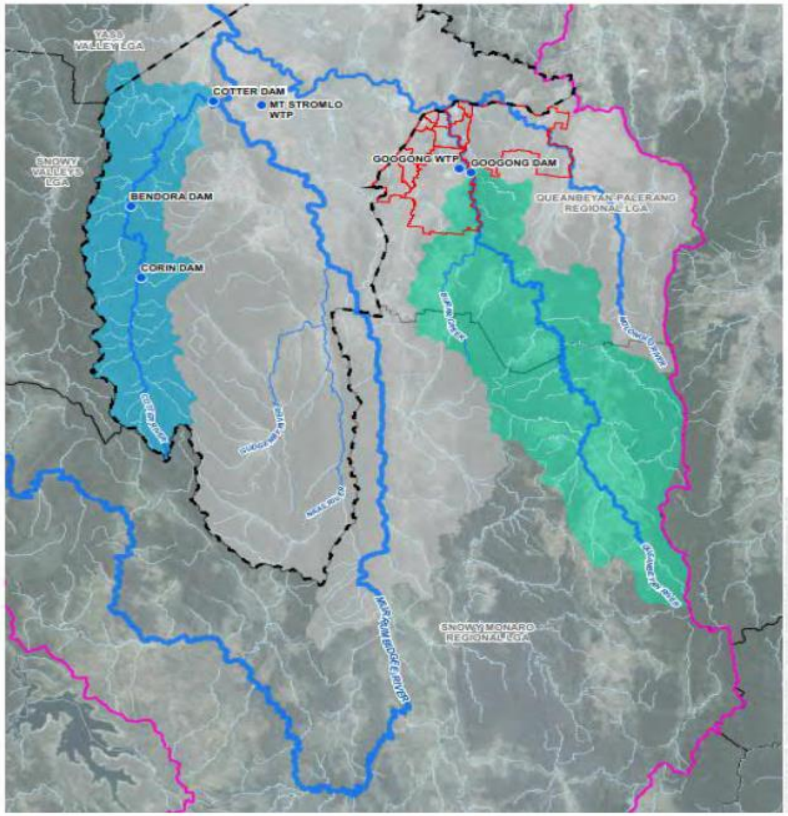
- Supply of Potable Water to the City of Queanbeyan (2009) – Actew Corporation Ltd and QCC (Service Level Agreement)
- Letter of Agreement – Supply of Water to Googong Township (2009) – ACTEW and QCC

Existing Urban Water Services

Existing Urban Water Services

Water Catchments & Treatment

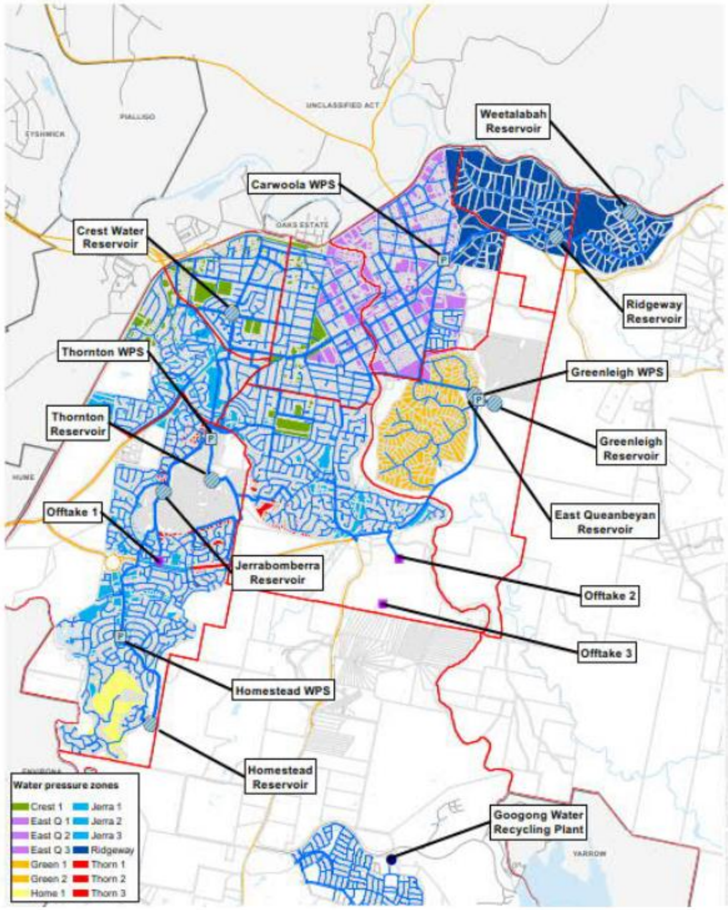
- Icon Water responsible for supplying potable water to the study area:
  - Cotter River catchment – raw water from Corin, Bendora, Cotter Dams treated at the Mt Stromlo WTP
  - Queanbeyan River catchment – raw water from Googong Dam treated at the Googong WTP



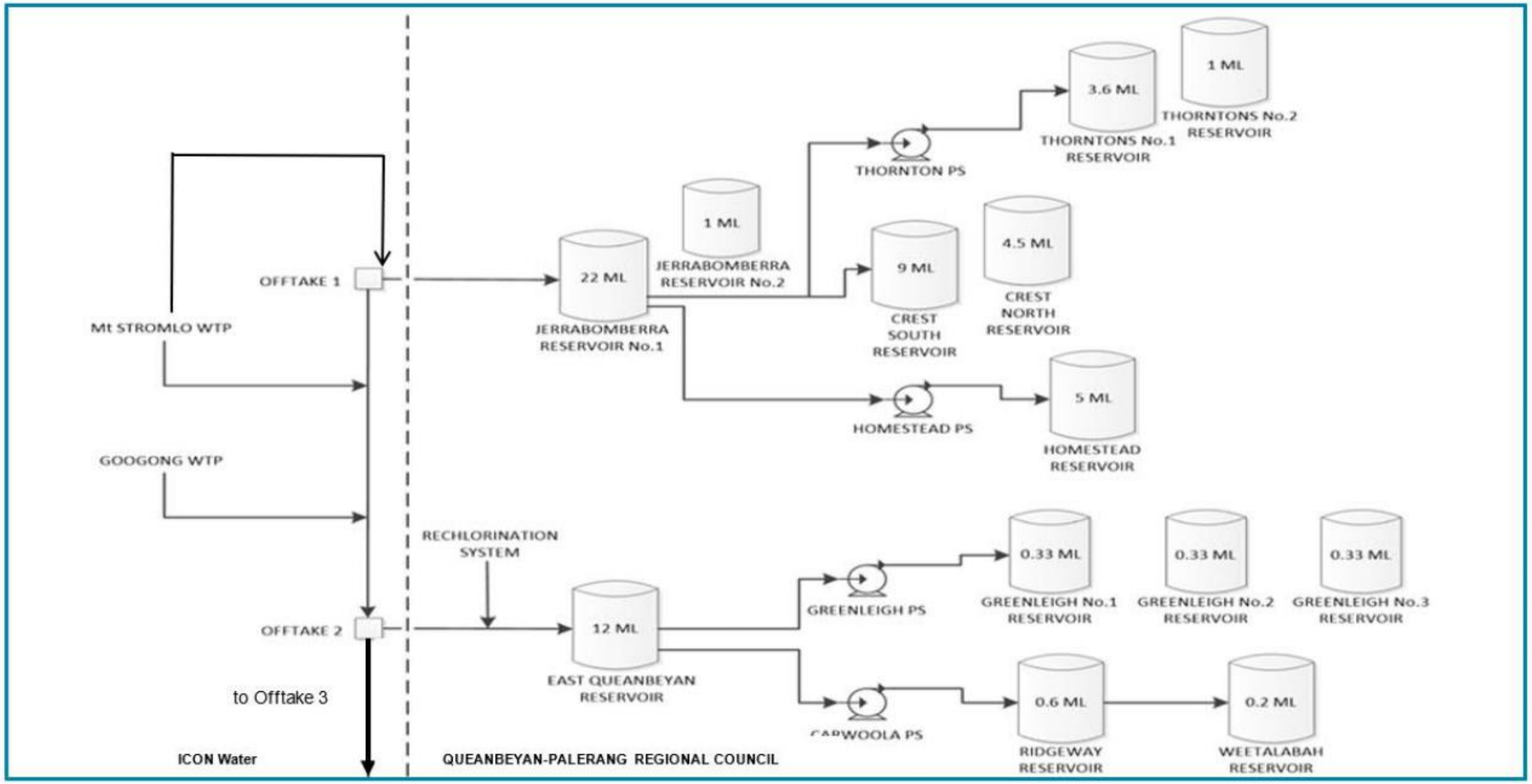
Existing Urban Water Services

Water Supply

- Treated water is transferred to Queanbeyan from Icon Water via 2 x bulk supply offtakes
- QPRC operates and maintains the water distribution network from the boundary point with Icon Water
- Seven Water Supply Zones (WSZs)
- QPRC holds 4 x Water Access Licences (WAL) issued under the Water Management Act 2000



Existing Urban Water Services – Water Supply



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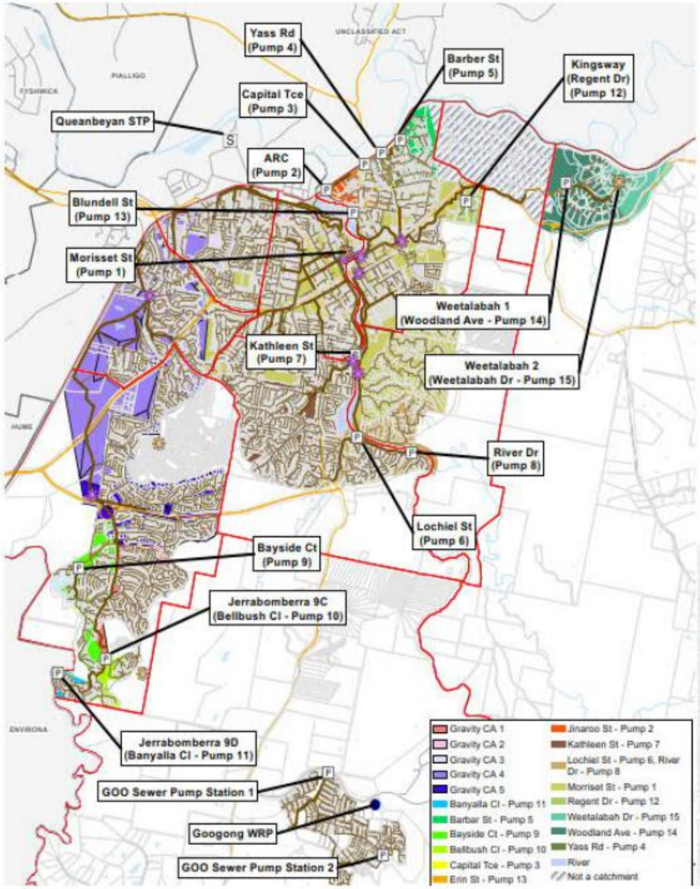
Existing Urban Water Services

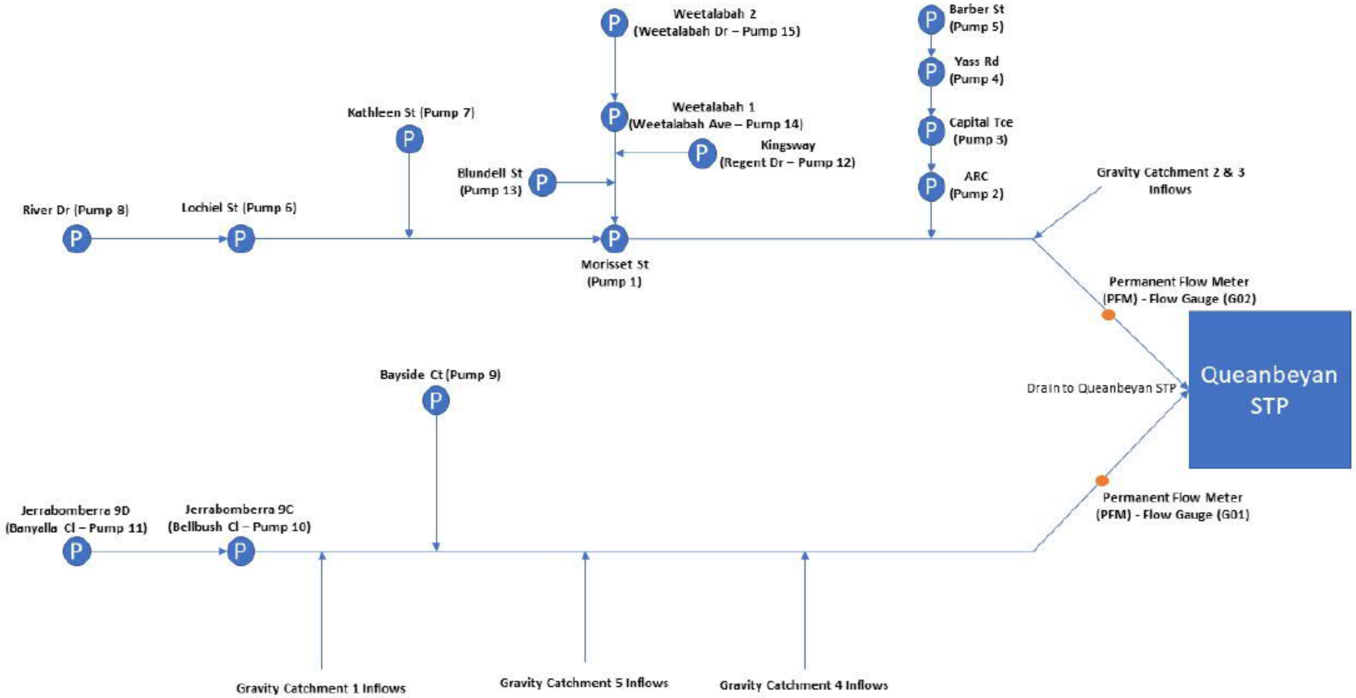
Sewerage Scheme

- Single scheme - Queanbeyan STP (located in ACT). Treated effluent discharges to Molonglo River – ultimately Lake Burley Griffin
- Approximately 20 sewer sub-catchments – gravity (5) & pumped (15)
- Approx. capacity of Queanbeyan STP of 34,500 EP
- Includes Oaks Estate located in ACT



AECOM

Existing Urban Water Services – Sewerage Scheme

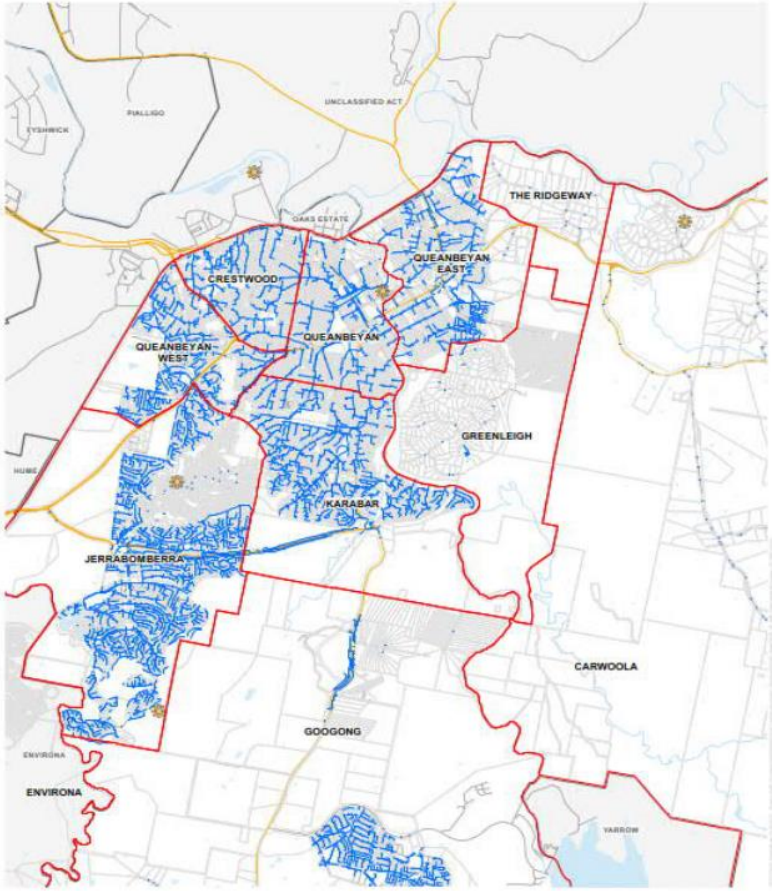


Effluent treated at Queanbeyan STP – discharge into Molonglo River

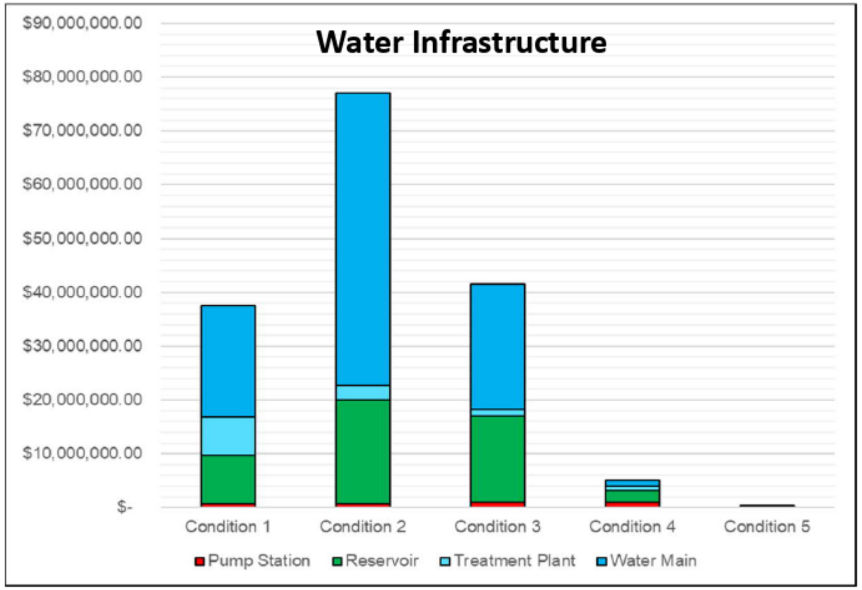
Existing Urban Water Services

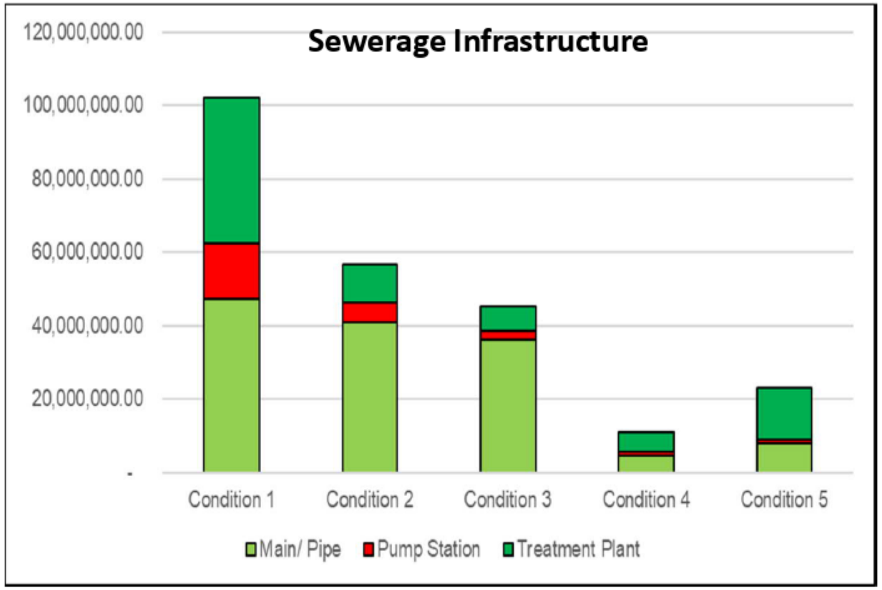
Stormwater Drainage Scheme

- QPRC responsible for stormwater drainage network:
  - Natural stormwater assets (man-made open waterbodies, creeks, open channels)
  - Stormwater drainage assets (pipes, pits, manholes etc.)
  - Stormwater quality and quantity assets (stormwater detention basins, gross pollutant traps)
- Several waterway catchments ultimately drain to Lake Burley Griffin:
  - Molonglo River
  - Queanbeyan River
  - Burra-Burra Creek
  - Jerrabomberra Creek



Asset Condition and Replacement Costs





System	Asset Replacement Cost	Written Down Value
Queanbeyan Water	$101,780,508	$62,315,770
Queanbeyan Sewerage	$141,454,650	$70,821,118
Queanbeyan Stormwater*	$112,885,327	$63,446,071
Total Value	$356,120,485	$196,582,959

Data Gap Analysis

- Key Data Gaps:
  - Customer billing database – discrepancies in the dataset (i.e. consumption and connection records)
  - Water, Sewer & Stormwater models – inadequate for analysis of water, sewer and stormwater network capacity assessment
  - Limited historical telemetry data available
  - Limited historical operation & maintenance records

Population and Development

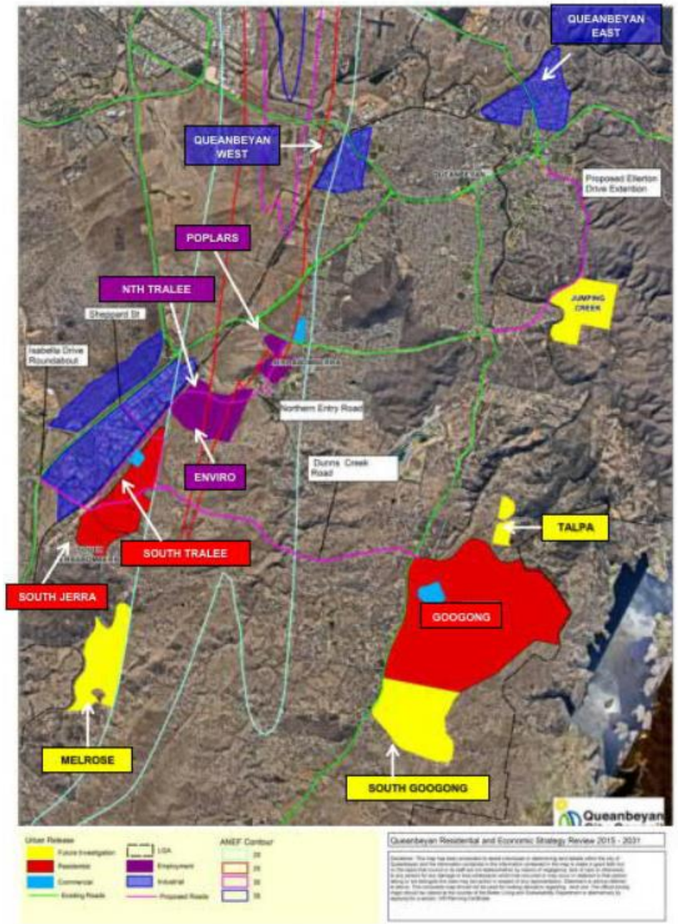
Population and Development

Historical Growth

- Around 2% per annum over the last 25 years – Jerrabomberra, Karabar and Queanbeyan West
- Approx. 65% of residential = low density)
- Remaining 35% = medium density (25%) and high density (10%) housing

Future Growth

- Based on Queanbeyan Residential and Economic Strategy Review 2015 – 2031
- Predominantly be focused on major fronts across Tralee-Environa



Population and Development – Residential

Queanbeyan IWCM Study Area	Forecast Year					
	2016	2021	2026	2031	2036	2050[3]
Total Population	**41,952**	**42,584**	**43,874**	**45,690**	**46,931**	**46,931**
Average household size	2.48	2.42	2.40	2.40	2.38	2.38
Total Dwellings[2]	**17,374**	**17,985**	**18,650**	**19,443**	**20,094**	**20,094**
Dwelling Increase (no. per 5 years)	-	611	665	793	651	N/A
Dwelling Increase (no. per annum)	-	122	133	159	130	N/A
Dwelling Increase (% per annum)	-	0.7%	0.7%	0.8%	0.6%	N/A

Population and Development – Non-Residential

Queanbeyan IWCM	Forecast year (Net Ha)						Total Growth (Net Ha)	Total Growth % Proportion
Summary	2016	2021	2026	2031	2036	2050		
Total Non-Residential	163	202	224	256	270	309	146	-
Commercial / Business / Mixed Use	10	22	34	49	56	75	65	45%
Industrial (General / Light)	152	177	177	182	188	207	55	38%
Recreational	UNK	3	13	26	26	26	26	18%
Take-up Rate (Ha/5yrs)	-	40	22	33	14	14	-	-
Take-up Rate (Ha/Year)	-	7.9	4.4	6.5	2.7	2.7	-	-
Non-Residential Increase (% per annum)	-	3.9%	2.0%	2.5%	1.0%	0.9%	-	-

Population and Development

Water Supply

Queanbeyan System	2016[1]	2021	2026	2031	2036	2050
Serviced Population	41,952	42,584	43,874	45,690	46,931	46,931
Serviced Employment (net Ha)	163	200	225	257	271	309

Sewerage Scheme

Sewerage Scheme[4,5]	Units	2016[1]	2021	2026	2031	2036	2050
Queanbeyan STP Catchment	Sewer connected properties	14,407	17,434	18,089	18,872	19,513	19,513
	ET - Total	14,407	17,434	18,089	18,872	19,513	19,513
	EP - Residential	35,873	44,507	46,075	47,952	49,473	49,473
	EP - Non Residential[2,3]	0	3,720	4,618	6,252	7,480	10,916
	EP - Total	**35,873**	**48,227**	**50,693**	**54,204**	**56,953**	**60,389**

General System Issues

General System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Operating Performance	• Levels of Service (LOS) specified are preliminary and yet to be formally adopted. • The majority of data required to report on annual operating performance against LOS has not been collected to date. • Preliminary LOS are specific for customers within the former QCC LGA and differ from the LOS adopted for the former PRC LGA. The adoption of a single LOS should be considered by QPRC. • The Drinking Water Management System (DWQMS) reporting has not yet been finalised by QPRC. • There is no formal procedure currently documented in QPRC's business management system to cover emergency situations (i.e. sewer overflows, contaminated water etc.).

General System Issues

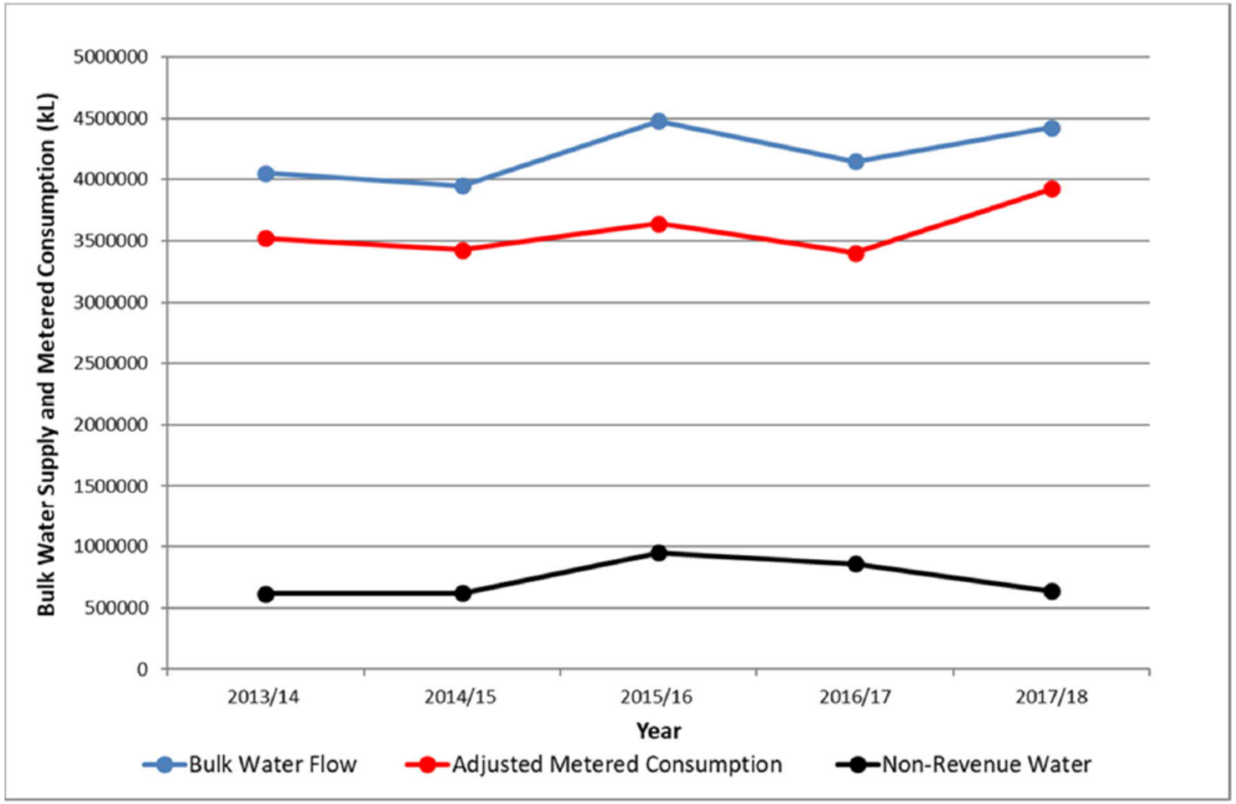
- QPRC currently does not have a formally adopted LOS for water supply and sewerage services.
- 2015 AMP describes the preliminary LOS proposed for former QCC water and sewer systems.
- The preliminary LOS has been distinguished into Community LOS and Technical LOS:
    - Technical LOS - updates to asset management plans currently being finalised
    - Community LOS – harmonisation process currently underway

Water Supply System Issues

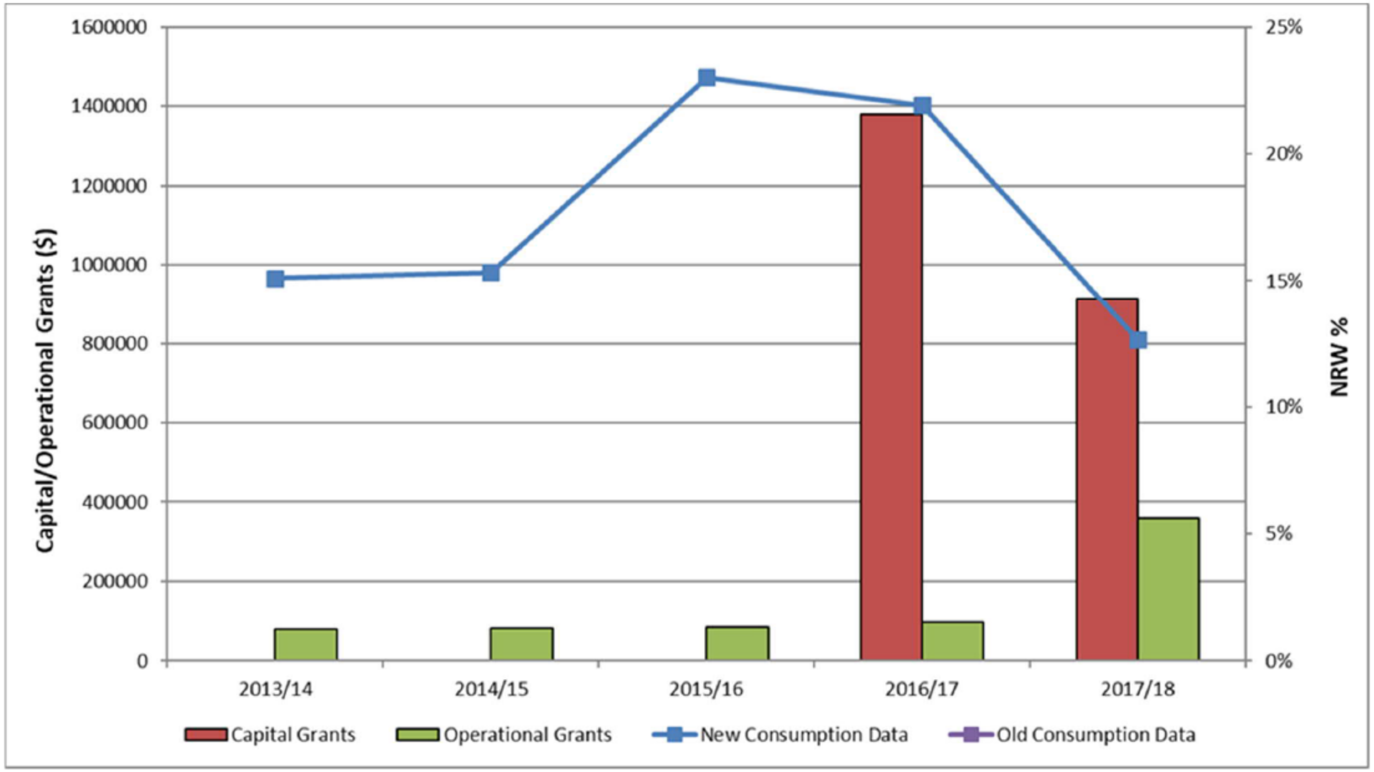
Water Supply System Issues – Levels of Service

Issue Type	Target for Compliance	Issue
Levels of Service	Bulk Supply Service Level Agreement (Icon Water)	• Service level agreement with Icon Water is not reflective of the current supply arrangements • The specified water quality targets do not match QPRC's NSW water quality guidelines or Queanbeyan's water quality plan • Currently the bulk supply agreement states that QPRC will comply with ACT water restrictions. This should be mandated via a QPRC ruling made under the Local Government Act. • Water quality parameters i.e. chlorine residual, are not currently featured in the Icon Water Service Level Agreement. • There is inadequate visibility/advance notice from Icon Water to inform/manage customers in the event of a bulk supply water quality incident.
	Water Quality	• No re-chlorination point at Offtake 1 (Jerrabomberra) hence this presents an increased water quality risk. • The DWMS Annual Report (2017) has identified a taste and odour issue believed to be due to the presence of Geosmin. • The DWMS Annual Report (2017) has documented repeated free chlorine failures in Queanbeyan which represent a water quality management issue.
	Water Supply Security	• Appropriate level of service criteria for water supply security in Queanbeyan needs to be defined (with reference to the bulk supply from Icon Water). • The impact of climate variability, whilst considered to be a long-term water security risk for Queanbeyan, should continue to be monitored into the future as the impacts of climate change become more visible.
	Reliability	• There is insufficient data available to verify and report on performance against water main breaks.
	Sustainability	• Non-Revenue Water (NRW) is observed to be relatively poor with NRW estimated at 18% of total system demand. This is above the target LoS of 11%.

Water Supply System Issues – NRW Analysis



Water Supply System Issues – NRW Analysis



AECOM

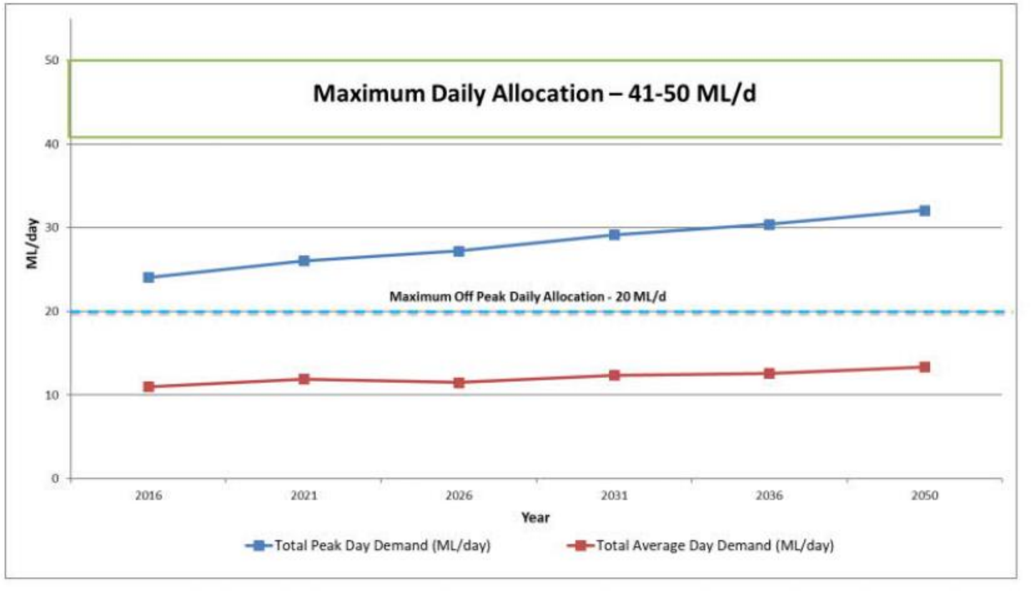
Drinking Water – Baseline Analysis

Offtake 1 + Offtake 2	Date	Volume (ML)	Daily Demand (ML/d)
PEAK DAY DEMAND	12-Feb-2014	24.4	24.4
PEAK WEEK DEMAND	10-16 Feb 2014	118.9	17.0
AVERAGE DAY DEMAND	2009-2016	-	10.5

- Ratio of PDD to ADD is 2.3

Water Demand Sensitivity	'Wet Year' Indicator	Adopted Average*	'Dry Year' Indicator
	2013/14	2013/14-2017/18	2017/18
Unit Consumption Rate (L/cap/day)	233	233	252

Drinking Water Levels of Service – Demand & Allocation



Queanbeyan IWCM [1, 2]	2016	2021	2026	2031	2036	2050
Average Day Demand (ADD)						
Total ADD (ML/day)	11.0	11.9	11.5	12.4	12.6	13.4
Peak Day Demand (PDD)						
Total PDD (ML/day)	24.1	26.1	27.2	29.2	30.4	32.1
Maximum Allocation from Icon Water (ML/d)[3]	41-50	41-50	41-50	41-50	41-50	41-50

Water Supply System Issues - Performance

Issue Type	Target for Compliance	Issue
Performance	Water Consumption Behaviour	• It remains unclear if permanent water conservation measures have been implemented by Council post-millennium drought and the extent to which water conservation measures may be influencing recent water consumption trends and behaviours remains unclear.
	Asset Capacity	• The existing water model requires validation of the trunk network and controls to better align the interaction of the bulk supply offtakes, reservoirs and pump stations within the network before it can used with confidence for reporting on asset capacity related performance. • A 'first principles' qualitative approach has been adopted for the Issues Paper. This is considered suitable as an initial indicator of asset capacity issues and will need greater rigour / improved confidence applied in subsequent phases of the IWCM to verify the 'first principles' outcomes. Growth • No material water network capacity related issues have been flagged following the 'first principles' analysis. However, more robust capacity assessment should be completed once a number of asset data and telemetry data gaps have been resolved. • Given the extent of growth forecast for Queanbeyan over the next 30 years it is expected that new drinking water network infrastructure will be required to extend service to the major Greenfield developments proposed at Tralee, Environa and South Jerrabomberra Reliability • Jerrabomberra Reservoir lacks a suitable by-pass arrangement and therefore cannot be taken off-line during planned or unplanned events without triggering extensive service continuity (reliability) risks. Jerrabomberra Reservoir represents a critical network asset. • Upper Thornton Reservoir, Thornton Pump Station, Jerrabomberra Reservoir, Greenleigh Reservoir, Greenleigh Pump Station and East Queanbeyan Reservoir are situated near bushland areas and this represents a higher risk of bushfire threat and service continuity (reliability) risk i.e. these assets are more vulnerable to bushfires.

Sewerage System Issues

Sewerage System Issues

Issue Type	Target for Compliance	Issue
Levels of Service	Sewer Agreement 1905	• The agreement covers discharges from Oaks Estate in the ACT however there are gaps in this agreement, including the absence of any mandate on Oaks Estate customers to pay QPRC for their sewerage service.
	Health and Safety (overflows)	• The performance against the number of sewage overflows per year remains unverified due to the limited data available. The existing sewer model is not fit for modelling surcharges in the system.
	Health and Safety (WHS)	• The performance in regard to the latest WHS audit remains unverified due to the limited data available. • Queanbeyan STP - changes in legislative WHS for operator safety represents an issue in regards to the continuing operation of the existing Queanbeyan STP, which is an old plant reaching the end of its design life.
	Reliability	• There is insufficient data available to verify and report on overflows due to sewer chokes. The existing sewer model is not suitable for modelling surcharges in the system. • Queanbeyan STP - anecdotal evidence suggests that it is an old plant reaching the end of its design life and the condition of various assets within the plant is making operation and maintenance of the STP difficult and expensive.
	Sustainability	• Targets needs to be defined for benchmarking sustainability performance of the system. • There is no specific LOS target defined for sustainability however the derived unit rate for sewer at 264 L/EP/day is higher than the derived unit rate for water (233 L/cap/day).
Trade Waste	Trade Waste	• The annual trade waste performance report is currently not provided.
Best Practice	Section 60 Approvals	• There is no effluent re-use currently in place at Queanbeyan STP (outside of STP operational purposes).

Sewerage System Issues – Baseline Analysis

Sewerage Scheme	Adopted ADWF (kL/d)	2016 EP	Adopted Unit Loading Rate (L/EP/day)
Queanbeyan STP	9,480	35,873	264

Adopted Sewer Unit Loading Rate (L/EP/day)	264
Adopted Potable Water Per Capita Rate (L/capita/day)	233
Comparative Sewer Unit Loading Rate - Return to Sewer method (80-85%) (L/EP/day)	186 to 198
Potential infiltration and inflow (L/EP/day)	66 to 78
Potential infiltration and inflow as % of the adopted sewer unit loading rate	25 to 29%

Sewerage System Issues – Baseline Analysis

Sewerage Scheme	Derived Peaking Factor ‘r’	Adopted ADWF (kL/d)	Adopted ADWF (L/s)	Adopted PDWF (L/s)
Queanbeyan STP	1.78	9,480	109.7	195.3

Sewerage Scheme	Storm Allowance (L/s)	Adopted PWWF-Instantaneous (L/s)	Instantaneous PWWF / ADWF	Equivalent Daily PWWF / ADWF[1]
Queanbeyan STP	836	1,031	9.4	4.1

Sewerage System Issues – Performance

Issue Type	Target for Compliance	Issue
Performance	Asset Capacity - Queanbeyan STP	• Some discrepancy is noted for the future EP projections between the STP Master Plan and the IWCM Issues Paper investigations and this may represent a risk to the outcomes of each project if key inputs and assumptions are not considered compatible. • EPA Licence Compliance – there is insufficient data available to benchmark the existing STP performance against environmental licence conditions. • Based on anecdotal evidence and historical sewer inflow data the Queanbeyan STP is very close to exceeding its existing design capacity, however the precise status remains unverified as evidence-based data was not available at the time. Regardless, the anecdotal evidence and projected growth forecast represents a capacity issue for Queanbeyan STP in the very near future.

	2016	2021	2026	2031	2036	2050
Projected EP	35,873	48,227	50,693	54,204	56,953	60,389
Existing STP Capacity (EP)[1]	34,500	34,500	34,500	34,500	34,500	34,500

Sewerage System Issues – Performance

Issue Type	Target for Compliance	Issue
Performance	Asset Capacity - Sewer Network	• The existing sewer model requires extensive update and validation before it can used with confidence for reporting on asset capacity related performance. • A 'first principles' qualitative approach has been adopted for the Issues Paper. This is considered suitable as an initial indicator of asset capacity issues and will need greater rigour / improved confidence applied in subsequent phases of the IWCM to verify the 'first principles' outcomes before a commitment to investment is made. • Based on the outcomes of the 'first principles' asset capacity analysis the following sewer network capacity related issues have been flagged as an indicator for further consideration: - Morriset St SPS: PWWF exceeds the pump station duty flow from 2021 onwards - Banyalla Cl – Pump 11 and Kathleen St – Pump 7 - PWWF exceeds pump station duty flow - Bayside Ct – Pump 9 - significant growth risk - SPS emergency storage: 7 x SPSs less than 4 hours storage in current and future horizons - South Jerrabomberra Trunk Sewer Main • The 2015 Sewer Asset Management Plan has identified a number of key assets within the sewer network with deficiencies and these are scheduled for future upgrade and/or renewal. This includes the South Jerrabomberra Trunk Main and nine (9) sewer pump stations including associated rising mains. • A sewer inspection and relining program has been undertaken for the Queanbeyan scheme with the aim of reducing inflow and infiltration. Internal analysis undertaken by QPRC in 2018 did not identify any material improvement in inflow or infiltration as a result of the program (noting that relining/refitting of manholes was not undertaken as part of the program). • Given the extent of growth forecast for Queanbeyan over the next 30 years it is expected that new sewer network infrastructure will be required to extend service to the major Greenfield developments proposed at Tralee, Environa and South Jerrabomberra.

Sewerage Asset Capacity Assessment – SPS

Supra Catchments	Duty Flow (L/s)	ADWF (L/s)[1]						PDWF (L/s)[1]						PWWF (L/s)[1]					
		2016	2021	2026	2031	2036	2050	2016	2021	2026	2031	2036	2050	2016	2021	2026	2031	2036	2050
Jerrabomberra 9D (Banyalla Cl – Pump 11)	9.4	1.0	1.1	1.2	1.2	1.2	1.2	3.6	4.1	4.1	4.1	4.1	4.1	8.7	9.9	9.9	9.9	9.9	9.9
Jerrabomberra 9C (Bellbush Cl – Pump 10)	32.0	2.3	2.7	2.7	2.7	2.7	2.7	7.7	8.9	9.0	9.0	9.0	9.0	19.5	22.7	22.8	22.8	22.8	22.8
Blundell St (Pump 13)	22.0	0.8	1.3	1.4	1.5	1.6	1.6	2.6	4.2	4.5	4.8	5.2	5.2	8.6	13.6	14.6	15.7	16.8	16.8
Kathleen St (Pump 7)	95.0	14.4	17.0	17.2	17.3	17.4	17.4	31.8	37.8	38.1	38.3	38.5	38.5	134.1	159.2	160.4	161.3	162.3	162.3
Morisset St (Pump 1)	460.0	63.2	78.9	80.1	81.2	82.3	82.3	129.4	161.3	163.9	166.1	168.3	168.3	612.2	759.0	770.6	780.4	790.3	790.3
East Weetalabah 2 (Weetalabah Dr – Pump 15)	3.7	0.2	0.3	0.3	0.3	0.4	0.4	0.6	0.8	0.9	1.0	1.1	1.1	1.6	2.2	2.4	2.7	3.0	3.0

Sewerage Asset Capacity Assessment – SPS Storage

Supra Catchment	Volume (L)	SPS Storage	Hours of Storage					
			2016	2021	2026	2031	2036	2050
Banyalla Cl – Pump 11	8588	Emergency Storage	2.4	2.1	2.1	2.1	2.1	2.1
Barbar St – Pump 5	2987	Emergency Storage	1.6	0.9	0.9	0.9	0.9	0.9
Bayside Ct – Pump 9	18907	Wet Well	1.5	0.4	0.3	0.2	0.2	0.1
Bellbush Cl – Pump 10	31755	Emergency Storage	6.7	5.7	5.7	5.7	5.6	5.6
Capital Tce - Pump 3	Dimensions not provided	Wet Well	-	-	-	-	-	-
Erin St – Pump 13	24740	Wet Well	7.6	6.7	6.6	6.6	6.5	6.5
Jinaroo St – Pump 2	6362	Emergency Storage	6.0	3.3	3.2	3.1	3.1	3.1
Kathleen St – Pump 7	25845	Wet Well (no emergency storage)	0.5	0.4	0.4	0.4	0.4	0.4
Lochiel St – Pump 6, River Dr – Pump 8	15678	Wet Well	0.9	0.7	0.7	0.7	0.6	0.6
Morriset St – Pump 1	1123220	Wet Well	7.4	5.8	5.8	5.7	5.6	5.6
Regent Dr – Pump 12	8906	Wet Well	21.9	9.1	8.7	8.5	8.3	8.3
Weetalabah Dr – Pump 15	7507	Wet Well	10.8	7.9	7.1	6.4	5.8	5.8
Woodland Ave – Pump 14	19204	Wet Well	18.0	11.3	9.9	8.6	7.6	7.6
Yass Rd – Pump 4	8359	Emergency Storage	2.2	1.6	1.6	1.6	1.6	1.6

Sewerage Asset Capacity Assessment – Rising Mains

			Velocity (m/s)					
Supra Catchment	**Rising Main Diameter (mm)**	**Rising Main Length (m)**	**2016**	**2021**	**2026**	**2031**	**2036**	**2050**
Banyalla Cl - Pump 11	100	382.1	0.5	0.5	0.5	0.5	0.5	0.5
Barbar St - Pump 5	225	164.3	0.0	0.1	0.1	0.1	0.1	0.1
Bayside Ct - Pump 9	225	620.4	0.2	0.9	1.1	1.4	1.8	2.3
Bellbush Cl - Pump 10	150	177.6	0.2	0.3	0.3	0.3	0.3	0.3
Capital Tce - Pump 3	225	238.7	0.0	0.0	0.0	0.0	0.0	0.0
Erin St - Pump 13	100	135.2	0.5	0.5	0.5	0.5	0.5	0.5
Jinaroo St - Pump 2	300	336.9	0.0	0.0	0.0	0.0	0.0	0.0
Kathleen St - Pump 7	225	160.0	0.8	1.0	1.0	1.0	1.0	1.0
Lochiel St - Pump 6; River Dr - Pump 8	300	113.6	0.2	0.2	0.2	0.2	0.2	0.2
Morriset St - Pump 1	600	398.3	0.3	0.4	0.4	0.4	0.4	0.4
Regent Dr - Pump 12	150	114.2	0.0	0.1	0.1	0.1	0.1	0.1
Weetalabah Dr - Pump 15	75	264.2	0.1	0.2	0.2	0.2	0.2	0.2
Woodland Ave - Pump 14	75	783.6	0.2	0.3	0.3	0.3	0.4	0.4
Yass Rd - Pump 4	200	195.2	0.1	0.1	0.1	0.1	0.1	0.1

Sewerage Asset Capacity Assessment – 2015 Sewer AMP

Sewer Pump Stations (SPS)	Sewer Trunk Mains
Barber St SPS	South Jerrabomberra Trunk Main
Capital Terrace SPS	Sewer rising mains – for each of the identified SPS's
Lochiel St SPS	-
River Drive SPS	-
Kingsway SPS	-
Bayside Court SPS	-
Kathleen St SPS	-
ARC SPS	-
Blundell St SPS	-

Stormwater System Issues

Stormwater System Issues – Levels of Service

Issue Type	Target for Compliance	Issue
Levels of Service	Performance Measures – Customer/ Technical	• Remain undefined. Targets yet to be established. • Development Design Specifications for Stormwater Drainage Design and Erosion Control and Stormwater Management do not specifically address waterway stability or refer to best practice stormwater management for waterway health.

Stormwater System Issues – System Performance

Issue Type	Target for Compliance	Issue
System Performance	Quality	• Periodic blooms of toxic blue green algae in Lake Jerrabomberra and Lake Burley Griffin, posing public safety, amenity and environmental concern. • The projected increase in pollutant loads cascading downstream to Queanbeyan River and Lake Burley Griffin may contribute to the cumulative impact on the water quality within the lake. • The increased stormwater volume from future development (2.6 GL/yr) has the potential to cause noticeable impacts on the health and structure of local ephemeral waterways.
	Waterway Erosion	• Waterway erosion upstream of Lake Jerrabomberra due to high flows and vegetation loss • Rainwater tanks that are sized to comply with BASIX and supply roof water for irrigation and toilet flushing are unlikely to have sufficient impact on stormwater volumes to have a benefit on stream erosion.
	Nuisance Flooding	• Letchworth Regional Park prone to surcharging due to high stormwater flows lifting off the stormwater pit lids (anecdotal evidence). • Stormwater drainage networks within some of the older areas (Crestwood, Queanbeyan, etc.) are prone to nuisance flooding and surcharging (anecdotal evidence).
	Asset Condition	• Stormwater asset valuation may contain some elements from other systems which cannot be easily identified from the asset database.
	Overland and Mainstream Flooding	• Potential for flooding in Queanbeyan CBD, impacting up to 50 residential properties and extensive areas of commercial development based on the Queanbeyan Floodplain Risk Management Plan. • The existing stormwater model requires extensive update and validation before it can used with confidence for reporting on asset capacity and flooding related performance.

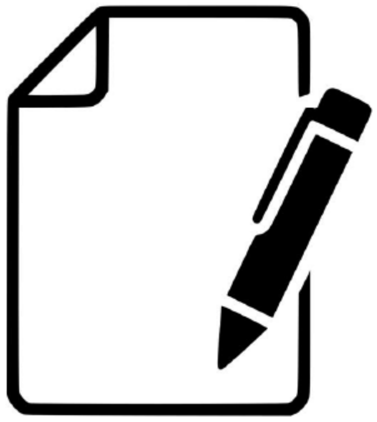
Stormwater System Performance – Future Loading

Existing Land Use	Existing Area (Ha)	Stormwater (ML/yr)	Total Suspended Solids (kg/yr)	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)
Industrial	152	0.78	161.12	0.24	1.72
Commercial	10	0.05	10.60	0.02	0.11
Residential	2,378	7.16	1,233.94	2.09	14.88
Parkland and Open Space	61	0.10	16.35	0.03	0.22
Forest	2,460	0.01	22.86	0.06	1.05
Quarry (no discharge)	55	0.00	0.00	0.00	0.00
Rural residential	14,439	9.10	749.38	1.34	14.58
Total Study Area	**19,528**	**17.20**	**2,194.24**	**3.77**	**32.57**

Future Land Use (2050)	2050 Area (Ha)	Stormwater (ML/yr)	Total Suspended Solids (kg/yr)	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)
Industrial	207	1.06	89.31	0.15	1.20
Commercial	95	0.49	76.06	0.14	1.19
Residential	3,190	9.60	1,297.16	2.34	17.68
Parkland and Open Space	87	0.15	17.39	0.03	0.27
Forest	2,460	0.01	22.86	0.06	1.05
Quarry (no discharge)	55	0.00	0.00	0.00	0.00
Rural residential	13,461	8.48	741.76	1.31	14.04
Total Study Area	**19,555**	**19.79**	**2,244.53**	**4.03**	**35.43**

Key Workshop Outcomes and Actions

- Key outcomes and actions to take away from the workshop?



Next Steps

- Issue Minutes and Slides from workshop
- Incorporate comments following PRG Workshop and Finalise Issues Paper
- Submit QPRC Issues Paper for endorsement (pre-xmas)
- Part 1 Hold Point
- Commencement of Part 2 – IWCM Strategy (2020)

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Minutes of Meeting

Queanbeyan IWCM Strategy - Issues Paper

Subject	Project Reference Group (PRG) Workshop	Page	1
Venue	Bungendore Council Chambers (10 Majara Street)	Time	10am - 2pm
Participants	Andrew Grant (QPRC) Gordon Cunningham (QPRC) Phil Hansen (QPRC) Brendan Belcher (QPRC) Natasha Abbott (QPRC) David Carswell (QPRC) Kate Monaghan (QPRC) Jessica Perkins (QPRC)	Roshan Iyadurai (DPIE Water) Andrew Sloan (DPIE Water) Tabitha Holliday (NSW Health) Nicole Vonarx (Icon Water) Hayden Seear (AECOM) Mark Wilton (AECOM) Shane Wickramasinghe (AECOM)	
Apologies	Peter Tegart (QPRC) Brett Meddemmen (QPRC) Tim Geyer (QPRC)	Peter Ledwos (DPIE Water) Sharon Peters (NSW EPA)	
File/Ref No.	60548525	Date	26-Nov-2019
Distribution	As above		

No	Item	Action
1.	**Welcome and Introductions**	
1.1	• PRG Workshop opened with welcome by QPRC (AG) • Round the table introductions of QPRC, DPIE Water, Icon Water and NSW Health stakeholder representatives • AECOM presented a safety moment regarding the recent/ongoing bushfires in NSW	N/A
2.	**Project and Workshop Objectives**	
2.1	• AECOM outlined the project and workshop objectives and highlighted the purpose of the IWCM Strategy and Issues Paper (including relevant definitions) in the context of the NSW Best-Practice Management of Water and Sewerage Framework (DPIE Water).	N/A
3.	**Project Roadmap**	
3.1	• AECOM highlighted the journey undertaken to date on the development of the IWCM Issues Paper (Part 1), including key project milestones from the project initiation in 2017 through to the current task (PRG Workshop) of Part 1. • AECOM highlighted the project roadmap in the context of the NSW Best-Practice Management of Water and Sewerage Framework (IWCM Strategy flow chart), including the current stage (Part 1 Issues Paper) and subsequent stages, namely Part 2 IWCM Strategy, Part 3 Strategic Business Plan and Part 4 Financial Plan.	N/A

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No	Item	Action
4.	**Project Team and Key Stakeholders**	
4.1	• AECOM highlighted the key project team members and the key internal and external stakeholder groups that have been engaged / consulted in the development of the IWCM Issues Paper since 2017.	N/A
4.2	• DPIE Water (RI) queried the absence of ACT EPA from the list of stakeholders engaged in Part 1, specifically in regards to the concurrent Queanbeyan STP Upgrade Project. QPRC acknowledged the focus on aligning the IWCM Strategy and STP Upgrade Project and confirmed the key issues captured in the STP Master Plan are represented in the IWCM Issues Paper. It was agreed to follow-up and close out any gaps post-workshop and transfer the latest findings from the STP Upgrade project to the Issues Paper as appropriate.	QPRC to close out any gaps between the two parallel projects/ Noted for IWCM Strategy – Part 2
4.3	• AECOM highlighted the Part 1 Community/Stakeholder drop-in sessions hosted by QPRC and facilitated by AECOM. Key notes: - The key focus from the Community Groups who attended the sessions revolved around stormwater and waterway health (particular demographic) - Agreed to add the drop-in session Memo/Report as an appendix to the Issues Paper and summarise the key drop-in session outcomes/messages in the main body of the report.	Noted
5.	**Study Area**	
5.1	• QPRC noted to refer to Palerang Council in the Issues Paper as 'PC' and not 'PRC'.	Noted for IWCM Strategy – Part 2
5.2	• Workshop discussion regarding separate IWCM Strategies for Googong Township and Queanbeyan and the need to consolidate / amalgamate these in the future, particularly in consideration of providing consistent rates i.e. the same Typical Residential Bill (TRB) irrespective of locality	Noted
5.3	Oaks Estate (ACT) – workshop discussion regarding current versus future status of Oaks Estate in the context of the IWCM Strategy. Key notes: • The estate holds a 99-year lease agreement with ACT Government i.e. no one in the ACT owns their land – to be noted in Issues Paper • The lease will be up for renewal within the 30-year horizon of the IWCM Strategy and there is uncertainty on the terms of a new lease that might be imposed by the ACT Gov – to be noted in Issues Paper • QPRC is a 3rd party to Icon Water in terms of sewerage rates paid by Oaks Estate customers – to be noted in Issues Paper against the existing contractual agreement between QPRC and Icon Water • Oaks Estate master plan is publicly available and indicates future growth, with associated increase in sewer flow assume will be transferred to Queanbeyan STP – to be captured as part of the Issues Paper	Noted for IWCM Strategy – Part 2
5.4	• Queanbeyan STP – noted the STP land is leased from ACT Government on 99-year lease i.e. no one in the ACT owns their land – to be noted in Issues Paper	Noted for IWCM Strategy – Part 2
6.	**Legislative and Contractual Requirements**	

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No	Item	Action
6.1	• DPIE Water noted the Issues Paper does not explicitly state if QPRC is compliant with the relevant legislation/regulatory requirements. Was agreed non-compliances are to be clearly stated and reported as an issue.	Noted for IWCM Strategy – Part 2
7.	**Existing Urban Water Services**	
7.1	Drinking Water system (key notes): • The network schematic presented in the Issues Paper is to indicate existing reticulation connectivity (supply zone boundaries) between Offtake 1 and Offtake 2 • DPIE Water queried if the existing Bulk Supply Agreement (SLA) appropriately documents the separation in ownership / responsibility between Icon Water and QPRC. These are clearly defined in the SLA.	Noted for IWCM Strategy – Part 2
7.2	Water Access Licences (WAL) (key notes): • Several existing bores / river water extractions remain un-metered and volumes are not recorded this to be highlighted as an issue. • Project team to consider opportunity for increased utilisation of existing Water Access Licences (WAL) for irrigation purposes - during the next stage.	Noted for IWCM Strategy – Part 2
7.3	Sewerage scheme (key notes): • Oaks Estate is to be shown on the Sewer Schematic in the report. The Oaks Estate flows connect into the Morisset Street gravity carrier just before the STP. • Typical flows pumped from Oakes Estate approx. 2 L/s (relatively small). Mostly residential with a small number of commercial/industrial lots. Also noted the Oaks Estate transfer pump is not Council owned. • Queanbeyan STP– workshop discussion regarding the existing STP design capacity. DPIE Water requested original STP design documentation be quoted/referenced in the Issues Paper. QPRC noted that original design documentation is not readily available and existing capacity at a strategic level is documented in the STP Master Plan – 34,500 EP represents the agreed capacity which is consistent with the Issues Paper. • STP Upgrade Project – the concurrent STP Upgrade Concept Design should inform the Issues Paper where relevant data / findings are available and alignment between the two projects is to continue into the next stage of the project.	Noted for IWCM Strategy – Part 2 QPRC to provide concept design data/info - Noted for IWCM Strategy – Part 2
7.4	Stormwater drainage scheme (key notes): • QPRC confirmed an additional detention basin (stormwater) recently implemented on Allabah Road that is required to be updated in the Issues Paper. This has been gifted to QPRC as part of the ACT's Basin Priority Project. It comprises a rainwater garden with GPTs either end to trap silt. • Workshop discussion on stormwater funding – separate funding mechanism (General Funding) however noted that water and sewer funding can be allocated to stormwater improvements if a strong and tangible link can be demonstrated i.e. consider strong nexus as proof. QPRC challenged the allocation of water and sewer funding for stormwater as it is not straightforward and may trigger an undesirable precedence in regards to community expectations. The team to consider this complexity/challenge during the next stage of project.	Noted for IWCM Strategy – Part 2

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No	Item	Action
7.5	Asset Condition and Replacement (key notes): • QPRC confirmed the asset condition and replacement cost data is based on 2018/19 data (best condition data currently available). • QPRC confirmed asset rating system with 1 being new/excellent, 5 being very poor condition and replacement required. • QPRC confirmed the age of water meters are about 10-15 years old i.e. not particularly old stock • Queanbeyan STP– workshop discussion regarding the condition of the various components of the plant – in the context of Category 1 (excellent condition) representing a significant proportion of the STP. This to be made clearer in the Issues Paper in terms of the significance of the 1980's plant upgrade, i.e. some components of the facility have been replaced more recently than its 1930s original construction. • Asset Management Plan (AMP) review – QPRC confirmed the latest AMP's are expected to be endorsed in early 2020. DPIE Water requested to leverage relevant preliminary information within the Issues Paper (where appropriate). • Efforts to update the STP condition data is not being undertaken due to the pending replacement of the plant.	Noted for IWCM Strategy – Part 2 Noted for IWCM Strategy – Part 2 QPRC to confirm latest AMP info/ Noted for IWCM Strategy – Part 2
8.	**Data Gap Analysis**	
8.1	• Workshop discussion regarding key data gaps – DPIE Water queried availability of historical telemetry data, O&M data (work orders) etc. QPRC confirmed there is a broader legacy issue regarding data management and disparate systems i.e. data is scattered and sitting in different locations and is very challenging to navigate, interrogate and consolidate. Confirmed this is a longer term journey of improvement for Council in terms of bringing the disparate sources of data together over time.	Noted
9.	**Population and Development**	
9.1	• Discrepancy noted between historical growth rate (2%/annum) versus future projected rate of growth (<1%/annum) – confirmed the future projections show less than 1% growth because of the following: - Growth has formally been revised down within a local planning context due to development constraints/restrictions around Canberra Airport and flight path - High growth in Googong Township has been excluded from the Queanbeyan IWCM strategy due to the study area extents – this has had a material impact on the reported rate of growth as growth across the remainder of Queanbeyan is lower than that in Googong	Noted for IWCM Strategy – Part 2
9.2	• Agreement to replace the 0% growth assumption beyond 2036 (to 2050) and instead adopt the historical growth rate (i.e. 2%/annum) for projecting out to 2050 as an assumption that infill growth (medium density) will continue beyond 2036 at a rate similar to historical levels (in the absence of formal growth projections >2036). This update to long-term growth to be undertaken as sensitivity analysis for the Issues Paper and the associate messaging/outcomes to be made clear in the report	Noted for IWCM Strategy – Part 2
9.3	• By projecting growth beyond 2036 at rate of 2%/annum it was noted that this will increase the future EP projection to 75,000 at 2050 - which is closely aligned to the projection derived for the STP Upgrade Project (alignment between the two projects is the desired outcome).	Noted

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No	Item	Action
9.4	• QPRC confirmed the STP Masterplan allows for an ultimate capacity of 150,000 EP in order to account for potential future cross-border servicing within the ACT (Fyshwick). The new STP site will allow for this potential future cross-border servicing expansion i.e. the new STP may be required to take additional flow from the ACT in the future. Also noted that if additional expansion is required in the future then the cost would be borne by ACT / Icon Water rate payers.	Noted for IWCM Strategy – Part 2
10.	**General System Issues**	
10.1	• Levels of Service – update Issues Paper to note that QPRC has effectively adopted Technical Levels of Service (LOS) with reference to the DPI annual performance reporting requirements i.e. established line of sight to the IWCM objectives, however QPRC remains in the process of engaging the community (Harmonisation process underway) to inform the development of Community LOS – which may result in the Technical LOS being revised in the future.	Noted for IWCM Strategy – Part 2
10.2	• DPIE Water to provide QPRC with template for LOS (promoting clearer line of sight to the IWCM objectives).	DPIE to provide template/ Noted for IWCM Strategy – Part 2
10.3	• Drinking Water Management System (DWMS) reporting for 2018 has been finalised. The 2018 annual report was delivered late but it is now available (QPRC noted opportunity to develop a better template for DWMS annual reporting). Agreed the 2018 reported outcomes to be captured in the Issues Paper alongside the 2017 reported outcomes	QPRC to provide 2018 report for incorporation/ Noted for IWCM Strategy – Part 2
10.4	• Emergency response procedures – agreed to tone down language in the report and to be more specific regarding gaps in procedures i.e. reference Business Continuity Plans (incident reporting), Icon Water notification procedures (bulk water quality/continuity).	Noted for IWCM Strategy – Part 2
11.	**Drinking Water – Gap Analysis and Key Findings**	
11.1	• QPRC noted Offtake 1 and 2 labelling is incorrect on Page 1 (executive summary) – this to be updated and sanity check remainder of report references	Noted for IWCM Strategy – Part 2
11.2	Bulk Supply Service Level Agreement (SLA) – key notes: • Confirmation the existing SLA covers water security for both the ACT and Queanbeyan to the same standard (Icon Water confirmed Queanbeyan is incorporated within Icon Water's water security projections and associated water pricing mechanisms via ICRC i.e. all renewals / drought etc). • Discussion regarding bulk WQ performance requirements in existing SLA (Icon Water) versus those adopted by QPRC (DWMS) – discrepancies noted where QPRC has adopted more stringent requirements downstream of Offtakes 1 & 2 – to be made clearer in the Issues Paper. • The existing SLA does not incorporate peak instantaneous flow allowances for Offtakes 1 & 2 which is perceived to be a gap. • QPRC acknowledged the existing SLA is regularly reviewed with Icon Water and many of the historical gaps/issues have been resolved – general consensus is that the existing SLA provides good coverage of the bulk supply requirements between Icon Water/QPRC i.e. no major gaps	Noted for IWCM Strategy – Part 2

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No	Item	Action
11.3	Water quality (key notes): • Offtakes 1 & 2 - confirmed that water quality monitoring at the offtakes is not currently undertaken by QPRC (i.e. reliant on monthly WQ monitoring reports from Icon Water) and this to be highlighted as an issue. • QPRC confirmed Offtake 2 re-chlorination plant is not currently operational and has not been operated in a long time (owned by Icon Water / operated by QPRC). Agreed to update Issues Paper to note this as an issue • Agreed that DWMS reported water quality performance for QPRC's network indicates the system is generally meeting the required performance levels (noting the minor exceedances). This messaging to be made clearer in the Issues Paper - additional summary to be provided below Table 9-2 • Noted Table 9-3 does not indicate spatial distribution of exceedances / complaints. The Issues Paper to be updated with spatial indication of WQ issues (where available) • Reservoirs - QPRC noted that air gaps remain on some reservoirs which pose contamination risks of the reservoirs. This to be noted as an issue	Noted for IWCM Strategy – Part 2
11.4	Service Reliability (key notes): • QPRC confirmed that Jerrabomberra Reservoir has poor condition issues at the bottom of the reservoir and is effectively not feasible to take off-line given the lack of by-pass arrangements in the existing network (duplicate storage tank discussed as an option) • QPRC noted there are reservoir access issues including antennas on roofs which pose OH&S risks at some reservoirs (access not restricted). This to be noted as an issue • QPRC noted that vandalism risk is a continuity/reliability concern particularly at remote reservoir sites (e.g. vandalism at Greenleigh Reservoirs). This to be noted as an issue. • QPRC highlighted concern over the potential failure of Icon Water's DN1800 trunk pipeline upstream of Offtake 1 & 2 i.e. if the trunk main fails (unplanned outage) then it would create significant risk as there would be no bulk water supply available. The time to repair could be extensive given the main may take up to 72 hours to drain + switch to Googong WTP. This to be highlighted as a business continuity risk/issue in the report.	Noted for IWCM Strategy – Part 2
11.5	• Sustainability - QPRC noted that the derived NRW of 18% is lower to what they were expecting. This expectation informed by the majority of parks not currently being metered, stand-pipe usage etc. QPRC is improving the metering to parks over time. Agreed the NRW calculations to be re-checked to confirm is correct.	Noted for IWCM Strategy – Part 2
11.6	• DPIE Water queried the peak day demand analysis / scaling factors derived. DPIE Water/AECOM to discuss this further off-line as a sanity check (which may impact on the reported capacity assessment).	Noted for IWCM Strategy – Part 2
12.	**Sewer – Gap Analysis and Key Findings**	
12.1	Sewer overflows (key notes): • Discussion regarding tree roots, wet wipes and fat being the main causes leading to sewer overflow. Acknowledged there is opportunity for further education campaign regarding this. • Confirmed controlled overflows into local waterway remain in place at Morrissett St SPS and to acknowledge this in the Issues Paper	Noted for IWCM Strategy – Part 2
12.2	Sustainability – I&I (key notes):	Noted for IWCM Strategy – Part

No	Item	Action
	• Discussion regarding the sewer unit loading rate being higher than the drinking water per capita rate – agreed to re-check the sewer EP calculation as this may be resulting in a higher loading rate (rather than the ADWF calculations) • Discussion regarding shallow water table locations and potential to be impacting higher infiltration flow during dry weather i.e. noted there is shallow groundwater at Seiffert Oval which could be infiltrating the sewer? • Acknowledgement that the unit loading rate (264 L/EP/day) should be more closely aligned to the unit rate adopted by the STP Upgrade Project (as an outcome) – this to be cross-checked with QPRC	2
12.3	• Trade Waste (key notes): there is an agreement in place between ACT/QPRC for taking Oaks Estate sewerage. This agreement should be reviewed in line with DPIE trade waste requirements. Agreed not a significant issue (marginal flows), however to be noted.	Noted for IWCM Strategy – Part 2
12.4	• EPA licence compliance (key notes): comment regarding insufficient data to be removed and project team to collect available STP performance (compliance) information from the concurrent STP Upgrade Project.	QPRC to provide EPA data/ Noted for IWCM Strategy – Part 2
12.5	• Queanbeyan STP capacity / performance – DPIE Water queried the design capacity of the plant including for individual components/processes within the plant. QPRC agreed to transition the latest design capacity information from the STP Upgrade Project into the Issues Paper (in the context of the scope of that project).	QPRC to confirm / provide latest design capacity data/ Noted for IWCM Strategy – Part 2
12.6	• Morisset St SPS capacity / performance – confirm if the PWWF was calculated based on two pumps running. QPRC confirmed that the duty flow is 600 L/s and the SPS represents a duty/assist arrangement	Noted
12.7	• East Weetalabah 2 SPS – QPRC confirmed this SPS has a lot of issues, however this is not reflected in the first principles analysis. QPRC to confirm data / performance for this pump station for update in the report	QPRC to provide SPS info / Noted for IWCM Strategy – Part 2
12.8	• SPS Storage – agreed the storage volumes used for the emergency storage analysis is to be confirmed by QPRC, including the Capital Terrace storage dimensions. To be highlighted as an Issue and reviewed in the next phase of the IWCM process.	QPRC to provide storage info / Noted for IWCM Strategy – Part 2
12.9	• Weetalabah Drive (Pump 15) rising main – QPRC confirmed the rising main as DN50 (not DN75). This to be updated in the first principles velocity calculations.	Noted for IWCM Strategy – Part 2
12.10	• Banyalla Cl – Pump 11, Kathleen St – Pump 7, Bayside Ct – Pump 9: potential future capacity issues reported which may lead to high velocities / performance issues in the rising mains. The rising mains currently not reported and to be checked.	Noted for IWCM Strategy – Part 2
13.	**Stormwater – Gap Analysis and Key Findings**	

No	Item	Action
13.1	• Stormwater quality - NSW Health confirmed that sampling is currently only tested during dryer periods and not during storm events.	Noted
13.2	• Discussion regarding stormwater offsets for Queanbeyan STP effluent discharges as a way to reduce sewer related investment – agreed there are complexities / challenges around this based on the disparate funding mechanisms	Noted
13.3	• Acknowledged there is opportunity for rainwater tanks to retain run-off and contribute to improving water quality. Project team noted that rainwater tanks will be most effective when stormwater is captured on a regional basis and is reticulated to the highest residential water end uses etc.	Noted
13.4	• Based on issues identified there is potential for Council to review the existing DCPs for new development (current DCP targets unlikely to mitigate the risks of future water erosion in particular)	Noted
13.5	• Stormwater issues – concluding discussion regarding the nexus between the stormwater issues and water/sewer issues and the relative importance of the stormwater issues in the context of the IWCM. Confirmation / agreement by the PRG that there are no big ticket stormwater issues in the context of the IWCM i.e. no obvious nexus points, as water security projections are healthy (key nexus driver). Therefore agreed stormwater related options / solutions are unlikely to be a key driver within the IWCM Strategy	Noted for IWCM Strategy – Part 2
14.	**Next Steps**	
14.1	Noted that the next steps for the project include: - Issuing minutes and slides from workshop - Incorporating comments following PRG workshop and finalise Issues Paper - Submitting QPRC issues paper for endorsement - Part 1 hold point - Commencement of Part 2 – IWCM Strategy (2020)	Noted
15.	**Meeting Closed**	

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Appendix F

Consultation Outcomes Report

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Appendix F Consultation Outcomes Report

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Queanbeyan Palerang Regional Council
23-Feb-2018

Queanbeyan Integrated Water Cycle Management Strategy

Issues Paper Consultation Outcomes Report

Queanbeyan Integrated Water Cycle Management Strategy

Issues Paper Consultation Outcomes Report

Client: Queanbeyan Palerang Regional Council

ABN: 95 933 070 982

Prepared by

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Prepared by	Alyse Phillips
Reviewed by	Sonia Doohan

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
0	23-Feb-2018	Final	Hayden Seear Project Manager	

Table of Contents

1.0 Introduction

1.1 Project Overview

Queanbeyan-Palerang Regional Council (QPRC) is developing a masterplan for the delivery of water services for the modern, progressive and growing city that is Queanbeyan. The masterplan is guided by the *NSW Government's Best-Practice Management of Water Supply and Sewerage Framework*[1], a requirement of which is for local water utilities to prepare and implement a 30-year Integrated Water Cycle Management (IWCM) strategy.

QPRC has engaged AECOM Australia Pty Ltd (AECOM) to support Council develop an IWCM strategy for the former Queanbeyan City Council (QCC) local government area (LGA).

Water management in the Queanbeyan-Palerang Regional Council (QPRC), particularly the former Queanbeyan City Council region of the new local government area, is influenced by a complex arrangement of interests. These range from Commonwealth, State, Territory and Local Government authorities, Canberra's neighbouring water utility (Icon Water), the position of the city within a catchment area that feeds one of the nation's most recognizable water bodies, and a vocal and committed set of volunteer catchment management organizations with passionate members.

Community consultation is a key consideration throughout the IWCM strategy development process. This report presents the outcomes of the community feedback received during Part 1 of the Queanbeyan IWCM, the *Gap Analysis* stage.

The feedback received during consultation will be incorporated into the summary report from Part 1 of the Queanbeyan IWCM, the *Queanbeayan IWCM Issues Paper*, scheduled to be completed in April 2018.

1.2 Engagement Objectives and Approach

The consultation approach involved engagement with local community stakeholders such as Council staff living in the area and local resident community groups.

The consultation approach aimed to provide early, meaningful and transparent consultation.

Early consultation enabled stakeholders to be informed of the preparation of the IWCM Issues Paper and also provided them with opportunity for their views, interests and issues to be heard.

The consultation also aimed to build positive relationships and strengthen the existing relationships with the community and stakeholders.

The consultation process aligned with national best practice and was guided by the International Association of Public Participation and QPRC's Community and Staff Communication and Engagement Plan. The approach also considered the Queanbeyan Sewage Treatment Plant upgrade community engagement program.

The key objectives of the IWCM Part 1 consultation process were to:

- inform key stakeholders and the community of the project;
- listen to stakeholder and community issues to inform the gap analysis and issues paper; and
- develop and engage with identified stakeholders.

1.3 Communication tools and techniques

A variety of communication tools and techniques were used to inform and invite feedback from stakeholders on the IWCM, presented in **Table 1**.

[1] https://www.water.nsw.gov.au/__data/assets/pdf_file/0005/549608/BPMF.pdf

Table 1 Communication Tools and Techniques

Tools and Techniques	Purpose
Email invitation to key stakeholders	Community and Project stakeholders were informed that the project had started, given information about community meetings and were informed of feedback mechanisms. Refer to **Appendix A** for the invitation.
Feedback mechanisms	Stakeholders were provided with an opportunity to ask questions and provide feedback on the IWCM project via email and phone.
PowerPoint presentation	The presentation provided a clear summary of the project and helped provide a structure for the workshops. Refer to **Section 2** for details on the structure of the presentation and **Appendix B** for presentation slides.
Stakeholder workshops	QPRC identified key community and stakeholder groups. Invites were sent to these stakeholders to inform them about the project and provide an opportunity for them to attend a stakeholder workshop. The stakeholder workshops aimed to inform and consult in order to gather valuable insights and feedback that would inform the Gap Analysis and development of the IWCM Issues Paper. **Sections 3, 4** and **Appendix C** present the feedback received during these workshops.
Poll Everywhere iPad application during the workshops	The *Poll Everywhere* iPad application was used during the stakeholder workshops to collect feedback. The feedback collected during this activity created a 'word cloud' in real time during the presentation for all participants to see hence better understand the relative quantity of various opinions.
Evaluation forms	At the end of the stakeholder workshops, participants were asked to complete evaluation forms to provide their feedback on the sessions. **Section 5** provides a summary of the feedback received from the workshop evaluation forms.

2.0 Stakeholder Workshop Structure

2.1 Purpose

The stakeholder workshop provided an opportunity for identified stakeholders and community members to be informed and share their experience, views, interests and issues on IWCM within the QPRC region. The feedback received during these workshops will inform the Queanbeyan IWCM Gap Analysis and Issues Paper.

2.2 Structure

The activities completed during each of the workshops sought to understand the issues, barriers, opportunities and gaps to consider in the development of the IWCM.

The format of the workshop is described below in **Table 2.** A copy of the presentation slides are provided in **Appendix B.**

Sections 3, 4 and Appendix C present the feedback received during these workshops.

Table 2 Format of the Stakeholder Workshops

Activity		Output	Outcomes
1	Introduction - Workshop rules - Ice breaker - Outline of workshop	Record of attendance	Clear understanding of what the workshop is about and who is in the room Build rapport between participants
2	How does water flow in and out of your home? Where does it come from and where does it go? - Exercise (small group) - Discussion	Qualitative results of community understanding of basic water knowledge	Educate participants on the role of the individual in the water cycle system. Create an understanding of the bigger picture
3	How do you use water? - Group activity	Content analysis of participants view and understand the water cycle – individual, community, region	Identify key community needs, wants and improvements for water cycle in the current environment
4	What about wastewater? - Group activity		
5	How do you use waterways? - Group activity		
6	What could it be like in 30 years? - Group activity	Participants view of the future of water cycle management	Identify community long term visions for water cycle management
7	What do you think are the barriers from your vision being achieved?	Word cloud showing all barriers	Educate participants on the roles everyone plays and understanding of who can take action

3.0 Stakeholder Workshop 1

Date: Wednesday 29 December 2017

Time: 9.30am - 12.30pm

Location: QPRC Office, 256 Crawford Street, Queanbeyan

3.1 Attendance

A total of seven (7) participants attended Stakeholder Workshop 1. A list of attendees is provided in **Table 3**.

Table 3 Stakeholder Workshop 2 Attendees

Queanbeyan IWCM Project Team		Workshop Attendees	
Name	**Organisation**	**Name**	**Organisation**
Sonia Doohan	AECOM (Principal, Communications and Engagement)	Vanessa Palmer	QPRC (Utilities Representative)
Alyse Phillips	AECOM (Consultant, Communications and Engagement)	Martin Brown	QPRC (Land use Planning Representative)
Ryan Signor	AECOM (Project Director)	Shlomi Bonet	QPRC (Sustainability Officer)
Hayden Seear	AECOM (Project Manager)	Simon Upward	QPRC (Natural Landscape and Health Representative)
Andrew Grant	QPRC (QPRC Assets Specialist)	Amelia Berry	QPRC (Sewage Treatment Plant Project Assistant)
		Thomas Hogg	QPRC (Contracts and Project Representative)
		Michael Gosier	QPRC (Communications Representative)
		Dirk Jol	QPRC (Senior Development Engineer)

3.2 Stakeholder Workshop 1 Feedback

Feedback received during Stakeholder Workshop 1 is summarised in **Table 4** and expanded upon in **Attachment C**.

Table 4 Stakeholder Workshop 1 Summary

Activity		Summary of Feedback
1	Introduction • Workshop rules • Ice breaker • Outline of workshop	At the beginning of the workshop, participants were provided with an overview of the structure and asked to introduce themselves around the room. This activity provided a clear understanding of what the workshop was about and helped build rapport between participants.
2	How does water flow in and out of your home? Where does it come from and where does it go? • Exercise (2-3 per group) • Discussion	This activity was designed to help refresh and educate participants on the role of the individual in the water cycle system. Through this exercise, participants were able to gain an understanding of how their use of water fit within the bigger picture. The exercise demonstrated that all participants had a clear understanding of how water flowed in and out of their property. When asked "How would the community go with this exercise?" participants felt that the community may use water daily without questioning where it comes from. **Figures 1 and 2** provide photos of participants during Activity 2.
3	How do you use water now? • Group Activity: - What do you use water for? - What good experiences have you had with water? - Where have you seen improvements? Where are they? - Where would you like to see improvements? Why?	Activities 3-5 helped to identify key community needs, wants and improvements for water cycle management in the current environment. This exercise demonstrated that participants use water for everyday uses such as drinking, cooking, personal hygiene and recreation. Some of the key positive experiences with water include recreation, livability and an appreciation for clean drinking water. Participants recognised improvements in today's supply of water and reminisced on the previous experience with drought and water restrictions. Some participants felt that there was a perceived improvement in water supply and reduction in water use due to the current behaviour of people using it for domestic use such as watering their gardens and washing their cars. Participants mentioned that they would like to see improvements in stormwater management, education, compulsory recycling for greywater and the provision of compulsory and more sustainable showerheads, washing machines and water tanks.

Activity		Summary of Feedback
4	What about wastewater? • Group Activity: - How does wastewater fit into the water cycle of our region? • Using the poster provided, tell us in your own words: - What is wastewater? - What about recycled water? - Where would you like to see improvements? Why?	This activity was designed to identify key community needs, wants and improvements in water cycle management in the current environment. This exercise demonstrated that participants had a clear understanding of and the difference between wastewater and recycled water. Participants would like to see improvements in the treatment and use of greywater. Some participants suggested more sustainable practices such as composting toilets and the use adaptable reuse of toilets and sinks as a combined use. Council rebate programs were also mentioned as a possible initiative.
5	How do you use waterways? • Group Activity: - How do you use waterways now? • Using the map and post-it notes provided, tell us: - Where and how are waterways used and enjoyed? - Where have you seen improvements? What are they? - Where would you like to see improvements? Why?	This activity provided a way for participants to mark on a map using post-it notes their responses regarding waterways. This exercise provided a way for them to locate areas within the QPRC region where they would like to see improvements. Some of the comments received include: • Sewage Treatment Plant upgrade; • More opportunities for recreation activities; • Stormwater retention; and • Footpaths along the river.
Break		
6	What could it be like in 30 years? • Group activity • Working in the same group: - Write, draw or use pictures to tell us what you want the water cycle to support your community? What do you want to feel, see, touch, hear, smell or perceive? What would visitors experience?	This exercise was designed to provide a way for participants to visually represent their experience and also the visitor experience with water in their community. Photos of the completed worksheets are provided in **Figures 3 and 4.** Some of feedback received included: • Water conservation; • Access to clean water; • Safe swimming; • Improved water quality; • Access to clean water; and • Recreation and redefining the river space.

Activity		Summary of Feedback
7	What do you think are the barriers from your vision being achieved? Poll Everywhere survey	This activity provided a way to not only understand the barriers but also a way to educate participants on the roles that everyone plays in understanding who can take action. Participants were asked to send their responses using the Poll Everywhere application on the iPad. **Figure 5** provides an image of the word cloud that was generated from Poll Everywhere. Some of the barriers listed include: • Political pushback. • Close relationship between Council and developers. • Council values and priorities changing. • Funding. • Climate change. • Reluctance to change. • Rapid development resulting in contamination. • Greater population. • Social expectations. • Community values. • Changing perceptions. • Negative social attitudes. • Legal challenges and restrictions. • Planning requirements and legislation. • Lack of rules and regulations. • Environmental restrictions. • Lobby groups. • Lack of decision makers.

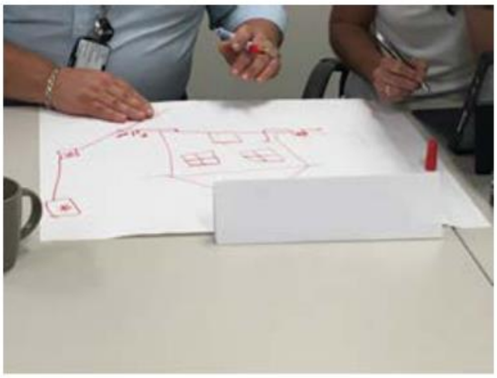


Figure 1: Photo taken during Stakeholder Workshop 1

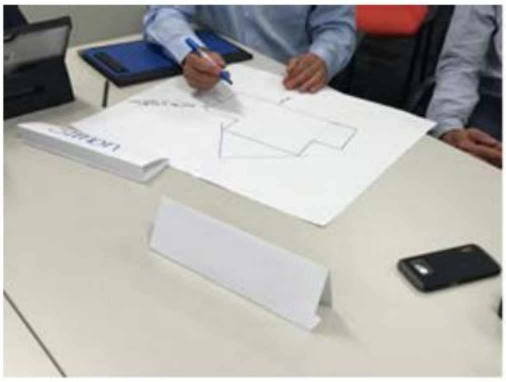


Figure 2: Photo taken during Stakeholder Workshop 1

Figure 3: Photo of Activity 6 worksheet

Figure 4: Photo of Activity 6 Worksheet

Figure 5 What do you think are the barriers from your vision being achieved?

4.0 Stakeholder Workshop 2

Date: Thursday 20 December 2017

Time: 5.30pm – 8.30pm

Location: Queanbeyan Library Activity Room, 6 Rutledge Street, Queanbeyan

4.1 Attendance

A total of six (6) people attended stakeholder workshop two. A list of attendees is provided in **Table 5.**

Table 5 Stakeholder Workshop 2 Attendees

Queanbeyan IWCM Project Team		Workshop Attendees	
Name	**Organisation**	**Name**	**Organisation**
Sonia Doohan	AECOM (Principal, Communications and Engagement)	Gordon Cunningham	QPRC Service Manager Utilities
Alyse Phillips	AECOM (Consultant, Communications and Engagement)	Sue Gibson	Wickerslack Area Group
Ryan Signor	AECOM (Project Director)	Ben Bryant	Upper Murrumbidgee Catchment Group
Hayden Seear	AECOM (Project Manager)	Roger Clement	Wickerslack Area Group
Andrew Grant	QPRC (Assets Specialist)	Sue Ball Guymer	Queanbeyan Residents and Ratepayers Association
Brendan Belcher	QPRC (Senior Engineer Utilities)	Russ Ball Guymer	Queanbeyan Residents and Ratepayers Association

4.2 Summary of feedback received from stakeholder workshop two

Feedback received during Stakeholder Workshop 1 is summarised in **Table 6** and expanded upon in **Appendix C**.

Table 6 Stakeholder Workshop 2 Summary

Activity		Summary of Feedback
1	Introduction • Workshop rules • Ice breaker • Outline of workshop	At the beginning of the workshop, participants were provided with an overview of the structure and asked to introduce themselves around the room. This activity provided a clear understanding of what the workshop was about and helped build rapport between participants.
2	How does water flow in and out of your home? Where does it come from and where does it go? • Exercise (2-3 per group) • Discussion	This activity was designed to help refresh and educate participants on the role of the individual in the water cycle system. Through this exercise, participants were able to gain an understanding of how their use of water fit within the bigger picture. The exercise demonstrated that all participants had a clear understanding of how water flowed in and out of their property and the different sources of water (potable vs extraction). **Figures 6 and 7** provide photos of participants during Activity 2.
3	How do you use water now? • Group activity - What do you use water for? - What good experiences have you had with water? - Where have you seen improvements? Where are they? - Where would you like to see improvements? Why?	Activities 3 -5 helped to identify key community needs, wants and improvements for water cycle management in the current environment. This exercise demonstrated that participants use water for everyday uses such as drinking, cooking and personal hygiene. Some of the key positive experiences with water include the taste of rainwater, the quality of water and good catchments. Participants recognised improvements in people being more water conscious, a change in behaviour such as not washing driveways with water and water saving devices. Participants mentioned that they would like to see improvements in the better use of non-potable water supplies, stormwater and the improved supply of non-drinking water for uses like washing.

Activity		Summary of Feedback
4	What about wastewater? • Group activity - How do you use wastewater and recycled fit? - How do you use wastewater now? - What good experiences have you had? - Where have you seen improvements? - Where would you like to see improvements?	This exercise demonstrated that participants had a clear understanding of and the difference between wastewater and recycled water. Participants have good experiences with greywater reuse, fewer lawns and the need for less water. Participants recognised improvements in recycling, non-chemical products, advances in technology and cultural change. Participants would like to see improvements in the management of recycled water in the Googong township and for it to be used for washing clothes, dishes and cleaning the house. Other improvements included investment opportunities.
5	• How do you use waterways? • Group activity - How do you use waterways now? Using the map and post-it notes provided, tell us: - Where and how are waterways used and enjoyed? - Where have you seen improvements? What are they? - Where would you like to see improvements? Why?	This activity provided a way for participants to mark on a map using post-it notes their responses regarding waterways. This exercise provided a way for them to locate areas within the QPRC region where they would like to see improvements. Some of the comments received include: • Swimming at Wickerslack • Location for gross pollutants • Question regarding misinformation and safety about swimming the in the river • Stormwater upgrade hotspots.
	Break	
6	What could it be like in 30 years? • Group activity • Working in the same group: - Write, draw or use pictures to tell us what you want the water cycle to support your community. - What do you want to feel, see, touch, hear, smell or perceive? - What would visitors experience?	This exercise was designed to provide a way for participants to visually represent their experience and also the visitor experience with water in their community. Photos of the worksheets are provided in **Figures 7 and 9.** Some of feedback received included: • More social and recreational opportunities • Recycled stormwater • Places for social events • No pine trees • Sustainable development • Best practice in stormwater, river management and the integrated management of bush and natural areas.

Activity		Summary of Feedback
7	What do you think are the barriers from your vision being achieved? Poll Everywhere survey	This activity provided a way to not only understand the barriers but also a way to educate participants on the roles that everyone plays in understanding who can take action. Participants were asked to send their responses using the Poll Everywhere application on the iPad. **Figure 10** provides an image of the word cloud that was generated from Poll Everywhere. Some of the barriers listed include: • Lack of trust in organisations • Poor land management • Climate change • Population growth • Existing built environment • Lack of environmental education and awareness • Lack of Council staff • Competing interests • Ignorance • Lack of political will • Lack of appreciation for the environment • More sustainable development

Figure 6: **Photo of Activity 5 worksheet**

Figure 7: **Photo of Activity 6 worksheet**

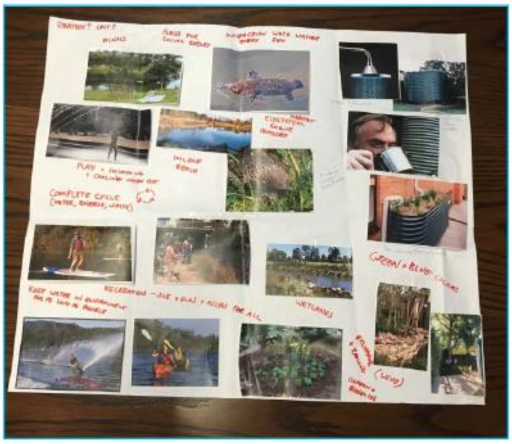


Figure 8: Photo of Activity 6 worksheet

Figure 9: Photo of Activity 7 worksheet

Figure 10: What do you think are the barriers from your vision being achieved?

5.0 Evaluation Forms

At the end of each workshop participants were asked to complete an evaluation form, such that future workshops could be tailored accordingly.

Of the 26 participants, 12 completed the evaluation form (46%) which contained 7 questions.

A snapshot of the feedback received from workshop attendees:

- 83 per cent of participants strongly agreed that the workshop was clear.
- 100 per cent of participants agreed that the activities allowed them to share their thoughts and opinions on the topic.
- 58 per cent of participants felt that there was enough time for discussion.
- 100 per cent of participants felt that the facilitators enabled fair discussion.
- 100 per cent of participants who completed the evaluation forms would like to be included in further conservations on the topic.

Participants were also asked “What parts of the workshop they found useful and informative” and “What they liked most? “Any suggestions for how future workshops could be improved? “

6.0 Conclusion

Early consultation during Stage 1 enabled stakeholders to be informed of the preparation of the IWCM Issues Paper and also provided them with opportunity for their views, interests and issues to be identified.

The feedback received during consultation in Part 1 of the IWCM will help inform the Gap Analysis and Issues Paper. **Table 7** below provides a summary of the key needs, issues, gap, barriers and opportunities identified within the feedback received from the workshops.

Table 7 Summary of Key Themes

Theme	Feedback
Needs	• More sustainable practices such as recycling of water, composting toilets. • Better use of non-potable water supplies. • Management of recycled water in the Googong Township and for it to be used for washing clothes, dishes and cleaning the house. • Stormwater management. • More water tanks. • Access to clean drinking water. • Make every creek, dam and river a safe place to swim. • Less contamination. • More ecologically friendly products. • Cultural change – changing the way we think about water. • Water going back into the river should be as good, or better than, the water extracted. • Sustainable development. • A need for a long term plan.
Issues	• The use of drinking water for watering gardens and washing cars. • Concern with why the Googong Township isn't putting its water into the dam. • Verge policy enforced. No gravel as it ends up in water ways.
Gaps	• Water for drinking. • Water for cooking and cleaning. • Water for recreation uses. • Water conservation. • Investment.
Barriers	• Local political barriers such as Council. • Lack of political will to improve and invest. • Perceived close relationship between Council and developers. • Council values and priorities changing. • Contamination. • Funding. • Expectations. • Water restrictions. • Environmental restrictions. • Rapid development resulting in contamination. • Greater population. • Political pushback. • Social expectations. • Community values. • Changing perceptions. • Negative social attitudes. • Legal challenges and restrictions. • Planning requirements and legislation. • Lobby groups.

Theme	Feedback
	• Lack of decision makers. • Lack of rules and regulations. • Reluctance to change. • Bottom up approach versus top down approach. • Drought proofing. • Lack of trust in organisations. • Poor land management. • Climate change. • Population growth. • Existing built environment. • Lack of environmental education and awareness. • Lack of Council staff. • Competing interests. • Ignorance. • Lack of political will. • Lack of appreciation for the environment. • More sustainable development.
Opportunities	• Education on water reuse and conservation. • Improvements in stormwater management. • Compulsory recycling of greywater. • Security of own supply of water rather than relying on others. • Improved retrofitting. • More recycled water for drinking. • Council to advertise rebates. • Sustainable and water efficient showerheads, washing machines and water tanks. • Redefine the river space. More social and recreational activities. • Onsite greywater treatment. • Use stormwater better. • Advances in technology overtime. • Places for social events. • Will people be charged water rates if the water is taken from the river?

Appendix A

Stakeholder Workshop Invitation

Appendix A Stakeholder Workshop Invitation

Invitation: share your thoughts on our water

Good morning [insert stakeholder group representative],

I'm just following up on our invitation to attend the workshop next **Thursday 30 November** for representatives from the [insert stakeholder group] to take part in an interactive workshop looking at the water cycle in Queanbeyan-Palerang Regional Council area (see invitation below).

We are yet to hear from you and are keen to ensure representatives from the [insert stakeholder group] attend and take part.

If you could let me know by Friday who will be attending, it would be greatly appreciated.

Please call me if you have any questions.

Kind regards

Appendix B

Presentation Slides

Water cycle for our future

How can integrated water cycle management help support our community

Shared rules for the workshop

Share your thoughts – be brave.

Be respectful and considerate of everyone's opinions.

Build and contribute to the conversation.

Keep focused on the discussion.

Have a question? Please ask.

Feedback – the more, the better.

Phones away - silent or off.

Ice breaker

30 second snap shot

- Name?
- What do you love about your community?
- What do you expect from this workshop?

3 Integrated Water Cycle Workshop AECOM

What we'll focus on in today's workshop

- Back to basics
  - How's your home connected?
- How do you use water and waterways? What about wastewater?
  - Small group activity
  - Workshop discussion
- What could happen in the future? What are the barriers?
  - Small group activity
  - Workshop discussion

4 Integrated Water Cycle Workshop AECOM

AECOM Imagine it. Delivered.

Back to basics

Working in pairs, can you connect the pipes?

Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

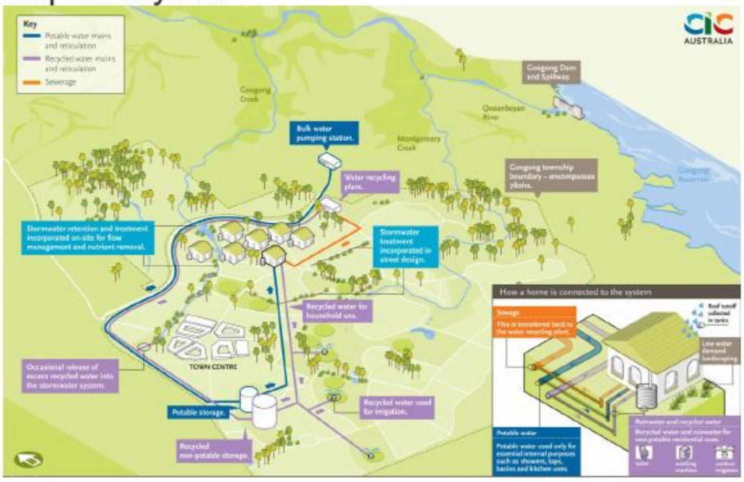
How does water flow in and out of your home? Where does it come from and where does *it* go?

Integrated Water Cycle Workshop

1/25/2018

What surprises you?

AECOM Imagine it. Delivered.



Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

Break into groups

4 – 5 people per group

8 Integrated Water Cycle Workshop

4

AECOM Imagine it. Delivered.

How do you use water now?

Using the poster provided, tell us:

- What do you use water for?
- What good experiences have you had?
- Where have you seen improvements? What are they?
- Where would you like to see improvements? Why?

9 Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

How does wastewater fit into the water cycle of our region?

Using the poster provided, tell us in your own words:

- What is wastewater?
- What about recycled water?
- Where would you like to see improvements? Why?

10 Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

How do you use waterways now?

Using the map and post-it notes provided, tell us:

- Where and how are waterways used and enjoyed?
- Where have you seen improvements? What are they?
- Where would you like to see improvements? Why?

11 Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

Break

12 Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

What could it be like in 30 years?

Working in the same group (15 mins)

- Write, draw or use pictures to tell us how you want the water cycle to support your community.
- What do you want to feel, see, touch, hear, smell or perceive?
- What would visitors experience?

13 Integrated Water Cycle Workshop

AECOM Imagine it. Delivered.

Paving the future - getting from A to B

What needs to happen to get to your future vision?

Integrated Water Cycle Workshop

1/25/2018

What do you think are the barriers from your vision being achieved?

Work in pairs and share your discussion with the wider group.

15 Integrated Water Cycle Workshop

8

Appendix C

Stakeholder Feedback from Stakeholder Workshops 1 and 2

Appendix C Stakeholder Feedback from Stakeholder Workshops 1 and 2

6.1 Workshop 1 Feedback

Table 8 Stakeholder Workshop 1 Detailed Summary

Activity	Response
Back to basics • How does water flow in and out of your home?	• How does water flow in and out of your home? Water in: - Water comes in from the dam / reservoir to the Water Treatment Plant. - Mains from Icon Water via network. - Runs from the meter to the house. - Rainwater tanks. - Roof to garden. - Stormwater runoff. - Bottled water. - Pool. Water out - Water flows out of the house and to the Sewage Treatment Plant. - Stormwater during and outside rain events. - Sewer. - Groundwater penetration. - Evaporation. - Sinks / toilets / showers.
How would the community go with this exercise?	• Water is an unseen service for the community. People use water without questioning where it comes from.
How do you use wastewater now? Using the poster provided, tell us: • What do you use water for? • What good experiences have you had? • Where have you seen improvements? Where are they? • Where would you like to see improvements? Why?	• What do you use water for? - Drinking. - Cooking. - Washing (clothes / cars / windows). - Recreation (pool / sprinklers). - Toilet. - Gardening. - Washing. - Cleaning. - Swimming. - Emergency services. - Hygiene (health and aesthetic). - Teeth. • What good experiences have you had? - Swimming. - Morning / hot showers. - Beer/beverages. - Cooking/drinking. - Safe. - Reliability. - Clean drinking water. - Fridge to make ice. - Aesthetic / garden.

Activity	Response
	- Sprinklers. - Slip and slide. - Pool. - Spa bath. - Cleaning car. - Cleaning windows. • Where have you seen improvements? Where are they? - Improvements since millennial drought. - Value of water. - More water tanks. - Watering gardens. - Recycling. - Native planting. - Accessibility e.g. free water/taps/stations. - Water Recycling Plant. - Innovative uses. E.g. community water planning. - Pool. - Growth pool Queanbeyan and Googong. - Drought education. • Where would you like to see improvements? Why? - Stormwater management. - Education regarding efficient use. - Showerheads / washing machines / water tanks / compulsory efficiency. - Compulsory recycling for greywater. - Securing own supply rather than relying on other stakeholders. - Education. - Increase water recycling usage. - Improved retro fitting.
How does wastewater fit into the water cycle of our region? Using the poster provided, tell us in your own words: • What is wastewater? • What about recycled water? • Where would you like to see improvements? Why?	• What is wastewater? - Sewage. - Any water 'used'. - Not used again. - Blackwater, greywater and freshwater. - Sewage – treatment plan –river. - Stormwater – river. • What about recycled water? - Garden water tank to be used later. - Treated and untreated water to be used later. - Greywater - gardens. - Water re-uses. e.g. bath water to garden. - Water Recycling Plant – irrigation –toilets. • Where would you like to see improvements? Why? - Suburban areas to change water methods. E.g. farmer versus urban dweller. - Augmentation treatment to reuse not discharge. - Fresh water to sewage. - Fresh water to greywater to blackwater. - Not fresh water for systems. e.g. toilet. - Methods prevent contamination. - Changes to structure. e.g. commercial / residential.

Activity	Response
	- Composting toilets. - More recycled water for drinking. - Treating greywater on site. - Stormwater – treated – remove litter. - More integrated grey water into blackwater. e.g. Toilets with sink on top. - Verge policy enforced. No gravel as it ends up in water ways. - Advertise council programs – washing machine rebates. - Reduce pressure on demand on water from environment. - Cost efficiency.
How do you use waterways now? Using the map and post-it notes provided, tell us: • Where and how are waterways used and enjoyed? • Where have you seen improvements? What are they? • Where would you like to see improvements? Why?	Refer to **Figure 8**.
What could it be like in 30 years? Working in the same group: • Write, draw or use pictures to tell us what you want the water cycle to support your community? • What do you want to feel, see, touch, hear, smell or perceive? • What would visitors experience?	- Change system. - Redefine the river space. E.g. more social and leisure activities. - Better use Googong. - Water system to capture not reliant on individual. - Water and security. - Water harvest and treatment- change to current service. - Wildlife (2). - Health (2). - Clean water. - Values? Nature (regenerate). - Education on water. - More recycling. - More water tanks. - Access to clean water. - Safe swimming. - Improved water quality. - Less contamination. - Water conservation. - On site greywater treatment. Refer to **Figure** 9 for photo of Stakeholder Workshop 1 thoughts on what it could be in 30 years.
What do you think are the barriers from your vision being achieved? • Work in pairs and share your discussion with the wider group.	Refer to **Figure 10** for Word Cloud of Stakeholder Workshop 1 thoughts on what it could be in 30 years.

Figure 8 Stakeholder Workshop 1 Waterway Usage Map

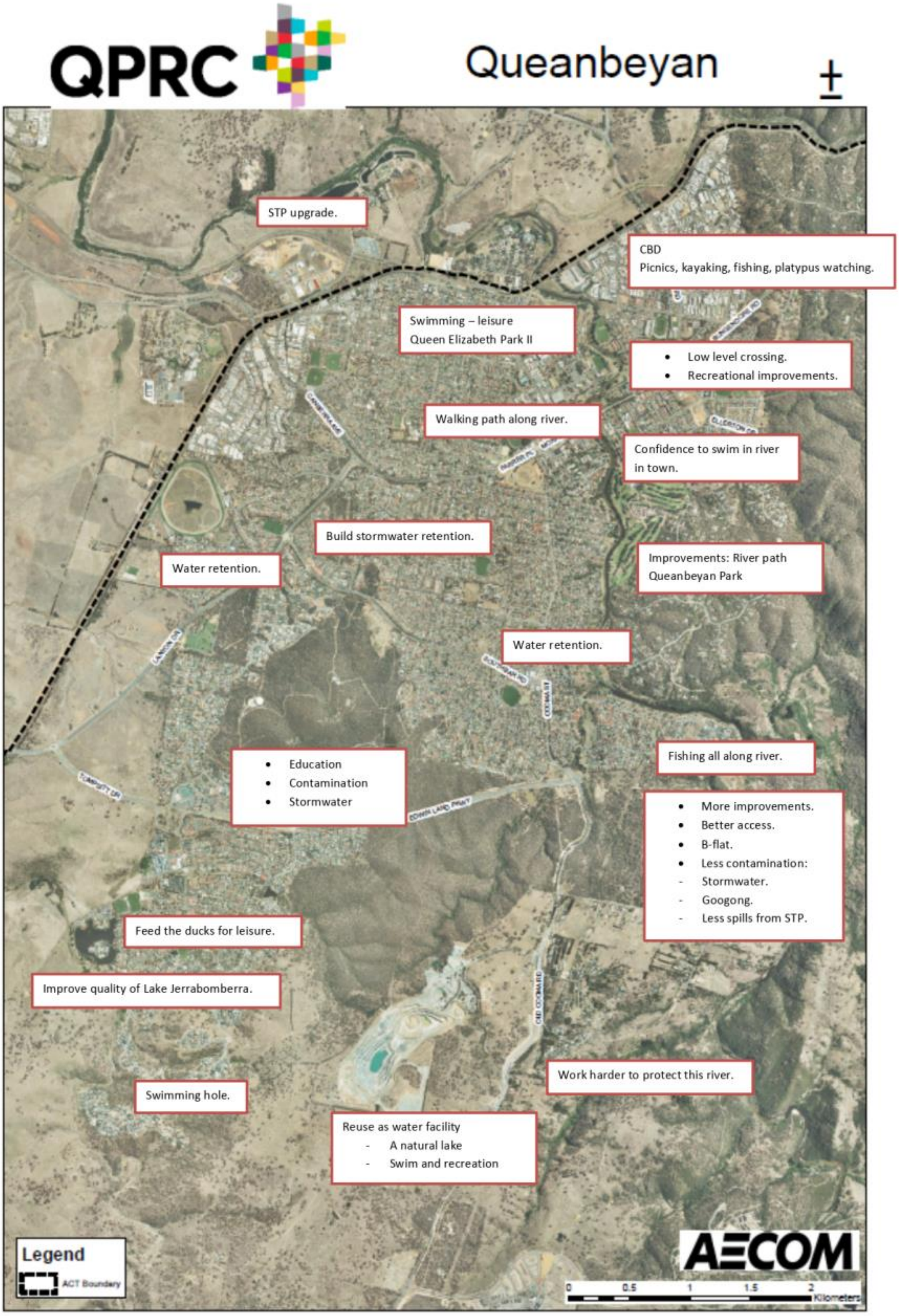


Figure 9 Stakeholder Workshop 1 – What it could be like in 30 years

Figure 10 Stakeholder Workshop 1 - Barriers preventing their vision being achieved

6.2 Workshop 2 Feedback

Table 9 Stakeholder Workshop 2 Detailed Summary

Activity	Response
Back to basics • How does water flow in and out of your home?	• How does water flow in and out of your home? Water in: - Dams/reservoirs – treatment plants – to homes. - Pump directly from Queanbeyan River using electric pump. - Stored uphill from house – unfiltered and untreated water. - Gravity feedback to house – all hot water taps and cold taps, toilets, bath, garden. - Gravity to garden to taps. - Potable water, roof collection of rainwater, stored gravity fed, untreated, unfiltered in tanks. - Reticulated – potable (Googong Dam mostly, Stromlo, Cotter etc. - Capturing rainwater within a rainwater tank. - Commercial businesses use rainwater. - Roof to garden. - Potable water goes in and then money goes out. Water out - Wastewater from bath and shower goes to a separate system that provides greywater to water the garden. - Stormwater – gutter – settling ponds – Queanbeyan River. - Sewage goes to the treatment plant. - Sewer – STP – Murrumbidgee. - Use rainwater to brush teeth. - Goes into grease trap, septic tank, water table and river. - Toilets have a separate system for wastewater. This is supposed to be inspected by Council but they haven't visited. • Evaporation.
How do you use drinking water now? Using the poster provided, tell us: • What do you use water for? • What good experiences have you had? • Where have you seen improvements? Where are they? • Where would you like to see improvements? Why?	• How do you use drinking water now? - Washing. - Drinking. - Cooking. - Cooling/heating. - Construction. - Gardens. - Irrigation. - Wisely. - Put it with Whisky. - Brushing teeth. - Washing lettuce/vegetables. • What good experiences have you had? - Rainwater tastes great (no chlorine). - Good quality – we are very lucky. - Good catchments.

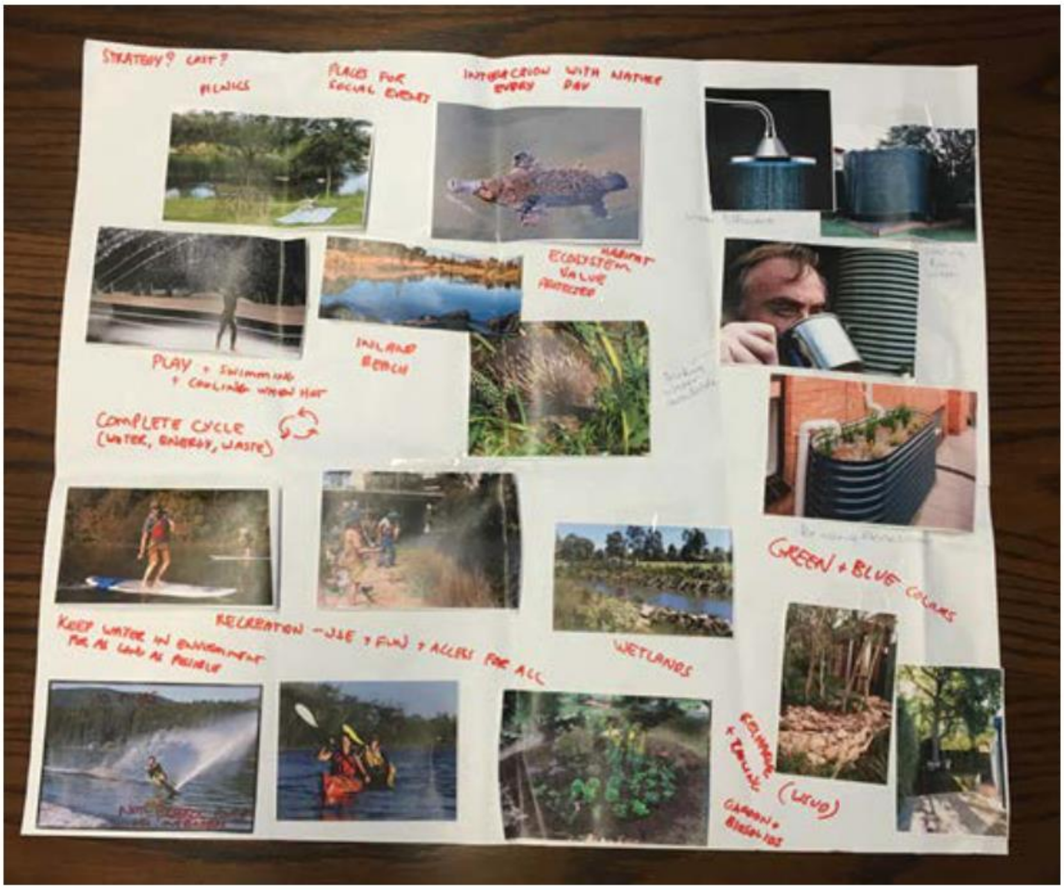
Activity	Response
	• Where have you seen improvements? Where are they? - Water conscious and lower demand. - No driveway washing. - Car wash recycling. - Water saving devices. • Where would you like to see improvements? Why? - Non-potable supplies. - Use stormwater better. - Don't use drinking water for watering garden / washing car. Can't understand why Googong Township isn't putting its water back into the dam.
How do you use wastewater and recycled fit?	• How do you use wastewater now? - Bucket bath water out to the garden. - Concerns about recycled water. Microfibres, hormones, medications and viruses. - Irrigation. - Environmental flows. • What good experiences have you had? - Use Grease trap residue to make compost. - Native gardens. - Use less water. - Fewer lawns. - Artificial grass. - Greywater reuse. • Where have you seen improvements? - Council helped put in flushing toilets replacing low flow shower heads. - More prepared to recycle. - Low chemical products (ecologically friendly). - Soaps and cleaners. - Solids reuse. - Advances in technology overtime. - Cultural change – changing the way that we think about water. • Where would to see improvements? - Water going back into river should be as good as or better than the water extracted. - Googong Township currently puts its recycled water into Googong Dam. - Recycled water in Googong Township should be used for washing clothes, dishes, cleaning the house. Not just for toilets and watering the garden. - Can't understand why Googong Township isn't putting its water back into the dam. - Investment and activity. By catchment area (not government boundaries).

Activity	Response
How do you use waterways now? Using the map and post-it notes provided, tell us: • Where and how are waterways used and enjoyed? • Where have you seen improvements? What are they? • Where would you like to see improvements? Why?	Refer to Figure 11.
What could it be like in 30 years? Working in the same group: • Write, draw or use pictures to tell us what you want the water cycle to support your community? • What do you want to feel, see, touch, hear, smell or perceive? • What would visitors experience?	- Strategy? Cost? - Picnics. - Places for social events. - Interaction with nature every day. - Playing, swimming and cooling when hot. - Complete cycle (water, energy, waste). - Inland beach. - No petrol powered outboards. - No pine trees. - Wetlands. - Recreation use – fun for all. - Recharge and cooling. - Garden and bio solids. - Drinking water available. - Habitat ecosystem value protected. - Water efficient. - Inland beach. - Places for social events. - Habitat, ecosystem, value protected. - Recycling stormwater. - Green and blue colours. - Queanbeyan well integrated with a sustainable region. - Make every creek, dam and river safe to swim. - Queanbeyan has implemented best practice in stormwater, river management, and the integrated management of bush and natural areas. - Sustainable development! - Get rid of carp, bring back the trout! - This is a better CBD park. Then the 4.1 billion. - Bring back the fish. - Platypus. - Every household has its own vegie patch. - People powered pleasure. - Potable water for drinking only. - Ngunnawal land is adjacent to Queanbeyan River. - Recycled water for other uses. - Bring back the fish. - Keep vegetables local. - Grow food not flowers. - Save and recycle water. - Everyone thinks that water is as precious as gold. - Are we still going to be rural residential in 30 years' time? - What is the long term plan?

Activity	Response
	- Will people still be charged water rates if the water is taken from the river? Refer to **Figure** 12 for photo of Stakeholder Workshop 2 thoughts on what it could be in 30 years.
What do you think are the barriers from your vision being achieved? • Work in pairs and share your discussion with the wider group.	Refer to **Figure 13** for Word Cloud of Stakeholder Workshop 2 thoughts on what it could be in 30 years.

Figure 11 Stakeholder Workshop 2 Waterway Usage Map

Figure 12 Stakeholder Workshop 2 – What it could be like in 30 years



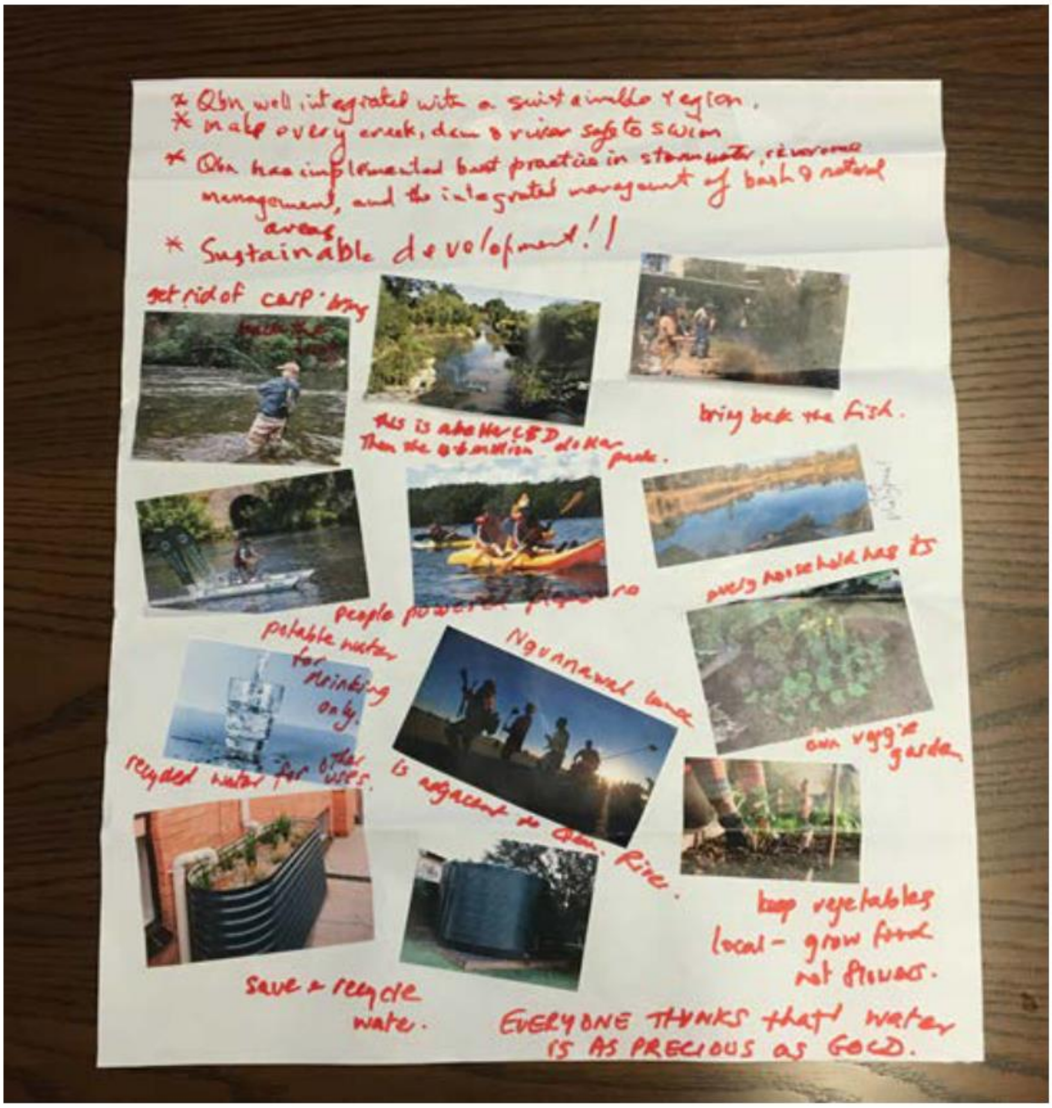

* Qbn well integrated with a sustainable region.
* make every creek, dam & river safe to swim
* Qbn has implemented best practice in stormwater, and the integrated management of bush & natural areas
* Sustainable development!!
get rid of carp
bring back the fish.
people powered
potable water for drinking only.
Ngunnawal land
own veggie garden
recycled water for other uses.
is adjacent to Qbn. River.
keep vegetables local - grow food not flowers.
save & recycle water.
EVERYONE THINKS that water IS AS PRECIOUS as GOLD.

Figure 13 Stakeholder Workshop 2 - Barriers preventing their vision being achieved

QUEANBEYAN-PALERANG REGIONAL COUNCIL

Council Meeting Attachment

18 JANUARY 2023

ITEM 9.2 QUEANBEYAN INTEGRATED WATER CYCLE MANAGEMENT (IWCM) REPORT

ATTACHMENT 2 IWCM ISSUES PAPER SUPPLEMENT

Queanbeyan IWCM Issues Paper – Supplementary Report

Introduction

This supplementary report provides supplementary information and explanations on the Queanbeyan Integrated Water Cycle Management (IWCM) Issues Paper. The aim is to:

> Update demand projections (resulting from planning considerations with the Queanbeyan Sewerage Treatment Plant (STP)) and consequent planning issues presented in the IWCM Issues Paper, thereby providing a more current understanding of planning issues for the Queanbeyan water supply and sewerage service area.

The supplementary report does not replace the IWCM Issues Paper.

Plans and Maps provided in the IWCM Issues Paper have not been included in this prologue. When reading through this supplementary report, please refer to the IWCM Issues Paper for details of information presented.

In addition, this supplementary report only covers matters that need to be revised in relation to the water and sewerage systems. QPRC did not find any new information or reason to revise the findings presented in the IWCM Issues Paper on stormwater or ground water systems.

IWCM Issues Paper Findings

In 2017, QPRC commissioned Aecom Pty Ltd to produce an Integrated Water Cycle Management (IWCM) Issues Paper to the requirements of the Department of Planning, Industry and Environment's (DPIE), Best Practice Management of Water and Sewerage Framework.

The IWCM Issues Paper was constrained to only cover the Queanbeyan Water Supply and Sewerage service areas[1] and as such, areas in the former Palerang LGA and the new Googong Township area are excluded from the analysis. The IWCM Issues Paper was presented to DPIE and relevant stakeholders in December 2019. The key findings of the IWCM Issues Paper were as follows:

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1 The QPRC Local Government area is an amalgamation of the Palerang and Quenbeyan LGAs. A separate IWCM report was prepared by the former Palerang Council to cover services in the old Palerang LGA. Googong Township is currently covered by other planning instruments.

IWCM Issues Paper Growth Forecast

		2016	**2021**	**2026**	**2031**	**2036**
Population		41,952	42,584	43,874	46,690	46,931
Water Demand	ADD (ML/D)	11.0	11.9	11.5	12.4	12.6
	PDD (ML/D)	24.1	26.1	27.2	29.2	30.4
Sewage Flow	ADWF (ML/D)	9.4	12.7	13.4	14.3	15.1
	PDWF (L/s)	195	262	275	294	309
	PWWF (L/s)	1,031	1,385	1,456	1,557	1,636

Subsequent to the December 2019 presentation, the growth forecast was updated to reflect additional planning work undertaken in relation to concept development for the Queanbeyan STP Upgrade Project.

Need for Review

Additional planning work was undertaken for the Queanbeyan STP project, including a full review of population growth projects and water and sewerage demands. This provided variations to water and sewage service demands from those presented in the IWCM Issues Paper. QPRC reviewed the revised demands and accepted these as the basis for identifying potential service issues over the IWCM planning horizon that will need to be addressed.

Revised Future Demands

Hunter H20 undertook additional analysis of development, population growth, and demands for water and sewerage services over a 20-year period (2018 to 2038). This analysis took into account more recent projections for development in the South Jerrabomberra and Jumping Creek areas.

		2019	**2025**	**2039**
Population		52,300	57,696	76,832
Water Demand[2]				
Average Day Demand	ML/D	12.18	13.44	17.90
Peak Day Demand	ML/D	28.01	30.91	41.17
Sewerage[3]				
Average Dry Weather Flow	L/s	139	154	205
Peak Wet Weather Flow	L/s	779	859	1,549

Issue: Peak daily demand for water will exceed Icon Water's maximum supply limit by 2025.

Issue: Queanbeyan STP hydraulic capacity will be exceeded by 2025.

2 Based on AECOM analysis of actual consumption data of 233 Lpcd, section 6.2, and ratios of 2.3 and 1.4 for peak day and peak week, section 6.4.

3 Based on Hunter H20 analysis, Hydraulic Assessment of Jerrabomberra and Morisset Truck Mains of peaking factors od 5.5 for Jerrabomberra and 7.0 for Morisset. Design loading of 230 Lpcd has been used for ADWF.

Levels of Service

QPRC undertakes annual reporting of water and sewerage services to Department of Primary Industries and Energy (DPIE) as part of the Annual Return process.

A review of data published by DPIE indicates that the Queanbeyan water and sewerage systems perform comparably with other local water utilities (LWUs) against service benchmarks, with QPRC generally positioned around mid-range for all reported data and benchmarks.

QPRC[4] developed a set of community based Level of Service indicators (KPIs) and provided these in its Water and Sewerage Asset Management Plans (AMPs)[5]. The Level of Service (LoS) indicators were identified but have not been tested or evaluated and its outcomes have not been reported to the community. At the time Council developed the LoS indicators and AMPs, Council did not consult the community about their views regarding acceptable criteria (LoS) for water and sewerage services.

Issue: The Community based Level of Service requirements needs to be revised and documented in future Asset Management plans (strategic, tactical, and operational).

Water Supply Capacity and Performance

Water Security

Potable water for Queanbeyan is sourced under a bulk agreement with Icon Water Ltd. Icon Water confirmed[6] it has assessed long term security of supply and determined there will be no issues meeting supply demands within the IWCM planning horizon. Icon Water predicted additional augmentation will not be required until at least 2059.

Icon Water security modelling includes an allowance for future Queanbeyan and Googong growth as well as an allowance for growth in other surrounding NSW townships (in the Queanbeyan LGA) if required and deemed feasible.

Due to development planned for the South Jerrabomberra area, an additional bulk water supply offtake may be required, subject to finalising water supply requirements and discussions with Icon Water.

Issue: Peak daily demands for new growth areas and potential additional offtake requirements and agreements needs to be reviewed.

Issue: Additional bulk water offtake (and agreement) for the South Jerrabomberra development area needs to be investigated.

Water Quality

Bulk water supplied by Icon Water must meet the Australian Drinking Water Guidelines as specified in its bulk water agreement with QPRC. However, the quality of water supplied varies depending on which water source is used to supply Queanbeyan (Stromlo WTP or Googong WTP), and Icon

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4 QPRC was formed by the amalgamation of the former Quenbeyan and Palerang councils circa May 2015. The level of service indicators and asset management plans referred to, were prepared by the former Queanbeyan council.

5 The Water Asset Management Plan and Sewer Asset Management Plan for the former Queanbeyan LGA were endorsed by the former Queanbeyan council in 2015

6 Private correspondence with QPRC

Water are not obliged to provide a higher standard of water than specified in its agreement with QPRC.

Although water supplied by Icon Water meets [spell out acronym] (ADWG) standards, it does not necessarily comply with QPRC adopted standards for pH and chlorine. Consequently, pH and residual chlorine values in the reticulation system can conflict with QPRC accepted standards.

Issue: Water quality standards for chlorine and pH can be exceeded.

Issue: Bulk water agreement and water quality requirements needs to be reviewed.

Non-Revenue Water

The QPRC water supply network has 18%[7] non-revenue water, on average. This is higher than the benchmark guide of <10% and was highlighted in the IWCM Issues Paper.

Non-revenue water is attributed to mismatched meter reading data, un-metered connections to QPRC parks, gardens and sports fields, as well as leaking reticulation pipework.

As QPRC purchase all water under a bulk water agreement, any water loss results in a direct revenue loss. If non-revenue water loss could be reduce to ≤10%, the resulting water savings would be approximately 500 – 700 ML/annum.

Issue: Additional investigations to identify and reduce non-revenue water are required.

Reservoirs

Base modelling undertaken by Aecom was not reassessed in line with the revised demand projections. QPRC assumed that projected flows can be prorated to provide an indication of reservoir capacity suitability.

QPRC does not expect demands to exceed reservoir capacity (based on current modelling of the network) within the planning period. However, this should be verified through additional modelling, taking better account of the revised growth projections.

Security of supply issues were not discussed in the IWCM Issues Paper. Following further discussions with QPRC's Service Manager – Utilities, an emerging issue may present itself at both Jerrabomberra Reservoir (offtake 1) and East Queanbeyan Reservoir (offtake 2). These are critical assets within the water system and cannot be placed off-line for an extended period of time to allow major repairs and/or refurbishment to be undertaken. There is no capacity or capability to cross supply utilising alternative offtakes.

In addition, reservoirs are located within bushfire prone land, increasing the level of risk to supply security.

Issue: Additional modelling to determine reservoir limitations and options for improving security of supply is required.

Issue: Supply continuity during major repairs/refurbishment of Jerrabomberra and East Queanbeyan Reservoirs to be assessed.

Issue: There needs to be better management of bushfire prone lands.

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[7] IWCM Issues Paper section 6.3

Water Pumping Stations

Base modelling undertaken by AECOM was not reassessed in line with the revised demand projections. QPRC assumed that projected flows can be prorated to provide an indication of pump station capacity suitability.

Based on current modelling, QPRC does not expect that pump station capacity will be exceeded within the planning period. Generally, the pumps operate less than four hours per day and have capacity to operate longer to transfer additional volumes to reservoirs within the system.

All pump stations are provided with duty/standby pump arrangements. Therefore, prolonged pumping failure is not expected to be critical to supply conditions within the water reticulation network. However, this should be verified through additional modelling, taking better account of the revised growth projections.

In addition, pumping stations are located within bushfire prone land, increasing the level of risk to supply security.

Issue: Additional modelling is required to determine pumping station limitations, optimal pumping regimes and options for improving security of supply.

Issue: Better management of bushfire prone lands is required.

Distribution Network

QPRC has an existing WaterGems network model for the Queanbeyan Water supply system, which was developed circa 2002. Although QPRC has updated the model from time, it has not been calibrated to confirm its suitability or reliability. At this time, QPRC is unable to confirm zone boundaries due to the loss of corporate knowledge and incomplete GIS / asset information about the pipe network.

Without a current and calibrated model, it is difficult to determine the capacity and performance of the network and so determine upgrades to meet increasing development demands. This could be a significant risk in ensuring adequate flows and pressures for firefighting requirements within high density developments, particularly within the Queanbeyan business district.

QPRC has assessed the condition of the water supply network as being grade 2, based on the general age of the infrastructure. QPRC only uses asset age to assess condition as there is insufficient information to correlate asset condition to pipe bursts and other factors. Replacement / refurbishment of water mains is undertaken based on operator experience and does not take into account the age or material of water mains.

Issue: Water model is not up to date and not calibrated.

Issue: Water main asset condition assessments needs to be improved.

Sewerage Scheme Capacity and Performance

Queanbeyan STP

The STP is being replaced in order to address a combination of age, capacity and work health and safety concerns.

Planning and design for the replacement of the STP is proceeding in parallel with the preparation of the Queanbeyan IWCM. The issues identified in the IWCM Issues Paper and this document will not impact delivery of the STP Upgrade Project, which is scheduled for completion by 2025. The new STP is designed to have sufficient capacity for demands over the IWCM planning period.

QPRC will need to operate and maintain the existing STP to meet ACT EPA discharge licencing requirements until the plant is replaced.

Issue: Existing STP needs to be operated and maintained to continue to meet discharge licence conditions until the new STP is commissioned.

Sewage Pumping Stations

Morisset Sewage Pumping Station (SPS)

Morisset Sewage Pumping Station (SPS) is the major pump station in the Queanbeyan sewerage network and a critical asset within the sewerage system. Indications are that the capacity of the Morisset SPS will be exceeded within the IWCM planning period. As part of the Queanbeyan STP Upgrade Project, options are being developed to ensure this SPS will deliver uninterrupted sewage flows to the Queanbeyan STP from the Central and Western parts of Queanbeyan.

QPRC will need to optimise future design options for the Morisset SPS to ensure the pump station can meet future demands.

Issue: Design options and timing of potential upgrades for Morisset SPS needs to be reviewed as part of the Queanbeyan STP Upgrade Project.

Other Sewage Pumping Stations

The criticality of all other sewage pumping stations within the Queanbeyan Sewerage Network is lower than for the Morisset SPS, and have been fitted with duty/standby pumps. Several of the pumping stations have been identified as having limited or no emergency storage capacity and may not have adequate hydraulic capability to handle peak wet weather flows over the planning period. QPRC considers most of the pumping stations will require augmentation and/or upgrading within the planning period to provide:

- Improved wet weather storage to meet minimum four hours Average Dry Weather Flow (ADWF) requirements;
- Additional pump capacity to meet increased demands;
- Rising main replacement / augmentation to ensure flow velocities are within acceptable limits;
- Updated electrical panels and controls to comply with current safety requirements.

Anecdotal evidence (provided by operational staff) together with analysis undertaken by AECOM (for the IWCM Issues Paper) indicates receiving sewer capacity is adequate to meet some increased pumped flows without causing additional overflows. This assertion needs additional modelling to verify capacity constraints in the sewer network.

Issue: Lack of detailed knowledge of capacity constraints may lead to additional augmentation work required to meet acceptable service standards.

Sewer Network

QPRC is undertaking a review of the Morisset and Jerrabomberra Trunk Sewers as part of the Queanbeyan STP Upgrade Project. Initial investigations indicate that surcharging currently occurs within these trunk mains and will become more pronounced as peak wet weather flow events increase over the planning period.

QPRC has an XPS (spell out) (SWMS) model for the Queanbeyan sewerage system, which was developed circa 2002. While this model has been updated from time to time to account for changes to the system, QPRC has not calibrated it to confirm its suitability / reliability.

QPRC has an existing WaterGems network model for the Queanbeyan Water Supply System, which was developed circa 2002. Although QPRC updated the model from time to time to account for changes to the system, QPRC has not calibrated the model to confirm its suitability / reliability. At this time, QPRC is unable to confirm the completeness or accuracy of the model due to the loss of corporate knowledge and incomplete GIS / asset information about the sewer network.

Without a current and calibrated model it is difficult to determine the capacity and performance of the network and so determine upgrades to meet increasing development demands. This could be a significant risk for high density developments, particularly within the Queanbeyan business district, in ensuring adequate sewer capacity to avoid overflows during wet weather events.

A large proportion of the sewer network has been examined using CCTV. As a result of the CCTV inspections, a significant number of sewers, feeding Morisset SPS, have been fully or partially relined. This is reflected in revised asset conditions within the asset register. Additional data is required to correlate condition to factors causing blockages, surcharge, and overflows[8]. This will improve the ability of QPRC to identify the need for sewer upgrades or rehabilitation as well as assess the potential overflow risk in the sewer network.

Issue: Sewer model is not up to date and not calibrated,

Issue: Sewer network asset condition assessments needs to be improved.

Next Stage – Developing Options to Address Issues

This supplementary report concludes the first phase of preparing the Queanbeyan IWCM strategy and plan.

The next stage for the IWCM strategy and plan will be to identify options to resolve the issues identified in the IWCM Issues Paper (including this supplementary report). This work, together with maintenance and renewal information in the water and sewerage asset management plans, will help QPRC prepare:

- An asset information improvement plan (GIS / attribute data, network models, condition assessment protocols, etc.);
- An operation and maintenance improvement plan;
- A long term capital works plan and program;
- A Water and Sewerage Business Plan;
- A forecast of water and sewerage charges needed to sustain services.

Options to resolve the issues identified in the IWCM Issues Paper include specific matters such as:

- Augmentation / upgrading the Morisset SPS, Morisset Trunk Sewer and Jerrabomberra Trunk Sewer;
- Augmentation / upgrading other sewage pumping stations in the Queanbeyan network;

[8] The data needs to cover a range of factors affecting the operating condition of sewers such as material, age, trench material, tree root intrusion, broken pipes, broken / dislocated joints, poor grade alignment, poor service junctions, etc.

- Improving sewer capacity, particularly in the Queanbeyan business district, to alleviate potential sewer surcharging / overflows caused by ongoing development;
- Improving continuity of supply during major maintenance of the Jerrabomberra and East Queanbeyan Reservoirs;
- Improving water supply conditions, particularly in the Queanbeyan business district, to ensure adequate flows and pressures for firefighting caused by ongoing development;
- Improving water quality conditions to ensure pH and Chlorine residual values are adequate throughout the network regardless of Icon Water source.

A Water and Sewerage Options Report on the above issues is expected to be undertaken and finalised during the 20/21 financial year.

QUEANBEYAN-PALERANG REGIONAL COUNCIL

Council Meeting Attachment

18 JANUARY 2023

ITEM 9.2 QUEANBEYAN INTEGRATED WATER CYCLE MANAGEMENT (IWCM) REPORT

ATTACHMENT 3 IWCM FINANCIAL ANALYSIS

GHD

Integrated Water Cycle Management

Strategy and Financial Plan

Queanbeyan-Palerang Regional Council

27 October 2022

→ **The Power of Commitment**

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S4	3	W van Lint	C West		G Pincombe		16/10/22
S4	4	C West	G Pincombe	On file	G Pincombe	On file	25/10/22

→ The Power of Commitment

Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.2 and the assumptions and qualifications contained throughout the Report.

Queanbeyan Palerang Regional Council (Council) has stewardship for provision of water and wastewater services for Queanbeyan Local Government Area. The NSW Integrated Water Cycle Management (IWCM) strategic planning instrument provides a framework for Council to determine long-term strategic planning for water management.

Council has recently undertaken the required analysis and prepared the IWCM Issues Paper (AECOM, 2019 and 2020). Council has also undertaken a strategic review of its water and wastewater services. These reviews considered the current and future water and wastewater infrastructure to identify feasible scenarios for the IWCM strategic plan. The issues identified covered general, water supply, sewerage, and stormwater system issues.

Following the development of this Issues Paper, Council engaged GHD to undertake a review of the water supply system and Hunter H_2O to prepare a review of the sewerage system.

The issues relating to sewerage services, as outlined in QPRC's supplementary report (AECOM, 2020), are:

1. Queanbeyan sewage treatment plant (STP) hydraulic capacity will be exceeded by 2025
2. The Community based Level of Service requirements needs to be revised and documented in future Asset Management Plans (strategic, tactical and operational)
3. Existing STP needs to be operated and maintained to continue to meet discharge license conditions until the new STP is commissioned
4. Design options and timing of potential upgrades for Morisset SPS needs to be reviewed as part of the Queanbeyan STP Upgrade Project
5. Lack of detailed knowledge of capacity constraints may lead to additional augmentation work required to meet acceptable service standards
6. Sewer model is not up to date and not calibrated
7. Sewer network asset condition assessments needs to be improved

Items 1 and 3 are being addressed as part of the STP Upgrade project and a summary of the master planning, options assessment and concept design have been drawn from Hunter H_2O (2021). Items 2 and 7 are being addressed by Council in parallel with the IWCM strategy development. Discussions regarding Items 4, 5 and 6 in Hunter H_2O (2021) are reproduced in this document.

Following the analysis undertaken for the water system, by GHD, the critical upgrade option to be considered for the current network is a duplication of the Jerrabomberra Reservoir. It was also recommended that further work to improve the model be undertaken including development and calibration of an operational model. It was also noted that there would be benefit in undertaking further investigation into the current system to confirm the chlorine levels and provide additional chlorine dosing if areas are found to be deficient.

It was determined through this process that there is only one feasible scenario for each of water and sewerage.

The preferred scenario for water supply is continued supply of bulk treated water from Icon Water. The preferred scenario for wastewater is the upgrade of the Queanbeyan STP.

Based on the above scenarios, analysis of financial modelling was undertaken. This modelling utilised financial information provided by Council, including water and sewer fund status, review of assets remaining life, cost estimates for proposed works, including the STP upgrade and operational costs.

Financial analysis was undertaken to assess the impact of the proposed capital expenditure programs on the financial position of the Council over a twenty-year period. The analysis considered the forecasted cashflow and account balances under external funding (grant and loan) scenarios.

QPRC is facing a more significant capital expenditure program for sewer infrastructure, with a growth/ enhancement program of in excess $160m in the four years, whereas the water capital funding relates mainly to the $20m required for the duplication of the Jerrabomberra Reservoir.

Table 1 Recommended Water funding scenario

Water Scenarios	Water Scenario1		
	No Grant, No Loans		
Sect 64 Balance	$10,000,000		
Fund Balance	$11,600,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate Increase - Initial 4 years	2.50%		
Rate increases - balance of the 20 years	2.50%		
CPI - Water	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	0.00%		
Grant Funding - Net Percentage	0.00%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	26,851,093
2022/23	0	0	32,325,725
2023/24	0	0	30,259,360
2024/25	0	0	31,003,677
2025/26	0	0	36,318,780
2026/27	0	0	6,580,176
2027/28	0	0	12,221,324
2028/29	0	0	18,735,533
2029/30	0	0	24,965,308
2030/31	0	0	31,924,641
2031/32	0	0	40,728,536
2032/33	0	0	50,036,903
2033/34	0	0	58,315,081
2034/35	0	0	68,685,694
2035/36	0	0	79,398,152
2036/37	0	0	90,927,984
2037/38	0	0	102,263,138
2038/39	0	0	110,852,023
2039/40	0	0	124,256,394
2040/41	0	0	137,665,480
	$0	$0	

The table above shows the preferred scenario and is based on:

- ✓ No grant funding sought
- ✓ No additional loans sought
- ✓ Annual rate increases aligned to consumer price index (2.5%)

Table 2 Recommended Sewer funding scenario

Sewer Scenarios	**Recommended Scenario**		
	25% Grant request,		$40m Loans
Opening Balance - Section 64	$7,000,000		
Opening Balance - Sewer Fund	$58,000,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate increases	6yrs/0 yrs/14 years		
Rate Increase - Initial period	6.50%		
Rate Increase - second period			
Rate increases - balance of 20 years	2.50%		
CPI - Sewer	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	0.00%		
Grant Funding - Net Percentage	16.72%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	59,604,903
2022/23	2,700,000	0	70,493,332
2023/24	17,648,432	20,000,000	44,233,581
2024/25	18,543,306	20,000,000	13,879,918
2025/26	0	0	11,502,257
2026/27	0	0	17,206,724
2027/28	0	0	8,949,438
2028/29	0	0	18,032,995
2029/30	0	0	27,566,075
2030/31	0	0	15,562,936
2031/32	0	0	11,402,223
2032/33	0	0	6,191,701
2033/34	0	0	10,440,744
2034/35	0	0	23,269,450
2035/36	0	0	36,733,177
2036/37	0	0	51,827,066
2037/38	0	0	61,502,430
2038/39	0	0	77,556,785
2039/40	0	0	94,338,828
2040/41	0	0	113,318,603
	$38,891,738	$40,000,000	

The table above shows the preferred sewer funding scenario, based on the following:

- ✓ 25% grant funding sought QSTP upgrades in 2023/24 and 2024/25 in addition to the $2.7m already granted for 2022/23
- ✓ Loan funding of $40m over the two year period 2023/24 and 2024/25
- ✓ Rate increases budget for across two stages;
  - Initial increase of 6.5% for six years.
  - Balance (14 years) annual rate increase aligned to consumer price index (2.5%)

Based on the existing data, the 'typical' residential bill is expected to increase by 2.98% per annum, increasing the 'typical residential bill' to $3,587 by 2040/41 compared to the current 'typical' bill of $2,054. Table 3 sets out the annual profile of the 'typical' residential bill.

Table 3 Summary of water and sewerage charges for selective financial years

	Sewer		Water		
	Rate Increase	Charge	Rate Increase	Water Bill	Typical Residential Bill
		$733.00		**$1,321.89**	$2,054.89
2022/23	6.5%	$780.65	2.5%	$1,354.93	$2,135.58
2023/24	6.5%	$831.39	2.5%	$1,388.81	$2,220.19
2024/25	6.5%	$885.43	2.5%	$1,423.53	$2,308.96
2025/26	6.5%	$942.98	2.5%	$1,459.12	$2,402.10
2026/27	6.5%	$1,004.27	2.5%	$1,495.59	$2,499.87
2027/28	6.5%	$1,069.55	2.5%	$1,532.98	$2,602.54
2028/29	2.5%	$1,096.29	2.5%	$1,571.31	$2,667.60
2029/30	2.5%	$1,123.70	2.5%	$1,610.59	$2,734.29
2030/31	2.5%	$1,151.79	2.5%	$1,650.86	$2,802.65
2031/32	2.5%	$1,180.58	2.5%	$1,692.13	$2,872.71
2032/33	2.5%	$1,210.10	2.5%	$1,734.43	$2,944.53
2033/34	2.5%	$1,240.35	2.5%	$1,777.79	$3,018.14
2034/35	2.5%	$1,271.36	2.5%	$1,822.24	$3,093.60
2035/36	2.5%	$1,303.14	2.5%	$1,867.79	$3,170.94
2036/37	2.5%	$1,335.72	2.5%	$1,914.49	$3,250.21
2037/38	2.5%	$1,369.12	2.5%	$1,962.35	$3,331.47
2038/39	2.5%	$1,403.34	2.5%	$2,011.41	$3,414.75
2039/40	2.5%	$1,438.43	2.5%	$2,061.69	$3,500.12
2040/41	2.5%	$1,474.39	2.5%	$2,113.24	$3,587.62
		3.75%		2.50%	2.98%

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1. Introduction

1.1 Purpose of this report

Queanbeyan-Palerang Regional Council (Council) have completed the first stage of the Integrated Water Cycle Management (IWCM) strategy for Queanbeyan: the IWCM Issues Paper (AECOM, 2019), including the Issues Paper Supplementary Report (AECOM, 2020). These documents have identified several issues for the water supply and sewerage network.

Council, together with their consultants, has also identified the available options for water and wastewater. This report brings the identified options together to present the recommended scenarios for the IWCM strategy and the water and wastewater typical residential bill (TRB) for those scenarios.

The outputs of this report will be used by Council to further develop the IWCM strategic implementation and planning into the future.

This report only addresses services in Queanbeyan and adjacent urban areas as an IWCM report has already been prepared and approved for Bungendore, Braidwood and Captains Flat.

1.2 Scope and limitations

This report has been prepared by GHD for Queanbeyan-Palerang Regional Council and may only be used and relied on by Queanbeyan-Palerang Regional Council for the purpose agreed between GHD and Queanbeyan-Palerang Regional Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Queanbeyan-Palerang Regional Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report based on information provided by Queanbeyan-Palerang Regional Council, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the financial assessment set out in section 7 of this report ("IWCM analysis") using information provided by Council or reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD and as agreed with Council.

The financial assessment has been prepared for the purpose of determining the water supply and wastewater typical residential bill (TRB) as required under the IWCM process and must not be used for any other purpose.

The financial assessment is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the financial assessment and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the typical residential bill can or will be the same or less than the financial analysis.

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

1.3 Assumptions

Separate sets of assumptions were made for the water (GHD, 2021) and wastewater (Hunter H_2O, 2021) reports. Additional assumptions relevant to the financial modelling of the systems have also been made for this report. These assumptions are summarised below.

1.3.1 Water

The assumptions made in GHD (2021) while undertaking the water system assessment included the following:

- The model provided by QPRC is suitable for use as the basis for this assessment
- Demands for 2050 growth scenario are correct
- The capital works for Googong will be sized, designed, and constructed by the developer to suit the development pattern. This is independent of the Queanbeyan water supply network.
- The infrastructure to supply the Tralee development has been design and constructed by the developer to suit the demands.

1.3.2 Wastewater

The Design Criteria and Assumptions Report was prepared by Hunter H2O in 2019 and summarised in Hunter H2O (2021). The report outlines the design criteria and assumptions that were used as the basis for the development of upgrade options and subsequent concept and reference designs. The design criteria and assumptions in the report were presented to QPRC at a Design Basis Workshop in June 2019 and were adopted as the basis for proceeding with the upgrade project. The noted assumptions include:

- The Queanbeyan STP adopted EP projections to 2038, and adopted flow and temperature assumptions
- The connection of a new regional pump station to the existing system via the Tralee SPS
- The inclusion of a developer funding new SPS servicing the Jumping Creek development area
- A review of historical inflows to STP data, which concluded that the catchment had moderate infiltration during wet weather

1.3.3 Financial modelling

Assumptions used in the financial modelling have been included in section 7.

2. Developing the IWCM Strategy

In accordance with the requirements of the NSW IWCM process, Council has considered the elements of the IWCM checklist as presented below.

2.1 Queanbeyan – description of existing systems

2.1.1 Water

Treated bulk water is supplied to Queanbeyan by Icon Water, which is the water service provider responsible for providing potable water supply to the ACT. Treated bulk water is transferred to Queanbeyan from Icon Water's Mt Stromlo Water Treatment Plant (located in the ACT) and Googong Water Treatment Plant (located in NSW) via two bulk supply 'offtakes' to end users in Queanbeyan. A service level agreement is in place to manage this supply.

2.1.2 Wastewater

The sewerage system in the study area is predominantly a gravity reticulation system, comprising over 282 km of pipelines and 15 pumping stations. The reticulated network services the majority of Queanbeyan and Jerrabomberra, except for some semi-rural outer suburbs (e.g., The Ridgeway) where decentralised septic systems are used. The reticulated sewerage network transfers sewerage to the Queanbeyan Sewage Treatment Plant (STP), located to the north of Queanbeyan, within the ACT, on the south bank of the Queanbeyan River. The Queanbeyan STP is operated by Council. The treatment plant discharges to Molonglo River in accordance with ACT Environment Protection Authority (EPA) licence conditions. Downstream of the STP the Molonglo River drains into Lake Burley-Griffin.

2.1.3 Stormwater

The stormwater system for Queanbeyan comprises a reticulated system that drains via gravity into the Queanbeyan River, which in turn flows into Lake Burley-Griffin. Stormwater from Jerrabomberra and future development areas to the south of the city drain into Jerrabomberra Creek, which feeds the Jerrabomberra Wetlands and Lake Burley-Griffin.

2.2 Issues identified

A final draft version of the IWCM Issues Paper for Queanbeyan was prepared by AECOM in late 2019 (AECOM, 2019). The issues identified in this Paper have been presented here.

2.2.1 Water

The AECOM (2019) IWCM Issues Paper identified that a review of the Queanbeyan bulk water system was required. The objectives of this review included the establishment of future capital work projects, the provision of scenario planning, and the provision of order of magnitude costs.

GHD (2021) drew on the issues identified in AECOM (2019) as a basis and considered other relevant planning studies and reports to identify and analyse upgrade options for the potable water supply services for Queanbeyan.

2.2.2 Wastewater

Following AECOM (2019), QPRC submitted a Supplementary Report to DPIE in May 2020 that summarised the most recent 30-year water demand and sewage loading projections and provided a brief description of the issues that QPRC will address as part of the IWCM Strategy. Hunter H_2O (2021) subsequently described the feasibility review of options and options assessment for the identified IWCM issues related to the Queanbeyan sewerage system.

The issues relating to sewerage services, as outlined in QPRC's supplementary report (AECOM, 2020), are:

1. Queanbeyan STP hydraulic capacity will be exceeded by 2025
2. The Community based Level of Service requirements needs to be revised and documented in future Asset Management Plans (strategic, tactical and operational)
3. Existing STP needs to be operated and maintained to continue to meet discharge license conditions until the new STP is commissioned
4. Design options and timing of potential upgrades for Morisset SPS needs to be reviewed as part of the Queanbeyan STP Upgrade Project
5. Lack of detailed knowledge of capacity constraints may lead to additional augmentation work required to meet acceptable service standards
6. Sewer model is not up to date and not calibrated
7. Sewer network asset condition assessments needs to be improved

Items 1 and 3 are being addressed as part of the STP Upgrade project and a summary of the master planning, options assessment and concept design have been drawn from Hunter H2O (2021). Items 2 and 7 are being addressed by Council in parallel with the IWCM strategy development and were excluded from Hunter H2O (2021). Discussions regarding Items 4, 5 and 6 in Hunter H2O (2021) are reproduced in this document.

2.2.3 Stormwater

The following items were identified as issues for the stormwater system.

1. There is up to 2 GL/year of extra stormwater discharge that could be captured (under average rainfall) as potable water offset when considering projected future water demand.
2. There is a large nutrient contribution from stormwater which could be managed to offset wastewater loads.

2.3 Assess strategic options

An evaluation of the options for the provision of water and wastewater to Queanbeyan and adjacent urban areas has been undertaken. The findings of these assessments are provided in this report from section 4 onwards.

2.4 Financial modelling

A financial assessment for the preferred scenario has been undertaken and this is presented at section 7.

3. Population, demands and growth

To prepare the IWCM strategy, consideration needs to be given to the population that the strategy will serve into the future and where infrastructure will be required to service this population. Below is an outline of the growth areas, populations and demands determined for this IWCM strategy.

3.1 Growth areas

Council has identified the location of future developments affecting water and wastewater services for Queanbeyan as shown in Figure 1 below.

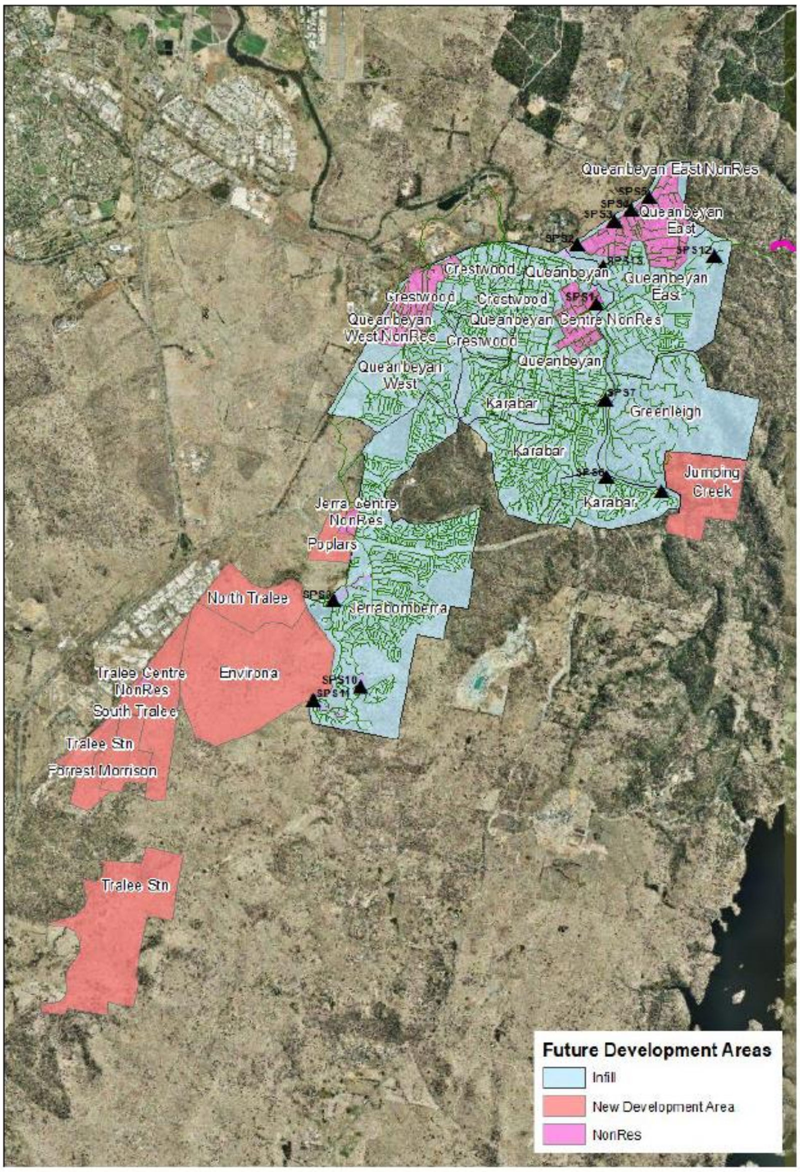


Figure 1 Future development areas

3.2 Population projections

The population projections that were included in the IWCM Issues Paper are presented in Figure 2. These projections didn't make allowance for the growth areas of South Jerrabomberra and Jumping Creek.

Table E1 Residential and Non-Residential Projections (Cumulative)

Queanbeyan IWCM	Forecast Year					
	2016	2021	2026	2031	2036	2050[2]
Residential Population	41,952	42,584	43,874	45,690	46,931	46,931
Residential Dwellings[1]	17,374	17,985	18,650	19,443	20,094	20,094
Non-residential (employment) Area, Ha	163	200	211	231	245	283
Non-residential (recreational) Area, Ha [3, 4]	UNK	3	13	26	26	26

Notes:

1. Dwellings assumed to represent low, medium and high density from private and non-private dwellings
2. There are no projections available for development areas beyond 2036 hence for the 2050 planning horizon there is no further growth assumed (as agreed with QPRC)
3. Existing (2016) recreational land area unknown (data not available)
4. Additional future recreational development (2021-2050) assumed to represent Public Open Space

Figure 2 Population projections (Queanbeyan IWCM Issues Paper, AECOM, 2019)

3.3 Demand projections

Investigations into demand projections have been included in previous documents. When preparing the water supply strategy, GHD was provided with the EP projections for future developments used by Hunter H_2O in their sewerage network analysis for consistency. For 2050, there is an EP of 77,521 which, when adopting a scaling factor of 0.88 (based on previous population to EP ratios), equates to a population of approximately 68,000 and a peak day demand (PDD) for water of 36.5 ML/d.

The stormwater discharge volumes are shown in Figure 3.

Table E4 Projected Stormwater Discharge (2050)

Future Land Use (2050)	2050 Area (Ha)	Stormwater (GL/yr)	Total Suspended Solids (Tonne/yr)	Total Phosphorus (Tonne/yr)	Total Nitrogen (Tonne/yr)
Industrial	207	1.1	89	0.2	1.2
Commercial	95	0.5	76	0.1	1.2
Residential	3,190	9.6	1,297	2.3	17.7
Parkland and Open Space	88	0.2	17	<0.1	0.3
Forest	2,460	<0.1	23	<0.1	1.1
Rural residential	13,461	8.5	742	1.3	14.0
Total Study Area	**19,500**	**19.8**	**2,245**	**4.0**	**35.4**

Notes:

1. No stormwater discharge is expected from the existing local quarry (55 Ha) therefore it is not featured in Table E4.

Figure 3 Projected stormwater discharge volumes (Queanbeyan IWCM Issues Paper, AECOM 2019)

4. Water supply scenarios

4.1 Existing water supply

4.1.1 Service level agreement

The current Queanbeyan bulk water supply is from Icon Water's network under a Service Level Agreement. Table 4 summarises the connections and supply from the Icon Water network, noting the following naming conventions:

- Offtake – a branch main off an Icon Water asset. It may have multiple supply points.
- Supply point – the meter on a line supplying a reservoir
- Limit of supply responsibility – a valve located on the Council side of the supply point that demarcates the limit of respective ownership for Council and Icon Water.

Table 4 Queanbeyan supply from Icon Water

Offtake	Supply Point	Description	Offtake Maximum Supply – Case 1	Offtake Maximum Supply – Case 2	Offtake Maximum Supply - Case 3
1	Jerrabomberra	Supply line to Jerrabomberra Reservoir	20 ML/d	27 ML/d	33 ML/d
	Tralee	Supply line to Tralee Low Level Reservoir			
2	East Queanbeyan	Supply line to East Queanbeyan Reservoir	7 ML/d	14 ML/d	17 ML/d
3	Googong Potable	Supply line to Googong Potable Water Reservoir	2.5 ML/d	2.5 ML/d	2.5 ML/d
	Googong Recycled	Supply line to Googong Recycled Water Storage Tank at WRP			
4	Kendall Avenue	Connection to facilitate emergency supply in the event of catastrophic incident on Googong Bulk Supply Main	To meet agreed emergency supply rates.		
Case 1 – Maximum off-peak daily demand where only Stromlo WTP is in operation. Off-peak is defined as the winter months Case 2 – Maximum peak daily demand. Both Googong and Stromlo WTP in operation Case 3 – Maximum daily demand where total Queanbeyan daily demand exceeds 41 ML/d and Icon have excess supply capacity					

An overview of the Queanbeyan network is shown in Figure 4. Note that the locations of the Offtakes are not shown accurately. A water system supply schematic is shown as Figure 5.

Whilst Googong is not covered in this document or the Queanbeyan IWCM it is worth noting that Googong currently exceeds the maximum demand of 2.5 ML/d. The reservoirs supplying Googong have a combined capacity of 5.9 ML, with a further 8 ML of storage planned to be added in the next two years.

Based on the current consumption data for Queanbeyan, and the forecast peak day demand of 36.5 ML/d in 2050, the demand is within the limits nominated in the current Service Level Agreement. It is however recommended that the Service Level Agreement be reviewed in line with the recommendations made in the Queanbeyan IWCM Issues Paper (AECOM, 2019).

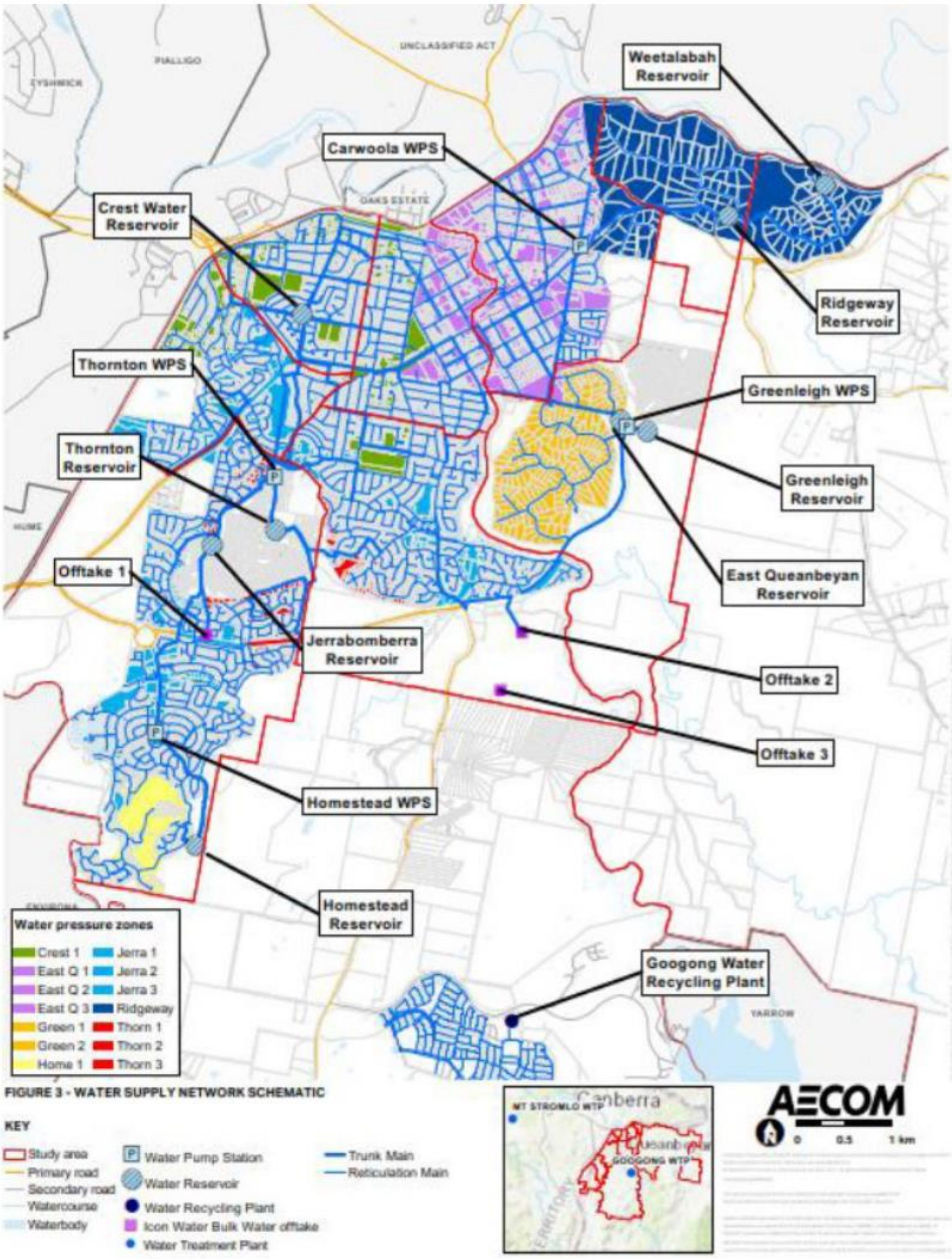


Figure 4 Water supply network layout (Queanbeyan IWCM Issues Paper, AECOM, 2019)

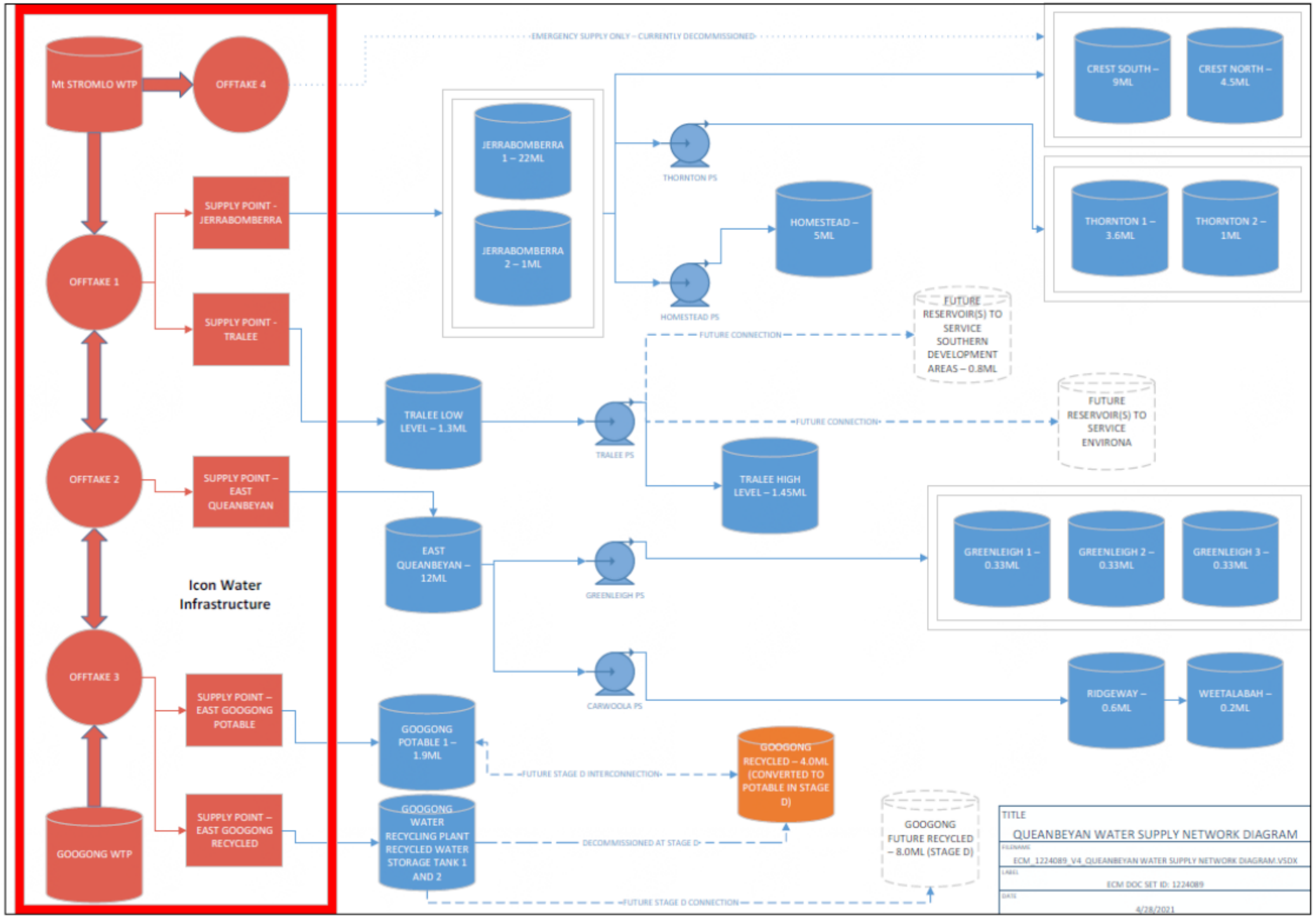


Figure 5 Water supply system schematic

There are currently no recycled water schemes or plans for one in Queanbeyan or Jerrabomberra.

QPRC also hold Water Access Licences (WAL) issued under the Water Management Act 2000 to extract either groundwater or water from Queanbeyan River for irrigation. Further details are included in the *Queanbeyan IWCM Issues Paper* (AECOM, 2019).

4.1.2 Water quality management

With reference to the ADWG, the safety of water in public health terms is determined by the microbial, physical, chemical and radiological quality of the water. Microbial quality is typically the most important issue. Effective disinfection of water using chlorine is the main treatment process used to achieve safe microbial quality in drinking water for Queanbeyan. In addition, maintaining chlorine residual in the water supply network and ultimately up to the customer taps is also recommended to minimize contamination risk.

The ADWG states "*When operating a distribution system, it is important to understand the difference between effective disinfection and maintaining a disinfectant residual. The water is effectively disinfected when the required C.t value has been achieved. After effective disinfection, enteric pathogens should not reappear within the distribution system, unless there is a failure in the integrity of the system. Therefore, unless there is a barrier breach within the distribution system the water should remain safe to drink even in the absence of adequate disinfectant residual. Barrier breaches could include such things as ingress, backflow, loss of pressure within the distribution system, or contamination within post-treatment storage tanks*".

From GHD corporate experience and with reference to the ADWG Chlorine fact sheet, the typical ranges for total and free chlorine in reticulation networks are as follows:

- Between 0.2 mg/L and 0.6 mg/L of total chlorine considering odour threshold
- Between 0.1 mg/L and 0.4 mg/L free chlorine

Given most of the time Queanbeyan is supplied with water from the Stromlo WTP, a significant distance away, there is a re-chlorination point owned by Icon Water and operated by Council to maintain a chlorine residual in the reticulation network. It is understood however that Council do not currently operate the re-chlorination system. There is only a dosing point at Offtake 2 and none at Offtake 1. It is understood that Council manually dose chlorine into the reservoirs.

Sampling is undertaken by Council within its network. The location of the sampling sites in Queanbeyan is shown in Figure 6. The light blue dots are current water sampling sites, and the dark blue ones are sampling sites no longer in use (GHD, 2021).

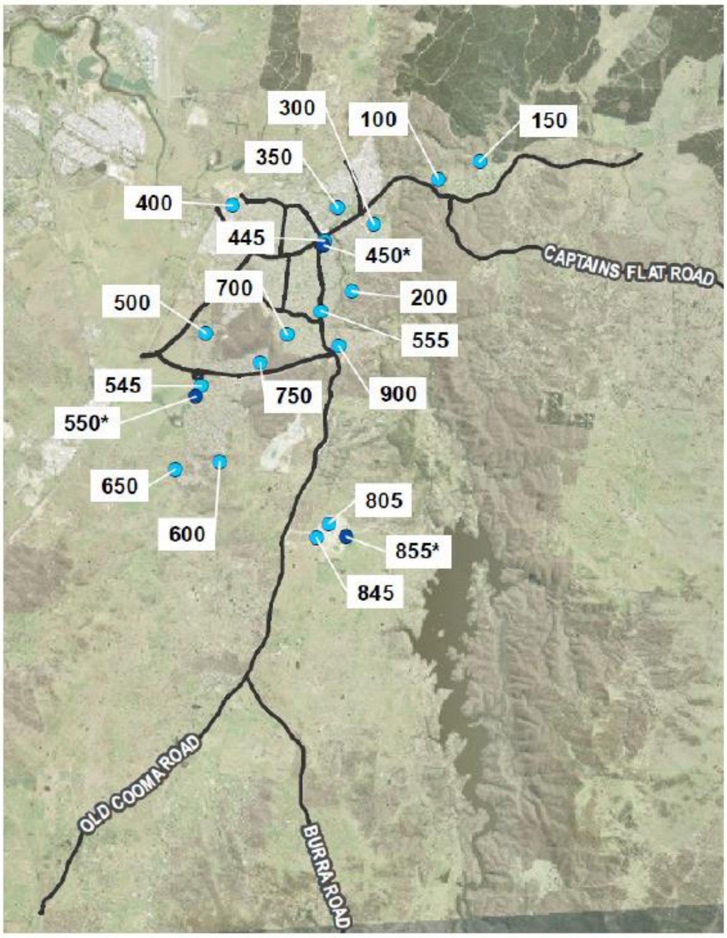


Figure 6 Chlorine residual sampling sites

4.1.3 Chlorine residuals

Figure 7 to Figure 10 show the sample values for free and total chlorine at the various sampling points in the reticulation network based on the data provided by Council. The typical range is shown as a light blue block on the charts. The data indicates that there is more chlorine in the water than would be typically expected which may result in customer taste and odour complaints.

Additional commentary from Council operations staff is that:

1. There are locations within the network where there is zero chlorine residual.
2. Within the network there are several dead ends and currently there are no regular operation plans that include flushing of these sections of the network.
3. Anecdotally there have been no customer complaints related to taste and odour.

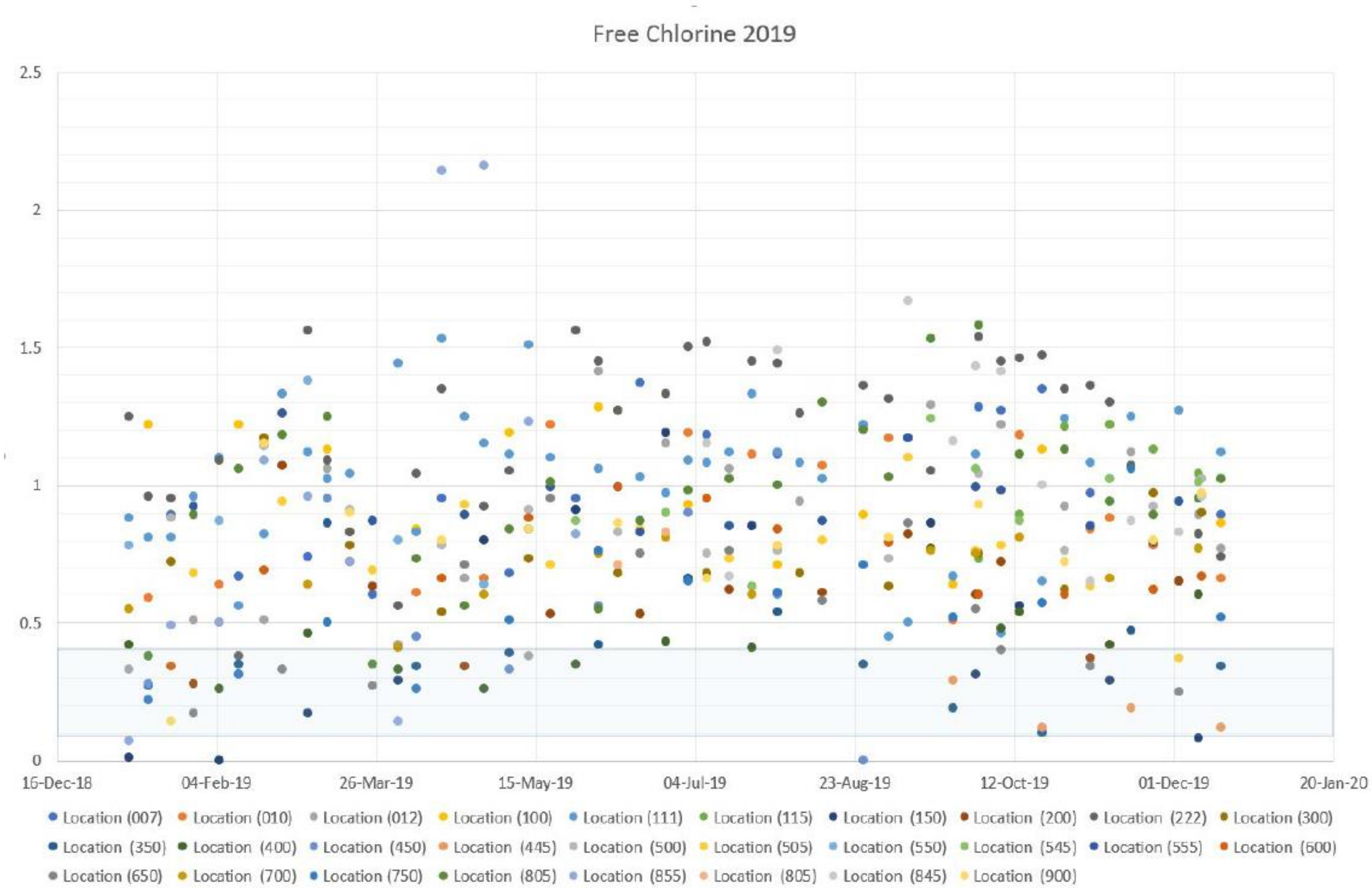


Figure 7 ***Free chlorine (mg/L) 2019***

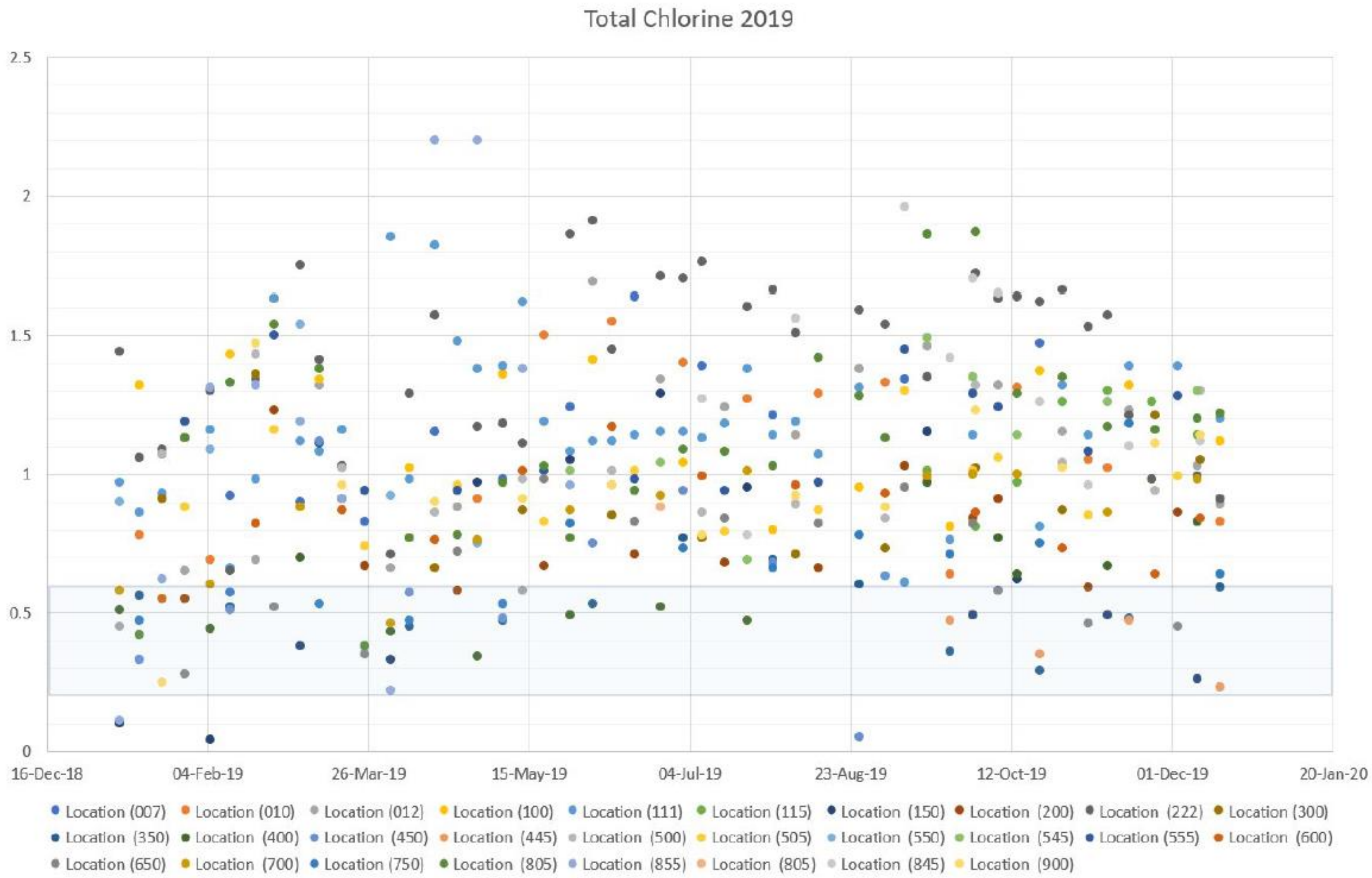


Figure 8 *Total chlorine (mg/L) 2019*

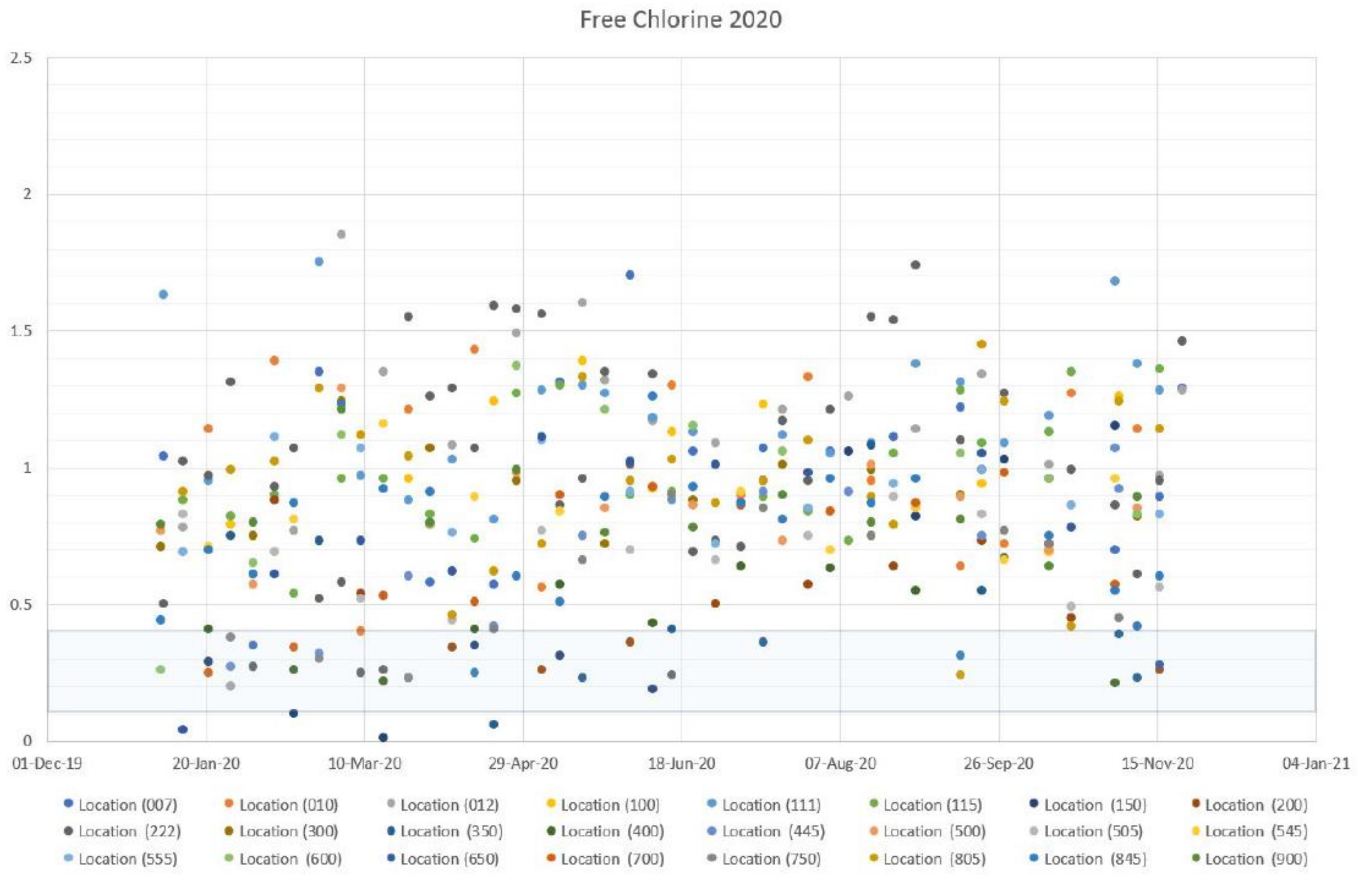


Figure 9 *Free chlorine (mg/L) 2020*

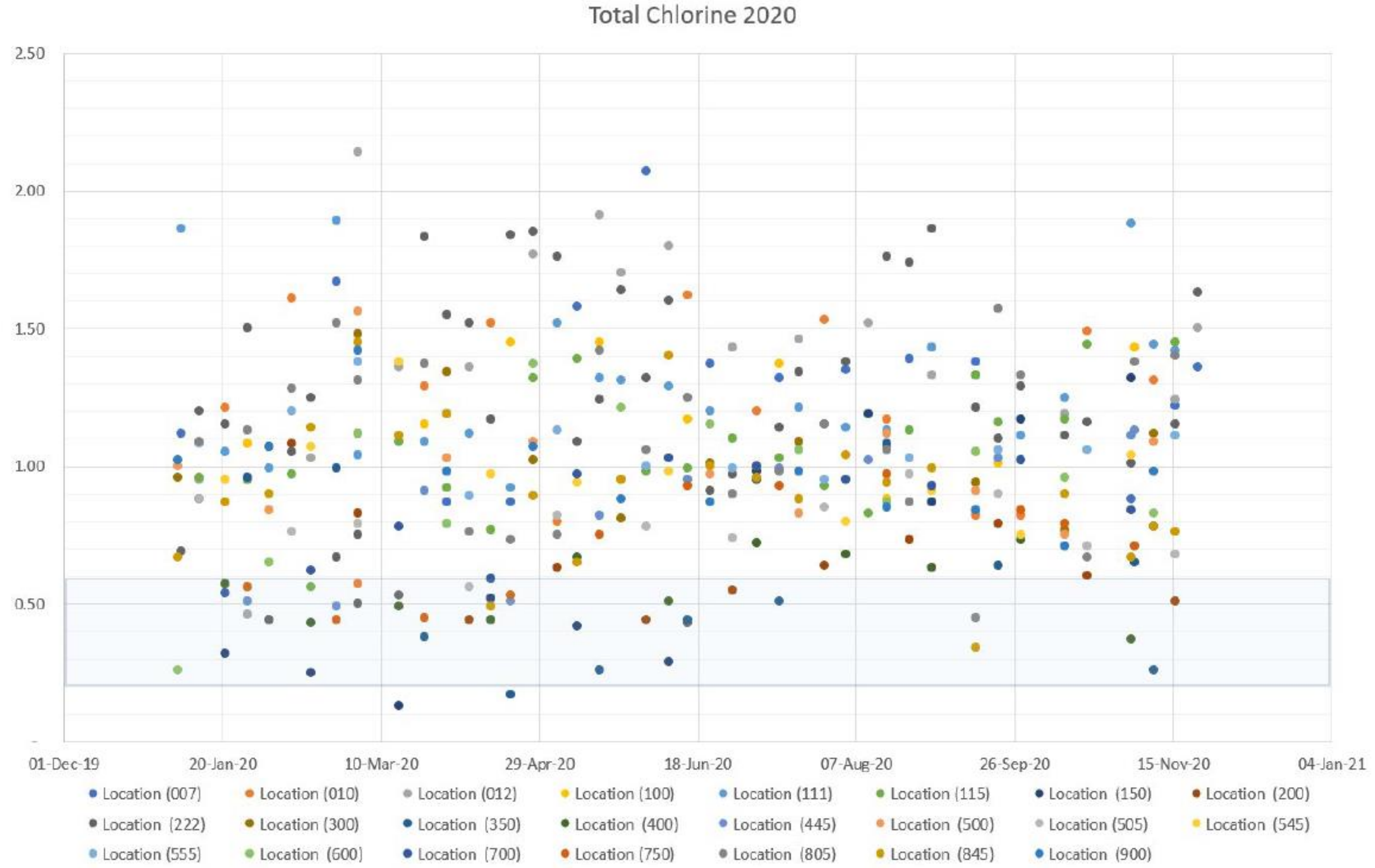


Figure 10 *Total chlorine (mg/L) 2020*

4.2 Demand analysis

4.2.1 Objectives

A demand analysis of the water system was performed through hydraulic modelling. The objectives of the hydraulic modelling included:

1. Assess the capacity of the trunk water supply network considering:
   a. Ability of reservoirs to meet demand conditions
   b. Ability of Icon Water offtakes to supply the service reservoirs
   c. Ability of supply network if any of the reservoirs are offline
2. Determine upgrade requirements.

4.2.2 Model scope

The water supply option developed by GHD (2021) included the following requirements about the modelling:

– A dynamic extended period simulation of the flows to be undertaken
– Network model to include pipes that distribute water to the service area and service reservoirs i.e. greater than DN250
– Model to include reservoirs, hydraulic structures, pump stations, rising mains connected to the water supply trunk system.

The modelling has been undertaken using Bentley's WaterCAD CONNECT Edition Update 3 (10.03.01.08).

Council provided a copy of the existing model that has been used as the basis for modelling undertaken. On review of the model and agreed with Council, the model was not skeletonised to include only the trunk infrastructure.

4.2.3 Modelling parameters

The modelling parameters adopted based on IWCM Issues Paper (AECOM, 2019) include:

– Annual average water demand 233 L/cap/day
– PDD = 2.3 ADD
– Ratio of the Peak Day to Average Day = 2.3
– Ratio of the Peak Day to Peak Week (7-day average) = 1.4

The following criteria are the conditions against which the hydraulic performance of the network was assessed:

– Reservoir capacity - Maintain a minimum of 2/3 PDD storage volume
– Pump stations - Pump Duty (extracted from middle value in pump curve) exceeds downstream PDD of the supply zone
– Trunk mains – Pipe velocity to be less than 2 m/s

4.2.4 Existing model

A high-level review was performed by GHD upon receipt of the existing model from Council. The condition and status of the model is summarised in the following sub sections.

4.2.4.1 Demands

The average daily demand and peak day demand of the existing model are shown in Table 5.

Table 5 Existing model demands

	Flow supplied (ML/d)	Flow demanded (ML/d)
Average daily demand	10.55	9.62
Peak day demand	24.26	22.12

4.2.4.2 Pipe details

After a review of the pipe data of the existing model, the following items were noted:

– There are 6,870 pipe elements in the model and 81 of which are inactive.
– Pipes were modelled using nominal diameter and not internal diameter.
– User-defined lengths were used in the model except for 39 pipes that have model-scaled lengths.
– Hazen Williams Roughness Coefficient (C) was used to account for the friction loss in pipes. It is noted that a constant C value was adopted for each pipe material, thus the age of the pipes was not considered. Table 6 shows the C values used in the model for different pipe materials.

Table 6 Hazen Williams coefficient, C

Pipe Material	Number of Pipes in the Model	Hazen Williams Coefficient (C)
Asbestos Cement (AC)	3,044	130 (1 pipe with C=90)
Cast Iron Cement Lined (CICL)	625	130
Ductile Iron (DI)	36	130, (2 pipes with C=90 and 1 pipe with C=120)
Ductile Iron Cement Lined (DICL)	2,963	120
PVCU	45	130
Steel	1	90
Unknown Pipe Material	156	90

4.2.4.3 Reservoirs

The existing model has two major offtakes, 1 and 2, that are represented by fixed-head reservoirs. The model also consists of thirteen service reservoirs that are represented as tanks. It is observed that some of these service reservoirs are inactive and not connected to the network. Table 7 summarises the details of the service reservoirs contained within the existing model. Note that some of the modelled reservoir volumes do not match the volumes nominated in Figure 5 water supply schematic. These differences have been noted but did not make material difference to the results and recommendations.

Table 7 Reservoir conditions

Reservoir	Existing model condition
Crest North / Tank 1	Inactive and not connected to the network. Storage volume is added to Crest South / Tank 2.
Crest South / Tank 2	Volume: 13.50 ML @ 7.68 m depth BWL: 636.12 mAHD
East Queanbeyan	Volume: 12.0 ML @ 8.50 m depth BWL: 661.50 mAHD
Greenleigh 1	Volume: 0.99 ML @ 5.0 m depth BWL: 687.50 mAHD
Greenleigh 2	Inactive and not connected to the network. Storage volume is added to Greenleigh 1.
Greenleigh 3	Inactive and not connected to the network. Storage volume is added to Greenleigh 1.
Homestead	Volume: 4.50 ML @ 6.0 m depth

Reservoir	Existing model condition
	BWL: 736.50 mAHD *Note: Network schematic nominates 5 ML volume*
Jerrabomberra 1	Volume: 23.60 ML @ 9.25m depth BWL: 674.25 mAHD *Note: Network schematic nominates 22 ML volume*
Jerrabomberra 2	Inactive and not connected to the network. Storage volume is added to Jerrabomberra 1.
Ridgeway	Volume: 0.77 ML @ 16.88 m depth BWL: 721 mAHD Combined inlet and outlet. *Note: Network schematic nominates 0.6 ML volume*
Thornton 1	Inactive. Storage volume is added to Thornton 2.
Thornton 2	Volume: 4.90 ML @ 5.0 m depth BWL: 739.88 mAHD *Note: Network schematic nominates total 4.6 ML volume*
Weetalabah	Volume: 0.27 ML @ 7.59 m depth BWL: 730.51 mAHD Combined inlet and outlet *Note: Network schematic nominates 0.2 ML volume*

4.2.4.4 Pumping stations

The existing model includes five pumping stations. Four pump stations are active whilst Water Pump Station 19 is set as inactive. Pump definitions are available in the model however it is observed that there are extra / redundant pump definitions that are not used in the model. Table 8 provides a summary of the pump station information as included in the model.

Table 8 Pumping station conditions

Pump station	Pump definition	Elevation	BEP Max. Flow (L/s)
Water Pump Station 1 (Homestead)	Water Pump Station 1	615.50	70.41
Water Pump Station 3 (Thornton Tank)	Water Pump Station 3	668.00	236.70
Water Pump Station 6 (Greenleigh)	Water Pump Station Greenleigh	640.00	53.33
Water Pump Station 8 (Ridgeway/ Carwoola)	Water Pump Station 8	598.09	44.69
Water Pump Station 19	N/A	0	N/A

In addition to the above water pump stations there is a water pump station at Tralee servicing the new development areas. This is not currently included in the model and has not been reviewed as part of this study.

4.2.4.5 Zone and control valves

The existing model contains seven zones namely Homestead, Thornton, Ridgeway, Crestwood, East Queanbeyan, Greenleigh and Jerra Park. This does not have an effect to the model results as zones are only used to group the elements physically.

The model consists of three types of control valves namely general-purpose valve (GPV), check valve (CV) and pressure release valve (PRV). From a high-level review of the model, several GPVs are closed and some PRVs and CVs are inactive, which can greatly affect the network, thus further investigation, beyond the scope of this engagement is needed to understand the purpose of these control valves in the model. Table 9 summarises the details of the control valves contained within the existing model. For the investigation, it has been assumed that the model reflects the true status of the valves.

Table 9 Control valve conditions

Valve Type	Number of Elements in the Model	Existing Model Condition
General-purpose Valve (GPV)	1,495	88 GPVs are closed
Pressure Release Valve (PRV)	9	3 PRVs are inactive
Check Valve (CV)	3	All are inactive 2 CVs are not connected to the network

4.2.5 2050 Peak day demand scenario

The 2050 base case scenario adopted the 2050 planning horizon along with a peak day 24-hour period. The adopted 2050 demand was 36.5 ML/d as per the adopted populations in the sewerage analysis (refer section 3.3).

As agreed with Council, the demands within the existing WaterCAD model were scaled such that the total system demand was equal to the Queanbeyan network peak day demand of 36.5 ML/d, including Tralee and Environa.

The location of connection point for Jumping Creek will be a new dedicated supply line constructed along Ellerton Drive, connecting to the network near the East Queanbeyan Reservoir (based on Jumping Creek water alignment sketches dated April 2020, provided to GHD). The connection point to the Poplars was assumed based on its proximity to the existing network. The demand for infill and non-residential areas were applied as a global multiplier to the existing network.

The supply to Tralee and Environa will be via a new supply line from Offtake 1. This line will supply a new low-level reservoir, that in turn feeds a high-level reservoir.

As noted in Table 5 (Section 3.4.1), the existing WaterCAD model has a PDD of 22.12 ML/d. This means that there is a 14.38 ML/d variance between the demand in the existing model and the projected demand for 2050 EP. This variance was distributed based on the projected EP of each area, and the computed demands were used in the model. The projected demand in 2050, distributed to future development areas, is detailed in Table 10.

Table 10 Projected 2050 future development EP and PDD

Future development area	Additional EP	% of total	Demand in ML/d	Service reservoir
Jumping Creek	960	2.9	0.41	Greenleigh 1– 100%
Tralee	4,040	12.0	1.73	Tralee Low Level & Tralee High Level
Tralee Station	10,800	32.1	4.61	Future reservoir– size unknown
The Poplars	2,160	6.4	0.92	Jerrabomberra– 100%
Environa / Robin	6,000	17.8	2.56	Future Reservoir– Environa – 100%
Infill – Crestwood	559	1.7	0.24	Crest South/ Tank 2– 100%
Infill – Jerrabomberra	67	0.2	0.03	Jerrabomberra 1– 100%
Infill – Karabar	214	0.6	0.09	Jerrabomberra 1– 75% Thornton– 25%
Infill – Queanbeyan	739	2.2	0.31	East Queanbeyan– 75% Crest South/Tank 2– 25%
Infill – Queanbeyan East	586	1.7	0.25	East Queanbeyan – 100%
Infill – Queanbeyan West	125	0.4	0.05	Jerrabomberra– 75% Crest South/ Tank 2– 25%
Non-Res	7,428	22.1	3.17	Crest South/ Tank 2– 10% East Queanbeyan – 50% Jerrabomberra 1– 40%

Future development area	Additional EP	% of total	Demand in ML/d	Service reservoir
TOTAL	33,678	100	14.38	

However, based on the drawing "Potable Water Supply Concept" for South Tralee dated February 2020 that was provided to GHD (see Figure 11), South Tralee will have an independent supply point from Offtake 1. Thus, the demands for South Tralee were assumed to be excluded from Queanbeyan water supply network.

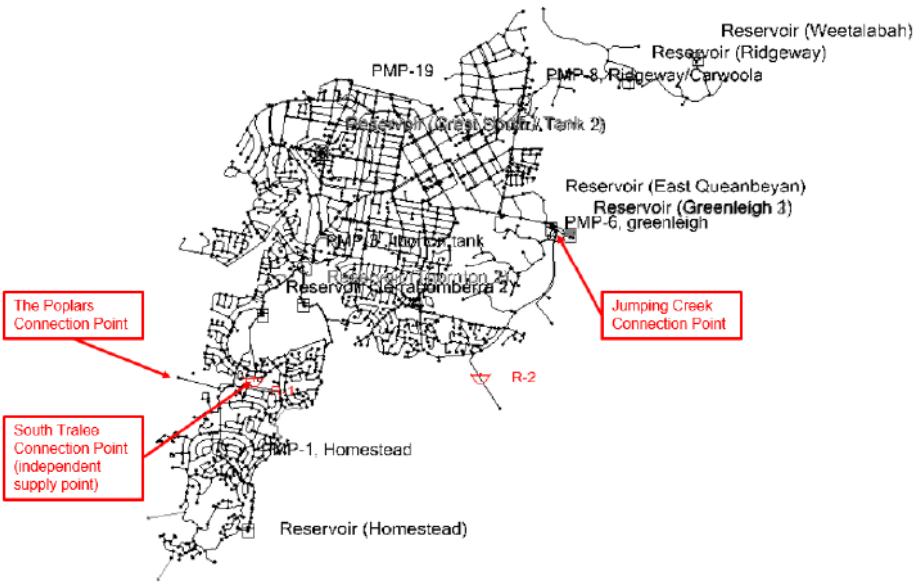


Figure 11 Connection points for future developments

4.2.5.1 Changes to the original model

Before running the 2050 PDD scenario, changes were made to the model to fix a model validation error. In the model provided to GHD, the trunk main that supplies Jerrabomberra 1 reservoir from offtake 1 was initially set to be closed, thus causing Jerrabomberra 1 reservoir to reach its emptying point. Similarly, the upstream and downstream pipes of Water Pump Station 1-Homestead were closed causing it to be isolated from the network. To correct these errors, the initial setting of these pipes was changed to "open".

In addition, the sizes of the trunk mains were also update from nominal diameter to actual internal diameter. Table 11 shows the changes in the pipe sizes. The reference tables for the adopted pipe sizes are included in Appendix A.

Table 11 Pipe size updates

Pipe type	Diameter in existing model (mm)	Adopted internal diameter (mm)
DICL	250	264.80
	300	322.40
	375	401.40
	450	479.90
	250	231.00

AC	300	279.40
	375	370.40
	450	444.00
	600	586.80

Lastly, the labels of offtakes 1 and 2 have been switched to match Figure 5 Water Supply System Schematic.

4.2.5.2 Pipe velocity results

Under the 2050 PDD scenario, the DN375 trunk main that extends from the offtake to East Queanbeyan reservoir has a velocity of 2.63 m/s. The total length of this trunk main is 2.88 km. All other trunk mains have a velocity of less than 2 m/s.

In the existing model maximum day scenario, the DN375 trunk main has a velocity of 2.53 m/s. Figure 12 below shows the location of this trunk main.

While this velocity is high, it does not appear to impact on the ability of the network to maintain supply to East Queanbeyan reservoir (see further results and discussion below). Notwithstanding this finding, high pipe velocities are associated with other risk factors, such as pipe scouring and water hammer.

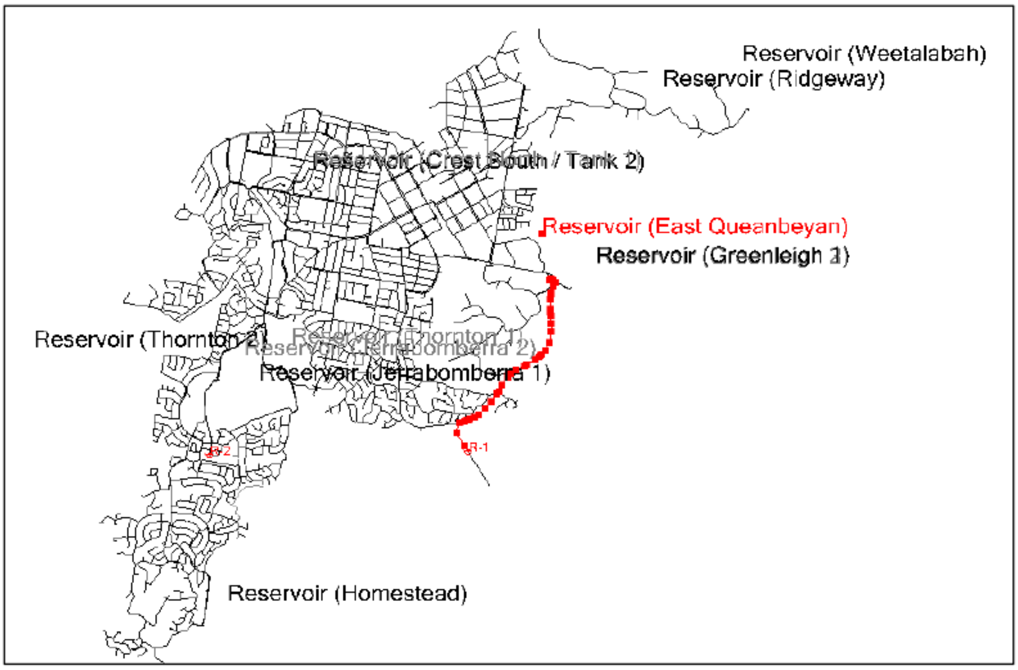


Figure 12 DN375 trunk main location

4.2.5.3 Reservoir storage

On a 24-hour period simulation under 2050 PDD scenario, Greenleigh 1, Jerrabomberra 1, Thornton 2 and Weetalabah reservoirs are observed to reach a storage level that is less than 67% of its capacity.

Table 12 shows a comparison of the lowest percentage of storage experienced by the active reservoirs under existing model PDD scenario and 2050 PDD scenario. Figure 13 shows the percentage over the 24 hour simulation period.

Table 12 Reservoirs storage

Reservoir	Lowest Percentage of Storage Under Existing Model PDD Scenario	Lowest Percentage of Storage Under 2050 PDD Scenario
Crest South/ Tank 2	82.0 %	82.0 %
East Queanbeyan	79.9 %	79.7 %
Greenleigh 1	57.7 %	57.5 %
Homestead	83.3 %	83.3 %
Jerrabomberra 1	83.2 %	62.9 %
Ridgeway	92.0 %	91.8 %
Thornton 2	48.4 % *	48.4 % *
Weetalabah	47.3 % *	47.3 % *
* Reservoir starting level based on model provided. Both reservoirs fill to 100% over 24 hr period		

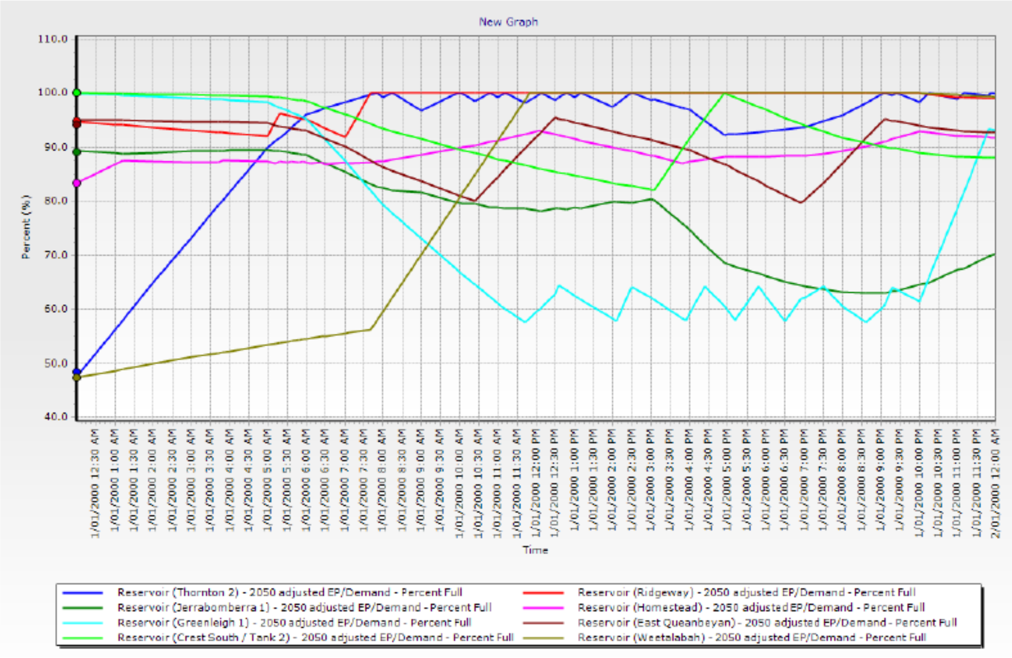


Figure 13 Reservoir storage percentage full

From the table and figure above, Greenleigh 1, Jerrabomberra and Homestead reach a level lower than 67% of their storage capacity on both present day and future 2050 PDD scenarios. Jerrabomberra 1 reservoir storage falls to 62.90% under the 2050 PDD scenario.

While the above reservoirs fail the criteria used for the purposes of this investigation, purely from worst-case security of supply perspective, the reservoir performance is deemed adequate. The figures below show that these reservoirs, except for Jerrabomberra 1 and Homestead, recover 70% to 100% of their capacity by the end of the 2050 PDD scenario.

Appendix B shows the graphs of Greenleigh 1, Jerrabomberra 1, Thornton 2 and Weetalabah reservoirs for the 24-hour simulation as well the behaviour of Jerrabomberra 1 reservoir during a 7-day simulation.

4.2.5.4 Water pumping stations performance

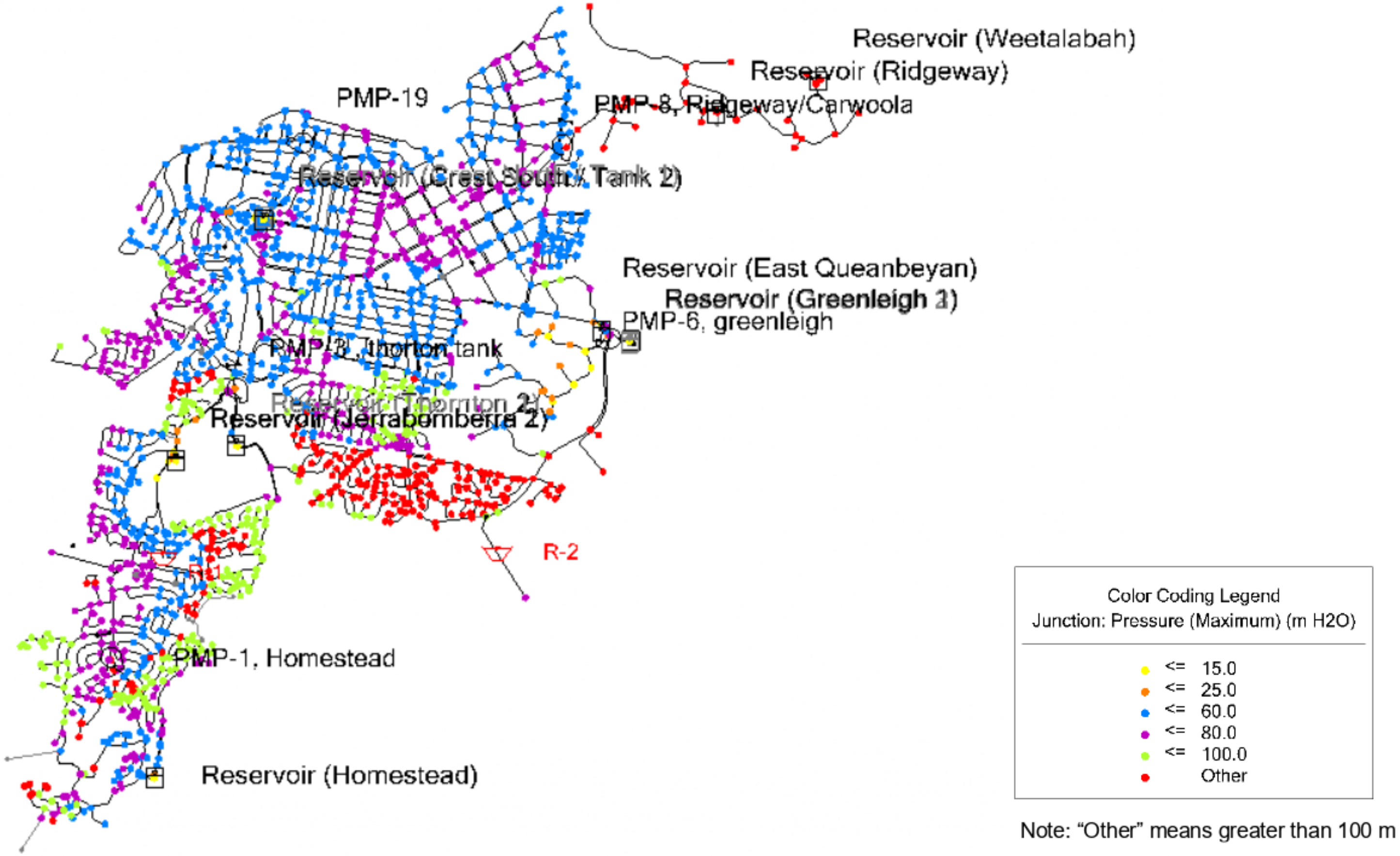
During 2050 PDD scenario, three out of four water pumping stations are operating at flows that are significantly less than their best efficiency points (BEP), as detailed in Table 13. Given that the 2050 PDD scenario contains no changes to reservoir operating levels, this may be an indication that the existing pump selections are unsuitable for their current purpose. More detailed investigations, involving a review of existing pump curves and operating pressures, would be required to confirm if there are any issues with pumping.

Table 13 Pump flows

Pump Station	BEP Max. Operating Flow (L/s)	Max. Flow at 2050 PDD Scenario (L/s)
Water Pump Station 1 (Homestead)	70.41	44.41
Water Pump Station 3 (Thornton Tank)	236.70	121.67
Water Pump Station 6 (Greenleigh)	53.33	53.75
Water Pump Station 8 (Ridgeway/ Carwoola)	44.69	33.28
Water Pump Station19	N/A	N/A

4.2.5.5 System Pressures

Figure 14 and Figure 15 show the maximum and minimum pressures in the network under 2050 PDD scenario.



Note: "Other" means greater than 100 m H_2O

Figure 14 Maximum pressure plot

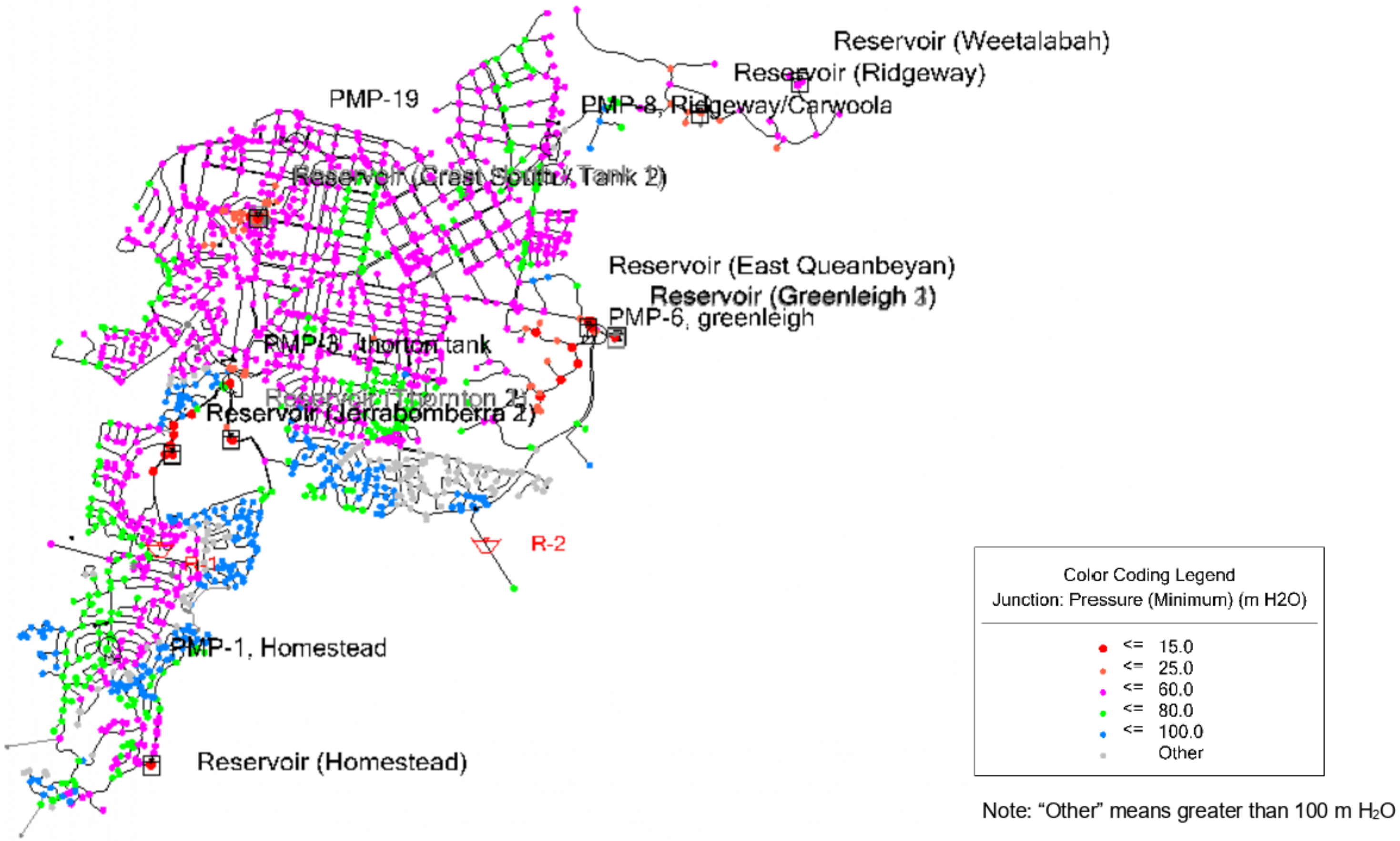


Figure 15 Minimum pressure plot

4.2.6 Stress tests

To further assess the performance of the network during possible worse case scenarios, GHD performed the following stress tests:

1. Global increase in demand by 20%
2. Taking offtake 1 offline
3. Taking offtake 2 offline
4. Taking Jerrabomberra 1 reservoir offline

4.2.6.1 Global increase in demand by 20%

If the actual demand became greater than the projected 2050 peak day demand, GHD globally scaled up the 2050 peak day demand by a factor of 1.20 and assessed the network performance against the modelling parameters. The 20% increase in demand is envisaged to allow for some increased per capita consumption as well as unplanned growth. The percentage full estimates for the reservoirs over the course of a day, with the increased demand, are presented in Figure 16.

With the 20% increase in demand, the following results are noted:

- Like the 2050 PDD scenario results Greenleigh 1, Thornton 2 and Weetalabah reservoirs still have storage below 67%.
- Jerrabomberra 1 reservoir's storage dropped to 42.40%. Refer to Table 14 for the summary of reservoir storage results.
- The DN375 trunk main that extends from the offtake to East Queanbeyan reservoir has a velocity of 2.63 m/s. All other trunk mains have a velocity less than 2 m/s.
- Pump 6 Greenleigh slightly exceeded maximum operating point.

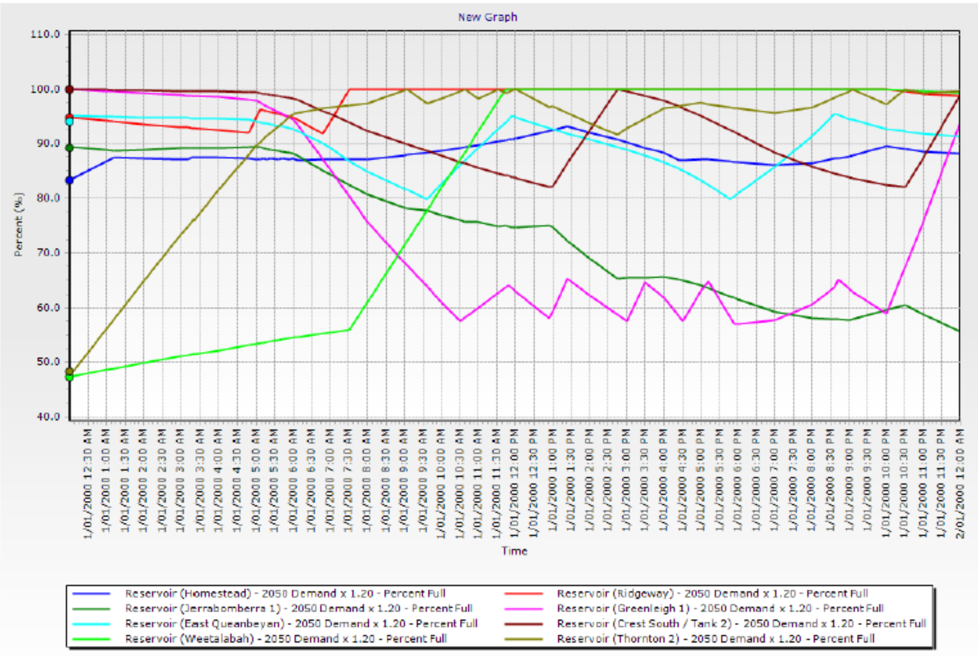


Figure 16 Reservoir percentage full global increase on demands

4.2.6.2 Offtake 1 is offline

Offtake 1 supplies Jerrabomberra 1 reservoir whilst Jerrabomberra 1 supplies three other smaller reservoirs (Greenleigh 1, Homestead, and Crest South Tank 2 reservoirs). In this scenario, since Offtake 1 is offline, the demand from the catchments of all these four reservoirs will need to be catered by the available storage in Jerrabomberra 1. The percentage full estimates for the reservoirs over the course of a day, with Offtake 1 offline, are presented in Figure 17.

At the end of the 24-hour period, the results are summarised as:

– Like the 2050 PDD scenario results Greenleigh 1, Thornton 2 and Weetalabah reservoirs still have storage below 67%.
– The results show that even if Jerrabomberra 1 is offline, Homestead reservoir can still get enough supply and maintain high storage. Refer to Table 14 and Figure 17 for the summary of reservoir storage result.
– The DN375 trunk main that extends from the offtake to East Queanbeyan reservoir has a velocity of 2.63 m/s. All other trunk mains have a velocity less than 2 m/s.
– Water Pump Station 6 Greenleigh slightly exceeded maximum operating point.

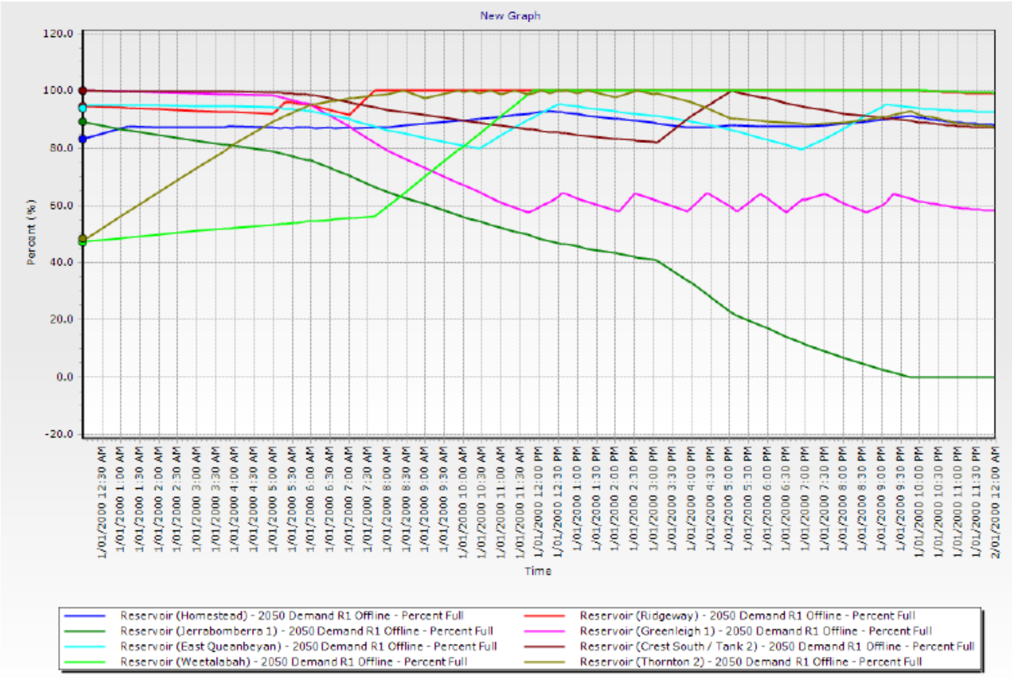


Figure 17 Reservoir percentage full Offtake 1 offline

4.2.6.3 Offtake 2 is offline

In this scenario, Offtake 2 is set as inactive, thus no supply is coming to East Queanbeyan reservoir. It is assumed that the supply to Greenleigh 1, Ridgeway and Weetalabah reservoirs will solely depend on what is stored in East Queanbeyan reservoir. The percentage full estimates for the reservoirs over the course of a day, with Offtake 2 offline, are presented in Figure 18.

At the end of the 24-hour period, the results are noted to be:

– Like the 2050 PDD scenario results Greenleigh 1, Thornton 2, Weetalabah and Jerrabomberra 1 reservoirs still have storage below 67%.

– East Queanbeyan reservoir's storage dropped to 43.5%. This is an expected result since East Queanbeyan reservoir supplies three subsequent reservoirs. Refer to Table 14 for the summary of reservoir storage results.
– Since Offtake 2 is offline, there is no flow for the DN375 trunk main that supplies East Queanbeyan reservoir. All other trunk mains have a velocity less than 2 m/s.
– Maximum flow at Water Pump Station 6 Greenleigh drops to 29.5 L/s.

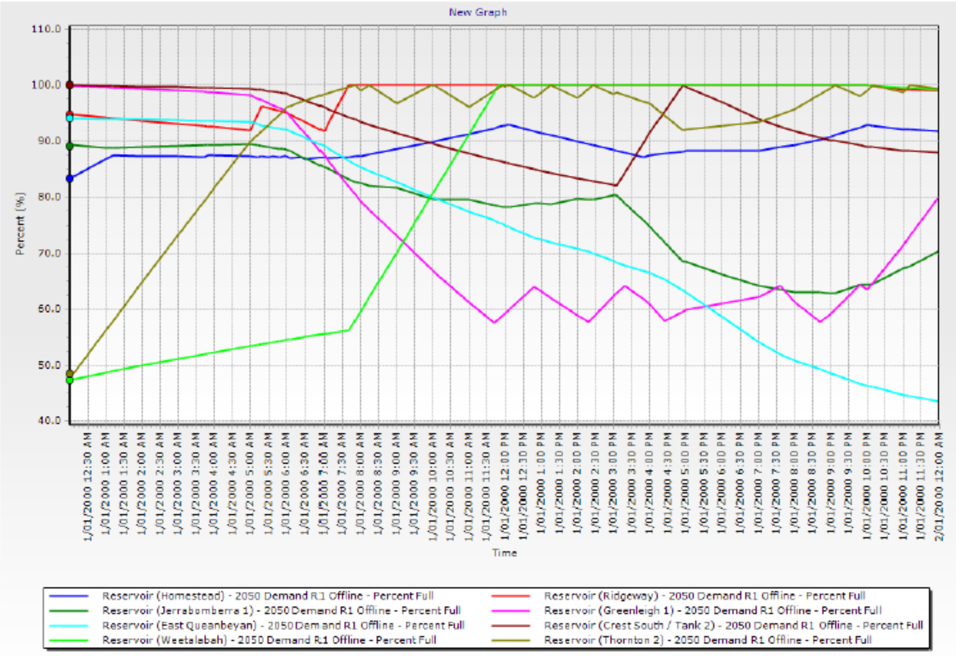


Figure 18 Reservoir percentage full Offtake 2 offline

4.2.6.4 Jerrabomberra 1 reservoir is offline

Since Jerrabomberra 1 is known to be in poor condition and it has the largest downstream supply zone, it plays a particularly crucial part in the network to ensure security of supply. This stress test scenario assessed the network performance when Jerrabomberra 1 becomes offline for at least 24-hour period. The minimum storage estimates for the reservoirs under this scenario are shown in Table 14, and the maximum flow estimates at the water pump stations are shown in Table 15. The operational observations from this scenario are summarised as follows:

– When Jerrabomberra 1 is offline, two of its subsequent reservoirs (Crest South Tank and Thornton 2) will reach their emptying point. Crest South Tank 2 will be empty after operating for 19 hours whilst Thornton 2 will be empty after approximately 12 hours of operation. Also, Homestead reservoir's storage dropped to 37.6%.
– The DN375 trunk main that extends from the offtake to East Queanbeyan reservoir has a velocity of 2.63 m/s. All other trunk mains have a velocity less than 2 m/s.
– Water Pump Station 6 Greenleigh slightly exceeded maximum operating point.

Given that there is a potential that Jerrabomberra 1 reservoir can be taken offline for three days, a separate run was made to check the condition of the network during this event. The results of this run can be summarised as follows:

– East Queanbeyan maintains 68.6% storage, Ridgeway maintains 87% storage and Weetalabah maintains 47.3% storage.
– All reservoirs downstream of Jerrabomberra 1 will be empty. Greenleigh reservoir will be the last to be emptied after operating for 1 day and 21 hours.

Table 14 Reservoir storage under stress test scenarios

Reservoir	Lowest percentage of storage using 2050 PDD x 1.20 (%)	Lowest percentage of storage when 1 is offline (%)	Lowest percentage of storage when 2 is offline (%)	Lowest percentage of storage when Jerrabomberra 1 is offline (%)
Crest South / Tank 2	82.0	82.0	82.2	0 (empty)
East Queanbeyan	79.8	79.9	43.5	79.9
Greenleigh 1	57.0	57.5	57.5	26.5
Homestead	83.3	83.3	83.3	37.6
Jerrabomberra 1	42.4	0 (empty)	62.9	Offline
Ridgeway	91.7	91.8	91.8	87.0
Thornton 2	36.9	48.4	48.4	0 (empty)
Weetalabah	47.3	47.3	47.3	47.3

Table 15 Pump flows under stress test scenarios

Water Pump Station	Max. Flow using 2050 PDD x 1.20 (%)	Max. flow when 1 is offline (L/s)	Max. flow when 2 is offline (L/s)	Max. flow when Jerrabomberra 1 is offline (L/s)
Water Pump Station 1 (Homestead)	44.4	44.4	44.4	26.7
Water Pump Station 3 (Thornton)	121.6	121.6	121.7	0.03
Water Pump Station 6 (Greenleigh)	53.8	53.8	29.5	53.9
Water Pump Station 8 (Ridgeway/ Carwoola)	33.3	33.3	33.3	33.4

4.2.6.5 Jerrabomberra 1 reservoir is offline under 2050 ADD

2050 average day demand was calculated by dividing the peak daily demand, which is 36.5 ML/d by a factor of 2.3 resulting to a demand of 15.90 ML/d. GHD derived the ADD of Tralee, Environa and The Poplars based on the PDD in Table 16 and added them in the existing "average day" demand in the existing model.

Table 16 Reservoir storage using 2050 ADD

Reservoir	Lowest percentage of storage when Jerrabomberra 1 is offline (%)
Crest South/ Tank 2	85.6
East Queanbeyan	79.9
Greenleigh 1	59.2
Homestead	83.3
Jerrabomberra 1	Offline
Ridgeway	92.0
Thornton 2	48.4
Weetalabah	47.3

To assess the severity of the effect of having Jerrabomberra 1 reservoir offline, a separate check was performed using 2050 ADD. Under this scenario, the results can be summarised in the following items:

– East Queanbeyan, Ridgeway, Thorton, Weetalabah and Homestead, reservoirs have maintained similar storage as compared 2050 PDD scenario.
– Crest South Tank 2 storage has jumped to 85.6% storage and Greenleigh 1 has increased to 59.2%.
– Similar to other scenarios, the DN375 trunk main that extends from the offtake to East Queanbeyan reservoir has a velocity of 2.63 m/s. All other trunk mains have a velocity less than 2 m/s.
– Water Pump Station 6 Greenleigh slightly exceeded maximum operating point.

4.2.7 Conclusion of hydraulic modelling

Overall, the network performance under the different scenarios is acceptable except for the scenario where Jerrabomberra 1 reservoir is offline. It is evident that having Jerrabomberra 1 offline has the worst effect in the network in terms of maintaining sufficient supply to the community. The East Queanbeyan reservoir is also identified as a critical asset in the network.

Based on the WaterCAD model, at 2050 PDD scenario, the combined demand of the downstream supply zones of Jerrabomberra 1 and its subsequent reservoirs comprises 75% of the total demand in the network. Jerrabomberra 1 reservoir is known to be in poor condition and cannot be taken offline without triggering service continuity risks due to insufficient by-pass assembly. To lessen the risk of supply interruption, the following recommendations can be considered.

– Duplication of Jerrabomberra reservoir.
– In the event the Jerrabomberra 1 is offline, GPVs installed at reticulations linking Crest South Tank 2 and East Queanbeyan reservoir supply zones can be opened. There are at least 15 GPVs that could link these supply zones given that East Queanbeyan reservoir has a capacity to supply a portion of its adjacent supply zone. Below is a list of GPVs that can be explored for this option. Note however, given the limited understanding of the network and location and status of valves this is unlikely to be a viable option.

Valve	ID number in Model
GPV	3033, 3349, 4097, 3353, 3906, 3679, 27460, 4036, 3723, 3038, 396, 3061, 2794, 27757, 2934

– Construct by-pass assembly to allow Offtake 1 to directly supply Pump 1 Homestead, Pump 3 Thornton and Crest South Tank 2 when Jerrabomberra is offline.
– Building an interconnecting pipeline between Offtake 1 and Offtake 2.

4.3 Water service extension

4.3.1 Option identification

Previous planning studies have considered the options available for the upgrading of Queanbeyan's water supply. These previous studies include:

– Queanbeyan STP Upgrade Masterplan, GHD Pty Ltd, 2016
– Queanbeyan IWCM Situational Analysis, AECOM Pty Ltd, 2019
– Queanbeyan IWCM Issues Paper, AECOM Pty Ltd, 2019
– Queanbeyan IWCM Issues Paper Supplemental Report, QPRC, 2020
– Queanbeyan STP Upgrade Concept Design Report, HunterH_2O Pty Ltd, 2020

The options considered from the noted previous studies can be summarised as follows:

1. Provision of a fourth connection from the Icon Water Stromlo to Googong Bulk Supply Main
2. Duplication of the Jerrabomberra Reservoir
3. Duplication of the East Queanbeyan Reservoir
4. Rationalisation of other service reservoirs, in particular Crest Reservoirs, Greenleigh Reservoirs
5. Installation of additional chlorination facilities
6. Renegotiation of tighter water supply targets with Icon Water

Regarding Item 6, it is unclear if this is about quantity, quality or both.

4.3.2 Infrastructure upgrades

Following the analysis undertaken, the proposed infrastructure upgrades include:

- Duplication of Jerrabomberra Reservoir. Based on GHD cost curves, a high-level cost estimate for a 20 ML steel reservoir would be in the order of is $10 million. This includes upgrades to access roads.

In addition, further investigation to be undertaken regarding:

- Additional reservoir at East Queanbeyan
- Recommissioning the Kendall Avenue connection to provide emergency supply only in the event of a major event affecting Offtake 1 and Offtake 2
- Installation of chlorination infrastructure at appropriate locations in the network, likely to be at Jerrabomberra and East Queanbeyan reservoirs.
- Possibility of decommissioning Crest Reservoirs
- Upgrades for WHS access for all reservoirs

4.3.3 Recommendations

Following the analysis undertaken to date, the critical upgrade option to be considered for the current network is a duplication of the Jerrabomberra Reservoir.

It is also recommended that further work to improve the model be undertaken including development and calibration of an operational model. This is a considerable project given the limited data available and understanding that significant ground truthing survey and field measurements will be required.

In addition to this, given the chlorine residual data analysed to date and commentary from Council, there would be benefit in undertaking further investigation into the current system to confirm the chlorine levels and provide additional chlorine dosing if areas are found to be deficient.

4.4 Preferred water supply scenario

Based on the above analysis the preferred water supply scenario is to continue to supply water to Queanbeyan and adjacent urban areas as bulk treated water from Icon Water whilst also undertaking the duplication of Jerrabomberra Reservoir.

5. Wastewater management scenarios

5.1 Queanbeyan sewage treatment plant

As identified in the IWCM Issues Paper (AECOM 2019), the capacity of the existing Queanbeyan STP is anticipated to be exceeded by 2025. There are also risks associated with the operation of the existing plant in terms of work health and safety and reliability. To address this, Council is currently undertaking an upgrade project for the Queanbeyan STP. The existing STP will need to continue operation until the STP upgrade project is complete.

5.2 Existing sewerage systems

5.2.1 Morisset St SPS

Morisset Street sewage pump station (SPS) is Council's largest sewer pump station. It receives gravity inflows from around 1/3 of the Queanbeyan sewerage network. It also receives pumped inflows from seven upstream sewage pump stations (River Drive, Lochiel Street, Kathleen Street, Weetalabah 1, Weetalabah 2, Regent Drive and Blundell Street).

Since the preparation of the IWCM Issues Paper (AECOM 2019), both a capacity review and condition assessment of the Morisset St SPS have been undertaken and the outcomes of each of these assessments are provided in this section.

Capacity Assessment

The Morisset St SPS Capacity Review was undertaken by Hunter H2O in 2019. The hydraulic capacity of the Morisset SPS pumps and discharge rising main from the Morisset SPS to the Morisset trunk sewer manhole was assessed. The key outcomes of the assessment were:

1. The existing Morisset SPS pumps are prone to ragging and blockage. It was recommended that QPRC progressively replace the pumps with Flygt N-Series pumps each selected for an individual duty point of 435 L/s @ 34 m. The preliminary system investigation showed that this requirement can be achieved by a Flygt NP 3312/835-670 pump with 565 mm impeller and 250 kW motor. The replacement pumps should be fitted with a 4901 flushing valve. This replacement may be achieved by a factory refurbishment of the existing pumps or a complete replacement (Hunter H2O, 2019).
2. The existing rising main is suitable for flow rates up to the design horizon and will not require augmentation to meet the required capacity (Hunter H2O, 2019).

In 2020, the pump station was refurbished with the new pumps as described in Item 1 above. The pumps were selected to be capable of a combined duty/ assist duty performance of 870 L/s at 34 m. These new pumps provide sufficient capacity for projected loadings beyond 2050. The pump controls have also been updated so they rotate duty between all pumps. There are no additional capacity related upgrades for the SPS and rising main prior to 2050.

Condition Assessment

A visual condition assessment of the Morisset SPS and the discharge manhole on Carinya Street was completed by Hunter H2O in April 2020.

The Morisset SPS was in good overall condition. The assessment identified some concerns that should be monitored/maintained over time to ensure continued reliable performance. This included coating deterioration, odour control and sewage sludge build-up (Hunter H2O, 2020).

The discharge manhole was in reasonable condition. It was noted that the step irons are in poor conditions and should be either removed or replaced with stainless items (Hunter H2O, 2020).

The condition assessment recommended additional coating inspection within 5 years and potential review of H_2S levels within the structure. Council will reinspect the pump station in 5 years, and revaluate the need for relining, which may be required in 10 years.

5.2.2 Sewerage network

At the time of the Issues Paper preparation, Council did not have an up-to-date model of its sewerage system. A trunk main model was developed in 2019 as part of the STP Upgrade project to evaluate whether there was sufficient capacity in the Jerrabomberra and Morisset trunk main for existing and future loadings. The trunk main modelling identified potential capacity constraints in both trunk mains that would be exacerbated under projected future loadings. It was recommended that a more detailed network model be developed to better assess capacity constraints and develop a staged upgrade strategy.

A detailed hydraulic model was developed in 2020. The model is currently not calibrated but Council is planning to calibrate the model using sewer flow gauging data collected over the past five years. This capacity analysis undertaken by Hunter H_2O is based on the theoretical model.

Existing Loadings Capacity Assessment

Capacity limitations were identified where the HGL rises to within 0.5 m of the ground surface (based on theoretical peak wet weather loadings) and are shown in Figure 19.

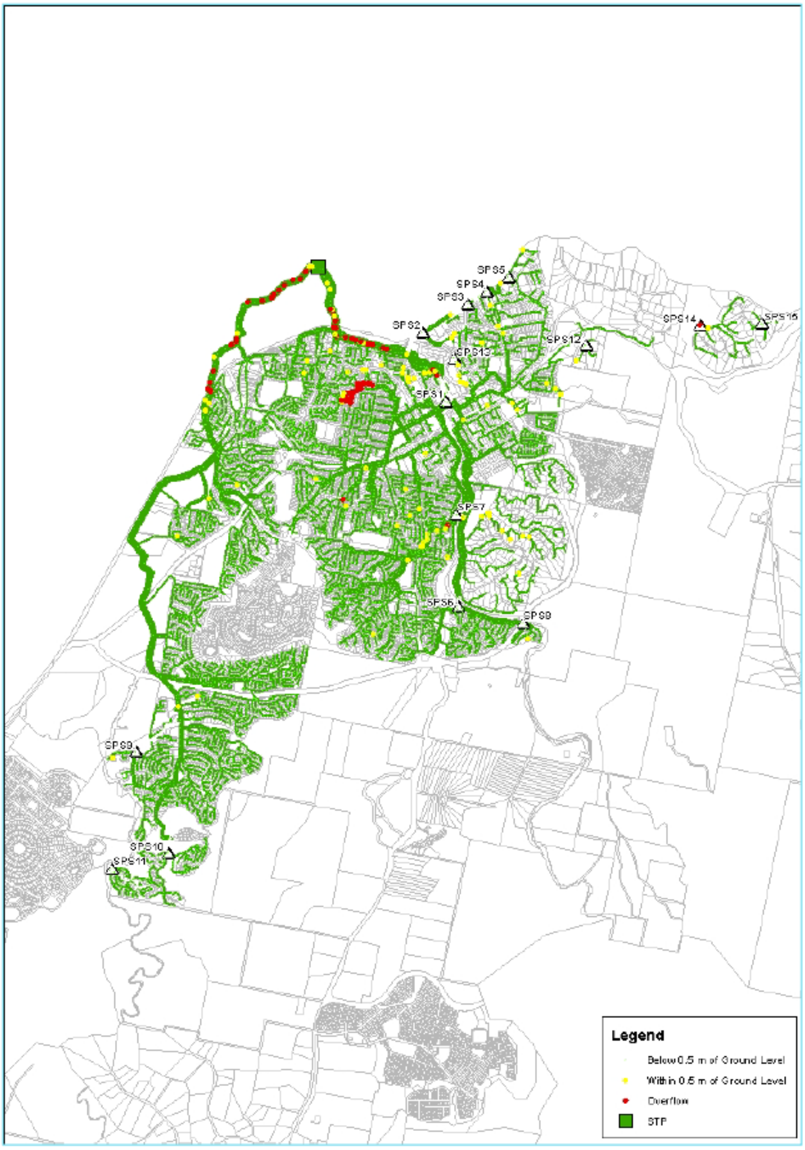


Figure 19 Existing system capacity constraints under peak wet weather flow conditions (existing loadings)

The hydraulic modelling identified that there are parts of the network that have insufficient capacity under existing peak wet weather flow conditions. The locations with capacity constraints are:

– The DN600 Jerrabomberra trunk main downstream of W34
– The DN750 Morisset trunk main downstream of the Morisset St SPS rising main discharge point
– Sections of the DN375 trunk main (parallel to the DN750 Morisset trunk main) downstream of F15
– Sections of the DN300 gravity main between Stomaway Road and Ross Road
– Sections of the DN300/375 between Sorrell Place and Malcolm Road immediately upstream of Kathleen St SPS and sections of DN150 between Kenneth Place and Dane Street

Future Loadings Capacity Assessment

Models were also developed to represent future loadings conditions in 2025 (+5 years), 2030 (+10 years), 2040 (+20 years) and 2050 (+30 years). The adopted future loadings from new development areas and infill development are summarised in Table 17, along with their proposed method for connection to the existing sewerage system.

Table 17 Future development areas EP and timing

Development area	Additional EP					Servicing notes
	Total	2020-25	2025-30	2030-40	2040-50	
Jumping Creek	960	960	0	0	0	Requires new SPS
Tralee	4,040	1082	2030	927	0	Requires new SPS
Tralee Station	10,800	0	0	5,400	5400	Requires new SPS
The Poplars	2,160	0	0	2,160	0	Gravity connection via sewer extension
Environa / Robin	6,000	0	0	2,626	3,374	Gravity connection via sewer extension
Infill - Crestwood	559	112	224	224	0	Infill
Infill - Jerrabomberra	67	13	27	27	0	Infill
Infill - Karabar	214	43	85	85	0	Infill
Infill - Queanbeyan	739	148	296	296	0	Infill
Infill - Queanbeyan East	586	117	234	234	0	Infill
Infill - Queanbeyan West	125	25	50	50	0	Infill
Non-Residential development	7,428	1,238	1,238	2,476	2,476	Infill or gravity connection via sewer extension

Loadings from new development areas and infill development were assigned to downstream trunk mains and the system capacity was assessed for future loading condition.

Capacity limitations (where the HGL rises to within 0.5 m of the ground surface) are shown in Figure 20 (based on theoretical peak wet weather loadings). There is also insufficient pump capacity at ARC SPS (SPS 2) and Weetalabah (SPS 14).

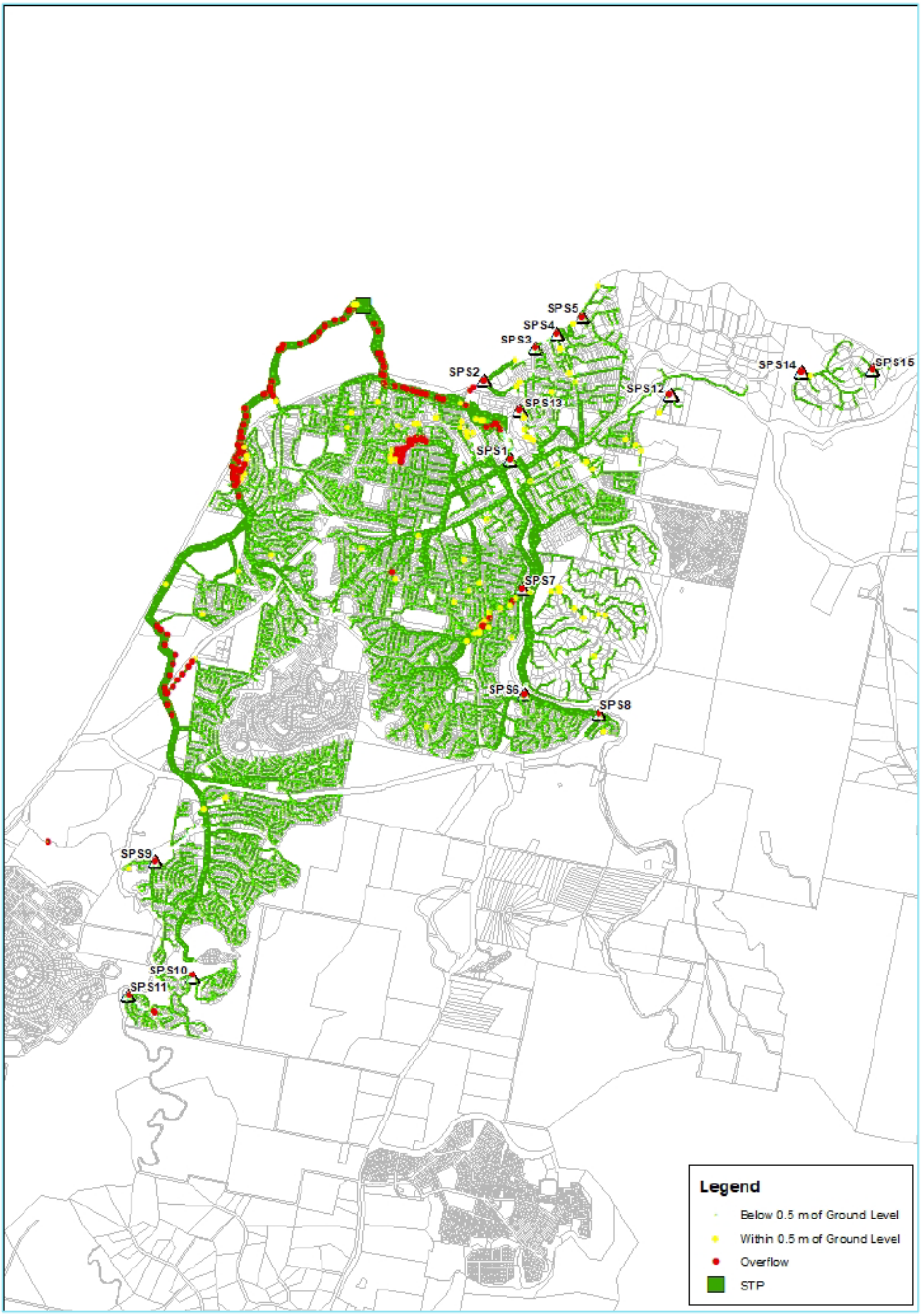


Figure 20 Existing system capacity constraints under peak wet weather flow conditions (2050 loadings)

5.3 Wastewater service extension

5.3.1 Feasibility review of options for non-build measures

Before consideration is given to the capital works upgrades that are required to address the identified IWCM Issues, non-build measures – including sewer inflow and infiltration (I&I) reduction and various operational /

management improvements – firstly need to be considered. This section provides an overview of the non-build measures that have been considered in the development of the inputs to the IWCM strategy.

A detailed assessment of the current levels of I&I into the sewerage system has not been undertaken at this stage. High volume of I&I was not identified as an IWCM issue but the potential for I&I reduction has been considered as part of options review and assessment.

Council has collected flow monitoring data in the sewerage systems over the past five years and is planning to calibrate its model of the Jerrabomberra subsystem in 2020/2021, and the Morisset subsystem in 2021/22. Following model calibration, Council will be in a better position to quantify the levels of I&I into the system and consider a targeted program for I&I reduction.

Council has previously implemented a pipe relining program with approximately 10% of pipes relined, the majority of which are in the Morisset subsystem. An overview of the extent of the pipe relining is provided in Figure 21. The effectiveness of the pipe relining to reduce I&I has not been monitored. Anecdotal information from Council has indicated that there have been no marked changes in I&I volumes because of the pipe relining program, and that the key benefit of the relining program has been to extend the life of the existing sewers and defer renewals.

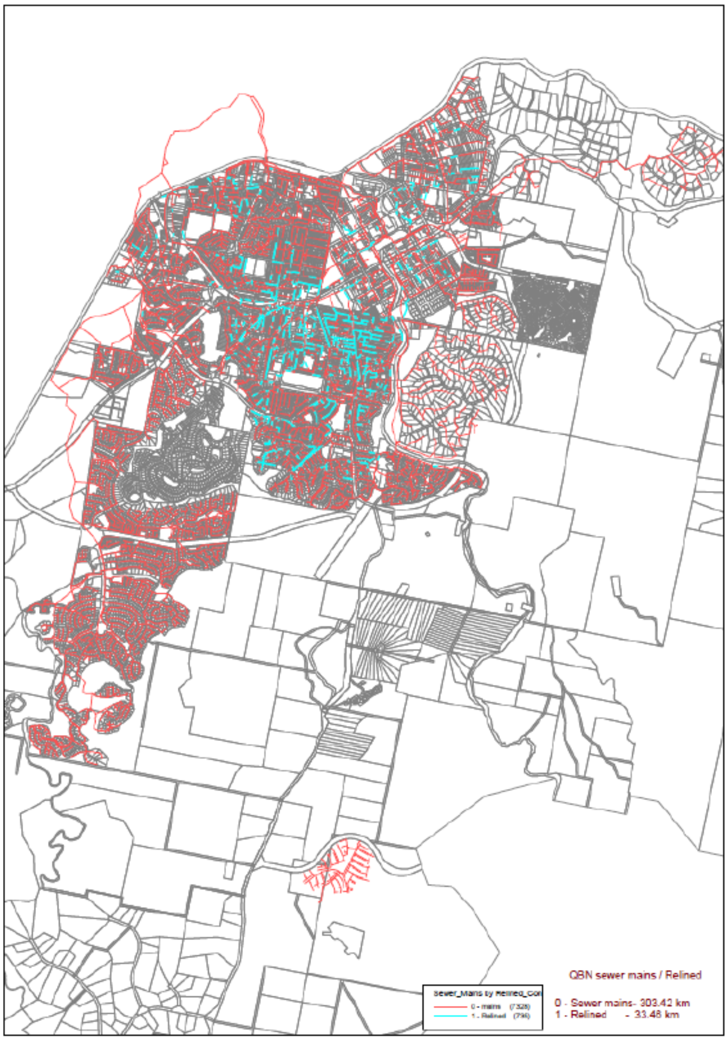


Figure 21 Relined pipes

A review of historical flow data (inflows to the STP) was undertaken by Hunter H2O as part of the design criteria and assumptions development for the STP upgrade project. The analysis found that there was a weak correlation between flow and 3-day rainfall, and that plant inflow does not significantly increase above dry weather values for low to moderate rainfall events less than 40 mm over three days (Hunter H2O, 2019). The analysis indicated that the highest flow over the period of analysis was up to 9 times average dry weather flow (ADWF), and a peak wet weather flow (PWWF) of 9 ADWF was adopted for the upgrade design. It was concluded that overall, the catchment looks like typical NSW catchments with moderate infiltration in wet weather (Hunter H2O, 2019).

A high-level assessment of the levels of ground water infiltration (GWI) in the catchment was also undertaken as part of this feasibility review to determine whether further investigation of rehabilitation works is warranted. Data from the flow gauges was analysed to assess if there is an excessive groundwater infiltration problem in the catchment. The analysis was based on the method described in the Water Services Association of Australia "Management of Wastewater System Infiltration and Inflow Good Practice Guide" and summarised below:

$GWI_1 = GWI_{(80\% \text{ of minimum flow})} / ADWF$

If GWI_1 is greater than 20%, it is an indicator that GWI, or base flow, is higher than expected.

Estimates of GWI_1 during dry weather for each flow gauge catchment WWTW catchment are provided in Table 18.

Table 18 Groundwater Infiltration Estimates

Flow Gauge	Subsystem	GWI_1 (%)	Notes
PFM_G01	Jerrabomberra	21%	
PFM_G02	Morisset	10%	
PFM_G03	Jerrabomberra	19%	
PFM_G04	Morisset	20%	
PFM_G05	Morisset	45%	
PFM_G06	Morisset	21%	
PFM_G07	Morisset	21%	
PFM_G08	Morisset	19%	
PFM_G09	Morisset	23%	Data unreliable; overnight flows less than 1 L/s
PFM_G10	Morisset	20%	
PFM_G11	Jerrabomberra	15%	

The analysis indicated that GWI is either within acceptable ranges or only marginally higher within the Jerrabomberra subsystem and most flow gauge catchments in the Morisset subsystem. Rehabilitation works to reduce groundwater infiltration within these catchments is not expected to have enough benefit to justify the cost of the works.

The only flow gauge catchment with high levels of GWI is PFM_G05, which is located near the Morisset St SPS. Its contributing catchment is part of the Morisset St SPS catchment. Further analysis of I&I levels during the model calibration phase is recommended to better define the extent of the problem. More targeted monitoring may also be required to better identify hotspots.

The above information suggests that inflow and infiltration volumes are not excessive, and the benefits of increased I&I reduction measures may be limited. It is recommended that Council reviews the need for additional I&I reduction measures following sewer model calibration.

5.3.2 Wastewater treatment options

This section describes the options assessment for the STP upgrade. Development in the ACT that may impact the STP upgrades in the future has not been considered at this stage, due to the uncertainty about the timing and extent of such development. The timing of these developments are unlikely to be within the 30-year horizon of this IWCM.

The IWCM Issues Paper Supplementary Report (QPRC, 2020) summarised the issues related to the Queanbeyan STP, that are being addressed by Council in parallel with the IWCM Strategy development. The issues related to the STP are:

– Queanbeyan STP hydraulic capacity will be exceeded by 2025
– Existing STP needs to be operated and maintained to continue to meet discharge license conditions until the new STP is commissioned

Several studies have informed the development of the STP concept to date, including:

– Masterplan for Sewage Treatment Plant Upgrade (GHD, 2016)
– Queanbeyan Sewage Treatment Plant Upgrade Project Design Criteria and Assumptions Report (Hunter H2O, 2019)
– Queanbeyan Sewage Treatment Plant Upgrade Project Design Options Selection Report (Hunter H2O, 2019)
– Queanbeyan Sewage Treatment Plant Upgrade Project Concept Design Report (Hunter H2O, 2020)
– Queanbeyan Sewage Treatment Plant Upgrade Environmental Impact Statement (Arup, 2020)

A summary of the outcomes from these previous studies is provided in this section, along with a brief summary of the proposed timeframe for completion of the STP upgrade.

5.3.3 Feasibility review of wastewater treatment options

The Masterplan for Sewage Treatment Plant Upgrade (GHD 2016, referred to as the Masterplan in this document) discussed three alternatives for the Queanbeyan STP:

1. Do Nothing
2. Build a new STP, using restored parts of the existing facility
3. Restore the STP and expand as needed to provide sufficient capacity.

The 'Do Nothing' option was not considered feasible due to the significant environmental and human health impacts (ARUP, 2020). A condition assessment was undertaken to investigate the option of reuse of parts of the existing facility. The assessment identified only limited components of the existing STP that could plausibly be used as structures, and not necessarily for their current process unit operations (ARUP, 2020). Many parts of the plant were considered not fit for reuse due to poor condition and being affected by the 100-year average recurrence interval (ARI) flood level.

Six build options were compared and are summarised in Table 19.

Table 19 QSTP upgrade options considered in the Master Plan

Option	Build strategy	Treatment technology
1A	Build New all process units and equipment, completely abandon the existing plant	BNR (Biological Nutrient Removal)/ CAS (Conventional activated sludge process)
1B	Build New all process units and equipment, completely abandon the existing plant	BNR/ MBR (Membrane process)
2A	Build New main process units and reuse some process units from the STP	BNR/ CAS
2B	Build New main process units and reuse some process units from the STP	BNR/ MBR
3A	Renew main QSTP process units & augment with new additional process units	BNR/ CAS
3B	Renew main QSTP process units & augment with new additional process units	BNR/ MBR

Data Source - Queanbeyan STP Upgrade Environmental Impact Statement

A Multi-Criteria Analysis (MCA) indicated that Options 1A and 1B were the preferred options. The MCA considered cost, constructability, operability, sustainability, future proofing and community acceptance. The "Build New" option was adopted as the basis for future planning.

5.3.4 Assessment of STP upgrade options

This section provides an overview of the development of the design criteria for the STP upgrade and the more detailed options assessment that was undertaken following the Masterplan.

5.3.4.1 STP upgrade design criteria and assumptions

The Design Criteria and Assumptions Report (Hunter H2O, 2019) set out the design criteria and assumptions that were used as the basis for the development of upgrade options and subsequent concept and reference designs. The design criteria and assumptions in the report were presented to QPRC at a Design Basis Workshop in June 2019 and were adopted as the basis for proceeding with the upgrade project. This section contains a summary of the design criteria and assumptions.

Population, size and flow

A significant review of EP projections from the STP Masterplan was undertaken with consideration given to the likely timeframe for the plant to be operational (2023/24) and QPRC's preference to have at least 15 years between upgrades. The adopted EP projections are summarised in Table 20.

Table 20 Queanbeyan STP Adopted EP Projections

Year	Projected EP	Growth Rate	Additional connection from Jumping Creek & Tralee	Total
2019	52,300			
2025	57,706	1.65%		
2038	71,832	1.70%	5,000	76,832
Ultimate				150,000

Data Source - Queanbeyan STP Upgrade Design Criteria and Assumptions Report

Following a review of data and inputs, the criteria shown in Table 21 were adopted for the design basis.

Table 21 Adopted Sewage EP, flow and temperature design summary

Parameter	Value	Units	Notes
EP Stage 1	75,000	EP	Increased from masterplan to account for higher measured load determined, increased current growth and future likely developments
Stage 2 EP	112,500	EP	
ADWF Flow loading	230	L/EP/day	200 L/EP day measured. Additional allowance as sewer may degrade over time and increase infiltration
Design ADWF	17.25 (Stage 1)	ML/d	34.5 ML/day ultimate with future upgrade
PDWF	1.35 (Stage 1)	ML/hr	Based on measured 95 %ile of 1.88 x average
PWWF	155.25 (Stage 1)	ML/d	Note one event of 9 ADWF was recorded
PIF	1,797	L/s	Set equal to PWWF.
Bioreactor and Sewage Temperature	12 – 24	°C	Operating temperature range

Data Source - Queanbeyan STP Upgrade Design Criteria and Assumptions Report

Influent and Effluent Quality

Influent quality data was analysed, and it was noted that it was generally typical of predominantly domestic sewage (Hunter H2O, 2019).

The ACT EPA advised that the current licence conditions will apply to the new plant (as at 9 September 2019). However, there are two issues with the licence which are difficult to comply with: Total Dissolved Solids (TDS) and ammonia limits. The treatment process cannot remove salt. As it is not practical or economic to remove salt to meet a TDS limit, an approach where the design was optimised to minimise salt addition was therefore proposed (Hunter H2O, 2019). Higher ammonia concentrations occur during wet weather bypass events. The design uses storm storage to balance wet weather flows and greatly reduce frequency of bypass events.

Biosolids

The upgrade is proposed to include a digestion process to achieve a biosolids stabilisation grade B suitable for Restricted use 2 applications under the current NSW EPA Biosolids Guidelines.

5.3.4.2 STP options selection

The Options Selection Report (Hunter H2O, 2019c) provided details on the treatment options that were selected for the STP upgrade, and the reasons for the selection.

Three secondary treatment options were developed for the upgrade for comparison:

- Oxidation ditch with continuous gravity clarification
- Membrane Bioreactor (MBR)
- Intermittently Decanted Extended Aeration (IDEA)

An Options Selection workshop was used to present and score each option using an MCA that considered whole of life cost, effluent quality, operability/complexity, maintainability, robustness, power and chemical use (Hunter H2O, 2019). The workshop was attended by stakeholders from the Department of Planning, Industry and Environment (DPIE) who agreed to the option selected as part of the Section 60 approval process for the STP upgrade.

The preferred secondary treatment process for the STP upgrade was an oxidation ditch with gravity clarifiers, tertiary granular filter media filter, UV disinfection, aerobic sludge digestion and sludge dewatering. It was noted that the plant would be configured to adopt full biological phosphorous removal in the future.

The key benefits of the selected process are:

- High ammonia removal to meet regulatory requirements
- Potential high total nitrogen removal or high nitrate production if required to protect Lake Burley Griffin
- Good treatment of storm flows
- Simple and robust process with many examples of successful implementation
- Multiple suppliers are available to provide replacement parts and equipment servicing
- Fewer chemicals are required than an MBR option and the same number of chemicals are required as the IDEA option.

5.4 Preferred wastewater scenario

5.4.1 STP Upgrade Preferred Option

The preferred option for the STP Upgrade is described in the Concept Design report (Hunter H2O, 2020a) and the Concept Design Addendum (Hunter H2O, 2022), to inform the preparation of the Business Case and Environmental Impact Statement (EIS). A Concept Design workshop was attended by DPIE, who gave approval for the concept to be used as the basis for the EIS and detailed design. The concept design also formed the basis for further design development prior to inviting tenders for the construction of the works. An overview of the concept design is provided in this section, based on the concept design as of October 2020.

The Queanbeyan STP Upgrade proposes the construction of a new treatment plant complete with screening and grit removal, a continuous oxidation ditch activated sludge process with gravity clarifiers, tertiary filtration, and UV disinfection. Waste sludge produced by the treatment process will be stabilised in an aerobic digester and dewatered; producing a biosolids product that is suitable for reuse. Treated effluent will be discharged via an on-bank discharge structure adjacent to the Molonglo River. Infrequent overflows from the Storm Pond will discharge at the same location (Hunter H2O, 2020).

An overview of the process showing major treatment processes is shown in Figure 22.

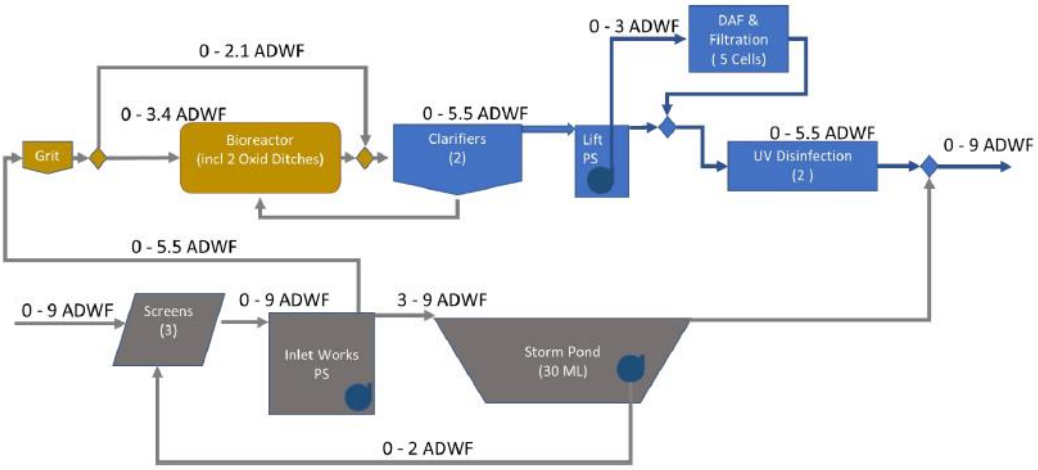


Figure 22 STP Upgrade – Proposed process configuration overview (Hunter H2O, 2020)

The design has been developed to provide a simple and robust process that provides reliable removal of nitrogen and phosphorus and treatment of storm flows (Hunter H2O, 2020).

The new STP will be constructed on the existing lease area to the south east of the existing treatment process. The site location provides a predominantly level area where the new treatment process may be constructed while maintaining operation of the existing STP. An overview of the site arrangement is provided in Figure 23.

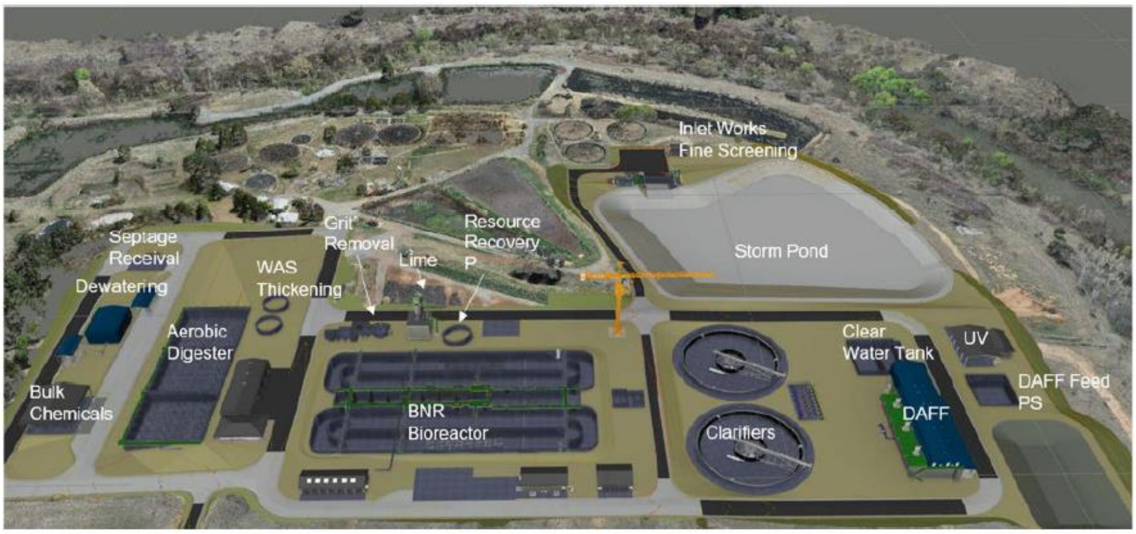


Figure 23 Overview of the Queanbeyan STP upgrade (existing plant in foreground) (Hunter H2O, 2022)

Development of the upgrade layout has considered the potential future requirements of the site. The site arrangement leaves space for a future stage 2 upgrade to expand the treatment capacity by 50% to 112,500 EP. Consideration to the needs of the future upgrade has been given as part of the hydraulic design, site layout and the process sizing of some aspects of the treatment facility which would be difficult to upgrade at a later date, such as the inlet works and grit removal facilities (Hunter H2O, 2020).

Effluent management

The STP currently discharges treated effluent to the Molonglo River. Treated effluent from the upgraded plant will be discharged via an on-bank discharge structure located adjacent the Molonglo River (Hunter H2O, 2020). Initially recycled water from the upgraded plant will be used onsite as well as being provided to water tankers for offsite uses such as dust suppression. The tertiary treatment will produce a high quality of treated effluent that will support future reuse opportunities (Hunter H2O, 2020).

5.4.1.1 STP upgrade costs

A cost estimate for the project was prepared in conjunction with the Concept Design. This estimate is being updated as the design progresses. The current estimate for the total project cost including the STP upgrade, maturation pond decommissioning and Mountain Road upgrade is in the order of $155M.

5.4.1.2 STP upgrade – project timeline

The current timeline for the STP upgrade is summarised in Table 22.

Table 22 Key milestones for STP upgrade project

Milestone	Current estimate
Draft EIS	Complete (October 2020)
Final EIS	August 2022
Detailed design complete	July 2022
Contract award	February 2023
Construction	February 2022 – June 2025
Decommissioning of maturation ponds	June 2025

5.4.2 Assessment of sewerage network options

This section describes the developed augmentation strategy for the sewerage network. The existing Morriset St SPS is described in section 5.2.1, and the sewerage network is described in section 5.2.2.

This section describes the options assessment for the network upgrades. Development in the ACT that may impact the existing sewerage network in the future has not been considered at this stage due to the uncertainty about the timing, extent, and connection point. The timing of these developments is unlikely to be within the 30-year horizon of this IWCM.

The IWCM Issues Paper Supplementary report (QPRC, 2020) summarised the issues related to the sewer network:

- Design options and timing of potential upgrades for Morisset SPS needs to be reviewed as part of the Queanbeyan STP Upgrade Project
- Lack of detailed knowledge of capacity constraints may lead to additional augmentation work required to meet acceptable service standards
- Sewer model is not up to date and not calibrated

Since the IWCM Issues Paper development, a capacity and condition assessment of the Morisset St SPS has been completed. A theoretical model of the sewerage system has also been developed and used to determine a preliminary upgrade strategy. Model calibration is expected to be completed in 2021/22.

Augmentation strategy methodology

Capacity limitations were identified where the HGL rises to within 0.5 m of the ground surface. Options to increase the hydraulic capacity at these locations were investigated. This usually involved augmentation of the system by adding parallel mains. All proposed augmentations were modelled and costed as parallel pipes i.e. the existing pipes would be maintained in operation. If this is not feasible, replacement pipes of larger diameter may be required.

Sewage pumping station capacity was assessed by comparing the current pump duty with the projected peak wet weather flow. Augmentations have been recommended where the capacity of the duty pumps (or duty/assist pumps depending on the station arrangement) is less than the peak wet weather inflow.

A staged augmentation strategy was developed to address the capacity constraints and allow for capacity for future connections in the catchment. The upgrades described in this section have been based on the theoretical model and will need to be refined following the development of the calibrated model.

Preliminary cost estimates were developed and for the proposed upgrades. The pipeline cost estimates are based on the latest rates for sewer mains provided as part of the current revaluation process. Sewage pump station cost estimates are based on the NSW Reference Rates Manual (Department of Primary Industries Office of Water, 2014). The estimates include:

– Survey, Investigation, Design and Project Management (SID) costs; the SID component can vary from 5% to 20% depending on the complexity of the project. An allowance of 10% of the project cost was applied for the pipeline cost estimates and 15% for the sewage pump stations
– Total preconstruction contingencies includes: an allowance for uncertainty in the scope of work, uncertainty in the costs to be applied and uncertainty in site conditions. An allowance of 30% of the contract rate was applied to the cost estimates to account for the high level of uncertainty at this preliminary planning stage
– Total preconstruction contingencies accounts for factors beyond the control of the designers or constructors, such as industrial issues, adverse weather, availability of labour and materials and extensions of time due to unforeseen circumstances. A contingency allowance of 20% of the contract rate was applied for all estimates.

Augmentation strategy overview

An overview of the proposed augmentation strategy is provided in Figure 24.

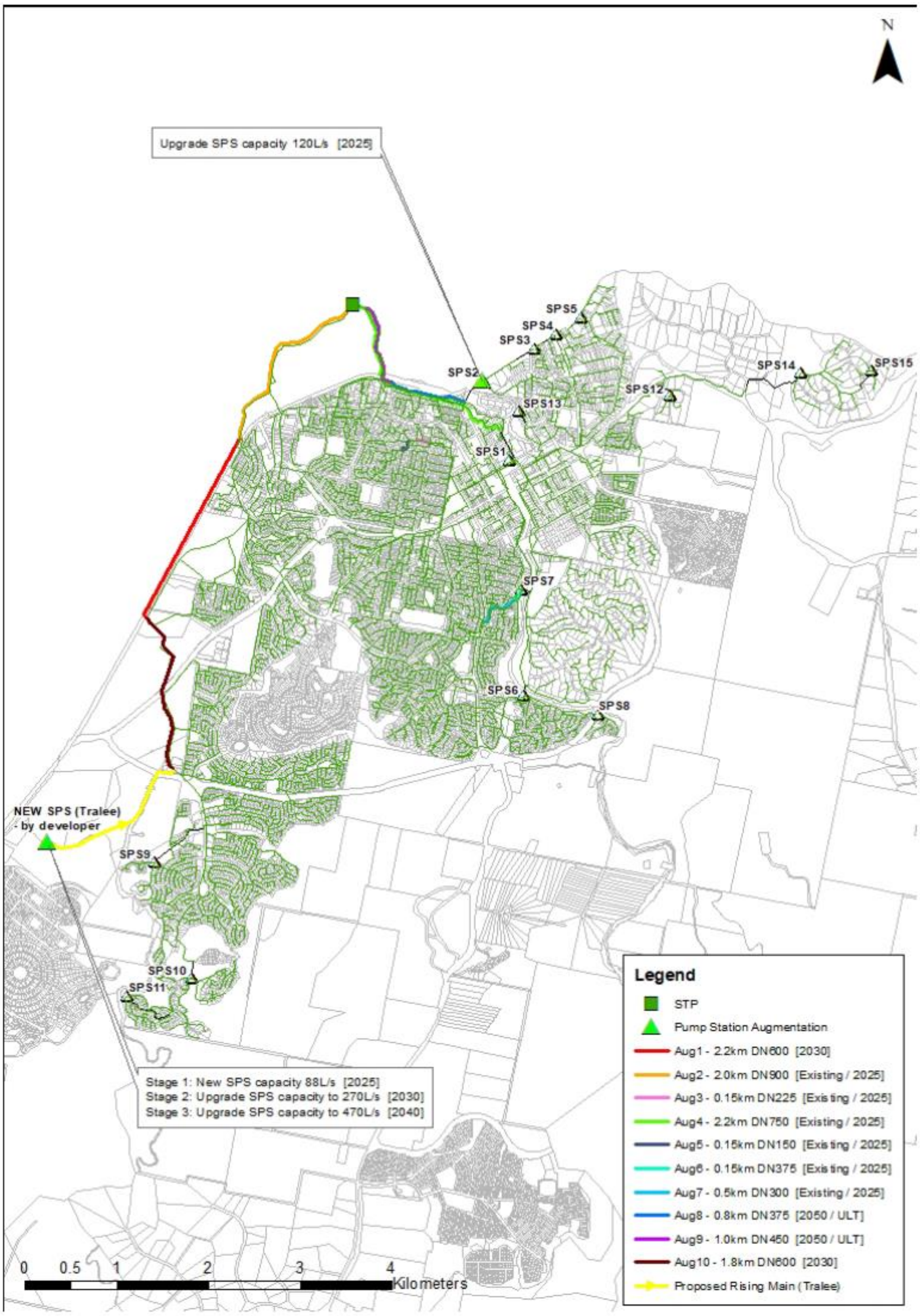


Figure 24 Augmentation strategy overview

Jerrabomberra subsystem augmentation strategy

The main capacity constraint in the Jerrabomberra subsystem is the Jerrabomberra trunk main. There are no capacity constraints in other parts of the system and all existing sewage pump stations have sufficient capacity for the additional projected loadings from infill development.

Augmentations required to increase system capacity are summarised in Table 23 along with their estimated capital cost and anticipated timing. For augmentations where modelling shows an existing capacity constraint, a timing of 2024 was adopted to reflect the likely timeframe required for project investigation, design, and construction.

Table 23 Sewerage network– staged augmentation strategy for the Jerrabomberra subsystem

Timing	Description	Estimated capital cost
2024 (part of STP upgrade)	Jerrabomberra trunk-main diversion/replacement - 225 m x DN900 gravity main from W1 to the new inlet works	$880,000
2024	1,775 m x DN900 gravity main from W26 to W1	$10,040,000
2030	2,200 m x DN600 gravity main from W61 to W26	$5,470,000
2030	1,850 m x DN600 gravity main from W76 to W61	$4,480,000

The upgrade from W26 to W1 is through an environmentally sensitive area owned by ACT government and would require an EIS. Sections of the Jerrabomberra trunk main within the STP site are known to leak and contain asbestos and would need to be replaced. Further analysis to determine the preferred route for the trunk main upgrade is required subject to field investigations. Alternatively, construction of a new SPS and rising main instead of the proposed trunk main augmentation, would provide more flexibility on the proposed pipeline route and may be a more cost-effective solution depending on the outcomes of the field investigations.

A new regional SPS will be required to service future developments in Tralee which do not drain via gravity to the existing sewerage system. Based on advice provided by Council, the new Tralee SPS will initially have a capacity of 88 L/s and discharge into the existing system at W76. The Jerrabomberra trunk main between the connection point and W61 has sufficient capacity for both existing and future connections up to 2030.

From around 2030, the projected peak flow from developments in the area will exceed 88 L/s. The SPS would either require an upgrade or replacement to increase station capacity to 270 L/s by 2030. The increased inflows will trigger augmentation of the Jerrabomberra trunk main downstream of the SPS discharge point from manhole W76 to W26. An alternative option for connecting the SPS further downstream and diverting flows from existing SPSs (SPS 9, 10 and 11) to reduce the loadings on sections of the Jerrabomberra trunk main could be assessed following development of the calibrated model. It is also noted that servicing the Tralee Station development area will require at least one additional SPS. It has been assumed that this SPS will connect to the existing system via the Tralee SPS, but the sizing and costing of the additional SPS(s) has not been considered at this stage.

An additional upgrade would be required for the Tralee SPS (beyond 2030) to accommodate the ultimate projected loadings of 470 L/s. Additional parallel rising main(s) will also be required with the proposed future pump upgrade. A summary of the regional infrastructure required to service large development areas is summarised in Table 24. Cost estimates have not been included as the infrastructure will be developer funded.

Table 24 Proposed Capacity and Timing for New Tralee SPS

Description	Timing
New Tralee SPS - 88L/s capacity and rising main 1,800 m x DN250	Under construction
Upgrade Tralee SPS to 270L/s capacity and upgrade rising main	2030
Upgrade Tralee SPS to 470L/s capacity and upgrade rising main	2040

Morisset subsystem augmentation strategy

The main capacity constraint in the Morisset subsystem is the Morisset trunk main. Other smaller upgrades are also required including two pump station upgrades.

Augmentations required to increase system capacity are summarised in Table 25 along with their estimated capital cost and anticipated timing. Upgrades required to alleviate existing system capacity constraints have been sized with sufficient capacity for future projected loadings. The ARC pump station upgrade has been costed as a replacement SPS. For the Woodland Ave SPS upgrade, the modelling indicated that the Woodland Ave SPS needs to be upgraded from 5 to 6 L/s. A cost has not been included for this upgrade as further investigation would be required to confirm what flow rate the SPS operates at and whether the upgrade could be achieved by impeller or pump replacement.

Table 25 Sewerage network– staged augmentation strategy for the Morisset subsystem

Timing	Description	Estimated Capital Cost
2024 (part of STP upgrade)	Morisset trunk-main diversion/replacement - 465 m x DN900 gravity main from F7 to the new inlet works	$1,980,000
2024	1,735 m x DN750 gravity main from MH 103303 to F7	$7,430,000
2024	150 m x DN225 gravity main from C604 to C371	$88,000
2024	150 m x DN150 gravity main from C703 to C605	$63,000
2024	150 m x DN375 gravity main from S26 to Kathleen St SPS	$242,000
2024	500 m x DN300 gravity main from S38 to S26	$330,000
2025	Replacement of ARC SPS – new 120 L/s capacity pump station	$1,790,000
2050	800 m x DN375 gravity main from F30 to F16	$1,045,000
2050	1,000 m x DN450 gravity main from F16 to F2	$1,408,000

A new SPS will be required for the Jumping Creek development area. It is assumed that this SPS will be developer funded and it has therefore not been included in the augmentation strategy. An allowance for the loadings from the new SPS was included in the modelling in the Morisset St SPS catchment.

6. Asset management

QPRC undertook a revaluation of the Water and Sewer Asset registers in August 2021. The restated asset register has been used to determine the 'assumed' asset replacement regime for existing assets. The replacement program was combined with the enhancement and growth profiles to establish the 20 year capital expenditure program applied to the funding and debt analysis.

6.1 Sewer Assets

Sewer Asset register had a WDBV of $75.5m as of 30th June 2021, consisting of 8,074 individually identified asses, remaining useful life ranging from 1 to 85 years.

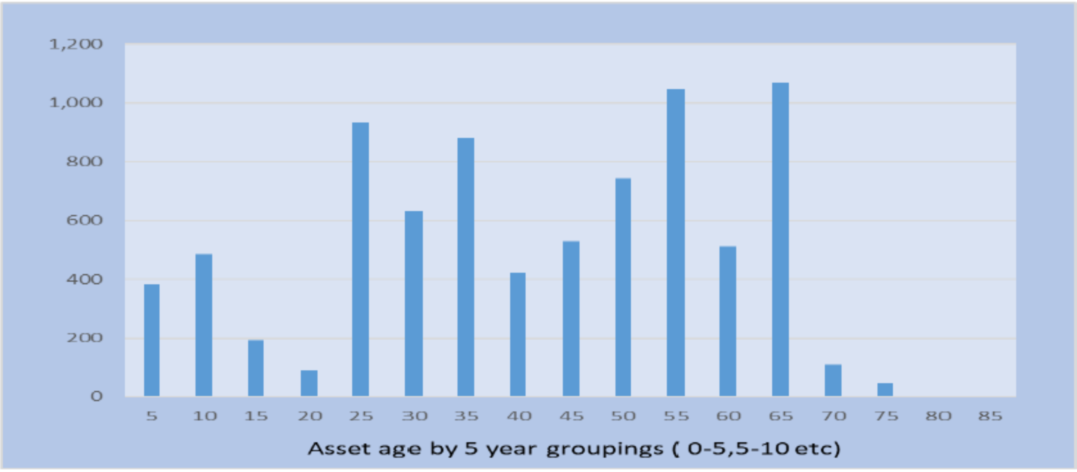


Figure 25 Sewer Assets - Remaining useful life (Yrs)

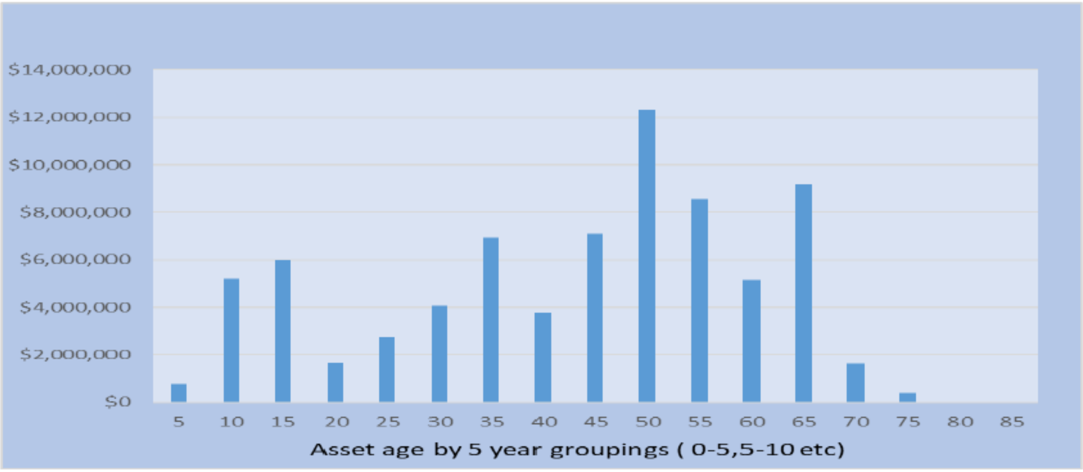


Figure 26 Sewer Assets - Written Down Book Value ($)

Table 26 Sewer Asset Register Summary

SEWER ASSET SUMMARY						Percentage Changes
	Year	Open Bal	Capex	Depn	WDBV	With Capex
1	2021/2022	75,534,532	0	2,951,535	72,582,997	-3.91%
2	2022/2023	73,671,742	72,115,750	2,951,535	142,836,065	93.88%
3	2023/2024	144,978,606	95,377,469	4,365,303	235,990,773	62.78%
4	2024/2025	239,530,635	28,537,094	6,214,334	261,853,395	9.32%
5	2025/2026	265,781,196	0	6,764,748	259,027,429	-2.54%
6	2026/2027	262,912,840	259,762	6,753,422	256,646,964	-2.38%
7	2027/2028	260,496,669	13,772,269	6,492,266	267,778,556	2.80%
8	2028/2029	271,795,234	36,498	6,762,556	265,160,097	-2.44%
9	2029/2030	269,137,498	18,096,164	6,378,105	280,864,841	4.36%
10	2030/2031	285,077,813	311,927	6,953,093	278,458,918	-2.32%
11	2031/2032	282,635,802	2,764,292	6,813,862	278,702,916	-1.39%
12	2032/2033	282,883,460	6,402,455	6,694,970	282,591,299	-0.10%
13	2033/2034	286,830,168	122,825	6,965,449	280,020,997	-2.37%
14	2034/2035	284,221,312	930,026	6,929,326	278,314,452	-2.08%
15	2035/2036	282,489,169	4,508,039	6,783,741	280,216,708	-0.80%
16	2036/2037	284,419,959	357,872	6,963,155	277,820,673	-2.32%
17	2037/2038	281,987,983	885,104	6,958,014	275,948,049	-2.14%
18	2038/2039	280,087,270	2,850,848	6,893,098	276,045,019	-1.44%
19	2039/2040	280,185,695	0	6,966,733	273,218,962	-2.49%
20	2040/2041	277,317,246	0	6,966,733	270,351,736	-2.51%

Note: Capex includes growth/enhancement assets as well as replacement of existing assets at their assumed 'end of useful' life.

6.2 Water Assets

Water Asset register had a WDBV of $80.7m as of 30th June 2021, consisting of 2,877 individually identified assets, with remaining useful life ranging from 1 to 100 years.

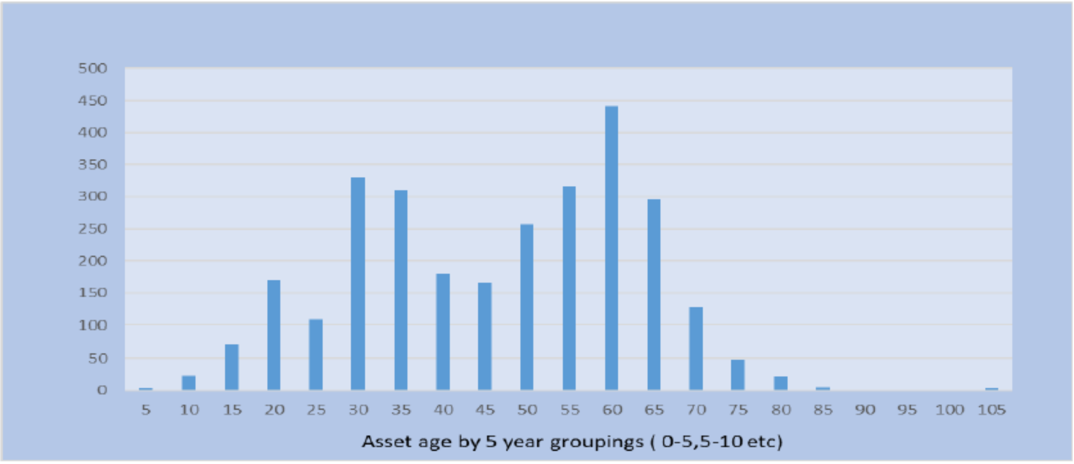


Figure 27 Water assets - remaining useful life (years)

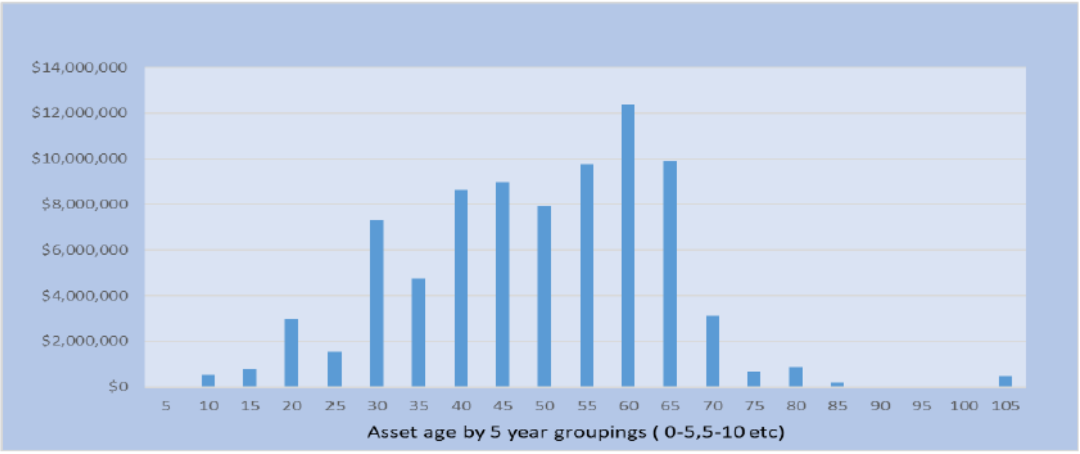


Figure 28 Water asset WDBV - remaining useful life (yrs)

Table 27 Water Asset Register Summary

ASSET SUMMARY						Percentage Changes
	Year	Open Bal	Capex	Depn	WDBV	With Capex
1	2021/2022	80,685,215	0	2,067,437	78,617,778	-2.56%
2	2022/2023	79,797,045	6,696,463	2,067,437	84,426,071	5.80%
3	2023/2024	85,692,462	3,659,874	2,232,374	87,119,962	1.67%
4	2024/2025	88,426,761	0	2,350,791	86,076,602	-2.66%
5	2025/2026	87,367,751	32,406,869	2,348,016	117,426,604	34.40%
6	2026/2027	119,188,003	0	2,655,291	116,539,183	-2.22%
7	2027/2028	118,287,270	475,774	2,643,025	116,120,019	-1.83%
8	2028/2029	117,861,819	0	2,655,291	115,221,445	-2.24%
9	2029/2030	116,949,767	1,105,757	2,591,010	115,464,515	-1.27%
10	2030/2031	117,196,482	0	2,655,291	114,541,192	-2.27%
11	2031/2032	116,259,309	0	2,655,291	113,616,207	-2.27%
12	2032/2033	115,320,450	664,055	2,626,905	113,357,600	-1.70%
13	2033/2034	115,057,964	0	2,655,291	112,408,940	-2.30%
14	2034/2035	114,095,074	165,142	2,648,928	111,612,163	-2.18%
15	2035/2036	113,286,346	42,671	2,653,559	110,701,138	-2.28%
16	2036/2037	112,361,655	2,835,016	2,626,946	112,569,724	0.19%
17	2037/2038	114,258,270	0	2,655,291	111,617,801	-2.31%
18	2038/2039	113,292,068	1,930,293	2,622,189	112,616,195	-0.60%
19	2039/2040	114,305,438	9,028,556	2,568,965	120,765,028	5.65%
20	2040/2041	122,576,504	0	2,655,291	119,921,213	-2.17%

Note: Capex includes growth/enhancement assets as well as replacement of existing assets at their assumed 'end of useful' life.

7. Adopted IWCM scenarios

7.1 Adopted scenarios

Based on the information presented above there is only one feasible scenario each for water and wastewater. As such the financial analysis has been prepared on this basis.

Table 28 Sewer Capex - Growth & Enhancement

Sewerage Capex by project			Asset Life
FY	**Description**	**Amount ($)**	
Pre 2020/21	Part QSTP Upgrade (spent to date) - current total estimated QSTP CAPEX is $155M	13,400,000	
2022/23	Part QSTP Upgrade	4000000	50
2023/24	Part QSTP Upgrade	65,900,000	50
2024/25	Part QSTP Upgrade	66,900,000	50
2024/25	Part Jerrabomberra trunk main (QSTP component)	880,000	50
2024/25	Part Jerrabomberra trunk main	10,040,000	50
2024/25	Part Morriset trunk main (QSTP component)	1,980,000	50
2024/25	Part Morriset trunk main	7,430,000	50
2024/25	Morriset gravity system upgrades	723,000	20
2025/26	Redundant QSTP Infrastructure Decomissioning	5,000,000	40
2025/26	ARC sewage pump station replacement	1,790,000	10
2030/31	Part Jerrabomberra trunk main	9,950,000	50
2032/33	Redundant QSTP Demolition	20,000,000	50
2049/50	Part Morriset trunk main	2,453,000	50
	Total Sewerage Infrastructure CAPEX (excl spent to date)	**210,446,000**	
	Total Infrastructure CAPEX (water + sewerage) excl spent todate	**250,446,000**	

Table 29 Water Capex - Growth & Enhancement

Water Capex by project			Est Life
FY	**Description**	**Amount ($)**	
Pre 2020/21			
2022/23			
2023/24	Water supply safety upgrade works	6,500,000	20
2024/25	Water supply chlorination upgrade works	2,000,000	20
2024/25	Water supply safety upgrade works	1,500,000	20
2026/27	Jerrabomberra Reservoir Duplication	20,000,000	80
2026/27	Water supply chlorination upgrade works	3,000,000	20
2026/27	Water supply safety upgrade works	7,000,000	20
	Total Water Infrastructure CAPEX	**40,000,000**	

7.2 Financial analysis

Financial analysis was undertaken to assess the impact of the proposed capital expenditure programs on the financial position of the Council over a twenty-year period. The analysis considered the forecasted cashflow and account balances under several alternative external funding options, assuming that external funding support would be available (modelling tests for 0%, 25%, and 50% and for specific asset support only). Grant funding was assumed to be available for the QSTP upgrades ($132.8m) over two years. Given the nature and the size of the Water capital expenditure, it was assumed that no request would be made for Water asset expansion.

7.2.1 Modelling Parameters

Table 30 summarises the key parameters adopted in the financial model as the base assumptions.

Table 30 Summary of general parameters adopted in the financial model

General Parameters		
Staff cost increase		2.50%
Inflation (CPI)		2.50%
Residential houses (growth_		0.50%
Vacant land (growth)		0.00%
Units (growth)		2.00%
Persons per household	#	2.60
Icon Bulk Water price re QPRC price		83.00%

Sewer and water access charges that are adopted in the financial model are presented in Table 31 and Table 32

Table 31 Sewer access charges for the financial year 2020 / 21

Sewer Access Chareges		
Sewer Access Charge 2020/21		
Residential		**Rate**
	Residential	$769.00
Industrial		
	Average	$1,566.25

Table 32 Water access charges for the financial year 2020 / 21

Water Access Charges		
Residential		**Rate**
	Average	$290.40
Industrial		
	Average	$616.52
Water Usage Charge		
	Average per kilolitre	$4.48
	Water Usage (kl/annum)	233

Note: 2020/21 data CPI adjusted in the financial modelling, and/or rates based on average derived from the 2021/22 rates notices.

Table 33 Water – Equivalent Tenancies Forecast – Water/Sewer

Growth re Table 16 - IWMC Finalisation Report		-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	18	27
		2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2039/40	2048/49
Residential Growth																			
Jumping Creek	960	0	240	240	240	240	0	0	0	0	0	0	0	0	0	0	0	0	0
Tralee	4,039	0	271	271	271	271	406	406	406	406	406	93	93	93	93	93	93	927	0
Trale Station	10,800	0	0	0	0	0	0	0	0	0	0	540	540	540	540	540	540	5400	540
The Populars	2,160	0	0	0	0	0	0	0	0	0	0	216	216	216	216	216	216	2160	0
Environ/Robin	6,000	0	0	0	0	0	0	0	0	0	0	263	263	263	263	263	263	2626	337
	23,959	0	511	511	511	511	406	406	406	406	406	1,111	1,111	1,111	1,111	1,111	1,111	11,113	877
Infill																			
Crestwood	560	0	28	28	28	28	45	45	45	45	45	22	22	22	22	22	22	224	0
Jerrabomberra	67	0	3	3	3	3	5	5	5	5	5	3	3	3	3	3	3	27	0
Karabar	213	0	11	11	11	11	17	17	17	17	17	9	9	9	9	9	9	85	0
Queanbeyan	740	0	37	37	37	37	59	59	59	59	59	30	30	30	30	30	30	296	0
Queanbeyan East	585	0	29	29	29	29	47	47	47	47	47	23	23	23	23	23	23	234	0
Queanbeyan West	125	0	6	6	6	6	10	10	10	10	10	5	5	5	5	5	5	50	0
	2,290	0	115	115	115	115	183	183	183	183	183	92	92	92	92	92	92	916	0
Non Residential Development	7,428	0	310	310	310	310	248	248	248	248	248	248	248	248	248	248	248	2476	248

Based on development sites forecasts and uptake rates

Table 34 Water Financial Statement

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Financial Statement	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**	**2027/28**	**2028/29**	**2029/30**	**2030/31**	**2031/32**	**2032/33**	**2033/34**	**2034/35**	**2035/36**	**2036/37**	**2037/38**	**2038/39**	**2039/40**	**2040/41**
Income																				
Rates and Annual Charges	6,318,879	6,831,364	7,383,774	7,979,136	8,611,461	9,292,277	9,648,682	10,017,100	10,397,908	10,915,623	11,452,726	12,009,861	12,587,695	13,186,915	13,808,228	14,452,365	15,120,079	15,812,146	16,529,366	17,188,289
User Charges and Fees	398,224	414,387	456,389	504,970	478,638	500,247	503,666	515,853	518,594	534,963	543,770	553,994	563,707	575,248	585,526	596,191	606,972	618,035	628,973	636,961
Water Consumption	16,266,370	16,524,041	16,907,312	17,183,651	18,045,387	18,522,158	18,342,153	18,711,526	19,104,998	19,599,805	19,871,543	20,261,915	20,657,858	21,054,507	21,425,515	21,822,574	22,221,428	22,621,087	23,021,572	23,315,477
Developer Contributions																				
Infill (based on 2004 DSP)	243,263	243,263	243,263	243,263	389,221	389,221	389,221	389,221	389,221	194,611	194,611	194,611	194,611	194,611	194,611	194,611	194,611	194,611	194,611	0
Developer - 5 years)	871,508	871,508	871,508	871,508	693,109	693,109	693,109	693,109	693,109	1,897,173	1,897,173	1,897,173	1,897,173	1,897,173	1,897,173	1,897,173	1,897,173	1,897,173	1,897,173	1,497,867
Total Income	24,098,244	24,884,563	25,862,246	26,782,528	28,217,817	29,397,014	29,576,831	30,326,809	31,103,830	33,142,174	33,959,822	34,917,553	35,901,043	36,908,453	37,911,053	38,962,913	40,040,263	41,143,051	42,271,694	42,638,594
Expenditure																				
Employee Expenses	875,622	898,870	922,714	947,170	972,148	997,767	1,024,044	1,050,995	1,078,638	1,108,278	1,138,667	1,169,826	1,201,776	1,234,537	1,268,131	1,302,579	1,337,905	1,374,132	1,411,283	1,448,663
Materials and contracts	1,669,120	1,645,708	1,730,382	1,745,155	1,757,007	1,779,748	1,814,430	1,836,178	1,859,730	1,886,310	1,913,883	1,939,616	1,966,381	1,993,976	2,021,835	2,049,768	2,078,270	2,107,221	2,136,523	2,166,198
Internal Charges	2,623,539	2,736,899	2,787,239	2,773,828	2,798,636	2,843,504	2,870,822	2,892,240	2,922,583	2,954,344	2,982,747	3,011,428	3,041,970	3,072,563	3,102,866	3,133,634	3,164,950	3,196,463	3,228,213	3,260,336
Operational	100,000	102,500	819,488	1,378,420	860,974	316,794	324,714	332,832	950,354	349,682	358,424	367,384	1,049,013	385,983	395,633	405,523	1,157,914	426,053	436,704	447,622
Bulk Water Supply(Icon)	13,501,087	13,714,954	14,033,069	14,262,430	14,977,671	15,373,391	15,223,987	15,530,566	15,857,148	16,267,838	16,493,381	16,817,389	17,146,022	17,475,241	17,783,178	18,112,736	18,443,785	18,775,502	19,107,905	19,351,846
Depreciation & Amortisation	2,108,174	2,108,174	2,108,174	2,468,508	2,666,495	2,669,324	3,117,787	3,130,295	3,130,295	3,064,747	3,130,295	3,130,295	3,101,350	3,130,295	3,123,806	3,130,295	3,128,529	3,101,391	3,130,295	3,130,295
Disposal of waste	36,995	25,066	25,223	24,354	28,607	26,458	26,815	27,223	27,958	27,791	28,133	28,470	28,790	29,003	29,314	29,617	29,911	30,198	30,504	30,809
Total Expenditure	20,914,537	21,232,173	22,426,288	23,599,865	24,061,538	24,006,987	24,402,599	24,800,329	25,826,706	25,658,990	26,045,529	26,464,409	27,535,301	27,321,598	27,724,753	28,164,153	29,341,264	29,010,961	29,481,427	29,835,768
Net cashflow from Operations	5,291,881	5,760,564	5,544,132	5,651,170	6,822,773	8,059,351	8,292,019	8,656,775	8,407,419	10,547,931	11,044,588	11,583,439	11,467,091	12,717,150	13,310,106	13,929,055	13,827,528	15,233,482	15,920,562	15,933,121
Capital Expenditure																				
Replacement Capex	0	0	0	0	97,403	0	545,407	0	0	1,364,172	0	0	868,632	0	224,615	0	61,254	4,149,780	0	0
Growth Capex	0	0	6,962,963	3,880,513	0	35,630,589	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net cashflow from Operations	5,291,881	5,760,564	-1,418,831	1,770,658	6,725,370	-27,571,239	7,746,613	8,656,775	8,407,419	9,183,760	11,044,588	11,583,439	10,598,459	12,717,150	13,085,491	13,929,055	13,766,274	11,083,702	15,920,562	15,933,121

Table 35 *Sewer Financial Statement*

	1	2	3	4	5	6	7	8	9	10
Financial Statement	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**	**2027/28**	**2028/29**	**2029/30**	**2030/31**
Income										
Rates and Annual Charges										
Residential	11,239,864	11,763,678	12,715,960	13,742,336	14,836,226	16,014,259	17,282,755	18,648,494	19,363,126	20,367,051
Industrial	2,174,258	2,293,749	2,498,484	2,720,144	2,947,441	3,192,795	3,457,592	3,743,322	3,899,417	4,060,977
Grants Contribution - Operating										
Grants Contribution - Capital										
DSP Revenue - infill	63,758	130,703	200,957	274,641	394,109	519,380	650,667	788,195	932,192	1,019,196
DSP Revenue - Developments /	304,499	312,111	319,914	327,912	267,307	273,990	280,840	287,861	295,057	827,819
Other Revenue	72,796	66,051	55,818	51,337	61,500	58,676	56,833	57,087	58,524	57,780
Interest & Investment Revenue										
Total Income	13,855,174	14,566,293	15,791,131	17,116,369	18,506,584	20,059,101	21,728,686	23,524,958	24,548,316	26,332,824
Expenditure										
Employee Expenses	1,754,217	1,800,930	1,848,842	1,897,983	1,948,163	1,999,630	2,052,419	2,106,562	2,162,095	2,221,753
Materials and Services	6,079,177	6,391,970	6,719,212	7,061,531	7,411,248	7,776,795	8,158,851	8,558,125	8,975,353	9,524,446
Operational	0	102,500	420,250	215,378	386,335	995,639	614,638	451,701	645,754	1,098,999
Depreciation (from Schedule)	3,009,693	3,009,693	3,088,017	4,549,975	6,108,661	6,258,399	5,992,097	6,267,713	6,267,713	5,864,014
Revaluation decrement/impairment										
Disposal of Assets/Waste	7,025	8,781	7,199	8,387	7,848	8,054	7,872	8,040	7,954	7,980
Total Expenditure	10,850,112	11,313,875	12,083,521	13,733,254	15,862,254	17,038,517	16,825,877	17,392,140	18,058,868	18,717,192
Net cashflow from Operations	6,014,755	6,262,111	6,795,627	7,933,089	8,752,991	9,278,982	10,894,907	12,400,530	12,757,161	13,479,645
Capital Expenditure										
Replacemet Capex	0	0	175,282	111,539	0	292,026	15,787,947	42,665	44,158	8,623,191
Growth Capex	0	4,140,000	70,593,728	74,974,829	7,791,681	0	0	0	0	13,560,829
Net cashflow from Operations	6,014,755	2,122,111	-63,973,382	-67,153,279	961,310	8,986,957	-4,893,040	12,357,866	12,713,003	-8,704,374

	11	12	13	14	15	16	17	18	19	20
Financial Statement	**2031/32**	**2032/33**	**2033/34**	**2034/35**	**2035/36**	**2036/37**	**2037/38**	**2038/39**	**2039/40**	**2040/41**
Income										
Rates and Annual Charges										
Residential	21,409,071	22,490,462	23,612,543	24,776,671	25,984,247	27,236,717	28,535,570	29,882,343	31,278,620	32,545,966
Industrial	4,228,178	4,401,201	4,580,232	4,765,465	4,957,096	5,155,330	5,360,378	5,572,456	5,791,788	6,018,604
Grants Contribution - Operating										
Grants Contribution - Capital										
DSP Revenue - infill	1,109,969	1,204,642	1,303,356	1,406,253	1,513,479	1,625,189	1,741,537	1,862,688	1,988,807	2,038,527
DSP Revenue - Developments /	848,515	869,728	891,471	913,758	936,602	960,017	984,017	1,008,617	1,033,833	836,644
Other Revenue	57,556	57,737	57,899	57,743	57,734	57,778	57,788	57,761	57,765	57,773
Interest & Investment Revenue										
Total Income	27,653,288	29,023,770	30,445,501	31,919,888	33,449,158	35,035,030	36,679,291	38,383,865	40,150,813	41,497,514
Expenditure										
Employee Expenses	2,282,914	2,345,621	2,409,913	2,475,835	2,543,429	2,612,739	2,683,812	2,756,695	2,831,434	2,906,582
Materials and Services	10,100,981	10,706,207	11,341,424	12,007,991	12,707,325	13,440,902	14,210,263	15,017,014	15,862,831	16,664,809
Operational	678,445	498,593	712,791	1,213,090	748,876	550,353	786,788	1,339,024	826,619	607,487
Depreciation (from Schedule)	6,620,835	8,059,239	8,222,387	8,498,195	8,465,275	8,495,590	8,312,907	8,495,856	8,490,614	8,499,505
Revaluation decrement/impairment										
Disposal of Assets/Waste	7,962	7,984	7,970	7,974	7,972	7,975	7,973	7,973	7,973	7,974
Total Expenditure	19,691,137	21,617,643	22,694,485	24,203,085	24,472,877	25,107,560	26,001,743	27,616,563	28,019,471	28,686,356
Net cashflow from Operations	14,582,986	15,465,366	15,973,404	16,214,999	17,441,556	18,423,061	18,990,455	19,263,159	20,621,956	21,310,663
Capital Expenditure										
Replacemet Capex	0	3,546,023	8,374,880	163,830	-31,485,221	389,457	6,471,172	523,839	1,321,108	0
Growth Capex	15,403,738	13,738,315	0	0	32,373,890	0	0	0	0	0
Net cashflow from Operations	-820,752	-1,818,972	7,598,523	16,051,169	16,552,886	18,033,603	12,519,282	18,739,320	19,300,849	21,310,663

7.3 Water & Sewer Accounts (Reserve & Loan)

QPRC operate two major fund accounts for the funding of their water and sewer infrastructure:

– Water/Sewer 'Working' Accounts – internal account which is used as a 'clearing account' between the income from water/sewer operations and the debt/repayments required to be made from time to time to ensure that the accounts are maintained according to the Council's guidelines.

– Water/Sewer Loan Accounts – comes into play when the internal operating cashflow plus grant funding is insufficient to match the capital expenditure needs to undertake the required capital expansion program. Rarely applied for water, as QRPC does not operate water treatment plants. The proposed sewer expansion program indicates that, besides grant funding, QPRC will need to seek loan funding post the upgrading of the QSTP in 2022/24.

7.4 Account Balances

7.4.1 Water

The capital expenditure program for water is $40m, with $20m in 2026/27.

7.4.1.1 Scenario 1

Water Scenarios	Recommended Scenario		
	No Grant, No Loans		
Sect 64 Balance	$10,000,000		
Fund Balance	$11,600,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate Increase - Initial 4 years	2.50%		
Rate increases - balance of the 20 years	2.50%		
CPI - Water	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	0.00%		
Grant Funding - Net Percentage	0.00%		
	Grant Funding	Loan Funding	Closing Balance
2021/22	0	0	26,851,093
2022/23	0	0	32,325,725
2023/24	0	0	30,259,360
2024/25	0	0	31,003,677
2025/26	0	0	36,318,780
2026/27	0	0	6,580,176
2027/28	0	0	12,221,324
2028/29	0	0	18,735,533
2029/30	0	0	24,965,308
2030/31	0	0	31,924,641
2031/32	0	0	40,728,536
2032/33	0	0	50,036,903
2033/34	0	0	58,315,081
2034/35	0	0	68,685,694
2035/36	0	0	79,398,152
2036/37	0	0	90,927,984
2037/38	0	0	102,263,138
2038/39	0	0	110,852,023
2039/40	0	0	124,256,394
2040/41	0	0	137,665,480
	$0	$0	

Figure 29 Water fund balances/funding assumptions

Modelling Assumptions

- ✓ Water fund has an open balance of $22.6m
- ✓ Pricing is based on the BAU pricing regime/mix.
- ✓ Rate increase have been assumed to be aligned to CPI growth (2.5%) and will be held at that rate across the analysis period.
- ✓ Capital cost is anticipated to increase at 1.0% in excess of CPI (2.5%+1.0%)
- ✓ With a balance increasing over the 20-year period, no grant funding.
- ✓ No additional loans sought

7.4.2 Sewer

QPRC is facing a more onerous capital expenditure program for sewer infrastructure, with a growth/enhancement program of in excess $160m in the four years. It is likely that QPRC will need to seek both grant funding and external (loan) funding to support this capital expenditure program.

7.4.2.1 Scenario 1

Sewer Scenarios	Scenario 1 Zero Grant, Zero Loans		
Opening Balance - Section 64	$7,000,000		
Opening Balance - Sewer Fund	$58,000,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate increases	4yrs/0 yrs/16 years		
Rate Increase - Initial period	4.50%		
Rate Increase - second period	-		
Rate increases - balance of 20 years	2.50%		
CPI - Sewer	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	0.00%		
Grant Funding - Net Percentage	1.16%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	59,753,211
2022/23	2,700,000	0	70,801,444
2023/24	0	0	7,087,754
2024/25	0	0	-60,020,079
2025/26	0	0	-59,189,100
2026/27	0	0	-50,543,626
2027/28	0	0	-56,389,901
2028/29	0	0	-45,676,671
2029/30	0	0	-34,478,977
2030/31	0	0	-44,570,325
2031/32	0	0	-46,632,858
2032/33	0	0	-49,530,578
2033/34	0	0	-42,828,903
2034/35	0	0	-27,472,743
2035/36	0	0	-11,391,962
2036/37	0	0	6,478,833
2037/38	0	0	19,230,185
2038/39	0	0	38,687,618
2039/40	0	0	59,229,479
2040/41	0	0	82,349,831
	$2,700,000	$0	

Figure 30 Sewer fund balance – Scenario 1

Modelling assumption

- ✓ Sewer fund has an open balance of $65.0m
- ✓ Pricing is based on the BAU pricing regime/mix.
- ✓ Rate increase have been assumed to be set at 4.5% for the initial four years and then reduced to the CPI rate of 2.5%.
- ✓ Capital cost is anticipated to increase at 1.0% more than CPI (2.5%+1.0%)
- ✓ No grant funding is assumed, except for the $2.7m already committed for 2022/23.

Overall result fails to achieve the required outcome, fund to achieve a positive balance, while minimising borrowings.

7.4.2.2 Scenario 2

Sewer Scenarios	**Scenario 2**		
	25% Grant request,		No Loans
Opening Balance - Section 64	$7,000,000		
Opening Balance - Sewer Fund	$58,000,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate increases	4yrs/0 yrs/16 years		
Rate Increase - Initial period	4.50%		
Rate Increase - second period	-		
Rate increases - balance of 20 years	2.50%		
CPI - Sewer	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	25.00%		
Grant Funding - Net Percentage	16.72%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	59,753,211
2022/23	2,700,000	0	70,801,444
2023/24	17,648,432	0	24,736,186
2024/25	18,543,306	0	-23,828,341
2025/26	0	0	-22,997,361
2026/27	0	0	-14,351,888
2027/28	0	0	-20,198,163
2028/29	0	0	-9,484,933
2029/30	0	0	1,729,889
2030/31	0	0	-8,361,459
2031/32	0	0	-10,423,992
2032/33	0	0	-13,321,712
2033/34	0	0	-6,620,037
2034/35	0	0	8,823,484
2035/36	0	0	25,153,308
2036/37	0	0	43,389,556
2037/38	0	0	56,510,015
2038/39	0	0	76,340,246
2039/40	0	0	97,258,634
2040/41	0	0	120,759,277
	$38,891,738	$0	

Figure 31 Sewer fund balance - Scenario 2

Modelling assumptions

- ✓ As for Scenario 1
- ✓ 25% grant funding application for QSTP upgrading.

Improvement in the net financial position but fails to maintain a positive account balance.

7.4.2.3 Scenario 3

Sewer Scenarios	Scenario 3		
	50% Grant request,		No Loans
Opening Balance - Section 64	$7,000,000		
Opening Balance - Sewer Fund	$58,000,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate increases	4yrs/0 yrs/16 years		
Rate Increase - Initial period	4.50%		
Rate Increase - second period	-		
Rate increases - balance of 20 years	2.50%		
CPI - Sewer	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	50.00%		
Grant Funding - Net Percentage	32.28%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	59,753,211
2022/23	2,700,000	0	70,801,444
2023/24	35,296,864	0	42,384,618
2024/25	37,086,613	0	12,363,397
2025/26	0	0	13,326,321
2026/27	0	0	22,191,512
2027/28	0	0	16,508,690
2028/29	0	0	27,494,139
2029/30	0	0	39,078,752
2030/31	0	0	29,277,277
2031/32	0	0	27,486,892
2032/33	0	0	24,835,064
2033/34	0	0	31,852,106
2034/35	0	0	47,680,348
2035/36	0	0	64,398,741
2036/37	0	0	83,027,443
2037/38	0	0	96,544,281
2038/39	0	0	116,774,855
2039/40	0	0	138,097,589
2040/41	0	0	162,006,621
	$75,083,477	$0	

Modelling assumptions

- ✓ As for Scenario 1
- ✓ 50% grant funding application for QSTP upgrading.

Overall result like 25% grant funding scenario. Optimal solution may be achievable with a slight increase in rates and consider both grant and loan funding.

7.4.2.4 Scenario 4

Sewer Scenarios

	Scenario 4		
	0% Grant request,		$40m Loans
Opening Balance - Section 64	$7,000,000		
Opening Balance - Sewer Fund	$58,000,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate increases	4yrs/0 yrs/16 years		
Rate Increase - Initial period	4.50%		
Rate Increase - second period	-		
Rate increases - balance of 20 years	2.50%		
CPI - Sewer	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	0.00%		
Grant Funding - Net Percentage	1.16%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	59,753,211
2022/23	2,700,000	0	70,801,444
2023/24	0	20,000,000	27,087,754
2024/25	0	20,000,000	-21,763,770
2025/26	0	0	-24,420,173
2026/27	0	0	-19,262,082
2027/28	0	0	-28,595,739
2028/29	0	0	-21,369,891
2029/30	0	0	-13,659,579
2030/31	0	0	-27,238,310
2031/32	0	0	-32,788,225
2032/33	0	0	-39,173,327
2033/34	0	0	-35,959,034
2034/35	0	0	-24,090,257
2035/36	0	0	-11,496,858
2036/37	0	0	2,885,506
2037/38	0	0	12,113,542
2038/39	0	0	28,012,426
2039/40	0	0	44,960,153
2040/41	0	0	64,450,430
	$2,700,000	$40,000,000	

Modelling assumptions

- ✓ As for Scenario 1
- ✓ Zero grant funding application for QSTP upgrading.
- ✓ Loan funding of $40m over two years

Improvement in the net financial position. Alternative funding options to be considered, as 50% grant funding may not be achievable.

7.4.2.5 Recommended Scenario

Sewer Scenarios	Recommended Scenario 25% Grant request, $40m Loans		
Opening Balance - Section 64	$7,000,000		
Opening Balance - Sewer Fund	$58,000,000		
Interest Rate - Debt	6.00%		
Interest Rate - Earnt	1.00%		
Loan Term (years)	20		
Rate increases	6yrs/0 yrs/14 years		
Rate Increase - Initial period	6.50%		
Rate Increase - second period			
Rate increases - balance of 20 years	2.50%		
CPI - Sewer	2.50%		
Capital cost CPI (CPI+Margin	1.00%		
Grant Funding - Percentage ask of eligible	0.00%		
Grant Funding - Net Percentage	16.72%		
	Grant Funding	**Loan Funding**	**Closing Balance**
2021/22	0	0	59,604,903
2022/23	2,700,000	0	70,493,332
2023/24	17,648,432	20,000,000	44,233,581
2024/25	18,543,306	20,000,000	13,879,918
2025/26	0	0	11,502,257
2026/27	0	0	17,206,724
2027/28	0	0	8,949,438
2028/29	0	0	18,032,995
2029/30	0	0	27,566,075
2030/31	0	0	15,562,936
2031/32	0	0	11,402,223
2032/33	0	0	6,191,701
2033/34	0	0	10,440,744
2034/35	0	0	23,269,450
2035/36	0	0	36,733,177
2036/37	0	0	51,827,066
2037/38	0	0	61,502,430
2038/39	0	0	77,556,785
2039/40	0	0	94,338,828
2040/41	0	0	113,318,603
	$38,891,738	$40,000,000	

Modelling assumptions

- ✓ Increase rates to 6.5% for the initial 6-year period, 14 year balance rate increase reduced to CPI (2.5%) annual increase.
- ✓ Grant funding sought for 25% for QSTP upgrade.
- ✓ Loan funding application for $40m over two years

7.5 Typical residential bills

The forecasted 'typical' residential bill is based on a BAU pricing regime, both in terms of how QPRC charge their users and how they QPRC is charged for labour, goods, and services, and in particular the pricing regime with Icon Water for the supply of bulk water. Based on the existing data and the recommended funding scenarios, the 'typical' residential bill is expected to increase by 2.98% (2/5% for water and 3.75% for sewer). The 'typical' bill will increase from $1,957 in 2021/22 to $3,587 by 2040/41.

Table 36 Typical residential bill values

	Sewer		Water		
	Rate Increase	Charge	Rate Increase	Water Bill	Typical Residential Bill
		$733.00		**$1,321.89**	$2,054.89
2022/23	6.5%	$780.65	2.5%	$1,354.93	$2,135.58
2023/24	6.5%	$831.39	2.5%	$1,388.81	$2,220.19
2024/25	6.5%	$885.43	2.5%	$1,423.53	$2,308.96
2025/26	6.5%	$942.98	2.5%	$1,459.12	$2,402.10
2026/27	6.5%	$1,004.27	2.5%	$1,495.59	$2,499.87
2027/28	6.5%	$1,069.55	2.5%	$1,532.98	$2,602.54
2028/29	2.5%	$1,096.29	2.5%	$1,571.31	$2,667.60
2029/30	2.5%	$1,123.70	2.5%	$1,610.59	$2,734.29
2030/31	2.5%	$1,151.79	2.5%	$1,650.86	$2,802.65
2031/32	2.5%	$1,180.58	2.5%	$1,692.13	$2,872.71
2032/33	2.5%	$1,210.10	2.5%	$1,734.43	$2,944.53
2033/34	2.5%	$1,240.35	2.5%	$1,777.79	$3,018.14
2034/35	2.5%	$1,271.36	2.5%	$1,822.24	$3,093.60
2035/36	2.5%	$1,303.14	2.5%	$1,867.79	$3,170.94
2036/37	2.5%	$1,335.72	2.5%	$1,914.49	$3,250.21
2037/38	2.5%	$1,369.12	2.5%	$1,962.35	$3,331.47
2038/39	2.5%	$1,403.34	2.5%	$2,011.41	$3,414.75
2039/40	2.5%	$1,438.43	2.5%	$2,061.69	$3,500.12
2040/41	2.5%	$1,474.39	2.5%	$2,113.24	$3,587.62
		3.75%		2.50%	2.98%

8. References

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AECOM (2019a). Queanbeyan IWCM Situational Analysis

ARUP (2020). Queanbeyan Sewage Treatment Plant Upgrade Environmental Impact Statement.

Department of Primary Industries, Office of Water (2014). NSW Reference Rates Manual

GHD (2016). Queanbeyan STP Upgrade Masterplan

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Hunter H_2O. (2019b). Morisset St SPS Capacity Review - Rev A.

Hunter H_2O. (2019c). Queanbeyan Sewage Treatment Plant Upgrade Project Options Selection Report.

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Hunter H_2O. (2020a). Queanbeyan Sewage Treatment Plant Upgrade Project Concept Design Report.

Hunter H_2O (2021). Queanbeyan IWCM – sewerage options assessment (final draft), 22/07/2021

QPRC (2020). Queanbeyan IWCM Issues Paper Supplementary Report

Appendices

Appendix A

Pipe size catalogues

PRODUCT DATA
A.C. Pressure Pipe

Dimensions and Classes — Australian Standard 1711-1975

Nominal Diameter of Pipe (mm)	Class	AS** 1711-1975 Factory Test Head (m)	*** Nominal Working Head (m)	Pipe: Overall Dimensions: Internal Diameter I.D. (mm)	Pipe: Overall Dimensions: Wall Thick. H (mm)	Pipe: Machining Dimensions: D ±0.8 (mm)	Pipe: Machining Dimensions: X min (mm)	Pipe: Machining Dimensions: F ±0.8 (mm)	Pipe: Machining Dimensions: Y ±1 (mm)	Pipe: Machining Dimensions: Z ±2 (mm)	Coupling: External Diameter E (mm)	Coupling: Length L (mm)	Ring: Code No.	Mass: Pipe Complete with Coupling (kg)	Mass: Coupling (kg)
58†	F	*	183	57.4	10.1	77.6	68	—	—	62	125	130	V58	20.5	2.0
80	B	122	61	76.8	9.4	95.6	68	—	—	62	139	130	V80	24.0	2.0
80	D	245	122	75.2	10.2	95.6	68	—	—	62	143	130	V80	26.0	2.5
80	F	367	183	69.6	13.0	95.6	68	—	—	62	151	130	V80	32.0	3.0
100	B	122	61	100.5	10.7	121.9	81	—	—	75	170	156	V100	36.0	3.5
100	D	245	122	96.5	12.7	121.9	81	—	—	75	178	156	V100	42.0	4.0
100	F	367	183	88.9	16.5	121.9	81	—	—	75	194	156	V100	53.0	5.5
150	B	122	61	154.5	11.4	177.3	83	—	—	78	227	172	V150	57.0	5.5
150	C	184	92	146.3	15.5	177.3	83	—	—	78	238	172	V150	75.0	7.0
150	D	245	122	141.7	17.8	177.3	83	—	—	78	246	172	V150	85.0	8.0
150	E	306	153	139.1	19.1	177.3	83	—	—	78	251	172	V150	91.0	8.5
150	F	367	183	133.5	21.9	177.3	83	—	—	78	262	172	V150	103.0	10.0
200	A•	61	30	208.2	12.0	232.2	83	—	—	78	281	172	V200	79.0	7.0
200	B	122	61	203.2	14.5	232.2	83	—	—	78	287	172	V200	94.0	8.0
200	C	184	92	195.6	18.3	232.2	83	—	—	78	299	172	V200	116.5	10.0
200	D	245	122	186.4	22.9	232.2	83	—	—	78	315	172	V200	143.0	12.5
225	A•	61	30	233.7	12.7	259.1	91	257.1	54	78	307	172	V225	93.0	8.0
225	B	122	61	228.5	15.3	259.1	91	257.1	54	78	314	172	V225	111.0	9.5
225	C	184	92	218.9	20.1	259.1	91	257.1	54	78	329	172	V225	142.5	12.0
225	D	245	122	209.3	24.9	259.1	91	257.1	54	78	346	172	V225	173.5	15.0
250	A•	61	30	259.6	13.2	286.0	91	284.0	54	78	335	172	V250	107.0	9.0
250	B	122	61	253.4	16.3	286.0	91	284.0	54	78	344	172	V250	130.5	11.0
250	C	184	92	243.4	21.3	286.0	91	284.0	54	78	359	172	V250	167.0	13.5
250	D	245	122	231.0	27.5	286.0	91	284.0	54	78	380	172	V250	211.0	18.0
300	A•	61	30	304.8	14.5	333.8	91	331.8	54	78	385	172	V300AB	137.0	11.0
300	B	122	61	299.2	17.3	333.8	91	331.8	54	78	393	172	V300AB	161.5	12.5
300	C	184	92	294.6	25.4	345.4	91	343.4	54	78	429	172	V300CD	239.5	18.5
300	D	245	122	279.4	33.0	345.4	91	343.4	54	78	454	172	V300CD	305.0	24.5
375	A•	61	30	381.0	16.0	413.0	107	410.0	67	91	468	208	V375AB	190.5	17.5
375	B	122	61	370.4	21.3	413.0	107	410.0	67	91	482	208	V375AB	249.0	22.0
375	C	184	92	363.2	31.5	426.2	107	423.2	67	91	526	208	V375C	371.5	33.0
450	A•	61	30	457.2	17.5	492.2	107	489.2	67	91	557	208	V450AB	250.5	24.5
450	B	122	61	444.0	24.1	492.2	107	489.2	67	91	568	208	V450AB	335.5	28.5
450	C	184	92	432.4	37.3	507.0	107	504.0	67	91	621	208	V450C	521.0	44.5
525	A•	61	30	533.3	19.1	571.5	107	568.5	67	91	633	208	V525AB	314.0	26.5
525	B	122	61	515.7	27.9	571.5	107	568.5	67	91	657	208	V525AB	449.5	37.0
525	C	184	92	506.0	40.6	587.2	107	584.2	67	91	709	208	V525C	660.5	56.5
600	A•	61	30	609.6	20.3	650.2	107	647.2	67	91	714	208	V600AB	379.5	31.5
600	B	122	61	586.8	31.7	650.2	107	647.2	67	91	745	208	V600AB	579.5	46.0
600	C	184	92	575.6	45.7	667.0	107	664.0	67	91	821	208	V600C	851.0	78.0

NOTE: For larger diameter pipe see Revised Standard Table on page 5.

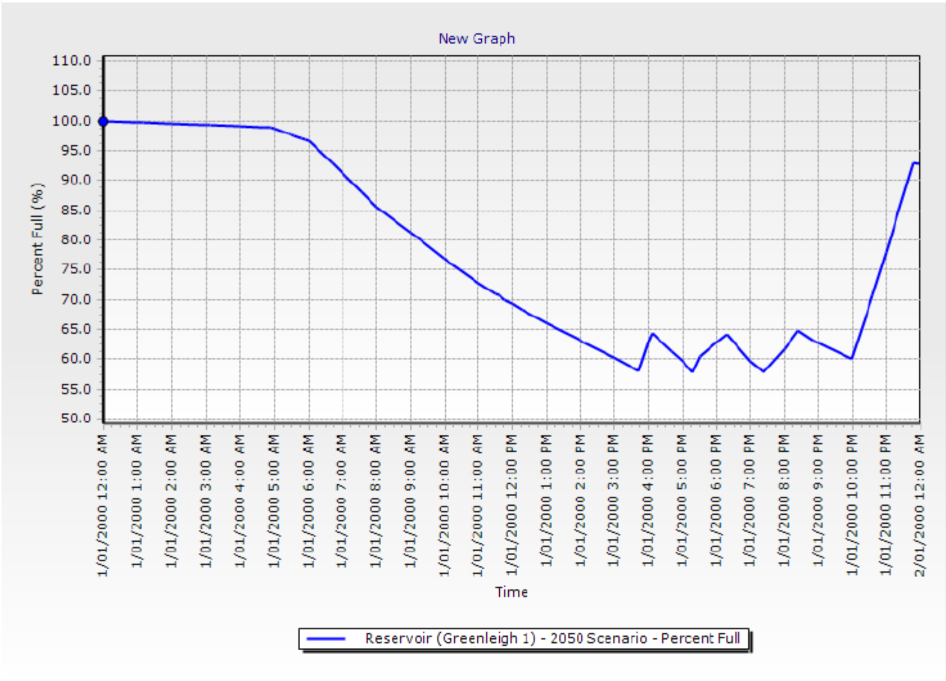
From Iplex DICL Pipe Catalogue

Irontite® pipe dimensions

Nominal diameter DN	PN35		Flange class		Mean outside diameter (y)	Allowable ovality
	Nominal wall thickness (t) mm	Minimum wall thickness (a) mm	Nominal wall thickness (t) mm	Minimum wall thickness (a) mm	mm	mm
100	5.0	3.0	7.0	6.0	122 +1, -2	4
150	5.0	3.0	8.0	6.0	177 +1, -2	5
200	5.0	3.0	8.0	7.0	232 +1, -2	7
225	5.2	3.2	9.0	7.0	259 +1, -2	8
250	5.6	3.6	9.0	8.0	286 +1, -2	9
300	6.3	4.3	10.0	8.0	345 +1, -2	10
375	7.3	5.3	10.0	9.0	426 ± 2	12
450	8.3	6.3	11.0	10.0	507 ± 2	15
500	9.0	7.0	12.0	10.0	560 ± 2	15
600	10.3	8.3	13.0	11.0	667 ± 2	15
750	12.2	10.2	15.0	13.0	826 ± 2	15

Appendix B

Percent full graphics of reservoirs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Percent Full (%)
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105.0
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
1/01/2000 12:00 AM
1/01/2000 1:00 AM
1/01/2000 2:00 AM
1/01/2000 3:00 AM
1/01/2000 4:00 AM
1/01/2000 5:00 AM
1/01/2000 6:00 AM
1/01/2000 7:00 AM
1/01/2000 8:00 AM
1/01/2000 9:00 AM
1/01/2000 10:00 AM
1/01/2000 11:00 AM
1/01/2000 12:00 PM
1/01/2000 1:00 PM
1/01/2000 2:00 PM
1/01/2000 3:00 PM
1/01/2000 4:00 PM
1/01/2000 5:00 PM
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1/01/2000 7:00 PM
1/01/2000 8:00 PM
1/01/2000 9:00 PM
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1/01/2000 11:00 PM
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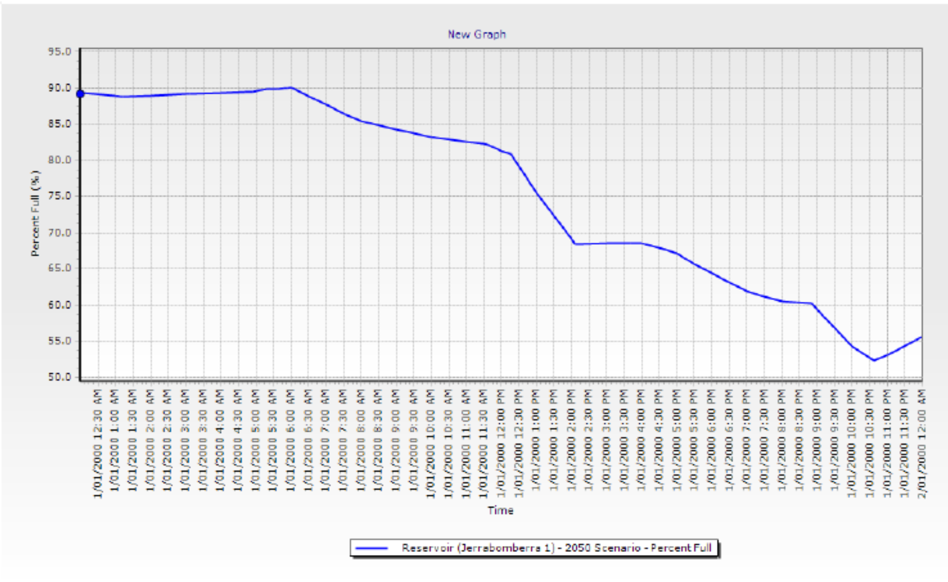
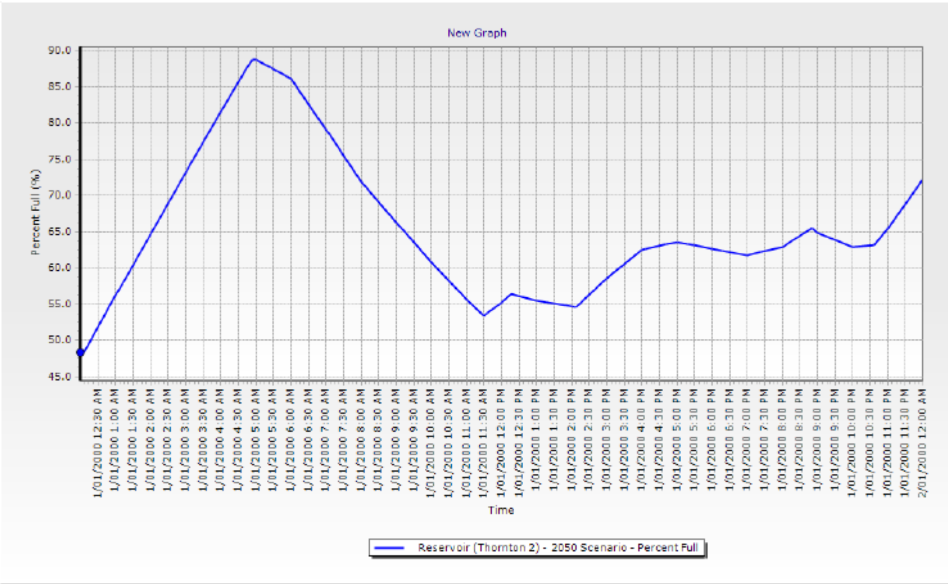
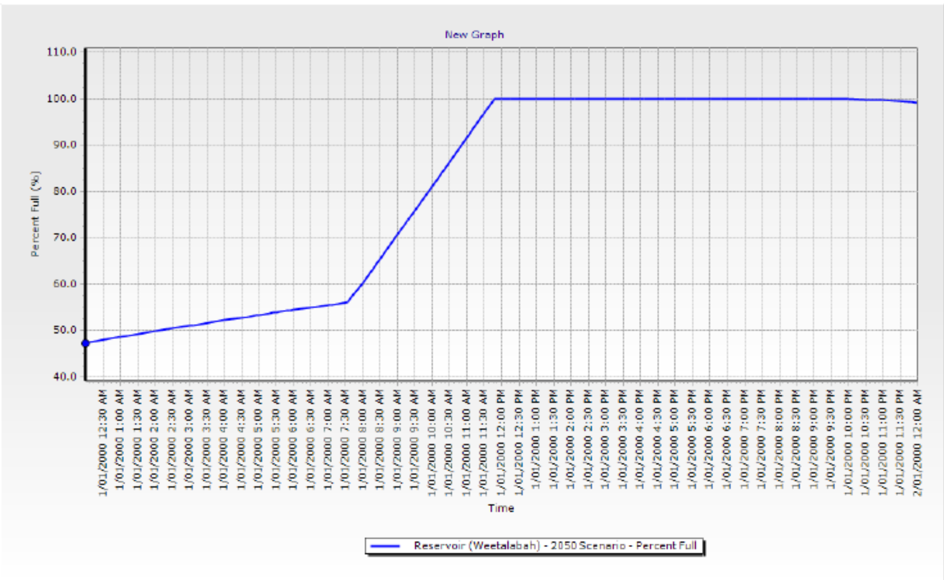
Time
Reservoir (Greenleigh 1) - 2050 Scenario - Percent Full


New Graph
Percent Full (%)
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
Time
Reservoir (Jerrabomberra 1) - 2050 Scenario - Percent Full


New Graph
Percent Full (%)
Time
Reservoir (Thornton 2) - 2050 Scenario - Percent Full


New Graph
Percent Full (%)
Time
Reservoir (Weetalabah) - 2050 Scenario - Percent Full

GHD

ghd.com

→ The Power of Commitment

QUEANBEYAN-PALERANG REGIONAL COUNCIL

Council Meeting Attachment

18 JANUARY 2023

ITEM 9.2 QUEANBEYAN INTEGRATED WATER CYCLE MANAGEMENT (IWCM) REPORT

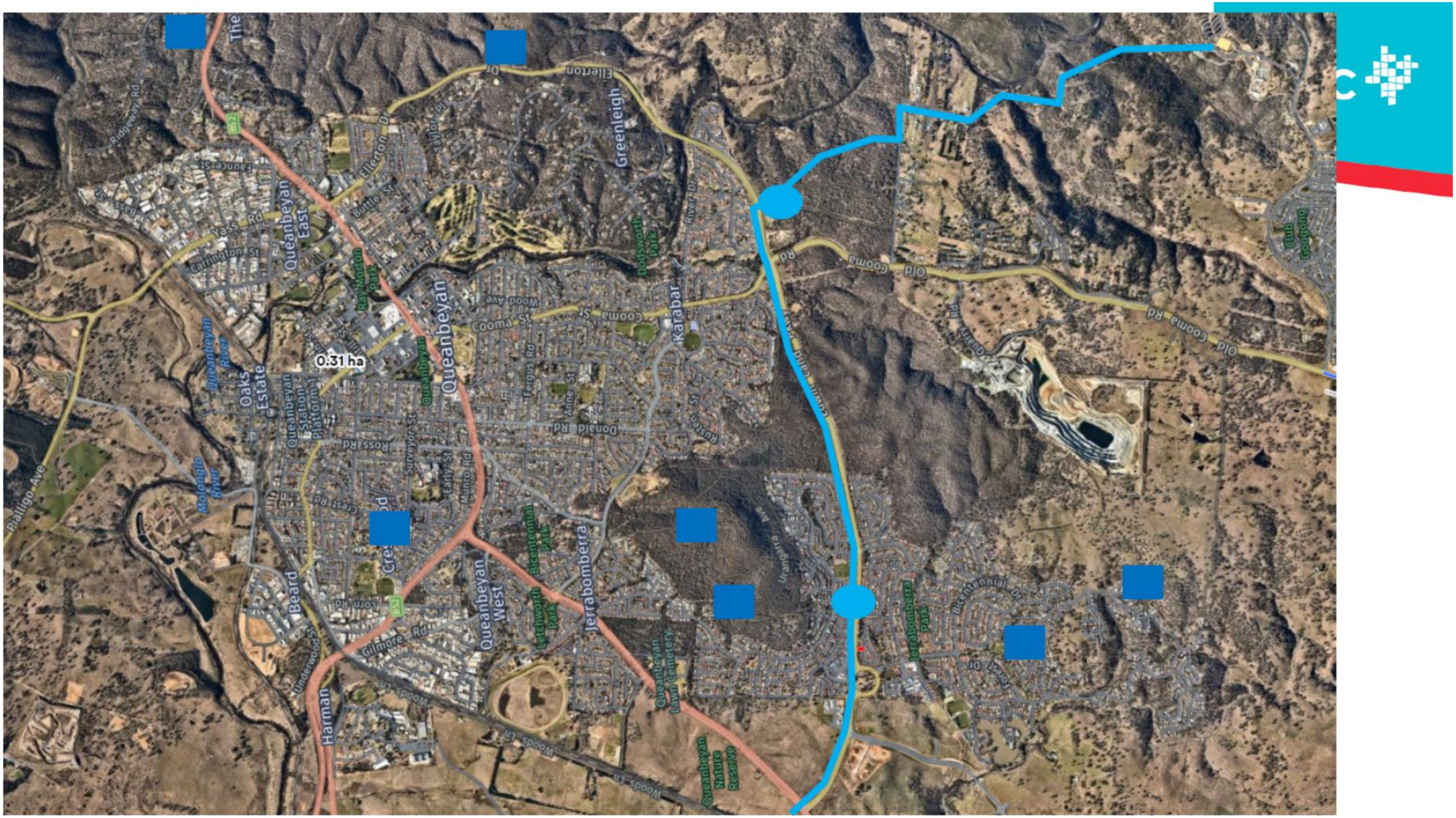
ATTACHMENT 4 IWCM & QSTP BUSINESS CASE PRESENTATION


QPRC
INTEGRATED WATER CYCLE MANAGEMENT PLAN
QSTP BUSINESS CASE
qprc.nsw.gov.au
dd Month yyyy
Doc Set ID: XXXXXXX

Water

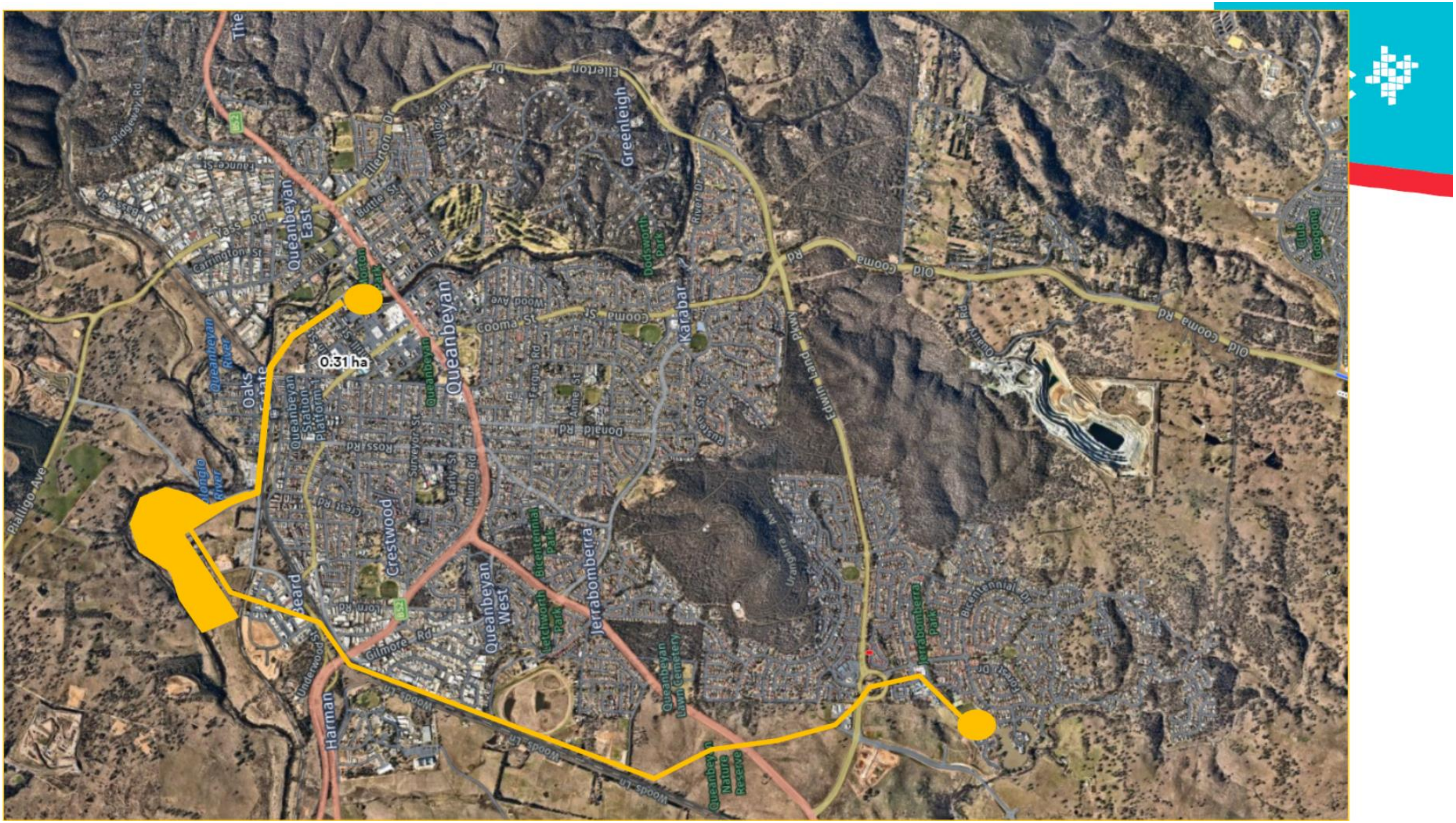
QPRC

- Treated bulk water is supplied to Queanbeyan by Icon Water, which is the water service provider responsible for providing potable water supply to the ACT.
- Treated bulk water is transferred to Queanbeyan from Icon Water's Mt Stromlo Water Treatment Plant (located in the ACT) and Googong Water Treatment Plant (located in NSW) via two bulk supply 'offtakes' to end users in Queanbeyan.
- A service level agreement is in place to manage this supply.


Ellerton Dr
Greenleigh
Ridgeway Rd
Faunce St
Queanbeyan East
Yass Rd
Carrington St
Buttle St
Dodsworth Park
River Dr
Ray Morton Park
Queanbeyan
Wood Ave
Cooma St
Karabar
Old Cooma Rd
Queanbeyan River
0.31 ha
Oaks Estate
Queanbeyan Station Platform 1
Fergus Rd
Donald Rd
Ross Rd
Surveyor St
Molonglo River
Pialligo Ave
Bicentennial Park
Jerrabomberra
Queanbeyan West
Letchworth Park
Beard
Gilmore Rd
Underwood St
Harman
Woods Ln
Queanbeyan Lawn Cemetery
Queanbeyan Nature Reserve
Jerrabomberra Park
Bicentennial Dr
Club Googong

Wastewater

- The sewerage system in the study area is predominantly a gravity reticulation system, comprising over 282 km of pipelines and 15 pumping stations.
- The reticulated network services the majority of Queanbeyan and Jerrabomberra, except for some semi-rural outer suburbs (e.g., The Ridgeway) where decentralised septic systems are used.
- The reticulated sewerage network transfers sewerage to the Queanbeyan Sewage Treatment Plant (STP), located to the north of Queanbeyan, within the ACT, on the south bank of the Queanbeyan River.
- The Queanbeyan STP is operated by Council.
- The treatment plant discharges to Molonglo River in accordance with ACT Environment Protection Authority (EPA) licence conditions.
- Downstream of the STP the Molonglo River drains into Lake Burley-Griffin.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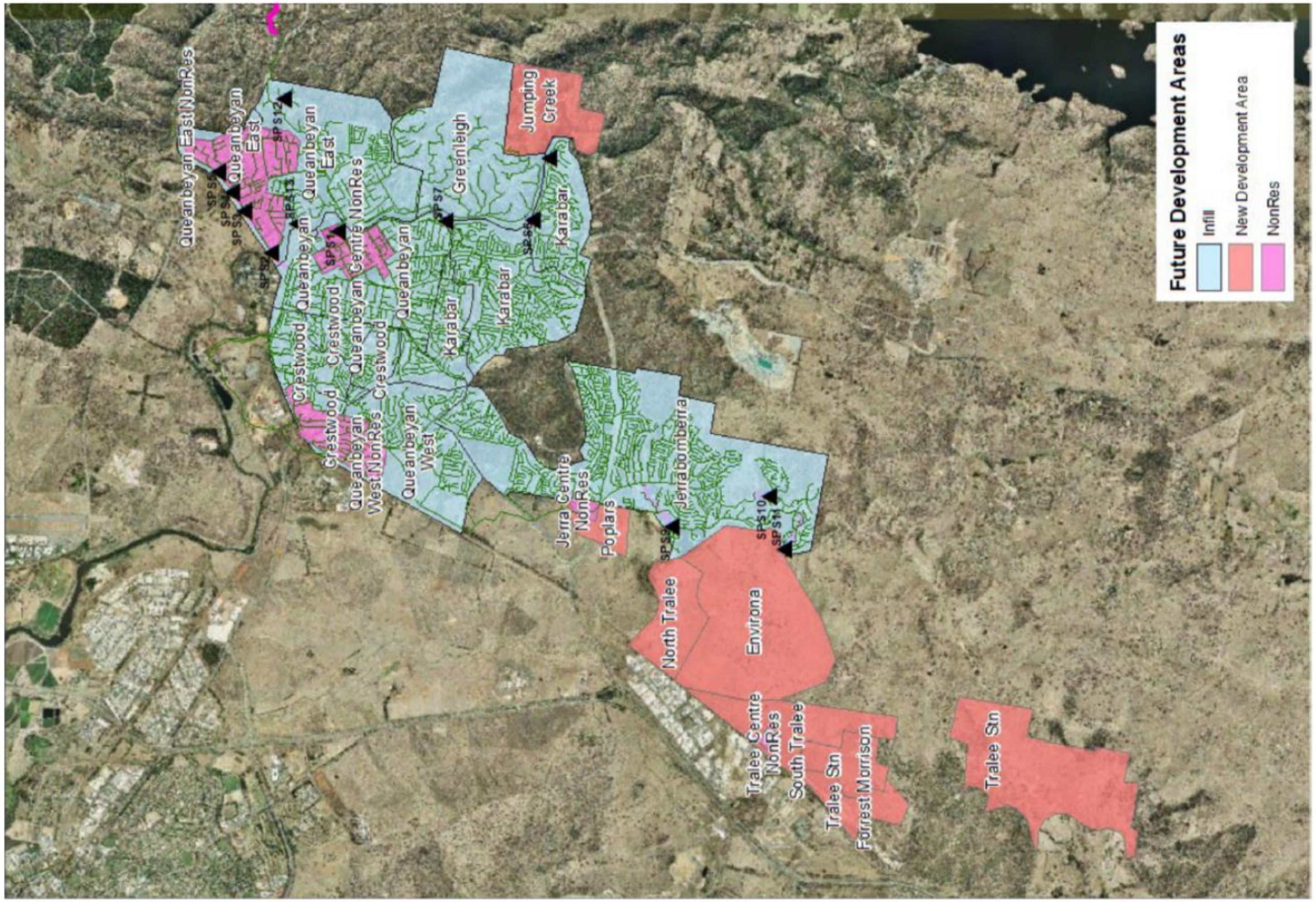
Crestwood
Queanbeyan West
Jerrabomberra
Karabar
Greenleigh
Edwin Land Pkwy
Ellerton Dr
Cooma St
Old Cooma Rd
Donald Rd
Ross Rd
Woods Ln
Harman
Pialligo Ave
Bicentennial Dr

Stormwater

QPRC

- The stormwater system in Queanbeyan comprises a reticulated system that drains via gravity into the Queanbeyan River, which in turn flows into Lake Burley-Griffin.
- Stormwater from Jerrabomberra and future development areas to the south of the city drain into Jerrabomberra Creek, which feeds the Jerrabomberra Wetlands and Lake Burley-Griffin

Growth Areas



Population Projections

QPRC

Table E1 Residential and Non-Residential Projections (Cumulative)

Queanbeyan IWCM	Forecast Year					
	2016	2021	2026	2031	2036	2050[2]
Residential Population	41,952	42,584	43,874	45,690	46,931	46,931
Residential Dwellings[1]	17,374	17,985	18,650	19,443	20,094	20,094
Non-residential (employment) Area, Ha	163	200	211	231	245	283
Non-residential (recreational) Area, Ha [3, 4]	UNK	3	13	26	26	26

Notes:

1. Dwellings assumed to represent low, medium and high density from private and non-private dwellings
2. There are no projections available for development areas beyond 2036 hence for the 2050 planning horizon there is no further growth assumed (as agreed with QPRC)
3. Existing (2016) recreational land area unknown (data not available)
4. Additional future recreational development (2021-2050) assumed to represent Public Open Space

Water Demand Analysis

- A demand analysis of the water system was performed through hydraulic modelling.
- The objectives of the hydraulic modelling included:
  - Assess the capacity of the trunk water supply network considering:
    - Ability of reservoirs to meet demand conditions
    - Ability of Icon Water offtakes to supply the service reservoirs
    - Ability of supply network if any of the reservoirs are offline
  - Determine upgrade requirements.

Future Water Supply Work

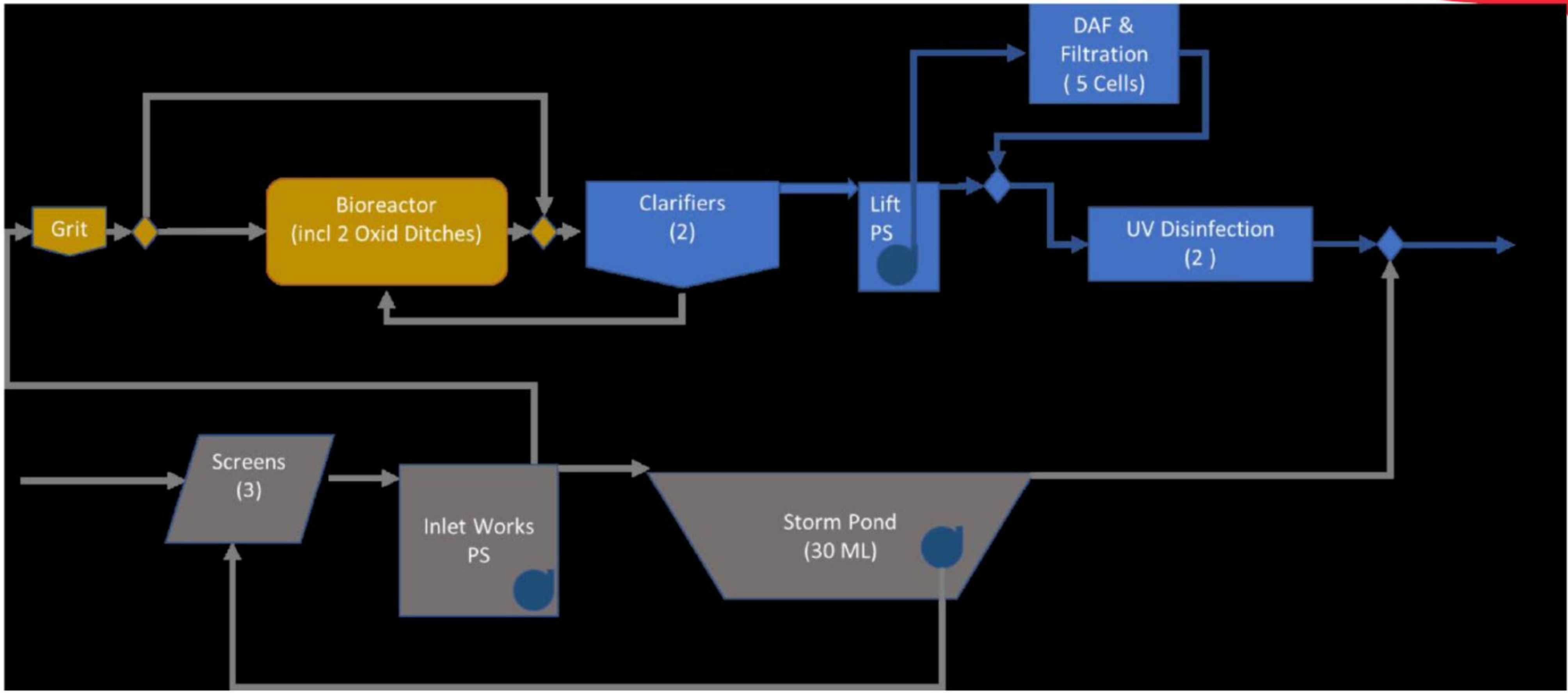
- Following the analysis undertaken, the proposed infrastructure upgrades include:
  - Duplication of Jerrabomberra Reservoir. Based on GHD cost curves, a high-level cost estimate for a 20 ML steel reservoir would be in the order of is $10 million. This includes upgrades to access roads.

- In addition, further investigation to be undertaken regarding:
  - Additional reservoir at East Queanbeyan
  - Recommissioning the Kendall Avenue connection to provide emergency supply only in the event of a major event affecting Offtake 1 and Offtake 2
  - Installation of chlorination infrastructure at appropriate locations in the network, likely to be at Jerrabomberra and East Queanbeyan reservoirs.
  - Possibility of decommissioning Crest Reservoirs
  - Upgrades for WHS access for all reservoirs

Wastewater Preferred Option

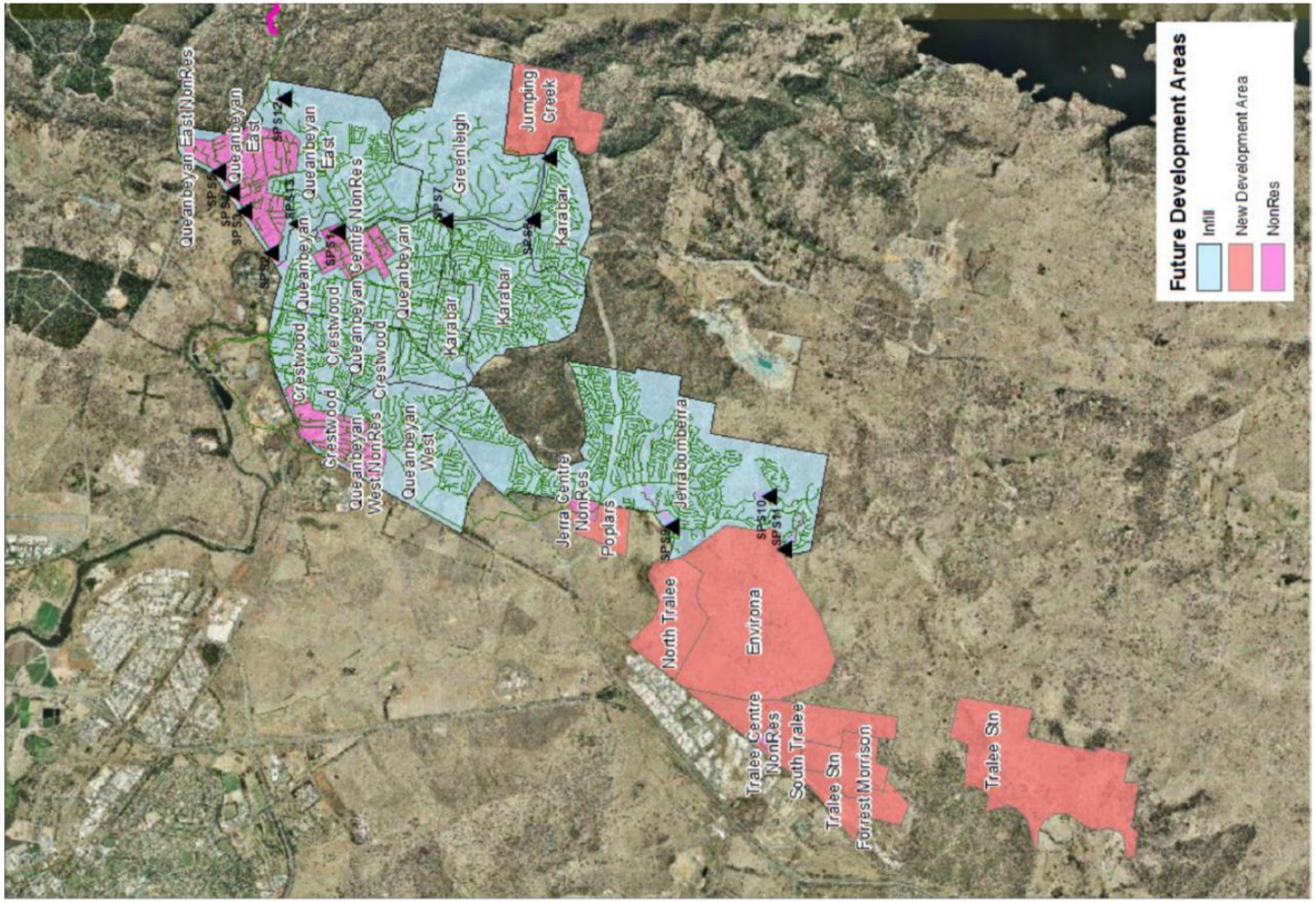
- The Queanbeyan STP Upgrade proposes the construction of a new treatment plant complete with:
  - Screening and grit removal
  - A continuous oxidation ditch activated sludge process with gravity clarifiers
  - Tertiary filtration
  - UV disinfection.
  - Waste sludge produced by the treatment process will be stabilised in an aerobic digester and dewatered; producing a biosolids product that is suitable for reuse.
  - Treated effluent will be discharged via an on-bank discharge structure adjacent to the Molonglo River.
  - Infrequent overflows from the Storm Pond will discharge at the same location.

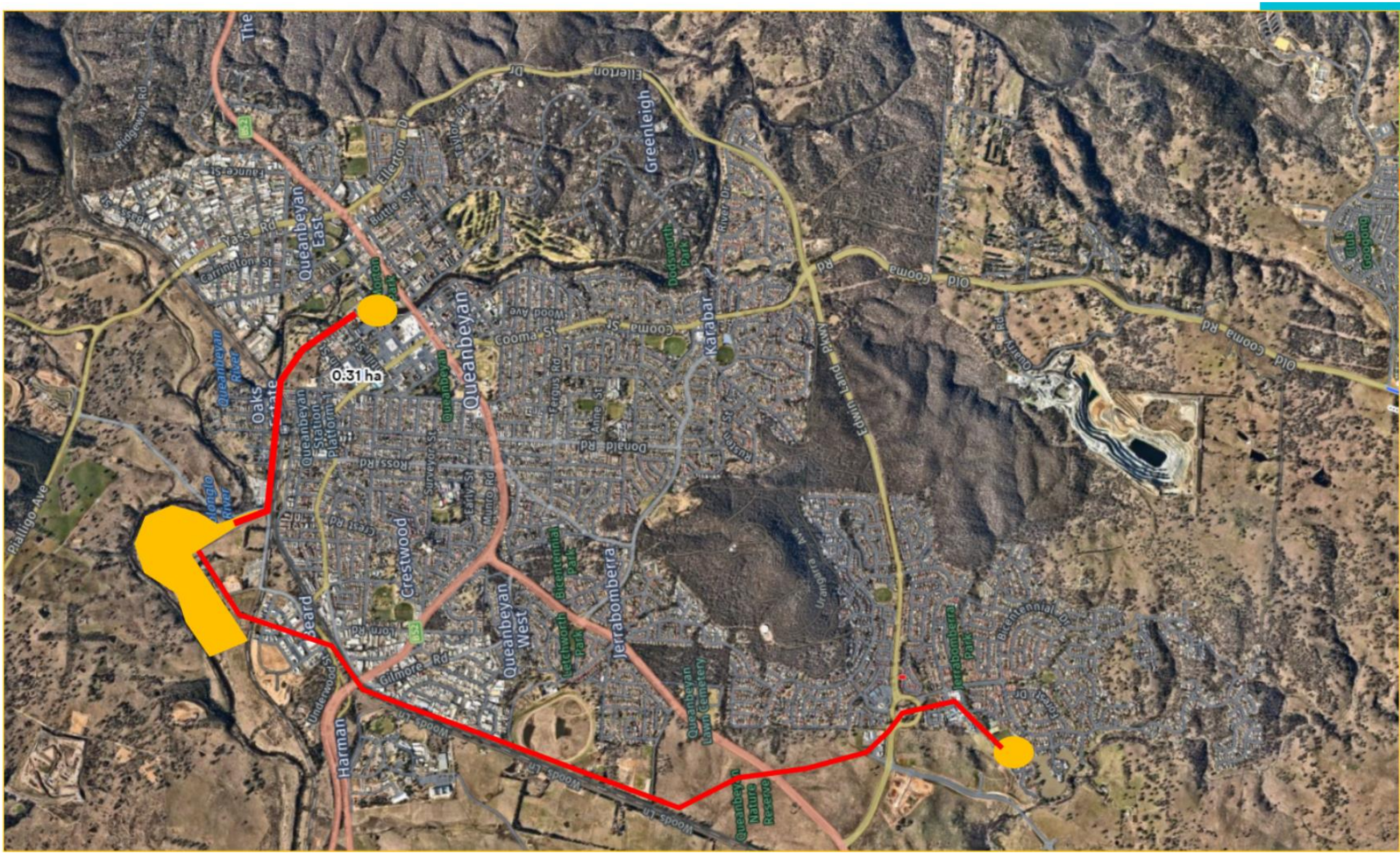
Treatment Process Flowchart



Growth Areas

QPRC

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Bicentennial Dr
Googong

Wastewater System Upgrades – Jerrabomberra subsystem

QPRC

Timing	Description	Estimated Cost
2024 (part of STP upgrade)	Jerrabomberra trunk-main diversion/replacement - 225 m x DN900 gravity main from W1 to the new inlet works	$880,000
2024	1,775 m x DN900 gravity main from W26 to W1	$10,040,000
2030	2,200 m x DN600 gravity main from W61 to W26	$5,470,000
2030	1,850 m x DN600 gravity main from W76 to W61	$4,480,000

Wastewater System Upgrades – Morisset Subsystem

Timing	Description	Estimated Cost
2024 (part of STP upgrade)	Morisset trunk-main diversion/replacement - 465 m x DN900 gravity main from F7 to the new inlet works	$1,980,000
2024	1,735 m x DN750 gravity main from MH 103303 to F7	$7,430,000
2024	150 m x DN225 gravity main from C604 to C371	$88,000
2024	150 m x DN150 gravity main from C703 to C605	$63,000
2024	150 m x DN375 gravity main from S26 to Kathleen St SPS	$242,000
2024	500 m x DN300 gravity main from S38 to S26	$330,000
2025	Replacement of ARC SPS – new 120 L/s capacity pump station	$1,790,000
2050	800 m x DN375 gravity main from F30 to F16	$1,045,000
2050	1,000 m x DN450 gravity main from F16 to F2	$1,408,000