Attachment 11

Demand

30 June 2022

Table of contents

11.1 Introduction ... 3

11.2 Proposed 2023–28 forecasts ... 5

11.2.1 Introduction ... 5

11.2.2 Water demand ... 5

11.2.3 Connections and billable fixtures ... 7

11.2.4 Sewage volumes ... 11

11.2.5 Development forecasts for capital contributions ... 12

List of tables

Table 11-1: Customer and community engagement feedback ... 4

Table 11-2: Icon Water's proposed dam abstractions forecast 2023–28 (ML) ... 6

Table 11-3: Tier 1 proportion of ACT water sales, estimated equation ... 7

Table 11-4: Proposed billed water sales forecast 2023–28 (ML) ... 7

Table 11-5: Proposed water connections forecast ... 8

Table 11-6: Proposed wastewater connections forecast ... 9

Table 11-7: Proposed billable fixtures forecast ... 10

Table 11-8: Forecast treated sewage effluent inflow volumes ... 11

Table 11-9: Proposed equivalent population infill growth ... 12

List of figures

Figure 11-1: Illustration of the 'building block' approach used to set prices ... 3

Figure 11-2: Simplified representation of the approach to forecasting water demand ... 6

Figure 11-3: Proposed water connections forecast ... 9

Figure 11-4: Proposed wastewater connections forecast ... 10

Figure 11-5: Proposed billable fixtures forecast ... 11

List of boxes

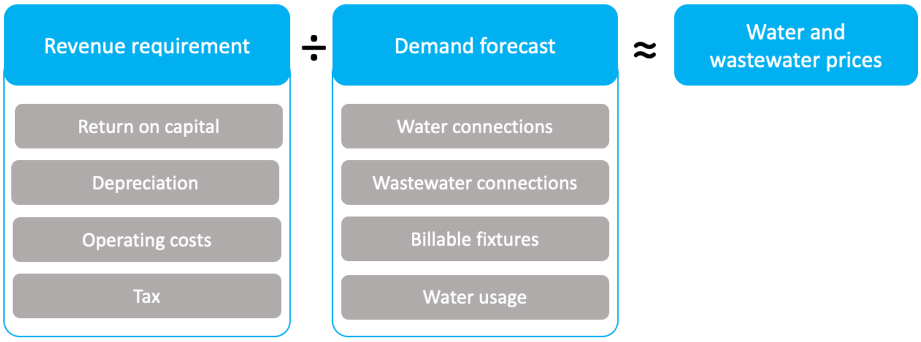
Box 11-1: Key points ... 4

11.1 Introduction

This attachment outlines Icon Water's proposed demand forecasts for water and wastewater services for the 2023–28 regulatory period. In developing these forecasts, Icon Water has adopted the methods set out in the 2021 decision by the Independent Competition and Regulatory Commission (the Commission/ICRC) on demand forecasting methodologies.[1]

Forecasting water and wastewater demand is a key part of setting prices. To determine the prices Icon Water can charge, the Commission divides Icon Water's revenue requirement by a forecast of demand for the five-year regulatory period. Some components of Icon Water's revenue requirement are also calculated using the demand forecasts (for example, maintenance and treatment costs). Therefore, having accurate demand forecasts is important for ensuring the Australian Capital Territory (ACT) community pays only for Icon Water's prudent and efficient costs of delivering water and wastewater services. Figure 11-1 provides an illustrative example of the 'building block' approach the Commission uses to set prices.

Figure 11-1: Illustration of the 'building block' approach used to set prices



Forecasting water demand can involve a degree of uncertainty, especially on shorter timescales when demand is highly influenced by the weather. The Commission applies a demand 'deadband' mechanism to help appropriately share the risk of demand volatility between Icon Water and customers. The deadband mechanism is described in **Attachment 4: Regulatory controls**.

Overview of this attachment

For each regulatory period, Icon Water must develop forecasts for four demand components which are directly used to set water and wastewater prices:

1. dam abstractions
2. billed water sales
3. connection numbers and wastewater billable fixtures[2]
4. wastewater volumes.

Icon Water also develops forecasts of 'equivalent population' growth and network augmentation requirements, which are used to set the capital contributions charge paid by ACT developers. This attachment outlines the forecasting methodology for each of the demand components and our proposed forecasts for the 2023–28 regulatory period.

[1] Independent Competition and Regulatory Commission, *Final Report: Review of water and sewerage services demand forecasting methods*, 2021, accessed via https://www.icrc.act.gov.au/water-and-sewerage/review-of-water-and-sewerage-services-demand-forecasting-methods

[2] Billable fixtures refers to the number of flushing fixture charges paid by Icon Water's customers. These charges are paid by non-residential customers for each flushing fixture in excess of two.

Box 11-1: Key points

- Icon Water's demand forecast is used to set water and wastewater prices – it helps ensure we recover the right amount of revenue to cover our approved costs for the 2023–28 regulatory period. The demand forecast also helps us plan the water and wastewater networks and prioritise investments as the network grows.
- The Commission conducted a detailed review of demand forecasting methodologies during the 2018–23 regulatory period. The review resulted in some updates to the forecasting methods, including using more up-to-date data on water usage, population growth and climate change. Icon Water has developed its demand forecasts for 2023–28 using the methodologies and data sources that were confirmed in the Commission's review.
- We are forecasting water connections to increase from 193,092 in 2021–22 to 215,890 by 2027–28, or around 1.9 per cent on average per year. Wastewater connections are forecast to increase from 192,123 to 209,558 over the same period (around 1.5 per cent per year). This growth is largely driven by ACT Government population growth projections for the Canberra region.
- Water sales are forecast to grow from 42.0 GL in 2021–22 to 46.0 GL in 2027–28, or around 1.5 per cent on average per year. We are forecasting a small decrease in average water usage per connection, from around 218kL in 2021–22 to 213kL in 2027–28.

Table 11-1: Customer and community engagement feedback

What we heard	Our response
The community agrees with the need to plan for the future, this includes investing in water security and exploring alternative water sources	Good demand forecasts allow us to plan for the future of the water and wastewater network by assessing how much customers use our services now, and how demand patterns are expected to change over time.
There is community support for achieving greater environmental sustainability and accelerating net zero while limiting impact on customer prices	As the ACT region grows and water usage changes, demand forecasts help us undertake forward-looking investments that maintain the quality services our community expects.
Affordability should underpin any investment decision. If we need to invest to avoid causing issues in the future, we will consider support for vulnerable customers and other impacted customer segments	Demand forecasts also help us to set prices at the right level, so we recover only the costs we need to efficiently provide a reliable and safe water and wastewater service. They also help determine how much we will need to spend over the five-year period, ensuring we can right-size our investments to keep pace with the ACT's growth and changing water usage behaviours.

11.2 Proposed 2023–28 forecasts

11.2.1 Introduction

In May 2021, the Commission commenced a review of water and wastewater demand forecasting methodologies. The review is a reset principle under the 2018–23 price direction, with the purpose of evaluating the forecasting methods to ensure they remain fit-for-purpose and use the best available data. Icon Water made several submissions to the Commission's review, and largely supported the existing methodologies noting they had performed well during the 2018–23 regulatory period.[3]

Icon Water appreciates the Commission including the demand forecasting review as a 'reset principle' which has allowed stakeholders time to provide feedback and consider the evidence ahead of the 2023–28 price proposal.

Since the forecasting methodology was addressed extensively in the Commission's review, it is not a focus of this submission, and Icon Water is not proposing any further changes to the methodology at this time. Icon Water's position on the forecasting methods can be found in our submissions to the Commission's review.

This attachment provides a brief overview of the Commission's approach to forecasting demand, and how it has been applied to determine Icon Water's forecasts for the 2023–28 period. Our proposed forecasts are based on the Commission's forecasts for 2023–28 provided to Icon Water in early 2022. A detailed description of the methodology and statistical results can be found in the Commission's final report.

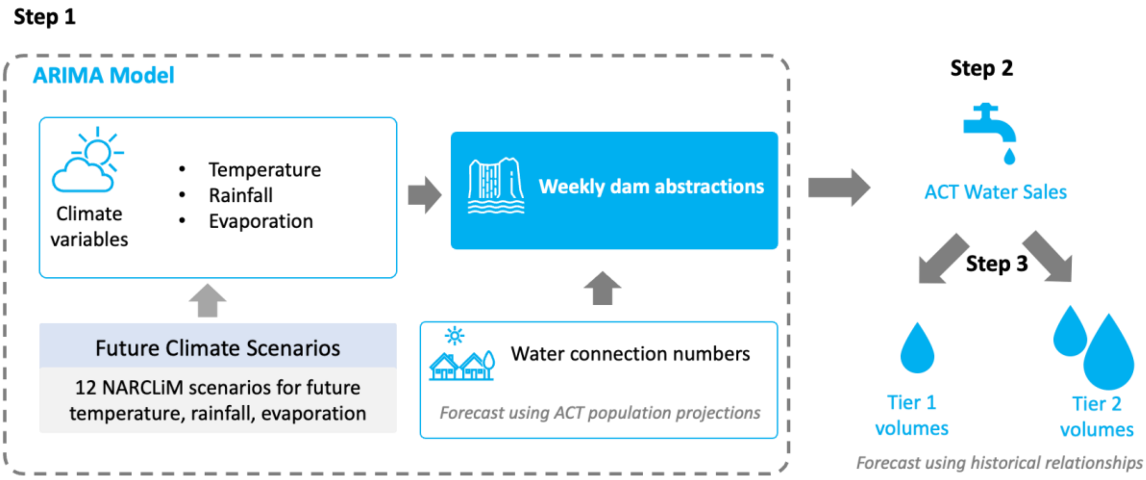
The forecasts in this proposal have been developed using actual data to 7 November 2021. We will update the forecasts with the latest available data ahead of our response to the Commission's draft price direction for the 2023–28 regulatory period in late 2022.

11.2.2 Water demand

The Commission derives forecasts for water demand using a three-step process, as shown in Figure 11-2.

[3] Icon Water's submissions to the demand forecasting review are published on the Commission's website: https://www.icrc.act.gov.au/water-and-sewerage/review-of-water-and-sewerage-services-demand-forecasting-methods

Figure 11-2: Simplified representation of the approach to forecasting water demand



Source: Independent Competition and Regulatory Commission, *Final Report on Demand Forecasting Methodologies*, 2021.

Step 1 involves forecasting dam abstractions based on the observed historical relationship between dam abstractions, climate variables (including temperature, rainfall, and evaporation), and water connection numbers. This is modelled using a multivariate Autoregressive Integrated Moving Average (ARIMA) model,[4] based on weekly historical data. The model uses historical data from July 2006 onwards to account for the change in water usage patterns that occurred following the millennium drought. To incorporate the effects of climate change, the model considers twelve future climate scenarios based on NSW and ACT Regional Climate Modelling (NARCLiM) projections. The final forecast is an average of the forecasts for the twelve climate scenarios.

Icon Water has adopted the Commission's forecasts, using actual dam abstraction and climate data to 7 November 2021. The resulting forecast is shown in Table 11-2.

Table 11-2: Icon Water's proposed dam abstractions forecast 2023–28 (ML)

	2023–24	2024–25	2025–26	2026–27	2027–28
Forecast abstractions	51,938	52,418	53,138	53,902	54,632

Source: ICRC demand forecasting Model, updated with actual data to 7 November 2021.

Step 2 produces a forecast of ACT water sales based on the observed historical ratio of water sales to total dam abstractions. This step is required because ACT water sales are lower than total dam abstractions due to factors such as water losses and sales of unregulated water (eg. to Queanbeyan-Palerang Regional Council). The historical relationship is estimated using a linear regression model based on aggregated annual dam abstraction and water sales data. This relationship is applied to the annual dam abstraction forecast obtained in Step 1 to estimate the forecast annual volume of ACT water sales for each year of the regulatory period.

Finally, in **Step 3**, the total ACT water sales are disaggregated across Tier 1 and Tier 2 of the water tariff. The Tier 1 price is payable on the first 50kL of water used by a customer per quarter. The Tier 2

[4] ARIMA is a type of econometric model which is commonly used to forecast a periodic time-series, such as water demand which has a strong seasonal component.

price, which is higher, applies to water usage over 50kL per quarter.[5] The Commission determines the split of Tier 1 and Tier 2 volumes based on the historical relationship between the proportion of Tier 1 sales and the average water usage per connection. For the 2023–28 period, the Commission determined that the relationship is best described using an exponential model of the form:

$$y = c + ae^{bx}$$

Where y is the Tier 1 proportion of total ACT water sales; x is the average annual ACT water consumption per customer; e is Euler's number;[6] and a, b, c are the coefficients of the regression. The model was estimated using historical data from 2009–10 to 2020–21, with the results shown in Table 11-3.

Table 11-3: Tier 1 proportion of ACT water sales, estimated equation

	Coefficient	Standard error	t-value	p-value	Significance
a	-2.048480	11.7908	-0.17373	0.865919	
b	9.137684	16.456	0.55528	0.592237	
c	78.12876	32.980	2.36896	0.041981	**

Source: ICRC demand forecasting model, updated with actual data to 7 November 2021.

This relationship was applied to produce the proposed forecast for Tier 1 and Tier 2 billed sales, as shown in Table 11-4.

Table 11-4: Proposed billed water sales forecast 2023–28 (ML)

	2023–24	2024–25	2025–26	2026–27	2027–28
Tier 1	27,286	27,675	28,139	28,623	29,101
Tier 2	16,426	16,438	16,574	16,727	16,857
Total	**43,712**	**44,112**	**44,712**	**45,350**	**45,958**

Source: ICRC Demand Forecasting Model, updated with actual data to 7 November 2021.

11.2.3 Connections and billable fixtures

Forecasts of water installations, wastewater installations, and wastewater billable fixtures are required to set prices and to determine Icon Water's required revenue for the regulatory period. In this context, connections and billable fixtures refer to the number of supply charges paid by Icon Water customers.[7]

Icon Water's annual water supply charge, wastewater supply charge, and flushing fixture charge account for around 60 per cent of Icon Water's regulated revenues. Unlike water sales, these forecasts are not subject to a demand volatility adjustment. Therefore, accurate connections and billable fixture

[5] In practice, due to differences in the timing of customer meter reads, the Tier 1 price is billed for consumption up to 0.548kL on average per day of a customer's billing cycle, and the Tier 2 price applies to consumption thereafter.

[6] Euler's number is a mathematical constant approximately equal to 2.71828.

[7] Icon Water's tariff structure includes fixed supply charges for water and wastewater, as well as two tiers of usage charges for water. Non-residential customers also pay a wastewater fixture charge for each flushing fixture in excess of two. For more on tariffs see **Attachment 12: Tariff structure and proposed prices**.

forecasts are essential to ensuring customers pay a fair and efficient price. If the forecasts are too low, prices will be set too high, and customers will pay more than the efficient cost of water and wastewater services. Similarly, if the forecasts are too high, prices will be too low, and Icon Water may not collect enough revenue to cover its costs.

The Commission's approach to forecasting connections and billable fixtures is based on ACT population projections. The approach involves estimating the historical relationship between ACT population[8] and each of the three variables: water connections; wastewater connections, and billable fixtures. This historical relationship is then applied to ACT population projections to derive forecasts for the 2023–28 regulatory period.

The Commission uses ACT population projections developed by the Australian Government's Centre for Population Studies, which are the most current projections available at this time.[9] Icon Water understands that the ACT Government is currently updating its population projections to account for the effects of the COVID-19 pandemic. We will consider adopting these updated forecasts if they become available prior to our response to the Commission's draft decision due in late 2022.

The sections below outline Icon Water's proposed forecasts for water connections, wastewater connections, and billable fixtures.

Water connections forecast

To forecast water connections, the Commission uses a cubic regression (polynomial of degree 3) with the following specification:

$$Connections_{water} = \alpha + \beta_1 Population + \beta_2 Population^2 + \beta_3 Population^3$$

where $\alpha, \beta_1, \beta_2, \beta_3$ are the regression coefficients.

The model was estimated using historical connections and population data from June 2007 to June 2021. The estimated relationship was then applied to ACT population projections for 2022 to 2028.

Icon Water notes that the Commission's model resulted in a forecast decline in water connections between 2020–21 and 2021–22. This result does not fit with the observed trend of connections consistently increasing each year. To correct for this, Icon Water made an adjustment to the regression results such that the fitted value for 2020–21 is equal to the actual number of water connections in that year. [10]

The resulting forecast for water connections is shown in Table 11-5.

Table 11-5: Proposed water connections forecast

	2023–24	2024–25	2025–26	2026–27	2027–28
Water connections	199,679	203,460	207,469	211,639	215,890

Source: ICRC Demand Forecasting Model, adjusted by Icon Water to prevent a decline in the forecast in 2021–22.

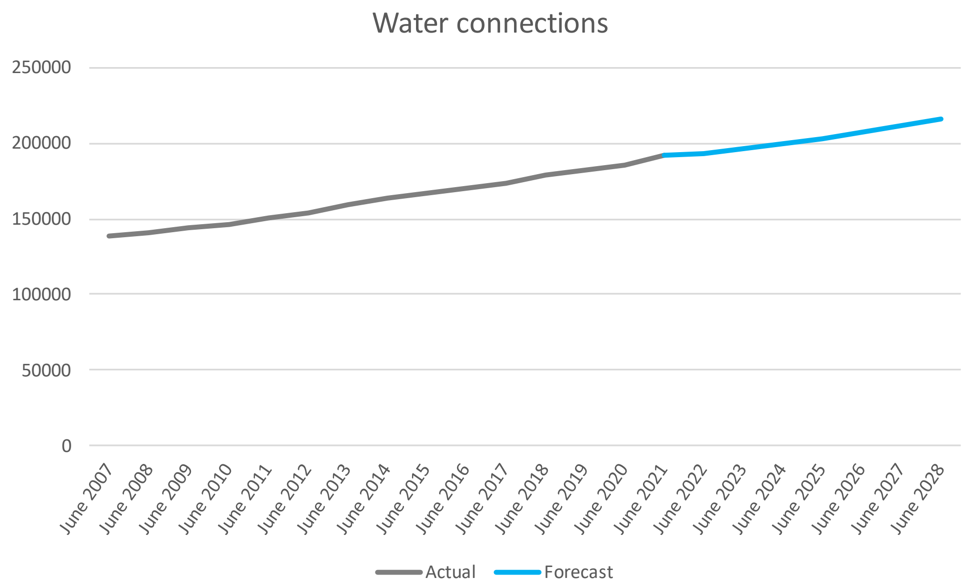
The actual and forecast water connection numbers are also shown in Figure 11-3.

[8] The Commission uses data from Australian Bureau of Statistics, *3101.0 National, State and Territory Population*, March 2022

[9] Australian Government Centre for Population, *Population Statement: State and Territory Population Projections, 2020-21 to 2031-32*, viewed 20 December 2021 at https://population.gov.au/data-and-forecasts/projections

[10] The adjustment involved adding a fixed constant of 3,588 connections to each year of the forecast. This is equivalent to an 'upward shift' in the regression line such that it passes through the final actual data point (2020–21). The 'slope' of the regression (ie the rate at which connections increase with population) was not changed.

Figure 11-3: Proposed water connections forecast



<u>Wastewater connections forecast</u>

The wastewater connections model was estimated by Icon Water using a linear regression with the following specification:

$$Connections_{wastewater} = \alpha + \beta\ Population$$

Where α and β are the regression coefficients. This is the same specification used by the Commission in its final report on demand forecasting methods.[11]

The model was estimated using historical connections and population data from June 2007 to June 2021. The estimated relationship was applied to population projections for 2022 to 2028. Similar to the forecast for water connections, it was necessary to adjust the regression results such that the fitted value is equal to the actual value in 2020–21.[12]

The resulting forecast for wastewater connections is shown in Table 11-6.

Table 11-6: Proposed wastewater connections forecast

	2023–24	2024–25	2025–26	2026–27	2027–28
Wastewater connections	197,572	200,538	203,565	206,592	209,558

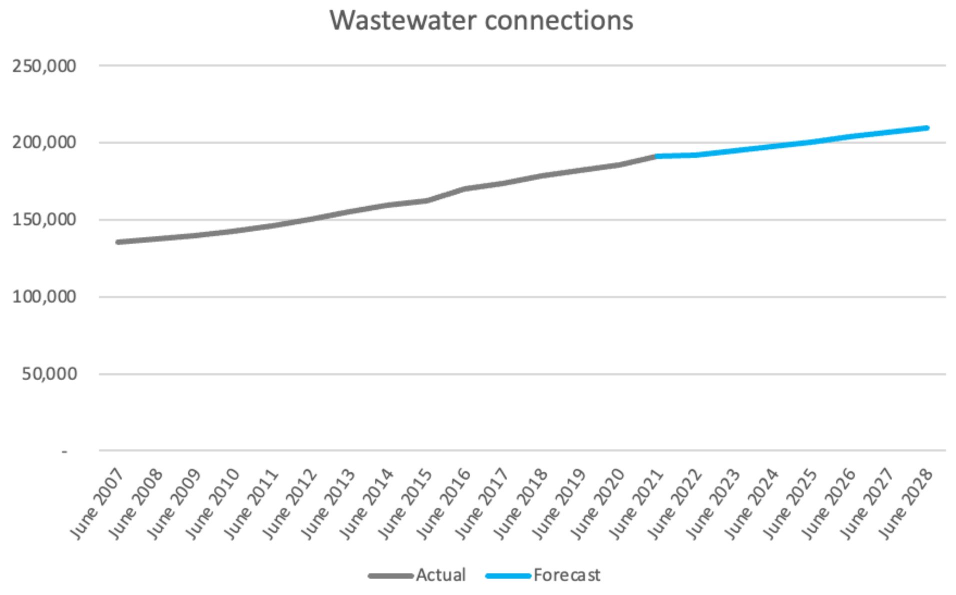
Source: Icon Water.

The actual and forecast wastewater connection numbers are also shown in Figure 11-4.

[11] Independent Competition and Regulatory Commission, *Final Report: Review of water and sewerage services demand forecasting methods*, 2021, p. 76. Accessed at https://www.icrc.act.gov.au/water-and-sewerage/review-of-water-and-sewerage-services-demand-forecasting-methods.

[12] The adjustment involved adding a fixed constant of 4,672 connections to each year of the forecast.

Figure 11-4: Proposed wastewater connections forecast



Billable fixtures forecast

The billable fixtures model was estimated using a linear regression with the following specification:

$$Billable\ Fixtures = \alpha + \beta\ Population$$

Where α and β are the regression coefficients. This is the same specification used by the Commission in its final report on demand forecasting methods.[13]

The model was estimated using historical billable fixtures and population data from June 2014 to June 2021. The estimated relationship was applied to population projections for 2022 to 2028. Similar to the forecast for wastewater connections, it was necessary to adjust the regression results such that the fitted value is equal to the actual value in 2020–21.[14]

The resulting forecast for billable fixtures is shown in Table 11-7.

Table 11-7: Proposed billable fixtures forecast

	2023–24	2024–25	2025–26	2026–27	2027–28
Billable fixtures	64,962	65,231	65,506	65,780	66,049

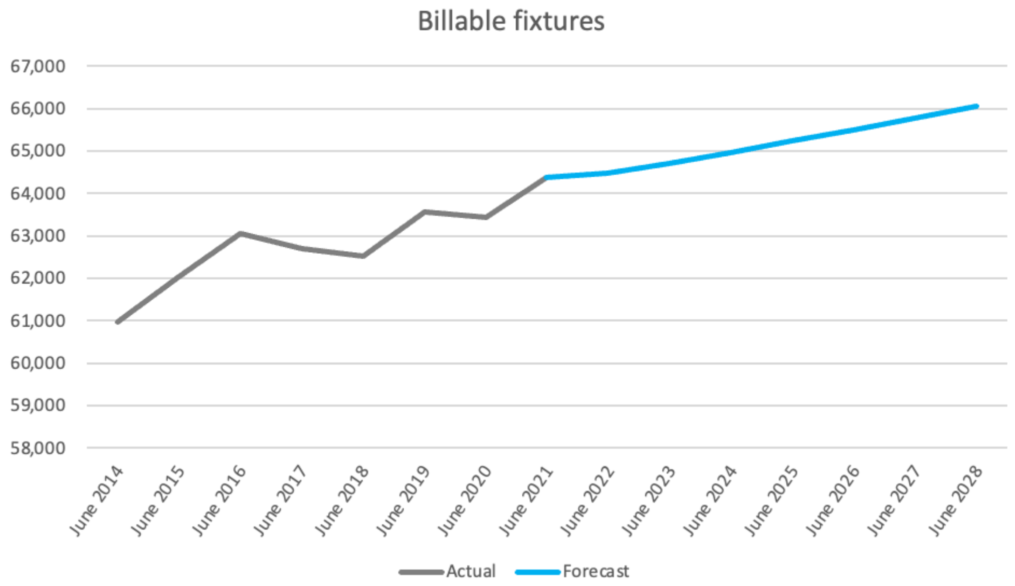
Source: Icon Water.

The actual and forecast billable fixtures are also shown in Figure 11-5.

[13] Independent Competition and Regulatory Commission, *Final Report Review of water and sewerage services demand forecasting methods*, 2021, p. 77.

[14] A constant of 519 fixtures was added to each year of the forecast results.

Figure 11-5: Proposed billable fixtures forecast



11.2.4 Sewage volumes

Forecasts of sewage volumes are required to forecast sewage treatment costs. Sewage volumes can be highly variable from year to year due to short-term factors such as weather and seasonal impacts. The wastewater system needs to be built to cope with above-average flows occurring over short periods of time.

To manage this variability, Icon Water uses a scenario-based approach to forecasting sewage volumes. This involves analysing historical average sewage flows into Lower Molonglo Water Quality Control Centre (LMWQCC), and estimating long-term trends based on different assumptions about:

- average annual sewage volume per resident
- population projections
- long-term climate scenarios (dry, average or wet)
- seasonal impacts
- rates of groundwater or surface storm water flow into the wastewater system.

The average of the scenarios is used to determine the final sewage volume forecast.

This approach was accepted by the Commission in its final report on demand forecasting methodologies.

Icon Water's proposed forecast for 2023–28 is shown in Table 11-8, which shows the average expected flow increasing from 37.58 GL per annum in 2023–24 to 39.81 GL per annum by 2027–28.

Table 11-8: Forecast treated sewage effluent inflow volumes

	2023–24	2024–25	2025–26	2026–27	2027–28
Inflow volumes (GL)	37.58	38.14	38.70	39.25	39.81

Source: Icon Water.

11.2.5 Development forecasts for capital contributions

To set our capital contributions charge (or 'Precinct Charge'),[15] we forecast 'equivalent population' growth in established suburbs and identify future network augmentation required to service that growth.

Icon Water makes an application to the Commission each year to propose the Precinct Charge for the following year. This application includes the financial model used to calculate the Precinct Charge which identifies:

> *Any revisions to the 20-year projections of ACT population growth and capital expenditure required to augment the water and sewerage network to service this growth.*[16]

This means that the forecasts developed for capital contributions purposes are for a longer time horizon than the other forecasts outlined in this attachment (ie. 20 years versus five to six years). Icon Water has an opportunity to review and update the forecast more frequently outside of the five-year regulatory submission process (ie. each year as part of the application to the Commission).

Icon Water's current 'within precinct' growth forecast for 2023–28 is shown in Table 11-9. This will continue to be reviewed and refined during the regulatory period based on the latest available data, and reported to the Commission in the annual price reset process.

Table 11-9: Proposed equivalent population infill growth

	2023–24	2024–25	2025–26	2026–27	2027–28
Infill growth (equivalent population)	4,370	4,370	4,370	4,370	4,370

Source: Icon Water.

Forecast augmentations for the 2023–28 regulatory period to service this growth are included in **Attachment 7: Capital expenditure**.

[15] Referred to as the 'Class 2 Infrastructure Charge', which is payable for developments 'inside a precinct'. Further information on the Precinct Charge is outlined in **Attachment 12: Tariff structure and proposed prices**.

[16] Independent Competition and Regulatory Commission, *Price Direction Regulated water and sewerage services 1 July 2019 to 30 June 2023*, 2019, Clause 11.1.1.

Abbreviations and acronyms

ACT	Australian Capital Territory
ARIMA	Autoregressive Integrated Moving Average
Commission	Independent Competition and Regulatory Commission
ICRC	Independent Competition and Regulatory Commission
LMWQCC	Lower Molonglo Water Quality Control Centre
NARCLiM	NSW and ACT Regional Climate Modelling