Redland Water & Waste

Desired Standards of Service Review – Water Supply

1 August 2006

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Redland Water and Waste

Desired Standards of Service Review – Water Supply

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1. Introduction

MWH was commissioned by Redland Water & Waste to undertake a review of the Draft Desired Standards of Service for the assessment and provision of water supply and sewerage infrastructure prepared in February 2005 for the future development of Redland Shire. In accordance with the project brief this review is presented in separate reports.

The review and update of the Desired Standards of Service (DSS) has occurred in three parts:

1. Review of the Current Sewerage Design Criteria
2. Review of the Current Water Supply Design Criteria (This report)
3. Integrated Water Management (IWM) Criteria and opportunities (This report).

Comparisons have been undertaken with design criteria adopted by other SEQ water authorities. Where applicable and justifiable the current criteria have been amended.

As part of the review the consistency of the criteria with the recently published NRM&W *Water and Sewerage Planning Guidelines* has been considered. The national WSAA Water Supply and Sewerage Codes have been reviewed to identify areas requiring change.

The final revised design criteria are presented in Section 5 of the report. It is proposed to include these recommendations in the overall infrastructure DSS currently being developed by council.

1.1 Purpose of the Document

The Desired Standards of Service (DSS) for water supply and sewerage is intended to form an integral part of the overall Water and Sewerage Infrastructure Charges Plan. The DSS is required to define the design standards to which infrastructure is to be provided as well as the linkage between these criteria and user benefits and environmental effects as required by the Integrated Planning Act (IPA - 2004)

1.2 Why Develop Desired Standards of Service

Desired Standards of Service relate to the characteristics that influence network planning and generally dictate the size of infrastructure items to be provided for a given level of demand. It is particularly important that in an environment in which developers pay directly for infrastructure that consistent, sustainable and affordable standards of service are required of all public (Federal, State and Local) and private sector providers alike. It is also important for consistent standards to be applied across ICP and agency boundaries, even though the criteria and measures might themselves, change.

The parameters used for describing the Standards of Service are generally related to one of two categories, those that shape or form a network (planning criteria), and those that define the required sizing of elements to achieve the desired outcomes (design criteria). It is these planning and design criteria that ultimately affect the cost of the network to be provided, and therefore need to be justified to the community.

1.3 Triggers for Defining Standards of Service – Planning & Design Criteria

To provide a level of service (at a definable cost) which is commensurate with the expectation (service objectives) of the community, criteria against which the planning and operational performance of the network are to be assessed need to be developed. There are a number of matters that will trigger these considerations and hence the measures against which networks are assessed. The more significant are health and safety factors, although published standards and 'best practice' associated with a range of operational matters need also to be considered. Published standards often have a quantitative basis, whilst policy based standards will usually be drafted in a qualitative or "code" format. The DSS criteria may therefore contain both quantitative and qualitative performance measures.

Table 1 below identifies the 'triggers' and indicates the generic areas, which will be covered by the standards of service.

Table 1 Standard of Service Triggers

Areas of Interest	Measurable Criteria
Network Design	Capacity, network performance, amenity etc
Health and Safety	Water quality, treatment effluent standard, etc.
Social	Noise, odour, etc
Environmental	Reduction of greenhouse gases, sewage overflows etc
Economic	Life cycle considerations, design life, cost

The quantitative standards specify values for each of the criteria. Qualitative standards set down the rules where it may be necessary to trade off one type of standard against another.

2. Planning Criteria

The Desired Standards of Service for the sewerage system are required to link to the Key Programs and Objectives of the RSC Corporate Plan, Our Redland's-Our Future, and the Redland Water Total Management Plans. These standards also form the basis for planning of the respective systems for the purposes of the ICP. Desired Standards of Service are reflected in the various Design Criteria, which are developed for achieving the Desired Standards of Service as outlined in this section of the report.

As part of establishing the Desired Standards of Service (DSS), it is necessary to consider the requirements of the Integrated Planning Act i.e. the balance between the user benefits which will be obtained and the likely environmental effects. This has been carried out and documented in Table 2.

Table 2 - Desired Standard of Service – Water Supply-Planning Criteria

Desired Standard of Service	User Benefit	Environmental Effect
Corporate / Business Objective	• Community and Customer Service • Quality and Safety	• Environmental Protection
Generic Objective • Drinking water will comply with the NHMRC Australian Drinking water guidelines *RSC Corporate Plan* • To supply healthy water in an ecologically sustainable manner. *RSC KPI* ➢ Microbiological water quality compliance (Coliforms), RSC Annual Target=95% ➢ Microbiological water quality compliance (EColi), RSC Annual Target=98% ➢ Microbiological water quality compliance (pH), RSC Annual Target=98% ➢ Microbiological water quality compliance (Chlorine),RSC Annual Target=98% ➢ Physical and chemical water compliance (Manganese) ,RSC Annual Target=95%	• Provides uniform quality of water monitored in relation to recognised standards.	• Improves community health
Generic Objective • Review and update water quality objectives and targets. *RSC Corporate Plan* • As above. *RSC KPI* ➢ As above. *RSC Annual Target* ➢ As above	• System operated and monitored in accordance with recognised standards.	• Environmental controls maintained

Desired Standard of Service	User Benefit	Environmental Effect
Corporate / Business Objective	• Community and Customer Service • Quality and Safety	• Environmental Protection
Generic Objective • Reduce Non Revenue Water *RSC KPI* • Under development *RSC Annual Target* • Under development	• Extend asset life • Defer system augmentation	• Improve environmental flows • Greenhouse gas reduction
Generic Objective • Investigate options to reduce consumption of water resources *RSC KPI* • Under development *RSC Annual Target* • Under development	• Reduced cost of water • Defer requirement for new water source	• Improve environmental flows • Greenhouse gas reduction • More sustainable development
Generic Objective • Develop a catchment management plan for Leslie Harrison Dam *RSC KPI* • Under development *RSC Annual Target* • Under development	• Cost effective treatment • Environmental flows maintained	• Improves community health • Required environmental flows maintained
Generic Objective • Implement a water efficiency program for the network and consumers *RSC KPI* • Under development *RSC Annual Target* • Under development	• Reduced cost energy • Cost effective service for community	• Greenhouse gas reduction • Reduced demand on finite resources
Generic Objective • Develop and implement management plans for key water supply	• Cost effective service for community	• Reduction in disposal of waste • Greenhouse gas reduction

Desired Standard of Service	User Benefit	Environmental Effect
Corporate / Business Objective	• Community and Customer Service • Quality and Safety	• Environmental Protection
infrastructure *RSC KPI* • Under development *RSC Annual Target* • Under development	• Reduced energy cost • Reduced maintenance costs • Reduced overall operation costs • Reduced replacement costs	• Reduced environmental effects from chemical production.
Generic Objective • The design of the water supply network shall provide specified water pressures *RSC KPI* • Under development *RSC Annual Target* • Under development	• Reliable water supply • Reduction in interruptions to supply • Adequate supply for community services • Adequate pressures for fire fighting purposes	• Maintains health of the community.

3. Design Criteria

Table below presents the proposed design criteria as well as a comparison with other similar local authorities. Where changes have been made to the DSS reasons for these changes are further discussed in Section 3 of this report.

Table 2: Draft Design Criteria

Item	Description	MWH Proposed Design Criteria	SEQ Comparisons	Discussion
	Water Demand			
1	Average Day Demand	320 L/EP/d based on production and sectoral data analysis from 2001 to 2004 (pre-drought) Including UFW	LW: 340 L/EP/d PW: 360 L/EP/d GCW: 800 L/ET/d	▪ Current DSS adopts 346 L/EP/d
	Global Demand Peaking Factors			
2	Mean Day Maximum Month / Average Day (MDMM / AD)	1.4	LW: 1.5 PW: 1.5 GCW: 1.41	▪ Based on detailed demand analysis (including climate correction) for 1998 to 2000
3	Peak Day / Average Day (PD/AD)	1.9	LW: 2.0 PW: 2.25 GCW: 1.91	▪ Based on detailed demand analysis (including climate correction) for 1998 to 2000
4	Peaking Factors for Various Land Uses	Refer table below		▪ Based on analysis of Gold Coast diurnal patterns and adjusted to suit Redland sectoral demands
	Peak Demand Period			
5	Peak Period (Bulk Distribution)	3 x PD	LW: 3 days PW: 3 days GCW: 3 days	▪ In accordance with NRM&W guidelines
	System Pressure			
6	Minimum Operating Pressure	22 m at property boundary	All use 22m except BW use 21m	▪ NRM&W state that 20-25m should be used for Residential and 25m for Industrial (there is no justification of this figure which has historically been 22m)
7	Maximum Operating	60 m at property boundary	GCW: 60m	▪ NRM&W suggest 80m

Item	Description	MWH Proposed Design Criteria	SEQ Comparisons	Discussion
	Pressure		LW: 80m PW: 80m	▪ RWW advice to reduce pressure related losses
	Fire Fighting Requirements			
9	System Pressure	12 m minimum at the property boundary	BW: 10m All others 12m	▪ In accordance with NRM&W guidelines
10	Fire Flow	Residential - 15 L/s Commercial / industrial fires - 30 L/s Special risk/hazard land use –assessed on case by case basis.	GCW: Same approach LW: Same approach PW: Same approach BW: 10 L/s from two adjacent fire hydrants	▪ Proposed standard In accordance with NRM&W guidelines (currently under review)
11	Background demand	Peak hour > 3,000 EP 2/3 PH < 2,000 EP Interpolation for 2,000-3,000 EP	GCW: Same approach LW: Same approach PW: Same approach	▪ As per new NRM&W guidelines (currently under review) ▪ In old guidelines the demand was MH for > 2,000 EP zones, 2/3 MH for < 2,000 EP zones
12	Reservoir level for Fire Flow analysis	Level determined on 3rd peak day	Same for GCW,LW and PW	
	Reservoir Storage			
13	Ground Level Storage Capacity	Minimum Operating Volume of 30% during a 3 PD demand period	LW: Same PW: 3(PD-MDMM) +4hrs of MDMM demand	▪ NRM&W guidelines. 3 x (PD - MDMM) + (greater of emergency or fire fighting storage) ▪ System security should be assessed for this criteria
14	Elevated Storage Capacity	6 (PH – 1/12 MDMM) + Fire fighting reserve of 150 kL	All councils use the same criteria	▪ As per NRM&W guidelines
	Pumping Capacity			
15	Duty Pump Capacity	MDMM demand over 24 hour operation (with 100 % standby)	LW: MDMM demand over 24hour PW: MDMM demand over 20 hours	▪ NRM&W guidelines state MDMM over 20hrs which can be confirmed or amended via modelling
16	Pumps serving Elevated Reservoirs	(6 PH – Operating Volume) / (6 x 3600)	All use the same approach	▪ As per NRM&W guidelines
17	Standby Pump Capacity	To match duty, except where more than one duty pump or based on risk assessment	All use the same approach	▪ As per NRM&W guidelines
	Pipeline Design			
18	Mains Capacity	MDMM for distribution and MH for reticulation	BW: PD for distribution All others use same approach	▪ As per NRM&W guidelines

Item	Description	MWH Proposed Design Criteria	SEQ Comparisons	Discussion
19	Friction Factors	Hazen Williams formula as given in Table 2	All use similar approach	▪ Not stated in guidelines
20	Maximum Velocity	2.5 m/s	All use 2.5m/s	▪ As per NRM&W guidelines

Table 1 : Peaking Factors for Various Land Uses

Land Use	Global Peaking Factors		MDMM / AD	PD / AD	PH / AD
	MDMM/ AD	PD/AD			
Urban Residential, Residential Low Density, Park Residential	1.4	1.9	1.42	1.96	4.2
Medium Density Residential			1.3	1.8	4.3
Major Centre, District Centre, Local Shopping, Service Commercial, General & Service Industries			1.2	1.3	2.5
Tourist, Business & Accommodation			2.2	2.21	5.2
Special Facilities, Public Purpose			1.2	1.3	2.5

Table 2 : Proposed Hazen Williams Friction Factors

Mains	Diameter (mm)	Adopted 'C' Value
Distribution	< 300	120
	300 – 600	130
	> 600	135
Reticulation	≤ 150	100
	200 – 300	110
	> 300	120

4. Design Criteria Discussion

This section discusses the reasons behind proposed changes to design criteria outlined in Table .

4.1 Average Day Demand

Water billing data from year 2001 to first quarter 2006 indicates that the average per account demand for single family households climate corrected is 80 kL/quarter. Using an occupancy rate of 2.9 EP / single family account this equates to 300 L/EP/day. As shown in Figure 1 the pre-drought rolling average (2001 to 2003) is 80 kL / quarter this trend was observed to continue up to the latest billing data.

Using the production model shown in Figure 2 a climate corrected ADD value of 380 L/capita/day was determined. Based on this average per capita demand and the assessment of total EP (residential and non-residential) an overall demand of 320 L/EP/day was calculated for planning purposes. This figure includes NRW.

A reduction of approximately 25% would be required to meet the OUM regional target of 230 L/EP/d by 2020. This is further discussed in Section 4.

Table 3: Average Day Demands (L/EP/day)

ADD for 2006	Regional Average	Regional Target @ 2020
300	300	230

Figure 1 : Consumption Data – Single Family Residential

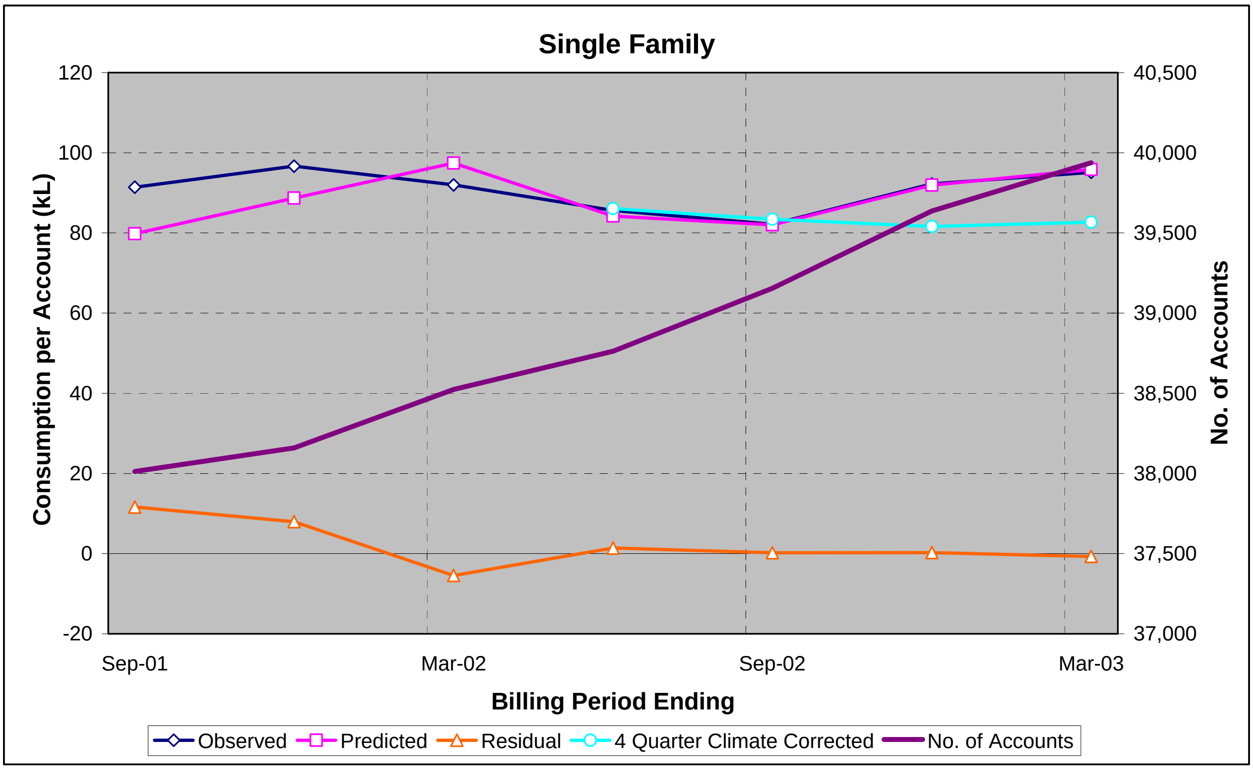
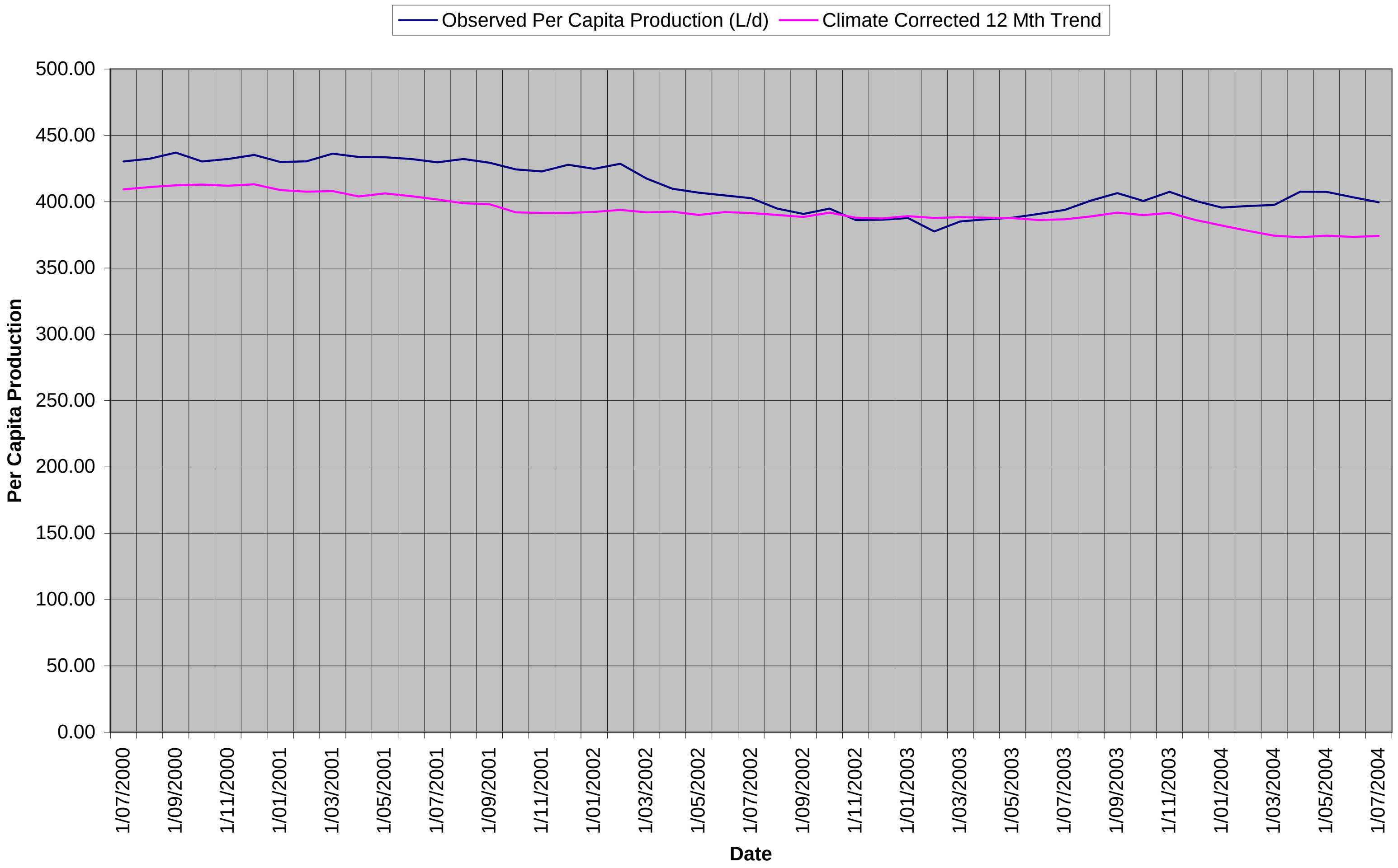

Single Family
Consumption per Account (kL)
No. of Accounts
120
100
80
60
40
20
0
-20
40,500
40,000
39,500
39,000
38,500
38,000
37,500
37,000
Sep-01
Mar-02
Sep-02
Mar-03
Billing Period Ending
Observed
Predicted
Residual
4 Quarter Climate Corrected
No. of Accounts

Figure 2 : Climate Corrected Production Data (L/capita/day)



4.2 Other Items

Other items considered for change were as follows:

- Peak Demand Periods: This was originally divided into bulk distribution and zonal reticulation categories. It is proposed to aggregate to a single criteria for Peak Period.
- System Pressure: The maximum operating pressure is to be changed to 60m to reflect the regional objective of pressure management and loss reduction.
- Pipeline Design: This section relates to sizing of trunk mains for hydraulic capacity. A criteria was added to include for MDMM to be used to design the capacity of trunk mains supplying ground level storages.
- Ground Level Storage Capacity: It was not proposed to change this item
- Duty Pump Capacity: MWH propose MDMM demand over a 24hr period due to RWW having full standby pump capacity.

5. Integrated Water Management Options

This section overviews the possible reductions in water demand that have been forecast under the Regional Water Supply Strategy Stage 2 project.

5.1 Water Use Efficiency

Water use efficiency includes the use of demand management techniques to improve the efficiency of use in households and businesses. Options for water use efficiency have been assessed as part of the SEQ RWSS. Short-listed demand management measures are listed in the Draft Integrated Urban Water Management (IUMW) Report 3. The possible measures include water efficient fittings (rebates and retrofits), permanent restrictions, tiered pricing structures and the like.

In addition to the options that may be included in future demand management strategies, the Queensland Development Code (QDC) has implemented a Sustainable Housing regulation that mandates water efficient appliances in all new houses and renovated bathrooms. The requirements for new Class 1 buildings are summarised in Table 4.

Table 4 : Mandated Conservation Actions – QDC (pt 29)

Item	Performance Criteria / Acceptable Solution	Applies to
P1	Use of water saving shower roses (AAA or 3 stars under WELS)	▪ New houses and sole occupancy dwellings ▪ Renovated bathrooms in houses and sole occupancy dwellings
P2	Water pressure to a dwelling is to be restricted to the levels set out in AS 3500.1 : 2003 or 500 kPa	▪ New houses
P3	Use of dual flush toilets not exceeding a 6/3L flush volume	▪ New houses and sole occupancy dwellings ▪ Where toilets are being replaced in houses and sole occupancy dwellings

Based on this new legislation the impact on residential single family dwellings can be assessed. A summary of the probable reduction in residential water use, as calculated in the RWSS IUWM project is summarised in Table 5.

Table 5 : Water Use Single Family Residential (after QDC implementation)

Use Type	Brownfield	Greenfield (QDC)
Indoor Use	180 L/EP/d	158L/EP/d
Outdoor Use	130 L/EP/d	130 L/EP/d

Based on MWH experience in the assessment of demand management programs, MWH suggests that a reduction of 8 - 10% of overall water use could be achieved by 2020, assuming that the right combination of investment and resources are provided to the program. The increase in discretionary water use outlined in the Draft IUWM report has already been included in these calculations up to 2025 which is when ultimate population yield occurs for Redland Shire. Further strategies will be developed after this time to address any further increase in discretionary use.

5.2 Source Substitution

The major options for source substitution are:

- recycled water
- rainwater tanks
- stormwater reuse
- greywater reuse
- indirect potable reuse.

As discussed with RW&W, there are limited opportunities to implement recycled water or stormwater reuse in the shire. Greywater reuse, although possible under state legislation, is difficult to implement due to expensive manual systems which will likely be difficult to regulate in an urban situation. It is an option that will be encouraged but it is not seen to be one of the major contributors to water conservation.

Redlands has recently undertaken a reuse scoping study which indicated that the major potential recycled water schemes across the Shire had the combined demand of 390 ML/yr which is less than 3% of the total effluent from the shire's treatment plants. The cost/ML of implementing these schemes were all above $8.50/kL with the exception of a small scheme to the Concrete Batching plants near the Cleveland WWTP. Supply to these industrial users, which is considered to be one of the more financially attractive schemes is estimated to be in the order of 40ML/a.

RSC are currently undertaking structure planning in the Kinross Road and South-east Thornlands areas. Both areas are in close proximity to existing treatment facilities and the opportunity to provide class A+ effluent or rainwater tanks for outdoor use and/or toilet flushing is being investigated. The potential savings have not as yet been quantified in the current study but our desk top review of potential savings for medium sized dwellings is that with rainwater tanks alone we could get a 19% reduction but with recycled water and rainwater tanks (5,000L) savings could be as high as 60% due mainly to the security of supply from recycled water. For the developments in question this would equate to 100 ML/a from rainwater tanks and 300ML/a if both recycled water and rainwater tanks were made available at both sites. In terms of overall reduction in consumption, these initative, if they progress represent a very small reduction in demand.

Therefore recycled water has not been considered in the Regional Water Supply Strategy as part of the strategy to reduce potable ADD in Redland Shire.

The QDC in Part 25 allows for local governments to mandate the use of rainwater tanks for residential development. Based on complimentary legislation in the Building Regulations, rainwater may be used for external uses, toilet flushing and for cold water to the laundry.

An assessment of rainwater tank performance undertaken for SEQ through the Regional Water Supply Strategy the following yield assumptions have been used for rainwater tanks in the residential sector.

- Tank Size: 5,000 L
- Assessed Yield: 200 L / household / day

With an ADD of around 900 L / household, this equates to a 20% reduction in ADD for new and retrofitted residential development.

5.3 Performance Against Regional Targets

Assuming that Water Use Efficiency options are successfully implemented demand should fall in the existing areas to 270 L/EP/d equating to a reduction of 10%. For new greenfield and infill developments the reduction from both the QDC and other measures will likely be around the same level. Taking account that a high participation is required to achieve an overall 10% reduction, this approach alone will not ensure that Redland Shire will meet the targeted 25% reduction.

To meet the residential demand reduction targets it will be necessary to mandate rainwater tanks for external and toilet use in all new developments in the Shire.

It is noted that the RWSS will review the targets on the basis of the opportunities for potable reduction available in each of the local governments. It would however be worthwhile to review the RWSS strategy report following completion prior to undertaking water modelling for the ultimate case.

5.4 Leakage Reduction

Analysis of billing data and production data, as part of the RWSS sub-project undertaken by Wide Bay Water, showed that Redland Shire has an existing NRW level of around 7 to 8% of total production. A comparison of Redland's loss performance is provided in Table 6. Based on these very low loss numbers, leakage reduction will not assist in reducing ADD across the shire. As the network ages this factor will increase or at best maintain a similar level.

It is however recommended that the loss level be confirmed at a zonal level using night flow testing.

Table 6 : System Losses - Comparison With Other Local Authorities

Council	2005 Water Production (ML/annum)	Loss Estimate as % of Production	Consumption Trend Average NRW (%)	Leakage (%)
Beaudesert	2726	34%	11%	10%
Boonah	674	18%	34%	22%
Brisbane	182000	15%	17%	17%
Caboolture	15026	11%	11%	10%
Caloundra	10885	9%	10%	10%
Gold Coast	70156	10%	10%	10%

Council	2005 Water Production (ML/annum)	Loss Estimate as % of Production	Consumption Trend Average NRW (%)	Leakage (%)
Ipswich	25554	10%	12%	10%
Maroochy	18461	16%	10%	13%
Noosa	7452	10%	15%	24%
Pine Rivers	13659	10%	12%	8%
Redland	18129	8%	7%	7%

* Table courtesy of SEQ Regional Water Supply Strategy Study

6. Recommended Design Criteria

The recommended Desired Standards of Service design criteria are outlined in Table 7.

Table 7 : Recommended Design Criteria – Water Supply

Item	Description	Design Criteria				
Water Demand:						
1	Average Day Demand (AD) (L/EP/day) Including NRW	Existing	2008	2013	2018	Ultimate
		320	320	320	300	300
Global Demand Peaking Factors						
2	Mean Day Maximum Month / Average Day (MDMM / AD)	1.4				
3	Peak Day / Average Day (PD / AD)	1.9				
4	Peaking Factors for Various Land Uses	Refer to Table 8				
Peak Demand Periods						
5	Peak Period Duration	3 x Peak Day				
System Pressure						
6	Minimum Operating Pressure	22 m at property boundary				
7	Maximum Operating Pressure	60 m at property boundary				
Fire Fighting Requirements						
8	System Pressure	12 m minimum at the property boundary or within the network				
9	Fire Flow	Residential - 15 L/s (simultaneous) Comm / industrial - 30 L/s Special risk/hazard land use –assess on case by case basis.				
10	Background demand	PH for > 3,000 EP zones 2/3 PH for < 2,000 EP zones Interpolate for 2,000-3,000 EP				
11	Reservoir level for Fire Flow analysis	Level determined on 3rd peak day				
Reservoir Storage						
12	Ground Level Storage Capacity	Design case - 3 x PD Minimum Operating Volume of 30%				
13	Elevated Storage Capacity	6 (PH – 1/12 MDMM) + Fire fighting reserve of 150 kL				
Pumping Capacity						
14	Duty Pump Capacity	24 hour operation with full standby				
15	Pumps serving Elevated Reservoirs	(6 PH – Operating Volume) /(6 x 3600)				

Item	Description	Design Criteria
16	Standby Pump Capacity	To match duty, except where more than one duty pump or as determined by risk assessment
Pipeline Design		
17	Mains Capacity	MDMM for distribution MDMM for mains supplying ground level reservoirs PH for reticulation
18	Friction Default Values	Hazen Williams formula using the friction factors outlined in Table 9
19	Maximum Velocity	2.5 m/s

Table 8 : Adopted Peaking Factors for Various Land Uses

Land Use	Global Peaking Factors		MDMM / AD	PD / AD	PH / AD
	MDMM / AD	PD/AD			
Urban Residential, Residential Low Density, Park Residential	1.4	1.9	1.42	1.96	4.2
Medium Density Residential			1.3	1.8	4.3
Major Centre, District Centres, Local Shopping, Service Commercial, General & Service Industries			1.2	1.3	2.5
Tourist, Business & Accommodation			2.2	2.21	5.2
Special Facilities / Public Purpose			1.2	1.3	2.5

Table 9 : Adopted Hazen Williams Friction Factors

Mains	Diameter (mm)	Adopted 'C' Value
Distribution	< 300	120
	300 – 600	130
	> 600	135
Reticulation	≤ 150	100
	200 – 300	110
	> 300	120

Note: The above friction factors are for planning purposes only and are not necessarily reflective of the hydraulic performance of existing infrastructure