PRICE MONITORING SUBMISSION - 2013 –15

Submitted to the Queensland Competition Authority.

INDUSTRY

Water Supply, Sewage Transport and Treatment

BUSINESS UNITS

Water Distribution,
Sewage Transport and Treatment, Trade Waste
and Water Retail Services

Unitywater

0229-01

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Dr Malcolm Roberts
Chairman
Queensland Competition Authority
Email: seqwater@qca.org.au
Brisbane QLD 4001

28 June 2013

Dear Dr Roberts

South East Queensland (SEQ) Price Monitoring Submission 2013-14 to 2014-15

Please find attached Unitywater's fourth Price Monitoring Submission to the Queensland Competition Authority (QCA). This submission contains Unitywater's forecast of water supply and retailing costs as well as sewage collection, transport and treatment costs for the period 2013-14 to 2014-15. The Board's Members Responsibility Statement is provided as Attachment 1 of this covering letter.

The former State Government legislated to impose a CPI price cap for 2011-12 and 2012-13. That legislation provided Unitywater with the option to increase the 2012-13 water supply and sewerage service prices by 1.3%[1]. Unitywater declared a freeze on water supply and sewerage service prices for the 2012-13 financial year and has since undertaken tariff reform with prices announced in April 2013. Unitywater's announcement delivers greater levels of customer control over their usage and billing, particularly at a time when many people are struggling with the rising cost of living.

Unitywater remains committed to its 24 hour service delivery, and capital works program for 2013-14 to 2014-15, as the business continues to address the need for investment in critical capital works to address growth, renewal, service standard or compliance issues in Unitywater's service area. Unitywater will continue to roll out investment in essential service infrastructure across its area of operations.

Increases in bulk water charges are in the hands of the Queensland State Government and beyond Unitywater's control. Unitywater is required by law to pass through in full, any State Government decision on bulk water prices.

The State Government legislation that removed the requirement for participating councils to publish price mitigation plans and final price paths has reduced duplication in reasonable pricing oversight and avoided additional operating costs.

[1] ABS index number 6401.0 Brisbane March to March all groups CPI.

Moreton Bay and Sunshine Coast Regional Councils as participants in Unitywater, utilise their returns[2] to contribute towards the quality and availability of social infrastructure within the Sunshine Coast and Moreton Bay regions. In 2013-14 Unitywater expects revenue to be below the Maximum Allowable Revenue (MAR), and that under recovery will have implications for Unitywater and its stakeholders.

Unitywater has elected to transition treatment of developer's contributions from revenue offset to asset offset. Unitywater notes the QCA's revised benchmark weighted average cost of capital (WACC) of 6.57% is a 30% reduction from the previous benchmark WACC of 9.35%. Unitywater has elected to depart from the benchmark WACC and proposes a more stable long term WACC of 7.62%. Unitywater fundamentally considers that the "saw-tooth" effect of volatile WACC observations should be addressed by taking a long term finance approach to managing long term infrastructure.

Unitywater has continued to propose the MAR Adjustment Transition Scheme (MAT scheme) to capture and carry forward revenue under-recoveries. Carried forward balances may be recouped in the future over a period to be determined with relevant stakeholders.

Unitywater has achieved much since it commenced operations on 1 July 2010 and remains committed to improving customer service, achieving operational efficiencies and providing high-quality, affordable and sustainable water supply and sewage collection, transport and treatment services that provide benefits to customers, community and the environment. Two examples of efficiency include the:

- Decision to divert sewage from the Brendale sewage treatment plant (STP) to Queensland Urban Utilities (QUU) Luggage Point STP that deferred Brendale STP augmentation saving of $25.7M; and

- Plan to divert sewage from the Suncoast STP by building a pipeline to the Maroochydore STP that will permit temporary decommissioning of the Suncoast STP rather than upgrading the plant saving $13.0M.

Unitywater is committed to promoting innovative solutions to address network constraints or to meet environmental standards and actively promotes discussion amongst stakeholders and regulators. Traditional approaches of upgrading STPs to meet increasingly stringent environmental standards may, in some circumstances, be a more expensive option when a non-network or network reconfiguration alternatives may address network constraints more cost-effectively.

Examples of non-network alternatives include undertaking works in the water catchment that reduces nutrient loads on receiving waters rather than investing in more advanced STPs, or approval of ocean outfalls rather than river outfalls that not only are more affordable but may also permit a different use of the carbon in the effluent and make electricity generation more attractive.

[2] Unitywater's returns to councils take the form of tax equivalents payments; interest on debt and participant returns.

Unitywater welcomes any opportunity to gain greater insight into the views of the QCA, DERM, DEWS and other interested stakeholders and customers on how Unitywater can:

1. Provide benefits through taking a whole of region approach to investment and management of water supply and sewerage infrastructure;
2. Minimise cost increases for customers;
3. Deliver innovative capital solutions;
4. Seek cost efficient environmental solutions;
5. Commitment to review service standards jointly with QUU and Gold Coast Water;
6. Deliver savings through rationalisation and leveraging investment in new systems; and
7. Ensure long term sustainability by balancing customer, network and business risks.

Unitywater's aim has always been, and will continue to be, to keep prices as low as possible, whilst reliably meeting customer obligations and maintaining the business as a credible water supply and sewerage service provider that customers and regulators trust.

Any queries relating to this submission can be emailed to pricemonitoring@unitywater.com attention the Manager of Regulatory Affairs, Damian Platts. Media enquiries can be directed to media@unitywater.com or contact the Unitywater Duty Media Manager on 0488 980 564.

Yours sincerely

[redacted]

George Theo
Chief Executive Officer

Attachment 1: Board Members Responsibility Statement

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Board Members RESPONSIBILITY STATEMENT

In the opinion of the Board Members of Unitywater:

a the *price monitoring information returns* set out on pages 1 to 59 are drawn up so as to fairly represent, in accordance with the requirements of the SEQ Price Monitoring Information Requirements for 2013-15 issued by the Queensland Competition Authority, ("Information Requirements"):

   i the information required by the Information Requirements;

   ii the information on *related party* transactions required;

   iii the information on *third party* transactions required by the Information Requirements; and

b the terms and definitions used in this statement accord with the definitions set out in the Information Requirements.

Signed in accordance with a resolution of the Board:

[redacted]

Mr Jim Soorley Dated 26/6/2013

Chairman

Please append an extract of the Minutes of the Board Meeting that the above attestation.

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1. BALANCED CUSTOMER OUTCOMES

This 2013-15 Price Monitoring Submission (PMS) reflects Unitywater's strategic direction in that Unitywater excels in aspects of the business that contribute towards reliably delivering potable water supply and sewerage services at the lowest possible cost to customers.

Unitywater's strategic direction emphasises a major focus on Operational Excellence through the achievement of the following strategic priorities:

- Enhance customer value;
- Improve sustainability; and
- Develop an operationally excellent organisation.

Unitywater's corporate strategic plan acknowledges that as Unitywater builds capabilities, during a time of evolving sector reform, Unitywater will continue to focus on long term economic, social and environmental sustainability. In addition, Unitywater will pursue non-regulated business opportunities for re-investment back into the business and participating councils.

The Queensland Competition Authority (QCA) 2010-11, 2011-12 and 2012-13 price monitoring reviews concluded there was no evidence of Unitywater exercising monopoly power, and that it had under-recovered its Maximum Allowable Revenue (MAR) by approximately $20.6M[1], $56.8M[2] and $40.7M [3] respectively. Furthermore, Unitywater is forecasting to under-recover its MAR by approximately $93.1M in 2013-14 and $91.6M 2014-15.

This document and the accompanying templates form Unitywater's response to QCA's 2013-15 information requirements request and is the fourth price monitoring submission in as many years.

1.1. ENSURE LONG TERM BUSINESS SUSTAINABILITY

Unitywater balances prices with operational risks, financial sustainability and fulfilling customer service standards (CSS) for water supply and sewerage services in a way that results in the least cost to customers.

Unitywater's infrastructure provides for sustainable regional development by upgrading sewage treatment plants (STPs) such as Redcliffe, Landsborough, Cooroy, Maleny, Noosa and Kawana. These investments facilitate population growth, housing and commercial expansion in a manner that does not degrade the environment.

Unitywater's planning explicitly considers the cost to serve our customers, regional growth and the maintenance of service standards. Unitywater will engage consultants to explore service standards and demand forecasting for the purposes of bulk supply estimates, fire standards, capital works planning and pricing. In Unitywater's opinion, the reconsideration of service standards could provide benefits through deferring construction or lowering operating costs. This aligns with the strategic direction which seeks to reduce the total cost of services and is consistent with the work being undertaken to reform tariffs.

[1] QCA Final Report SEQ Interim Price Monitoring Part A – Overview March 2011, pi
[2] QCA Final Report SEQ Interim Price Monitoring Part A – Overview March 2012, pii
[3] QCA Final Report SEQ Interim Price Monitoring Part A – Overview March 2013, pi

2. WHO WE ARE AND WHAT WE DO

2.1. WHO IS UNITYWATER?

Unitywater provide water supply and sewerage services to residential and business customers throughout the Moreton Bay and Sunshine Coast regions. Unitywater commenced operations on 1 July 2010.

Unitywater provides water supply and sewerage services to approximately 722,030 residents with approximately 282,000 residential and business water supply connections and 269,748 residential business and sewerage connections across a service region of approximately 5,223 km^2, stretching from Ferny Hills in the south to Noosa in the north.

Twenty-four hours a day, seven days a week (24/7) Unitywater's priority is to provide customers with value for money water supply and sewerage services that they can trust and rely on. Unitywater operates and maintains more than $2.8 billion of essential service infrastructure to provide water supply and sewage collection, transport and treatment services.

Unitywater's corporate values are a platform for the Strategic Plan, the values reflect the types of behaviour required in achieving the strategic plan. Unitywater's corporate values are:

- Reliability
- Safety
- Honesty and Integrity

Unitywater's network statistics as at 30 June 2012 are in Table 1 below:

Table 1 – Unitywater quick statistics

Unitywater quick statistics	Moreton Bay	Sunshine Coast	Total
Population[4]	399,406	322,624	722,030
Residential Water Connections[5]	142,737	124,373	267,110
Non-Residential Water Connections	6,721	8,486	15,207
Residential Sewerage Connections	132,201	124,599	256,800
Non-Residential Sewerage Connections	5,455	7,493	12,948
Water reservoirs	43	65	108
Pump stations (79 water and 777 sewage)	372	484	856
Water supply network (km)	3,087	2,455	5,542
Recycled water network (km)	64	15	79
Wastewater network (km)	2,839	2,513	5,352
Sewage treatment plants (STPs)	8	10	18
Advanced water treatment plants (AWTPs)	2	-	2

[4] ABS, Regional population growth, Australia, 2011-12, cat no 3218 and unpublished data

[5] Connection numbers residential, non residential, sewer and water as of 1 June 2013 Unify system generated

Unitywater currently has two participating councils: Moreton Bay Regional Council (MBRC) and Sunshine Coast Regional Council (SCRC).

The Noosa referendum passed a motion to de-amalgamate from Sunshine Coast Regional Council and the reconstituted Noosa Shire Council is expected to be established by 1 January 2014. Unitywater will welcome Noosa as a third participating council and will continue to provide water supply and sewerage services for Noosa residents and businesses.

Unitywater has an independent skills based Board that was appointed by its participating councils. Participating councils receive returns from Unitywater in accordance with a Participation Agreement.[6] The returns to participating councils contribute towards the quality and availability of social infrastructure within their regions.

The majority of infrastructure transferred to Unitywater was developed by local governments over the past eight decades and the portfolio of assets has varying capacities, condition, technologies, performance and degrees of integration. Unitywater continues to learn about the condition and performance of its network of pipes, pumps, reservoirs and treatment plants and actively considers opportunities to optimise network utilisation, integration and design in order to defer capital expenditure, achieve business efficiencies in order to constrain price rises thus lowering cost of living pressures for customers.

Maintaining and operating an asset intensive business takes a great deal of planning, co-ordination and hard work to ensure that, all day, every day, customers can turn on a tap or flush a toilet, knowing they will receive safe, reliable water supply and sewerage services.

Within its geographical area Unitywater:

- Provides customers with drinking quality (food grade) water supply;
- Operates and maintains water supply and sewerage system infrastructure;
- Collects, transports and treats sewage and trade waste for disposal as environmentally safe wastewater into rivers and ultimately Moreton Bay;
- Reticulates recycled water to commercial and residential customers;
- Plans and delivers new infrastructure to maintain services standards and meet customer growth in compliance with stringent environmental standards that require older STPs to be upgraded to meet modern standards for the total load not just new load;
- Contributes to positive environmental and ecosystem outcomes within Moreton Bay Marine Park, Pumicestone Passage, Sunshine Coast estuary and waterways by ensuring wastewater returned to the environment does not adversely impact the health of waterways and estuaries;
- Provides 24/7 emergency response to restore water supply and sewerage services; and
- Manages customer accounts including meter reading, customer billing and enquiries.

[6] The Participation Agreement is available at http://unitywater.com/About-us/Participation-agreement.aspx

Unitywater's service area

Diagram 1 Unitywater's service area.

2.2. CHALLENGES UNITYWATER FACES

Unitywater's service region provides a number of key challenges:

- **Relatively low population density.** Population in Unitywater's service area is spread over a large area, meaning that more pipes, pumps and STPs are required per person than for other water and sewerage businesses. This necessitates a higher per person spend on infrastructure and maintenance than is the case for other water and sewerage businesses.
- **Rapid population growth.** While Unitywater's population density is relatively low, the region is one of the fastest growing in Australia. This means infrastructure expansion must accommodate population growth, meet environmental conditions and be financially sustainable.
- **Legacy issues.** Unitywater's creation involved the amalgamation of two former council water supply and sewerage businesses which were created from six smaller council businesses. This resulted in Unitywater inheriting several different infrastructure control mechanisms, two rates-based billing systems, two asset management systems, duplicated call centres

and no records management system.

Unitywater has made excellent progress in establishing integrated systems, but still faces significant, often very complex, legacy issues in relation to practices, processes and data quality. For example, progress has been made in implementing a single customer billing and services system as well as progress in reforming tariffs and prices. Legacy pricing regimes developed prior to council amalgamations, in most cases were not structured to recover the full cost of providing services nor did they create incentives to conserve water.

- **Areas of high environmental sensitivity.** Unique physical features in Unitywater's operating area, such as the environmentally sensitive Moreton Bay Marine Park, are such that the region requires a higher level of care in regard to the standard of effluent released into waterways (Refer Appendix 1).
- **Ageing infrastructure.** Unitywater's infrastructure is relatively young in comparison to many other water supply and sewerage businesses; however some of the network dates back to the 1940s. What that means is that resources are required to maintain, replace and renew ageing and poor performing infrastructure in order to maintain services. Balancing maintenance of services and keeping services affordable is a challenge.

More generally, South East Queensland (SEQ) distributor-retailers face a range of challenges:

- **Working within a heavily legislated and regulated sector**. Unitywater recognises the value of legislation and regulation to ensure customer service, price performance and environmental protection. Balancing regulatory compliance against moving toward more innovative lower cost options to deliver the same or better outcomes is a challenge.
- **Nutrient offsets and bubble licences**. Unitywater is encouraged by policy makers and discussion amongst a range of stakeholders including economic and environmental regulators, instrumentalities and departments to align policy objectives of healthy waterways with easing cost of living pressures on customers. The regulatory framework should create a tool or guideline to support non-network investment on private or public lands that achieves total water cycle outcomes and enables the utility to recover at least their efficient costs and roll non-network investment into the Regulatory Asset Base (RAB). Refer to Appendix 1. Unitywater welcomes the opportunity to participate in discussions, focusing on the Total Water Cycle Management Plans (TWCMP) that may consider:
    a. Influent demand side management;
    b. Operating expenditure solutions or alternative treatment planning such as ocean rather than river outfalls that may facilitate the use of carbon in sewage to generate electricity;
    c. Network augmentation options with multi-disciplinary prioritisation and option assessment; and
    d. Bubble licences and nutrient offsets that would encourage investment to reduce pollutants, sediment or nutrients within a catchment at a more affordable cost than capital intensive STP augmentations.
- **Climate change adaptation.** Consensus predictions are for more intense rainfall, longer periods of drought and possible variation of water table levels. This is expected to bring operational challenges to water supply and sewerage businesses. Infrastructure planning must accommodate anticipated changes.

- **Changes in political and regulatory environments.** The past four years has seen consistent change in how water supply and sewerage services are delivered in SEQ and further change is expected. Constant change means that collaborative work amongst water utilities and government departments can be delayed, deferred or abruptly changed. Government regulation of the water industry has evolved in recent years, requiring agility on the part of agencies to quickly adapt.
- **Competition from the resources sector.** Competition for skilled staff with the mining and gas industries has previously been a challenge. Labour competition means it can be difficult to source or retain staff with knowledge of Unitywater infrastructure and processes.

Unitywater acknowledges the challenges and is addressing them with planning and initiatives in the strategic plan and documents supporting the Netserv Plan.

2.2.1. GOVERNANCE AND RISK MANAGEMENT

Unitywater is governed by an independent skills based Board which was appointed by the participating councils. The Board is responsible for setting the organisation's strategic direction and priorities as set out in the Strategic Plan. Unitywater's Executive Leadership Team (ELT), led by the Chief Executive Officer, work to deliver the goals set out in the Strategic Plan and oversee daily operations of the business.

The Board has established a number of committees to support the delivery of the organisation's goals: Audit and Risk Committee; Capital Works Committee; Retail and Marketing Committee; Environment Committee and Nominations and Remuneration Committee. The Committees have been established to endorse strategies and make recommendations to the Board. Unitywater is committed to responsible, ethical, accountable and transparent governance. Unitywater's governance framework ensures scrutiny of operations to achieve corporate objectives of delivering cost efficient sustainable outcomes for customers, stakeholders and the environment.

Unitywater's approach to risk management applies an organisation-wide method to identify, prioritise and manage risks aligned with ISO 31000:2009, *Risk Management – Principles and Guidelines.*

2.2.2. WORKING WITH OTHER WATER ENTITIES

Unitywater works closely with Local and State Government departments and associated bodies to comply with legislation and regulations to meet environmental obligations, as well as the *Australian Drinking Water Guidelines*.

Unitywater has worked closely with other SEQ water supply and sewerage service providers to develop standardised policies and codes such as the *South East Queensland Design and Construction Code,* that standardises water supply and sewerage infrastructure works. Other initiatives include the proposed Utility Model to guide the connections process across SEQ.

Unitywater maintains memberships in peak water associations, including the Australian Water Association, Urban Development Institute of Australia, Water Services Association of Australia and Healthy Waterways, allowing networking, professional development, knowledge sharing and leveraging research and development learnings.

2.2.3. HOW DOES UNITYWATER BENEFIT THE COMMUNITY?

Unitywater provides communities of the region with essential water supply and sewerage services. Unitywater seeks to optimise asset performance to enable environmental, social and economic benefits for communities served.

Unitywater's investment in infrastructure stimulates the local economy, safeguards the environment and caters for population growth which is a major economic driver in the region. Unitywater is always looking for new or better ways to protect the environment and manage the total water cycle in a way that is environmentally sustainable and cost efficient.

Unitywater is a significant employer and contributor to the Moreton Bay and Sunshine Coast regions, employing approximately 865 staff and creates local employment opportunities through the graduate engineer and apprenticeships programs. The community also benefits from Unitywater's returns to participant councils, being reinvested into local government projects.

Unitywater actively seeks ways to connect with communities, through a range of forums such as the Customer Advisory Group, community information days and project openings. Unitywater also participates in creek side greening initiatives and adopts a proactive approach through use of media releases on projects and matters of interest to customers.

2.2.4. SUCCESS STORIES

Unitywater's focus on innovation has created significant benefits for customers, stakeholders and the environment that will continue well into the future. This focus is reflected by the recognition of achievements by Unitywater's staff through a number of prestigious awards, including:

- Water Industry Operator's Association (WIOA) Qld Operator of the Year;
- Australian Water Industry Association (AWA) Qld Water Industry Woman of the Year;
- AWA Qld Program Innovation Award – for Unitywater's laboratory team's breakthrough initiative for faster detection of E. coli bacteria in water samples;
- National Riverprize – in partnership with the Sunshine Coast Rivers Initiative, for excellence in sustainable river management;
- Healthy Waterways Awards – Finalist, Water Sensitive Urban Design Award; and
- Government Award, for MBRC's Total Water Cycle Management Strategy.

Unitywater has a teams based approach to incident management 24/7 and has proved its resilience and capability during the December 2010, January 2011 and January 2013 flood and storm events that tested the water supply and sewerage network and Unitywater's around-the-clock service delivery. The Unitywater team responded admirably to the challenges, maintaining services and drinking water quality and keeping customers informed of service interruptions.

Unitywater's Inflow and Infiltration Program helps to reduce stormwater entering the sewerage networks. This has helped protect beaches, waterways and public areas by identifying and rectifying causes of rainwater and groundwater entering the sewerage network.

By working with customers to rectify plumbing and drainage defects on private property, and renewing infrastructure as part of the Sewer Network Rehabilitation Program, Unitywater is taking positive steps toward minimising sewage overflows and safeguarding community health and the environment.

Stormwater entering our sewer networks cause:

- Sewage overflows into waterways, which can lead to environmental harm and risks to community health;
- Increased pumping and treatment costs;

- Reduced capacity of the sewerage network and may consequently drive increases in capital works expenditure; and
- Increased hydraulic loading on STPs which may result in breach of the environmental licence in respect of effluent quality and flow limitations.

Unitywater has implemented a sewer inflow and infiltration[7] source detection program involving smoke testing, private property inspections and manhole inspections to realise the following benefits:

- A reduction in the number of sewer overflows;
- Improved protection of public health and the natural environment;
- An on-going contribution to meeting customer expectations and services standards;
- Compliance with statutory requirements; and
- Justification of the prudency and efficiency of investment in capital works and operational works programs associated with sewer overflow abatement.

Since 1 July 2010 over 32,000 properties have been inspected across the various Unitywater STP catchments. The inspections have identified 1,288 properties with defects and notices have been issued for rectification. 1,062 (82%) private defects/illegal connections have been rectified to date. 76 private defects/illegal connections have been referred to participating councils for compliance action.

It is the responsibility of the property owner to rectify defects in private plumbing and drainage. In each case Unitywater issues a maximum of three letters to the property owner; each letter allowing 28 days for rectification. If the property owner has failed to advise Unitywater that the defect has been rectified after the issuance of three letters and the defect relates to regulatory plumbing, the case will be referred to council to action under the *Plumbing and Drainage Act 2002*. Unitywater will take legal action on those that relate to non-regulatory plumbing defects.

Table 2 below provides a summary of the defects found on private property and the status of these defects actioned during 2012-13.

[7] Inflow is stormwater that enters the sewer through illegal connections and infiltration is groundwater and stormwater runoff that enters the sewer through defects in the sewer.

Table 2 – Private plumbing and drainage defects – identification and rectification status for 2012-13

Defect Type	No.	Defect Type-Percentage of Total	No. Rectified to Date	Defects Outstanding		
				Notices being Issued	Referred to Council for Further Action	Referred to Legal Section for Further Action
Overflow Relief Gullies – low	251	61%	113	138	10	0
Inspection Openings – cap removed, damaged etc.	75	19%	47	28	0	0
House drainage pipes – displaced joints, cracked, etc.	34	8%	19	15	0	0
Roof-water pipes connected to sewer.	46	11%	23	23	0	0
Rainwater tank overflows connected to sewer.	3	1%	2	1	0	0
Wash-down bay draining to sewer.	0	0%	0	0	0	0
Total	409	100%	204	205	10	0

2.2.5. CARING FOR THE ENVIRONMENT

Unitywater's *Environmental Management Plan* charts environmental targets, to obtain and maintain business certification with environmental standards and create a culture of environmental awareness, continual improvement and compliance.

Some elements of the plan include:

- Ongoing contribution to the SEQ Healthy Waterways Partnership to monitor and protect waterways in Unitywater's service area;
- Reducing the use of natural resources and requirements for disposal to landfill;
- Identifying and responding to risks associated with climate change;
- Cutting greenhouse gas emissions and pollution;
- Protecting bio-diversity and providing offsets such as planting trees, where appropriate; and
- Reducing waste, through water efficiency and water recycling initiatives including Unitywater's leak reduction program.

Unitywater is encouraged by the direction being set within the Department of Energy and Water Supply (DEWS) discussion paper on the 30 year water strategy, noting several references to nutrient offsets and water catchment planning.

Recommendation No.1
Unitywater suggests stakeholders and regulators hold a workshop to discuss non-network investments, to support initiatives such as nutrient offsets or investment in natural assets such as riparian or water catchment forestation that may also provide carbon credits or offsets.

3. OUR FUTURE - STRATEGIC DIRECTION

3.1. UNITYWATER STRATEGIC PLAN 2013-18

Unitywater's Strategic Plan defines our values, goals and strategies. Unitywater's Netserv Plan outlines how these priorities will be realised in the business functions. The Netserv Plan also ensures that asset planning and management is aligned with State and Local Government land use and growth planning.

Unitywater's strategic goals of reducing the total cost to serve and generating new revenue sources; have supporting strategic priorities aimed to enhance customer value; improve sustainability and develop an operationally efficient organisation. These priorities are supported by nine strategies detailed in Diagram 2.

3.2. OPERATIONAL EXCELLENCE AT UNITYWATER

Diagram 2 Unitywater's Strategic Plan 2013-18.

3.3. EMERGING CAPABILITIES AND INFORMATION CONSTRAINTS

Unitywater was formed in November 2009 and took responsibility for water supply and sewerage assets from 1 July 2010. The change created an opportunity to innovate; refine business processes and systems, improve operational performance; and invest to meet customer growth, service standards and environmental controls. Unitywater quickly moved to establish a consolidated water supply and sewerage service business.

Consolidation of systems and processes continues, however it is evident through the extreme weather events of January 2011 that Unitywater's key achievement has been to establish capability to respond to adversity with the combined skills and knowledge of its workforce.

Within Unitywater, systems and processes that would be typical of an established business are under development or have been introduced and require time to build datasets before benefits are realised. For example, Unitywater commissioned phase 1 of a Consolidated Asset Management System (CAMS) to better inform capital planning and maintenance programs. When fully implemented CAMS has the capacity to reduce unplanned asset outages by supporting the development of preventative maintenance programs that proactively avoid asset failure to ensure services are maintained with least disruption.

3.4. NETSERV PLAN

Unitywater continues to experience success in deferring and reducing capital and operating expenditure. Through a gateway approval process, Unitywater continues to challenge and assess prudency, efficiency and delivery of network expenditure to maintain the existing network and meet new demands for development, customer growth, service standards and environmental requirements.

The *South-East Queensland Water (Distribution and Retail Restructuring) Act 2009* requires all SEQ distributor-retailers to have a Water and Wastewater Network and Services Plan (Netserv Plan) in place by 1 July 2013. Under the Act, the key purposes of the Netserv Plan are to:

- Provide for strategic planning;
- Ensure provision of safe, reliable and secure water supply and sewerage services;
- Plan delivery of infrastructure for water supply and sewerage services for the next 20 years;
- Integrate land use and infrastructure planning for water supply and sewerage services; and
- Manage water supply and sewerage services in an ecologically sustainable way.

Unitywater has developed a Netserv Plan[8] that provides a framework with which to address business challenges and constraints. The Netserv Plan outlines the approaches to optimise network performance, reduce costs, price services, and maintain or renew assets. Netserv Plans are separated into Part A, with information for customers, and Part B that sits under Unitywater's Corporate Strategic Plan and is a key tool for planning, compliance, and continual improvement.

Development of Part A involved public consultation in 2012. The Netserv Plan has subsequently been approved by the Minister for State Development, Infrastructure and Planning, and endorsed by participant councils. This ensures consistency with the SEQ Regional plan and that councils are satisfied that their planning assumptions have been taken into account.

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[8] NetServ Plan is the new Water Network Service Plan introduced by the DEWS that distributor-retailers in SEQ must prepare. The NetServ Plan brings together, or replaces requirements under the Sustainable Planning Act, the Water Supply (Safety and Reliability) Act and the Environmental Protection Policy (Water).

4. REGULATORY PRICE MONITORING

The former Premier and Treasurer of Queensland referred Unitywater's distribution and retail of water supply, trade waste and sewage collection, transport and treatment services to the QCA, for three annual price monitoring reviews starting 1 July 2010 and concluding 30 June 2013. The Treasurer and Minister for Trade and the Attorney General and Minister for Justice directed the QCA to price monitor for a further two years commencing 2013.

Unitywater notes the recent intent of QCA to develop a long term regulatory framework which will assist the journey towards the cost reflective provision of services. As the regulatory framework evolves and greater collaboration between environmental and economic regulators occurs, Unitywater will continue to seek a regulatory framework that addresses the treatment of under and over recoveries in addition to previous requests for guidelines on investment in non-network nutrient or turbidity reduction, and address the tax treatment of developer's contributions. Unitywater believes the current tax legislation and regulatory framework penalise Unitywater when receiving developer cash contributions.

Unitywater has proposed Maximum Allowable Revenue Adjustment Transition Scheme (MAT Scheme) – to capture revenue under (over) recoveries, being the difference between actual revenues and MAR[9]. The MAT Scheme will operate until such time as prices recover MAR, and then any under (over) recoveries would be recovered in accordance with a QCA approved price path over a period to be determined.

The two year revenue forecast in this price monitoring submission is not based on a Net Present Value (NPV) - neutral glide path and is indicative only. Unitywater intends to retain the revenue offset approach for the treatment of contributed and donated assets for 2012-13 and then proposes the asset offset approach for subsequent years.

The change is linked to the QCA updating the benchmark Weighted Average Cost of Capital (WACC) of 6.57% being a 30% reduction from the previous benchmark WACC of 9.35%. Unitywater has fundamental concerns with the existing methodology and has proposed a methodology that will derive a more stable WACC by taking longer term views of key inputs. This approach is proposed to align with the long term nature of water and sewerage infrastructure and the desire to mitigate pricing impacts to customers. Unitywater proposes a WACC of 7.62%, details of which are set out in Return on Capital - Chapter 11.

Recommendation No.2

Unitywater would like to discuss with the QCA its WACC departure, the tax treatment of developers contributions and the future of the MAT scheme in recording and carrying forward MAR under (over) recoveries.

[9] MAR is an abbreviation for maximum allowable revenue which is the product of a standard regulatory building blocks approach to determine the benchmark efficient cost of providing the relevant service

5. PRICING

5.1. HOW UNITYWATER SETS PRICES

Unitywater needs to be financially sustainable in order to deliver reliable, fit for purpose services to its customers. Unitywater's prices provide for maintenance, compliance, improvement and growth of water supply and sewerage networks to deliver customer, stakeholder and environmental outcomes.

In setting prices, Unitywater is guided by legislation and other guidelines from the local, state and federal government. The National Water Initiative (NWI) sets the following pricing principles for best practice water pricing:

- Efficient cost recovery – prices should recover at least the cost of providing the service level;
- Efficient pricing – prices should recover the costs of providing services while promoting the efficient use of resources;
- Cost allocation - prices should reflect the cost of providing services to that class of customer;
- Transparency - prices should be set so that they can be easily understood by customers;
- Improved productivity - prices should incentivise to reduce costs or improve productivity;
- Non-commercial objectives - prices should not be set to achieve equity or other non-commercial objectives;
- Transitional arrangements - prices to customers should be transitioned if there is a significant increase and there are demonstrable issues regarding customers' ability to pay; and
- Regulatory efficiency - pricing should minimise regulatory intrusion and compliance costs.

Pricing principles support the provision of financial returns to participant councils, the returns to councils help fund other services for local communities. Unitywater is committed to reforming tariffs and prices by:

- Standardising application of prices across the region;
- Providing incentives to customers to limit their water consumption; and
- Simplifying pricing structures across all customers.

One of Unitywater's biggest challenges is consolidating complex and variable tariffs and prices inherited from participating councils developed prior to amalgamations, when six local councils were responsible for water supply and sewerage services. In most cases, local government tariffs and prices were not set to recover the full cost of providing services or to incentivise water conservation.

Unitywater commenced tariff reform in 2010-11 by aligning tariffs within each of the regional councils' boundaries. In 2011-12 Unitywater introduced a three year transitional pricing plan aimed at cost recovery for recycled water and standardised pricing for recycled water and trade waste services.

Changes to State Government Legislation (Fairer Water Prices for SEQ Amendment Act 2011), enacted in June 2011, capped Unitywater's fixed access and water usage price increases at the Brisbane CPI for two years, and delayed tariff reform.

Unitywater froze its 2012-13 prices for water supply and sewerage services, except for trade waste, recycled water and a small number of miscellaneous fees and charges and did not increase by the permitted CPI of 1.3% for residential and small business customers.

That decision saved customers up to $15 per annum for 2012-13.

The price cap did not however apply to the bulk water component of customer accounts. Unitywater is required to pass on the full bulk water price increase to customers.

5.2. TARIFF REFORM

Unitywater inherited a complex set of tariffs, fees and charges with more than 130 charges and 800+ combinations. Feedback from our customers has made it clear they want more emphasis on user pays.

Unitywater made significant inroads into ensuring the consistency in charging structures in 2010-11, when the tariffs levied on residential customers within each participating council region were aligned (specifically the water and sewerage access charges applicable to the Moreton Bay district). Despite the past reforms to the charging structure, Unitywater has historically levied different charges based on different pricing principles across six different service areas (or former councils prior to amalgamation) for selected customers.

The following inconsistencies are examples of the different charging structures that were applied;

- Levying water access charges in a number of forms, including a single access charge irrespective of the number and size of connections, the number and size of connections, or based on a deemed capacity factor taking into account the size of each connection and the water consumed through each connection;
- The existence of three consumption charge tiers in the Moreton Bay district and two consumption charge tiers in the Sunshine Coast district, the adoption of different threshold levels, and significant differences in the level of consumption charges applied to each tier; and
- Inconsistencies in the levying of charges on unconnected properties.

From 2013-14 Unitywater is introducing a new pricing structure that will:

- Adopt a user-pays approach so those who use less will pay less and those who use more will pay more;
- Give customers greater control over their bill by increasing volumetric charges and reducing fixed access charges;
- Encourage customers to be water wise;
- Simplify pricing for customers by harmonising the application of prices across all customer categories across the service region; and
- Align volumetric charges for all customers across Unitywater's service region.

The new tariffs have been designed to be revenue neutral based on forecast 2012-13 revenue with a 3% price increase applied to the new tariffs.

Stand-alone residential houses are moving to the new pricing structure on 1 July 2013. All other properties will receive a 3% price increase to existing charges until they move onto the new pricing structure. All Unitywater customers will be on the new pricing structure by 30 June 2015.

Given the wide variety of charging structures currently applied across each region, the reforms will have a range of impacts across regions and customer categories.

Essentially, those with relatively low usage of the water and sewerage systems (including relatively low capacity to draw from the systems through smaller connections) are expected to experience decreases in their water and sewerage bills, with the extent of reduction dependent on how they are levied charges under current charging structures.

At a high level, the following key changes are noted:

- Reduced access charges and increased consumption charges;
- Two tier consumption charge, with the first tier threshold being 300kL per annum; and
- Introduction of sewerage usage charges – via a two-tier usage charge (with the second tier charge being nil for residential customers) – for residential customers in all service areas and introduction of usage charges for non-residential customers (phased in) in the Caboolture, Pine Rivers, Redcliffe, Caloundra and Noosa service areas.

Table 3 – Moreton Bay district

Price Schedule	2012-13		2013-14 (Tariff reform)	
Moreton Bay Residential	Usage (kL pa)	Price	Usage (kL pa)	Price
Water Charges				
Water (by volume)				
Tier 1	up to 280	$0.176 per kL	up to 300	$0.644 per kL
Tier 2	280-360	$0.849 per kL	over 300	$1.288 per kL
Tier 3	Over 360	$1.305 per kL	n/a	n/a
Water access (up to 25 mm water meter)		$346.00		$293.56
Sewerage Charges				
Sewerage (by volume)	n/a	n/a	capped at 270	$0.644 per kL
Sewerage access		$744.88		$695.24
State Government Bulk Water charge		$2.192 per kL		$2.437 per kL

Table 4 – Sunshine Coast district

Price Schedule	2012-13		2013-14 (Tariff reform)	
Sunshine Coast Residential	**Usage (kL pa)**	**Price**	**Usage (kL pa)**	**Price**
Water Charges				
Water (by volume)				
Tier 1	up to 219	$0.538 per kL	up to 300	$0.644 per kL
Tier 2	over 219	$1.036 per kL	over 300	$1.288 per kL
Water access (up to 25 mm water meter)		$232.04		$231.76
Sewerage Charges				
Sewerage (by volume)	n/a	n/a	capped at 270	$0.644 per kL
Sewerage access		$570.80		$509.84
State Government Bulk Water charge	$1.610 per kL		$1.855 per kL	

6. CUSTOMER SERVICE STANDARDS

6.1. OVERVIEW

In general the same customer service standards (CSS) apply across all customer groups of Unitywater's large service area. The QCA's definition of customer group includes customers with commercially negotiated arrangements or where prices are not included in the entity's pricing schedule. Unitywater does not have separate contractual arrangements with customers in relation to these activities and core services, although it does have customer-specific arrangements for trade waste in some instances. Trade waste agreements are effectively an approval to discharge into the sewer network, and are conditional based on the quantities/flow rates and types of discharge (strength, toxicity and volume).

Unitywater has a contract for the supply of recycled water to Amcor (classified as other core services). Amcor is expected to cease operations by December 2013. The contract sets specific service standards and does not have implications to other customers.

Unitywater does not have, nor intends to have, formal service standards in relation to unregulated services, although laboratory services must comply with the standards required by the National Accreditation Test Association (NATA). The scope of service standards considered relate to:

- The CSS required under the *Water Supply (Safety and Reliability) Act*;
- Those expressed in Strategic Asset Management Plans (currently SAMPs and TMPs but soon to be the Netserv Plan); and
- The Customer Code under the requirements of the South-East Queensland Water (Distribution & Retail Restructuring) Act 2009.

Unitywater aligned CSS across both regions prior to 1 July 2011. The Customer Charter was provided to the QCA as Appendix 2 of the 2011-12 price monitoring submission. Service levels defined in the SEQ Water Strategy and design standards set through codes or policies under council planning schemes, and the SEQ Design and Construction Manual are out of scope for QCA purposes (Refer Appendix 2).

Unitywater has provided details of the contractual service standards with Seqwater in previous price monitoring submissions. As the standards have not changed they have not been repeated here. The Customer Charter was circulated to all customers and is available on Unitywater's website. CSS are incorporated in Unitywater's Netserv Plan, which replaces SAMPs and other plans.

6.2. CUSTOMER SERVICE STANDARDS

The Customer Charter summarises service levels and describes how Unitywater will:

- Deliver a safe and reliable water supply and sewerage service;
- Minimise inconvenience during planned and unplanned service interruptions;
- Respond to customers in a respectful, efficient and timely manner;
- Issue and manage accounts; and
- Handle customer queries and complaints.

6.3. REACHING UNITYWATER

Customers can contact us via the easy to remember 1300 0 UNITY number (1300 086 489) that can be called anytime, for faults and emergencies. Unitywater aims to answer 80% of calls to the Customer Service Call Centre within 30 seconds with a person, not an Integrated Voice Response and responds with a written resolution to enquiries within 10 days.

6.4. CUSTOMER COMMUNICATIONS

Unitywater is committed to keeping customers and stakeholders informed. Unitywater's Community Advisory Group was created to better understand the needs of customers, the community and business leaders.

The group provides a forum for sharing ideas and information, and obtaining feedback on a range of issues and projects. Unitywater also provide regular briefings to community organisations and groups on topics relevant to their area such as community information days; infrastructure project openings and partnerships with other organisations. At times, Unitywater also invests in customer research forums to gauge the effectiveness of communications and gain feedback on planned initiatives. Unitywater balances disseminating information against the cost of producing the material. Newsletters, fact sheets and other inserts to promote key messages are mailed with customer accounts, to save postage or are made available online.

Unitywater informational material includes *Be Sure, Read it More* meter reading brochure, *Customer Charter,* the *Unitywater Update* newsletter and brochures designed to educate customers on a range of topics including water quality issues; preventing damage to infrastructure or the environment.

As part of the Customer Charter, Unitywater provides customers with 48 hours notice of planned works that may interrupt water supply. Information on major works is shared via a range of communication tools including letters to residents, fact sheets, media releases and project briefings, notices of significant unplanned outages are also posted on our website.

Unitywater is now using Facebook and may consider Twitter, and SMS messaging as complementary means of communicating with targeted customers. Unitywater's You Tube channel provides customers with audio-visual information about services and programs. Unitywater has launched an online projects information portal and simplified customer payment plans.

6.5. INITITATIVES AND PLANS – JOINT WORKINGS ON SERVICE STANDARDS

Unitywater, Queensland Urban Utilities (QUU) and SEQ council water businesses are exploring CSS and demand forecasting approaches and will consult with interested stakeholders including the QCA, Department of Energy and Water Supply (DEWS) and Department of Environment and Heritage Protection (DEHP) and Queensland Fire and Rescue. The review is at a preliminary stage of scoping and consultants appointment.

Service standards are a core driver of operational and capital costs and Unitywater wants to understand more about the technical, social, customer expectations, environmental, safety, financial and customer impacts with a view to reviewing CSS in order to reduce the cost to serve our customers.

Recommendation No.3

Unitywater is seeking QCA endorsement and their participation in a regional working group to discuss CSS.

7. DEMAND FORECASTING

7.1. QUEENSLAND TREASURY POPULATION ESTIMATES

Unitywater's service area spans 5,223 km^2, with an estimated residential population of 722,030[10] at 30 June 2012. This equates to approximately 16.2% of Queensland's total population. The Office of Economic and Statistical Research (OESR) population estimates indicate that the growth in population within Unitywater's geographical area (Moreton Bay and Sunshine Coast local government areas) will be to 807,465 residents by 2016 and 1,041,343 residents by 2031.

Note, not all of the current population is provided with water supply and sewerage services. However, given the constrained amount of rural residential development now permitted under current council planning schemes, it is expected that almost all of the future projected growth will occur within Unitywater's Service Area.

7.2. UNITYWATER'S LONG TERM GROWTH FORECASTS

Water - In relation to long term water demand forecasts, Schedule 5 of the South East Queensland System Operating Plan (SOP) requires all Distributor-Retailers to provide the DEWS and the Queensland Bulk Water Supply Authority (Seqwater) with an annual 20-year water demand forecast. This forecast must align with Unitywater's *Netserv Plan*, be approved by the Unitywater Board, and be provided to DEWS and Seqwater by no later than 31 May each year. This forecast is also used by Unitywater for longer term capital planning purposes.

A copy of this forecast, along with the covering correspondence, is included in Appendix 3

Sewerage - Long term sewerage load forecasts are determined in a similar manner to water. A copy of the long term sewerage load forecasts, derived as part of Unitywater's long-term recently adopted Treatment Services Plan, are included in Appendix 4.

7.3. UNITYWATER'S SHORT TERM FORECASTS

Water - Short term water demand forecasts are derived by multiplying projected residential population by estimated litres per person per day (LPD).

Projected residential population is based on the number of water connections (sourced from the Unitywater customer billing system) by the regional occupancy factor, that is the average number of persons per household published by the OESR for Unitywater's service area. The serviced residential population is then escalated by OESR's medium population series to project residential population.

Estimated residential water consumption is calculated by taking the total daily residential water consumption and dividing it by the estimated serviced population. The resulting estimate is escalated by QCA's estimate of growth in daily per capita consumption LPD, allowing for expected drought rebound[11]. The resulting residential forecast consumption ranges between 164 – 181 LPD for MBRC and 191 – 214 LPD for SCRC.

Projected non-residential water connections are estimated by escalating the number of non-residential water connections, sourced from the Unitywater customer billing system, by the OESR medium series dwelling growth forecast. Average consumption per connection for non residential

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[10] Australian Bureau of Statistics, Regional Population Growth, Australia, 2011-12, cat no 3218 and unpublished data.
[2] (OESR), Queensland Regional Profiles, Unitywater region, page 2, profile generated on 22 August 2012,

[11] SKM's Draft report to QCA ,Review of demand projections for QUU and Unitywater, 16 October 2012,page 30

customers is sourced from the Unitywater billing system and no escalation is applied as Unitywater is not expecting a drought rebound on this group in the short term.

Total non-residential billed water is calculated by multiplying the projected regional water connections by the average consumption values. Short term forecasts differ from long term forecasts used for capital planning purposes. The principle reason is that long term forecasts assume levels of consumption in accordance with Unitywater's standards of service (i.e. for water, 230 L/EP/d) rather than current rates of consumption. In addition estimates take into consideration approved development coming on line in addition to new development in order to manage the network risk profile.

Sewerage - Short Term Sewage Demand Forecast uses the number of sewerage connections to Unitywater's network, extracted from the Unitywater customer billing system for residential and non-residential sewerage customers and escalated by OESR's medium dwelling series.

7.4. DEMAND FORECASTS – INITIATIVES AND PLANS

Unitywater has discussed internally the views of the QCA and their consultants identified in the 2012-13 Interim Price Monitoring reports. Unitywater is now seeking to establish common terms of reference for a joint working group with other Seqwater businesses with the objective to examine the shared assumptions that underpin demand forecasting methodologies and, where economically justified, share work on technology and processes. The QCA will be invited to join that working group.

Another important demand forecasting initiative scheduled for the coming 12 months is the development of a spatially-based demand model that links to the council's land use database, and progressively captures development approvals as they occur. This tool, referred to as DMaTT (Demand Management and Tracking Tool) will greatly enhance Unitywater's capacity to make water and sewerage load projections, and to quickly and easily incorporate changes in the status of Council Planning Schemes, State Government Master Planned Areas, OESR population projections, etc. It is expected that DMaTT will be available by the end of 2013.

7.5. HOW WE MANAGE DEMAND FOR WATER

Unitywater has a number of policies and initiatives to balance water conservation and water consumption to achieve economic and environmental sustainability. Managing demand for water is important in order to conserve water during periods of drought and, conversely, to allow customers the freedom to consume the water they want to and can afford to pay for, within reason. Managing the timing and how much water is used helps to keep operating costs down by deferring infrastructure upgrades and operational costs such as electricity. If every customer uses water at the same time, larger capacity infrastructure is required to handle peak demands. If consumption throughout the day is uniform, the infrastructure capacity does not need to be as large, lowering construction and maintenance costs.

Unitywater's water demand management strategy includes:

- Educating customers by providing information about their household's water consumption and promoting water conservation measures and the use of water saving devices;
- Supporting water conservation measures set by the State Government;
- Assisting business customers to develop Water Efficiency Management Plans;
- Minimising system losses from water mains, pipes and storages;

- Accurately measuring and monitoring water consumption to inform demand management and infrastructure planning;
- Using tiered prices to encourage customers to conserve water; and
- Providing an enhanced level of information on bills which enables residential customers to readily understand how much water they have consumed in relation to average residential consumption.

Minimising leakage from the network also assists to prevent wastage and minimise costs. Based on national and international benchmarks using the Infrastructure Leakage Index (ILI) established by the International Water Association, Unitywater has a comparatively low level of leakage from its water supply network when compared to many other Australian water businesses and will continue to strive to prevent or minimise leakage, using strategies are economically viable and don't outweigh the cost of lost water.

A project (Unbilled Water Project) has been scoped to quantify and classify Non Revenue Water (NRW). The NRW is the gap between the bulk water purchased by Unitywater and that amount billed to customers. Identifying that gap accurately is a challenge for all water businesses because there are many uses of water that are not measured such as fire fighting, flushing and cleaning of water mains, leaks from Unitywater's pipes and those of its customers, unmetered facilities and theft. The Unbilled Water Project will allow Unitywater to benchmark its proportion of NRW against other water businesses and identify initiatives where the benefits of reducing the NRW exceed the costs of doing so. This Project complements Unitywater's Netserv Plan, the Growth Management Plan and the System Water Loss Minimisation Plan.

Recommendation No.4
Unitywater is seeking QCA endorsement and their participation in a regional working group to discuss Demand Forecasting.

8. OPERATING EXPENDITURE

8.1. OPERATING COST ACTIVITIES AND DRIVERS

Unitywater estimates operating expenditure by taking into account:

- Expected demand for water supply and sewerage services;
- Expenditure required to maintain the quality, reliability and security of water supply and sewerage services to customers;
- Customer numbers and expected growth in connections;
- Requirements to meet compliance obligations and support the operations of the business;
- Requirements to pump potable water supplies to customers and sewage through Unitywater's networks to STPs; and
- Requirements to operate STPs within environmental licences.

Unitywater's operations are supported by the following activities:

- Asset management and planning;
- Works scheduling and dispatch;
- Network maintenance and operation;
- Treatment plant operation;
- Water quality and environmental management;
- Customer services; and
- Support costs including human resource management, safety management, financial services, administration support, information, systems and communications management, procurement and regulatory compliance.

8.2. ASSET MANAGEMENT AND PLANNING

Asset management and planning is a complex activity to optimise the investment in our assets by considering a range of diverse factors including population growth, customer demand, industry standards, our customer charter, current asset condition and emerging technologies. Our asset management strategy is key in developing maintenance plans to optimise asset life, and to develop plans for renewing and replacing our network assets and catering for growth.

Initiatives to confirm that our assets are optimised include:

- Sewer overflow abatement activities such as smoke testing to detect illegal connections;
- Sewer corrosion and odour management plans to extend asset life; and
- System leakage management plans to minimise water losses including a trial of a solution which detects, and provides real-time information on network efficiency, hidden leaks and bursts.

The primary costs incurred are employee costs, and services to support a range of asset management activities.

8.3. WORKS SCHEDULING AND DISPATCH

The scheduling of work and dispatch to crews in an efficient manner is critical to maintaining security and reliability of supply to customers. On 1 July 2010, Unitywater inherited two asset management systems, two network control rooms and a north vs south approach to works management. During 2012-13 Unitywater commissioned a consolidated asset management system (Maximo) to support a single system and process for dispatch of work to crews and consolidated primary network operations in a single operations centre in Maroochydore and a back up operation in South Caboolture. This is the first phase of a range of initiatives to improve asset management activities.

During 2013 job costing will be enabled to support greater visibility of maintenance costs and further projects will commence to improve the quality of underlying asset data including existence, condition and location of Unitywater's assets.

The primary cost incurred in undertaking this activity is labour which has been optimised through the consolidation of operations.

8.4. NETWORK MAINTENANCE AND OPERATION

Unitywater performs both planned and reactive maintenance to ensure that water supply and sewerage networks meet the needs of customers for safe, reliable and secure supply of water supply and sewage collection, transport and treatment. Unitywater is developing a proactive approach to maintenance and will progress toward condition and performance based methodology in the future. A single asset management system will provide Unitywater greater ability to identify risks and defects prior to unplanned network incidents requiring reactive repair.

The primary costs incurred in maintaining and operating the network are:

- Labour (including overtime and allowances);
- Electricity costs for pumping of water and sewage to and from customer's properties;
- Chemical costs to maintain water quality;
- Chemical costs to reduce odour from the network and corrosion of assets; and
- Materials and services required to maintain assets (e.g. small consumable parts, landscaping supplies, traffic control services, plant hire, cctv inspection).

8.4.1. CCTV PIPE CAMERA AND VEGETATION MANAGEMENT

Unitywater conducts inspections to detect potential defects requiring remedial, programmed or priority response. Typically the most difficult parts of the network to inspect are the pipe networks for both water supply, and sewer network. Routine inspection periods for the same type of asset may change due to acid sulphate soils, stormwater inundation, leakage, vegetation type and illegal connections.

Unitywater is continually learning about the condition and performance of its networks and conducts kilometres of optic fibre camera reconnaissance. Observations assist with understanding the condition and performance for the age of particular assets that can be used to better inform and schedule planned maintenance programmes.

Unitywater's vegetation management balances network reliability due to vegetation root growth with community views on riparian corridors, domestic gardens and environmental concerns regarding tree removal. Unitywater mitigates unnecessary removal of trees by using special compounds that only kill encroaching roots in the pipe network. Modern pipes have fewer problems than older style clay pipes due to greater pipe flexibility and fewer joints connecting the pipes.

Table 5 – CCTV meters inspected and defects identified

Region	Metres CCTV Inspected	Defects Sewer Main to be Repaired	Total Number of House Connection Branch	House Connection Branch that Require to be Repaired	Number of Mains to be Repaired	Number of Metres to be Relined	Approximate % of Sewer Main reviewed to be relined
Southern Catchment	109,188.30	42	3,009	80	177	9,787.80	9%
Northern Catchment	40,810.40	28	557	43	169	9,178.30	25 %
Total Unitywater	149,998.70	70	3,566	123	346	18,966.10	n/a

8.4.2. REACTIVE REPAIR

Reactive repairs are required to fix damage to infrastructure as a result of isolated incidents or as a result of recurrent asset failure of a similar kind for example acid sulphate soils weakening pipes. Reactive repairs intended to address unplanned outages and rectify failure of an asset that impacts on the performance, security, supply, or reliability of water reticulation or sewage treatment services. Reactive repair restores network serviceability and functionality and may be temporary until a permanent repair is arranged.

8.5. EMERGENCY RESPONSE

The SEQ 2011 floods demonstrated that Unitywater is well prepared to continue operations during a major incident and the 2013 Australia Day flooding reconfirmed Unitywater's capability. Most of Unitywater's critical infrastructure has alternative stand-by electricity generation in order to maintain operation. During the January 2011 floods, Unitywater activated its Incident Management Teams (on call 24/7 to respond to all types of incidents) to minimise impacts on customers, the environment and infrastructure.

Unitywater's experience with the SEQ floods suggests the network outperformed expectations and the treatment plants were never off line, although some did operate in by-pass mode due to the level of storm and flood water that inundated the sewer system increasing flows beyond the plant's design capacity. Within less than a week all of Unitywater's STPs were operating normally.

8.5.1. IMPROVEMENT INITIATIVES

A range of improvement initiatives has commenced including start and finish on site, delivery of goods to site, consolidated service centres, rationalisation of stores, category management of goods and services, implementation of the consolidated asset management system and electricity demand management projects.

Further details are set out in Chapter 10.

8.6. TREATMENT PLANT OPERATION

Unitywater operates eighteen (18) sewerage treatment plants and 2 advanced water treatment plants producing recycled water. Twelve of these plants are currently undergoing upgrades to meet current capacity requirements, predicted growth in the region and to ensure that environmental licence conditions are met.

The cost of operating treatment plants is driven by the treatment technology of the plant, the environmental licence conditions and the volume of effluent treated and required to be disposed of. Four primary costs are incurred:

- Labour;
- Chemicals;
- Sludge (biosolids) disposal; and
- Electricity.

Each of Unitywater's eighteen STPs currently support around 14,000 customers which is well below the industry average of 55,000. The level of investment per customer and the associated operating costs has a flow on impact to prices. Unitywater has therefore embarked on a range of initiatives focused on reducing the cost to serve, these initiatives include:

- A 50 year treatment services strategy, focused on the rationalisation of STPs over this period;
- Investigation into curtailment of electricity demand and biosolids disposal options; and
- Production of on-site Magnesium Hydroxide (MHL) at Maroochydore STP to reduce chemical costs.

8.7. WATER QUALITY AND ENVIRONMENTAL MANAGEMENT

Water quality and environmental management are essential activities performed by Unitywater to ensure drinking water supplied to customers meets *Australian Drinking Water Quality Guidelines* and effluent disposed to receiving water ways meet's each treatment plant's licence conditions. These activities are performed by our water quality testers and qualified laboratory technicians at Unitywater's NATA (National Accreditation Test Association) accredited laboratories.

Aligned with Unitywater's focus on reducing cost to serve, a project has commenced to consolidate Unitywater's labs to reduce operating costs and future investment required in laboratory equipment.

8.8. CUSTOMER SERVICE

Operating expenditure is required to provide customer services such as meter reading; account generation and distribution; customer contact centre; credit and collections; customer communications and engagement and complaint and ombudsman stakeholder interaction.

Key initiatives over the last few years have focused on call centre consolidation and functionality, go live of Unify (a consolidated billing and customer information management system), rolling meter reading, billing in arrears and bill production and issue in a more timely manner (ie. generally within 4 days of the meter read).

Unitywater's customer billing and information system was commissioned in January 2012 and is delivering the following benefits:

- Enabled quarterly billing to meet legislative requirements and is capable of tenant billing if that is implemented;
- Improved timeliness of billing;
- Improved customer service;
- Replacement of two property-based legacy systems;

- Aligned billing and customer systems with strategic business and enterprise architectures; and
- Removed reliance on regional councils' Information and Communications Technologies (ICT) infrastructure and support.

8.9. SUPPORT COSTS

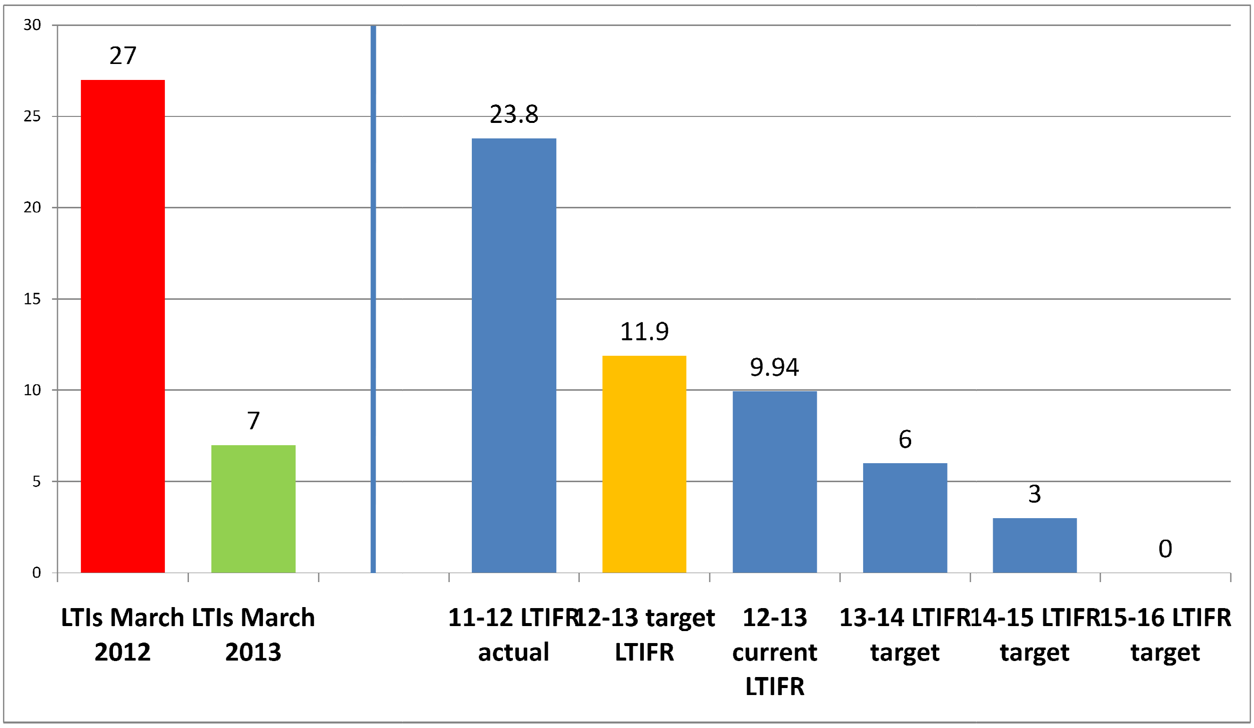
8.9.1. HUMAN RESOURCES AND SAFETY MANAGEMENT

Unitywater employs staff across a broad range of skills and professions, from engineers, chemists, field staff (both trade qualified and non-trade), through to computer technicians, scientists, accountants, human resource specialists, solicitors, managers and administration staff. Unitywater's workforce planning aims to attract and retain skilled staff, whilst at the same time continuing to build the capacity of existing staff.

Unitywater faces two key challenges in terms of its people. Firstly the relatively high average age of our workforce presents a challenge of retaining the wealth of knowledge that may potentially be lost as team members retire. Secondly, Unitywater is challenged in its efforts to attract skilled tradespeople and engineers, by ongoing skills shortages and high competition from the mining and related sectors.

Unitywater remains committed to Zero Harm and continues to develop a culture of safety, with zero injuries and less downtime. Unitywater is improving the organisations system to ensure staff are informed of inherent risks involved in their roles; are provided with appropriate protective equipment; are encouraged to share responsibility for their safety and that of their colleagues; and that the business reports and responds appropriately to all hazards, injuries and near misses.

Diagram 3 – Safety achievements and targets as at 31 April 2013.



As at 31 May 2013, Unitywater's year to date LTIFR was 9.04.

Other investments made to improve safety include:

- Medical assessments and fitness for work;
- Frontline awareness and safety leadership;
- Implementation of safety management system to improve its reporting of incidents; and
- Proactive health and safety rehabilitation.

In addition to investments in safety, Unitywater is investing in developing a skilled and flexible workforce through:

- Development of a competency framework and a learning management system;
- Providing literacy and numeracy education for staff;
- Offering apprenticeships and graduate programs and partnering with learning institutions to develop and provide opportunities for shared learning for Unitywater and students involved; and
- Improving the human resource information system to reduce manual effort to pay employees and offer online human resource management.

Unitywater's employees were previously covered by the SEQ Distribution and Retail Water Reform Workforce Framework 2009 (the Workforce Framework) which protected terms and conditions of employment for employees affected by the transfer of water and wastewater functions from local governments to Unitywater. Although the Workforce Framework was repealed in December 2012, the Workforce Framework ensured employment security (no forced redundancies), income and travel protection, resulting from water reforms within either the councils or the new water entities.

Within the constraints of the Workforce Framework, Unitywater made significant progress within its first Certified Agreement (No.1 - 2011) by delivering the following benefits:

- Extending current ordinary working hours so that the workforce start and finish times are staggered, thereby more closely matching workforce availability with customer needs and work volumes;
- Introducing afternoon shift work for field-based roles;
- On-site start/finish work arrangements for field service crews; Improving employees' pay parity across Unitywater's workforce streams (i.e. same work/same pay); and
- Consolidation and simplification of allowances.

Unitywater looks forward to continuing collaborative discussions with stakeholders and settling the terms of the next agreement.

8.9.2. INFORMATION AND SYSTEMS MANAGEMENT

Unitywater's first strategic plan identified a number of challenges, programs and key initiatives relating to information, communication and technology services as follows:

Table 6 ICT key challenges and initiatives

Challenges	Key Initiatives
Disparate ICT landscapes inherited from councils contained duplicated application functionality for core business systems and multiple network domains constraining system access and knowledge sharing	Establish the ICT architecture framework
220+ applications decentralised ICT procurement practices in councils created duplication and a cost-ineffective ICT environment	Consolidate operations (aligned around a program of systems consolidations)
Poor and inadequate data quality within inherited information systems	Establish core controls to improve information systems management
Multiple data sources which feed manually into reporting processes	Develop and approve core / key ICT capabilities, processes and governance

Major ICT initiatives since Unitywater's inception include implementation of:

- Electronic Data Records Management System;
- Consolidated GIS, asset management system, HR payroll system, and billing and customer management system;
- A single Unitywater Computer Network;
- Enterprise service bus to standardise interfaces;
- Data warehouse capability; and
- Exited off council platforms.

Focus is now on stabilising new system capability and planning activity to improve data quality and leverage off current investments.

Other ICT initiatives undertaken to reduce costs include:

- A Wide Area Network (WAN) improvement project to standardise and consolidate networks and contracts; and
- A telecommunications review project to rationalise and consolidate services to reduce costs.

8.9.3. OTHER SUPPORT EXPENDITURE

Other support costs are incurred to meet compliance costs, provide support to the core activities of the business, inform our stakeholders and to improve business performance.

Unitywater is a Statutory Authority and is required to comply with a broad range of legislation including the SEQ Water Reform (Distribution and Retail Restructuring) Act, the Financial Administration Act (FAA), the Financial Management Performance Standard, the Statutory Bodies Financial Arrangement Act (SBFA) and the QLD Government State Procurement Policy. Compliance costs are primarily labour costs but also include Queensland Audit Office and QCA fees.

Activities that support the operation of the business include facilities management costs, fleet management and logistics. During 2012-13 Unitywater rationalised fleet numbers and models which has contributed to savings made during the year. In 2013-14 Unitywater will consolidate facilities with the opening of the Northern Service Centre expected in early 2014.

8.10. OPERATING EXPENDITURE OVERVIEW

Unitywater's total operating expenditures are set out in Table 6 in accordance with QCA's expenditure categories. The 2013-14 operating expenditure is estimated to be $284.8M based on Unitywater's budget and represents an increase of $25.2M compared to the 2012-13 forecast.

Table 7 Forecast Operating Expenditure by category ($M)

Expenditure category ($M)	FY2012	FY2013	FY2014	FY2015
Bulk water costs	91.0	114.9	134.9	158.9
Employee expenses	46.2	48.2	49.9	51.4
Contractor expenses	11.3	8.3	8.2	8.5
Electricity charges	7.3	8.7	10.0	10.7
Sludge handling costs	4.8	4.2	4.5	4.7
Chemicals costs	4.2	4.8	4.9	5.2
Other material and services	11.3	13.5	12.9	13.3
Licence or regulatory fees	0.2	0.3	0.3	0.3
Corporate costs	60.0	48.9	53.2	49.0
Non recurrent costs	5.0	6.3	4.5	4.6
Indirect taxes	1.4	1.5	1.4	1.4
Total Operating Costs	242.6	259.6	284.8	308.2

[1] *Costs are based on second quarter full year forecast*

Increases in input costs such as bulk water, chemicals, electricity and disposal of bio-solids will impact on future operating expenditures.

8.11. BULK WATER COSTS

Bulk water costs account for 49.9% and 54.2% of total Unitywater operating expenditures for 2013-14 and 2014-15 respectively and represent the cost of water purchased from Seqwater. Seqwater manages the SEQ catchments and stores, treats and transports water to bulk supply points.

Unitywater's bulk water costs reflect expected demand by region and published bulk water prices for Moreton Bay and Sunshine Coast. Bulk water costs continue to increase at rate greater than Unitywater's other operating costs reflecting price increases of 11.1% for Moreton Bay and 15.2% for Sunshine Coast in 2013-14.

Unitywater is required to pass on bulk water costs to customers.

8.12. ELECTRICITY AND CHEMICALS

Unitywater is taking steps to reduce electricity and chemical expenditure through:

- Procurement and market tendering that result in saving from bulk purchase volume discounts;
- Considering ways to create and use Unitywater's own chemicals (such as Magnesium Hydroxide Liquid) and small scale electricity generation;
- Through the capital works projects to rationalise the number of pump stations in order to optimise network asset utilisation and operating expenditures; and
- Using new technology such as variable frequency drive controllers and motors to reduce energy usage at pump stations and STPs.

Unitywater considers these and other initiatives will result in reduction of the number of kWh required whilst maintaining the desired level of service for water supply and sewage transport and treatment.

8.13. CORPORATE EXPENDITURE

Corporate expenditure for 2011-12 was $60 million. This represented 24.7% of total operating expenditure. Forecast efficiencies are expected to reduce corporate expenditure to $49 million by 2014-15, representing 15.9% of 2014-15 total operating expenditure. Forecast corporate expenditure as a percentage of total operating expenditure appears below:

Table 8 Forecast Corporate Expenditure ($M)

($M)	FY2012	FY2013	FY2014	FY2015
Corporate Expenditure	60.0	48.9	53.2	49.0
Operating Expenditure	242.6	259.6	284.8	308.2
Corporate Expenditure as a Percentage of Operating Expenditure	24.7%	18.8%	18.7%	15.9%

8.14. RELATED PARTIES

Unitywater is increasingly becoming self sufficient and in 2012-13 only relied on participating councils for part provision of development management and charges and some minor accommodation for staff.

9. CAPITAL EXPENDITURE

Unitywater's Capital Works Program takes into consideration planning assumptions contained in the State Government's SEQ Regional Plan; participating councils' planning schemes, as well as fulfilling various legislative, regulatory, policy and other strategic planning requirements.

The MBRC and the SCRC are developing new planning schemes to manage sustainable land use and development. Unitywater's Water Supply and Sewerage Network Plans and Capital Works Program will be revised in accordance with the finalised planning schemes when complete.

Factors affecting the capital expenditure forecasts include:

- **Condition and performance of assets in service** - directly influencing the level and timing of renewal programs;
- **Spare capacity** - influences the impact of growth requirements on the capital works program. In the last few years the Moreton Bay region reached the point where the growth required significant capital expenditure. The Sunshine Coast region is now entering this phase;
- **Population and water consumption** - Capital expenditure forecasts reflect expected growth in customer numbers, consumption and connections;
- **Compliance** - capital augmentation to meet environmental licence conditions to deliver reliable sewage and trade waste treatment so that discharges to the environment comply with STP environmental licence conditions;
- **Customer service standards** - from a capital expenditure perspective, the most important factors driving investment are the environmental impact of wastewater and the volume of sewage being treated due to customer numbers and commercial trade waste volume and obligations to provide safe, secure and reliable drinking water supply; and
- **Balanced outcomes** providing services in a manner that balances network security, environmental, compliance, sustainability and customer and stakeholders outcomes.

Unitywater's expenditure approval processes and efforts to identify least cost and innovative solutions have already reduced capital expenditure programs compared to forecasts based on council budgets in 2010-11, prepared prior to Unitywater's formation.

Unitywater's capital expenditure process includes rigorous assessment by a dedicated committee of the Board and the Capital Works Committee. The Capital Works Committee meets monthly and monitors and reviews capital expenditure planning, program delivery, to ensure alignment with strategic objectives and management of network risk. Unitywater established a multi-divisional Asset Steering Committee (ASC) to review and endorse capital and operating projects and programs for submission to the Capital Works Committee.

The ASC was responsible for development of Unitywater's Capital Works Justification Process, to satisfy the linkage between capital and operating expenditure programs and Unitywater's strategic objectives. More recently the ASC has been pivotal in progression of the Netserv Plan that captures Unitywater's activities, initiatives and plans.

9.1. FORECAST CAPEX BY SERVICE

Unitywater considers itself to be one region, and does not use the QCA's approach of sub classifying expenditure by individual participating council regions. Unitywater's capital expenditure by service for the period 2012-13 to 2014-15 is included in the table below on an 'as capitalised' basis.

Table 9 Capital expenditure, capitalised by service (including developer provided assets)

As Capitalised by Service ($M) Service	FY2013	FY2014	FY2015
Water	26.4	35.6	40.2
Wastewater	97.3	116.9	104.6
Non-regulated	26.1	26.6	23.4
Total Capitalised	**149.8**	**179.1**	**168.2**

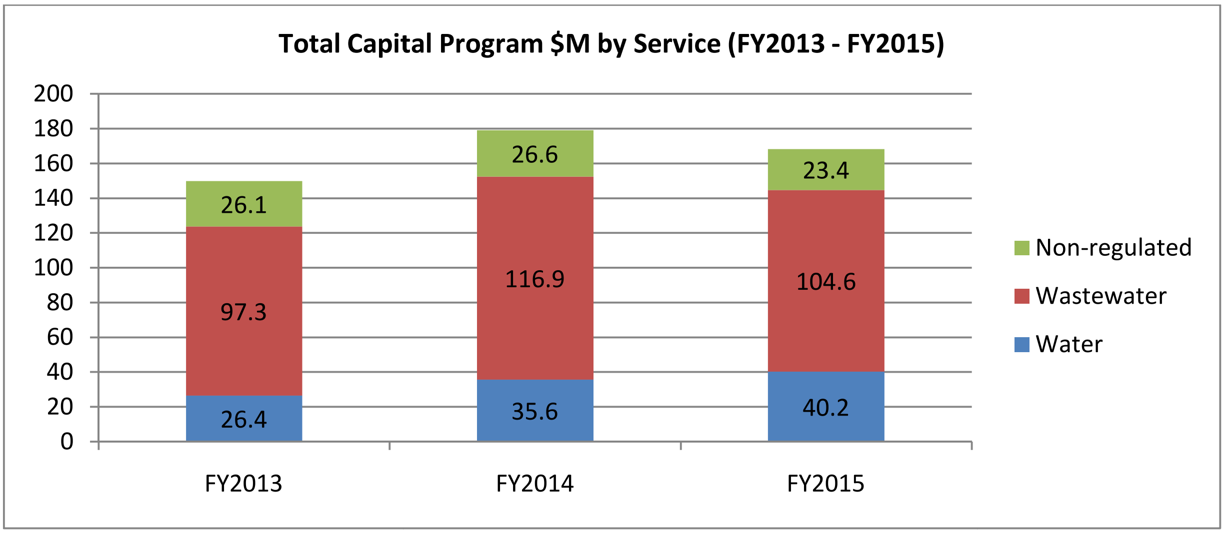
Unitywater's capital expenditure projects are mapped to QCA specified price monitoring cost drivers of growth, compliance renewal and service improvement. Unitywater maps projects on a one project one driver basis, we are considering development of multiple drivers mapping per project. Apportionment methods are not straightforward and require application of engineering opinion, the test is being able to obtain reliably repeatable outcomes from the process.

9.2. FORECAST CAPITAL EXPENDITURE (2013-14 TO 2014-15)

Unitywater developed the forecast capital expenditure program for 2013-14 to 2014-15 with reference to the need for expenditure to meet growth in customer numbers; maintain reliable and secure supply; compliance; asset renewal and replacement; and expected future demand.

Total commissioned capital expenditure is split between Moreton Bay and Sunshine Coast region over the period 2013-14 to 2014-15 as follows: $172.4M (35.6%) for Moreton Bay and $264.4M (64.4%) for Sunshine Coast. Sewage services account for a larger proportion of capital expenditure than water services. This is illustrated below with 64.1% of total expenditure for the period relating to the provision of sewage treatment and trade waste services.

Figure 1 Total capital program $M by service (2012-13 – 2014-15)



The significant capital expenditure for sewage services is a result of the following factors:

- Major upgrades of some STPs over the next few years;
- STP upgrades often require reissuance of licence conditions on the entire load, not just the incremental new load. As such reconfiguration of STP design and functionality to meet current licence conditions for all loads is a considerable driver of capital expenditure; and
- Deferral of investment in water distribution infrastructure due to falling levels of both residential and business water consumption, with much of this attributable to water restrictions and government initiatives regarding demand and rebound in demand less than estimated.

9.3. BENEFITS THROUGH TAKING A WHOLE OF REGION APPROACH

Unitywater considers itself to be one region. Unitywater continues to take a whole of region approach and invest in capital projects in both the Moreton Bay and Sunshine Coast to deliver fit for purpose, reliable water supply and sewage collection, transport and treatment services to customers. Historical under-investment in critical infrastructure, particularly on the Sunshine Coast, has forced Unitywater to invest significant funds to comply with environmental licences and support population growth.

Unitywater is committed to funding critical capital works to support population growth, customer service standards and to meet increasingly stringent environmental requirements. Unitywater considers that delivery of the capital works program across its region benefits from efficiencies in the capital planning cycle from each region. In short, the combined capital works program provides for a smoother combined capital expenditure that permits greater efficiencies in planning, procurement and delivery than would be available to a smaller disaggregated business.

9.4. WATER AND SEWERAGE PROJECTS

Investing in water and sewerage infrastructure is a significant part of Unitywater's budget. About 70% of costs to customers are derived from investment in infrastructure, such as pipes, pumps, water meters, reservoirs, STPs and systems. Unitywater invests for a variety of outcomes including:

Maintaining service standards – water infrastructure. As infrastructure ages, its performance deteriorates. Unitywater replaces existing water supply infrastructure in order to continue service delivery to the standards outlined in the Customer Charter. Examples of projects over the next five years include replacement of the water main in Finland Road, Coolum and Pacific Paradise, and replacing various hydrants.

Maintaining service standards – sewerage infrastructure. As for water supply infrastructure, Unitywater also replace sewerage infrastructure to ensure continued provision of services to the standards set out in the Customer Charter. Over the next five years we plan to replace or renew a range of sewerage pipes and pump station components.

Enabling regional growth – water supply. Unitywater provides new water infrastructure to enable regional growth. This typically involves building new pipes, pump stations and reservoirs. Examples of projects over the next five years include water mains in Bli Bli Road, Nambour, and Old Gympie Road, Caboolture; reservoir at Tanawha Road, and a water pump station at Ballinger Road, Buderim.

Enabling regional growth – sewerage. Unitywater provide new sewerage infrastructure to enable regional growth. This typically involves upgrading or building pipes and sewage pump stations. Examples of projects over the next five years include sewer rising mains in Main Drive, Parrearra;

Pumicestone Passage, Bribie Island, and Okinja Road, Alexandra Headland; a gravity sewerage pipe in Millwell Road East, Maroochydore, and upgraded sewage pumping stations at Bundilla Boulevard, Mountain Creek, Hercules Road, Kippa Ring and Caloundra Road, Caloundra.

Protecting the community. Unitywater's activities protect the community by testing the network's water quality and making sure there is suitable flow and pressure for fire fighting. Water quality initiatives include introducing new sampling points to monitor water quality throughout the network to ensure adequate representation and overall measurement of water quality on a system-wide basis. Unitywater's fire flow program aims to ensure adequate pressure and flow for fire fighting.

Water meter replacement. Ensures accurate measurement of the water Unitywater buys, distributes and sells to customers is necessary for operating the business efficiently. Unitywater plan to replace ageing customer water meters (residential and business),and bulk meters that measure the water from the SEQ water grid, and district meters help monitor water distribution and system losses.

Minimising water system leakage. Water system leakage reduction measures include installing localised pressure management valves to better manage loss through joints, and sealing reservoirs to prevent leaks. Unitywater invests in order to conserve water resources and save customers cost.

Protecting the waterways. Periods of heavy rainfall can sometimes lead to local flooding of sewerage networks, and result in rain-diluted sewage being leaked into waterways. To minimise the likelihood and severity of system overflow, Unitywater invests in overflow prevention measures such as creating emergency storages to hold excess sewage and identifying and sealing cracks and faulty joints in sewer pipes or removing illegal stormwater connections. Planned projects over the next five years include two emergency storages at Redcliffe and one each at Woody Point and Beerwah.

Protecting the environment. Once sewage is treated at STPs, the effluent water is discharged to natural waterways under licences from the DEHP. Unitywater invests in projects to ensure STPs continue to meet environmental licence requirements. Some of the spending includes increasing the capacity of STPs to cater for population growth. Projects over the next five years include planned upgrades of our STPs at Kawana, Nambour, Landsborough, Coolum and Maleny.

System monitoring and control. Being able to monitor and control the networks means that Unitywater can plan and operate more efficiently and respond to issues faster. Major investment in the installation of an integrated Supervisory Control and Data Acquisition (SCADA) system will enable the network to be managed from one control centre. SCADA will optimise pump and network monitoring and control, allowing faster response to outages, and improve performance reporting.

Protecting Unitywater people. Staff safety is paramount at Unitywater, so is investing in safety. Spending includes the introduction of improved safety structures and alarm systems to improve workplace health and safety for field workers.

9.5. KEY CAPITAL PROJECTS

Below are some of the major infrastructure capital works over the next few years.

Redcliffe Sewage Treatment Plant Upgrade – 2013 to 2015

Since July 2012 Unitywater has been operating the Redcliffe STP after a 10 year period where the plant was wholly operated by an external contractor. Since that time a number of emergent refurbishment requirements have been actioned to ensure ongoing safe and reliable plant operation while the long term plant requirements can be fully assessed. Detailed planning for the upgrade is scheduled to be completed in early 2013 with an initial estimate of $37.5M (to be confirmed as part of business case development) budgeted for upgrade works which will be carried out during 2013 to 2015. The final scope and cost of the upgrade will be confirmed at the completion of the detailed planning work and business case preparation process.

Landsborough Sewage Treatment Plant Upgrade – 2013 to 2015

The Landsborough STP requires an upgrade in treatment capacity to service growth in the catchment. The future of Landsborough STP is being considered in the context of the rationalisation of STPs detailed in the Treatment Services Plan. An option being considered is the closure of Landsborough STP and diversion of flows to the Kawana STP.

Noosa Sewage Treatment Plant Upgrade – 2014 to 2016

The current approved five year capital works budget includes $29M to upgrade the Noosa STP to ensure ongoing compliance with its environmental licence. The final scope of the upgrade will be dependent on the negotiation of environmental licence conditions with the DEHP. The current schedule has licence negotiations being finalised in 2013 with construction scheduled for 2014-2016.

Kawana Sewage Treatment Plant Upgrade – 2015 to 2017

The Kawana STP is located in Bokarina and has potential to be a key regional plant to service anticipated growth in existing infill areas as well as the major Greenfield development areas of Palmview and Caloundra South. As such a major upgrade is planned for 2015-2017, which will see approximately $370M ($250M for the STP and $120M for the ocean outfall) invested to increase the capacity of the STP to treat the additional loads and ensure ongoing environmental compliance. Part of this investment will be funded by developer contributions.

9.6. NON SYSTEM CAPITAL

Primarily non-system capital expenditure relates to fleet, asset and information systems, billing system and tools. These capital expenses are discussed below:

- Property management Unitywater owns, leases and maintains a range of properties including depots, STPs, corporate buildings, and land on which other infrastructure is built. Unitywater's property management planning ensures the property portfolio is managed effectively. CAMS will allow Unitywater to more easily assess property condition and prioritise maintenance.
- Unitywater has a fleet of heavy and light vehicles plus specific plant and machinery. Unitywater's fleet planning is designed to determine the optimal level of plant and equipment to enable efficient business operation without wastage. Unitywater's fleet management plans include initiatives to better track the usage and need for vehicles (using CAMS) and to reduce CO_2 emissions through gradual changeover to lower emission vehicles. Unitywater is monitoring its replacement program; utilisation rates, and expects improvements as some trucks and plant are replaced with assets that can be used for a range of requirements.

Information and communications technologies (ICT)

ICT - Program Paramount represented establishment of key organisational capabilities to deliver improvements in operating efficiency. Major ICT initiatives undertaken recently include development of an EDRMS; Enterprise Data Warehouse/Services (integration); GIS consolidation; CAMS; Unity network single domain; Unify billing and customer services system and an upgrade to the SCADA system. Unitywater also completed project EXIT which decommissioned applications/systems and unstructured data from councils.

ICT plays a vital role in enabling Unitywater to operate efficiently, consistently and responsively. New or improved systems that are helping Unitywater to achieve these aims include:

- **Unify** Unitywater inherited billing systems from each of the participating councils that were not built for utility billing. Unify is an integrated billing and customer service system designed for water and sewerage utilities commissioned in 2011-12 with rolling quarterly billing in arrears. This has streamlined interacting with customers, enabling faster resolution of customer issues.
- **Supervisory Control And Data Acquisition project (SCADA)** SCADA is currently under development, the system aims to upgrade monitoring and communications infrastructure for Unitywater's water supply and sewerage network. SCADA allows Unitywater to safely and automatically monitor and control plant and equipment; record performance to allow better reporting, analysis and planning; and better protect the environment against sewage spills. Having a single and consistent control system for the entire network provides operational efficiencies through less site visits to modify or check operations and helps to deliver more reliable services.
- **Consolidated Asset Management System (CAMS)** Asset management systems are an integral tool to aid planning and maintenance, condition and performance of the network. CAMS stores a wealth of information about the assets Unitywater owns, including water and sewerage infrastructure, vehicles, buildings and property, and unites the disparate asset information that was inherited from our two owner councils. CAMS allows field workers to easily access and update information on the condition and construction of assets; provide more reliable information to treatment plant operators; and assists with planning for asset renewal and replacement. CAMS can also to store images and videos making it easier to assess changes in the state of assets.
- **Geographical Information System (GIS)** GIS technology partners with CAMS by being a visual tool through which Unitywater can access and update asset information. GIS ensures that staff members know exactly which assets they are working with, as it adds a spatial dimension to database information.
- **Electronic Document Record Management System (EDRMS)** From early 2012, Unitywater's enterprise-wide documents and records management system - Objective - went live. This system is used by all staff that creates or uses documents, emails that need to be shared with other parts of the business or kept as a record for legislative requirements.

Unitywater expects that the new systems will require a period of time to mature and gain sufficient information to identify and realise benefits.

9.7. VARIATIONS IN PREVIOUS FORECASTS FOR CAPITAL EXPENDITURE

The capital expenditure forecast provided in the 2012-13 submission varies from forecast data provided in this submission. This can be attributed to various factors including but not limited to:

- Unitywater efforts to optimise capital forecasts and innovative lower cost capital options as opposed to relying on council estimations of future capital requirements;
- Unitywater gaining more information on assets condition and performance;
- Unitywater undertook a market engagement exercise through a public tender for the supply of pipe and associated fittings. Based on expected expenditure for pipes and associated fittings, and prices being charged prior to the market engagement exercise, Unitywater will achieve savings of the order of 18%. There are additional incentives for further price reductions through volume ordering and delivery;

- Unitywater having the benefit of operational information to obtain a greater understanding of its area and the business's capital needs, resulting in a more accurate prediction of expenditure and network requirements;
- Unitywater achieving efficiencies and sourcing alternatives to expenditure than previously forecast by the individual councils (as evidenced by the Brendale STP capital expenditure deferral by pumping sewage into QUU's network for treatment); and
- The capital justification process put in place to justify needs, options, scope and delivery of major projects.

9.8. HOW UNITYWATER ENSURES WE SPEND MONEY WISELY

Unitywater has a number of committees to ensure major expenditure is aligned with the organisation's strategic objectives. Unitywater's prices are monitored by the QCA, who assess Unitywater's expenditure for prudency and efficiency. The *QCA Interim Price Monitoring Report 2012-2013* found that Unitywater's total revenue was $57 million below the maximum allowable level, or the equivalent of approximately $200 per household.

Unitywater's expenditure can be split into three types:

- Expenditure on 'normal' capital works (i.e. water and sewerage infrastructure, properties, IT hardware, vehicles and machinery);
- Expenditure on operations (including staff costs, minor maintenance items, fuel, energy, rental of offices, bulk water costs); and
- Expenditure on 'special' capital works that reduce operating costs in the long term, making the business more efficient. Examples include Unify, SCADA and CAMS.

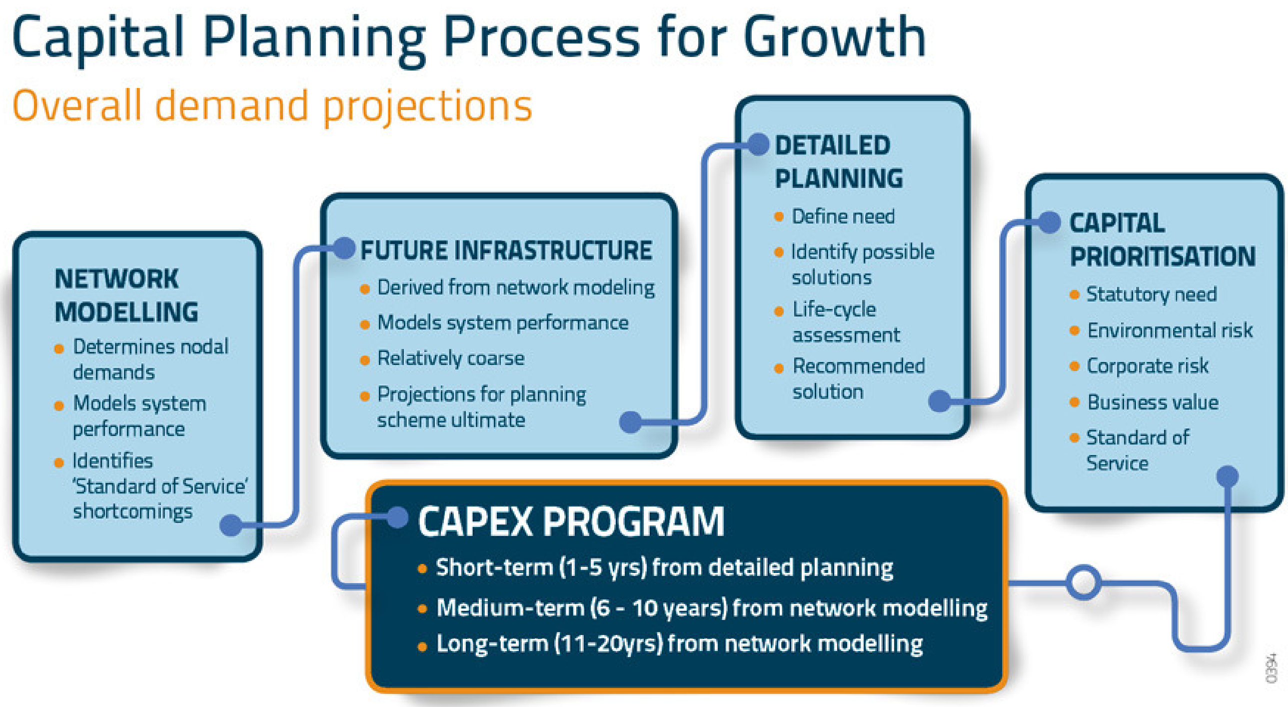
9.8.1. NORMAL CAPITAL WORKS EXPENDITURE

Unitywater's Capital Works Committee (CWC) advises the Board on strategic capital works, annual capital works expenditure and significant capital works commitments. Unitywater also established an Asset Steering Committee, to review and test the need for a project and endorse investment decisions for capital and operations projects.

In order to compile Unitywater's Capital Works Program, detailed planning proposals are prepared for all new infrastructure projects. Planning proposals contain a business case, options analysis, concept designs and detailed cost estimates. Planning can take three to six months for minor projects and up to 12 months for more complex projects involving multi-million dollar expenditure. The Capital Works Program also budgets and plans for non-infrastructure projects and for renewal of degraded assets.

The Capital Works Justification Process is used to maintain efficiencies throughout the life of a major project. Projects are peer reviewed at critical milestones such as initiation, design, procurement, construction, commissioning and close-out. The process as a whole ensures prudency (the need for a project at the time proposed) and efficiency (selecting the right option among a range of options that are considered). Unitywater uses a risk-based prioritisation model to assess, score and rank projects. The aim is to deliver the right infrastructure at the right time and at the best value life-cycle cost.

Diagram 4 – Capital planning process for growth



9.8.2. CAPITAL EXPENDITURE ON BUSINESS IMPROVEMENTS TO LOWER OPERATIONAL COSTS

Unitywater has established an Investment Steering Committee (ISC), which uses processes similar to the Capital Works Justification Process to develop business cases. Business cases analyse the strategic alignment, need, timing, options and the best delivery of potential initiatives, to improve the efficiency and effectiveness of business operations and justify prudency and efficiency.

9.9. BEING WELL PLANNED

Delivering safe and reliable water supply and sewerage service is a complex business. Unitywater plans capital works on a 20 year outlook. Unitywater's culture of continuous improvement means strategic plans are regularly reviewed, looking for more efficient or better ways to address challenges.

9.9.1. WATER QUALITY MANAGMENT

Unitywater must supply water that complies with the *Public Health Regulation 2005* and the *Australian Drinking Water Guidelines* issued by the National Health and Medical Research Council. Unitywater operates under a *Drinking Water Quality Management Plan* approved by the Office of the Water Supply Regulator (DEHP).

Unitywater's bulk water is purchased from treatment plants owned and operated by Seqwater. Unitywater liaise closely with Seqwater to ensure the bulk water received is fit for purpose. Once received into Unitywater's network, water quality can gradually degrade, depending on a number of factors including water age, which is determined by flow rates and distance travelled, as well as other factors such as the condition of pipes and reservoirs. To maintain drinking water quality standards, Unitywater continuously monitor water quality at various points across our network, and treat or flush the water if required.

9.9.2. WATER CYCLE PLANNING

Water cycle planning looks at how water is managed regionally by taking into consideration waterways, dams, stormwater, groundwater, and effluent discharge from STPs. Holistic catchment management aims to balance environmental protection with providing water to homes and businesses at an affordable level.

Unitywater has helped its two owner councils to produce their Total Water Cycle Management Plans, and carries out any agreed activities included in the plans. The standard of effluent discharged from STPs is a key component of total water cycle management. Unitywater is investigating innovative ways of managing effluent, such as recycling bio-solids for agricultural or industrial use, using more cost effective techniques for nutrient removal, and creating wetlands to filter treated effluent before it reaches waterways.

9.9.3. FIRE FLOW MANAGEMENT

Unitywater is required to supply water to fire hydrants at an appropriate pressure and flow rate to enable effective fire fighting. Unitywater is undertaking sophisticated modelling to highlight areas that have deficiencies in flow rate or pressure. A rectification program will be carried out over the next five years to address any fire flow issues.

Over the next two years Unitywater and other distributor-retailers in SEQ will discuss and consider service standards such as fire water pressure and flow to determine what standard is required by modern day fire fighting vehicles. If the standards are too high that means the water pressure is higher, resulting in more frequent pipe breakages and increasing the potential for system leakage. So water pressure for fire fighting, needs to be balanced with safety, customer costs, system reliability and minimising system losses.

9.9.4. SEWER ODOUR AND CORROSION INITIATIVE

This initiative is being developed to further safeguard community health and amenity by addressing the causes of sewer corrosion and odour. The initiative involves identifying the causes of these issues and proposes changing the way Unitywater operate the networks to minimise production of substances that corrode pipes and contribute to odour generation.

9.9.5. SEWER OVERFLOW ABATEMENT INITIATIVE

Unitywater has developed a region-wide overflow abatement plan that details an extensive program of investigations, flow gauging, modelling and environmental and waterway monitoring to identify capital or operating projects necessary to minimise sewage overflows. Unitywater Inflow and Infiltration Program is one of a number of initiatives being implemented in order to protect public health and has also helped protect beaches, waterways and public areas by indentifying and rectifying causes of rainwater and groundwater entering Unitywater’s sewer network.

9.9.6. CLIMATE CHANGE INITIATIVE

Predicted climate change means Unitywater will have to adapt its operations to ensure it can continue to provide services. For instance, rainfall is expected to intensify in the region and this will heighten the risk of flooding in the sewerage network. Unitywater also is trying to reduce greenhouse gas emissions by assessing contributing factors such as the energy used in pumping water and sewage, and gas emissions during sewage treatment. Unitywater is considering Climate Change to analyse impacts on operations, devise means of adaptation, and outline actions to reduce Unitywater’s contribution to climate change.

9.9.7. RESEARCH AND DEVELOPMENT INITIATIVE

Unitywater's vision "to be a sustainable, industry-leading, community and customer oriented water and allied services business" requires appropriate investment in research and development (R&D). R&D aims to reduce costs and create financial opportunities by positioning Unitywater as an innovative and learning organisation that can identify and apply emerging technologies and innovations, and can apply for research grants and subsidies.

9.9.8. TREATMENT PLANT INTIATIVE

Unitywater has a long term plan to examine innovative ways of processing sewage collected and turning it into a variety of valuable by-products. The essence of this idea is to turn treatment plants into factories to provide better environmental outcomes, generate income and reduce costs to customers. Possibilities include recovering phosphorus for fertiliser, extracting trace metals for re-use, and harvesting methane gas for energy recovery.

The Treatment Services Plan identifies the direction for sewage treatment services to transition over the next 50 years from 18 treatment plants to two major centralised facilities and to nine decentralised facilities in Unitywater's service area.

Centralisation of treatment services for the urbanised areas will offer opportunities for; growth in the region, optimal operation, least environmental and community impact (e.g., 60 tonnes of nitrogen per annum will be removed from the region's waterways and less people will live in close proximity to a treatment plant), energy generation, and recovery of water, nutrients and other materials for recycling.

In the future, Unitywater's STPs will be matched with specific treatment themes, with the selection of treatment processes and equipment targeted to optimise operations and business opportunity such as recovery of nutrients. Increased automation of treatment plants will improve operational efficiency and meet tighter performance objectives.

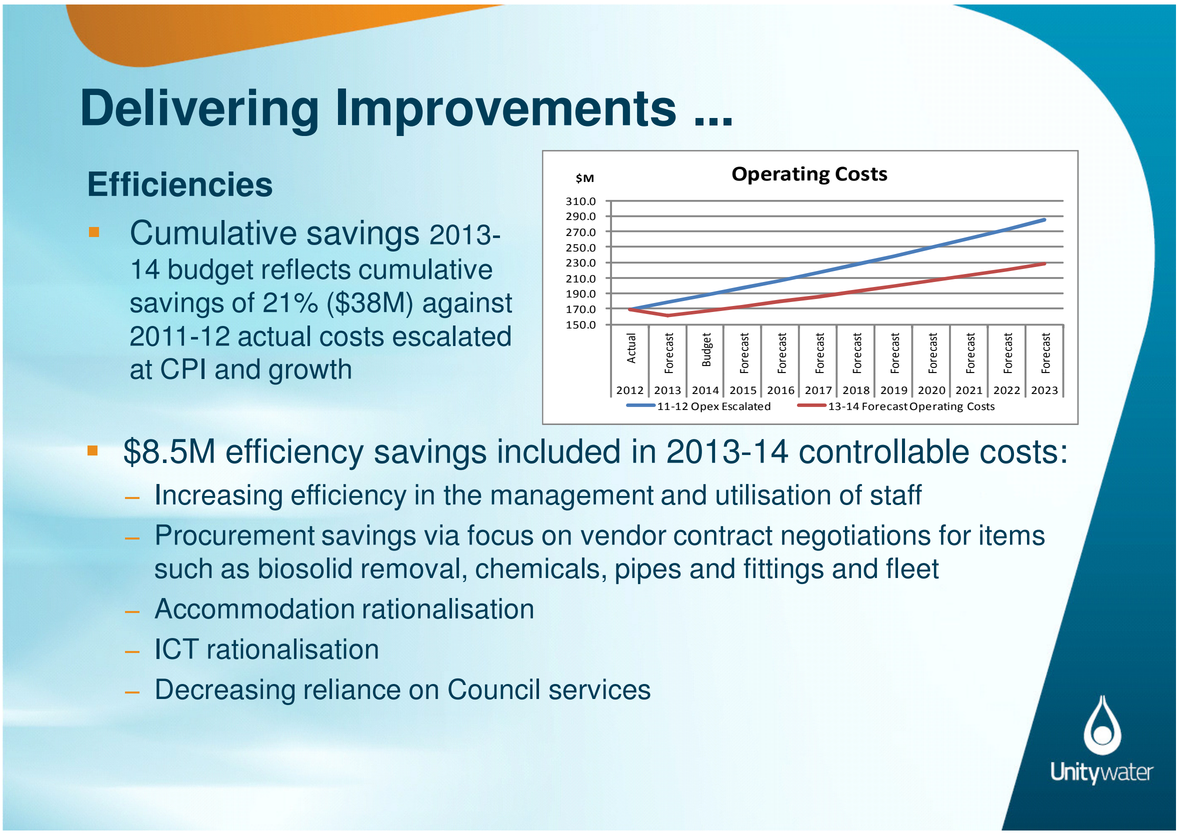
10. DRIVING IMPROVEMENTS

Unitywater's 2013-14 budget includes operational efficiencies and Unitywater remains committed to achieving further efficiencies that do not affect fit for purpose service delivery. Unitywater considers it has exceeded QCA's deemed efficiency factors and included these cost reductions in operating expenditure forecasts to June 2015. As such, no additional efficiency factor should be applied to forecasts. Most recently Unitywater identified an opportunity to trial and roll out if successful advanced variable frequency drives and pump motors that will lead to a reduction in electricity consumption per pump for a modest investment.

In late 2011, Unitywater decided to defer augmentation of the Suncoast STP by planning to build a pipeline to transfer sewage to the Maroochydore STP that has capacity to treat more sewage under its existing environmental licence. That decision defers approximately $14.8M in capital expenditure and optimises utilisation of existing environmental licences by taking steps to interconnect sewerage networks and optimise portfolio performance of STPs.

Unitywater has delivered significant savings when comparing controllable operating expenditure from earlier budgets that are escalated for volume, cost and growth and compared against more recent budgets. The savings demonstrate the commitment of Unitywater to reducing the cost to serve customers. Unitywater cannot control the bulk water price and is obliged to pass through the full cost to customers. Hence bulk water is excluded from the definition of 'controllable operating expenditure'.

Diagram 5



10.1. BENCHMARK EFFICIENCY

Unitywater considers benchmarking amongst distributor-retailers in SEQ or other regions is problematic and prone to appropriate comparator error. Unitywater contests that its plant design, performance and operational circumstances, customer density and geographical location, particularly with parts of the adjacent coastline protected Marine Park, present Unitywater with unique challenges that require its STPs to be operated on a more stringent set of licence conditions than would otherwise be the case. Unitywater is also concerned with comparing a new or emerging business with a well established business. That said, Unitywater considers Hunter Water's network characteristics would be the closest fit as a comparator business, noting that Hunter Water is well established and Unitywater is three years old.

10.2. OPERATIONAL SAVINGS IN 2012-13

Unitywater has made significant inroads in delivering improvements through attention to detail across a range of areas such as human resources, purchasing, rationalising, and in-house service provision, and joint workings.

Unitywater monitors performance by separate areas of the business and compares actual performance against the original budget. Through the use of KPIs in performance agreements staff are incentivised to pursue savings initiatives and aligned with the strategic plan. Summary of savings identified during 2012-13 are summarised in Table 10 below.

Table 10

Division	2012-13 Savings	$M
All	FTE management.	1.5
Field Services	Cost of electrical apprentices compared to contractors. Overtime saving due to afternoon shift and staggered start implementation. Materials due to more efficient use and control over spend, plus lower levels of planned maintenance.	0.2 0.3 1.3
Treatment Plants	Kedron Brook reduction in transfer of sewage to QUU Contracted services/Consultants due to savings / cancellation of projects and/or delays.	1.2 0.3
Corporate Services	Reduction to consultants/contractors to recognise alternate approaches taken to meet deliverables. Insurance premiums due to not re-insuring for contractors. Fleet costs due to rationalisation. Legal matters handled in-house. Lease costs due to property rationalisation.	0.2 0.5 0.3 0.2 0.2
ICT	Savings due to exit off council platforms and new ICT service provider. Equipment hire due to termination of lease agreements. Savings achieved through Endpoint Telco & WAN review.	1.1 0.2 0.3
Retail	Mail out savings. Savings in market research, website and other communications. Credit card payment numbers on bills to reduce forwarding calls.	0.3 0.2 Call costs
HR	Training costs based on updated learning and development plan	0.2
Finance	Savings in consultants/contractors by cost sharing with QUU. Savings in external audit fees for 2011-12 and 2012-13 audits.	0.1 0.1
Total		**$ 8.7**

Many initiatives undertaken by Unitywater will have long lasting benefits and in some instances the benefits do not occur in the year the opportunity was identified or resourced with benefits realised in succeeding financial years. Unitywater is pleased to be working on a range of chemical and electricity savings initiatives that have significant potential to reduce costs. The table below provides a high level summary of three such initiatives.

Table 11

Division	Savings expected in 2013-14 due to work initiated in 2012-13	$M
Field Services	Manufacture of Magnesium Hydroxide Liquid (MHL) in house, to commence in Q4 2013. Savings will be realised from June 2013.	0.6
	Odour control initiatives being trialled in collaboration with third parties to assess odour mitigation/reduction and extension of the life of sewer networks. Potential savings will be realised in 2013-14	TBD
	Variable speed pump trial undertaken, and to be expanded into 2013-14. Potential savings will be realised in 2013-14	TBD
Treatment Plants	A trial will be undertaken to see the impact of the reduction in use of methanol. Alternative trials planned during 2013-14 include Free Nitrous Acid (FNA) which has potential to be manufactured in-house.	TBD

10.3. SUBSTITUTION BETWEEN CAPEX AND OPEX

Unitywater supports deferral of capital expenditure and using alternative solutions such as non infrastructure solutions to address growth, renewal, improvement, or compliance. Unitywater considers options to address network constraints, including operating expenditure solutions, design alternatives, sequencing and sizing of augmentation, and uses a multi factor prioritisation tool to select the most appropriate alternative.

Unitywater recently embarked on one such project where, through joint workings with QUU, an innovative solution to provide lasting benefits to Unitywater customers by deferring STP augmentation at Brendale and pumping sewage for treatment at QUU's luggage point STP.

10.3.1. BRENDALE – OPERATING EXPENSE SOLUTION

Operating expenditure associated with the Brendale STP is one example where Unitywater is applying new approaches to meet demand for services in a least cost way. The original extended aeration plant at Brendale was commissioned in 1978 with a design capacity of 10,000 equivalent persons (EP). Brendale was upgraded in 1990 with Queensland's first biological nutrient reduction process to serve 20,000 EP. Brendale has been progressively upgraded and currently treats approximately 41,500 EP and is operating at or close to its treatment capacity.

Catchment growth is expected to continue to increase and by 2030, the Brendale STP will be serving 77,000 EP. Brendale releases treated waste water into the South Pine River and current licence conditions permit up to 50,000 EP loads into the river system. Increasing the load above 50,000 EP will require substantial augmentation of the treatment plant to meet current standard licence conditions for the total load. Augmentation may require capital intensive advanced water treatment technology and or a recycled water scheme. Odour plume may also be a factor, as land buffer zones are encroached by regional development. The options assessment considered:

- Two stage major augmentation of the treatment plant;
- Interim upgrade and pumping of load to Murrumba Downs STP with a future augmentation of Brendale; and

- Diversion of load to QUU for treatment at Luggage Point STP and an interim upgrade of Brendale. Unitywater already transfers some sewage load to QUU from the Hills district to take advantage of geographical characteristics.

After considering a range of factors, Unitywater decided the best option was to construct a diversion pipeline to divert flow for treatment by QUU. Unitywater pays a negotiated fee for this service but it defers substantial capital expenditure at Brendale that would have been required in 2011 to meet the growth and compliance with licence conditions. The option permits Brendale to defer $65.5M capital expenditure until around 2016. The first flow of load to Luggage Point commenced in June 2012.

10.4. NORTHERN SERVICES CENTRE

Unitywater is actively pursuing operational efficiency of its property portfolio through development of the Northern Services Centre to provide a single facility to support field operations in the northern region of Unitywater's operating area. Unitywater undertook an independent review of its property portfolio to integrate the business across its operating area; and to identify operating efficiencies such as rent reduction and customer service improvement. Field operations in the northern region were previously operating from nine separate locations. Co-location will result in time savings, integration of work practices, functional support rationalisation, stores and facility maintenance.

10.4.1. QUALITY MANAGEMENT CERTIFICATION

In May 2013, Unitywater "whole of business" was certified to international standards for environment systems (AS/NZS ISO 14001:2004) and quality management systems (AS/NZS ISO 9001:2008) by Compliance Australia.

10.4.2. ICT SYSTEMS RATIONALISATION

Unitywater introduced a single set of region wide systems reducing reliance on legacy council systems and delivering standalone capability such as GIS, SCADA, CAMS, EDRMS and Customer Service and Billing Solutions (Unify).

Unitywater is using Global Position System (GPS) for vehicle tracking in order to deliver productivity improvements through more efficient dispatch, and to reduce response times of field crews to rectify customer service issues. One recent anecdote of the practical value of GPS plant tags was the recovery of an excavator stolen from a Unitywater depot. The ICT investment provided the information on the location of the missing excavator in real time.

10.5. INNOVATION

Unitywater has adopted innovative sewage treatment capital solutions including:

- The first full year of operation of the diversion of sewage from Brendale to Luggage Point that defers augmentation of the Brendale STP for several years by paying QUU to treat the diverted sewage from Arana and Ferny Hills, previously discussed in this submission;
- Diverting sewage from the Suncoast STP by building a pipeline to the Maroochydore STP permitting decommissioning of the Suncoast STP rather than upgrading the current plant to a more stringent environmental licence and saving $13.0M. Suncoast STP and its current licence will be retained in case growth requires re-commissioning;
- Planning wetlands at Maleny and Coolum as an alternative capital solution rather than STP augmentation to deliver cost efficient environmental solutions;

- Promoting and receiving bubble licences for STPs flowing into the same river system (i.e. a single licence for multiple plants);
- Promoting total water cycle management plans; nutrient offsets; load diversions and wet lands; to help optimise value chain solutions e.g. undertaking works in the water catchment that reduce nutrient loads on receiving waters rather than investing in highly advanced STPs. Unitywater was nominated for and won multiple awards in 2012 including: Parsons Brinckerhoff award for Excellence in Strategic Planning and Conceptual Design for the Total Water Cycle Management Plan, National Riverprize; Queensland Program of Innovation; Queensland Infrastructure Project Innovation; and Healthy Waterways; and
- Unitywater is identifying and removing illegal stormwater connections to the sewer network through smoke testing. Removing illegal connections is more cost effective than augmenting the network to perform in all weather conditions and is also expected to contribute to a reduction in duration, frequency and severity of wet weather sewage overflow events.

11. RETURN ON CAPITAL

11.1. WEIGHTED AVERAGE COST OF CAPITAL

In proposing a departure to QCA's WACC, Unitywater has had regard to a range of literature supporting the use of long term estimates of inputs to minimise the variability of WACC's derived for regulatory purposes. Unitywater promotes this approach as it is aligned to the nature of the assets (long life) and to mitigate price shocks to customers (Refer Appendix 5).

Unitywater has applied a WACC of 7.62% (post-tax nominal vanilla). The assumptions are provided in table 12 and explained below.

Table 12

Parameter	Estimate
Risk-free rate	5.24%
Gearing (debt to value)	60%
Asset beta	0.35
Debt beta	0.11
Equity beta	0.66
Market risk premium	6.5%
Corporate tax	30%
Gamma	0.50
Cost of debt	6.37%
Cost of equity	9.50%
Post tax nominal (vanilla) WACC	**7.62%**

11.2. TERM TO MATURITY

Unitywater has assumed a ten year term to maturity for the purpose of estimating the risk-free rate and debt margin. This assumption is considered most appropriate for infrastructure with long economic lives and complements the long term horizon of investors.

11.3. COST OF DEBT

A fundamental separation can be made between the estimation of the forward-looking cost of debt and equity, with the former being more readily observable in the market. Unitywater considers that the first issue to consider in establishing the cost of debt is what sort of debt management approach (or range of approaches) might an efficient and prudent service provider adopt. Noting that Unitywater is not subject to periodic resets of its WACC by the QCA, it considers that an efficient approach for an infrastructure provider is to issue long term debt, which is progressively refinanced through time to manage interest rate and refinancing risk . Refer Appendix 6.

An appropriate 'benchmark' approach is to assume that this refinancing task is spread evenly through time, that is, over a ten year horizon one-fortieth of the debt is refinanced each quarter. Consideration also needs to be given to new borrowings to fund capital expenditure.

The starting point for this approach is the ten year cost of debt. In order to maintain appropriate alignment between the assumed cost of debt and actual borrowing costs, it is necessary to update the cost of debt in the WACC each year (either up or down) to reflect the cost of debt that is being refinanced, as well as capturing the costs of new borrowings for capital expenditure.

Unitywater considers that this approach has two main benefits for end users. First, in achieving closer alignment between the assumed cost of debt and changes in interest rates through time, users directly benefit from any reductions in interest rates. Further, given it is only assumed that one-tenth of the debt portfolio is being refinanced, it will reduce price shocks that could otherwise occur if the WACC was subject to periodic resets. This 'staggered portfolio' approach is also being considered by the Australian Energy Regulator (following rule changes for energy network businesses introduced by the Australian Energy Market Commission) for businesses that are subject to periodic WACC resets.

As Unitywater is intending to implement this approach now, the starting point for the cost of debt is still the prevailing cost of debt. Going forward, the cost of debt will be updated on an annual basis as new borrowings are made and a percentage of the existing borrowings are refinanced at prevailing rates. The prevailing cost of debt has been determined consistent with current Australian regulatory practice, with averages calculated using daily data for the month of April. The resulting cost of debt of 6.37% is comprised of:

- A ten year CGS yield of 3.28%;
- A ten year BBB debt margin of 2.97%, which was estimated by extrapolating the Bloomberg seven year BBB yield using the 'matched pairs' approach[12]; and
- An allowance for debt raising costs of 0.125%.

11.4. COST OF EQUITY

The cost of equity is not directly observable and is set in a fundamentally different market[13]. Apart from the challenges in estimating the forward looking cost of equity in the current environment, one of Unitywater's main objectives in setting the WACC is to achieve long term certainty and stability. It considers that the most appropriate way to ensure this is to apply assumptions that are more likely to be consistent with long term average values and less vulnerable to changes in short term market conditions.

In the context of price regulation, one of the most contentious issues in setting rates of return at the current time is estimating the forward looking cost of equity. In particular, concerns have been raised that the practice of combining:

- A short term average of the risk-free rate, which has been at historical lows following the Global Financial Crisis; with
- A long run average Market Risk Premium (MRP), the value of which has also been a topic of some debate, could result in a cost of equity that materially understates the return that equity investors expect in the current environment.

For example, in recent water decisions Independent Pricing and Regulatory Tribunal (IPART) has had regard to the WACC that would apply if long term averages were adopted for all of the parameters, in

[12] This informs the term structure of interest rates (that is, the likely difference between a seven and ten year yield) by looking at bonds issued for different terms by the same issuer (and in the relevant credit rating category).
[13] Although comparisons can be made between the margins on debt and equity when assessing the market price of risk.

recognition of concerns that its current approach to estimating WACC might result in an estimate that is too low.[14]

11.4.1. RISK-FREE RATE

Unitywater has estimated a long term average of the ten year Commonwealth Government bond rate over the last ten years (from 1 May 2003 to 30 April 2013). Ten years is considered an appropriate horizon for a long term average of the risk-free rate noting that debt markets have undergone structural change over time (e.g. the implementation of credible monetary policy targeting in the early to mid 1990s). It is also noted that IPART estimated a ten year average in its recent decision for Gosford City Council and Wyong Shire Council.[15]

The resulting estimate (annual effective) is 5.24%.

Unitywater does not consider it inappropriate to use a different basis to set the risk-free rate in the cost of debt and equity. As noted above, the two are set in different markets and the cost of debt is more readily observable. Unitywater's approach to the cost of debt is to assume a ten year portfolio starting today, which will be progressively refinanced through time to manage risk (as well as taking on new borrowings). The resulting cost of debt will ultimately also be a long term average, but it will be based on a 'trailing' (or progressively updated) average.

11.4.2. BETA

Unitywater has adopted an equity beta of 0.66 consistent with the QCA's Final Report for SEQ Interim Price Monitoring (the QCA's 2011 Decision). However, it remains concerned that this estimate understates the systematic risk of an urban water business and intends to review this in future, along with other key parameters such as gamma and the MRP.

11.4.3. MARKET RISK PREMIUM

As outlined above the expected value of the MRP has been subject to some debate. Unitywater has not reviewed this in detail at the current time however considers it important to examine this in future within the context of the overall cost of equity (including reconciling historical estimates with forward looking measures and potentially referencing models other than the Capital Asset Pricing Model). It has therefore adopted a value of 6.5%. This is the mid-point of the range in which long term historical averages in Australia have fallen (6% to 7%). Refer Appendix 7.

11.5. OTHER ASSUMPTIONS

11.5.1. GEARING

60% has been assumed, consistent with the value applied in the QCA's 2011 Decision.

11.5.2. GAMMA

Unitywater has adopted a gamma of 0.5, consistent with the QCA's 2011 Decision. Unitywater is of the view that the value of gamma is more likely to be between 0.5 and zero (if not zero). Particularly given the Australian Competition Tribunal's ruling for Energex and Ergon Energy (resulting in a gamma of 0.25), it expects this issue to be examined more fully in future reviews.

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[14] For example, refer: Independent Pricing and Regulatory Tribunal (2013). Gosford City Council and Wyong Shire Council, Prices for Water, Sewerage and Stormwater Drainage Services from 1 July 2013 to 30 June 2017, Final Report, May.

[15] Independent Pricing and Regulatory Tribunal (2013). p.179.

12. REGULATORY ASSET BASE (RAB)

12.1. GENERAL APPROACH

Unitywater applied a four stage approach to calculate the RAB value used for the preparation of this submission. The four stages included:

1. Calculating the opening RAB at 1 July 2008 that reconciled with the Minister's value;
2. Rolling forward the opening RAB value to 1 July 2010 (to derive the Participation RAB) in accordance with the process specified by the:
   (i) Minister in the Participation Agreement; and
   (ii) QCA in its publication 'Information Requirements for 2011-12'.
3. Deducted work in progress from the 1 July 2010 Participation RAB and added establishment costs; and
4. Rolling-forward the RAB to 30 June 2015 in accordance with the QCA specified process.

Table 13 Participation and Regulatory RAB Values 1 July 2010 ($M)

Description ($M)	Adjust ±	MBRC	SCRC	Total
RAB 1 July 2008		1,110.0	919.9	2,029.9
Add Net Roll Forward	+	225.2	148.5	373.7
RAB 30 June 2010	=	1,335.2	1,0684	2,403.6
Add Capital Works in Progress	+	184.0	21.1	205.1
Ministers Value Participation RAB 1 July 2010	=	1,519.2	1,089.5	2,608.7
Participation Rights %	**%**	**58.24%**	**41.76%**	**100.0%**
Less Capital Works in Progress	-	(184.0)	(21.1)	(205.1)
Add Establishment Costs	+	7.3	5.8	13.1
Regulatory RAB for QCA price monitoring	**=**	**1,342.5**	**1,074.2**	**2,416.7**

12.2. RAB ROLL FORWARD 30 JUNE 2015

Rolling-forward the RAB each year to 30 June 2015, the 1 July 2010 opening RAB was adjusted for indexation, depreciation, disposals and additions for each financial year to 30 June 2015. Key assumptions/approaches were:

1. For the purposes of this information return, the revenue offset method for calculation of the RAB has been applied for the periods 2010-11 to 2012-13 inclusive. Then a move to asset offset has been adopted;
2. Unitywater adopted an aggregated approach to valuing the RAB data extracted from the fixed assets register;

3. Indexation was applied to commissioned assets, developer provided assets all assuming to occur halfway through the year;
4. Capital projects are added to the RAB on an as-commissioned basis. Capital projects are capitalised and added to the RAB at the mid-point of the commissioning year. Any expenditure that occurs after the commissioning date is capitalised in the year of spend; and
5. Renewal projects are capitalised each year regardless of commissioning date.

Table 14 Estimated RAB roll-forward for this period ($M)

Description ($M)	Moreton Bay Regional Council	Sunshine Coast Regional Council	Combined Total
Initial RAB 1 July 2010	1,342.5	1,074.2	2,416.7
Add Commissioned Assets	500.9	396.4	897.3
Add Indexation	190.5	144.8	335.3
Less Regulated Depreciation	273.1	198.6	471.7
Closing RAB 30 June 2015	1,760.8	1,416.8	3,177.6

Negligible asset disposals are expected and have a nil disposal value. Further details of the RAB roll-forward can be found in the templates accompanying this submission.

12.3. INTEREST DURING CONSTRUCTION

Consistent with statutory accounting requirements, Unitywater has applied interest on projects that extend beyond 12 months. This is calculated as the difference between the commencement date and the commissioning date. Renewals are capitalised on a yearly basis so do not incur any interest during construction.

12.4. INDEXING THE ASSET BASE

RAB indexation uses the annual June to June ABS Consumer Price Index (all groups, Brisbane) for historical years; the March to March observation for the most recent financial year 2012-13 and the RBA CPI estimate of 2.50% in all forecast years. The indexation factors applied by Unitywater are as illustrated below.

Table 15 CPI for RAB Indexation

CPI indexation rate	Observation	Source
FY2010-11 June to June	3.88%	ABS publication 64010
FY 2011-12 June to June	0.90%	ABS publication 64010
FY2012-13 March to March	2.10%	ABS publication 64010
FY2013-14 to FY 2014-15	2.50%	RBA May 2013 Statement on Monetary Policy page 62

12.5. CONTRIBUTED / DONATED ASSETS

Unitywater receives capital revenue from the state government or property developers. In the case of the state government, this has been in the form of grants or subsidies. In the case of property developers, this has been in the form of cash contributions (developer charges); or asset contributions via donated trunk infrastructure in lieu of cash contributions, or the donation of non-trunk infrastructure.

Capital revenue is a form of infrastructure funding with the intention that payment of the infrastructure is made by those who receive the benefit.

Unitywater is subject to the Local Government Tax Equivalents Regime and therefore pays an income tax equivalent to the participating councils. Capital revenue received in the form of cash contributions is included in Unitywater's taxable income and as a result a share of this funding is returned to the councils. This practice reduces the funds available to Unitywater to build infrastructure and leaves Unitywater at a disadvantage to council operated water businesses.

Two changes made by the State Government are likely to have a significant impact on the level of capital revenue:

1. The removal of the 40% State infrastructure subsidy for STP upgrades; and
2. The recent decision to set a maximum charge for the level of infrastructure charges for water and sewerage until 30 June 2013. It is expected the State Government will extend this arrangement for the 2013-14 financial year.

The combined impact of these two changes has seen increased pressure on utility charges to fund the infrastructure to deliver water supply and sewerage services.

12.5.1. CONTRIBUTED CASH AND ASSETS – MOVE TO ASSET OFFSET

Unitywater has elected to move from the revenue offset approach to asset offset for capital contributions. Unitywater considers there to be several administrative and practical limitations associated with full asset offset and would like to discuss operational and modelling business rules.

This decision is also linked to the volatile regulatory benchmark WACC that was advised by the QCA in January 2013 being 30% lower than the previous benchmark which would result in Unitywater over recovering.

This outcome is not acceptable in the current environment where customers are very sensitive in relation to cost of living pressures and there is no QCA approved mechanism for Unitywater to offset an over recovery against previous under recoveries.

12.5.2. FORECAST CONTRIBUTION LEVELS

The information for 2012-13 is based on Unitywater's second quarter estimates and will need to be updated when final results are known. At present the estimate is likely to be lower than the actual receipts. This will have an impact on the final RAB and MAR calculations.

The forecast level of cash contributions and donated assets for each region and service is based on the results of negotiations with the participating councils to set the level of developer charges in accordance with the draft State Planning Regulatory Provision (SPRP) which provides for Unitywater's agreed apportionment of the maximum adopted charge.

The table below indicates current estimates of cash and asset contributions.

Table 16 Forecast cash and asset contributions.

$M	Classification	FY2012	FY2013	FY2014	FY2015
Water	Cash contribution	12.4	13.7	13.3	14.2
	Donated assets	13.1	14.2	17.5	15.4
	Total	**25.5**	**27.9**	**30.8**	**29.6**
Wastewater	Cash contribution	19.6	13.7	16.1	16.6
	Donated assets	26.6	23.4	21.3	25.3
	Total	**46.2**	**37.1**	**37.4**	**41.9**
Unitywater	**Total**	**71.7**	**65.0**	**68.2**	**71.5**

13. REVENUE

13.1. MAXIMUM ALLOWABLE REVENUE

Unitywater's forecast maximum allowable revenue has been derived based on QCA's building block methodology and is set out in Table 17.

Table 17 – Maximum allowable revenue breakdown

MAR ($M)	FY2012	FY2013	FY2014	FY2015
Operating Costs (incl. Bulk Water)	242.6	259.6	284.8	308.2
Return on Assets	257.5	272.1	230.6	239.5
Depreciation	84.0	94.3	102.6	112.1
Indexation	(24.4)	(61.1)	(75.3)	(78.1)
Revenue Offset	(70.7)	(65.0)	0.0	0.0
Net Tax	11.2	6.4	5.4	5.7
Maximum Allowable Revenue	500.2	506.3	548.1	587.4

	FY2012	FY2013	FY2014	FY2015
RAB (Closing)	2835.4	2952.0	3074.2	3177.6
WACC	9.35%	9.35%	7.62%	7.62%
Return on Assets	257.5	272.1	230.6	239.5

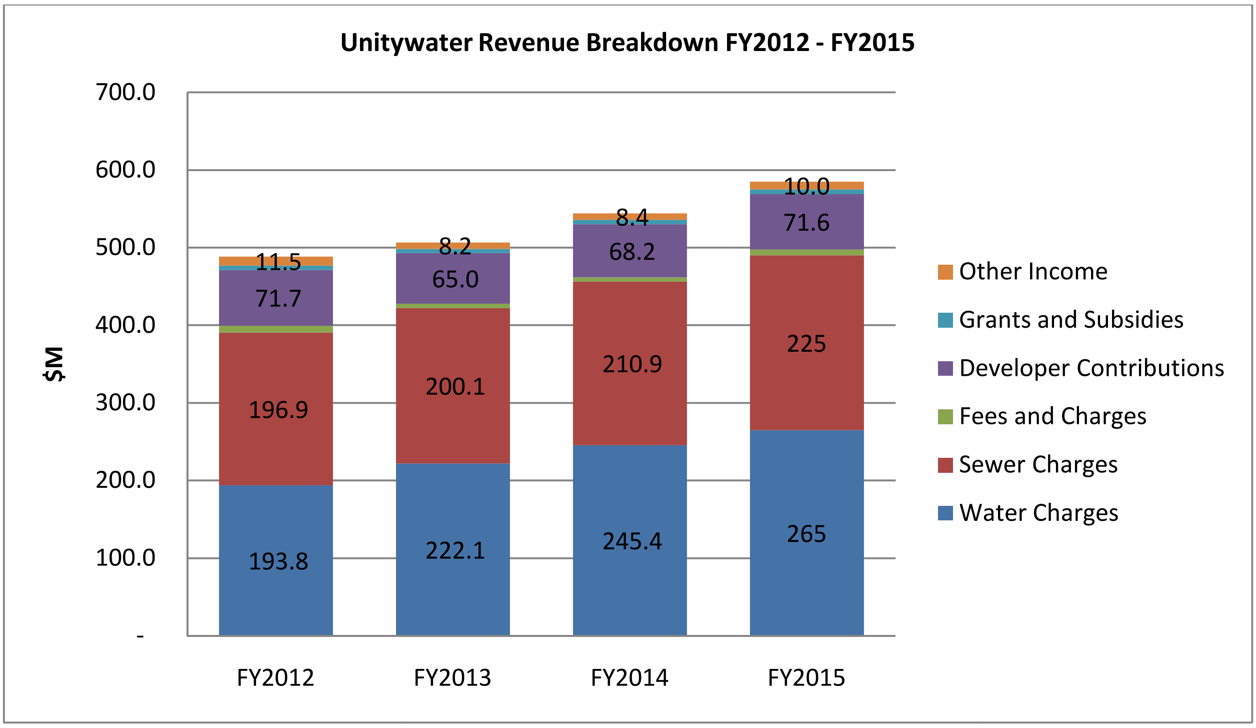
13.2. FORECAST REVENUE

Unitywater's forecast revenue from water and sewerage services is based on growth in customers and customer demand and a price increase of 3% per annum.

Table 18 Unitywater revenue breakdown

Services ($M)	FY2012	FY2013	FY2014	FY2015
Water Charges	193.8	222.1	245.4	265.0
Sewer Charges	196.9	200.1	210.9	225.0
Fees and Charges	8.9	5.7	5.4	7.5
Developer Contributions	71.7	65.0	68.2	71.6+
Grants and Subsidies	5.8	5.6	5.9	5.9
Other Income	11.5	8.2	8.4	10.0
Total Revenue	**488.5**	**506.7**	**544.3**	**585.0**

Figure 2



13.3. NON-REGULATED SERVICES

Unitywater has made a strategic decision to develop non-regulated revenues by leveraging core business capability. Unitywater has two primary non-regulated services: laboratory services and private works.

The table below summarises expected revenue from non-regulated services.

Table 19 Non Regulated Revenue

Non Regulated Services ($M)	FY2011	FY2012	FY2013	FY2014	FY2015
Revenue	5.3	5.5	4.9	5.2	5.5

13.3.1. LABORATORY SERVICES

Unitywater's laboratories are accredited by the National Association of Testing Authorities. The laboratories provide services to Unitywater and external clients including government departments, councils, and private customers by:

- Testing drinking water to ensure it complies with *Australian Drinking Water Guidelines*;
- Analysing the quality of water from rainwater tanks, bores, dams and swimming pools;
- Monitoring sewage for compliance with STP licenses;
- Monitoring industrial and landfill discharges;
- Assessing environmental issues within the region's waterways and beaches; and
- Responding to customer enquiries and water quality issues.

13.3.2. PRIVATE WORKS

Unitywater maintenance crews provide 'private works services' an example is moving a manhole or installing a new connection on a customer's property at their request and cost.

13.4. FORECAST RECOVERY AGAINST MAR

Unitywater expects to under recover against MAR in 2013-14 by $93.1M resulting in cumulative under recoveries of $334.3M. Forecast under recoveries are detailed in Table 20 below.

Table 20 Forecast Recovery against Maximum Allowable Revenue ($M)

($M)	FY2011	FY2012	FY2013	FY2014	FY2015
Maximum Allowable Revenue	392.9[16]	500.2	506.3	548.1	587.4
Actual / Forecast Regulated Revenue	350.8	390.6	416.8	455.0	495.8
Under / Over Recovery	(42.1)	(109.6)	(89.5)	(93.1)	(91.6)

Unitywater indicated in its previous three submissions that achieving MAR immediately would result in significant price shocks to customers.

Unitywater welcomes progress by the State Government and QCA to affirm that price monitoring will continue, and that the QCA develop the longer term regulatory framework over the next two years. Two of the core matters to resolve are treatment of under recoveries and pricing principles.

[16] Source QCA SEQ Interim Price Monitoring Review Part A

Unitywater has consistently committed to carrying forward under (over) recoveries between revenue and MAR on an NPV neutral basis for possible future recovery over a timeframe yet to be determined.

Unitywater's MAR adjustment transition scheme (MAT scheme) provides certainty. If Unitywater under recovers, it impacts the amount of work that Unitywater can undertake and ultimately the returns to participating councils. Moreton Bay and Sunshine Coast Regional Councils receive returns from Unitywater's operation. Those returns contribute toward the quality and availability of social infrastructure in the Sunshine Coast and Moreton Bay regions.

The purpose of the MAT scheme is to capture and annually index under (over) recoveries from providing water supply and sewerage services to Moreton Bay and Sunshine Coast customers until such time as Unitywater's prices achieve MAR.

The clearing of the under (over) recovery balance may occur through establishing a medium term price path in consultation with relevant stakeholders. After the balance is cleared, prices will be set to achieve MAR. Unitywater submitted as an appendix to its 2011-12 IPMS a paper prepared by Synergies Economic Consulting on the appropriateness, form and operation of the MAT scheme.

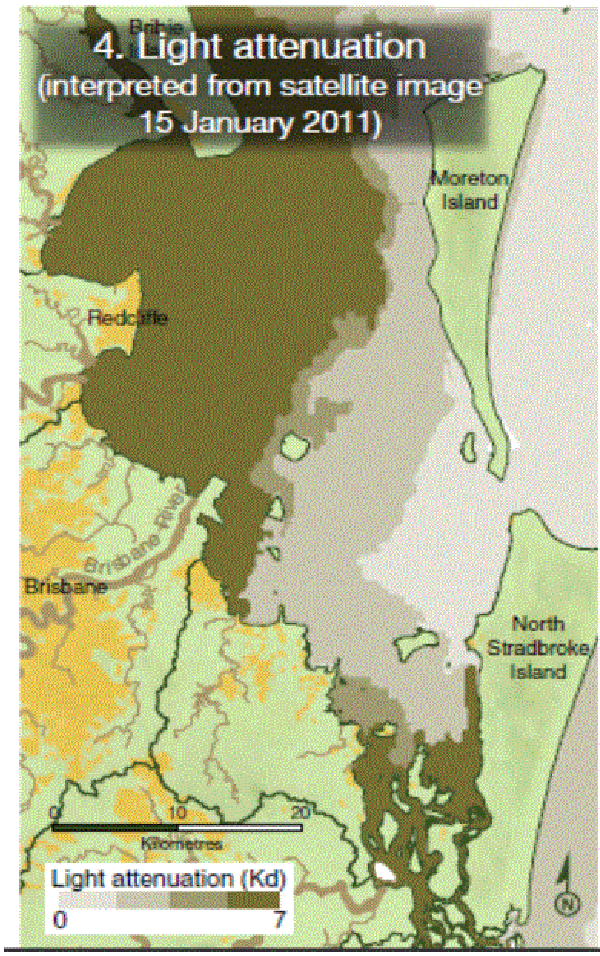
Recommendation No.5
Unitywater will continue to operate its MAT scheme and record and carry forward MAR under (over) recoveries for possible inclusion in future periods.

APPENDIX 1

NUTRIENT OFFSETS

Unitywater operates its network within a unique hydrologic cycle[1] bordering sensitive sea grass and mangrove ecosystems. Unitywater's treated effluent ultimately discharges into Moreton Bay Marine Park. Moreton Bay's currents move in a clockwise direction, resulting in outflows from the Brisbane River, and STPs that discharge into the Brisbane River, pluming northward adjacent to Unitywater's service area and receiving waters.[2] Diagram 6 vividly demonstrates the January 2011 flood plume as it moved into northern sections of Moreton Bay.

Diagram 6 January 2011 Flood Plume[3]



Nutrient loaded receiving waters are compounded by upstream water catchment infrastructure that reduced the Pine River's ability to flush northern sections of Moreton Bay.

[1] Hydrologic cycle is an application of hydrology; being the study of movement, distribution, and quality of water

[2] Healthy Waterways Newsletters #1, February 2011 and #3 April 2011 demonstrating the January 2011 flood plume from the Brisbane River flowed to the north and out of Moreton Bay through the North passage

[3] ibid

Consequently, nutrient carrying and discharge capacity of rivers flowing into the northern section of Moreton Bay are more constrained than would otherwise be the case. Therefore, STP licences are stricter.

The law of diminishing returns applies to STP augmentations particularly when complying with stricter environmental licences. That is the incremental cost of each additional kilogram of nitrogen removed increases as new technology, processes or additional chemicals and energy are used to remove more nitrogen.

Unitywater supports investment in alternative nutrient or pollutant reduction initiatives to achieve lower cost environmental benefits in preference to continual focus on STP licences. In Unitywater's experience, increasingly stringent environmental licences attached to new or upgraded STPs may not be the best allocation of resources. For example Unitywater's STPs contribute approximately 10% of the nitrogen in local river systems. A focus and investment in the remaining 90% would achieve greater reductions in nutrients at a lower cost than STP augmentations.

Unitywater is encouraged by policy makers and discussion amongst a range of stakeholders including economic and environmental regulators, instrumentalities and departments to align policy objectives of healthy waterways with easing total water and sewage cost pressures on customers. Unitywater welcomes the opportunity to participate in discussions, focusing on the Total Water Cycle Management Plans (TWCMP) that may consider:

- Influent demand side management;
- Operating expenditure solutions or alternative treatment planning such as ocean rather than river outfalls that may facilitate the use of carbon in sewage to generate electricity;
- Network augmentation options with multi-disciplinary prioritisation and option assessment; and
- Bubble licences and nutrient offsets that would encourage investment to reduce pollutants, sediment or nutrients within a catchment at a more affordable cost than STP augmentations.

The regulatory framework should create a tool or guideline to support non-network investment on private or public lands that achieves total water cycle outcomes and enables the utility to recover at least their efficient costs and roll non-network investment into the Regulatory Asset Base (RAB).

APPENDIX 2

STANDARDS WE BUILD TO

Unitywater is required to build new infrastructure to the standards set out in the *South East Queensland Design and Construction Code.* The Code was a collaborative project of water and sewerage service providers in South East Queensland, as required under the *South East Queensland Water (Distribution and Retail Restructuring) Act 2009.*

This uniform code is expected to be in force by 1 July 2013 and replaces the provisions of participating councils planning schemes that currently apply to the design and construction of water and sewerage infrastructure. The code will apply to Unitywater, Queensland Urban Utilities and the Logan, Redlands and Gold Coast Council owned water businesses.

Approval of the code involves public consultation, approval from each of the South East Queensland service providers, and sign off by the Minister for Energy and Water Supply.

A common design and construction code across South East Queensland (SEQ) will make it easier for businesses in the region to service other SEQ distributor-retailers. The *South East Queensland Design and Construction Code* is based on the five *Water Services Association of Australia (WSAA) National Codes* listed below, but also includes modifications to suit the specific geographical and climatic conditions of South East Queensland:

- Water Supply Code
- Sewerage Code
- Sewage Pumping Station Code
- Vacuum Sewerage Code
- Pressure Sewerage Code.

By standardising water and sewerage infrastructure works across South East Queensland, the code aims to provide:

- Greater consistency in asset planning, design and construction standards;
- Greater standardisation of processes, including development assessments, and consistency in planning of asset networks;
- A common reference point for regulators when assessing construction standards; and
- Better service and lower costs to customer.

South East Queensland System Operating Plan
Schedule 5 (1) Requirement for Water Demand Forecasts

Unitywater's 20 Year Water Demand Forecast Methodology

Water demand projections used by Unitywater for network planning purposes are derived from future population estimates provided by the Queensland Government and the participating Councils and assumptions about future per capita water use.

Future Population Estimates

Population projections are prepared using geographic land parcel based models. The population models assign "people" to each individual land parcels in the service area for planning horizons extending in 5 year increments from 2011 to 2031. The assignment is based on land use planning information, zoning, development densities, developable land, anticipated timing of development, previous development applications, future occupancy ratios, etc.

The population models for both Unitywater North and South disaggregate the projections into low density (detached dwellings) and high density (unit development) residential populations. This is to allow different per capita consumptions to be applied to people living in different dwelling types.

Non-residential demand[1] estimates are also included in the model for various categories of non-residential land use, such as industry, commercial, retail, open space. This estimate of non-residential demand is generally based on an assumption about "Non Residential Equivalent Persons (EP) per hectare" for the landuse category as adopted by the respective Councils in the past.

Since these models are spatially or geographically based, population projections from 2011 through to 2031 can be aggregated for each of the geographically defined Demand Zones shown in Figures A and B.

Comparison with State Government Projections

In order to confirm that the population model output is suitable for the purpose of providing 20 year demand projections, it is essential to check the derived "bottom-up" residential populations provided by these models with the comparable "top-down" State Government projections.

The Queensland Government Office of Economic and Statistical Research (OESR) provide projections of population, household formation and dwellings for the years 2011 through to 2031. This data is considered the Queensland Government's official population forecast.

A comparison of the 2011 edition OESR medium series projection and Unitywater's population model output is provided in Figures 1 and 2 below for Unitywater South and Unitywater North respectively. Also indicated are the OESR high series and low series projections. The variation, or uncertainty, in the State Governments OESR population projections (that is, the difference between the lower and medium, and upper and medium) is, by 2031, approximately 10%.

[1] Water supply demand is calculated in units of "Equivalent Person". An "Equivalent Person" is the water supply demand of a single person living in a detached dwelling. Hence the demand of a non-residential land use (e.g., a bakery) can be equated to a common unit of demand with residential land uses.

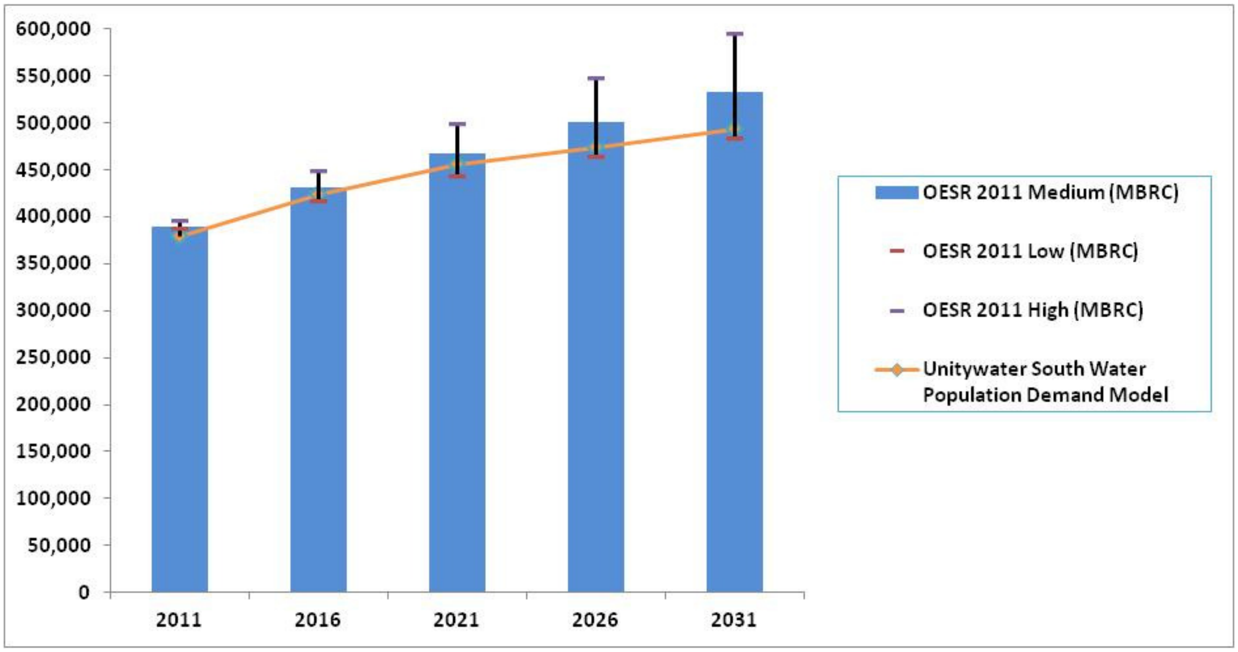


Figure 1: Comparison of population predictions for Unitywater South

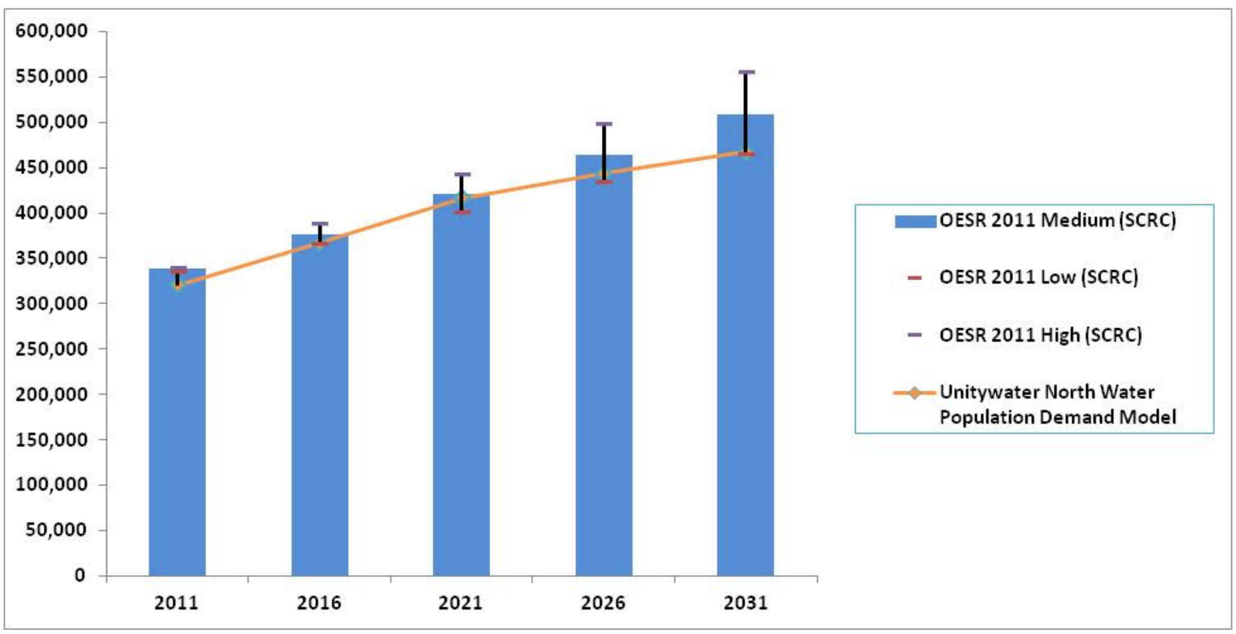


Figure 2: Comparison of population predictions for Unitywater North

In broad terms, the calculated population derived from Unitywater's population model should be somewhat less than the OESR Medium Series Projection, since not all residents are connected to water. Figures 1 and 2 indicate that the current Unitywater demand model aligns reasonable well with longer term State Government population projections. The use of Unitywater's demand models to calculate the 20 year Water Demand Forecasts is therefore considered appropriate.

The population model output, for each of the defined Demand Zones, then needs to be multiplied by the assumed per capita demand.

Assumed Average Day Per Capita Demand

The average day demand used by Unitywater for planning purposes is 230 litres per capita per day (L/cap/d) for low and medium density (detached) dwellings, and 200 L/cap/d for residents in high density (attached) dwellings.

The figure of 230 L/cap/d was the original consumption target set by the Queensland Water Commission (QWC) in the first SEQ Water Supply Strategy. This target was underpinned at the time by the introduction of various water conservation initiatives, many of which have recently been revoked (i.e. Permanent Water Conservation Measures, mandatory rainwater tanks requirements in new buildings, etc). Nevertheless, as a result of the dramatic reduction in consumption that occurred during the drought, the target was further reduced to 200 L/cap/d in the current version of the SEQ Water Strategy (July 2010). However, notwithstanding this reduction, the current Level of Service objectives adopted by the State Government for the supply of water to SEQ include the requirement that *"during normal operations sufficient water will be available to meet an average total urban demand of 375 litres per day (including residential, non-residential and system losses), of which 230 litres per person per day is attributed to residential demand".*

Overall consumption averaged across the Unitywater service area is currently about 180 L/c/d.

There is considerable conjecture regarding likely future levels of per capita consumption. The difficulty with predicting future consumption is that a major influencing factor appears to be societal attitudes towards discretionary (largely external) water use. Hence, as a precautionary measure it is recommended that the current planning assumptions of 230 L/cap/d for low and medium density development, and 200 L/cap/d for high density development be utilised for the purposes of 20 year projections.

It should be noted that in addition to the assumed per capita demand, an allowance for system leakage needs to be added. The current System Leakage Management Plan estimates Non-Revenue Water (NRW) for Unitywater is approximately 7,000 ML/year. This is equivalent to 22 L/cap/d for the 2013 projected population from the population model. Assuming a reduction in NRW by 1% each year with implementation of leakage control measures, the NRW in year 2032 is projected to be 18 L/cap/d.

Demand Projections

Utilising the population model output, and assumptions about per capita consumption as set out above, a 20 Year Water Demand Forecast for each of the defined Demand Zones has been prepared and is included in Attachment 1.

The Water Demand Forecast also includes estimates of upper and lower bounds as requested in the SOP. These upper and lower bounds have been derived by applying ± 5% initially and ±10% by 2031 to the demand to account for the uncertainty regarding population projections. The upper and lower bounds do not capture the uncertainty discussed above relating to the long term per capita consumption.

20 YEAR WATER DEMAND FORECAST

In accordance with Schedule 5 (1) of the SEQ System Operating Plan, Unitywater has provided a 20 Year water demand forecast for each of Unitywater's demand zones to Queensland Bulk Water Authority (Seqwater) and to the Department of Energy and Water Supply (DEWS).

These forecasts are based on Unitywater's current population models for the Moreton Bay and Sunshine Coast regions. Note that these models are compiled from the respective Council planning schemes and advice from Council regarding the nature, scale and timing of further development.

Unitywater	2015							2016						
					Average Daily Demand (ML/d)							Average Daily Demand (ML/d)		
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	14,036	4,887	18,923	3,860	**5.26**	**5.58**	**5.90**	14,416	4,936	19,351	3,916	**5.35**	**5.70**	**6.04**
Caboolture WTP Service Area	13,903	3,789	17,692	6,717	**5.67**	**6.02**	**6.37**	14,119	3,792	17,910	6,964	**5.76**	**6.13**	**6.51**
NPI Service Area	114,470	3,789	118,259	6,717	**29.49**	**31.30**	**33.11**	116,894	3,792	120,685	6,964	**30.01**	**31.95**	**33.88**
Woodford Zone	6,350	109	6,458	1,654	**1.92**	**2.04**	**2.15**	6,527	109	6,635	1,669	**1.96**	**2.08**	**2.21**
Dayboro Zone	2,192	0	2,192	945	**0.74**	**0.79**	**0.83**	2,207	0	2,207	991	**0.75**	**0.80**	**0.85**
Redcliffe Zone	41,611	20,066	61,676	15,675	**17.75**	**18.84**	**19.93**	41,956	20,284	62,240	15,866	**17.86**	**19.01**	**20.16**
Pine Rivers North (Petrie)	81,143	3,659	84,802	18,013	**24.24**	**25.73**	**27.22**	85,008	3,834	88,841	18,797	**25.29**	**26.92**	**28.55**
Pine Rivers South	99,817	4,501	104,319	21,029	**29.56**	**31.37**	**33.19**	100,798	4,546	105,343	22,189	**29.96**	**31.89**	**33.82**
Total	**373,521**	**40,800**	**414,322**	**74,609**	**114.63**	**121.68**	**128.72**	**381,923**	**41,291**	**423,214**	**77,356**	**116.95**	**124.48**	**132.02**
Unitywater North														
Caloundra - Ewen Maddock Zone	66,341	32,088	98,429	24,880	**28.29**	**30.03**	**31.77**	67,708	33,473	101,182	25,465	**28.94**	**30.80**	**32.67**
Caloundra - Landers Shute Zone	16,164	947	17,112	4,329	**5.05**	**5.36**	**5.67**	16,791	1,027	17,818	4,435	**5.22**	**5.56**	**5.89**
Kenilworth Zone	548	246	794	267	**0.24**	**0.26**	**0.27**	612	275	886	274	**0.27**	**0.28**	**0.30**
Maleny Zone	3,327	508	3,835	1,264	**1.19**	**1.27**	**1.34**	3,631	559	4,190	1,332	**1.29**	**1.37**	**1.45**
Maroochy - Landers Shute Zone	68,137	46,214	114,350	32,703	**33.52**	**35.58**	**37.64**	69,636	48,473	118,109	33,911	**34.50**	**36.73**	**38.95**
Maroochy Town - Image Flat WTP Zone	38,310	23,107	61,417	18,063	**18.17**	**19.29**	**20.40**	38,377	24,928	63,305	18,652	**18.64**	**19.84**	**21.04**
Noosa WTP Zone	37,773	20,530	58,302	19,489	**17.84**	**18.94**	**20.03**	38,967	21,206	60,173	20,090	**18.34**	**19.52**	**20.70**
Caloundra South	0	1,116	1,116	52	**0.25**	**0.26**	**0.28**	0	1,260	1,260	65	**0.28**	**0.29**	**0.31**
Total	**230,600**	**124,756**	**355,356**	**101,048**	**104.56**	**110.98**	**117.41**	**235,721**	**131,201**	**366,922**	**104,224**	**107.47**	**114.40**	**121.32**

Unitywater	2017							2018						
					Average Daily Demand (ML/d)							Average Daily Demand (ML/d)		
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	14,684	4,978	19,662	3,978	**5.42**	**5.78**	**6.15**	14,952	5,020	19,973	4,040	**5.48**	**5.87**	**6.26**
Caboolture WTP Service Area	14,648	3,841	18,489	7,285	**5.95**	**6.35**	**6.75**	15,178	3,890	19,068	7,605	**6.14**	**6.57**	**7.00**
NPI Service Area	118,970	3,841	122,811	7,285	**30.48**	**32.53**	**34.59**	121,046	3,890	124,937	7,605	**30.94**	**33.12**	**35.30**
Woodford Zone	6,592	110	6,703	1,679	**1.97**	**2.10**	**2.23**	6,658	112	6,770	1,689	**1.98**	**2.12**	**2.26**
Dayboro Zone	2,291	0	2,291	1,040	**0.78**	**0.84**	**0.89**	2,375	0	2,375	1,090	**0.81**	**0.87**	**0.93**
Redcliffe Zone	42,165	20,596	62,761	16,067	**17.95**	**19.16**	**20.37**	42,373	20,908	63,281	16,268	**18.05**	**19.32**	**20.59**
Pine Rivers North (Petrie)	87,288	3,936	91,224	19,165	**25.84**	**27.58**	**29.33**	89,568	4,039	93,608	19,533	**26.39**	**28.25**	**30.11**
Pine Rivers South	101,327	4,570	105,897	23,722	**30.34**	**32.39**	**34.44**	101,856	4,593	106,450	25,254	**30.72**	**32.89**	**35.05**
Total	**387,966**	**41,873**	**429,838**	**80,220**	**118.74**	**126.74**	**134.75**	**394,008**	**42,454**	**436,462**	**83,085**	**120.51**	**129.00**	**137.48**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,715	34,934	102,650	26,480	**29.38**	**31.36**	**33.34**	67,722	36,395	104,118	27,495	**29.81**	**31.91**	**34.01**
Caloundra - Landers Shute Zone	17,489	1,307	18,796	4,715	**5.49**	**5.86**	**6.23**	18,188	1,587	19,774	4,994	**5.76**	**6.16**	**6.57**
Kenilworth Zone	617	282	899	272	**0.27**	**0.29**	**0.30**	622	290	912	270	**0.27**	**0.29**	**0.31**
Maleny Zone	3,632	559	4,191	1,337	**1.28**	**1.37**	**1.46**	3,633	559	4,192	1,342	**1.28**	**1.37**	**1.46**
Maroochy - Landers Shute Zone	70,544	53,081	123,625	34,706	**35.73**	**38.14**	**40.55**	71,452	57,689	129,141	35,501	**36.95**	**39.55**	**42.15**
Maroochy Town - Image Flat WTP Zone	38,376	26,685	65,061	19,011	**19.02**	**20.30**	**21.58**	38,376	28,442	66,818	19,371	**19.39**	**20.76**	**22.12**
Noosa WTP Zone	39,113	21,275	60,388	20,492	**18.42**	**19.66**	**20.90**	39,259	21,345	60,604	20,893	**18.49**	**19.79**	**21.10**
Caloundra South	0	1,260	1,260	389	**0.35**	**0.38**	**0.40**	0	1,260	1,260	713	**0.43**	**0.46**	**0.49**
Total	**237,487**	**139,384**	**376,871**	**107,402**	**109.93**	**117.35**	**124.76**	**239,253**	**147,567**	**386,819**	**110,581**	**112.38**	**120.29**	**128.20**

Unitywater	2019							2020						
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Average Daily Demand (ML/d)			Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Average Daily Demand (ML/d)		
					Lower Limit	Best Estimate	Upper Limit					Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	15,221	5,063	20,284	4,102	**5.55**	**5.96**	**6.36**	15,489	5,105	20,594	4,164	**5.64**	**6.05**	**6.46**
Caboolture WTP Service Area	15,707	3,940	19,647	7,926	**6.33**	**6.79**	**7.25**	16,237	3,989	20,226	8,246	**6.53**	**7.01**	**7.49**
NPI Service Area	123,123	3,940	127,062	7,926	**31.39**	**33.70**	**36.01**	125,199	3,989	129,188	8,246	**31.96**	**34.31**	**36.66**
Woodford Zone	6,724	114	6,838	1,699	**1.99**	**2.14**	**2.28**	6,790	116	6,905	1,709	**2.01**	**2.15**	**2.30**
Dayboro Zone	2,459	0	2,459	1,139	**0.84**	**0.90**	**0.96**	2,543	0	2,543	1,189	**0.87**	**0.93**	**1.00**
Redcliffe Zone	42,582	21,220	63,802	16,468	**18.14**	**19.47**	**20.81**	42,790	21,532	64,322	16,669	**18.30**	**19.64**	**20.99**
Pine Rivers North (Petrie)	91,849	4,142	95,991	19,901	**26.93**	**28.91**	**30.89**	94,129	4,245	98,374	20,270	**27.57**	**29.60**	**31.62**
Pine Rivers South	102,386	4,617	107,003	26,787	**31.10**	**33.38**	**35.66**	102,915	4,641	107,556	28,320	**31.58**	**33.90**	**36.22**
Total	**400,050**	**43,036**	**443,086**	**85,949**	**122.27**	**131.25**	**140.23**	**406,092**	**43,617**	**449,709**	**88,813**	**124.46**	**133.61**	**142.75**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,730	37,856	105,586	28,511	**30.24**	**32.46**	**34.68**	67,737	39,317	107,054	29,526	**30.78**	**33.04**	**35.30**
Caloundra - Landers Shute Zone	18,886	1,867	20,753	5,274	**6.02**	**6.46**	**6.91**	19,585	2,146	21,731	5,553	**6.31**	**6.77**	**7.23**
Kenilworth Zone	628	297	925	268	**0.27**	**0.29**	**0.31**	633	305	938	266	**0.27**	**0.29**	**0.31**
Maleny Zone	3,634	559	4,193	1,348	**1.28**	**1.37**	**1.47**	3,635	559	4,194	1,353	**1.28**	**1.37**	**1.47**
Maroochy - Landers Shute Zone	72,360	62,297	134,658	36,297	**38.16**	**40.96**	**43.76**	73,268	66,905	140,174	37,092	**39.50**	**42.40**	**45.30**
Maroochy Town - Image Flat WTP Zone	38,375	30,199	68,575	19,730	**19.77**	**21.22**	**22.67**	38,375	31,957	70,331	20,090	**20.21**	**21.69**	**23.18**
Noosa WTP Zone	39,405	21,414	60,819	21,295	**18.57**	**19.93**	**21.29**	39,551	21,483	61,034	21,697	**18.71**	**20.08**	**21.46**
Caloundra South	0	1,260	1,260	1,037	**0.50**	**0.54**	**0.57**	0	1,260	1,260	1,361	**0.58**	**0.62**	**0.66**
Total	**241,018**	**155,750**	**396,768**	**113,759**	**114.80**	**123.23**	**131.66**	**242,784**	**163,932**	**406,716**	**116,938**	**117.63**	**126.27**	**134.91**

Unitywater	2021							2022						
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Average Daily Demand (ML/d)			Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Average Daily Demand (ML/d)		
					Lower Limit	Best Estimate	Upper Limit					Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	15,758	5,148	20,905	4,226	**5.68**	**6.13**	**6.58**	15,882	5,183	21,065	4,289	**5.71**	**6.18**	**6.65**
Caboolture WTP Service Area	16,766	4,038	20,805	8,567	**6.69**	**7.22**	**7.76**	17,045	4,038	21,084	8,818	**6.79**	**7.35**	**7.91**
NPI Service Area	127,276	4,038	131,314	8,567	**32.29**	**34.86**	**37.43**	129,004	4,038	133,042	8,818	**32.63**	**35.33**	**38.03**
Woodford Zone	6,855	118	6,973	1,719	**2.01**	**2.17**	**2.33**	7,087	125	7,212	1,767	**2.07**	**2.24**	**2.41**
Dayboro Zone	2,627	0	2,627	1,238	**0.90**	**0.97**	**1.04**	2,639	0	2,639	1,281	**0.90**	**0.98**	**1.05**
Redcliffe Zone	42,999	21,844	64,842	16,870	**18.32**	**19.78**	**21.24**	43,276	22,018	65,295	17,089	**18.41**	**19.93**	**21.45**
Pine Rivers North (Petrie)	96,410	4,348	100,757	20,638	**28.00**	**30.23**	**32.46**	96,549	4,354	100,903	20,904	**28.00**	**30.31**	**32.62**
Pine Rivers South	103,445	4,665	108,110	29,853	**31.83**	**34.37**	**36.90**	103,971	4,689	108,660	30,817	**32.06**	**34.71**	**37.36**
Total	**412,135**	**44,199**	**456,333**	**91,678**	**125.73**	**135.73**	**145.74**	**415,453**	**44,445**	**459,899**	**93,783**	**126.57**	**137.03**	**147.49**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,744	40,778	108,522	30,541	**31.08**	**33.56**	**36.03**	67,735	40,805	108,540	31,006	**31.08**	**33.65**	**36.22**
Caloundra - Landers Shute Zone	20,283	2,426	22,709	5,833	**6.55**	**7.07**	**7.59**	20,312	2,444	22,757	5,839	**6.53**	**7.07**	**7.61**
Kenilworth Zone	639	312	951	263	**0.27**	**0.29**	**0.32**	641	312	953	264	**0.27**	**0.29**	**0.32**
Maleny Zone	3,636	559	4,195	1,359	**1.27**	**1.37**	**1.47**	3,637	559	4,196	1,359	**1.27**	**1.37**	**1.48**
Maroochy - Landers Shute Zone	74,176	71,514	145,690	37,887	**40.54**	**43.77**	**46.99**	75,060	72,654	147,715	38,272	**40.92**	**44.30**	**47.68**
Maroochy Town - Image Flat WTP Zone	38,374	33,714	72,088	20,450	**20.50**	**22.13**	**23.76**	38,388	34,019	72,407	20,495	**20.50**	**22.20**	**23.89**
Noosa WTP Zone	39,698	21,552	61,249	22,098	**18.71**	**20.20**	**21.69**	39,708	21,552	61,260	22,161	**18.66**	**20.20**	**21.74**
Caloundra South	0	1,260	1,260	1,686	**0.65**	**0.70**	**0.75**	0	4,320	4,320	1,793	**1.29**	**1.40**	**1.50**
Total	**244,550**	**172,115**	**416,665**	**120,116**	**119.58**	**129.09**	**138.60**	**245,482**	**176,666**	**422,148**	**121,188**	**120.52**	**130.48**	**140.43**

Unitywater	2023							2024						
					Average Daily Demand (ML/d)							Average Daily Demand (ML/d)		
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	16,007	5,218	21,224	4,353	**5.74**	**6.23**	**6.72**	16,131	5,253	21,384	4,416	**5.77**	**6.28**	**6.79**
Caboolture WTP Service Area	17,324	4,038	21,362	9,069	**6.89**	**7.48**	**8.07**	17,603	4,038	21,641	9,320	**6.98**	**7.60**	**8.22**
NPI Service Area	130,732	4,038	134,770	9,069	**32.97**	**35.79**	**38.62**	132,460	4,038	136,498	9,320	**33.30**	**36.26**	**39.21**
Woodford Zone	7,318	133	7,451	1,815	**2.13**	**2.31**	**2.49**	7,550	140	7,690	1,864	**2.19**	**2.38**	**2.57**
Dayboro Zone	2,651	0	2,651	1,324	**0.91**	**0.99**	**1.07**	2,662	0	2,662	1,367	**0.92**	**1.01**	**1.09**
Redcliffe Zone	43,554	22,192	65,747	17,307	**18.49**	**20.07**	**21.66**	43,832	22,366	66,199	17,525	**18.57**	**20.22**	**21.87**
Pine Rivers North (Petrie)	96,689	4,360	101,050	21,169	**27.99**	**30.39**	**32.78**	96,829	4,367	101,196	21,435	**27.98**	**30.46**	**32.95**
Pine Rivers South	104,497	4,713	109,210	31,782	**32.29**	**35.06**	**37.83**	105,024	4,736	109,760	32,746	**32.52**	**35.41**	**38.30**
Total	**418,772**	**44,692**	**463,464**	**95,888**	**127.40**	**138.32**	**149.24**	**422,091**	**44,939**	**467,030**	**97,992**	**128.22**	**139.61**	**151.00**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,726	40,831	108,557	31,471	**31.07**	**33.74**	**36.40**	67,717	40,857	108,574	31,935	**31.07**	**33.83**	**36.59**
Caloundra - Landers Shute Zone	20,341	2,462	22,804	5,844	**6.52**	**7.08**	**7.64**	20,371	2,480	22,851	5,850	**6.51**	**7.09**	**7.66**
Kenilworth Zone	643	312	956	264	**0.27**	**0.30**	**0.32**	645	312	958	264	**0.27**	**0.30**	**0.32**
Maleny Zone	3,638	559	4,197	1,359	**1.26**	**1.37**	**1.48**	3,639	559	4,198	1,359	**1.26**	**1.37**	**1.48**
Maroochy - Landers Shute Zone	75,944	73,795	149,740	38,657	**41.29**	**44.83**	**48.36**	76,828	74,936	151,764	39,042	**41.65**	**45.35**	**49.05**
Maroochy Town - Image Flat WTP Zone	38,402	34,324	72,727	20,541	**20.50**	**22.26**	**24.02**	38,417	34,629	73,046	20,587	**20.50**	**22.32**	**24.14**
Noosa WTP Zone	39,719	21,552	61,271	22,223	**18.61**	**20.20**	**21.80**	39,730	21,552	61,282	22,286	**18.55**	**20.20**	**21.85**
Caloundra South	0	7,380	7,380	1,901	**1.93**	**2.10**	**2.26**	0	10,440	10,440	2,009	**2.56**	**2.79**	**3.02**
Total	**246,415**	**181,216**	**427,631**	**122,260**	**121.45**	**131.86**	**142.27**	**247,347**	**185,766**	**433,113**	**123,332**	**122.38**	**133.25**	**144.12**

Unitywater	2025							2026						
					Average Daily Demand (ML/d)							Average Daily Demand (ML/d)		
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	16,256	5,288	21,544	4,479	**5.80**	**6.33**	**6.86**	16,380	5,323	21,704	4,542	**5.82**	**6.38**	**6.93**
Caboolture WTP Service Area	17,882	4,038	21,920	9,571	**7.08**	**7.73**	**8.38**	18,161	4,038	22,199	9,822	**7.17**	**7.85**	**8.54**
NPI Service Area	134,188	4,038	138,226	9,571	**33.63**	**36.72**	**39.81**	135,916	4,038	139,954	9,822	**33.95**	**37.18**	**40.41**
Woodford Zone	7,781	148	7,929	1,912	**2.24**	**2.45**	**2.65**	8,013	155	8,168	1,960	**2.30**	**2.52**	**2.74**
Dayboro Zone	2,674	0	2,674	1,409	**0.93**	**1.02**	**1.10**	2,686	0	2,686	1,452	**0.94**	**1.03**	**1.12**
Redcliffe Zone	44,110	22,540	66,651	17,744	**18.65**	**20.36**	**22.07**	44,388	22,714	67,103	17,962	**18.72**	**20.50**	**22.28**
Pine Rivers North (Petrie)	96,969	4,373	101,342	21,701	**27.97**	**30.54**	**33.11**	97,109	4,379	101,488	21,967	**27.96**	**30.62**	**33.27**
Pine Rivers South	105,550	4,760	110,310	33,710	**32.75**	**35.76**	**38.77**	106,076	4,784	110,860	34,675	**32.97**	**36.10**	**39.24**
Total	**425,410**	**45,186**	**470,596**	**100,097**	**129.03**	**140.90**	**152.76**	**428,729**	**45,433**	**474,161**	**102,202**	**129.83**	**142.18**	**154.53**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,708	40,884	108,592	32,400	**31.06**	**33.92**	**36.77**	67,699	40,910	108,609	32,865	**31.05**	**34.01**	**36.96**
Caloundra - Landers Shute Zone	20,400	2,498	22,898	5,856	**6.50**	**7.09**	**7.69**	20,429	2,516	22,945	5,862	**6.48**	**7.10**	**7.72**
Kenilworth Zone	648	312	960	265	**0.27**	**0.30**	**0.32**	650	312	962	265	**0.27**	**0.30**	**0.32**
Maleny Zone	3,640	559	4,199	1,359	**1.25**	**1.37**	**1.48**	3,641	559	4,200	1,359	**1.25**	**1.37**	**1.49**
Maroochy - Landers Shute Zone	77,712	76,077	153,789	39,427	**42.02**	**45.88**	**49.74**	78,596	77,218	155,814	39,812	**42.37**	**46.40**	**50.43**
Maroochy Town - Image Flat WTP Zone	38,431	34,935	73,366	20,633	**20.50**	**22.38**	**24.27**	38,445	35,240	73,685	20,679	**20.50**	**22.44**	**24.39**
Noosa WTP Zone	39,741	21,552	61,293	22,348	**18.50**	**20.20**	**21.90**	39,752	21,552	61,304	22,410	**18.45**	**20.20**	**21.96**
Caloundra South	0	13,500	13,500	2,117	**3.19**	**3.49**	**3.78**	0	16,560	16,560	2,225	**3.82**	**4.18**	**4.54**
Total	**248,280**	**190,317**	**438,596**	**124,404**	**123.29**	**134.63**	**145.96**	**249,212**	**194,867**	**444,079**	**125,476**	**124.19**	**136.00**	**147.81**

Unitywater	2027							2028						
					Average Daily Demand (ML/d)							Average Daily Demand (ML/d)		
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	16,371	5,358	21,729	4,577	**5.81**	**6.39**	**6.96**	16,362	5,392	21,754	4,611	**5.80**	**6.39**	**6.98**
Caboolture WTP Service Area	18,466	4,085	22,550	9,976	**7.26**	**7.97**	**8.68**	18,771	4,131	22,902	10,130	**7.34**	**8.09**	**8.83**
NPI Service Area	137,923	4,085	142,008	9,976	**34.32**	**37.70**	**41.07**	139,931	4,131	144,062	10,130	**34.69**	**38.21**	**41.73**
Woodford Zone	8,128	156	8,284	1,980	**2.32**	**2.55**	**2.78**	8,243	157	8,401	2,000	**2.34**	**2.58**	**2.82**
Dayboro Zone	2,686	0	2,686	1,452	**0.94**	**1.03**	**1.12**	2,686	0	2,686	1,452	**0.93**	**1.03**	**1.12**
Redcliffe Zone	44,507	23,146	67,653	18,110	**18.80**	**20.65**	**22.49**	44,626	23,578	68,204	18,257	**18.87**	**20.79**	**22.70**
Pine Rivers North (Petrie)	97,318	4,389	101,707	21,967	**27.90**	**30.64**	**33.39**	97,527	4,398	101,926	21,967	**27.85**	**30.67**	**33.50**
Pine Rivers South	106,519	4,804	111,323	34,739	**32.96**	**36.20**	**39.44**	106,961	4,824	111,785	34,803	**32.96**	**36.30**	**39.65**
Total	**431,918**	**46,022**	**477,940**	**102,776**	**130.32**	**143.13**	**155.93**	**435,107**	**46,611**	**481,718**	**103,350**	**130.80**	**144.07**	**157.34**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,701	40,910	108,611	33,012	**30.97**	**34.01**	**37.06**	67,704	40,910	108,614	33,160	**30.89**	**34.02**	**37.16**
Caloundra - Landers Shute Zone	20,461	2,548	23,009	5,897	**6.48**	**7.12**	**7.75**	20,493	2,581	23,074	5,933	**6.48**	**7.13**	**7.79**
Kenilworth Zone	650	312	963	263	**0.27**	**0.30**	**0.32**	651	312	963	261	**0.27**	**0.30**	**0.32**
Maleny Zone	3,641	559	4,200	1,355	**1.24**	**1.37**	**1.49**	3,641	559	4,200	1,352	**1.24**	**1.36**	**1.49**
Maroochy - Landers Shute Zone	78,620	77,466	156,086	39,557	**42.21**	**46.36**	**50.51**	78,644	77,714	156,359	39,303	**42.05**	**46.32**	**50.58**
Maroochy Town - Image Flat WTP Zone	38,468	35,240	73,708	20,703	**20.43**	**22.44**	**24.44**	38,491	35,240	73,731	20,726	**20.36**	**22.43**	**24.49**
Noosa WTP Zone	39,769	21,552	61,320	22,392	**18.38**	**20.18**	**21.99**	39,785	21,552	61,336	22,373	**18.31**	**20.17**	**22.02**
Caloundra South	4,352	16,560	20,912	3,156	**5.00**	**5.49**	**5.98**	8,704	16,560	25,264	4,087	**6.17**	**6.80**	**7.43**
Total	**253,662**	**195,148**	**448,810**	**126,336**	**124.98**	**137.27**	**149.55**	**258,112**	**195,429**	**453,541**	**127,195**	**125.77**	**138.53**	**151.29**

Unitywater	2029							2030						
					Average Daily Demand (ML/d)							Average Daily Demand (ML/d)		
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	16,353	5,427	21,779	4,645	**5.80**	**6.40**	**7.01**	16,344	5,461	21,804	4,680	**5.79**	**6.41**	**7.03**
Caboolture WTP Service Area	19,076	4,177	23,253	10,284	**7.43**	**8.21**	**8.98**	19,380	4,224	23,604	10,438	**7.51**	**8.32**	**9.13**
NPI Service Area	141,939	4,177	146,116	10,284	**35.06**	**38.73**	**42.40**	143,946	4,224	148,170	10,438	**35.42**	**39.24**	**43.06**
Woodford Zone	8,359	158	8,517	2,020	**2.37**	**2.61**	**2.86**	8,474	159	8,633	2,040	**2.39**	**2.64**	**2.90**
Dayboro Zone	2,686	0	2,686	1,452	**0.93**	**1.03**	**1.13**	2,686	0	2,686	1,452	**0.93**	**1.03**	**1.13**
Redcliffe Zone	44,745	24,010	68,754	18,404	**18.95**	**20.93**	**22.91**	44,863	24,442	69,305	18,552	**19.02**	**21.07**	**23.13**
Pine Rivers North (Petrie)	97,737	4,408	102,144	21,967	**27.79**	**30.70**	**33.61**	97,946	4,417	102,363	21,967	**27.74**	**30.73**	**33.72**
Pine Rivers South	107,404	4,844	112,248	34,867	**32.95**	**36.40**	**39.85**	107,847	4,864	112,710	34,931	**32.95**	**36.50**	**40.05**
Total	**438,297**	**47,200**	**485,497**	**103,923**	**131.27**	**145.01**	**158.75**	**441,486**	**47,789**	**489,276**	**104,497**	**131.74**	**145.95**	**160.16**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,706	40,910	108,616	33,308	**30.81**	**34.03**	**37.25**	67,708	40,910	108,618	33,455	**30.72**	**34.04**	**37.35**
Caloundra - Landers Shute Zone	20,525	2,614	23,139	5,969	**6.47**	**7.15**	**7.83**	20,557	2,647	23,204	6,005	**6.47**	**7.17**	**7.87**
Kenilworth Zone	651	312	964	260	**0.27**	**0.29**	**0.32**	652	312	964	258	**0.27**	**0.29**	**0.32**
Maleny Zone	3,641	559	4,200	1,349	**1.23**	**1.36**	**1.49**	3,641	559	4,200	1,346	**1.23**	**1.36**	**1.49**
Maroochy - Landers Shute Zone	78,668	77,963	156,631	39,048	**41.89**	**46.27**	**50.66**	78,693	78,211	156,903	38,794	**41.73**	**46.23**	**50.73**
Maroochy Town - Image Flat WTP Zone	38,514	35,240	73,754	20,750	**20.30**	**22.42**	**24.54**	38,537	35,240	73,777	20,774	**20.23**	**22.41**	**24.59**
Noosa WTP Zone	39,801	21,552	61,353	22,354	**18.24**	**20.15**	**22.06**	39,817	21,552	61,369	22,335	**18.17**	**20.13**	**22.09**
Caloundra South	13,056	16,560	29,616	5,017	**7.34**	**8.11**	**8.87**	17,408	16,560	33,968	5,948	**8.49**	**9.41**	**10.33**
Total	**262,562**	**195,710**	**458,272**	**128,055**	**126.54**	**139.78**	**153.03**	**267,012**	**195,991**	**463,003**	**128,915**	**127.31**	**141.04**	**154.77**

Unitywater	2031							2032						
	Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Average Daily Demand (ML/d)			Low and Medium Density Residential Population	High Density Residential Population	Total Residential Population	Non-Res (EP)	Average Daily Demand (ML/d)		
					Lower Limit	Best Estimate	Upper Limit					Lower Limit	Best Estimate	Upper Limit
Unitywater South														
Caboolture Zone														
Bribie Island Service Area	16,334	5,495	21,830	4,714	**5.80**	**6.42**	**7.05**	16,325	5,530	21,855	4,748	**5.79**	**6.43**	**7.07**
Caboolture WTP Service Area	19,685	4,270	23,955	10,592	**7.62**	**8.45**	**9.27**	19,990	4,316	24,306	10,746	**7.71**	**8.56**	**9.42**
NPI Service Area	145,954	4,270	150,224	10,592	**35.91**	**39.79**	**43.66**	147,962	4,316	152,278	10,746	**36.27**	**40.30**	**44.33**
Woodford Zone	8,589	160	8,750	2,060	**2.42**	**2.68**	**2.94**	8,705	161	8,866	2,080	**2.44**	**2.71**	**2.98**
Dayboro Zone	2,686	0	2,686	1,452	**0.93**	**1.03**	**1.13**	2,686	0	2,686	1,452	**0.92**	**1.03**	**1.13**
Redcliffe Zone	44,982	24,873	69,855	18,699	**19.17**	**21.23**	**23.30**	45,101	25,305	70,406	18,846	**19.24**	**21.38**	**23.51**
Pine Rivers North (Petrie)	98,155	4,427	102,582	21,967	**27.78**	**30.78**	**33.78**	98,365	4,436	102,801	21,967	**27.73**	**30.81**	**33.89**
Pine Rivers South	108,289	4,884	113,173	34,995	**33.06**	**36.63**	**40.20**	108,732	4,903	113,635	35,059	**33.06**	**36.73**	**40.40**
Total	**444,676**	**48,379**	**493,054**	**105,071**	**132.70**	**147.01**	**161.32**	**447,865**	**48,968**	**496,833**	**105,645**	**133.15**	**147.95**	**162.74**
Unitywater North														
Caloundra - Ewen Maddock Zone	67,710	40,910	108,620	33,603	**30.76**	**34.07**	**37.39**	67,712	40,910	108,622	33,750	**30.67**	**34.08**	**37.49**
Caloundra - Landers Shute Zone	20,589	2,679	23,268	6,041	**6.49**	**7.19**	**7.89**	20,621	2,712	23,333	6,076	**6.49**	**7.21**	**7.93**
Kenilworth Zone	652	312	965	256	**0.27**	**0.29**	**0.32**	653	312	965	254	**0.26**	**0.29**	**0.32**
Maleny Zone	3,641	559	4,200	1,343	**1.23**	**1.36**	**1.49**	3,641	559	4,200	1,340	**1.22**	**1.36**	**1.49**
Maroochy - Landers Shute Zone	78,717	78,459	157,176	38,539	**41.72**	**46.22**	**50.73**	78,741	78,707	157,448	38,285	**41.56**	**46.18**	**50.80**
Maroochy Town - Image Flat WTP Zone	38,560	35,240	73,800	20,797	**20.24**	**22.42**	**24.61**	38,583	35,240	73,823	20,821	**20.17**	**22.41**	**24.66**
Noosa WTP Zone	39,833	21,552	61,385	22,316	**18.17**	**20.13**	**22.09**	39,849	21,552	61,401	22,298	**18.10**	**20.11**	**22.12**
Caloundra South	21,760	16,560	38,320	6,879	**9.68**	**10.72**	**11.77**	26,112	16,560	42,672	7,809	**10.82**	**12.02**	**13.22**
Total	**271,462**	**196,271**	**467,734**	**129,774**	**128.55**	**142.42**	**156.29**	**275,912**	**196,552**	**472,465**	**130,634**	**129.30**	**143.67**	**158.04**

LONG TERM DEMAND FORECAST

The Long Term Sewage Demand Forecast is expressed in the industry standard demand units of EP and derived from the planning assumptions for Moreton Bay Regional Council and Sunshine Coast Regional Council under the current versions of the relevant planning schemes. The planning assumptions are made in quantitative terms and address the various components for each form of development initiatives.

Sewerage Service Catchment	2011			2016			2021			2026			2031			2050		
	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs
Brendale (Within PIA)	34,272	10,423	**44,694**	34,595	12,861	**47,456**	35,519	14,888	**50,407**	35,000	16,889	**51,889**	35,308	16,889	**52,196**			
Brendale (With Master Planned Areas)	34,272	10,423	**44,694**	36,102	14,246	**50,348**	37,891	19,847	**57,738**	38,472	22,714	**61,186**	39,144	23,034	**62,177**			
Kedron Brook	13,132	636	**13,768**	12,791	748	**13,540**	12,494	860	**13,354**	12,146	973	**13,119**	12,146	973	**13,119**			
Murrumba Downs	108,456	25,547	**134,004**	132,258	32,208	**164,466**	144,254	35,846	**180,100**	145,072	38,918	**183,990**	146,641	38,918	**185,559**			
Murrumba Downs (with MP Areas)	108,456	25,547	**134,004**	132,758	32,243	**165,001**	146,254	35,883	**182,137**	148,572	39,457	**188,029**	151,141	39,757	**190,898**			
Burpengary East	41,604	6,005	**47,609**	44,711	7,887	**52,598**	47,595	9,369	**56,964**	48,800	10,630	**59,430**	48,959	11,691	**60,650**	48,993	16,375	**65,368**
Burpengary East (With MP Areas)	41,604	6,005	**47,609**	44,952	8,079	**53,031**	50,706	10,561	**61,267**	55,888	12,000	**67,888**	60,774	13,208	**73,982**	65,959	18,667	**84,626**
Caboolture South	48,750	8,283	**57,033**	54,460	9,931	**64,391**	59,796	11,356	**71,152**	63,173	12,991	**76,164**	66,330	15,485	**81,815**	66,922	16,988	**83,910**
Caboolture South (with MP Areas)	48,750	8,283	**57,033**	55,458	10,653	**66,111**	61,780	13,394	**75,174**	66,039	16,466	**82,505**	70,138	23,279	**93,417**	78,920	32,356	**111,276**
Bribie Island	25,194	3,053	**28,247**	27,290	3,332	**30,622**	28,990	3,628	**32,618**	29,722	3,925	**33,647**	29,812	4,083	**33,895**	29,812	4,083	**33,895**
Woodford	2,102	360	**2,462**	2,296	400	**2,696**	2,565	415	**2,980**	2,887	434	**3,321**	3,174	439	**3,613**	4,099	654	**4,753**
Redcliffe	59,399	14,841	**74,240**	62,213	15,795	**78,008**	64,809	16,796	**81,605**	67,064	17,886	**84,950**	69,758	18,695	**88,453**			
Dayboro	1,178	452	**1,631**	1,196	537	**1,733**	1,275	621	**1,897**	1,325	706	**2,031**	1,325	706	**2,031**			

Res EPS	Residential Equivalent Persons for Sewerage
NR EPS	Non Residential Equivalent Persons for Sewerage
EPS	(Total) Equivalent Persons for Sewerage

Future Sewerage Service Catchment	2011			2016			2021			2026			2031		
	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs
Coolum STP North	6,077	464	6,540	8,690	611	9,300	10,511	710	11,222	10,511	710	11,222	10,511	716	11,228
Coolum STP South	16,958	2,225	19,183	19,722	3,688	23,410	22,010	3,755	25,765	22,010	3,755	25,765	22,010	3,787	25,796
Cooroy STP Cooroy	2,524	1,604	4,128	3,619	1,729	5,349	4,020	1,771	5,791	4,036	1,771	5,807	4,062	1,871	5,933
Cooroy STP Pomona	1,230	744	1,974	1,942	795	2,737	2,393	853	3,245	2,393	853	3,245	2,393	714	3,106
Kawana STP Caloundra South	0	0	0	1,485	476	1,960	10,015	3,136	13,151	22,436	5,696	28,133	36,049	8,313	44,362
Kawana STP Central	47,285	14,431	61,716	57,694	16,019	73,713	59,659	16,607	76,266	59,663	17,558	77,221	59,663	17,416	77,079
Kawana STP North	27,182	6,912	34,094	30,888	9,137	40,025	34,265	13,429	47,693	34,336	13,466	47,802	34,336	13,207	47,544
Kawana STP Palmview	106	0	106	2,893	1,444	4,338	12,089	1,960	14,050	16,537	2,284	18,821	16,537	2,259	18,796
Kawana STP Sippy Downs Mountain Creek	25,860	3,332	29,193	33,647	4,110	37,757	39,343	4,905	44,248	40,354	5,355	45,709	40,565	5,513	46,079
Kawana STP South	11,321	672	11,993	14,002	840	14,842	16,025	976	17,000	16,025	976	17,000	16,025	978	17,003
Kenilworth STP	407	222	629	651	245	896	686	233	920	697	234	932	700	219	919
Landsborough STP Beerwah	2,646	1,323	3,970	4,293	1,811	6,104	6,635	2,776	9,411	6,715	2,809	9,524	6,854	2,899	9,753
Landsborough STP Glasshouse	1,060	178	1,238	1,973	197	2,170	2,436	250	2,686	2,436	250	2,686	2,436	239	2,675
Landsborough STP Landsborough	2,056	766	2,822	2,662	1,578	4,239	3,985	1,915	5,900	3,985	1,915	5,900	3,988	1,821	5,809
Landsborough STP Mooloolah	920	94	1,014	1,437	109	1,546	1,814	128	1,942	1,814	128	1,942	1,814	116	1,930
Maleny STP	1,581	695	2,276	4,062	1,265	5,327	4,062	1,265	5,327	4,062	1,265	5,327	4,062	1,196	5,259
Maroochy STP Bli Bli	5,342	309	5,651	7,000	418	7,417	7,577	480	8,056	7,577	480	8,056	7,577	547	8,123
Maroochy STP Buderim	6,815	3,499	10,314	7,739	4,129	11,868	7,739	4,161	11,900	8,282	4,241	12,523	8,282	4,413	12,695
Maroochy STP Forest Glen	144	401	544	583	864	1,447	583	864	1,447	583	864	1,447	483	922	1,405
Maroochy STP Maroochydore	50,441	18,599	69,040	58,854	22,733	81,587	70,187	25,565	95,752	72,591	26,188	98,778	73,621	25,257	98,878
Nambour STP Eumundi	627	464	1,091	1,339	556	1,895	2,153	622	2,775	2,153	622	2,775	2,153	548	2,701
Nambour STP Nambour	13,957	10,098	24,055	16,640	11,015	27,655	18,324	12,389	30,714	21,442	13,104	34,546	21,442	12,747	34,190
Nambour STP Woombye Palmwoods	5,415	881	6,296	6,617	981	7,598	7,599	1,106	8,705	7,599	1,120	8,720	7,599	864	8,463

Future Sewerage Service Catchment	2011			2016			2021			2026			2031		
	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs	Res EPSs	NR EPSs	EPSs
Nambour STP Yandina	1,647	2,126	3,773	2,374	2,407	4,780	3,502	2,788	6,291	3,502	2,788	6,291	3,502	2,734	6,236
Noosa STP Noosa Heads	11,195	2,225	13,419	13,020	2,628	15,647	13,020	2,628	15,647	13,020	2,628	15,647	13,020	2,496	15,516
Noosa STP Noosaville	11,660	3,935	15,595	13,311	5,036	18,347	13,311	5,036	18,347	13,311	5,036	18,347	13,311	5,173	18,484
Noosa STP Peregian	3,995	187	4,181	5,810	221	6,031	5,810	221	6,031	5,810	221	6,031	5,810	197	6,006
Noosa STP Sunshine Beach	7,060	91	7,151	7,749	116	7,865	7,749	116	7,865	7,749	116	7,865	7,749	105	7,854
Noosa STP Tewantin	10,590	1,053	11,643	11,840	1,192	13,032	11,890	1,192	13,082	11,890	1,192	13,082	11,890	1,341	13,230
Suncoast STP	12,220	2,427	14,648	14,469	3,576	18,045	14,734	3,594	18,328	14,734	3,594	18,328	14,734	3,582	18,316
TOTAL	**288,322**	**79,957**	**368,279**	**357,004**	**99,925**	**456,929**	**414,126**	**115,429**	**529,555**	**438,254**	**121,217**	**559,471**	**453,178**	**122,189**	**575,367**

Review of the WACC to apply to Unitywater for the 2013-15 Price Monitoring Period

June 2013

Synergies Economic Consulting Pty Ltd
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Executive Summary

Unitywater is reviewing the Weighted Average Cost of Capital (WACC) it will apply for pricing purposes for the 2013-15 price monitoring period. It has requested advice from Synergies Economic Consulting (Synergies), SFG Consulting (SFG) and Queensland Treasury Corporation (QTC) as to the appropriate methods and parameters to apply, having regard to the Queensland Competition Authority's (the Authority's) recommendation. The focus of this advice is on proposed departures from the Authority's recommendation.

The analysis considers the most appropriate approach to apply to a business that is subject to price monitoring. In this regard, one of Unitywater's overarching objectives is to achieve an appropriate degree of price certainty and stability, which is also desirable for consumers.

A summary of the proposals are as follows:

1. A ten year term to maturity should be used to estimate the risk free rate and debt margin. This is considered the most appropriate assumption to apply when determining the WACC to apply to a water utility, where the assets have long economic lives.

2. In relation to the cost of equity, it is proposed that going forward, the estimation approach is widened to incorporate alternative models and market evidence, rather than sole reliance on the Sharpe-Lintner Capital Asset Pricing Model. This will involve:

    - developing an informed estimate of the expected market return using methods that rely on historical data as well as current market information. This contrasts with the current approach of combining a current estimate of the risk free rate with a static MRP;
    - estimating the cost of equity for the benchmark firm, conditional upon the market return estimate. As the overarching objective should be to improve the quality of the estimate, SFG recommends using all relevant information, regardless of the specific risks that are considered to be incorporated into equity prices.

    This will result in a more reliable and stable estimate than the current approach. This benefits both investors and consumers – investors get more stable returns (in line with actual required returns) and consumers get more stable prices.

3. As it is recognised that further work is required to implement the above approach, it has not been used to estimate the expected cost of equity for the 2013-15 price monitoring period. However, the objective should be to transition to this approach at the end of that period. As the approach currently used by the Authority is likely to materially underestimate the cost of equity in the prevailing conditions in the market, in the interim it is proposed to address this by:

   - applying a ten year average of the risk free rate; and
   - adopting a MRP of 6.5%.

4. It is proposed to apply a trailing average approach to estimate the benchmark cost of debt. This replicates a prudent and efficient benchmark debt management strategy for a water services provider, being the issuance of long term debt that is progressively refinanced through time in order to minimise refinancing risk. For the purpose of the next price monitoring period the benchmark cost of debt is still established with reference to prevailing market rates (that is, Unitywater will transition to the new approach rather than assuming that it is currently in place). Going forward, the cost of debt will be updated on an annual basis as new borrowings are made and a percentage of the existing borrowings are refinanced at prevailing rates. This approach will also smooth the impact of changes in the cost of debt through time, which will be beneficial to consumers.

Contents

1 Introduction

Unitywater is reviewing the Weighted Average Cost of Capital (WACC) it will apply for pricing purposes for the 2013-15 price monitoring period. It has requested advice from Synergies Economic Consulting (Synergies), SFG Consulting (SFG) and Queensland Treasury Corporation (QTC) as to the appropriate methods and parameters to apply.

In being subject to long-term price monitoring rather than periodic resets, one of Unitywater's overarching objectives is to achieve an appropriate degree of price certainty and stability. This is also considered desirable for consumers.

Unitywater has not requested a detailed re-examination of its WACC for this next price monitoring period. The starting point is the WACC advised by the QCA, which is 6.57% (post-tax nominal vanilla).[1] This is nearly 3% lower than the 9.35% advised for the 2010-13 Interim Price Monitoring review. The Authority is also currently undertaking an industry-wide WACC review. The overall scope, timing and implications of this review for Unitywater remain uncertain.

Some fundamental issues have been identified with the methods used to determine the costs of debt and equity, both in terms of the extent to which the current approaches applied by the Authority result in an outcome that is commensurate with market conditions and efficient financing practices, as well as the degree of volatility in outcomes that are observed between reviews (as evidenced by the most recent Authority recommendation). The purpose of this analysis is to examine the most appropriate approaches to apply to estimate the cost of debt and equity, recognising that a more fundamental change in approach, in line with regulatory developments in other Australian jurisdictions, may be better suited to the next review.

This paper summarises the basis for departures from the approaches and parameters advised by the Authority for the 2013-15 price monitoring period. It is supported by the following:

- a paper from SFG, which examines alternative approaches to assessing the cost of equity; and
- a paper from QTC, which examines the cost of debt.

[1] http://www.qca.org.au/water/SEQRetailPriceMon201315/WACC.php

2 Term to maturity for the risk free rate and debt margin

The Authority's preferred approach has been to align the term to maturity for the risk free rate and the cost of debt with the length of the regulatory period. As Unitywater is only subject to price monitoring, there is no regulatory period bounded by periodic resets, which means that this issue is not relevant in this case. We note also that in its most recent pricing review for regulated retail electricity prices, the Independent Pricing and Regulatory Tribunal (IPART) assumed a ten year term to maturity because:[2]

> …in this review there is no issue with ensuring NPV-neutrality between regulatory periods, the term-to-maturity should be consistent with the expected life of the assets – that is, the 10-year term-to-maturity.

Even if this WACC was being determined in the context of formal price regulation with a specified regulatory period, we fundamentally disagree with the practice of aligning the term to maturity with the length of the regulatory period and its assumption that this is necessary to achieve an 'NPV equals zero' outcome. There are a number of arguments that have been submitted in other forums that have highlighted the issues with this approach.

For example, a paper submitted by SFG as part of Aurizon Network's most recent access undertaking proposal[3] showed that the QCA's term matching approach is unnecessary in order for NPV neutrality to hold and indeed is more likely to result in an underestimate of the WACC in the usual upward sloping yield curve environment. It also highlights the implications of this approach, including the implicit assumption that the WACC could be lowered simply by adopting a shorter regulatory period without any value loss to the firm (in other words, risk has reduced). Basing prices on what is an administrative consideration is not consistent with outcomes that would be observed in a competitive market.

A ten year term to maturity is considered the most appropriate assumption to apply when determining the WACC to apply to a water utility, where the assets have long economic lives. This has therefore been applied in estimating the risk-free rate and debt margin.

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[2] Independent Pricing and Regulatory Tribunal (2013a). Review of Regulated Retail Prices and Charges for Electricity, From 1 July 2013 to 30 June 2016, Electricity – Final Report, June, p.189.

[3] SFG Consulting (2012). Term to Maturity Estimate of the Risk Free Rate in the Regulated Return.

3 Expected cost of equity

3.1 Estimation model

3.1.1 Current issues

The sole reliance on the Sharpe-Lintner version of the Capital Asset Pricing Model (CAPM) by most Australian regulators[4] has always been the subject of some contention, given its known deficiencies and hence questionable reliability in producing a reasonable estimate of the forward looking return on equity that is likely to align with investor expectations.

In more recent times (particularly post the commencement of the Global Financial Crisis (GFC)), the issues with the CAPM have become more pronounced. However, it is recognised that this could be primarily driven by the way the CAPM has been implemented (not the model itself), including the lack of flexibility in adjusting the parameter values to respond to changing market conditions.

In particular, the approach of combining a spot estimate of the risk free rate with a long term average market risk premium (MRP) (which again, is more a problem with the way the CAPM has been implemented rather than a deficiency of the model itself), is producing estimates that suggest that investors' expectations of the return on equity is lower than ever before. It also means that the estimate - and consequently prices - are highly volatile, as evidenced by the vastly different cost of equity estimates advised by the Authority for the 2010-13 Interim Price Monitoring Review (8.85%) and the 2013-15 review (6.69%).

As highlighted in the accompanying report by SFG, the estimate of the expected return on equity that would result from the application of this approach at the current time is implausible. This is particularly the case when compared to the cost of debt and more specifically corporate debt margins, which have not materially contracted since the start of the GFC.

It is noted that the Authority has previously attributed this anomaly to expected losses from default.[5] SFG does not consider it appropriate to set regulated (or monitored) prices on the expectation that those prices cause a material probability that the regulated entity will have to default and we concur with that view. This is certainly not

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4 It should be noted that in some cases this was subject to a legislative mandate, e.g. the National Electricity Rules. However, there is no such legislative requirement in Queensland.

5 Queensland Competition Authority (2011). Final Report – SEQ Interim Price Monitoring for 2010/11, Part B - Detailed Assessment, March.

contemplated under the *Queensland Competition Authority Act 1997*, with the pricing principles (section 168A(a)) requiring prices to be set to:

> …generate expected revenue for the service that is at least enough to meet the efficient costs of providing access to the service and include a return on investment commensurate with the regulatory and commercial risks involved…

Indeed, we would question the circumstances under which a business would estimate a rate of return based on anything other than the promised yield to maturity (unless it was for the purpose of sensitivity analysis or risk assessment). We note that in its Interim Report on its WACC methodology, IPART indicated that one of the internal consistency checks it will do is to test whether the expected cost of debt is lower than the cost of equity, in order to make sure that the estimates "make economic sense"[6].

SFG attributes three main reasons why the cost of equity that is estimated using the Authority's current approach is too low:

1. The sole reliance on the Sharpe-Lintner CAPM, which ignores the fact that risks other than market risk might be incorporated into the cost of capital (such as firm size and book to market ratios).

2. The key inputs into the cost of equity calculation are set independently, in particular, the expected return on the risk free asset, and the expected 'average' market price of risk (the MRP), without consideration of the overall reasonableness of the outcome. Putting the beta factor aside (which 'scales' the MRP to reflect the systematic risk of the firm), the combination of the Authority's inputs implies that equity investors' return expectations are the lowest they have ever been. As SFG highlights, actual return expectations are not as volatile as these outcomes suggest. Instead, the more likely explanation is that the cost of equity is being incorrectly estimated due to the combination of what has been a static estimate of the MRP and a spot (or twenty day average) estimate of the risk free rate.

3. The outcomes depend upon regression-based estimates of systematic risk (by estimating equity betas from the historical returns of listed comparators), which are known to be prone to estimation error. It also ignores other factors that can explain stock returns.

6 Independent Pricing and Regulatory Tribunal (2013b). WACC Methodology, Research – Interim Report, June, p.10.

3.1.2 Addressing the problem

SFG's solution to the above problem is to use a range of estimation techniques, some of which are used to develop individual firm estimates of the cost of equity and others that are applied to the broader market. They state:[7]

> The logic for this is straightforward. Ultimately, the adoption of more than one estimation technique or model for estimating a benchmark firm's cost of equity will lead to different estimates, due to estimation error. We do not know for certain just which risks are incorporated into asset prices and we do not have absolutely precise techniques for measuring these risks. So ultimately the regulator reaches a final decision on parameter inputs in light of all available evidence. The expected market return is one of these estimates upon which the regulator makes a decision, and the regulator's expectation for the market return is the same, regardless of how the regulator propose to account for firm-specific information.

The techniques examined include:

- the Sharpe-Lintner CAPM;
- the Fama-French three factor model;
- the dividend discount model; and
- use of market-wide indicators.

Reference is made to the accompanying report from SFG for an explanation of these methods. Importantly, SFG shows that:

- there is evidence to support the validity of examining these alternative approaches; and importantly
- they are feasible to implement in practice.

Historically, while the CAPM's deficiencies have been widely recognised there has been a reluctance to depart from this model in a regulatory context because of the absence of a clearly superior alternative (noting that in some jurisdictions, such as electricity, the regulator is required to use the CAPM). As noted above, the current problems largely arise from the way the CAPM has been applied.

While different approaches have their strengths and weaknesses, the risk of error is only exacerbated in continuing to place sole reliance on a model whose deficiencies

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7 SFG Consulting (2013a). Techniques for Estimating the Cost of Equity, p.5.

(and the way in which it has been applied) are significant enough to produce modelled outcomes that could be materially different to the actual expectations of investors, especially in the market environment following the GFC.

This has been acknowledged by the Australian Energy Market Commission (AEMC) and has resulted in changes to the rules governing regulated energy network businesses (being the National Electricity Rules and the National Gas Rules, collectively referred to here as 'the Rules'):[8]

> The rate of return estimation should not be formulaic and be driven by a single financial model or estimation method. The estimation approach to equity and debt components should include consideration of available estimation methods, financial models, market data and other evidence to produce a robust estimate that meets the overall rate of return objective. This means giving the regulator discretion on how it should estimate these components, rather than limiting the estimation process to a particular financial model or a particular data source. In the context of estimating the return on equity, the estimation should not be limited to the standard CAPM, but should consider other relevant evidence.

Further:[9]

> There are a number of other financial models that have varying degrees of weaknesses. Some of the financial models that have gained some prominence include the Fama-French three-factor model, the Black CAPM, and the dividend growth model. Weaknesses in a model do not necessarily invalidate the usefulness of the model. Ultimately, it is important to keep in mind that all these financial models are based on certain theoretical assumptions and no one model can be said to provide the *right* answer.

In its final determination the AEMC concluded that the use of a specific model or models should not be prescribed in the Rules. Instead, it requires that a range of estimation methods, financial models, evidence and market data be considered.[10] The Australian Energy Regulator (AER) is currently reviewing how this will be implemented as part of its review of the WACC guidelines to apply to regulated energy network businesses.

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8 Australian Energy Market Commission (2012a). Economic Regulation of Network Service Providers, and Price and Revenue Regulation of Gas Services, Draft Rule Determinations, 23 August, p.47.

9 Australian Energy Market Commission (2012a). p.48.

10 Australian Energy Market Commission (2012b). Economic Regulation of Network Service Providers, and Price and Revenue Regulation of Gas Services, Final Position Paper, 29 November.

As noted above, IPART is also currently reviewing its WACC methodology, prompted by the following circumstances:[11]

> Our WACC methodology worked well from early 2000 until 2008/09, as financial market conditions were fairly stable in Australia. However since the GFC, market conditions have been much more uncertain and volatile. For example, in the past 2 years, the midpoint of this range fell from 6.0% to 3.5%. The gap between the expected costs of debt and equity also narrowed.

We note that IPART's proposed solution to this problem, which it has implemented in a number of recent water decisions, is to compare the WACC range that is derived from using current market data with long run averages. In its Interim Report on its WACC methodology IPART proposes the following approach:[12]

1. Estimate a WACC range based on current market data with a 40-day averaging period.
2. Estimate a WACC range based on long-term averages with a 10-year averaging period.
3. Establish a WACC range using the midpoints of these 2 WACC ranges (in Steps 1 and 2). The midpoint WACC, the average of the upper and lower bound of the WACC range, is the default WACC point estimate.
4. Having regard to relevant financial market information, assess the appropriateness of the default WACC point estimate (i.e., whether a WACC point estimate should be above, below or at the midpoint WACC within the range).

IPART intends to release a Final Decision on its methodology at the end of the year.

3.1.3 Proposed approach

It is recognised that there are a number of issues that need to be addressed in estimating the cost of equity using more than one model. Apart from producing the estimates using each model (which SFG has demonstrated is quite feasible), consideration has to be given as to how to reconcile the different estimates.

SFG recommends the following process. The first step is to develop an informed estimate of the expected market return using methods that rely on historical data as

[11] Independent Pricing and Regulatory Tribunal (2013b). p.4.

[12] Independent Pricing and Regulatory Tribunal (2013b). p.2.

well as current market information. This contrasts with the current approach of combining a current estimate of the risk free rate with a static MRP.

The second step estimates the cost of equity for the benchmark firm, conditional upon the market return estimate. As the overarching objective should be to improve the quality of the cost of equity estimate, SFG recommends using all relevant information, regardless of the specific risks that are considered to be incorporated into equity prices. For example, it shows that even if the Authority were to continue to rely on CAPM, a regression-based beta estimate can be made more reliable by examining firm characteristics, variation in analyst forecasts, and the cost of equity estimates from the dividend discount model analysis.

SFG recommends compiling cost of equity estimates using the CAPM, Fama-French model and the dividend growth model, with the final number based on an assessment of the reliability of each of the estimates. This could, for example, involve the assignment of weights based on pre-specified criteria. The use of more information will improve the reliability of the estimate and should also result in more stable outcomes through time.

It is recognised that further work is required to implement the above approach. It has therefore not been used to estimate the expected cost of equity for the 2013-15 price monitoring period. However, the objective should be to transition to this approach at the end of that period.

In the meantime, the estimate for the forthcoming price monitoring period continues to be based on the Sharpe-Lintner CAPM. While we have not been asked to undertake a fundamental review of all of the parameters, the estimate has been developed having regard to the issues discussed above.

3.2 Inputs using the Sharpe-Lintner CAPM

3.2.1 Risk free rate

As noted above, one of Unitywater's main objectives is to achieve a more stable WACC through time. This would result in more stable returns for investors (in line with actual required returns) and more stable prices for consumers. The risk free rate is the key driver of the material compression in the cost of equity estimates observed using the Authority's traditional approach. In practice, it is considered highly unlikely that investors have revised their return expectations downwards to such an extent (if at all), noting that observed corporate debt margins have remained relatively stable since the commencement of the GFC.

The most appropriate way to resolve this in this context is to use a long term average of the risk free rate. The question then becomes one of the length of the averaging period. Regard needs to be given to structural changes that may have influenced the pricing of Commonwealth Government debt, such as the implementation of credible monetary policy targeting by the Reserve Bank of Australia in the early 1990s.

A ten year horizon is considered appropriate. This is still considered 'long term' in the context of the Commonwealth Government bond market but will also put more weight on recent data than say, an averaging period that commences in 1993. This is also consistent with the horizon applied by IPART in its recent water decisions (including its most recent decision for Hunter Water Corporation[13]) and is also recommended in its Interim Report.

The estimate has been produced over ten years from 1 May 2003 to 30 April 2013. The resulting estimate (annual effective) is 5.24%. This will be applied to the cost of equity.

3.2.2 Market risk premium

Issues with the Authority's current approach

As stated above, Unitywater has not sought a detailed review of the value of the MRP at this stage. However, SFG has highlighted the issues with the Authority's current approach, which has consistently arrived at a value of 6%. They observe that the Authority has:[14]

> ...placed 50% weight on two estimates of the long-term average market risk premium, 25% weight on its estimate of the current market risk premium, and 25% weight on survey evidence, and finally rounds this estimate to the nearest percent.

It is also noted that because the purpose and horizon of the survey estimates are not specified, it is possible that this is a long-term average estimate, which means that the actual weight placed on contemporaneous estimates could be anywhere between 25% and 50%. They state:[15]

> The combination of this weighting scheme and the QCA's rounding convention means it is almost impossible to observe a set of circumstances in which the QCA's estimate of the market risk premium will alter from the estimate of 6%. This is borne

13 Independent Pricing and Regulatory Tribunal (2013c). Hunter Water Corporation's Water, Sewerage, Stormwater Drainage and Other Services, Review of Prices from 1 July 2013 to 30 June 2017, Water – Final Report, June.

14 SFG Consulting (2013a). pp.2-3.

15 SFG Consulting (2013a). p.3.

> out in the QCA's decisions in which it has *never* departed from the market risk premium estimate of 6%. It is implausible that the QCA places any material weight on contemporaneous estimates of the market risk premium when we have recently observed one period of very high market volatility and another period of unprecedented low government bond yields and throughout there was zero change in the estimate of market risk premium.

They conclude that:[16]

> There is no benefit to investors or consumers from expressing the market risk premium estimate to the nearest percent, when all returns estimates retain more precision.

As with any other parameter, estimates of the long term historical MRP are vulnerable to the methodology and the time horizon. Historical averages have also been compressed by the significant fall in returns that followed the commencement of the GFC, even though equity investors' forward-looking return expectations may not have reduced. This is one of the challenges in using historical data to inform forward-looking estimates.

In a paper published in 2012, the Authority provided updated estimates of the MRP using four methods, being:

- Ibbotson historical averaging
- Siegel historical averaging
- Cornell method
- survey evidence.

We are not of the view that survey evidence should be referred to at all unless the survey is carefully constructed in a way that we can be confident that the responses are relevant to the purpose and are based on a consistent frame of reference (which in this case, is informing an estimate of the forward-looking MRP). They are also vulnerable to bias. SFG has noted the Australian Competition Tribunal's comments on the three conditions that must be met for survey responses to be given any material consideration, which are:[17]

> - The survey must be timely – there must have been no change in the prevailing conditions in the market for funds since the survey was administered;

16 SFG Consulting (2013a). p.3.

17 SFG Consulting (2013b). Testing the Reasonableness of the Regulatory Allowance for the Return on Equity, Report for Aurizon Network, March.

- There must be clarity about precisely what respondents were asked so that there is no ambiguity about how to interpret their responses; and
- The survey must reflect the views of the market and not a sample that is small, unresponsive, or without sufficient expertise.

They observe that the evidence relied upon by the QCA does not satisfy these requirements.

Alternative estimates

SFG recommends the use of four market-wide indicators to estimate the MRP, being the dividend yield, risk free rate, corporate bond spread and term spread. Their approach is transparent and readily implemented. Reference is made to Figure 1 in the accompanying report from SFG, which plots the result of the analysis at six monthly intervals from the second half of 2002 to the second half of 2012. Some of the key observations made by SFG are as follows:

- the six month average estimates of the market cost of equity range from 10.6% (second half of 2012) and 13.6% (second half of 2009);
- the MRP ranges from 5.9% in the first half of 2002 to 8.7% in the first half of 2009; and
- until Commonwealth Government bond yields began to fall when the GFC commenced towards the end of 2008, the average estimated MRP between the first half of 2002 and the second half of 2008 was 6.6%.

SFG's analysis also shows that in January 2013, all four indicators suggest that the MRP is high relative to what might be observed in 'average' market conditions – their estimate is 7.5%.

Officer and Bishop have also submitted extensively on the value of the MRP, including estimating the forward-looking MRP using implied volatility analysis. For example, in work recently prepared for Aurizon Network they noted that:[18]

- the historical MRP has continued to range between 6% and 7%, and is vulnerable to the time interval chosen. They conclude that 7% is the best estimate of the historical average MRP; and

[18] Value Adviser Associates (2013). Review of Debt Risk Premium and Market Risk Premium, Report Prepared for Aurizon, February.

- the current forward-looking view is above the historical average (at least 8%), based on information from forward markets, debt spreads and dividend growth models.

Proposed estimate

There is a range of evidence suggesting that the Authority's preferred MRP value of 6% is too low. This in turn means that the Authority's approach (including combining this estimate with a spot risk free rate) is likely to be materially understating the expected return on equity in the current environment.

In Australia, the long-run average MRP has ranged between 6% and 7% (as noted by Officer and Bishop). It is therefore considered appropriate to set the MRP based on the mid-point of this range, being 6.5%. This estimate is considered conservative if regard is given to current forward-looking estimates, which suggest a value well in excess of 7%. If a higher forward-looking estimate was applied, this would be combined with a contemporaneous estimate of the risk free rate. Instead, we have chosen to combine this long-run average MRP with a long-run average risk free rate.

This approach results in an expected return on the market (before the beta adjustment) of 11.74%. This is considered an appropriate estimate for long-run average conditions. It also falls within the range of market cost of equity estimates reported in SFG's analysis, as cited above. Referring to Figure 1 in the SFG report, an expected return on the market of 11.74% is also consistent with the most recent contemporaneous estimates they have computed.

3.2.3 Equity beta

While there is a range of evidence that suggests that an MRP of 6% is too low, any revision to the equity beta requires a more extensive review. This also needs to be done in the context of the other parameters, including the potential application of alternative models, as outlined above.

In 2011, SFG did undertake a detailed analysis of equity beta estimates for IPART as part of the review of the WACC to apply to the Sydney Desalination Plant.[19] It recommended an equity beta of 0.8 with 70% leverage. Otherwise, if IPART did not concur with SFG's views on the internal consistency of WACC parameters, the value should be 0.7.

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19 SFG Consulting (2011). Cost of Capital Parameters for Sydney Desalination Plant, 10 August.

4 Expected cost of debt

4.1 Issues with the current approach to estimating the benchmark cost of debt

In estimating the expected cost of debt for a business that is subject to periodic regulatory resets, the debt management strategy that the approach applied by the Authority (and to date, other Australian regulators) replicates, assumes that the entire debt portfolio is refinanced around the regulatory reset date. Indeed, if a regulated business wanted to replicate the regulated cost of debt, it would refinance its portfolio over the same twenty day averaging period that is used to set the cost of debt. However, it would still be exposed to changes in market rates for borrowings undertaken to fund new investments during the regulatory period, which are assumed to be funded at the regulated WACC. This approach remains implicit in the QCA's current approach to setting the WACC for price monitoring purposes.

As Unitywater is subject to price monitoring and not periodic resets, the above practice is not considered relevant. In any case, we are also of the view that even if the business was subject to periodic resets, the practices implied by the current approach are not efficient.

In the context of incentive regulation it is important to remain cognisant that the objective here is to determine an appropriate methodology that is used to set the benchmark cost of debt. Regard needs to be given to the likely strategies that would be employed by an efficient water business to manage its debt, that is, what is the efficient benchmark debt management strategy, or strategies. This in turn allows the business to appropriately manage its actual costs relative to this efficient benchmark and encourages the business to reduce costs relative to that benchmark (having regard to the risk of doing so).

The objective is not to seek to exactly match what each business does in practice. However, it is not considered appropriate to determine the benchmark cost of debt with reference to a debt management strategy that is neither prudent nor efficient.

4.2 Proposed solution

Regulation should complement efficient practices that would occur in a competitive market. Efficient practice for an infrastructure services provider is to issue long-term debt and manage the consequent refinancing risk by maintaining a staggered portfolio of long-term debt instruments maturing through time – not having all of the debt maturing on or around a single point in time. This holds regardless of whether the exposure is being managed on a physical basis (i.e. the buying and selling of bonds), via derivatives, or a combination of both. As highlighted in the accompanying paper by QTC, staggering the refinancing task has been acknowledged by the Authority's own consultant, Associate Professor Martin Lally.

This issue has received more attention in the context of regulation in recent times because the problems associated with a concentrated refinancing task – apart from being inherently inefficient – became more pronounced following the commencement of the GFC. One solution to the problem is to calculate the benchmark cost of debt assuming a benchmark portfolio of long term fixed rate debt with evenly spaced maturity dates over a ten year period. This approach, which has been developed by QTC, has been referred to as the 'trailing average' approach. This replaces the current 'rate on the day' approach, where the benchmark cost of debt is set over a short period (typically twenty days).

The key features of the trailing average approach are highlighted in the accompanying paper by QTC. In essence, it is assumed that one-tenth of the debt portfolio is refinanced each year, with the maturing debt replaced with new ten year fixed rate debt based on the then prevailing market rates. The prevailing ten year rate for each year is also applied to any new borrowings undertaken in that year. The benchmark cost of debt must therefore be updated on an annual basis as new borrowings are made and a percentage of the existing borrowings are refinanced at the then prevailing rates.

Given the benchmark cost of debt is currently based on a different debt management practice, it is assumed that the business transitions to this approach over a ten year period. Initially, the benchmark cost of debt is determined based on prevailing rates (consistent with the current approach). Each subsequent year, it is assumed that one-tenth of the benchmark portfolio is refinanced at prevailing market rates.

As highlighted above, it is important to maintain the distinction between the benchmark debt portfolio and what businesses actually do. The benchmark debt portfolio is an objective reference point for establishing the benchmark cost. The assumption that one-tenth of that portfolio is refinanced each year does not mean that the businesses exactly replicate this in practice – this only determines the level of compensation recoverable through prices.

In practice, businesses may choose to refinance more or less frequently depending on their individual circumstances and market conditions and indeed they should be incentivised to do so as this could generate efficiency gains (noting that this strategy can vary through time as these circumstances and/or market conditions change). However, for the purpose of establishing the benchmark cost of debt based on a staggered refinancing strategy, it is considered appropriate to assume that 'on average', this is executed evenly through time.

Apart from ensuring that the benchmark cost of debt is set with reference to a prudent and efficient debt management strategy, this approach will result in a considerably smoother cost of debt compared to a periodic reset (noting that periodic resets are not relevant under price monitoring). This in turn reduces any price shocks to consumers. It also means that they immediately benefit if interest rates fall.

Support for the trailing average approach

While the application of this approach in a regulatory context is a new concept, it is gaining support. As noted above, the Authority's own consultant has also acknowledged that the refinancing task may be staggered through time.

It has been examined as part of the AEMC's rule change process for electricity and gas network businesses (referred to above). The AEMC stated that:[20]

> The return on debt estimate represents the return that investors of debt capital would require from a benchmark efficient service provider. Aligning the return on debt estimate with the efficient expected cost of debt of a service provider is therefore an important element in determining the rate of return.

It considered that the most appropriate methodology for estimating the benchmark cost of debt may vary between different service providers with different characteristics (which may influence their ability to implement particular debt management strategies). Accordingly, it concluded that the Rules should not prescribe a particular benchmark strategy although should provide some guidance on how this should be determined. It has allowed for three approaches to be used, being:

- the prevailing cost of funds approach;
- an historical trailing average approach; or
- some combination of the two.[21]

The AER is currently considering implementation of this in the review of its WACC guidelines, including transitional issues. While it recognised that there are arguments in favour of the current 'on the day' approach, its preliminary views on this issue included:[22]

20 Australian Energy Market Commission (2012b). p.73.

21 Australian Energy Market Commission (2012b). p.90.

22 Australian Energy Regulator (2013). Consultation Paper, Rate of Return Guidelines, p 80.

We agree with stakeholders that refinancing risk is a relevant consideration and, as such, a benchmark efficient entity may be better served by holding a portfolio of staggered debt issued at different dates. This is particularly true in light of the known issues with the "on the day" approach, as described above. Additional considerations in favour of such a portfolio approach are as follows:

1. It smooths movements in the return on debt over a number of years, which would result in lower price volatility for energy consumers and more stable returns for investors than the "on the day" approach.

2. It minimises the consequences of a single measurement error.

3. It is more reflective of the actual debt management approaches of non-regulated businesses and, therefore, is more likely to represent efficient financing practice.

The Australian Competition and Consumer Commission's (ACCC's) Regulatory Development branch also supported this approach in a paper released in April 2013.[23] Issues it identified with the current approach include:

- how a regulated business that issues ten year debt can practically hedge its debt exposure if the cost of debt is reset once every five years (which is the case for energy network businesses); and

- businesses are exposed to risk on borrowings undertaken during the regulatory period, which could have a detrimental impact on investment if the cost of debt has risen from the reset date.

It states:[24]

> While the current regulatory framework provides the regulated business with an incentive to issue all of its debt at the start of the access arrangement with a term of debt equal to the period of regulation, refinancing risk creates a counterbalancing incentive for the business to:
>
> - limit the percentage of debt refinancing in any particular year
>
> - issue debt with a longer term.
>
> Given the current incentives in the regulatory framework and the given that regulated businesses do not issue all of their debt to match the regulatory period,

[23] Australian Competition and Consumer Commission (2013). Estimating the Cost of Debt, A Possible Way Forward, Regulatory Development, April.

[24] Australian Competition and Consumer Commission (2013). p.13.

one can conclude that it is efficient for a regulated business to spread its borrowing over time rather than to issue all of its debt at the start of the access arrangement.

It therefore supports the trailing average approach although we note that it does not currently support the annual update of the benchmark cost of debt, although this in turn is linked to a practical constraint, being whether annual updating is actually allowed for under different regimes. In our view, implementing this approach without the annual updates will materially undermine its effectiveness and expose the business to ongoing risk.

Proposed approach

We endorse the application of the trailing average approach to Unitywater, as set out by QTC in the accompanying paper. We consider this an appropriate approach to apply to establish the benchmark cost of debt regardless of whether or not the business is subject to price monitoring or formal price regulation.

For the purpose of the 2013-15 price monitoring period the benchmark cost of debt is still established with reference to prevailing market rates. Going forward, the cost of debt will be updated on an annual basis as new borrowings are made and a percentage of the existing borrowings are refinanced at prevailing rates.

QTC has estimated the prevailing cost of debt consistent with current Australian regulatory practice, with averages calculated using daily data for the month of April. The resulting cost of debt of 6.37% is comprised of:

- a ten year CGS yield of 3.28%;
- a ten year BBB debt margin of 2.97%, which was estimated by extrapolating the Bloomberg seven year BBB yield using the 'matched pairs' approach ;
- an allowance for debt raising costs of 0.125%.

QTC benchmark cost of debt approach

A REPORT PREPARED FOR UNITYWATER

QUEENSLAND TREASURY CORPORATION

Background

This report provides a description of QTC's approach for calculating the benchmark cost of debt for businesses that are subject to economic regulation or price monitoring arrangements. The approach is based on replicating the cost that would be produced by a benchmark portfolio of fixed rate debt with evenly spaced maturity dates out to ten years. Over time the cost produced by this type of portfolio will be similar to a ten-year trailing average of the ten-year fixed rate corporate cost of debt.

Rationale for developing an alternative cost of debt approach

Most Australian regulators calculate the benchmark cost of debt by estimating a risk-free rate and corporate debt risk premium over a short averaging period just prior to the start of each regulatory period (the 'on the day' approach). Although regulators do not explicitly prescribe the use of a particular debt strategy, calculating the benchmark cost of debt in this way implies the use of a strategy that unintentionally creates risks for businesses and consumers.

Outcomes for businesses

The debt management strategy implied by the 'on the day' approach requires a business to fully refinance and reprice its entire debt balance during each averaging period. This requires the business to adopt a highly concentrated debt maturity profile with all borrowings either maturing or being repurchased during the next averaging period.

Some regulated businesses may be able to use interest rate swaps to lock in a fixed base rate on their total debt balance for the duration of each regulatory period. However, there are no hedging instruments that can be used to manage the debt risk premium component of the total cost of debt in the same way. Furthermore, this type of hedging strategy is not typically used by unregulated infrastructure businesses, which suggests that it is a rational response to a regulatory distortion rather than efficient practice.

Outcomes for consumers

A full reset of the benchmark cost of debt over a short averaging period exposes consumers to the risk of prices being set during a period of relatively high corporate interest rates, with the outcome being locked in for the next five years. This approach may lead to large 'step changes' in prices at the start of each regulatory period.

QTC's alternative approach is designed to create incentives for regulated businesses to adopt efficient debt financing practices and to produce more stable regulated revenues and consumer prices by reducing volatility in the benchmark cost of debt.

Efficient debt financing costs

A fundamental principle of economic regulation is that a business should only recover the efficient costs of providing a regulated service, and this principle also applies to price monitoring arrangements.

Efficient debt financing costs are the costs that would be expected to be incurred by a business that prudently structures and manages its borrowings based on a range of market-based constraints and risks as refinancing and interest rate risk. Efficient debt financing costs can be viewed as the *outcome* from adopting and maintaining efficient debt financing strategies.

Characteristics of efficient debt financing strategies

An efficient debt financing strategy will result in a business's equity providers being exposed to an acceptable level of refinancing and interest rate risk. Refinancing risk is the possibility that a borrower is unable to raise new debt to repay a maturing debt, of if new debt can only be raised on unfavourable terms. Interest rate risk is the potential for a mismatch between a business's revenues and its regular interest payments.

The specific strategy required to best manage these risks will not be the same for all businesses and will depend on factors such as the average life of the assets, the level of gearing and the nature of the revenues. For businesses that operate long-lived infrastructure assets, employ above market average gearing and have relatively stable revenues, refinancing and interest rate risks can be kept at an acceptable level by:

- maintaining a portfolio of fixed rate debt with equally spaced maturity dates out to ten years (or longer if possible)
- having approximately ten per cent of the total debt maturing each year (ie, equal borrowing amounts for each maturity date), and
- refinancing each maturing debt with new ten-year fixed rate debt.

This type of debt management strategy was described by Associate Professor Martin Lally in advice provided to the Queensland Competition Authority:

> *'In addition, in the presence of debt refinancing risks, the firm might seek to stagger the roll-over of their debt, so that approximately the same proportion is rolled over each year, and also seek a sufficiently long average term on their debt that the proportion rolled over each year is sufficiently small. For example, the firm might seek an average debt term of ten years so that, in conjunction with staggering of the maturity dates, approximately 10% of its debt requires roll-over in any one year.'* [1]

[1] Lally, M., September 2010, *The appropriate term for WACC parameters for the SEQ interim price monitoring*, p. 8

Further evidence of the efficiency of maintaining a diversified debt maturity profile can be found by examining the debt maturity profiles of borrowers that are not subject to economic regulation. Although the business risk profiles of some of these borrowers may differ from Unitywater, they are exposed to a common risk of having to refinance maturing debt or fund new investment when credit market conditions are unfavourable.

Appendix A displays the debt maturity profiles for a range of businesses. The businesses most closely related to Unitywater are those with long-lived infrastructure assets such as the Sydney Airport Corporation, Brisbane Airport Corporation, Telstra and Transurban. The maturity profiles for these businesses are well-spaced and extend out to at least ten years. As at 30 June 2012, the average remaining debt tenor for these businesses was 7.1 years, which is consistent with an average debt issue tenor in excess of ten years.

Alternative benchmark cost of debt approach

QTC's benchmark cost of debt methodology has been designed to replicate the cost produced by a portfolio of fixed rate debt with evenly spaced maturity dates out to ten years.

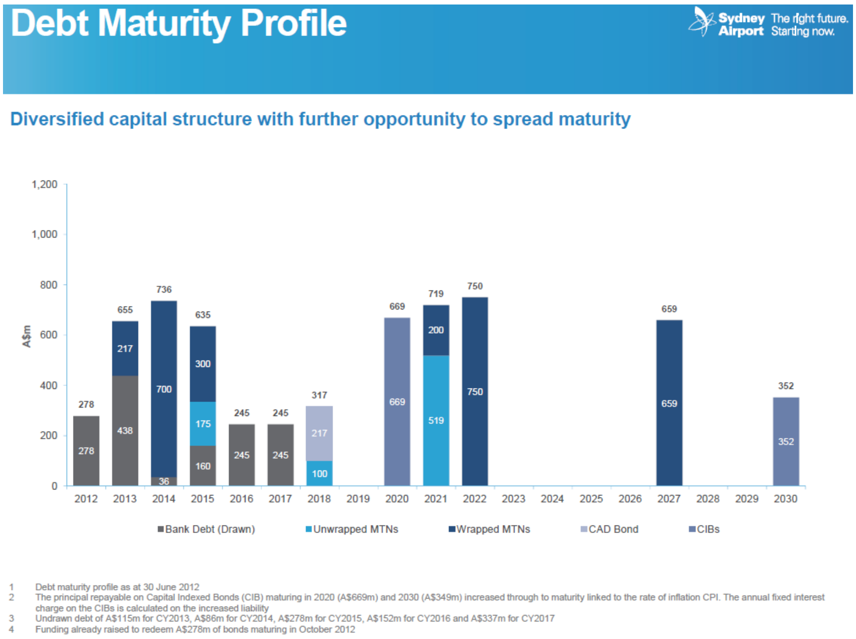
The specific features of the QTC approach are as follows:

1. The benchmark debt portfolio is made up of 40 fixed rate borrowings with remaining terms to maturity of 0.25 years to 10 years.
2. Each maturing borrowing is refinanced with new ten-year fixed rate debt at the prevailing interest rate. This will maintain a diversified maturity profile out to ten years, and a constant refinancing risk exposure.
3. The benchmark cost of debt is calculated as the internal rate of return (IRR) based on the future principal and interest cash flows for the benchmark debt portfolio.
4. The IRR is calculated quarterly and updated annually. Any intra-year mismatches are amortised over the remaining debt profile at the next annual update.
5. Any increases in the debt balance are compensated based on the prevailing ten-year fixed corporate cost of debt.

Over time, the average cost produced by the benchmark debt portfolio will be similar to the ten-year trailing average of the ten-year fixed corporate cost of debt. The cost of debt will be relatively stable on a year-by-year basis and will be largely protected from short-term volatility in corporate interest rates. This is considered to be a significant improvement over the current 'on the day approach', which exposes consumers and businesses to unnecessary risks.

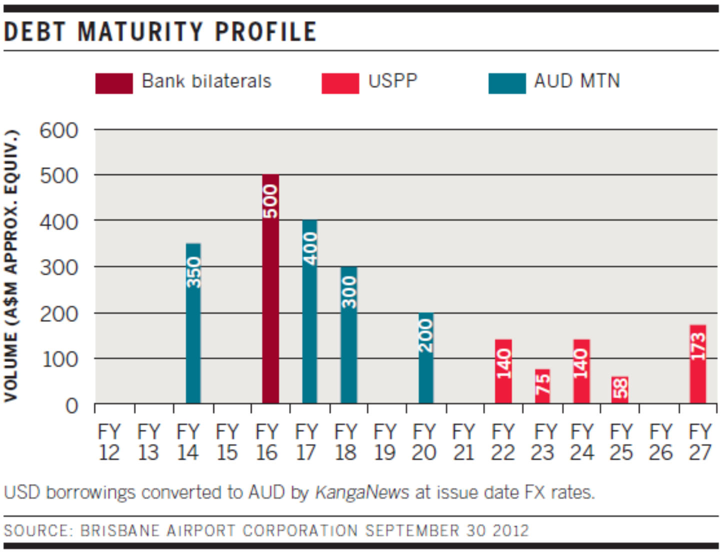
Appendix A – Debt maturity profiles

Sydney Airport Corporation



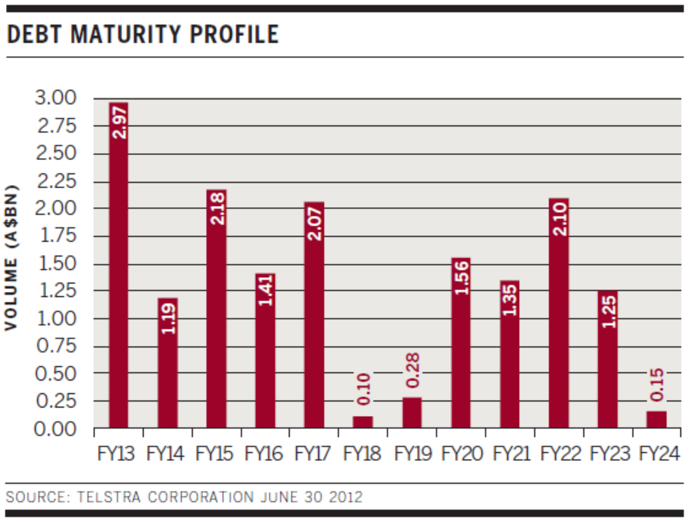
Source: Sydney Airport – AUD, CAD & US144A Debt Investor Update, 19 September 2012

Brisbane Airport Corporation



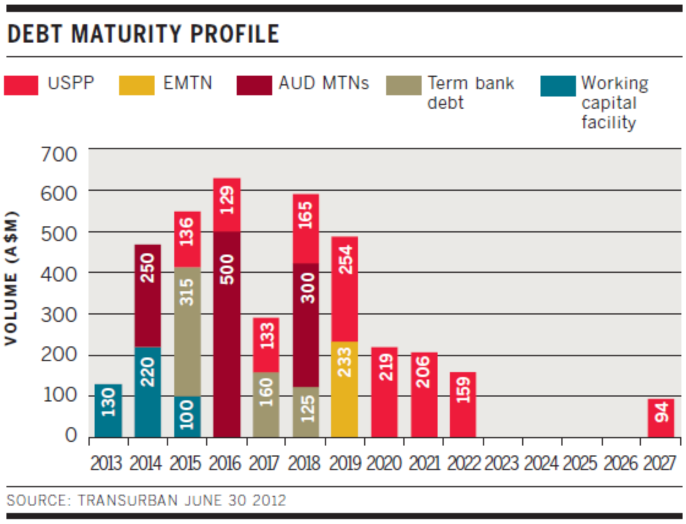
Source: KangaNews issuer profile

Telstra Corporation



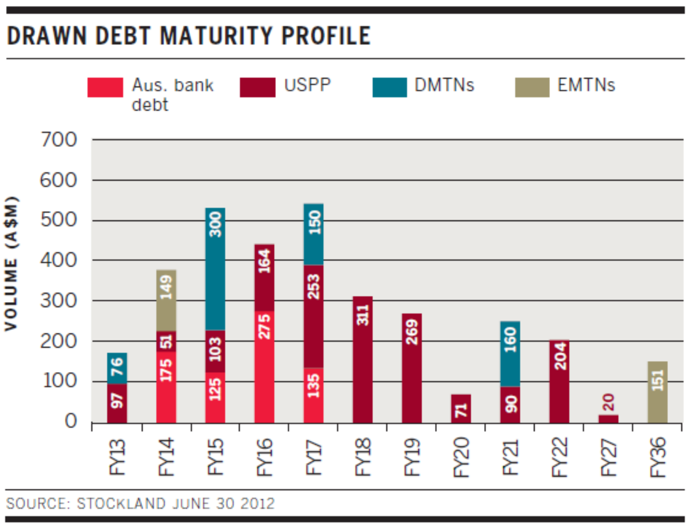
Source: KangaNews issuer profile

Transurban



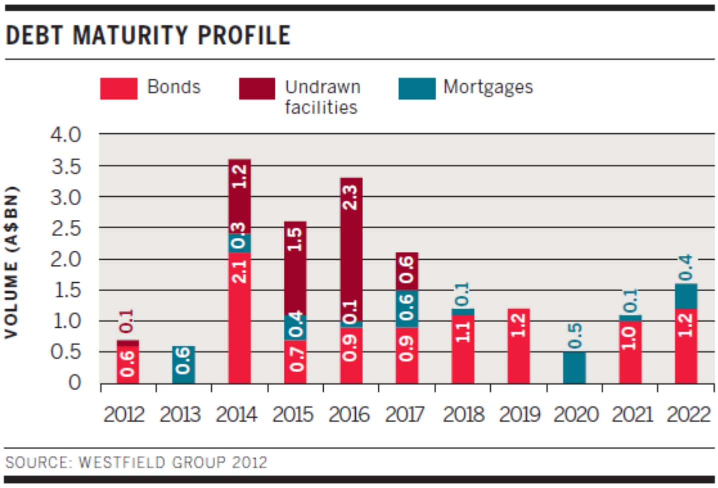
Source: KangaNews issuer profile

Stockland



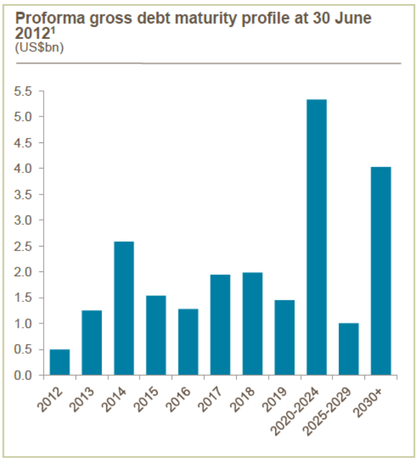
Source: KangaNews issuer profile

Westfield Group



Source: KangaNews issuer profile

Rio Tinto



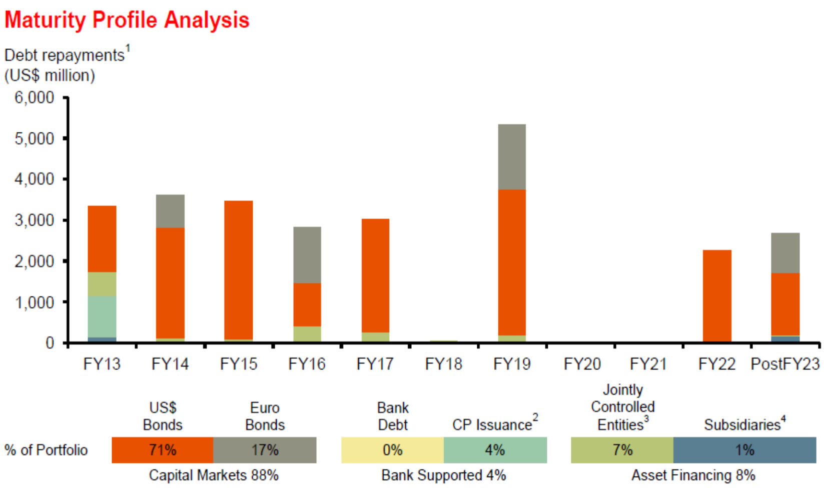
[1] 30 June 2012 maturity profile adjusted for $3 billion bond issue August 2012 and $0.5 billion bond maturity September 2012

- Aim to maintain a single A credit rating
- Long term and smooth debt maturity profile
  - Weighted average maturity of over nine years
  - $5.5 billion of bonds issued in 2012 with a weighted average maturity of around 12 years and coupon of 3.6%
  - $1.7 billion of bonds falling due over next 18 months
- Approximately two thirds of gross debt at fixed interest rates

RioTinto

Source: Rio Tinto Investor Seminar, London/New York, 9 October 2012

BHP Billiton



1. Based on debt balances as at 30 June 2012.

Source: BHP Billiton Credit Summary as of 30 Jun 2012

Techniques for estimating the cost of equity

14 June 2013

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Contents

1. Introduction and summary

We have been engaged by Unitywater to make recommendations regarding the estimation of its cost of equity capital. The Queensland Competition Authority ("QCA" or "the Authority") has recently estimated the cost of equity for a benchmark water utility at 6.70%.[1] It also estimates the value of a dollar of corporate tax paid (referred to as gamma in Officer, 1994) at 0.50. The QCA's parameter inputs for the weighted average cost of capital are presented in Table 1, which also contains parameter inputs for the previous regulatory period.

We have not been engaged to make a specific recommendation regarding the cost of equity capital for Unitywater. Rather, we have been asked to make recommendations for how this estimate can be made more reliable in future analyses. In this paper we make recommendations with respect to the Australian equity market as a whole, and for estimation techniques which can be applied to a benchmark water utility.

We also do not discuss the issue of the value of imputation credits, apart from noting that the QCA's estimate of value is well above estimate made by the Australian Energy Regulator ("AER") and the Independent Pricing and Regulatory Tribunal ("IPART") on the basis of a recent decision by the Australian Competition Tribunal (2011). The Tribunal estimated that a dollar of corporate tax paid is priced at 25 cents by the market, while the QCA considers this to be worth 50 cents. Or in terms used in regulatory decision-making the Tribunal considers a value for gamma of 0.25 to be appropriate, in contrast to the QCA's estimate of 0.50. If the QCA continues with this assumption we consider it appropriate for the QCA to explain exactly what evidence it considers to be more persuasive than the evidence relied upon by the Tribunal, so this evidence can be evaluated by Unitywater.

In comparison to the estimates for the cost of debt capital the QCA's estimates for the cost of equity are implausibly low. In the next regulatory period of 1 July 2013 to 30 June 2015, the estimated cost of equity of 6.70% is only marginally above the 6.49% estimate of the cost of debt. For the prior regulatory period the QCA estimates a cost of debt capital which exceeds the cost of equity.

Both results are implausible. With respect to the prior regulatory period, the implication is that a return of 9.69% is required to entice debt holders to invest in a benchmark water business, but equity holders will be prepared to invest at a lower return of 8.85%. Regardless of the framework by which the cost of capital is estimated, this outcome is at odds with investors' required returns being compensation for risk. Debt holders are exposed to less risk than equity holders for investing in the same corporation, and this difference in risk is independent of whether the risk considered is systematic risk, default risk or some other concept.

The only reason this difference in risk is mathematically possible is that the cost of equity capital is typically estimated as an *expected* return, which is the probability-weighted average of all possible returns. In contrast, the cost of debt is typically estimated as the yield to maturity on debt, which is the return debt holders receive in the absence of default. So if the risk of default is large enough the expected return on debt could be lower than the QCA's estimate of the expected return on equity. For example, if there was a 98% chance of receiving the yield to maturity of 9.69% and a 2% chance of default, and an associated return of –50.00%, the expected return on debt is 8.50% (0.0969 × 0.98 – 0.5000 × 0.02 = 8.50%).

[1] The QCA reports a figure of 6.69% rather than 6.70% so there is a rounding difference between these two estimates. For the purpose of the conceptual issues in this report this makes no difference.

Table 1. Cost of capital assumptions adopted by the QCA

Parameter	2010-13	2013-15
Risk-free rate (%)	4.91	2.76
Market risk premium (%)	6.00	6.00
Debt margin (%)	4.78	3.73
Debt funding (%)	60.00	60.00
Debt beta	0.11	0.11
Asset beta	0.35	0.35
Equity beta	0.66	0.66
After-tax cost of equity = $r_f + \beta \times MRP$ (%)	8.85	6.70
Cost of debt = r_f + debt margin (%)	9.69	6.49
Vanilla WACC = $D/V \times r_d + E/V \times r_e$	9.35	6.57
Value of imputation credits (gamma)	0.50	0.50
Tax rate (%)	30.00	30.00

http://www.qca.org.au/water/SEQRetailPriceMon201315/WACC.php on 5 June 2013.

However, regulated prices are set such that equity holders are projected to earn their cost of capital in the absence of default. So in the most likely case projected by the Authority, equity holders would earn a return of 8.85% and debt holders would earn a return of 9.69%. For the next regulatory period of 2013–15, equity and debt holders would earn almost the same return, despite equity holders being exposed to considerably more risk than debt holders. We also consider it implausible that a corporation would approve investment in a project in which the most likely scenario was a case in which shareholders earn a lower return than debt holders. This is the reason why it is standard practice to use the yield to maturity on debt in the weighted average cost of capital estimate. We suggest that the QCA estimates of the cost of equity for both periods are implausible and result from adopting a set of parameter inputs that are appropriate.

The reason for the low estimates of the cost of equity is a combination of a number of factors. First, the QCA adopts the Sharpe-Lintner Capital Asset Pricing Model (“CAPM”; Sharpe, 1964; and Lintner, 1965) and so ignores the possibility that risks other than systematic risk might be incorporated into the cost of capital. In particular, the QCA ignores the empirical evidence that size and the book-to-market ratio are indicators of required returns to equity holders.[2] All else equal, water businesses will have higher returns than other firms with similar size and beta estimates because they will have a high book-to-market ratio.

Second, in its implementation of the CAPM the QCA estimates the risk-free rate and market risk premium independently. So during recent years when we have observed low government bond yields, the aggregate cost of equity estimate is unreasonably low for both the overall market and the benchmark water business.

The QCA (2012) states that it in estimating the market risk premium it considers information from long-term average market returns and from contemporaneous market information. It places 50% weight on two estimates of the long-term average market risk premium, 25% weight on its estimate of the current market risk premium, and 25% weight on survey evidence, and finally rounds this estimate to the nearest percent. With respect to surveys it is never entirely clear whether survey responses actually capture respondents’ estimates of the risk premium actually incorporated into market prices at the time, or whether they capture a long-term average estimate they use for valuation (under an assumption that the market is pricing risk incorrectly), or whether they capture a long-term average estimate for illustrative purposes. So the QCA actually places somewhere from 50% to 75% weight on

[2] Small firms on average earn higher returns than large firms and firms with a high book-to-market ratio earn higher returns than firms with a low book-to-market ratio.

a long-term average estimate and somewhere from 25% to 50% weight on a contemporaneous indicator.

The combination of this weighting scheme and the QCA's rounding convention means it is almost impossible to observe a set of circumstances in which the QCA's estimate of the market risk premium will alter from the estimate of 6%. This is borne out in the QCA's decisions in which it has *never* departed from the market risk premium estimate of 6%. It is implausible that the QCA places any material weight on contemporaneous estimates of the market risk premium when we have recently observed one period of very high market volatility and another period of unprecedented low government bond yields and throughout there was zero change in the estimate of market risk premium.

There is no benefit to investors or consumers from expressing the market risk premium estimate to the nearest percent, when all returns estimates retain more precision. For example, if the risk-free rate is estimated at 2.76% and the market risk premium is estimated at 6.22%, adding these two figures together implies a market cost of equity of 8.98%. There is no benefit to investors or consumers from rounding the market risk premium to 6.00% and arriving at a market cost of equity benefit of 8.76%. It is correct that we do not know with precision what the market cost of equity is, or what the market risk premium is. But this imprecision is not reduced by the use of a market risk premium estimate of 6.00% instead of 6.22%. The QCA (2010) has also relied upon the rounding of market risk premium to 6.00% to justify maintaining the same market risk premium, despite changing its estimate of the risk-free rate to the yield to maturity on government bonds. This means that the QCA's view on the expected return on the market depends upon whether the administrative decision was made to use a five- or ten-year regulatory period. The QCA's rounding approach simply reduces the weight placed on contemporaneous information – because it makes it almost impossible for the estimate to change – for absolutely no improvement in the reliability of the final estimate of the cost of equity.

Third, in its implementation of the CAPM the QCA relies entirely on regression-based estimates of systematic risk from comparable firm analysis, thereby giving no regard to estimation error in these values. This is despite decades of research into the CAPM to understand just why regression-based estimates of systematic risk do such a poor job of estimating the cost of equity. This was the very reason that characteristics such as size and book-to-market ratio were investigated as possible proxies for risk, because there is so little ability to explain stock returns under the joint assumption that the CAPM holds and we can estimate beta reliably with regressions of stock returns on market returns.

If the CAPM continues to be adopted by the QCA, it could improve the estimates of its inputs by considering (1) information from the variation in analyst forecasts (that is, estimating beta with regard to the variation in analyst earnings per share forecasts, rather than relying exclusively on historical stock returns), (2) information from firm characteristics (that is, there are techniques for having the beta estimates account for information like book-to-market ratio, return on assets and stock volatility, rather than rely exclusively on historical returns information), and (3) information in share prices and analyst earnings forecasts (that is, estimating the cost of equity which sets the present value of expected dividends to share price). With advances over two decades in the availability of data and development of estimation techniques, we can improve our estimates of risk by incorporating information other than historical stock returns.

These three factors – placing exclusive on the CAPM as the sole asset pricing model, holding the market risk premium constant at 6%, and estimating risk exclusively with respect to historical stock returns – all contribute to cost of equity estimates that we consider to be implausibly low. In this paper we make recommendations with respect to each of these issues.

Our report is structured as follows. In Section 2 we discuss estimation techniques and models relating to the cost of equity for individual firms (CAPM, Fama-French model, dividend discount model) and estimation techniques and models relating to the broader market (dividend discount model[3], market-wide indicators of the market risk premium). In Section 3 we discuss how information from these approaches can be implemented, regardless of the QCA's choice of asset pricing equation.

[3] Note that we do not use market-wide variables to generate a dividend discount model estimate for the broader market. We make individual firm estimates of the cost of equity using this model and estimate the cost of equity for the market as a market capitalisation-weighted average of individual firm cost of equity estimates.

2. Estimation techniques

2.1 Introduction

In this section we discuss estimation techniques and models that apply to individual firm estimates of the cost of equity (CAPM, Fama-French and the dividend discount model) and estimation techniques and models that apply to the broader market (dividend discount model, market-wide indicators of the market risk premium). The estimation techniques for the market return and for individual firms need to be considered jointly, because the estimate of the market return will be a feature of any technique used to estimate the cost of equity for an individual firm. In the CAPM and Fama-French models, this is explicit – the term r_m appears as an input into the equation. But if the dividend discount model is used to estimate the cost of equity for a benchmark firm, this should be done in a manner consistent with the QCA's view on the market return.

The logic for this is straightforward. Ultimately, the adoption of more than one estimation technique or model for estimating a benchmark firm's cost of equity will lead to different estimates, due to estimation error. We do not know for certain just which risks are incorporated into asset prices and we do not have absolutely precise techniques for measuring these risks. So ultimately the regulator reaches a final decision on parameter inputs in light of all available evidence. The expected market return is one of these estimates upon which the regulator makes a decision, and the regulator's expectation for the market return is the same, regardless of how the regulator propose to account for firm-specific information.

Put another way, in implementing the CAPM the regulator asks, "If I believe that the expected return on the market is … and the risk-free rate is … what is the expected stock return?" The regulator answers this question by making an estimate of beta. In implementing the Fama-French model the regulator asks the same question, "If I believe that the expected return on the market is … and the risk-free rate is … what is the expected stock return?" The regulator answers this question by estimating three risk exposures and an additional two risk factors. The same concept applies to an application of the dividend discount model, which could be performed with respect to comparable firm analysis just like the CAPM and Fama-French models. The regulator again asks the question, "If I believe that the expected return on the market is … and the risk-free rate is … what is the expected stock return?" This question can be answered with firm-specific information, but analysed in a manner which is consistent with the market return view. If the market return is not considered, the regulator might implement an estimation process which results in an entirely different market return estimate to the regulator's view. In simple terms, the regulator's expectation for the market return is the same, regardless of the model or dataset or estimation technique the regulator decides to adopt in arriving at a benchmark cost of equity estimate for a firm.

2.2 Sharpe-Lintner Capital Asset Pricing Model

According to the Sharpe-Linter CAPM, the required return on equity for the benchmark firm can be computed using the following equation:

$$r_e = r_f + \beta_e \times (r_m - r_f)$$

where r_e is the cost of equity for the benchmark firm, r_f is the risk-free rate of interest, r_m is the expected return on the market portfolio and β_e (beta) is an estimate of systematic risk for the equity in the benchmark firm.[4]

For both 2010–13 and 2013–15 the QCA has adopted an equity beta estimate of 0.66 and a market risk premium estimate of 6.00%. The corresponding risk-free rate estimates are 4.91% and 2.76%, respectively. This results in estimates of the cost of equity capital of 8.85% and 6.70% for the two periods.

The beta estimate of 0.66 results from the re-gearing of an asset beta estimate of 0.35, according to the following equation:

$$\begin{aligned}\beta_e &= \beta_a \times \left[1 + \frac{D}{E} \times \left(1 - \tau \times (1 - \gamma)\right)\right] - \beta_d \times \frac{D}{E} \times \left(1 - \tau \times (1 - \gamma)\right) \\ &= 0.35 \times \left[1 + \frac{60}{40} \times \left(1 - 0.30 \times (1 - 0.50)\right)\right] - 0.11 \times \frac{60}{40} \times \left(1 - 0.30 \times (1 - 0.50)\right) \\ &= 0.35 \times 2.275 - 0.11 \times 1.275 \\ &= 0.80 - 0.14 \\ &= 0.66\end{aligned}$$

This means that, in the absence of any debt finance, the QCA estimates of the cost of equity for a benchmark water utility would be 7.01% for 2010–13 and 4.86% for 2013–15. These figures result from incorporating the asset beta estimate of 0.35 into the Sharpe-Lintner CAPM. The QCA has also adopted the assumption that the cost of equity for the market as a whole is 10.91% for 2010–13 and 8.76% for 2013–15, which is the sum of the risk-free rate and the market risk premium. So the QCA's view is that the expected return on the market fell by 2.15% over this period.

The justification for the asset beta estimate is presented by the QCA (2011, pp.244–247) with reference to regression-based estimates from water utilities listed in the United States and the United Kingdom, and energy networks listed in Australia and the United States. The re-levered beta estimate of 0.66 is close to the estimate regression-based estimate of 0.65 we provided to the Independent Pricing and Regulatory Tribunal ("IPART"; SFG, 2011). In that analysis we stated that if we were to only rely upon regression-based estimates of systematic risk, and ignore whether the outcome is economically-reasonable in the context of other parameters, we would use a beta estimate of 0.65.

The problem is that in making an estimate of the cost of equity capital using the CAPM, this conclusion places an unreasonable amount of faith in both the CAPM itself and the ability of regression-based estimates of beta to generate appropriate risk measures. We first consider regression-based estimates of risk and then the CAPM itself.

Regression-based estimates of beta are simply a measurement of the historical association between stock returns and market returns for a set of comparable firms. Beta estimates from regression analysis have very little ability to predict future stock returns and are highly unstable across firms in the same industry and over time for the same set of firms (Gray, Hall, Klease and McCrystal, 2009). So there is the very real potential for a firm with systematic risk about equal to the market to have a beta *estimate* from regression analysis which is well below one. In adopting a beta estimate of 0.66 the QCA does not consider the possibility that the regression-based estimate of risk could understate the true measure of risk.

[4] β is also termed market risk or economic risk and represents the risk associated with overall market movements, in contrast to the risk associated with company-specific events. In statistical terms it is the covariance of excess stock returns and excess market returns, scaled by the variance of excess market returns. The term "excess returns" refers to returns in excess of the risk-free rate of interest.

There is a wealth of empirical evidence that stocks with low beta estimates from regression analysis earn returns which are higher than projected by the CAPM, and stocks with high beta estimates earn returns which are lower than projected by the CAPM. For instance Da, Guo and Jagannathan (2012) find no association between beta estimates and subsequent stock returns when beta estimates are performed using standard regression analysis. But when they disentangle the returns that can be explained by firm characteristics (book-to-market ratio, firm-specific returns volatility and return on assets) they find that beta estimates formed from the residual returns have a positive association with realised returns.

There is also no need to restrict analysis to historical returns in estimating beta. Analyst forecasts provide a source of information and we can measure the variation in analyst earnings forecasts in association with earnings forecast changes for the market. This analysis is performed by Da and Warachka (2009) who find a positive association between beta estimates constructed in this manner and average stock returns.

The point is that the QCA relies upon a measure of systematic risk which has relatively little association with actual stock returns. This is partly because it is an imprecise measurement technique and partly because the CAPM itself is likely to ignore relevant sources of risk. The CAPM is formed under the assumptions of a perfect capital market, and in particular the ability for all investors to borrow and lend at the same risk free rate of interest. Once these assumptions are violated we would not necessarily expect the CAPM to hold.

For instance, in a perfect capital market all investors have complete information and form the same expectations regarding variance, covariance and expected security returns. But in reality investors have access to different information and form different expectations. Williams (1977) demonstrated that once different expectations amongst investors are introduced, diversifiable risk has a positive impact on realised returns of risky securities.

As another example, consider the crucial assumption that all investors are able to borrow and lend at the risk-free rate of interest, which also does not hold in reality. Black (1972) and Brennan (1971) demonstrated that once differential borrowing and lending rates are introduced, we would no longer expect the return on zero beta asset to equal the risk-free rate. Rather, we would expect the return on a zero beta asset to be above the risk-free rate but below the cost of borrowing. This means that, under the Black CAPM and in contrast to the Sharpe-Lintner CAPM, we would observe relatively higher returns for low beta stocks and relatively lower returns for high beta stocks.

To place this specific example in context, under the Black CAPM we have the following equation for the cost of equity capital:

$$r_e = r_z + \beta_e \times (r_m - r_z)$$

where r_z is the expected return on an asset with zero beta.

In the case where investors can invest in the risk-free asset (which is close to saying they can invest in government bonds) but they cannot borrow, Black (1972) demonstrated that r_z lies between the risk-free rate (r_f) and the market return (r_m). And in the case where investors can invest in the risk-free asset and can also borrow at a higher rate (r_b), Brennan (1971) demonstrated that r_z lies between the risk-free rate and the cost of borrowing. Also note that, in practice, estimates of the return on a zero beta asset can be above the cost of borrowing, which increases the expected returns on assets with low beta estimates even further.

To apply this to the parameters already estimated by the QCA, suppose that investors can borrow at the cost of debt estimate for the benchmark firm and so r_b is estimated at 9.69% for 2010–13 and 6.49% for 2013–15.[5] This means that even if the beta estimate of 0.66 is a reliable measure of systematic risk, the cost of equity estimate could lie anywhere from 8.85% to 10.49% for 2010–13[6] and 6.70% to 7.98% for 2013–15.

In summary, by relying exclusively on the CAPM populated by regression-based estimates of systematic risk the QCA places an unreasonable amount of confidence in this estimate of the cost of equity capital. For clarity, there are two important issues involved. One is whether the CAPM equation is likely to be an appropriate asset pricing model. The other is whether the implementation of this equation – using regression-based estimates of beta – is likely to generate reliable estimates of the cost of capital. There is no prescription in the CAPM itself that this is the only technique that can be used to estimate beta.

Regression-based estimates of beta have little association with realised stock returns and can be improved upon by considering firm characteristics and analyst forecasts. The model itself is not expected to hold under real-world assumptions – in particular expected returns on low beta stocks will be higher than predicted under the model, and other sources of risk are expected to be priced by the market once divergent expectations are allowed. And finally, there is no guarantee that the set of firms available for analysis form the basis for a reliable measure of risk. Given this uncertainty over the ability of the QCA's implementation of the CAPM to deliver a reliable estimate of the cost of equity, it is worth incorporating alternative estimates of the cost of equity as considered below.

2.3 Fama-French three factor model

The equation known as the Fama-French model resulted from two influential papers. Fama and French (1992) documented that firms with small market capitalisation and high book-to-market ratios earned relatively higher returns than other firms. In their subsequent paper the researchers compiled what we refer to as size and book-to-market factors. This was done in order to demonstrate that the reason small, high book-to-market firms earn relatively high returns is because of their exposure to risks not captured by regression-based estimates of beta. The size factor *(SMB)* is constructed as the difference in returns between a portfolio of small stocks and a portfolio of large stocks, and the book-to-market factor *(HML)* is constructed as the difference in returns between a portfolio of high book-to-market stocks and a portfolio of low book-to-market stocks.

Incorporating these factors into an asset pricing equation we have what is referred to as the Fama-French model, in which the coefficients *s* and *h* measure exposure to the size and book-to-market factors, just as the coefficient β_e measures exposure to the market factor:

$$r_e = r_f + \beta_e \times (r_m - r_f) + s \times SMB + h \times HML$$

Fama and French themselves report estimates of *SMB* and *HML* for U.S.-listed stocks over a long period of time on Professor French's website. The annual average values for *SMB* and *HML* are 3.58% and 4.81%, respectively, over the 86 years for which data is available until 2012.

[5] Other estimates for the cost of borrowing could be used (for example, margin loan rates). The cost of borrowing for the benchmark firm is merely used for illustrative purposes. There could also be an estimate of the return on a zero beta asset which exceeds the cost of borrowing.

[6] If the expected return on a zero beta asset is estimated at 9.69% for 2010–13 we have 0.0969 + 0.66 × (0.1091 – 0.0969) = 0.0969 + 0.0080 = 10.49%. If the expected return on a zero beta asset is estimated at 6.49% for 2013–15 we have 0.0649 + 0.66 × (0.0876 – 0.0649) = 0.0649 + 0.0149 = 7.98%.

The positive average returns to these factors is persistent over time and across markets. For the United States series there is no time period longer than 16 years for which the average annual *HML* return is less than zero, and there is no time period longer than 22 years for which the average annual *SMB* return is less than zero. If we consider the last four 20-year periods ending in 2012 the average returns for *SMB* are 2.14%, 3.76%, 2.89% and 7.81%, and the average returns for *HML* are 4.03%, 7.05%, 4.33% and 6.29%.

Fama and French do not report a series of size factor returns for Australia, but they do report a series of *HML* factor returns.[7] For the 38 years until 2012 the average annual return is 7.34% and there is no consecutive 10-year period for which the average return is less than zero. For the most recent 20-year period the average *HML* return is 5.00% and it is 9.94% for the first 18 years.

In a recent paper using Australian data, Brailsford, Gaunt and O'Brien (2012) construct *SMB* and *HML* factors over a 25 year period ending in 2006. They report an average *monthly SMB* return of –0.22% and an average *monthly HML* return of 0.76%, equivalent to around 9% per year. The authors' conclusion includes the following implications for cost of capital estimation (p.279):

> This evidence is important for a number of reasons. Firstly, the findings appear to settle the disputed question as to whether the value premium is indeed a positive and significant factor in the Australian market. Given the growing trend to utilize the three-factor model in asset-pricing tests and in practical strategies of portfolio formation in the funds management industry, these findings provide direction. Secondly, the evidence continues the decline of the single-factor model, which has obvious implications for future research. This future research should include the added benefits of using a multifactor model to estimate cost of capital for firms.

Standard & Poor's reports indices for Australia portioned into small versus medium/large market capitalisation stocks, and value versus growth stocks.[8] These indices are available for 23 years. The factor returns which can be computed from these indices are lower, on average, than those computed under the Fama-French technique of partitioning stocks into portfolios. But the data still illustrates the general concept that the size and book-to-market factors are a phenomenon in Australia. On average the S&P small stock index has earned annual returns 0.33% higher than the S&P large/medium stock index and there is no consecutive 16 year period in which the average return is negative. For *HML* the average return is more pronounced. On average the value stock index has earned returns 2.14% higher than the growth stock index and there is no consecutive 15 year period in which the average return is negative.

Over the last 20 years an extensive literature has been devoted to understanding the relative risks of small, value stocks compared to large, growth stocks. For example, Petkova and Zhang (2005) find that when the market has high risk expectations, the *HML* premium has high exposure to market movements.[9] The implication is that part of the returns to value stocks is due to the fact that they are exposed to more systematic risk during bad times, and less market risk during good times. One

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[7] These factor returns are computed in a different manner to the United States *HML* returns, and are computed according to the technique described in Fama & French (1998). For this purpose of this discussion the difference in computation is not material because we are not drawing conclusions from the magnitude of the returns. Rather, we are demonstrating that the factor returns are relevant across markets.

[8] Stocks with a high book-to-market ratio are often referred to as value stocks and stocks with a low book-to-market ratio are often referred to as growth stocks. In making an allocation to the value or growth index S&P considers the growth characteristics of sales growth, earnings change/price and momentum, and the value characteristics of book/price, earnings/price and sales/price. So other factors than the book-to-market ratio are considered, but these factors are likely to be correlated with the book-to-market ratio.

[9] Market risk expectations are considered high when dividend yields are high, when the spread between long-term and short-term government bond yields is high, when the spread between corporate and government bond yields is high and when the Treasury bill rate is low.

theoretical reason for this market risk exposure is that value firms are unable to reduce investment during economic downturns because more of their value is attributed to tangible assets (Zhang, 2005).

This is one possible explanation for the value premium. But the important issue for cost of capital estimation is not discussion of the precise risks which can be attributed to the size and book-to-market factors. It is whether the empirical evidence suggests that these are, indeed, priced risk factors and whether we can measure the exposure to these risk factors. For cost of capital estimation this can be broken down into two distinct questions.

First, do we expect the *SMB* and *HML* returns to persist in the future? With respect to the book-to-market factor it seems most unreasonable to expect *HML* to no longer be positive in the future. This average return has been large and persistent in the United States for 86 years and in Australia for 25 years. So we are hard pressed to see why this phenomenon would end in the near future. With respect to the size factor, the magnitude of average returns is lower than the book-to-market factor in both markets, and in Australia is slightly negative on average according to the estimate of Brailsford et al. (2012). So there is some contention over whether small stocks will continue to earn higher returns than large stocks in the future. Nevertheless, if the average size premium is small, it should make little difference if this is incorporated into the asset pricing model. However, it is important that the estimate of *SMB* and *HML* be made in a manner consistent with the estimation of exposure to those factors (that is, s and h).

Second, are we able to estimate the exposure to *SMB* and *HML*? The standard way this is done is exactly the same as the standard way that beta is measured for application in the CAPM, by regressing excess stock returns against returns factors in historical data. In the previous section we noted that this regression technique generates parameter estimates which are unstable across firms in the same industry and unstable over time for the same firms. There will be the same imprecision associated with estimates of s and h using this technique. And perhaps there is other information which can be used to form more reliable estimates of exposure to the size and book-to-market factors, just as information other than stock returns can be used to improve estimates of beta.

However, the key point is that if regression-based estimates of risk exposure are considered sufficiently reliable for use in the CAPM they must be considered sufficiently reliable for use in the Fama-French model. The QCA has relied exclusively on regression-based estimates of risk to arrive at a final beta estimate of 0.66 for use in the CAPM. So there seems to be no reason to exclude regression-based estimates of risk from the Fama-French model.

To illustrate the potential impact of applying the Fama-French model to cost of capital estimates, we performed the following exercise. We compiled four-weekly stock returns for nine industry indices compiled by FTSE, along with estimates of the market return, *SMB* and *HML*. For the market return we used the All Ordinaries Index and for *SMB* and *HML* we used the S&P indices referred to earlier.[10] The four-weekly returns are overlapping and computed each day, so all daily closing prices are used in the analysis.[11] The time period runs from 1 January 1994 to 22 February 2013.

For each industry index we estimate its risk exposure under the CAPM (β) and the Fama-French model (β, s and h) and then estimate the overall risk premium associated with this exposure. Under the CAPM

[10] In estimating beta we ignore the risk-free rate so compute market returns rather than excess market returns. In estimating risk exposure for a set of comparable firms we would perform the analysis using excess market returns but results generally change little when the risk-free rate is incorporated.

[11] If issues of statistical significance are considered then the standard errors need to be adjusted to take into account the overlapping returns. Typical standard errors are based upon the assumption that all observations are independent and so need to be adjusted to take into account that overlapping returns are not independent. But we are not making statistical inferences here and so standard errors are not computed.

this risk premium is estimated as β × *MRP* and under the Fama-French model this risk premium is estimated as β × *MRP* + *s* × *SMB* + *h* × *HML*. For the purpose of this illustration we assume that the long-term average *MRP* is 6.00%, *SMB* is 0.33% and *HML* is 2.14%. The long-term average *MRP* estimate is simply the current estimate adopted by the QCA and the other two estimates are simply the long-term average of the time series used to estimate *s* and *h*. Our intent is to illustrate the material impact inclusion of the Fama-French factors has on cost of capital estimation. Also note that the industry index *Utilities* is *not* the same as the listed energy firms previously relied upon by the QCA (there is an average of 3.1 firms in the Utilities index over the estimation period) and that the estimates in the table have *not* been adjusted for leverage. So the estimates in the table for utilities cannot be compared to the beta estimate of 0.66 previously adopted by the QCA. They are different firms and have different leverage. Results are presented in Table 2.

Across the nine industries the exposure to the book-to-market factor (*h*) ranges from –0.54 for Basic Materials to +0.62 for Financials, and the exposure to the size factor (*s*) ranges from –0.32 for Consumer Services to +0.35 for Industrials. To examine the impact of incorporating the Fama-French risk factors into the analysis we need to compare the risk premiums associated with each model. Incorporating the Fama-French factors changes the industry risk premium from the CAPM estimate by a material amount. At the lower and upper bounds, for Basic Materials the estimated risk premium falls by 1.40% and for Financials the estimated risk premium increases by 1.59%. We also observe an increase in explanatory power for each regression by incorporating the Fama-French factors. On average the R-squared increases by 3.4%.

The industry estimates can be used to consider the two questions we proposed about whether the Fama-French model is a viable alternative to the CAPM. The first question is whether we expect the average returns from *SMB* and *HML* to persist in the future. The second question is whether we can use regression analysis to make reliable estimates of exposure to the risk premiums. We noted that there is debate over whether *SMB* is likely to be, on average, positive. But the contribution of *SMB* to the risk premium estimates in the table is negligible. The range is from –0.11% for Consumer Services to +0.12% for Industrials. But for *HML* the impact on the cost of capital estimate is material. It ranges from –1.17% for Basic Materials to +1.32% for Financials.

As mentioned above, to rely upon the CAPM estimates in preference to the Fama-French estimates requires us to impose one of the following two assumptions. Either *HML* is expected to be zero in the future, despite having a large, positive average value over decades in different markets. Or the reported exposures to *HML* (that *h* coefficients) are not reliable estimates of future exposure, despite being estimated using exactly the same estimation procedure as the QCA relies upon in estimating beta. Neither of these assumptions appears reasonable.

The Fama-French model should also not be dismissed according to some notion that the CAPM has a stronger theoretical basis. The very reason the Fama-French factors were developed was because the CAPM, populated with regression-based estimates of beta, does such a poor job of estimating the cost of capital. This is because (a) the CAPM could well not explain expected returns because of its restrictive assumptions; and (b) even if the CAPM does hold the regression-based estimates of beta are unreliable. The publication of the Fama-French model has been followed by two decades of theoretical development which explains why the size and book-to-market factors are priced risks. In sum, if the objective is to make the most informative estimate of the cost of equity, and the only evidence relied upon is regression-based estimates of risk, the Fama-French estimates should be given more weight than the CAPM estimates.

Table 2. Industry cost of capital estimates

Output	Oil & gas	Basic materials	Ind-ustrials	Consumer goods	Health care	Consumer services	Telecom	Utilities	Financials
Avg firms	7.5	15.0	12.0	5.6	7.6	19.0	1.9	3.1	29.0
Avg MC ($b)	71	95	34	10	28	73	19	10	261
Intercept (%)	0.11	0.14	0.06	0.20	0.41	0.00	0.66	0.77	0.27
Beta	1.11	1.13	0.93	0.63	0.62	0.88	0.45	0.44	0.95
R-sq (%)	52	57	49	17	31	57	15	11	67
Risk prem (%)	6.69	6.75	5.55	3.77	3.74	5.29	2.72	2.62	5.73
Intercept (%)	0.18	0.25	0.04	0.20	0.40	-0.03	0.63	0.72	0.15
Beta	1.08	1.07	0.94	0.64	0.63	0.90	0.47	0.47	1.02
s	0.25	0.31	0.35	0.18	0.08	-0.32	-0.16	0.18	-0.30
h	-0.32	-0.54	0.28	0.24	0.09	0.05	0.10	0.39	0.62
R-sq (%)	54	62	53	18	32	60	16	15	77
Risk prem (%)	5.88	5.35	6.35	4.39	4.00	5.38	2.96	3.70	7.32

Risk premium estimates are computed as $\beta \times 0.06 + s \times 0.0033 + h \times 0.0214$. Estimates are made by regressing four-weekly index returns on market returns, *SMB* and *HML* over the period 1 January 1994 to 22 February 2013. Four-weekly returns are overlapping and computing using daily closing prices. The average market capitalisation presented is the average market capitalisation of the industry index rather than the average market capitalisation of individual firms.

2.4 Dividend discount model

2.4.1 Introduction

In the previous two sections we considered the use of two models referred to as "asset pricing models," the CAPM and Fama-French models. The term asset pricing model refers to an equation in which the cost of capital appears on the left hand side and compensation for risks appear on the right-hand side. The way these two techniques are implemented requires an estimate of the return per unit of risk (*MRP, SMB* or *HML*) and the amount of risk (β*, s* or *h*).

In this section we consider the use of cost of equity estimates resulting from analyst forecasts and share prices. The difference between these estimates and the estimates from asset pricing models is that the risk factors priced by the market are not specified in the computation of the cost of capital. The sole issue is what discount rate is consistent with expectations for future cash flows and the share price. The discount rate may well reflect particular risk factors but in this analysis there is no disaggregation of those risk factors.

Cost of equity estimates derived from analyst forecasts are often referred to as *dividend growth model* estimates. The reason for this terminology is that the task is to estimate the cost of equity after accounting for near term dividend forecasts, typically from one to three years, and the growth in those dividends over time. However, it is important to understand that there is no requirement that dividends grow at a single, constant rate outside of this near term forecast horizon.

The conceptual task is relatively straightforward to understand. It is analogous to estimating the yield to maturity on corporate bonds as the discount rate which sets the present value of payments to bond holders equal to the bond price. The application, however, is more challenging because we need to estimate a perpetual series of dividends, despite only having a short series of dividend and earnings expectations from analyst forecasts. This means that we need to *jointly* estimate a series of dividends and a cost of capital. The dividend series will be determined, in the short term, by analyst expectations of earnings and dividends per share. But outside of this explicit forecast period, the dividend series will be determined by expectations for growth of those dividends. Depending on the model adopted there could be one or more growth stages. The reason we refer to this as a *process* by which dividends evolve is to emphasise that growth does not need to be constant at any particular stage or in perpetuity. While convenient for computations, constant growth is just one process by which dividends could evolve.

The most important issue to understand about growth expectations is that these cannot be arbitrarily imposed on the analysis on the basis of what is considered reasonable by the person undertaking the task. What is being estimated is the growth rates incorporated into share prices set by the market, not imposed on the analysis from an external source.

The caution against imposing a growth rate on the analysis according to the researcher's or analyst's view as to what is correct is made by Easton (2006) who states:

> In light of the fact that assumptions about the terminal growth rate are unlikely to be descriptively valid, the inferences based on the estimates of the expected rate of return that are based on these assumptions may be spurious. The appeal of O'Hanlon and Steele (2000), Easton, Taylor, Shroff and Sougiannis (2002) and Easton (2004) is that they simultaneously estimate the expected rate of return and the expected rate of growth that are implied by the data. The other methods assume a growth rate and calculate the expected rate of return that is implied by the data and the assumed growth rate. Differences between the true growth rate and the assumed growth rate will lead to errors in the estimate of the expected rate of return.

So we present a version of the dividend growth model which does not depend upon an arbitrary assessment of what is reasonable. There are constraints imposed on the analysis, because there are some assumptions which, if incorporated jointly, simply do not allow us to estimate the cost of equity. For example, we cannot assume that long-term growth is greater than the cost of equity, because the value of the stock would be infinite. These constraints are detailed in the analysis.

2.4.2 Limitations of the constant growth assumption

The version of the dividend growth model that we present incorporates an assumption that parameter inputs revert to long-term estimates over time. Before presenting this model we describe the case of constant growth, purely to illustrate some basic concepts because a constant growth version is easier to explain. Imposing a constant growth assumption, when the inputs are based upon recent historical data, leads to outcomes with a high degree of dispersion across firms and which do not move in a direction consistent with market conditions. In contrast, estimates which rely upon mean reversion exhibit considerably less dispersion across firms and are relatively higher when other indicators of market risk are high. So these are the estimates we present.

The simplest form of the dividend discount model of equity valuation is the case where dividends are expected to grow at a constant rate in perpetuity. In this constant growth version of the dividend discount model, we have the following equation:

$$P = \frac{D_1}{r_e - g}$$

where P is the share price, D_1 is the expected dividend in one year, r_e is the cost of equity capital and g is the constant expected growth rate of dividends.

This equation can be re-arranged to derive the cost of equity capital as the sum of dividend yield (D_1/P) and growth (g):

$$r_e = Dividend\ yield + growth = \frac{D_1}{P} + g$$

Growth in dividends per share can come from both the reinvestment of earnings and from the issue of new shares. In the case of reinvestment of earnings, there will be positive growth in dividends per share provided those investments earn a positive return on equity. In the case of growth from the issue of new shares there will only be growth in dividends per share if the investments funded by new shares earn a return above the cost of capital.

The equation for growth from each of these two sources – reinvestment of earnings and issue of new shares – is given below. This expresses growth as a function of three inputs, the reinvestment rate (*RR*, the proportion of earnings per share retained in the firm, which can also be expressed as one minus the dividend payout ratio or *DPR*), the expected return on equity from new investments (*ROE*), the percentage increase in the number of shares (*C*), and the price/earnings ratio (P/E_1, where price is the present value of expected dividends and E_1 is next year's forecast earnings per share). The derivation of the equation is presented in Section 5.1.

$$g = \frac{(1 + RR \times ROE)/(1 + C)}{1 - \frac{C}{1 + C} \times \frac{P}{E_1} \times ROE} - 1$$

For example, suppose that the reinvestment rate *(RR)* is 20%, the expected return on equity *(ROE)* is 18%, the percentage change in shares *(C)* is 1%, and the price/earnings ratio *(P/E_1)* is 16. The implied growth rate is 5.58%, computed as follows:

$$\begin{aligned} g &= \frac{(1 + 0.20 \times 0.18)/(1.01)}{1 - \frac{0.01}{1.01} \times 16 \times 0.18} - 1 \\ &= \frac{1.0257}{0.9715} - 1 \\ &= 5.58\% \end{aligned}$$

The limitation of the constant growth model is that *ROE* in the above equation has considerable impact on the growth estimate and therefore the estimated cost of equity. Under any objective process for estimating the cost of equity we will encounter anomalies under the constant growth assumption. Consider the following alternatives.

As we discussed earlier, the analyst cannot simply impose a view on what is a reasonable return on equity. In the above example, if the analyst considered 12% to be a reasonable *ROE* then the implied growth rate would be 3.35%, and if the analyst considered 24% to be a reasonable *ROE* then the implied growth rate would be 7.86%. The point is that we need to *estimate* *ROE* at the same time as estimating r_e. It is not reasonable to suggest that we already *know* what returns the firm will earn on its investments but we *do not know* what the cost of equity is.

What about the economic argument that in the long-term *ROE* is expected to be equal to r_e? This assumption is adopted by Bloomberg for cash flows in the terminal state, after an extended forecast period of variable growth. Under this assumption, it would be expected that long-term price/earnings ratios will be equal to the inverse of the cost of equity capital.

To see why this is the case, consider the equation for price in a constant growth state:

$$P = \frac{D_1}{r_e - g} = \frac{D_1}{r_e - RR \times ROE}$$

If the return on equity (*ROE)* is set equal to the cost of equity *(r_e)* then we have:

$$P = \frac{D_1}{r_e - g} = \frac{D_1}{r_e - RR \times r_e}$$

Then if we set the reinvestment rate equal to (1 – Dividend payout ratio), that is, (1 – D_1/E_1) we can solve for the price/earnings ratio:

$$
\begin{aligned}
P &= \frac{D_1}{r_e - (1 - D_1/E_1) \times r_e} \\
&= \frac{D_1}{r_e - r_e + D_1/E_1 \times r_e} \\
&= \frac{D_1}{D_1/E_1 \times r_e} \\
\frac{P}{E_1} &= \frac{1}{r_e}
\end{aligned}
$$

For example, suppose the cost of equity capital was somewhere within the range of 9% to 13%. In the terminal growth state, if investments are expected to earn their cost of capital, the price/earnings ratio will be within the range of 7.7 to 11.1. These price/earnings ratios are well below the values we observe in the market for even the largest and most mature listed firms.

As a snapshot of the price/earnings ratios observed for very mature firms we compiled the listing dates for the ASX20. We then computed the price/earnings ratios from 1 July 2002 to 31 December 2012 (the period we use for estimation, discussed below) for firms *listed for longer than 20 years prior* to 1 July 2002. There were nine firms in this cohort, which were listed on average for 44 years prior to our sample period. The average price/earnings ratio for these firms over the sample period was 15.8.[12]

What this means is that imposing an assumption that expected returns are equal to the cost of capital is entirely inconsistent with the actual pricing of stocks. So rather than impose an assumption about *ROE,* we implement a process whereby the *ROE* is an outcome of the data. Under the process and estimates subsequently reported, the average price/earnings ratio in the constant growth state is projected to be 14.6. This lies slightly below the price/earnings ratio of 15.8 we observe for the largest and most mature firms. So the outcome of this process is long-term pricing of stocks which is consistent with the pricing we actually observe.

The third option which could be undertaken in a constant growth dividend discount model is to use recent *ROE* as the estimate of future *ROE*. But under this process the estimated growth rate and cost of equity is high when times are good (and the firm has recently earned high returns on investment), and low when times are bad (and the firm has recently earned low returns on investment). What this means is that, if implemented, the cost of equity estimates are high for the period prior to the global financial crisis and low for the period subsequent to the global financial crisis. This result is inconsistent with other indicators of risk, namely the difference between short and long-term government bond yields, the difference between corporate and government bond yields, the dividend yield and government bond rates. These indicators imply higher cost of funds during the global financial crisis.

2.4.3 Mean-reversion in parameter inputs

General framework

In the previous sub-section we documented the limitations of a constant growth version of the dividend discount model for cost of equity estimation. So rather than assume constant growth of

[12] The specific firms are BHP (listed 117 years, P/E 14.5), Santos (listed 48 years, P/E 21.8), Origin (listed 41 years, P/E 20.2), Rio Tinto (listed 40 years, P/E 14.6), ANZ (listed 33 years, P/E 12.6), Westpac (listed 32 years, P/E 12.9), Woodside (listed 31 years, P/E 19.7), QBE (listed 29 years, P/E 13.2) and National Australia Bank (listed 28 years, P/E 12.4).

dividends in perpetuity, we implement a ten-year period in which parameter inputs revert to long-term values prior to the constant growth state. The equation below is the dividend discount model, with a ten year explicit forecast period, followed by a period of constant growth. This equation states that the price *(P)* is equal to the present value of expected dividends *(D)* discounted at the cost of equity capital *(r_e)*.[13]

$$P = \frac{D_1}{(1+r_e)^1} + \cdots + \frac{D_{10}}{(1+r_e)^{10}} + \frac{D_{10} \times (1+g)}{(r_e - g) \times (1+r_e)^{10}} = \sum_{t=1}^{10} \frac{D_t}{(1+r_e)^t} + \frac{D_{10} \times (1+g)}{(r_e - g)(1+r_e)^{10}}$$

To populate this equation we set price equal to the analyst's price target, and D_1 and D_2 equal to the year one and year two dividend forecast. In cases in which there is no dividend forecast provided, we use the last actual dividend payout ratio multiplied by the earnings forecast for years one and two. To project dividends over the next eight years, we project return on equity, earnings per share and the dividend payout ratio.

The challenge in measuring the cost of equity using the dividend growth model is to allow dividend growth to be determined by the data, and not by an arbitrary choice of the analyst. So we allow three inputs – growth *(g)*, return on equity *(ROE)* and the cost of equity *(r_e)* – to take on a large number of combinations of alternative inputs and jointly determine which set of inputs are consistent with the data.

In our technique, we consider 2,672 possible combinations of the cost of equity, long-term growth and return on equity. The cost of equity takes on a range of 4% to 20%, long-term *ROE* takes on a range of 3% to 30% (and which can't be more than 1% below the cost of equity) and long-term growth takes on a range of 1% to 10% (and which must be less than the cost of equity). We measure *ROE* over the first two forecast years according to analyst earnings forecasts, and then assume that this return on equity changes incrementally in equal amounts to the long-term *ROE* estimate. The dividend payout ratio also changes incrementally in equal amounts to the long-term dividend payout ratio, which is equal to 1 – *g* ÷ *ROE*.

From all combinations of r_e, *g* and *ROE* this allows us to compute 2,672 valuations for each analyst price target, earnings forecast and dividend forecast on each stock. To decide upon the combination of inputs which best fits the data we require that combination to provide a valuation close to the analyst price target and to provide a smooth transition from near-term growth to long-term growth. First, we take all the cases in which the valuation is within 1% of the price target. Then within this set of unbiased cases, we then want to know which combination of inputs is most likely to represent the dividend projections and discount rate incorporated into the valuation. Our criteria is to compare the earnings growth rate in year 10 with the long-term growth rate. We select the case in which the ratio of

[13] In this equation the cost of equity capital is held constant over the life of the expected cash flows, so is conceptually equivalent to the yield to maturity on debt. So our estimate of the cost of equity capital is in no sense a short-term estimate of the cost of equity.

year 10 growth to long-term growth is closest to one, and this provides us with our best estimate of the cost of equity, long-term growth and long-term return on equity.[14]

Numerical example

A numerical example illustrates our process. To populate the above equation we set price equal to the analyst's price target, and D_1 and D_2 equal to the year one and year two dividend forecast. In cases in which there is no dividend forecast provided, we use the last actual dividend payout ratio multiplied by the earnings forecast for years one and two. To project dividends over the next eight years, we project return on equity, earnings per share and the dividend payout ratio.

To illustrate, suppose that D_1 and D_2 are \$0.16 and \$0.18, respectively, and E_1 and E_2 are \$0.25 and \$0.30. Also suppose that the book value per share at time zero (B_0) is \$1.60. This means that forecast *ROE* in year one is 15.63% ($E_1 \div B_0 = \$0.25 \div \$1.60 = 15.63\%$). The book value per share at the end of year one is equal to \$1.69 ($B_1 = B_0 + E_1 - D_1 = \$1.60 + \$0.25 - \$0.16 = \$1.69$). This means that the return on equity in year two is 17.75% ($E_2 \div B_1 = \$0.30 \div \$1.69 = 17.75\%$).

These initial values form the starting point for our projections over the next eight years. In forming these projections we incorporate a large number of combinations of r_e, g and *ROE* (2,672 combinations in total), and perform valuations. *ROE* reverts in equal increments from an initial value to long-term value, and the dividend payout ratio also reverts in equal increments to its long-term value. The long-term dividend payout ratio is equal to $1 - g \div ROE$.

One combination would be growth of 6%, cost of equity of 10% and return on equity of 15%. Long-term *ROE* of 15% and growth of 6% implies a long-term dividend payout ratio of 60% (that is, 1 – 0.06/0.15 = 0.60). To estimate the initial dividend payout ratio we take an average of the payout ratio for the first two years, which is 62.00% in this case ($D_1 \div E_1 = \$0.16 \div \$0.25 = 0.64$; and $D_2 \div E_2 = \$0.18 \div \$0.30 = 0.60$. To estimate the initial *ROE* we also take an average of the estimates over two years, which in this example is 16.69% ($E_1 \div B_0 = \$0.25 \div \$1.60 = 15.63\%$; and $E_2 \div B_1 = \$0.30 \div \$1.69 = 17.75\%$). This means that each year over the next eight years, the return on equity falls by 0.21% until it reaches the long-term value of 15%, and the dividend payout ratio falls by 0.25% until it reaches the long-term value of 60.00%. This allows us to project, every year, earnings per share, dividends per share and book value per share.

Incorporating the assumptions of 6% growth, 10% cost of equity and 15% return on equity result in a valuation of \$3.75 per share. This is 6.13% below the price target of \$4.00 so is not an acceptable combination of inputs. We consider an unbiased valuation to be within 1% of the price target. We compile all the combinations of inputs which lead to unbiased valuations. The final step is to select the combinations in which the growth of earnings per share in year 10, relative to the long-term growth, is smallest in percentage terms.

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[14] The process by which we project earnings and dividends over a 10 year forecast horizon and then into perpetuity is presented in more detail in Fitzgerald, Gray, Hall and Jeyaraj (2013). There are two differences between the method presented in that paper and the one applied here. First, in the current analysis we incrementally adjust the year two dividend payout ratio to the long-term dividend payout ratio. In the academic paper we maintain a constant dividend payout ratio over the first 10 years and then shift in one step to the long-term dividend payout ratio. Second, in the current analysis we determine the best estimates according to the ratio of year 10 growth in earnings compared to long-term growth in earnings. The ratio closest to one implies the smoothest transition of growth over time. In the academic paper we assume that all analysts covering the stock incorporate the same cost of equity capital, long-term growth rate and long-term *ROE* and measure which combination generates the lowest dispersion of valuations relative to price targets. This assumption leads to estimation error because the analyst price targets exhibit too much dispersion for it to be reasonable to assume they all have the same long-term inputs. Other published papers make the even more tenuous assumption that all firms in the same industry have the same long-term expectations.

To complete the example, if we use input of 8% for long-term growth, 12% for the cost of equity and 19% for return on equity, the valuation is $4.04 (within 1% of the price target) and year 10 growth in earnings per share is 9.45%. Compared to long-term growth of 8.00% this is a difference of 18.09% (that is, 0.0945 ÷ 0.0800 = 18.09%). This provides us with an estimate of the cost of equity of 12%.[15]

Specifics involved in estimation

In this sub-section we detail some specific computational issues involved in estimation.

Dividend yield is the average of dividend per share forecasts in years one and two, divided by price target. The reason we use the average dividend over two forecast years is to mitigate estimation error, because this average is more likely to represent the current income distribution of the firm, compared to either the first or second year forecast. Essentially we treat the first two forecast years as the current state of play. The reason we use the analyst's price target rather than the share price, is because the earnings and dividend forecasts could reflect a degree of optimism or pessimism compared to what is incorporated into the share price. But it is reasonable to assume that, whatever the optimism or pessimism reflected in earning and dividend forecasts is also reflected in the analyst's price target.[16] Initial dividends of zero is likely to be a source of estimation error and affects 2% of our sample. So we winsorize the dividend yield and the dividend payout ratio at the 2nd and 98th percentiles.[17]

Reinvestment rate (*RR*) is one minus the average of the dividend payout ratio (dividends per share/earnings per share) over forecast years one and two.

Price/earnings ratio (*P/E*) is the price target divided by the average earnings per share over the first two forecast years. Cases of negative earnings present a challenge in estimating initial growth, because the price/earnings ratio is incorporated into the equation which accounts for growth from new share issues. In our dataset 2% of observations comprised firms with earnings per share forecasts which were negative over two forecast years. So we winsorize the sample with respect to this input at the 2nd and 98th percentile. The reason we winsorize the dataset at the lower and upper end of the distribution is because we don't want to bias the results by excluding cases in which the firm had very low profits (that is, loss-making firms) but retaining cases in which the firm had very high profits.

Initial return on equity is the average return on equity (earnings per share/book value per share) over the first two forecast years. As with the dividend yield, the use of average return on equity over two years is to mitigate estimation error. The two year period represents the current state of play.

In implementing this process we impose an upper bound on the initial return on equity such that the growth in earnings per share cannot change from positive to negative over the ten years prior to

[15] An even more precise estimate of the cost of equity could be obtained if all possible values were considered rather than only considering even percentages of the cost of equity, such as 10%, 11% and so on. But in large samples this increase in precision will make no difference to our final conclusions and the increase in computational requirements would be substantial.

[16] There are studies which report that analyst earnings expectations are optimistic. But these conclusions are generally based upon the average difference between the analyst earnings per share forecast and the actual earnings. On average forecasts are above the actual earnings, but in general the median forecast are close to actual results. The reason for this difference is probably to do with the causes of earnings surprise. The analyst forecast represents the analyst's best guess as to what the earnings per share will be, not the average outcome from all possible events. And there is more chance of an event, such as an asset write-down, which causes earnings to be well below projections, than an event which causes earnings to be well above projections. So in the median case, the analyst forecast is about right because half the time things turn out better than expected and half the time things turn out worse than expected. But the average forecasts appears optimistic, because there are some occasions when things turn out much worse than expected, but fewer occasions when things turn out much better than expected. What this means is that analyst projections are not, in general optimistic. But for our purposes it does not matter if they are optimistic or pessimistic, provided the same optimism or pessimism is reflected in the price target.

[17] The term "winsorize" means that we replace the observation with the 2nd percentile or the 98th percentile. The observations are not removed from the dataset.

constant long-term growth. For example, if the initial *ROE* is very high we can have a case where growth is 50% initially, then declines to –10% by year 10, and then increases to 5% in the long-term. We ensure that the initial return on equity is sufficiently low that growth does not change from positive to negative and then back again.

Computation of the initial reinvestment rate. Growth results from both the reinvestment of earnings and the issue of new shares as given by the equation below.

$$g = \frac{(1 + RR \times ROE)/(1 + C)}{1 - \frac{C}{1 + C} \times \frac{P}{E_1} \times ROE} - 1$$

Rather than make long-term projections about new share issues, we compute an initial growth rate according to this equation (based upon recent share issues) and then estimate what reinvestment rate would be required to achieve the same growth rate. Percentage change in shares on issue (*C*) is computed as double the percentage change in shares on issue computed over the prior six months, because it needs to be estimated as an annualised rate of change in shares on issue. This allows us to account for growth from reinvestment and new share issues, but only make specific projections of the reinvestment rate. Above, we presented an example in which there was 1% per year new share issuance, reinvestment of 20% and growth of 5.58%. What we want to know is, to maintain the same growth rate of 5.58% without issuing new shares but instead paying less dividends, what would the reinvestment rate need to be? The reinvestment rate would need to increase to 31%, computed as follows:

$$g = RR \times ROE$$
$$RR = \frac{g}{ROE} = \frac{0.0558}{0.1800} = 31.03\%$$

We imposed constraints on the inputs to exclude unreasonable cases. As mentioned above, it is important to minimise subjective judgement in the application of this technique, because subjective judgement can be used to justify a wide range of inputs and lead to an equally wide range of cost of capital estimates. But there are some cases in which the model simply cannot accommodate the inputs because they cannot mathematically be part of a firm in a constant growth state. The constraints are as follows.

First, we impose the constraint that the total growth in earnings per share and dividends per share *(g)* cannot be more than what it would be if there was 100% of reinvestment of earnings and no new share issuance. It is inconsistent for a firm in a steady state to be growing so fast that it invests all of its earnings back in the firm and raises further capital from new share issuance. If this occurred, then growth would be more than the cost of equity (provided returns are at least the cost of funds) and the constant growth dividend discount model can no longer hold. So we constrain the growth in new share issuance so that total growth cannot exceed *ROE*.

Second, we do not allow the number of shares to decrease so we constrain growth in new share issuance to be at least zero. In 10% of cases the percentage change in the number of shares over six months was less than zero. So we winsorized the growth in new share issuance at the 10^{th} and 90^{th} percentiles. As with the return on equity, the reason we winsorize the dataset at the low end and the high end is because there are some cases in which growth in shares is unusually low, and some cases in which growth of shares is unusually high. If we only constrain the cases in which growth in shares is negative then we will overstate growth from new share issuance.

Imputation credits

The cost of equity estimates presented in this report do not include any benefits of imputation credits. This means that they represent an estimate of the return investors require from dividend and capital gains. If the Authority makes an assumption that imputation credits have a positive value the cost of equity capital is higher than the estimates presented here. So the cost of equity estimates presented in this paper are what equity investors expect in the absence of any of these tax benefits.

There are two reasons we present estimates which do not account for imputation benefits. First, this requires an assumption about the value of imputation credits, and while we have a regulatory assumption for this input we want our analysis to be independent of the Authority's assumption regarding the value of imputation credits. Second, our sample includes ordinary shares and stapled securities. If we are to account for the tax benefits of dividend imputation in our analysis we also need to account for the tax benefits of stapled securities. Accounting for these tax benefits requires even more assumptions, including the marginal tax rates of security holders and the value of deferred capital gains tax. Those assumptions will be specific to each individual stapled security and will vary over time for the same security. So as with the analysis of imputation, we do not want our estimates impacted by our own assumptions regarding the tax benefits of stapled securities.

2.4.4 Comparison to Bloomberg estimates

In outlining our process it is useful to compare our estimation technique with that of Bloomberg. Bloomberg has two stages of growth prior to reaching a perpetual growth state, and the length of these stages is contingent upon whether the security is classified as having low, average, high or explosive growth. Ultimately, however, the assumption made by Bloomberg incorporated into the terminal value is that returns on reinvested earnings equal their cost of capital.

This means that Bloomberg solves the problem of simultaneously estimating g and r_e by assuming that, in the terminal state, $g = RR \times r_e$. This is the crucial assumption adopted by Bloomberg to allow it to estimate the cost of equity capital for each firm in the market, and for the market risk premium as a market capitalisation-weighted average for all firms.[18]

The process by which we project dividends and then simultaneously estimate g and r_e is different. We jointly estimate a set of three parameters (long-term growth, cost of equity and long-term return on equity). In contrast, Bloomberg imposes the assumption that the long-term payout ratio is 45% and that long-term returns on equity equal the cost of equity capital.[19] In the table below we summarise the differences between the computation of our cost of equity estimates and those of Bloomberg.

[18] Note that the cost of equity estimates that Bloomberg reports for individual firms are a combination of dividend discount model estimation and a Capital Asset Pricing Model estimate. Bloomberg compiles individual firm cost of equity estimates, takes a market capitalisation-weighted average of these estimates to determine the market-wide cost of equity and market risk premium, and then applies its estimate of firm-specific beta to determine each firm's cost of equity estimate.

[19] It is generally-accepted in the accounting literature that accounting standards are conservative, in that accounting earnings and balance sheet values have more chance of being understated than overstated (Cheng, 2005; Easton, 2006). So whether return on equity (NPAT/Equity) has more chance of being overstated or understated depends upon whether those conservative accounting assumptions have a relatively greater impact on the income statement or the balance sheet. This means that we can observe return on equity which exceeds the cost of equity capital even if, in economic substance, that economic rents are zero. In relation to conservative accounting assumptions, Cheng cites the example of research and development expenditure being expensed, even though this expenditure is expected to generate future economic benefits. In relation to economic rents, Cheng states that the absence of perfect competition can mean that some firms can set prices above their marginal costs and generate abnormal earnings. The key points are that we do observe return on equity in historical data which exceeds the cost of equity capital, there are reasons why we would not necessarily expect the return on equity and the cost of equity capital to converge, and that we are able to estimate the cost of equity capital without imposing the assumption that it equals the return on equity.

Table 3. Comparison between SFG and Bloomberg estimates of the cost of equity

	SFG	Bloomberg
Time period prior to constant/mature growth	10 years	19 years
What is the *ROE* at maturity?	3% to 30%	r_e
What is the dividend payout ratio at maturity?	$1 - g \div ROE$	45%
What is the constant growth rate at maturity?	1% to 10%	$(1 - DPR) \times r_e$
How to transition to long-term growth?	Explicit forecasts of dividends and earnings in years 1 and 2.	Explicit forecasts of dividends and earnings in years 1 and 2.
	ROE in year 2 reverts to long-term ROE over remaining 8 years.	"Growth" stage of either 3, 5, 7 or 9 years.
	DPR in year 2 reverts to long-term DPR over remaining 8 years.	"Transition" stage of either 14, 12, 10 or 8 years.
	Reversion is in equal increments.	Length of stages contingent upon Bloomberg's classification of the firm into explosive, high, average or slow growth. This classification is based upon the distribution of growth rates for all firms.
		Growth rate during "growth" stage is analyst's average estimate of long-term growth.
		Reversion in equal increments to mature growth rate over transition stage.
Data	Average values computed for all analyst inputs for each firm over a six month period. Earnings and dividend expectations matched with price target.	On each date, average values computed for all outstanding analyst inputs available at that data. Earnings and dividend expectations matched with share price.

2.4.5 Dividend growth model estimates

Data

For Australian-listed firms we compiled individual analyst forecasts of earnings per share, dividends per share and price targets over the 10.5 year period from 1 June 2002 to 31 December 2012 from the Institutional Brokers' Estimate System ("IBES").[20] We then grouped the sample into six monthly intervals according to the announcement date of the year one earnings per share forecast. An individual analyst can have more than one input during the six month period. So if a stock was covered by two analysts, and the first analyst submitted one forecast and the second analyst submitted two forecasts, we compile three estimates of the cost of equity for that firm during the six month period.

[20] On average, the price target is 14% above the share price. So if we had used the share price in our analysis our cost of capital estimates would have been higher.

Our analysis relies upon individual analyst inputs for each firm because this mitigates estimation error. So our dataset comprises 39,564 sets of analyst forecasts and there is a cost of capital estimate derived for each set of analyst forecasts. Once these cost of capital estimates are compiled, we take an average of the cost of capital estimates for each firm every six months. In an appendix we also present results from the alternative process whereby we first take averages of analyst inputs and then estimate the cost of capital. On average the results are approximately the same, but this analysis results in more dispersion of cost of capital estimates.

The total number of analyst inputs which had sufficient data available for analysis was 39,564. This means that over the 10.5 year period there were just under 40,000 combinations of earnings per share expectations, dividends per share expectations and price targets for Australian-listed firms with all other data available for analysis. We partitioned the sample into six month intervals so we have a large number of firms and analyst inputs available in every six month period. An individual analyst can make more than one input for each firm in a six month period. For each of the 39,564 observations we estimate the cost of equity capital, and average these estimates across all analyst inputs for each firm every six months.

This allows us to compile a sample of 4,567 average cost of equity estimates. On average, each time a firm appears in a six month period, there are 8.7 cost of equity estimates for that firm. There are also 561 individual firms in the dataset which means that, on average, each firm appears in the dataset 8.1 times over the 10.5 year period. There were 31 firms that appeared in the sample in all 21 half-year periods. These firms include 13 of the ASX20. Across the 4,567 sample firm/half-years, we have the following average values – dividend yield of 4.6%, price/earnings ratio of 18.0[21], initial return on equity of 17.5% and change in shares on issue of 1.7%.

Individual firm estimates

In Table 4 we summarise our estimates for individual firms. We present results for all 4567 firm/half-years. In the subsequent table we present results on an industry basis. It should be emphasised that the results presented in this table are for the average Australian-listed firm from the second half of 2002 (2H02) to the second half of 2012 (2H12). They are not estimates of the cost of capital at the end of 2012.

Across all observations the average cost of equity is 10.8% and the standard deviation is 2.4%. This is slightly different to the cost of equity for the market, which we discuss subsequently. For the market cost of equity, as an input into asset pricing models, we compute a market capitalisation-weighted average cost of equity over time.

The average estimated long-term growth rate is 5.8% and the average estimated return on equity is 18.1%. As mentioned above the average initial return on equity in this process was 17.5%, so the long-term return on equity is close to the average initial value. Firms with high initial *ROE* experience a decline in *ROE* and firms with low initial *ROE* experience an increase in returns on investment. But *ROE* does not need to revert to the cost of equity capital.

[21] These dividend yield values and price/earnings ratios are based upon price targets. If we compute the price/earnings ratio as the price target on the basis of the share price, rather than the price target, the average price/earnings ratio is 16.0 and the average dividend yield is 5.1%.

Table 4. Estimates assuming mean-reversion in growth (%)

				Percentiles				
	N	Mean	StDev	5th	25th	Median	75th	95th
Cost of equity	4567	10.8	2.4	6.0	9.5	10.9	12.1	14.6
Long-term growth		5.8	2.2	1.7	4.5	6.0	7.3	9.3
Long-term return on equity		18.1	5.7	10.4	13.3	17.1	23.0	28.0
Dividend yield		4.6	2.0	1.4	3.2	4.5	5.8	8.2

An important issue is whether the variation in the estimates across firms is sufficiently low for them to be relied upon in estimating the cost of capital. Variation in the estimates will occur both because there truly are differences in the cost of equity across firms and because of estimation error. Across all firm/half-years the standard deviation of the cost of equity estimates is 2.4%. The dispersion of outcomes is lower if we first compute an average cost of equity capital for each of the 561 firms.[22] In this instance the standard deviation of the estimates is only 2.2%. This occurs because estimation error in different six month periods for the same firm is cancelled out.

As a benchmark we can compare the variation in the estimates from this technique to what we would observe under the CAPM, if implemented in the manner currently used by the QCA. The Authority applies a constant estimate of the market risk premium (at all times this estimate has been 6%) to an estimate of beta and a constant input for the risk-free rate. In estimating beta the only quantitative analysis used is the regression of stock returns on market returns, and the beta estimates across all firms from this technique have a standard deviation in the range of about 0.6 to 0.8 depending upon the sample. So the standard deviation of the cost of equity estimate across all firms, from the current approach, would be in the range of 3.6% to 4.8%. And this standard deviation does not account for estimation error in the market risk premium. If we accounted for imprecision in the market risk premium estimate in the CAPM, the dispersion of cost of capital estimates would be even wider.

So while there are some high and low values for the estimated cost of equity (10% of outcomes are either below 6.0% or above 14.6%), we observe even more extreme outcomes under the application of the CAPM, if the beta estimate is derived only from regression analysis of stock returns. Ideally there would be less dispersion in the cost of equity estimates, so the only variation represents true differences in risk across firms. But if we are to implement a process which applies to all firms, and not select individual inputs for each firm, there will be some noise in this process. However, the data suggests there is less noise in our estimates than those derived from the current approach. Importantly, as with any cost of capital estimation technique, we should refer to portfolio of firms in reaching conclusions rather than rely upon the cost of capital estimate from any individual firm.

Industry estimates

In Table 5 we report mean values across industry sectors for the estimated cost of equity, long-term growth, return on equity and dividend yield. The industry sectors are those reported by IBES. Across the sectors the average estimate for the return on equity ranges from 9.8% for Health care to 11.6% for Transportation. Average long-term growth rates range from 5.2% to 7.0% and the average long-term return on equity ranges from 15.6% to 21.1%.[23] Nine of the 12 industry sectors have an average estimated cost of equity within the range of 10.2% to 11.0%, so the industry differences in the estimated cost of equity are relatively small.

[22] This is an alternative way to estimate the cost of equity capital over the sample period for the average firm. In this calculation each firm carries equal weight in the calculation. In the figures presented in Table 4 each firm/half-year carries equal weight.

[23] The average long-term return on equity estimates are consistent with the return on equity estimates from forecasts years one and two, and with return on equity estimates derived from historical earnings only. Based upon the first two years forecast earnings, the mean and median return on equity values across the sample are 22.6% and 16.9%, respectively. Based upon actual earnings, the mean and median return on equity values are 30.5% and 15.7%, respectively.

Table 5. Industry equity estimates assuming mean-reversion in growth (%)

	N	Cost of equity	Long-term growth	Return on equity	Dividend yield
Basic industries	740	11.2	5.8	17.9	3.6
Capital goods	503	11.5	5.8	18.2	4.3
Consumer durables	183	11.0	5.6	20.5	5.6
Consumer non-durables	318	10.4	5.7	18.1	4.5
Consumer services	745	10.2	5.4	19.1	4.7
Energy	256	10.3	5.9	17.1	3.6
Finance	1167	10.8	6.2	16.7	5.4
Health care	183	9.8	6.0	18.2	3.5
Public utilities	99	10.7	5.5	20.8	5.3
Technology	269	10.6	5.2	21.1	4.6
Transportation	104	11.6	7.0	15.9	3.4
All firms	4567	10.7	5.8	18.1	4.5

Market

As mentioned in the introduction to this section it is important for the Authority to adopt a consistent view of expected market returns across any alternative models, data or estimation techniques used to compile benchmark cost of equity estimates for a firm. In this sub-section we turn our attention to the Australian market as a whole. The expected return on the market is a market capitalisation-weighted average of the expected return on each stock. We compiled this estimate every six months and report our results in Table 6. The table shows that the average expected return on the market over this period was 10.6%. This can be compared to the 5.3% average yield on 10 year government bonds to form an estimate of the market risk premium over this period. The average market risk premium over this period is estimated at 5.3%.[24]

The global financial crisis began to materially impact asset prices in the second half of 2008, following which we observed substantial increases in corporate debt yields and decreases in the yield on government bonds. In our sample we also observe an increase in the estimated market cost of equity during this period. From 2H02 to 1H08 the average cost of equity for the market was 10.3%, which increased to an average 10.9% from 2H08 to 2H12. In comparison to a declining risk-free rate, the estimated market risk premium rose from an average 4.7% to 6.2%. In the last six months of the sample the market risk premium is estimated at 7.9%.

The estimates provide by Bloomberg provide a point of comparison. Bloomberg estimates are only available from the second half of 2008 onwards. On average the expected return on the market from Bloomberg is 13.7% from 2H08 to 2H12 (compared to our estimate of 10.9%) and the average implied market risk premium is 9.0% (compared to our estimate of 6.0%).

The Bloomberg approach incorporates higher growth assumptions, especially in the short term, which leads to a higher estimated cost of equity capital. The Bloomberg process for transitioning from initial growth to long-term growth is summarised in Table 3. In the long term, the approach adopted by Bloomberg means that investments earn their cost of capital. So ultimately the estimates compiled by Bloomberg will lead to price/earnings ratios that are the inverse of the cost of equity capital.

[24] We reiterate that this estimate of the market risk premium does not include any tax benefits of imputation or other tax benefits. It represents the market risk premium from dividends and capital gains only.

Table 6. Market capitalisation-weighted estimates assuming mean-reversion in growth (%)

Period	N	Cost of equity	Long-term growth	Return on equity	Dividend yield	Risk-free rate	Market risk premium	Bloom-berg r_e	Bloom-berg ERP
2H02	143	10.3	5.9	19.6	3.9	5.6	4.7		
1H03	146	10.0	5.4	19.5	4.2	5.1	4.8		
2H03	150	10.3	5.8	19.6	4.3	5.6	4.7		
1H04	156	10.8	6.2	20.4	4.6	5.7	5.1		
2H04	164	10.8	6.1	19.3	4.6	5.5	5.3		
1H05	186	10.6	5.9	19.5	4.1	5.4	5.2		
2H05	168	10.6	5.4	21.7	4.0	5.3	5.3		
1H06	164	9.7	4.4	22.6	3.9	5.5	4.2		
2H06	188	10.2	4.8	22.5	4.3	5.7	4.5		
1H07	232	10.2	5.2	20.8	3.6	5.9	4.3		
2H07	253	10.2	5.4	21.0	3.7	6.1	4.1		
1H08	265	10.5	5.9	19.5	4.5	6.3	4.3		
2H08	244	10.7	5.5	18.5	5.2	5.4	5.3	13.2	7.8
1H09	228	11.3	6.4	17.7	5.4	4.6	6.7	16.0	11.4
2H09	263	10.6	6.2	16.9	4.4	5.5	5.2	12.0	6.5
1H10	283	10.5	6.0	17.9	4.1	5.5	5.0	13.7	8.2
2H10	274	10.8	5.9	18.6	4.3	5.2	5.7	15.6	10.4
1H11	281	10.7	5.7	18.5	4.4	5.4	5.3	14.7	9.3
2H11	261	11.1	6.1	18.0	4.7	4.3	6.8	14.4	10.0
1H12	267	11.2	6.3	17.3	4.7	3.7	7.6	12.7	9.0
2H12	251	11.0	5.8	17.0	4.7	3.1	7.9	11.4	8.3
Average	217	10.6	5.7	19.3	4.4	5.3	5.3	13.7	9.0
2H02-1H08	185	10.3	5.5	20.5	4.1	5.6	4.7		
2H08-2H12	261	10.9	6.0	17.8	4.7	4.7	6.2	13.7	9.0

The cost of equity is a market capitalisation-weighted average of the average cost of equity estimates for each firm during the six month period. The risk-free rate is the average of daily annualised yields on 10 year government bonds. The market risk premium is then the difference between the market capitalisation-weighted average cost of equity and the average risk-free rate. The Bloomberg cost of equity is the average of the daily estimates of the cost of equity for Australia provided by Bloomberg, and the Bloomberg equity risk premium is simply the difference between the Bloomberg cost of equity estimate and the risk-free rate reported in the table.

Estimating the cost of equity for a specific industry

In the prior sub-section we presented estimates of the cost of equity over time for the Australian market as a whole, and we presented estimates for separate industries over the entire time period. What we did not present was analysis over time for each individual industry. The reason we do not present these estimates is because whether there are sufficient observations to draw reliable conclusions about the cost of equity, for an individual industry at any point in time needs to be determined on a case-by-case basis. The total number of firm/half-years is 4,567 and there are 11 industry groups and 21 half-years. So on average each industry in each half-year will be comprised of 20 observations.

We recommend the following technique to mitigate estimation error in arriving at an estimate of the cost of equity capital for a set of comparable firms. For exposition purposes we consider the firms in the Finance industry group. But the principle applies to any set of comparable firms constructed for the purposes of cost of capital estimation.

First, for each observation in the comparable firm set, compute an estimate of the equity risk premium and take a ratio of this equity risk premium to the market risk premium estimate for the same time period. For example, in the most recent six month period, we estimate the market risk premium at 7.9%. For the 65 firms in the Finance industry group the average equity risk premium over this time period is 8.5%, so the average ratio of the risk premiums is 1.08 (that is, 0.085 ÷ 0.079 = 1.08). We compute this ratio for all 1167 observations in the Finance industry group and compute an average value of 1.02. This means that we estimate that firms in the Finance industry group have an equity risk premium which is 1.02 times the market risk premium. So that under current market conditions the cost of capital for this set of comparable firms is estimated at 11.2% (that is, 0.031 + 1.02 × 0.079 = 11.2%).

The key point is that if the number of firms in the comparable firm set is small, there will be variation over time in the direct dividend growth model estimate, purely due to noise in the data – just like there would be if the inputs to the CAPM and Fama-French models were estimated over a very short period of time. But we can draw more reliable inferences about the relative risks of different sets of comparable firms if we examine a larger dataset over the entire time period, and combine this with estimates of the overall market cost of equity over time.

2.5 Use of market-wide indicators for estimating the market risk premium

There are four market-wide indicators of the market risk premium which are useful for estimation – dividend yield, risk free rate, corporate bond spread and term spread. These indicators are used in the finance literature as proxies for market conditions in a number of fields. For example, Petkova and Zhang (2005) measure the relative risk of value and growth stocks during periods of different market conditions. They use these four variables as indicators of the expected market risk premium and estimate the expected market risk premium as the predicted value from the following regression equation, presented as equation 1 in their paper:

$$r_{mt+1} = \delta_0 + \delta_1 DIV_t + \delta_2 DEF_t + \delta_3 Term_t + \delta_4 TB_t + e_{mt+1}$$

where r_{mt+1} is the market return relative to the risk free rate in month $t+1$ and the four conditioning variables in month t are the dividend yield *(DIV),* default spread *(DEF),* the term spread *(TERM)* and the short term treasury bill rate *(TB).*[25]

Given that there are no regulators in Australia that estimate the market risk premium directly with reference to these indicators, we have compiled estimates using an approach that we believe is as simple to estimate and explain to businesses and consumers as possible. There may be more sophisticated approaches to incorporating these indicators into the analysis. But at this stage we think it is important to establish the validity of this approach as providing useful information about the market risk premium at each point in time, without conjecture about just how precise the measurement can be made with more sophisticated analysis.

The advantage of this technique is that it is transparent and easily implemented. Its disadvantage is that it remains an indirect estimate of the market risk premium, rather than being a direct estimate of the discount rate incorporated into share prices at a point in time.

The approach presented is this paper is to estimate, at each point in time, where the indicator lies relative to its historical distribution, and then apply this to a distribution for the market risk premium. We have assumed that the market risk premium is uniformly distributed between 3% and 9%, so that the mid-point is equal to the regulators' standard assumption that the market risk premium is 6%. We arrived at the lower bound of 3% because in estimates of the market risk premium derived from share prices published in the academic literature, there are few estimates that are below 3%, and that for the purposes of regulation it seems unrealistic to think that a regulator would actually set the *MRP* below this level. The regulator would be unlikely to set the *MRP* below this level because of the risk that the regulated rate of return is below the true cost of funds purely because of measurement error.

[25] In turn, Petkova and Zhang (2005) cite the following papers as justification for the use of these found indicators of the market risk premium – Fama and French (1988) for the dividend yield, Keim and Stambaugh (1986) for the default premium, Campbell (1987) and Fama and French (1989) for the term premium, and Fama and Schwert (1977) and Fama (1981) for the short-term Treasury bill rate.

The four market-wide indicators we rely upon are:

1. The risk free rate – 10 year government bond yields estimated by the Reserve Bank of Australia;

2. The term spread – The difference between 10 year and 2 year government bond yields estimated by the Reserve Bank of Australia;

3. The corporate spread – The difference between the UBS all maturities credit yield and the UBS treasury yield; and

4. The dividend yield on the All Ordinaries Index, estimated by Datastream.

We take average values of these indicators each calendar month, and compute the percentile based upon where this average lies compared to all previous monthly averages and the current monthly average. In compiling percentiles we use all available historical information for the relevant indicator. To illustrate, in January 2013 we had the following four averages and percentiles:

1. The risk free rate was 3.4% which was the 99th percentile compared to the average monthly risk free rate from July 1969 to January 2013.[26]

2. The term spread was 0.6% which was the 61st percentile compared to the average monthly term spread from January 1976 to January 2013.

3. The corporate spread was 1.0% which was the 67th percentile compared to the average monthly corporate spread from September 1996 to January 2013.[27]

4. The dividend yield was 4.2% which was the 75th percentile compared to the average monthly dividend yield from January 1987 to January 2013.

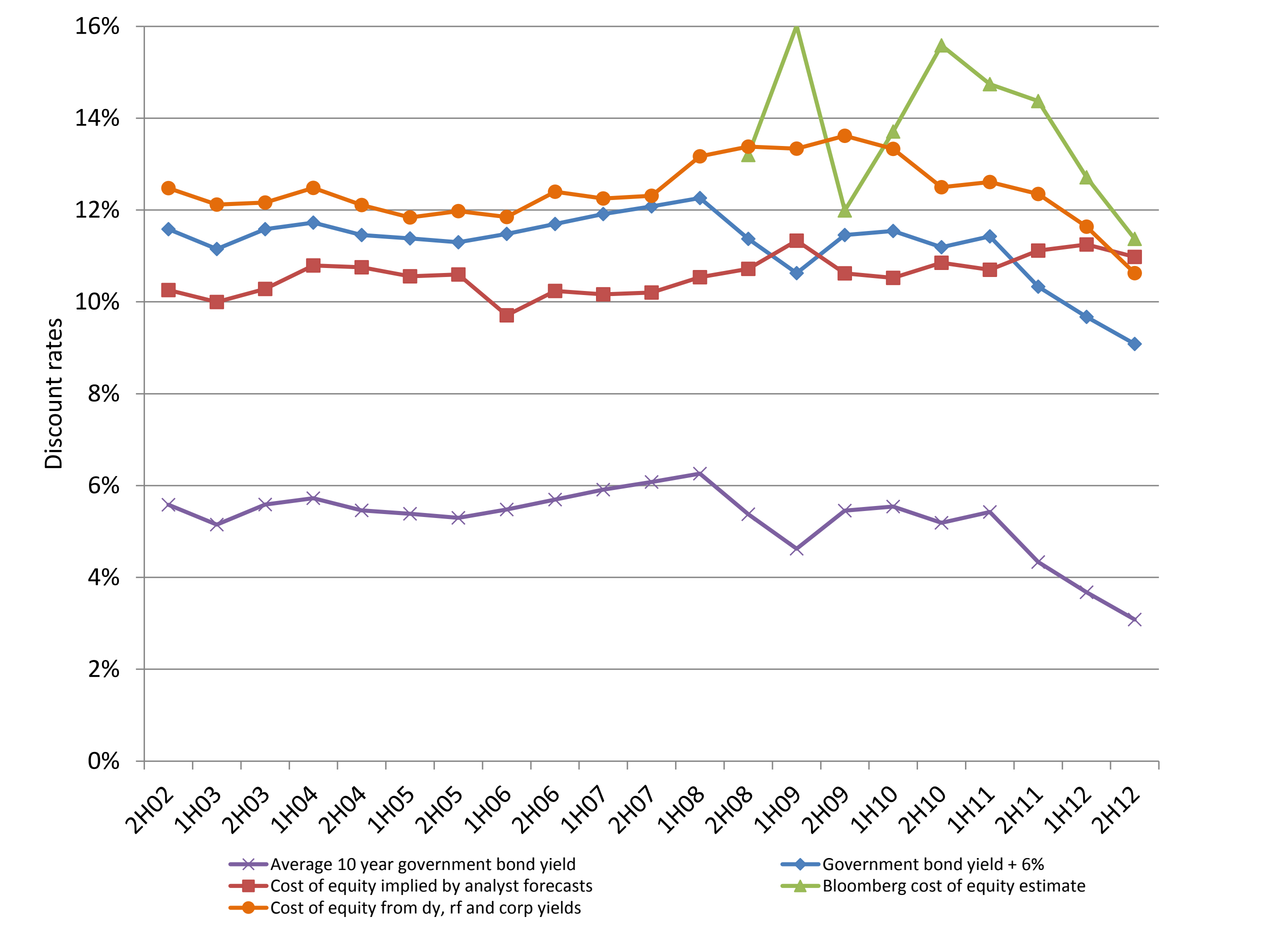
All four indicators suggest that the market risk premium in January 2013 is high relative to what we would observe in average market conditions. On average, each indicator is at the 75th percentile of its historical distribution. Applying this to a uniform range of 3% to 9% for the market risk premium, we have an estimate of 7.5%, computed as 3% + 0.75 × (9% – 3%) = 7.5%.

In Figure 1 we illustrate our estimates of the market risk premium on a six monthly basis over the 10.5 year period from 2H02 to 2H12. The figure also contains our dividend growth model estimates and those provided by Bloomberg. The data points are average estimates every six months, but the estimates can also be computed as a point estimate on a monthly basis or as a rolling average every month. With respect to the six month average estimates the highest market cost of equity estimate was 13.6% in the second half of 2009 and the lowest cost of equity estimate was 10.6% in the second half of 2012. The range for the market risk premium was from a high of 8.7% observed in the first half of 2009 to a low of 5.9% observed in the first half of 2002. Until government bond yields began to decline in the second half of 2008, the average estimated market risk premium from 1H02 to 1H08 was 6.6%, which is 0.6% higher than under the assumption of a constant market risk premium of 6.0%.

[26] With respect to the risk free rate we convert this from the 1st percentile to the 99th percentile so that it is directionally consistent with the other indicators.

[27] This is not of the same magnitude as the investment grade corporate bond spread typically estimated by regulators in determining the debt component of the regulated rate of return. It is derived from a broad sample of corporate credit instruments with different default risk and different terms to maturities. The spread is lower than the spread on BBB or BBB+ corporate bonds with five or ten years to maturity.

Figure 1. Market cost of equity from alternative estimation techniques



In interpreting the figure, it should be reiterated that the required return from the dividend growth model estimates does not include any return from imputation credits. If the QCA places a positive value on imputation credits, the corresponding regulated return would need to plot above this line in order to provide the same return excluding the value of credits.

3. Implementation

The overall implication of the analysis presented above is that a more reliable estimate of the cost of equity for a regulated business can be made with the use of more information than currently relied upon by the QCA. In this section we document just how this information could actually be used in a systematic process to mitigate estimation error.

The first step is to make an informed view of the expected market return. At present the QCA adds 6% to the government bond yield. As discussed earlier, the figure of 6% is the QCA's view on the market risk premium from analysis of historical returns. Despite its commentary that it places weight on contemporaneous information, this consideration has never altered its 6% market risk premium estimate, even when we have observed large equity market volatility and unprecedented low government bond rates. We suggest that the market cost of equity can be informed by (1) dividend discount model estimates of the cost of equity for a large sample of firms, aggregated to generate a market cost of equity; (2) market-wide indicators of the market risk premium – the risk-free rate, term spread, corporate bond spread and dividend yields; and (3) historical equity market returns.

The second step is to make an estimate of the cost of equity from the data and estimation techniques which the QCA considers will improve the reliability of its cost of equity estimate for a benchmark firm, conditional upon its market return estimate. We recommend the QCA consider all relevant information, regardless of which particular risks it considers to be incorporated into equity prices.

Specifically, suppose the QCA forms a view that only systematic risk is incorporated into equity prices, and on this basis decides to adopt only the CAPM as its estimation model. This does not mean that the QCA must continue to rely only upon regressions of stock returns on market returns for making its beta estimate. The beta estimate can be made more reliable by considering firm characteristics, variation in analyst forecasts, and from the cost of equity estimates from the dividend discount model analysis. As an example, suppose the risk-free rate is estimated at 4%, the market risk premium at 6% and the beta estimate from historical returns information is 0.7. If this beta estimate is incorporated into the CAPM the cost of equity estimate is 8.2%. Now suppose that the cost of equity estimate from the dividend discount model analysis is 9.0%. In this example there is already a view that systematic risk is the only priced risk, so the implication of the dividend discount model analysis is that the beta estimate is 0.83 [that is, (9.0% – 4.0%) ÷ 6.0% = 0.83]. So we have two beta estimates – one from analysis of historical stock returns and one from current market pricing – that can be used to reach a final conclusion on the beta estimate.

As another example, again suppose the CAPM is adopted but the regulated entity has a very high proportion of tangible assets in it valuation. This means it has a high book-to-market ratio. We know that historically firms with a high book-to-market ratio earn higher returns than firms with a low book-to-market ratio, and it is implausible that this empirical regularity suddenly ended in 2012. The analysis from Fama and French (1992, 1993) and Brailsford et al. (2012) is that firms with a high book-to-market ratio are expected to earn higher returns than would be suggested by their beta estimates from analysis of historical returns. So if the regression-based beta estimate of 0.7 is implemented in the CAPM with no adjustment, it is likely that the cost of equity will be understated. Remember that it has already been determined in this example that the CAPM holds, so perhaps the beta estimate from regression is understated.

A useful approach would be to compile estimates of the cost of equity from the CAPM, Fama-French model and dividend growth model, rather than include or exclude any particular equation for computing the cost of equity. Then arrive at a final conclusion on the cost of equity based upon an assessment of the reliability of each of the three estimates. In reaching this conclusion we would also give consideration to the market return itself as an individual firm estimate. The reason for this is that all cost of equity estimation techniques involve a degree of estimation error. In addition, it is entirely plausible that an efficient level of gearing is one in which results in equity holders bearing the same risk as the average firm.

In summary, there is a considerably broader array of data and estimation techniques which the QCA can adopt to make a more informed estimate of the cost of equity capital for Unitywater. We have documented how these computations can be performed and how the results can be implemented in a systematic framework. There is no reason to think that the use of more information will lead to less confidence in the regulatory outcome than the QCA's current approach. In the estimates for market returns we presented, these are more stable over time than which result from the QCA's current approach. And with respect to individual firm estimates, the dividend discount model estimates across firms exhibit less dispersion than result from the application of the CAPM using regression-based beta estimates. Furthermore, the use of multiple cost of equity estimates can only lead to the QCA making a more informed decision about the firm's cost of equity.

4. References

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5. Appendices

5.1 Derivation of the growth in earnings per share

Growth in earnings per share *(g)* is the percentage change in earnings per share from years 1 *(E_1)* to 2 *(E_2)*. It will be the same as growth in dividends per share if the reinvestment rate (*RR*) is constant. The reinvestment rate is the proportion of earnings per share not distributed as dividends, so is equal to one minus the dividend payout ratio *(D_1/E_1)*. So we begin with the equation for growth in earnings per share.

$$g = \frac{E_2}{E_1} - 1$$

Earnings per share can be expressed as net profit after tax divided by shares on issue. We assume any new shares are only issued at the end of the year. So earnings per share in year two is $NPAT_2 \div N_2$ where N_2 is the number of shares on issue at the start of year 2. We have the corresponding expression for earnings per share in year one *($NPAT_1 \div N_1$)*.

$$1 + g = \frac{NPAT_2}{N_2} \div \frac{NPAT_1}{N_1} = \frac{NPAT_2}{NPAT_1} \times \frac{N_1}{N_2}$$

Net profit after tax in year two can be expressed as the sum of three components – net profit after tax in year one, return on the reinvestment of year one earnings *($NPAT_1 \times RR \times ROE$)* and return on equity raised at the end of year one *[$(N_2 - N_1) \times P_0 \times (1 + g) \times ROE$]*.

$$1 + g = \frac{NPAT_1 + NPAT_1 \times RR \times ROE + (N_2 - N_1) \times P_0 \times (1 + g) \times ROE}{NPAT_1} \times \frac{N_1}{N_2}$$

If we then disaggregate the first factor into three terms, we have the equation below.

$$1 + g = \left[\frac{NPAT_1}{NPAT_1} + \frac{NPAT_1 \times RR \times ROE}{NPAT_1} + \frac{(N_2 - N_1) \times P_0 \times (1 + g) \times ROE}{NPAT_1}\right] \times \frac{N_1}{N_2}$$

$$1 + g = \left[1 + RR \times ROE + \frac{(N_2 - N_1) \times P_0 \times (1 + g) \times ROE}{N_1 \times E_1}\right] \times \frac{N_1}{N_2}$$

Then, factorising the term on the right-hand side we have the equation below.

$$1 + g = \frac{N_1}{N_2} + RR \times ROE \times \frac{N_1}{N_2} + \frac{(N_2 - N_1) \times P_0 \times (1 + g) \times ROE}{N_2 \times E_1}$$

Collecting (1 + g) on the left-hand side of the equation and then defining *C* as the percentage change in shares on issue ($(N_2 - N_1) \div N_1$), we arrive at a final expression for growth.

$$(1 + g) \times \left(1 - \frac{N_2 - N_1}{N_2} \times \frac{P_0}{E_1} \times ROE\right) = \frac{N_1}{N_2} + \frac{N_1}{N_2} \times RR \times ROE$$

$$1 + g = \frac{\frac{N_1}{N_2} \times (1 + RR \times ROE)}{1 - \frac{N_2 - N_1}{N_2} \times \frac{P_0}{E_1} \times ROE}$$

$$1+g=\frac{\frac{N_1}{N_2}\times(1+RR\times ROE)}{\frac{N_2}{N_2}-\frac{N_2-N_1}{N_2}\times\frac{P_0}{E_1}\times ROE}$$

$$1+g=\frac{1+RR_1\times ROE}{\frac{N_2}{N_1}-\frac{N_2-N_1}{N_1}\times\frac{P_0}{E_1}\times ROE}$$

$$1+g=\frac{1+RR_1\times ROE}{1+C-C\times\frac{P_0}{E_1}\times ROE}$$

$$g=\frac{\frac{1+RR_1\times ROE}{1+C}}{1-\frac{C}{1+C}\times\frac{P_0}{E_1}\times ROE}-1$$