



Thames Water

Final Water Resources Management Plan 2015-2040

Main Report



Section 2: Water Resources Programme 2010 to 2015

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Section 2 Water Resources Programme 2010 to 2015

The water resources programme from 2010 to 2015 (AMP5) was agreed with Ofwat as a part of the Price Review process undertaken in 2009 (PR09).

In this section we set out our progress on our water resource programme for 2010-2015 and the activity we will have completed by the end of March 2015.

We present our forecast performance on leakage and show we expect to beat our original target.

We present the result of studies undertaken as part of the actions from the Public Inquiry on our 2009 plan.

We show that we have achieved our PR09 Final Determination requirements and acted on the directions of the WRMP09 Public Inquiry.

By the end of 2015, we will have delivered our AMP5 water resources programme. This consists of leakage reduction, metering and water efficiency as well as a resource development programme in the Swindon and Oxfordshire WRZ to maintain supply security.

We forecast we will outperform our leakage target of 673 MI/d, by 8 MI/d, thus preventing leakage from rising from the position reported in 2011/12, the base year of this plan. Our programme of progressive metering was delayed whilst our previous WRMP was approved, following the 2010 Public Inquiry. However, we forecast to have installed 63,000 meters on a compulsory basis by 2015 and deliver the forecast demand savings.

We have undertaken a large programme of studies into aspects of our plan which were identified to require additional investigation at the WRMP09 Public Inquiry. This includes an independent review of our mains replacement activity, the continuation of our detailed assessment of the potential for wastewater reuse in London, wider assessment of the issues relating to a transfer from the River Severn to the River Thames and an operational trial of an innovative groundwater option, aquifer storage and recovery (ASR).



The remainder of this section is structured as follows:

- Introduction
- AMP5 Demand Management Programme
- AMP5 Resource Development Programme
- Update on Supply Demand Studies
- AMP5 Environment Programme
- AMP5 Supply Demand Balance

2.1 Introduction

All water resources management plans start from a 'Base Year'. The Base Year for this plan is 2011-12. Our activity through to 2015 was agreed with Ofwat as a part of the Price Review process undertaken in 2009 (PR09). In this section we set out the activity we will have completed by the end of March 2015.

Our performance each year is reported to Ofwat in a process known as the Annual Return (AR). Further details are available on the Ofwat website. We also publish an Annual Review of the Water Resources Management Plan¹. Please refer to these documents for further details on our activity in this period.

2.2 AMP5 Demand Management Programme

Demand management is any activity that reduces the amount of water we need to put into supply. This includes the reduction of losses from our distribution system in transit to customers and how much our customers use. Typical demand management activities include:

- Leakage Reduction – fixing leaks on distribution network and customer supply pipes.
- Metering – metering helps us and customers identify leaks and can reduce demand for water by raising awareness of how much is being used. As such it is an important 'enabler' for both leakage reduction and water efficiency.
- Water efficiency – activity to enable customers to be efficient in their water usage and reduce wastage. This can be device led (e.g. tap inserts, efficient shower heads, trigger nozzles for hosepipes) and/or advice led, to improve awareness.

To 2015 we will deliver the following demand management outcomes, summarised in Table 2-1.

¹ Annual Review 2011-12 'Table 10b' - <http://www.thameswater.co.uk/about-us/5392.htm>

Table 2-1: Activity within the AMP5 demand management programme

Activity	Unit	2010/11 Actual	2011/12 Actual	2012/13 Actual	2013/14 Forecast	2014/15 Forecast
Reported leakage level (AR Table 10)	MI/d	665	637	646		
Dry year leakage level*	MI/d	665	665	665	665	665
Optant metering	Nr	23,700	36,817	29,083	27,000	26,000
Progressive metering	Nr	0	0	0	4,109	58,942
Water efficiency	MI/d	5.07	6.06	6.45	4.42	4.42

*Annual Return Table 10 consistent. For WRMP planning purposes actual leakage performance has been adjusted to take account of the impact of weather on leakage. In cold winters, leakage will be higher than in warmer winters. Based on the current reported leakage level, the “dry year” leakage level is that which will only be exceeded 1 out of 5 years.

2.2.1 Leakage

We have made significant progress in reducing leakage and leakage control remains a high priority. In 2011/12 we achieved our leakage target for a sixth consecutive year. The reported normalised leakage value of 665 MI/d² is 8 MI/d below target. To 2015 we intend to maintain this outperformance and at least maintain this level of leakage. The total leakage reduction achieved since the peak in 2003/04 is over 300 MI/d. This also means our leakage is at its lowest levels since privatisation in 1989.

Leakage is being reduced primarily through:

- Mains replacement in London – replacing mains with new ones where leakage is high or performance is poor;
- Active Leakage Control (ALC) – our daily monitoring and ‘find and fix’ activity;
- Pressure Management – reducing pressure within our mains to extend their life and reduce leakage; and
- Customer-side leakage reduction – reducing leakage on pipes that are the responsibility of our customers, through subsidised repair and notification.

Although replacing the oldest and leakiest parts of our network is the best way to make long-term sustainable reductions in leakage, ALC still forms a key part of the leakage strategy to offset leakage recurrence levels that are well in excess of other companies. Currently we detect and repair between 70,000 and 80,000 leaks per annum, with an estimated leakage benefit value in excess of 500 MI/d.

² Active reported leakage was 637 MI/d. Normalising for the drought conditions in 2011/2012 the level is 665 MI/d.

Approximately one quarter of leakage comes from supply-pipe leaks from customers' own pipes. We offer our domestic customers a free leak repair and pipe relay service.

An independent review of the whole life costs and benefits of mains replacement in London has been completed (see section 2.4.1). It critically reviewed and assessed the case for mains replacement based on the work carried out to date to inform further mains replacement in this plan. We have acted on the findings and recommendations.

For further information on the leakage reduction options considered in our plan see Section 7 and Appendix M.

2.2.2 Metering

Table 2-2 presents the total number of optional and progressive meters installed in AMP5 compared to the anticipated outputs over the period.

Table 2-2: Optant and Progressive meter installations in AMP5

New Meter Installations		2010/11	2011/12	2012/13	2013/14	2014/15	AMP5 Total
		JR11	AR12	AR13	AR14	AR15	
Optant Metering	Target	29,000	29,000	28,000	27,000	26,000	139,000
	Actual/Forecast	23,700	36,817	29,083	27,000	26,000	142,600
	Difference	-5,300	7,817	1,083	0	0	3,600
Progressive Metering	Target	36,038	36,038	4,528	4,528	4,528	85,660
	Actual/Forecast	0	0	0	4,109	58,942	63,000
	Difference	-36,038	-36,038	-4,528	-419	54,414	-22,660
TOTAL	Target	65,038	65,038	32,528	31,528	30,528	224,660
	Actual/Forecast	23,700	36,817	29,083	31,109	84,942	205,651
	Difference	-41,338	-28,221	-3,445	419	54,414	-18,171

Optant Metering

The number of optant meter installations (metering at the request of the customer) remains relatively high compared to historical records. The increase to over 36,000 in the base year (2011/12) is associated with an initiative using our Customer Analysis and Rollout Design (CustARD) database to identify customers who could financially benefit from having a meter installed, and then writing to them promoting the free meter option scheme. This scheme, along with a revised presentation of the offer to our customers following focus group feedback and improved water efficiency promotions, has significantly improved the uptake of optant meters by our customers.



Progressive Metering

As a result of the delay in the approval of our WRMP09 until July 2012, we took the opportunity to review our rollout programme for progressive metering, to ensure it delivers best value and is progressed sensitively.

The metering programme from the 2009 WRMP was focused on cost effective meter installations fitted in existing boundary boxes (installed as part of the Victorian Mains Replacement (VMR) and District Mains Replacement programmes). Customers would be scattered across the region and consistency of messaging across our customer base would have been difficult and programme efficiency low. We defined six governing control criteria to develop the rollout programme.

These are:

1. Maximise customer satisfaction
2. Maximise stakeholder engagement and align our proposals with existing projects/ plans
3. Maximise benefit delivery – deliver supply-demand benefits in most water-stressed areas
4. Scalability - ensure the plans for AMP5 are suitable for the larger rollout in AMP6+
5. Affordability and cost performance - to be cost effective and align with other workstreams where possible
6. Protect and enhance company reputation

Based on these criteria our improved rollout programme includes a number of changes that will deliver the same benefit but has a better overall performance:

- Focus the installation programme by London Boroughs, which provides a clearer roll out plan for customer and Borough, allowing easier communication, protecting company reputation and providing a scalable delivery plan.
- Install meters at houses (i.e. not flats with more complex plumbing arrangements) only during AMP5, which allows innovation and contractor teams to develop improved solutions for flats. This will deal with multiple meters per flat and the existing low survey to fit rates, which could damage company reputation.
- The majority of meters to be fitted as new installations. This provides improved cost benefits and a scalable programme by Boroughs, rather than scattered across London.
- Approximately 63,000 meters will be delivered to achieve a demand saving of at least 5.6 MI/d (compliant with the Final Determination target), which maximises benefits per meter whilst working in focused areas by Borough.
- Preference for fixed network meter reading technology for all installations to deliver a range of improved benefits to both customers and the Company
- An installation profile of ~4,000 meters in 2013/14 and ~59,000 meters in 2014/15

Engagement



We have liaised with Ofwat to confirm the change in the number of meters against the Final Determination that achieves at least the same demand reduction of 5.6 MI/d.

As part of our customer research programme, early in AMP5, we conducted a series of focus groups to explore customers' attitudes and expectations around the key stages of our proposed progressive metering customer journey. The results of these focus groups have been shared with both Ofwat and CCWater and have been used to inform our metering roll-out programme, our communications planning, literature design, and our charging methodology in order to manage bill impacts and to help customers budget for the changes between unmeasured and measured charging.

Affordability

Recognising the potential affordability issues associated with the extension of household metering, we have set out a number of measures to protect vulnerable customers, strengthening the package of support already offered.

Existing support offered to disadvantaged or vulnerable customers includes:

- WaterSure tariff – where bills are capped at the level of the average bill, for metered customers that have a need to use higher than normal volumes of water, due either to suffering from certain medical conditions or having three or more children under the age of 19, providing that they also qualify for certain means-tested benefits.
- Water Direct and Payment Plans – to make budgeting easier for lower-income customers Thames Water offers a variety of payment plans and also can arrange for payments to come directly from benefits.
- Thames Water Trust Fund – a charitable trust has been established and began operating in February 2009 with the aim of helping disadvantaged customers that are not able to pay their water and sewerage charges. The application process also helps disadvantaged customers through carrying out benefits entitlement checks.

Additional support offered associated with the metering programme includes:

- Deferring metering in areas with a high density of lower-income households until later in the metering programme – given concerns about potential bill increases for lower income households moving from rateable value charging to metered charging. Individual customers will still be able to opt for a meter as normal.
- An enhanced water efficiency offering, with plumber assistance, for lower income households receiving a meter - to ensure lower income customers can save water and save money, including the energy costs associated with reduced hot water usage.
- A revised customer side leakage policy with Thames Water offering free repairs, and where appropriate free pipe relays and assistance with wastage (leaks on internal plumbing), to customers where meters are installed.



- Social tariff – enabling legislation for social tariffs was included in the Flood and Water Management Act (2010), and Defra issued Guidance in June 2012. Under the guidance, companies can decide whether to introduce a social tariff, who should be eligible and who should pay, and how the tariff should be structured. We introduced a social tariff, called WaterSure Plus, in 2014. The tariff will provide a 50% discount to those customers who most struggle to afford their water services charges. It will be available to both metered and unmetered customers.

Since we first examined the potential affordability issues associated with our progressive metering programme, the economic conditions across the UK have continued to change. We regularly refresh our modelling to understand and predict potential customer affordability issues and use this information to plan our programme effectively.

We have also been liaising with neighbouring companies to ensure that confusion is minimised for customers who receive wastewater and clean water services from different water companies. We have worked extensively with both Southern Water and South East Water to ensure that customers in these areas, both with universal metering programmes of their own, receive a clear and consistent charging message that promotes water conservation.

We have continued engagement with both Ofwat and CCWater to develop and agree the principles of our approach that appropriately mitigates the distributional impact of our progressive metering programme. These meetings have focused on:

- the transition arrangements for customers who are switched from unmeasured to metered charging
- our communications programme and literature development
- our charging methodology
- the mechanisms for appropriately mitigating customer bill impacts

We have used this as the basis on which to put forward our case for metering in this WRMP. For further details see Section 7 and Appendix N.

Technology

We believe technology in metering will play a key role in the development of long-term sustainable water service in England and Wales.

Our meters are installed through our Meter Managed Service provider. Currently we are using Sensus meters with Homerider Advanced Meter Reading (AMR) technology as standard on all new and replacement meter installations. AMR enables us to read meters automatically from a hand-held reader without having to access properties or lift covers.

We have also been trialling the installation of two types of 'fixed network' meter reading systems and have installed meters on all connections to our mains in five specific areas (District Meter Areas) across our supply area. These meters allow access to near 'real time' metering data across the area to help build the evidence base for future progression from our current metering to a form of 'smart' metering.



We have used this evidence to help develop this plan and we are already working with our managed meter service provider on how technology can improve the metering benefits and experience.

For further information see Section 7 and Appendix N.

2.2.3 Water efficiency

Our programme has grown significantly in breadth and scale over the course of the current period and the work we have undertaken for this plan shows water efficiency continues to be important for the future.

The 2011/12 water efficiency programme has successfully delivered 6.06 MI/d water savings, exceeding our annual target by 1.64 MI/d³. This was achieved through a range of activities including the integration of water efficiency advice and audits with our Water Regulations Inspections, which targeted premises identified to be high risk and the provision of water-saving products and literature to partnership projects.

- We offer all our customers a wide range of free water-saving products which can be ordered via our website or via a freepost coupon.
- We work in partnership with other organisations, for example, we teamed up with British Gas and Dyno Rod to offer customers free water-saving products, fixing leaking toilets and dripping taps.
- Our Water Regulations team identifying opportunities to reduce water wastage during water regulation inspections. This may involve implementing enforceable changes and identifying plumbing losses.
- We have several larger projects designed to build our understanding and evidence for water efficiency activity such as Save Water Swindon. In this project we have partnered with a number of external organisations including the Environment Agency, Energy Saving Trust, WWF, Waterwise, Warm Front, WRAP and Swindon Borough Council to deliver the programme.

For further details see Section 7 and Appendix O.

³ In October 2008, Ofwat confirmed the introduction of mandatory water efficiency targets from 2010, based on a reduction in consumption of 1 litre per person per day. For us, this equalled a baseline target of 3.45 MI/d per annum. In addition, we agreed an enhanced programme as part of the Price Review to deliver a further 0.97 MI/d per annum (so a total of 4.42 MI/d per annum) of water efficiency activity.

2.3 AMP5 Resource Development Programme

Resource development is any activity that increases the value of water available for supply.

In AMP5 we have undertaken a number of schemes in the Swindon and Oxfordshire (SWOX) WRZ, in response to a deficit against peak demand. The position as reported for the base year 2011/12 is provided below.

The schemes are a combination of groundwater development and network constraint relief. By the end of the period we will be able to output an extra 28 MI/d at peak times, an increase of approximately 8%.

Table 2-3: AMP5 Resource Development schedule

X Delayed forecast of benefit X Current forecast of benefit

Option	Scheme type	Target MI/d		Forecast MI/d		Delivery schedule					Current Forecast Delivery	
		AA	CP	AA	CP	10/11	11/12	12/13	13/14	14/15		
SWOX	Goring Gap 1	Groundwater enhancement	4.5	4.5	9.5	16.0	X					complete
	SWOX NC1	Constraint removal	1.0	1.0	0.6	1.0	X					complete
	SWOX NC2	Constraint removal	0.3	0.3	0.7	0.3		X				complete
	Lambourn Down	Groundwater enhancement	0.94	0.94	0.94	0.94		X				complete
						0.67			X			complete
	SWOX NC3	Constraint removal	2.0	2.0	1.5	1.6				X		2013/14
	SWOX NC4	Constraint removal	1.0	1.03	0.6	1.14		X				complete
	SWOX NC5	Constraint removal	0.3	0.3	0.7	0.3		X				complete
	Goring Gap 3	Groundwater development	5.0	10.0	0.0	0.0						deferred
	SWOX NC6	Constraint removal	2.1	2.1	3.0	3.6			X			complete
	Goring Gap 2	Groundwater enhancement	5.4	5.8	2.4	2.3					X	2014/15
	Total AMP5 annual average MI/d (23)		23		20		10.1	2.9	3.0	1.5	2.4	
Total AMP5 critical period MI/d (28)			28		28	17.0	2.7	4.3	1.6	2.3		

Note that the under delivery against annual average benefit is made up by out-performance on leakage reduction in London. This decision was considered appropriate as the SWOX zone was comfortably in surplus, whereas the reintroduction of climate change assumptions into our planning processes would mean a substantial deficit in London at the start of the planning period.

2.4 Update on Supply Demand Studies

We have undertaken supply demand studies during AMP5 on the following subjects:

- Mains Replacement Programme Independent Review
- Water transfer from the River Severn to the River Thames
- Wastewater reuse in London
- Aquifer Storage and Recovery



These follow on from actions from the 2010 Public Inquiry.

Below we provide a brief summary of the key findings, with further detail on the Severn-Thames transfer and wastewater reuse studies available in the appendices.

2.4.1 Mains Replacement Programme Independent Review

The need for a review of our mains replacement programme ('the Review') was agreed at the 2010 Public Inquiry into our WRMP09. The project was jointly sponsored by Ofwat and Thames Water and was undertaken by independent consultants, Black and Veatch.

The objective of the review was to understand the potential scale of an ongoing mains rehabilitation programme which is required to manage deterioration of our assets and reduce leakage. In addition, the review challenged our unit costs, and the benefits and efficiencies of the mains replacement programme delivered to date.

The Review was commissioned in May 2011, and the 'Findings and Recommendations' report, was released in July 2012⁴.

The key recommendations of the report were:

- Targeting Solutions: Develop risk based techniques that allow development of solutions at pipe and pipe groupings, rather than DMA level.
- Improved Cost Benefit Analysis: Include range of benefits against each solution, including reduction in leakage and bursts, as well as direct impacts on customer such as interruptions to supply, low pressure and unwanted customer contacts.
- Customer Metering: Utilise advanced metering technologies to allow improved targeting of customer leakage / wastage and Thames side mains rehabilitation.
- Innovate: Utilise construction methods such as replacement, semi structural and structural spray lining, and condition assessment techniques to provide cost effective mix of solutions causing least disruption to the customer.

The recommendations from the report are being taken forward and have informed both the delivery programme during the remainder of AMP5, and the consideration of mains replacement options within this WRMP (see Section 7).

The review was developed to showcase new instrument tools we have put in place since 2009 to improve targeting of investment.

⁴ Thames Water Mains Replacement Programme Independent Review Findings and Recommendations Report, Thames Water, Ofwat, July 2012, Black & Veatch



2.4.2 Severn-Thames Transfer

River Severn Investigations

One of the options identified for investigation and inclusion in this plan is a transfer of water from the River Severn to the River Thames to increase the flow in the River Thames during periods of low flow. This provides increased resources to meet demand for water in London through allowing for more water to be abstracted from the Lower Thames to the London reservoirs. We have undertaken investigation into the feasibility and likely costs of this option and are also undertaking investigation into the potential impacts this option could have on the River Severn and the River Thames.

River Severn Appropriate Assessment

One of the principal concerns identified when the River Severn transfer option was identified for consideration in more detail was the potential for the abstraction from the River Severn to have an adverse impact on the Severn Estuary which is designated as a Special Area of Conservation (SAC) under the European Habitats Directive for both its habitat and the bird life that it supports. We have investigated the potential impact of the abstraction on the Severn Estuary through undertaking an 'Appropriate Assessment' (AA) of the impacts that could occur.

An HRA (Habitats Regulations Assessment) screening stage was undertaken and reported in the form of a 'Scoping Report' for the Appropriate Assessment⁵. The Scoping Report concluded that a Likely Significant Effect (LSE) could not be ruled out on certain qualifying features of the Severn Estuary/Môr Hafren SAC and Special Protection Area (SPA) (collectively known as the Severn Estuary European Marine Site (EMS)) and of the Severn Estuary Ramsar site. This report was commissioned by us to inform the subsequent stage of the HRA, an Appropriate Assessment of the Severn to Thames transfer project options.

The Scoping Report defined the scope and methodology for the Appropriate Assessment and this was reviewed and agreed by key statutory stakeholders including Natural England, the Countryside Council for Wales/Cyngor Cefn Gwlad Cymru and the Environment Agency (Midlands Region). The agreed methodology in relation to the qualifying features, other than migratory fish, of the Severn Estuary/Môr Hafren European Marine and Ramsar sites, was to compare the predicted freshwater flows to the Severn Estuary (with the transfer scheme in operation) with the flow requirements established as necessary to support good ecological status or potential under the Water Framework Directive.

⁵ Cascade Consulting (2012), Severn Thames Transfer Appropriate Assessment – Scoping Report. Report for Thames Water



It was agreed that if these flow requirements were met, it could be concluded that there would be no significant adverse effect on the qualifying features, other than migratory fish, of the Severn Estuary/Môr Hafren European Marine and Ramsar sites. However, as migratory fish could be affected by the proposed abstractions while outside their designated sites, a different approach was required for these features to ensure that all relevant potential effects were considered. Thus migratory fish species were therefore considered individually and the requirements of each species were assessed at all stages of its life cycle, using the significant amount of information assembled for the Severn Estuary/Môr Hafren European sites⁶ Review of Consents⁷ and the most up to date research.

The assessment has shown that for all scenarios and all capacity options for the proposed Severn-Thames transfer, including the options supported by reservoir storage at Longdon Marsh, the WFD criteria for freshwater flow to the Severn Estuary, based on long-term flow duration curves, will still be met by a considerable safety margin. In accordance with the agreed approach, it was therefore concluded that these water transfer options would have no adverse impact on the integrity of the Severn Estuary/Môr Hafren European and Ramsar⁸ sites with respect to habitat features and sessile communities and birds dependent on these habitats.

Furthermore, examination of the effects of changes in the flow regime in the lower River Severn due to the proposed Severn-Thames water resources transfer shows that, with the proposed 'Hands off flow' (HoF) maintained, there will be no significant adverse effects on any of the migratory fish interest features of the European and Ramsar sites as a result of either the direct abstraction transfer options (via pipeline or via the Cotswold Canals) or the supported pipeline option.

The report to inform the Appropriate Assessment was forwarded to the Environment Agency and Natural Resources Wales (NRW) for review. Comments from both parties were addressed through an updated report. NRW provided the following further comment on the updated report:

'NRW also raised a number of concerns regarding potential effects on lamprey in low flow and required that, in the event that any of the Severn Thames transfer proposals became preferred options or that other changes to preferred options were brought forward, then NRW would require a reconsideration of the HRA process (including screening and any appropriate assessments).'

The Severn Thames transfer proposal is not a preferred option at this stage and we note the comments from NRW and will work with NRW to address their concerns regarding lamprey.

⁶ Severn Estuary/Môr Hafren Special Area of Conservation (SAC) and Special Protection Area (SPA) (collectively known as the Severn Estuary European Marine Site (EMS), excluding the terrestrial component of the SPA) and of the Severn Estuary Ramsar site

⁷ Environment Agency (2009). Severn Estuary SPA & cSAC: Habitats Directive Review of Consents. Proforma for Stage 3 Appropriate Assessment. Part 1: Sections A - E Final and Part 2: Multifunctional in-combination assessment. Version 3, October 2009

⁸ Ramsar sites are sites listed as wetlands of international importance in accordance with the Convention on Wetlands of International Importance, especially as Waterfowl Habitat, signed in Ramsar, Iran, 1971. Consideration of Ramsar site features is not a requirement of the Habitats Regulations but it is UK Government policy to include these features within a Habitats Regulations Appraisal.

Severn-Thames Water Quality and Ecology

Further work has been completed on the potential impacts on water quality and ecology of a Severn to Thames transfer option. An initial review⁹ was undertaken using the available literature as the basis for identifying key water quality and ecological issues associated with the transfer options and subsequently to re-evaluate these issues against recent baseline data.

Risk in terms of Environmental Quality Standards (EQS) for a range of water quality parameters was assessed based on the degree to which EQS values are potentially exceeded (impact on compliance) and also by how much baseline conditions in the Thames are likely to be exceeded (relative impacts).

Additionally a high level assessment of the risk to drinking water treatment was carried out based on a review of current treatment issues identified through the Drinking Water Safety Plans in the Severn and Thames catchments. An initial high level assessment was also undertaken of current concentrations of parameters in both rivers and the degree to which these parameters can be removed from raw water through treatment. Parameters identified as of concern in this initial assessment, and which require further assessment of individual concentrations, timing and treatability include:

- Metaldehyde: risk from higher concentrations as there is currently no means to treat or monitor transfer concentrations. Concentrations are significantly above Prescribed Concentration Values (PCV) for sustained periods.
- Individual and combined pesticides;
- Phosphates;
- Ammonia;
- Nitrate and nitrite;
- Taste and odour forming compounds;
- Pathogens including cryptosporidium;
- Total organic carbon and colour;
- Turbidity and suspended solids;
- Bromide concentrations.

Flows in the Severn will be protected by the HoF and hence the percentage change in flows in the Severn will be relatively small. The capacity for dilution of point and diffuse sources of pollution will therefore not be significantly impacted. From an environmental perspective, parameters identified as presenting a high risk to EQS compliance at sites on the Thames included phosphorus, where there is a high risk that both low and high volume discharges to

⁹ Atkins (2012) Severn Thames Transfer: Water Quality and Ecology Assessment. Phase 1: Initial Review, Final Report. Report for Thames Water, 21 December 2012



Cricklade and higher volume discharges to Lechlade (proposed canal transfer) would present a risk to WFD compliance. There is also high confidence that the transfers would increase the concentration of copper and zinc in the Thames. Unless some pre-treatment (settlement) is included in the scheme design, there is a high risk of significantly increasing sediment concentrations in the Thames as a result of a direct transfer. There is also a risk of transfer of metals and pesticides associated with particulates to the River Thames.

Historic (and recent) concentrations of metaldehyde in the River Severn and Gloucester and Sharpness canal would present an increased risk of non compliance with the current drinking water standard and represents a high financial risk in terms of additional drinking water treatment required to ensure drinking water quality compliance.

Elevation of bromide concentrations in the Severn as a function of high spring tides would need to be managed, as there is no treatment available for its removal. The potential transfer of higher concentrations of bromide than currently present in the River Thames therefore presents a moderate to high risk for drinking water quality.

Ecological impacts on the Severn are considered to be low. This is because the effects of the abstraction are for the most part relatively minor even during dry year scenarios due to the HoF being in place. However, ecological impacts are likely to be much more significant on the Thames. Five potentially important impacts were identified through the literature review: changes to the temperature regime; changes in flow/velocity; increases in turbidity and sedimentation; changes in water quality including chemical, nutrient supply and toxic substances, and; transfer of animal, plants or pathogens from the River Severn to the River Thames.

In view of the concerns and risks identified, a second phase of the Water Quality and Ecology study is required and will be undertaken in 2013/14. This work will focus on the key issues identified in phase 1 and will examine these specific water quality and ecology risks in more detail.

We have produced a detailed specification for the work required in phase 2 of the Water Quality and Ecology study taking into account the comments received from the EA and other stakeholders, including GARD, on Phase 1 of the investigation. We have invited consultants to tender for this work and will be appointing the preferred consultant in Autumn 2013 with work likely to commence thereafter.

River Severn Flows Assessment

In order to assess the potential deployable output of a scheme to transfer water from the River Severn to the River Thames, we have sought a dataset for the flow in the Severn of a similar length to that which we use for the Thames. This process highlighted a number of issues with the flow record for the lower River Severn, which needed to be resolved before a reliable assessment of scheme benefit could be made.



Flows based on Severn Trent Water's water resource model were used initially, but these modelled flows do not match the recent gauged flow in the Lower Severn. This is likely to be because there are no abstractions by Severn Trent Water in the lower part of the River Severn below Bewdley and so their model calibration is not focussed on this section of the river. Therefore we have undertaken a review of the flow data for the lower Severn to develop a suitable flow sequence. A record based on the modelled flows at Bewdley and the subcatchment inflows further down the River Severn has been developed¹⁰. This record has been used to assess the scheme yields of any Severn Thames transfer scheme. We will continue to work with Severn Trent and the Environment Agency to develop improved modelled flows in the Lower Severn.

Longdon Marsh Reservoir, Flood Risk Assessment

In our previous assessments of flood risk associated with a potential reservoir at Longdon Marsh, we allowed for costs associated with floodplain compensation (the provision of additional storage in the flood plain). We were challenged that an alternative would be to use the reservoir storage itself to provide flood compensation (flood storage within the reservoir). We have undertaken a study of this option¹¹.

This study has shown that it is technically feasible to mitigate the loss of natural floodplain caused by development of Longdon Marsh reservoir by creating additional flood storage capacity within the reservoir and using high capacity pumps to lift flood water into it. It is understood that the Environment Agency would be prepared to accept such an engineered scheme¹² and, if this remains the case, then it is concluded that a flood pumping scheme is likely to be a lower cost means of mitigation than level for level floodplain compensation along the banks of Bushley Brook and the River Severn as previously proposed.

However, there are greater risks associated with the flood pumping scheme in comparison to floodplain compensation. The latter, once constructed, is a physical means of compensation for floodwater and is guaranteed to work when flood volumes remain within historical volumes. The risks in both systems would include reliability of flood pumping equipment, the flexibility to adapt for climate change, the performance during floods exceeding the design event, the performance during construction, the increase in company insurance and legal liability and the management and disposal of potentially poor quality water abstracted and stored during flood events.

In view of these risks the option to use a flood pumping scheme is considered highly uncertain particularly for such a potentially significant scheme in an area known to have a high risk of flooding.

¹⁰ HR Wallingford Ltd (2013), Analysis of River Severn transfer resource options: Development of a suitable flow series for the River Severn at Deerhurst for options appraisal. Report to Thames Water Utilities Ltd. March 2013,

¹¹ Jacobs Ltd (2012), Severn Thames Transfer – Longdon Marsh Reservoir. Report on flood pumping and storage. Version 3, Report for Thames Water Utilities Ltd. July 2012.

¹² Environment Agency (2010) Option Note provided to Thames Water WRMP09 public inquiry

Summary

We have undertaken considerable new work on the option of a Severn-Thames transfer. As seen later in this report we consider this and other large regional transfer options should continue to be developed to protect long-term supply security in London.

2.4.3 Wastewater Reuse in London

In water stressed areas, most of the available water resources have already been used. To try and abstract more water from watercourses can cause environmental damage. Planned wastewater reuse is where treated wastewater that would otherwise be lost to the catchment is returned upstream for re-abstracting. In such cases this effluent is usually treated to a higher level and transferred to another place where it can then subsequently be used to support the water available for drinking water supplies.

Figure 2-1 shows the differences between planned and unplanned reuse.

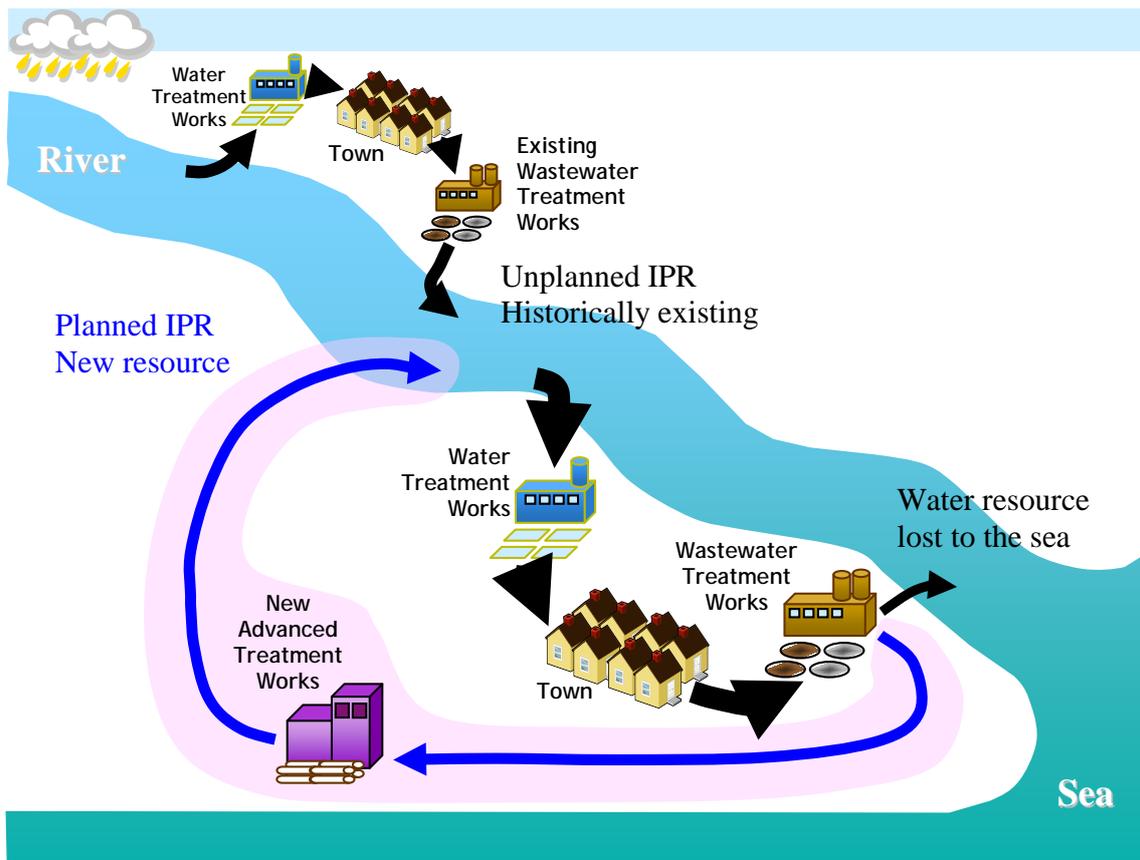


Figure 2-1: Planned and unplanned wastewater reuse

Whilst some wastewater is already being recycled and our drinking water treatment plants are designed to treat that water. It is important to understand that the make up of the wastewater from different sites may be significantly different.



Some wastewaters come from catchments which have a large range of different industries discharging into the sewers or commercial companies may tanker specific waste or trade effluent to a wastewater site. In other catchments there may be a large amount of surface water drainage and capture of rainfall run off which brings potentially different contaminants and some dilution, whilst some wastewater catchments have very little or no surface water dilution.

This means that wastewater effluents from different sources could have different risks in terms of chemicals and contaminants or when used as a source of water for drinking water treatment.

Studies into wastewater reuse

For a number of years we have been studying the potential for large-scale wastewater reuse in London, whereby treated effluent currently discharged to the Tideway is captured and used for drinking water supply. The programme of work included:

- The development and operation of a trial wastewater reuse pilot plant at Deephams STW
- Water Quality studies
- Environmental studies
- Health studies
- Public and Stakeholder engagement work

Representations received on our WRMP09, through public consultation and at Public Inquiry, clearly demonstrated the sensitivity and complexity of implementing such wastewater reuse schemes. Work on the feasibility of this type of option has continued in AMP5, with further work ongoing on the options for wastewater reuse at various sites across our supply area. Other challenges focused on the level of treatment required, public acceptability and whether sufficient site-specific environmental studies had been undertaken. Elements of work for the current period include:

- Completing trials on existing pilot plant and report findings – We have operated a reverse osmosis (RO) based advanced treatment plant from June 2008 until May 2012 treating final effluent from Deephams sewage treatment works (STW).
- Reviewing different treatment technology options – We have operated a range of alternative IPR treatment technologies, the most relevant being a membrane bioreactor (MBR) based treatment plant at the Old Ford Water Recycling Plant since October 2011.
- Assessing the environmental impact on the Salmon and Pymmes Brooks and the River Lee and understand the flow diversion limitations associated with reusing effluent from Deephams STW
- Carrying out research into the health effects of returning wastewater reuse water into river eco-systems to demonstrate that the plant would not increase health risks
- Undertaking public perception work to understand potential barriers to implementing IPR



- Consulting with regulators, particularly the Drinking Water Inspectorate
- Commissioning an Independent Panel of experts to review the programme and findings¹³

Full details of this work are provided in Appendix L.

The wastewater reuse option selection process is described in Section 7. At this stage we consider wastewater reuse to be a feasible option and we have considered the potential at a number of sites across London, using two levels of water treatment, with reverse osmosis and without reverse osmosis. It has the potential to provide a long-term solution to water supply resilience in London. Based on the output of the field trials to date and the findings of the Independent Expert Panel Review¹⁴, the higher level of treatment using reverse osmosis is preferred based on current knowledge; however it is more expensive than simpler treatment chains¹⁵.

There remain important water quality and environmental considerations to resolve as well as public perception issues to overcome if such a scheme is to be successfully implemented. This limits the deliverability of this option in the short-term.

2.4.4 Aquifer Storage and Recovery

Aquifer Storage and Recovery (ASR) is an innovative groundwater option whereby water is pumped into, and stored within, an aquifer when water is plentiful and then recovered in times of need.

The most significant target for implementing ASR is the Lower Greensand aquifer. There are a number of sites in the Thames catchment where ASR could be viable and we include this type of option in our list of potential future resource development options (see Section 7). In our previous plan, ASR was considered an important contingency option and this remains the case.

We are planning ahead of the introduction of ASR at Horton Kirby to assess the operational viability of ASR as a future water resource option that can provide a resource of benefit to the London WRZ.

The proposed trial has two construction phases and a testing phase. Phase 1 will drill one new ASR borehole to the south of Horton Kirby (in the Darent Valley) and three new observation boreholes. Phase 2 will provide connections that will allow the boreholes to be recharged with potable water and abstracted. There will then be cycle testing over a 15 month period. The testing will collect the hydraulic and water quality data necessary to assess operational viability of ASR. Groundwater level and quality modelling will also be carried out to support the field data and will be presented in an assessment report.

¹³ Technology Choice for Planned Indirect Potable Reuse for London. Report of the Independent Expert Review Panel March 2013

¹⁴ Technology Choice for Planned Indirect Potable Reuse for London. Report of the Independent Expert Review Panel March 2013

¹⁵ Reverse osmosis plants are more expensive and more complex to operate than membrane bio-reactor technology.

The design stage for Phases 1 and 2 is complete, with planning permission secured for parts of the scheme, and land access arrangements progressed. The construction and testing phases have been approved internally such that the project can now be taken forward in 2013/14. With this start date, the output would be completed early in AMP6.

2.5 AMP5 Environment Programme

This section discusses progress on schemes to reduce the environmental impact of public water supply. Water companies do this through working closely with the Environment Agency to identify where abstraction may be having an adverse environmental impact and putting plans in place to address this impact if it is necessary to do so.

The mechanism by which this is achieved is through the National Environment Programme (NEP), which is how the Environment Agency identifies and prioritises its requirements for water companies to undertake measures to improve the environment.

The process by which adverse environmental impact is assessed is as follows:

Firstly, the Environment Agency identifies sites where there is concern that the impact of abstraction may be adversely affecting the environment.

Secondly, once the sites of concern are identified, an investigation is undertaken to determine the exact impact of the abstraction on the flow in a river or the water level in a wetland. This requires understanding of the hydrology, if the abstraction is from a surface water source, and both the hydrology and the hydrogeology if the abstraction is from a groundwater source. If a significant hydrological impact is identified then the impact on the flow or level in a waterbody is assessed to determine the impact on the ecology supported by that waterbody. This process of investigation may be undertaken quite quickly in simple cases where there is clear evidence of a direct impact or may take several years if the impact is complex, and it may require a programme of measurement and monitoring of hydrological variables and ecology.

Thirdly, if an adverse impact on the environment is clearly demonstrated through this process of investigation, or in cases where it is not possible to demonstrate no adverse impact and the site is very sensitive (e.g. a site designated under the European Habitats Directive), then the next stage is to assess all the options to address the impact. This is termed an options appraisal and is undertaken by the water company if the investigation concludes that it is necessary.

Finally, if the options appraisal identifies that a feasible option is available it will be put forward for implementation. The decision as to whether an option is implemented will normally need to take account of the costs and benefits of the option to determine whether it is cost-beneficial. In cases relating to sites designated under the European Habitats Directive, cost benefit assessment is not a requirement although if an option is very expensive or 'disproportionately costly' then a different option or a mitigation option may be considered as an alternative.

The NEP sets out the requirements for investigations, options appraisals and scheme implementations that water companies are required to undertake.



During the current period, a number of sustainability reductions, investigations and options appraisals are taking place, in response to concerns raised by the Environment Agency regarding the impact of abstractions on the environment. These are discussed below in sections 2.5.1 and 2.5.2.

For information on schemes in later periods, see Section 4. There is considerable uncertainty on the long-term levels of sustainability reductions. We have not included an allowance for these in our plan but we include scenario tests on how sustainability reductions affect our plan in Section 10.

2.5.1 Licence Reductions and Mitigation Schemes

The schemes identified by the Environment Agency as needing specific reductions or mitigation schemes during AMP5 are related to our abstractions at Speen, Axford, Ogbourne and the West Berkshire Groundwater Scheme. Additionally, the AMP4 scheme for the River Darent was concluded following resolution of funding issues.

Speen

A scheme for licence reduction at Speen is required to reduce the risk of abstraction impacts on the Kennet and Lambourn Floodplain SAC. The licence reduction requirement is to reduce the average licence from 11.4 MI/d to 7.4 MI/d and the peak licence from 13.6 MI/d to 8.6 MI/d. This scheme requires an infrastructure solution to enable the transfer of water from the Reading area to the Newbury area. The Kennet Valley WRZ is in sufficient supply/demand surplus to allow the licence reduction to take place without the WRZ being moved into deficit and so no replacement resource development is required as a result of this scheme. The scheme is due for completion by the end of March 2015.

Axford

The sustainability reduction for Axford was identified following an investigation undertaken in AMP3 and options appraisal undertaken in AMP4. The required solution is to reduce the licence in low flow periods from 12 MI/d to 6 MI/d average and peak. This licence reduction will require a network infrastructure solution and will incorporate the delivery of the Ogbourne sustainability reduction (discussed below) because the solution is common to both reductions.

It was expected that this scheme would be funded through the Environment Agency's compensation scheme. However, the Water Bill removed through payment of compensation and therefore this scheme has been included in our Business Plan for PR14. Work on this scheme has started in 2013 and it is likely to take approximately two-three years before completion.

Ogbourne

The requirement for a sustainability reduction at Ogbourne was identified following an investigation in AMP4 followed by an options appraisal in AMP5 which was completed in 2013. The requirement identified was for a reduction of the licence to zero MI/d. The scheme to deliver



this licence reduction requires similar network modification to the licence reduction for Axford and so the solution for Axford will incorporate the requirements for the licence reduction at Ogbourne, with the two reductions being delivered to the same timescale.

West Berkshire Groundwater scheme (WBGS)

The WBGS operating agreement has been reviewed by the Environment Agency as a requirement of the Habitats Directive Review of Consents (RoC) and this has identified potential constraints to its use which are subject to ongoing modelling studies. The Environment Agency has previously stated that it does not believe the outcome of these studies will necessitate a reduction in deployable output and our plan therefore assumes there will be no reduction in the planning period linked to the Habitats Directive RoC. The modelling studies are due for completion in September 2014 and when complete this work will inform the decision on whether the WBGS operating agreement needs changing.

River Darent

The resource developments required to deliver the reduction of 27 Ml/d were delivered in 2008 through the construction of the new water treatment works (WTW) at Bean. However, we did not agree the final reduction of the Horton Kirby and Eynsford licences until February 2013 to allow for the compensation provision by the Environment Agency to be finalised.

Compensation has now been provided under the Environment Agency's Environmental Improvement Unit Charge (EIUC) scheme and the licences have been reduced to deliver the full requirements of the scheme.

2.5.2 Site Investigations and Options Appraisals

AMP5 Investigations

A number of investigations at non-statutory sites were initiated prior to or during AMP5 to identify the potential environmental impact as a result of abstraction. Table 2-4 outlines the investigations. Regular progress updates are provided to the Environment Agency and these investigations are now complete. The Environment Agency has used the outcome of these investigations to inform the requirement for sustainability reductions and included this in the NEP. It has also identified the requirements for further options appraisals following the outcome of these investigations.

The only AMP5 investigation to date that has led to a requirement for a likely sustainability reduction, as identified in the NEP, to be included in the WRMP baseline is at Childrey Warren on the Letcombe Brook. The confirmation of the requirement for any sustainability reduction will be determined following completion of an options appraisal.

The investigations for the Lower Thames, Waddon and Pann Mill have led to the requirement for options appraisals to follow the investigations and the requirement for sustainability reductions in these cases is classified as 'unknown' in the NEP and is addressed through scenario analysis. The investigation at Mousehill and Rodborough has confirmed that no further action is required.

Table 2-4: Environmental investigations in AMP5

Investigation	Waterbody	Completion Date	WRZ
Lower Thames	Lower Thames	31/03/2013	London
Waddon	Waddon Ponds & River Wandle	31/03/2013	London
Manor Road (and Childrey Warren)	Letcombe Brook	31/03/2013	SWOX
Pann Mill	River Wye	31/03/2013	SWA
Mousehill and Rodborough	Royal Brook	31/03/2013	Guildford

AMP5 Options Appraisals

A number of investigations to determine the impact of abstraction at several non-statutory sites completed previously concluded that our abstractions may be contributing to environmental impacts and options appraisal was required. Table 2-5 outlines the options appraisals underway in the current period. Some further work is required beyond March 2013 in some cases. The table also identifies the options appraisals required as a result of the investigations undertaken in AMP5 and of these, Thames Water has only recently been informed of the requirement for options appraisals at Pann Mill, Childrey Warren and Waddon and so they are scheduled to be completed at the end of March 2014 or earlier.

Table 2-5: Environment options appraisals in AMP5

Options Appraisal	Waterbody	Completion Date	WRZ	Status
Lower Thames	Lower Thames	31/10/2013	London	Draft report complete
Orpington & North Orpington	River Cray	31/03/2013	London	Complete
New Gauge	Amwell Magna loop	31/10/2013	London	Draft report complete
Pann Mill	River Wye	31/03/2014	London	Ongoing
Ogbourne	River Og	31/03/2013	SWOX	Complete
Farmoor	Oxford Watercourses	31/10/2013	SWOX	Draft report complete
Childrey Warren	Letcombe Brook	31/12/2013	SWOX	Ongoing
Pangbourne	River Pang & Sulham Brook	31/03/2013	Kennet Valley	Complete
Waddon	Waddon Ponds and River Wandle	31/03/2014	London	Ongoing

Eel screens

There is a requirement¹⁶ to install screening at all abstraction intakes where the abstraction has the potential to result in the entrainment of eels.

The Regulations require all abstraction intakes to be reviewed to determine the requirement for screening protection and where required, it should be installed by 1 January 2015. It is likely that our intakes on the Lower Thames and Lower Lee will require screening with other intakes in the Thames Valley also likely to require screening, but at a greater aperture size. The implementation of these requirements must be carried out in such a way that they do not affect abstraction volumes. Where compliance with the regulations is not possible by 2015 the EA can issue an exemption until a suitable solution can be agreed and implemented. In the interim period mitigation measures may be required.

We are currently investigating specific requirements for all our intakes and will develop more detailed environmental and engineering design specifications in the latter part of AMP5 and during AMP6. On completion, the timescale and funding will need to be agreed prior to a proposed phased roll-out programme in AMP6 and beyond. The installation of these screens will need to be undertaken in light of the forthcoming Water Framework Directive requirement to prevent the deterioration of fish status as a result of entrainment at abstraction intakes.

The cost of these screens is not included in the WRMP but has been included in our Business Plan. Given the size of our intakes, the small mesh size required is likely to lead to a high overall environmental programme cost.

¹⁶ Under the Eel (England and Wales) Regulations 2009, which arise from European Commission's Eel Recovery Plan 2007

2.6 Supply demand balance from 2011/12 to 2014/15

The supply demand balance for AMP5 is shown below, taking into account the impact of the demand management programme, the resource development programme and the sustainability reductions resulting from the Environment Programme.

All zones are in surplus except for London, which goes into deficit due to the inclusion in our analysis of the latest climate change assessments (see Sections 4 and 5). The PR09 Final Determination specifically excluded investment for climate change because Ofwat considered that the proposed investment had not been determined using the recently published UKCP09 climate change scenarios. As such prior to the Annual Review 2013 we have reported our supply-demand balance in our annual reports excluding the forecast impacts of climate change but have updated regulators and stakeholders on the actual position.

We have exceeded our leakage target for the last 6 years consecutively. This performance has helped maintain a secure supply-demand balance and accommodate the impact of environmental improvements.

Table 2-6: AMP5 Supply Demand Position (including allowance for climate change)

WRZ	Item	Volume (MI/d)			
		2011/12	2012/13	2013/14	2014/15
London (DYAA ¹⁷)	Demand	2022	2030	2033	2035
	Headroom	57	96	99	104
	Supply	2098	2086	2083	2079
	Balance	19	-40	-48	-59
SWOX (ADPW ¹⁸)	Demand	319	321	322	323
	Headroom	9	11	11	12
	Supply	365	359	359	362
	Balance	37	27	27	27
SWA (ADPW)	Demand	166	167	167	168
	Headroom	11	12	13	13
	Supply	198	192	192	192
	Balance	21	14	12	12

¹⁷ Dry Year Annual Average – See Appendix Z

¹⁸ Average Day Peak Week – See Appendix Z



WRZ	Item	Volume (MI/d)			
		2011/12	2012/13	2013/14	2014/15
Kennet Valley (ADPW)	Demand	119	119	120	120
	Headroom	4	6	6	7
	Supply	164	158	158	153
	Balance	41	33	32	26
Guildford (ADPW)	Demand	61.5	61.8	61.9	62.0
	Headroom	4.3	4.7	4.8	5.2
	Supply	72.6	68.1	68.1	68.0
	Balance	6.8	1.6	1.4	0.9
Henley (ADPW)	Demand	19.0	19.0	19.1	19.2
	Headroom	0.9	0.9	1.0	0.9
	Supply	25.2	25.3	25.3	25.3
	Balance	5.3	5.3	5.2	5.1