Introduction

Section 37A of the Water Industry Act 1991 (the Act) makes it the Company statutory duty, as a water undertaker, to prepare and maintain a Water Resources Management Plan (WRMP) detailing how the Company will manage and develop water resources so as to be able, and continue to be able, to meet the Company obligations under Part III of the Act.

The Water Resources Management Plan explains how the Company will ensure a secure and sustainable supply of high quality water for customers over the next 25 years, taking into account the far reaching changes likely to occur during that period of time.

The Company prepared and published its draft WRMP for consultation in May 2008 in accordance with section 37B (3)(a) of the Act and the Environment Agency's Water Resources Management Plan guidelines. The consultation was open to any person or organisation that wanted to make a comment on the plan until August 2008, when the consultation period ended. All comments received were directed to the Secretary of State for the Environment and in accordance with section 37B (4) of the Act, the Company published its Statement of Response in January 2009 detailing:

- the consideration that the Company had given to the representations received;
- the changes that the Company had made to its draft WRMP as a result of the consideration of these representations, and the Company reasons for doing so; and
- where the Company had made no changes to its draft WRMP as a result of the consideration of any representation, the reason for this.

In August 2009, the Secretary of State informed the Company that he was satisfied with the changes the Company made to its draft Water Resources Management Plan and that the Company could publish its final Water Resources Management Plan, in accordance with regulation 6 of the 2007 Regulations. A copy of Defra's Direction Statement can be found in Appendix 1.

The Company does not consider that there are any parts of the plan that are commercially confidential, for the Company or for any third party, and the entire plan is published. Furthermore, no information has been excluded on the grounds that it would contrary to the interests of national security.

The Company's Water Resources Management Plan consists of four parts:

- Overview and summary of the plan
- Main Report
- Tables
- Detailed studies, carried out by the Company to support the Water Resources Management Plan and which reports are available upon request.

These are:

- Deployable Output Assessment
- Outage Assessment
- Climate Change
- Sustainable Economic Level of Leakage
- Domestic Micro-component Forecast
- Housing and Population Forecasts
- Commercial Forecast
- Demand Forecast
- Headroom Assessment
- Options Appraisal
- Level of Service
- Environmental report.

The Strategic Environmental Assessment (SEA) accompanies the Water Resources Management Plan, as it is important to have an independent look at the impact of the plan on the environment. Expert consultants have provided a robust SEA and evaluated how the WRMP complies with the requirements of the SEA Directive. The SEA has influenced the Company in defining its final supply/demand strategy which consists mainly of demand management schemes with low environmental and social impacts.

The Company is providing hard copies of the plan to the regulatory authorities (DEFRA, Ofwat, Environment Agency, Consumer Council for Water, Natural England and Drinking Water Inspectorate). The plan is also available to consultees, stakeholders (Appendix 2) and the general public through the Veolia's websites:
http://www.veoliawater.co.uk/en/media/wrmp/
https://southeast.veoliawater.co.uk/media-publications.aspx

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in this document for specific locations

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ABBREVIATIONS LIST

ADPW	Average day demand peak week
AISC	Average incremental social cost
ALF	Alleviation of low flows
CAMS	Catchment abstraction management strategies
CAPEX	Capital expenditure
CLG	Communities and Local Government Department
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of Environment, Transport and the Regions; (now Defra)
DoE	Department of the Environment; (now Defra)
DMP	Drought Management Plan
DMG	Drought Management Group
DO	Drought Order
DP	Drought Permit
DWRMP	Draft Water Resources Management Plan 2008
EA	Environment Agency
EIA	Environmental Impact Assessment
ES	Environmental Statement
LPA	Local Planning Authority
LTA	Long-term average
GCM	Global circulation models
GCCM	Global climate change models
JR07	June Return 2007, annual report to Ofwat
Ml/d	Megalitres per day; Megalitres = one million litres (1000 cubic metres)
MLE	Maximum Likelihood Estimation
NEP	National Environment Programme
OASIS	Operational Assessment of Summer Impacts and Stress
ODPM	Office of the Deputy Prime Minister (now replaced by CLG Dept.)
Ofwat	The Water Services Regulation Authority
ONS	Office for National Statistics
OPEX	Operating expenditure
PCC	Per capita consumption - consumption per head of population
SEA	Strategic Environmental Assessment
SEMD	Security and Emergency Measures Direction
SMD	Soil moisture deficit
SRO	Source Reliable Output
SSSI	Site of Special Scientific Interest
UKCIP	UK Climate Impacts Programme
UKWIR	United Kingdom Water Industry Research Limited
WAFU	Water available for use
WIA	Water Industry Act 1991
WRP	Water Resources Plan 2004
WRMP	Water Resources Management Plan 2009
VWSE	Veolia Water Southeast
WTW	Water Treatment Works
Water UK	Water UK - the trade association representing the water industry

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1 General information

1.1 Planning period

The Company's WRMP looks at the water resources situation over a 25-year period from 2010 until 2035. The Company uses 2006/07 as the base year for its Water Resources Management Plan. The 2006/07 base year has been prepared using a one-year forecast from the 2005/06 normal year.

1.2 Resources Zone

A resource zone is the largest possible area in which all water resources, including imports and exports, can be shared and hence the zone in which all customers experiences the same risk of supply failure from a resource shortfall. The Denge Security Main allows the transfer of treated water from the North to the South and effectively integrates the supply system across the Company's area. The Company believes that moving to one resource zone complies with the Environment Agency's definition. The Environment Agency (EA) agreed to the change, as indicated to the Company in their letter received on the 29th of October 2008. The evidence provided to the EA to support the change is included in Appendix 3.

The final WRMP and final Business Plan have been prepared on the basis of a single company-wide water resource zone, as shown in Figure 1.

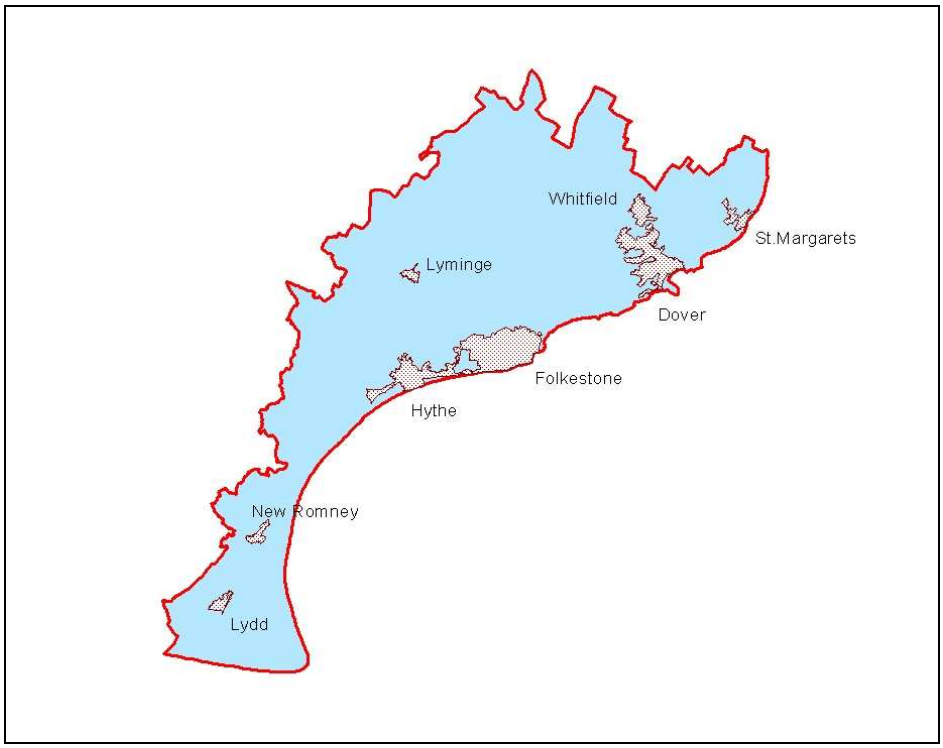

Figure 1: Map of our supply area

1.3 Scenarios

The EA guidelines recommend using 2006/07 as the base year for the demand forecasts. However, in the Company and South East area, that year was characterised by hosepipe restrictions and extensive publicity surrounding the drought. Some work has been done at UKWIR level to attempt to quantify the effects of this, but the results were not conclusive at water company level. It is therefore difficult to attempt to normalise that year to derive a base position.

On the other hand, the 2005/06 year was relatively climatically normal in terms of overall rainfall and sunshine; although the temperature anomaly compared to the 1961-1990 average, shows that the year was warmer than the baseline. The Company has, therefore, used the 2005/06 year as a base year, and forecasted forward one year to generate figures for 2006/07 in the WRMP.

To derive the dry year planning scenarios, demand was benchmarked against the 2003/04 hot dry year. For each component of demand, dry year average and dry year critical factors have been applied.

We have assumed that commercial consumption increases by 10% at peak compared to annual average in a normal year, and that consumption in a dry year peak period is 1.5% greater than in the normal year peak period.

Metered domestic consumption is assumed to increase by 17.5% at normal year peak condition compared to normal year average, while unmetered consumption increases by 25%. In a dry year peak, domestic consumption is assumed to be 17% greater for unmetered customers and 12% greater for metered customers, than in the dry year average case. Unmetered peak and dry year factors have been adjusted to reconcile to the benchmark year of 2003/04. This is a departure from the UKWIR methodology, but it is considered to provide a more robust methodology for the forecasts where a large metering programme is proposed.

The Maximum Likelihood Method MLE was used to reconcile the water balance and minimise uncertainty in the base year demand.

The Company's weekly distribution input for 1992-2009 is shown in Figure 2.

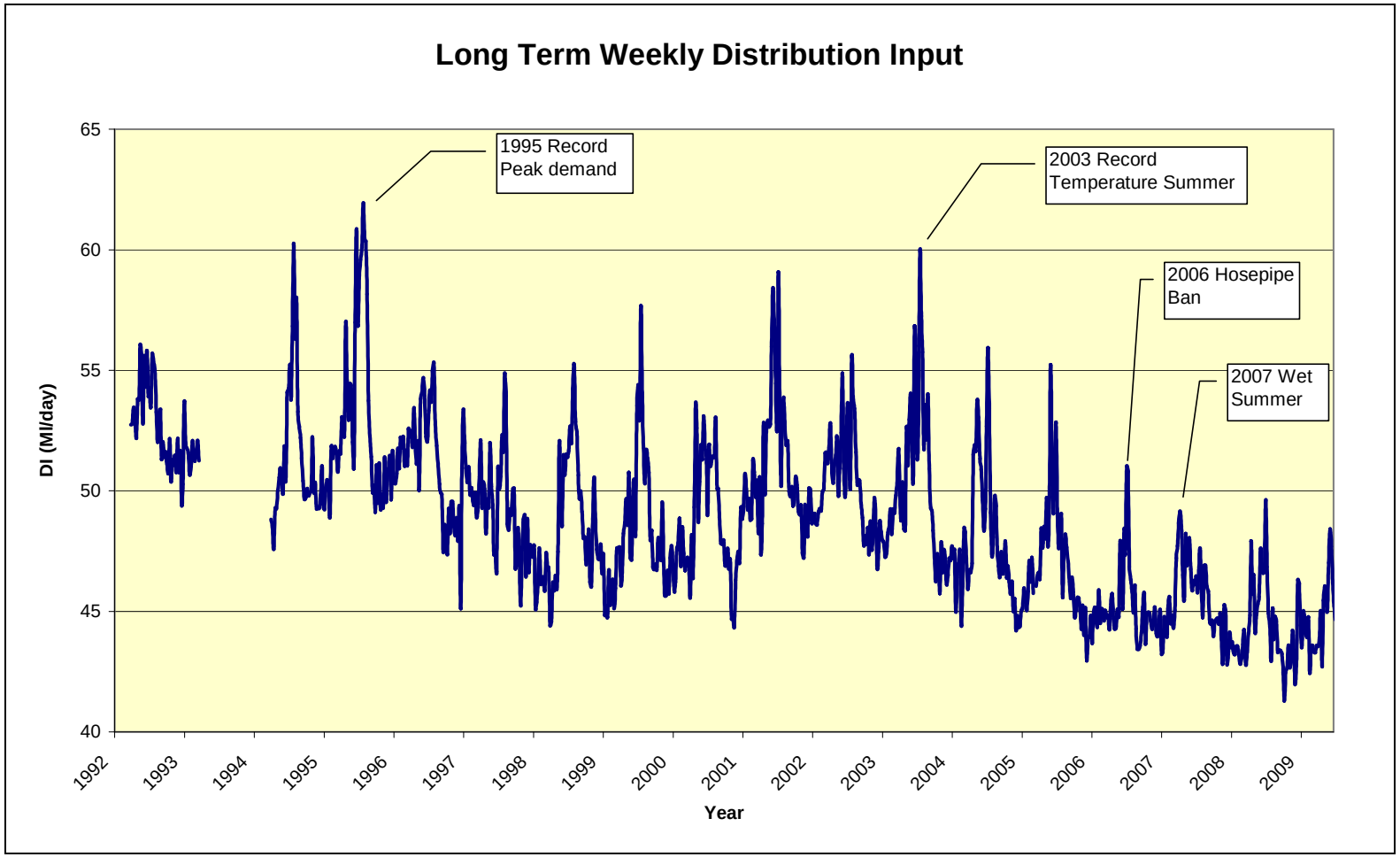

Figure 2: Distribution Input 1992-2008

1.4 Reconciliation of data

Water balances have been prepared for the 2005/06 year at water resources zone level. At the time, the Company reported on two water resources zones: Denge and Hills. However, since October 2008 the Company is reporting at company level following the merger of its two water resources zones. The water balance and maximum likelihood estimation for 2008/09 are shown in Appendix 4.

The Company has used the maximum likelihood estimation (MLE) method to reconcile the water balance at resources zone level in order to minimise the uncertainty in the base year estimates. MLE provides a good framework to reconcile the water balance and ensure the sum of the estimated components equates to distribution input. The Company followed the 1995 UKWIR/NRA methodology detailed in the *Demand Forecasting Methodology Main Report.*

Table 1 shows the way that each component is derived for the Company:

- Either from a bottom up approach estimated at zonal level;
- Or from Company level redistributed according to population or properties as appropriate;
- Or from Company level estimated with no amendments.

Company Component	Estimate Basis
Billed measured household	Bottom Up
Billed measured non-household	Bottom Up
Billed unmeasured household	Company Level Estimate
Billed unmeasured non-household	Company Level Estimate
Per capita consumption (unmeasured household-excluding supply pipe leak)	Company Level Estimate
Per capita consumption (measured household - excluding supply pipe leak)	Bottom Up
Underground supply pipe leakage (unmeasured households)	Company Level Estimate
Underground supply pipe leakage (excluding metered households)	Company Level Estimate
Underground supply pipe leakage (other metered households)	Company Level Estimate
Underground supply pipe leakage (void properties)	Company Level Estimate
Meter under-registration (measured households)	Company Level Estimate
Meter under-registration (measured non-households)	Company Level Estimate
Distribution system operational use	Re-weighted
Water taken legally unbilled	Re-weighted
Water taken illegally unbilled	Re-weighted
Water taken unbilled	Re-weighted
Total leakage	Bottom Up
Distribution input	Bottom Up

Table 1: Components assessment

The following tables (2 & 3) provide details of the water balance and adjustments for each zone.

Water Balance 2005-06

Folkestone & Dover Water Services Denge		2001-02 Projected from last year	2005-06 Pre MLE	2005-06 Post MLE
Water Delivered - Volumes				
Billed measured household	Ml/d	72.41	0.83	0.80
Billed measured non-household	Ml/d	155.68	4.39	4.21
Billed measured	Ml/d	228.09	5.22	5.01
Billed unmeasured household	Ml/d	471.07	1.42	1.14
Billed unmeasured non-household	Ml/d	13.94	0.04	0.02
Billed unmeasured	Ml/d	485.01	1.45	1.16
			165.39	
Water Delivered - Components				
Estimated water delivered per unmeasured non-household	l/pr/d	1,163.70	400.00	217.52
Per capita consumption (unmeasured household-excluding supply pipe leak)	l/h/d	170.56	165.39	132.22
Per capita consumption (measured household - excluding supply pipe leak)	l/h/d	161.25	107.82	103.49
Underground supply pipe leakage (unmeasured households)	l/pr/d	45.19	45.00	40.49
Underground supply pipe leakage (excluding metered households)	l/pr/d	20.62	14.00	12.60
Underground supply pipe leakage (other metered households)	l/pr/d	46.00	45.00	40.49
Underground supply pipe leakage (void properties)	l/pr/d	44.60	38.00	34.19
Meter under-registration (measured households)	Ml/d	2.18	0.03	0.02
Meter under-registration (measured non-households)	Ml/d	7.02	0.23	0.22
Distribution system operational use	Ml/d	1.72	0.00	0.00
Water taken legally unbilled	Ml/d	4.77	0.00	0.00
Water taken illegally unbilled	Ml/d	0.00	0.00	0.00
Water taken unbilled	Ml/d	4.77	0.00	0.00
Water delivered (potable)	Ml/d	717.87	6.67	6.17
Water delivered (non-potable)	Ml/d	0.07		2.17
Water delivered (non-standard rates: potable)	Ml/d	0.79		0.01
Water delivered (non-standard rates: non-potable)	Ml/d	0.07		2.17
Distribution losses	Ml/d	91.69	-0.18	0.58
Total leakage	Ml/d	141.11	0.01	0.75
Distribution input	Ml/d	811.28	6.49	6.75
Bulk Imports	Ml/d			1.01
Bulk Exports	Ml/d			0.01
Water Treated own works to own customers	Ml/d			5.73
Overall Water Balance				
Billing				
Households billed unmeasured water	000	940.13		2.693
Households billed measured water (external meter)	000	177.11		3.499
Households billed measured water (not external meter)	000	18.05		0.122
Households billed water	000	1,135.296		6.314
Household properties (water supply area)	000	1,146.85		6.437
Households: unmeasured sprinkler/hosepipe charge	000			0.01
Non-households billed unmeasured water	000	11.98		0.092
Non-households billed measured water	000	54.71		0.428
Non-households billed water	000	66.693		0.520
Non-household properties (water supply area)	000	72.63		0.550
Non-households: unmeasured sprinkler/hosepipe charge	000			
Void Properties				0.153
Population				
Population - households billed unmeasured water	000	2,512.88		7.832
Population - households billed measured water	000	421.26		7.230
Population - non-households billed unmeasured water	000	5.18		0.000
Population - non-households billed measured water	000	5.00		0.322
Population - total	000	2,944.32		15.38
Lines 26-30 unused				
Population				
Population (winter)	000	2,944.32		15.38
Population (summer)	000	2,944.32		15.38

Water Balance Error Reconciliation

Ref	Water Balance Component	Unit	Pre- MLE	Component Errors %ge	Component Errors Ml/d	Adjustment Ml/d	Final	SP Losses l/pr/d
	Measured Household Consumption	Ml/d	0.78	2%	0.02	-0.03	0.75	
	Measured Household SP losses (Internally Measured)	Ml/d	0.01	5%	0.00	0.00	0.00	40.49
	Measured Household SP losses (Externally Measured)	Ml/d	0.05	5%	0.00	0.00	0.04	12.60
T10.1	Billed Measured Household	Ml/d	0.83				0.80	
	Measured Non-Household Consumption	Ml/d	4.38	2%	0.09	-0.18	4.20	
	Billed Measured Non-Household SP Losses	Ml/d	0.01	5%	0.00	0.00	0.01	12.60
T10.2	Billed Measured Non-Household	Ml/d	4.39				4.21	
T10.3	Billed Measured	Ml/d	5.22				5.01	
	Unmeasured Household Consumption	Ml/d	1.30	10%	0.13	-0.26	1.04	
	Unmeasured Household SP Losses	Ml/d	0.12	5%	0.01	-0.01	0.11	40.49
T10.4	Billed Unmeasured Households	Ml/d	1.42				1.14	
	Unmeasured Non-Household Consumption	Ml/d	0.03	25%	0.01	-0.02	0.02	
	Unmeasured Non-Household SP Losses	Ml/d	0.00	5%	0.00	0.00	0.00	40.49
T10.5	Billed Unmeasured Non-Household	Ml/d	0.04				0.02	
T10.6	Billed Unmeasured	Ml/d	1.45				1.16	
	Void Properties SP Losses	Ml/d	0.01	5%	0.00	0.00	0.01	34.19
T10.21	Water Taken Legally Unbilled	Ml/d	0.00	25%	0.00	0.00	0.00	
T10.22	Water Taken Illegally Unbilled	Ml/d	0.00	25%	0.00	0.00	0.00	
T10.23	Water Taken Unbilled	Ml/d	0.00				0.00	
T10.24	Water Delivered		6.68				6.17	
T10.20	Distribution Sytem Operational Use	Ml/d	0.00	25%	0.00	0.00	0.00	
	Distribution Losses	Ml/d	0.64	5%	0.03	-0.06	0.57	
T10.29	Total Leakage	Ml/d	0.83			-0.08	0.75	
	Distribution Input (Sum of components)	Ml/d	7.32				6.75	
T10.30	Measured Distribution Input	Ml/d	6.49	-2%	-0.13	0.26	6.75	

Water Balance Error	Ml/d	-0.83
Water Balance Error %ge	%	-12.74%

Sum of Positive Errors	0.28
Sum of Negative Errors	0.13
Apportionment to Positive Errors	-0.57
Appoertionment to Negative Errors	-0.26
Apportionment to Leakage	0.00

Table 2: Water balance error reconciliation – Denge zone

Water Balance 2005-06

Folkestone & Dover Water Services Hills		2001-02 Projected from last year	2005-06 Pre MLE	2005-06 Post MLE
Water Delivered - Volumes				
Billed measured household	Ml/d	72.41	7.80	7.85
Billed measured non-household	Ml/d	155.68	10.59	10.66
Billed measured	Ml/d	228.09	18.38	18.51
Billed unmeasured household	Ml/d	471.07	15.43	15.91
Billed unmeasured non-household	Ml/d	13.94	0.30	0.33
Billed unmeasured	Ml/d	485.01	15.73	16.24
			165.39	
Water Delivered - Components				
Estimated water delivered per unmeasured non-household	l/pr/d	1,163.70	400.00	430.06
Per capita consumption (unmeasured household-excluding supply pipe leak)	l/h/d	170.56	165.39	170.85
Per capita consumption (measured household - excluding supply pipe leak)	l/h/d	161.25	140.99	141.92
Underground supply pipe leakage (unmeasured households)	l/pr/d	45.19	45.00	45.74
Underground supply pipe leakage (excluding metered households)	l/pr/d	20.62	14.00	14.23
Underground supply pipe leakage (other metered households)	l/pr/d	46.00	45.00	45.74
Underground supply pipe leakage (void properties)	l/pr/d	44.60	38.00	38.63
Meter under-registration (measured households)	Ml/d	2.18	0.23	0.24
Meter under-registration (measured non-households)	Ml/d	7.02	0.55	0.56
Distribution system operational use	Ml/d	1.72	0.05	0.05
Water taken legally unbilled	Ml/d	4.77	0.01	0.01
Water taken illegally unbilled	Ml/d	0.00	0.00	0.00
Water taken unbilled	Ml/d	4.77	0.01	0.01
Water delivered (potable)	Ml/d	717.87	34.12	34.75
Water delivered (non-potable)	Ml/d	0.07		2.17
Water delivered (non-standard rates: potable)	Ml/d	0.79		0.01
Water delivered (non-standard rates: non-potable)	Ml/d	0.07		2.17
Distribution losses	Ml/d	91.69	6.27	5.36
Total leakage	Ml/d	141.11	8.35	7.48
Distribution input	Ml/d	811.28	40.44	40.17
Bulk Imports	Ml/d			1.01
Bulk Exports	Ml/d			0.01
Water Treated own works to own customers	Ml/d			39.15
Overall Water Balance				
Billing				
Households billed unmeasured water	000	940.13		33.952
Households billed measured water (external meter)	000	177.11		25.325
Households billed measured water (not external meter)	000	18.05		0.882
Households billed water	000	1,135.296		60.159
Household properties (water supply area)	000	1,146.85		61.714
Households: unmeasured sprinkler/hosepipe charge	000			0.019
Non-households billed unmeasured water	000	11.98		0.759
Non-households billed measured water	000	54.71		4.019
Non-households billed water	000	66.693		4.778
Non-household properties (water supply area)	000	72.63		5.061
Non-households: unmeasured sprinkler/hosepipe charge	000			
Void Properties				1.838
Population				
Population - households billed unmeasured water	000	2,512.88		84.030
Population - households billed measured water	000	421.26		52.500
Population - non-households billed unmeasured water	000	5.18		0.000
Population - non-households billed measured water	000	5.00		3.917
Population - total	000	2,944.32		140.45
Lines 26-30 unused				
Population				
Population (winter)	000	2,944.32		140.45
Population (summer)	000	2,944.32		140.45

Water Balance Error Reconciliation

Ref	Water Balance Component	Unit	Pre- MLE	Component Errors %ge	Component Errors Ml/d	Adjustment Ml/d	Final	SP Losses l/pr/d
	Measured Household Consumption	Ml/d	7.40	2%	0.15	0.05	7.45	
	Measured Household SP losses (Internally Measured)	Ml/d	0.04	5%	0.00	0.00	0.04	45.74
	Measured Household SP losses (Externally Measured)	Ml/d	0.35	5%	0.02	0.01	0.36	14.23
T10.1	Billed Measured Household	Ml/d	7.80				7.85	
	Measured Non-Household Consumption	Ml/d	10.53	2%	0.21	0.07	10.60	
	Billed Measured Non-Household SP Losses	Ml/d	0.06	5%	0.00	0.00	0.06	14.23
T10.2	Billed Measured Non-Household	Ml/d	10.59				10.66	
T10.3	Billed Measured	Ml/d	18.38				18.51	
	Unmeasured Household Consumption	Ml/d	13.90	10%	1.39	0.46	14.36	
	Unmeasured Household SP Losses	Ml/d	1.53	5%	0.08	0.03	1.55	45.74
T10.4	Billed Unmeasured Households	Ml/d	15.43				15.91	
	Unmeasured Non-Household Consumption	Ml/d	0.27	25%	0.07	0.02	0.29	
	Unmeasured Non-Household SP Losses	Ml/d	0.03	5%	0.00	0.00	0.03	45.74
T10.5	Billed Unmeasured Non-Household	Ml/d	0.30				0.33	
T10.6	Billed Unmeasured	Ml/d	15.73				16.24	
	Void Properties SP Losses	Ml/d	0.07	5%	0.00	0.00	0.07	38.63
T10.21	Water Taken Legally Unbilled	Ml/d	0.01	25%	0.00	0.00	0.01	
T10.22	Water Taken Illegally Unbilled	Ml/d	0.00	25%	0.00	0.00	0.00	
T10.23	Water Taken Unbilled	Ml/d	0.01				0.01	
T10.24	Water Delivered		34.19				34.75	
T10.20	Distribution Sytem Operational Use	Ml/d	0.05	25%	0.01	0.00	0.05	
	Distribution Losses	Ml/d	5.21	5%	0.26	0.09	5.29	
T10.29	Total Leakage	Ml/d	7.29			0.19	7.48	
	Distribution Input (Sum of components)	Ml/d	39.45				40.10	
T10.30	Measured Distribution Input	Ml/d	40.44	-2%	-0.81	-0.27	40.17	

	Water Balance Error	Ml/d	0.99
	Water Balance Error %ge	%	2.45%

Sum of Positive Errors	2.20
Sum of Negative Errors	0.81
Apportionment to Positive Errors	0.73
Apportionment to Negative Errors	0.27
Apportionment to Leakage	0.00

Table 3: Water balance error reconciliation - Hills Zone

1.5 Sensitivity testing

As part of developing the WRMP, assumptions which affect almost every part of the plan have to be made. Sensitivity analysis has been completed to provide reassurance that the plan is robust.

Sensitivity of the supply/demand balance to data uncertainty

The effect of data uncertainty is assessed and an allowance made for this under the Headroom analysis (Chapter 5). For the WRMP, the Company has undertaken a target headroom calculation using the 2003 methodology. This methodology determines a likely range of values for headroom for selected years within the planning period. It requires the uncertainty for each headroom component to be defined as a probability distribution and then combines these using Monte Carlo simulations. The result is a range of possible values for headroom uncertainty at given probability. The Company then has to determine which level of uncertainty to adopt as target headroom. The key components of the headroom calculation are:

- S1 Vulnerable surface water licences
- S2 Vulnerable groundwater licences
- S3 Time limited licences
- S4 Bulk transfers
- S5 Gradual pollution causing a reduction in abstraction
- S6 Accuracy of supply side data
- S7 Single source dominance and critical periods (old method only)
- S8 Uncertainty of climate change on yield
- S9 Uncertain output from new resource developments (new method only)
- D1 Accuracy of sub component data
- D2 Demand forecast variation
- D3 Uncertainty of climate change on demand
- D4 Uncertain outcome from demand management methods (new method only)

Of these categories, S1, S2 and S3 are identified by the EA as not being required for the assessment of headroom uncertainty as these elements are taken care of in the NEP programme and covered under the presumption of renewal respectively. S9 and D4 are taken account of explicitly in the modelling of supply/demand options.

Sensitivity of the proposed actions in the plan to assumptions or changes in the supply/demand balance

The uncertainty over timing and/or magnitude of the deficit in the supply/demand balance has been assessed, and the results of the analysis are detailed under the Sensitivity Analysis paragraph (Chapter 8).

1.6 Company policies

The greatest challenges the Company faces are ensuring a reliable supply of safe drinking water, and continuing to balance customers' demand for water with the water which is available. The Company needs to do this in a sustainable manner, and therefore needs to anticipate and respond to changes that will impact upon sustainability and the way the Company delivers its service.

Two significant issues that have to be addressed are climate change and the Company's impact on the natural environment.

- The effect of climate change, with more erratic periods of rainfall, more intense rainfall and drier periods are already being experienced. This change is expected to become more severe and it will have a negative impact on existing water resources that normally recharge through winter months, thus reducing the water available for supply to customers.
- In order to improve and protect inland and coastal waters; drive sustainable use of water as a natural resource; and create better habitats for wildlife that lives in and around water, a major piece of European legislation came into force in December 2000, and transposed into UK law by December 2003: the Water Framework Directive (WFD). The Water Framework Directive promotes a new approach to water management through river basin planning and applies to all surface freshwater bodies (including lakes, streams and rivers), groundwaters, groundwater dependant ecosystems, estuaries and coastal waters out to one mile from low-water.

It is more likely that the effect of climate change and the application of the WFD will reduce the volume of water available for supply to customers, in what is recognised a water scarce area. Indeed, the EA's local Catchment Management Strategies (CAMS) identify potential licence reductions to reduce environmental impacts over abstraction, and these are to be used in developing River Basin Management Plans (RBMP) to be implemented under the WFD.

The Company's strategy to manage the impact of these key issues is to continue its "twin track" approach of restraining demand and delivering additional resources. In order to achieve a sustainable use of water resources, the Company will:

- Achieve and maintain a Security of Supply Index score of 100 by 2010.
- Accelerate its compulsory metering programme from the current target of 90% by 2015 to ensure that 96% customers can be metered by April 2012.
- Develop, test and implement new charging structures, which will reduce the price for water used for essential purposes (drinking, washing, cooking and cleaning), but charge a higher price for discretionary use (garden watering, filling swimming pools etc).
- Support new charging structures with more frequent meter readings and provision of improved information to customers concerning their water consumption. This will include consideration of the most appropriate technology (SMART meters, web-based accounts).
- Promote the benefits of water efficient appliances and devices to our customers and develop schemes to assist them with their purchase and/or installation.

- Engage with planners and developers to ensure new housing and commercial developments meet requirements for water efficiency.
- Work with schools to support the education of school children on water management, including the environment, waste and water efficiency.
- Support and promote rainwater harvesting and grey-water reuse projects.
- Control leakage from our pipes to ensure that leakage levels remain below that where it becomes uneconomical to spend more to reduce, whilst taking into account environmental impacts of leakage and in particular the impact of carbon emissions.
- Continue to plan for the possibility of supply and/or other non-essential use restrictions no more than once in every 10 years.
- Work with local stakeholders to ensure the requirements of the Water Framework Directive are met by 2027. A review of abstraction licences under the Habitats Directive and Alleviation of Low Flows Project has recently been completed and already the next set of investigation are being identified by the EA's Restoring Sustainable Abstraction (RSA) programme and the Water Framework Directive (WFD).
- Monitor our resources for deterioration in raw water quality, threat to pollution and impact of climate change by developing adaptation plans where necessary.
- Investigate potential new sources of water including desalination, effluent reuse and reservoir supplies to ensure sufficient water to meet customer needs is accessible.
- Participate in the development of a regional WRMP for the South-Sast of England and looking at shared resources and bulk transfers from neighbouring water companies.
- Achieve 1% reduction in energy carbon use annually until 2020.
- Use a minimum of 20% renewable energy by 2020.

1.7 Levels of service[1]

Levels of Service set out the standard of service that customers can expect to receive from the Company. The Company's current levels of service (LoS) remain unchanged since the previous plan and are:

- The return period for hosepipe ban is once in 10 years;
- The return period for drought order/permit is once in 40 years;
- The interruption to supply rota cuts/standpipes is unacceptable.

The Company has investigated the frequency at which current and planned hosepipe ban level can be justified using groundwater level and rainfall data, as required by regulation and as it may be demanded by customers.

The Company obtains 100% of its supply from groundwater, and supply is therefore dependant on the amount of groundwater recharge received each year. To assess the correlation between the occurrence of low groundwater levels and hosepipe restrictions, long term records of groundwater levels are required.

[1] Levels of service report – June 2009 (available upon request)

The groundwater levels are driven by recharge to the aquifer system, and recharge is dependant on rainfall. In general terms, rainfall occurring between September and April has the potential to contribute to rising groundwater levels. Rainfall occurring between May and August generally does not contribute significantly to recharge as higher evaporation rates return most of the precipitation to the atmosphere within a fairly short time. There is also frequently a lag to the upturn of groundwater levels as it can take up to three months for recharge to reach the water table. Therefore, variations in rainfall pattern and intensity account for the change in annual pattern of water level changes. An analysis of rainfall records was conducted in order to extend the period of analysis and understand expected return periods.

There are no reliable long term data records for groundwater levels in the Company area, so rainfall patterns were analysed as a substitute. MORECS data square 174 were used, but this is only available from 1961. A longer term data set from Canterbury was compared to the MORECS data and found to have good correlation. The rainfall data was analysed and dry periods were linked with periods of low groundwater levels and known hosepipe bans.

The return period of low rainfall periods that lead to hosepipe bans varies depending exactly on the deficit deemed critical to induce the need for a hosepipe ban. In the past 33 years, there have been 5 hosepipe bans which equates to a return period of 1 in 7 years. The only slightly dubious hosepipe ban is 1976, which had very low rainfall, but the groundwater levels did not drop to a significantly low level. If the hosepipe ban had not been implemented, there would have been 4 bans in 33 years, increasing the average return period to 1 in 8 years.

Analysis of the cumulative deficit in rainfall over one or more recharge period indicated 20 periods with significant (>10mm) average deficit, which were spread relatively evenly across the time period. Comparison with recent hosepipe bans revealed that a deficit of closer to 20 to 30mm was required for restriction to become necessary. 16 occurrences were identified as having deficits of at least 20mm which gives a return period of 1 in 7 years, which is equal to the observed return period of the past 33 years. A deficit of 30 mm would give a return period of 1 in 11 years, which is closer to the stated level of service.

Hazen[2] and Weibull methods were used to calculate the return period of the differing rainfall amounts. The analysis shows many hosepipe bans to occur with rainfall equal to or less than a 1 in 10 year return period.

In conclusion, the analysis suggests that level of service for hosepipe bans of between 1 in 7 and 1 in 11 years can be justified. The current stated level of service of 1 in 10 years is therefore valid.

1.8 Details of competitors for each resource zone

Currently, there are no competitors in the Company's supply area

[2] Hazen and Weibull methods consist of determining the statistical distribution of rainfall amounts for the duration of interest and define the rainfall associated with the return period of interest.

1.9 Strategic environmental assessment[3]

The draft WRMP recommended future projects and therefore felt under the scope of the European Directive (2001/42/EC) 'on the assessment of the effects of certain plans and programmes on the environment', known as the Strategic Environmental Assessment (SEA) Directive. The Directive was transposed into English law by the associated Environmental Assessment of Plans and Programmes Regulations (SI 1633 2004). These Regulations require SEA to be undertaken on plans and programmes that are likely to have significant environmental effects and for these to be considered when making decisions about the plan.

SEA is a process for assessing the impacts of a plan or programme on the environment. The environment includes ecology, historic environment, landscape, material assets and human beings. It has formed part of the decision making process, informing the choice of preferred outcomes. The Environmental Report summarised the SEA process and is available upon request.

The revision of the climate change impact and the continuation of our existing bulk supplies over the 25-year period have considerably improved the Company's supply/demand balance. The final WRMP confirms that the Company has sufficient resources to meet forecast demand for annual average and peak week conditions throughout the plan period. As a result, there will be no significant effects arising from the implementation of the final WRMP.

1.10 Habitats Regulations assessment

The Company has assessed the WRMP with regards to appropriate assessment. None of the site specific options are located near to sites identified under the Habitats regulations.

The only Natura 2000 site of relevance to the Company's abstraction is the Denge Peninsula. Habitat Regulation Assessment will be made as part of the AMP5 investigations, building on those already undertaken by the EA to investigate the impacts of a changed abstraction regime. No schemes are proposed for this area in the life of the plan, thus no other assessments are required.

[3] Strategic Environmental Assessment report – April 2008 (available upon request)

2 Water supply

2.1 Deployable output[4]

The current source yield assessment methodology is based on the earlier approaches outlined by UKWIR in 1995. This methodology is focused on determining deployable outputs under drought conditions only.

Since the 2002/03 submission, there has been no period during which water levels were lower in the Company's supply area than the last minima in 1996. However, there has been an extended period (autumn 2003 to summer 2006) of low recharge, which has placed a degree of pressure on source performance. The highest demand was seen in 2003, a year when the water levels dropped to relatively low levels. The Deployable Output (DO) of sources and groups of sources has been reviewed and updated where appropriate.

A number of schemes that have been implemented during the current AMP4 period have also resulted in changes in DO. These include a mixture of licence variations arising from the Memorandum of Understanding (MoU) signed by the Environment Agency (EA) and the Company in November 2004, outstanding AMP3 schemes and AMP4 projects. Although some new schemes, implemented as a result of the MoU, have not currently been fully commissioned, they are in an operational condition, subject only to final quality testing. Hence, they are all accounted for in the new DO reference year values which are 2007/08 for this DO assessment.

Following the re-evaluation of the base year (2007/08) deployable outputs, the results were compared with the equivalent AMP4 base year results, as shown in Table 4.

	Equiv. AMP4 Position: Ave. DO	Equiv. AMP4 Position: Peak DO	Current Position: Ave. DO 2007/08	Current Position: Peak DO 2007/08	Difference Ave.	Difference Peak	Comments
Company Level	45.20	59.80	51.15	65.09	5.95	5.29	Inclusion of treatment losses, AMP4 schemes no longer allowed for under the MoU, borehole collapse due to earthquake and correction to DO due to observed infrastructure restrictions.

Table 4: Deployable output

The Company recognises that the Deployable Output assessment for the Denge gravel sources does not follow the UKWIR methodology, as the nature of the aquifer and method of operation of the wells are not consistent with the application of the methodology. Outputs from this source have remained robust over low recharge periods, but there are concerns on the environmental impact of potential abstraction, which is investigated as part of the NEP programme.

Deployable outputs will be reviewed following the next drought when water levels reach or exceed previous lows. Data will be gathered from all sources during this period to allow a

[4] Deployable output report – December 2008 (available upon request)

revision of previous understanding of the capability of these sources. Other studies, such as the Dover Deal investigations (pumping tests programme available in Appendix 5) will also allow re-assessment of other assumptions made in derivation of the deployable output. These may result in changes to the deployable output in the future.

2.2 Reductions in deployable output

In November 2008, the EA advised National Environmental Programme (NEP) activities relating to the Company. The EA has identified two sites for further activities under the initial NEP. These are listed in the tables below.

Site Name	River Basin District	Current Lead Driver	Current Status	Licences	PR09/AMP5 Comment
Little Sour	AMP assessment	BAPw1	Investigation	9/40/04/0273/GR 9/40/04/0377/G 9/40/04/0060/GR	Options appraisal to identify licence changes or other measures to protect the environment from existing extraction. This options appraisal will be more complex due to the fact that there are three water companies involved.

Table 5: EA NEP investigations after letter 28/11/2008

Investigations into the impact of abstraction on flows in the Little Stour have been undertaken during AMP3 and AMP4 in relation to the Alleviation of Low Flows project. These investigations are ongoing and the outcome of the current studies will be an assessment of the impact of water company abstractions on flows in the Little Stour.

Following on from the impact assessment, there will be a need to evaluate various options for improving the environmental status of the river. This may be by increasing flows in the channel or by improving channel conditions such that the ecology benefits within the current flow regime (or a combination of the two). The three water companies have sought funding in PR09 for this “options appraisal”.

Veolia Water Southeast and South East Water as well as Southern Water abstract in the Little Stour catchment. The three water companies have worked together successfully in AMP4 and the majority of the AMP5 work will also be run in partnership.

The appraisal should review the options for improving the environmental condition of the Little Stour in terms of enhancements to the physical structure of the river and/or modifying abstractions in order to increase flows at critical times. Whether it is appropriate to consider abstraction changes will depend on the outcome of the current impact assessment study.

In considering any modifications to water company abstraction licences which impact on deployable output, some thought should be given to how this loss will be compensated so that the supply/demand balance is maintained. In making an informed assessment of how best to address problems in the Little Stour catchment an initial look at where else water for public supply might come from is needed to ensure wider sustainability issues are considered.

Site Name	River Basin District	Current Lead Driver	Current Status	Licences	PR09/AMP5 Comment
Dungeness	Dungeness SAC Investigation	Hw3	Stage 4 Appraisal (EA)	09/40/05/0071/G	Implementation: PR09 funding is required to implement licence changes in order to comply with the Habitats Directive. The licence changes which will be implemented by 2014/15 will insure the necessary protection to the environment. The EA has agreed the Company proposal that this can be achieved without impacting on the Deployable Output.

Table 6: EA NEP investigations after letter 28/11/2008

Dungeness has been subject to a series of investigations to look at the impact of the Company's public water supply abstraction on water levels within the beach. These concluded in AMP3 that there was no impact on the Blackthorn bushes and their epiphytes (the subject of the investigations) and thus no funds were sought in AMP4 for further work or options appraisal. The current version of the EA table given in the letter states 'Implementation (Supply/Demand)', but at this stage no options appraisal has been undertaken by the Company.

With regard to the Deployable Output assessment for the Denge source, no allowance for a sustainability reduction was included in the draft plan, and this position is also reflected in the final plan.

In July 2008, the EA published the SAC Habitats Regulations Stage 4 Site Action Plan (SAP) for Denge, which proposed a change in the groundwater level conditions for boreholes 7, 8 and 26 of the Denge wells.

As a result of the Review of Consents process, the discrepancy between the licences and the Company's current operational regime, the EA has indicated that it requires the Company to undertake further work to demonstrate what impact current and possible future operational abstraction patterns would have on the requirements of the Habitats Directive, and thus licence modification to the operational constraints on a number of abstraction wells.

No stage plan has been received from the EA to date, and it is unclear at the present time if these changes are likely to significantly impact the current deployable output of the source.

Consequently, the Company proposed to seek funding to:

- Improve the conceptualisation of the behaviour of the aquifer and the impact of individual sources buy undertaking the following activities:
- infill gaps in the hydrological and environmental data, and undertake a topographical survey in the vicinity of the Open Pits (the area of interest under the Habitats Directive)

- undertake environmental surveys of the Open Pits to determine the relationship of the concerned species to known water level changes
- determine the extent and pattern of abstraction that provides protection to the designated habitat/species
- determine the extent and pattern of abstraction that provides protection against saline intrusion as far as possible
- trial alternative operational regimes, with enhanced monitoring to demonstrate that the revised abstraction pattern does not infringe the ecology of the Open Pits and that the current deployable output can be maintained
- evaluate the medium to long-term sustainability of the Denge aquifer as a groundwater resource in the context of environmental, water quality and climate change considerations
- to agree licence changes that will protect the key habitats, whilst allowing the company to meet its obligations as a water supplier
- identify alternative water resource options in the Dungeness area to address any loss in deployable output that studies identify may be necessary
- development and use of a groundwater model to allow alternative strategies to be evaluated

The project is due to start in April 2010, but the Company is already in discussion with the EA and Natural England to agree on the detailed scope, programme and resources associated with the project.

2.3 Outage[5]

The outage assessment used the UKWIR 1995 methodology, described in *Outage Allowances for Water Resource Planning.*

Assessments were completed for each source works and standard pro-formas were developed for the assessments:

- Groundwater sources
- External transfers and imports

For each source, assessments were predominately based on interviews with experienced operational staff, and historical data was used as an aid to assessing outage. The potential impact of flooding[6] is fully accounted for in the outage allowance

The standard outage pro-forma for all groundwater and transfers was then applied to a Monte-Carlo based model using Crystal Ball software, which was created specifically for this outage assessment. Monte-Carlo model was created for the company-wide resource zone. The model gives outage values specified levels of certainty.

The outage in periods of average water demand was found to be 1.84 Ml/d, whilst at critical periods of water demand (estimated to be a one month period from mid-July to mid-August) the outage reduces to 1.97 Ml/d.

[5] Outage report – January 2009 (available upon request)
[6] Flood risk assessment report – January 2009 (available upon request)

The results of the Crystal Ball Monte-Carlo modelling process list a number of different percentiles of certainty, and total outage is set at a 95% level of certainty. This approach is consistent with the level of confidence used for 2002/03 assessment.

	Average DO (Ml/d)	Average Outage (Ml/d)	Peak DO (Ml/d)	Peak Outage (Ml/d)
Company Level	51.15	1.84	65.09	1.97

Table 7: Outage at 95% level of certainty

The Company recognises the need to improve its outage event recording system to enable better understanding of real outage risk for use in future plans. The Company will look into developing an automatic system during AMP5 to report operational unplanned and planned outage data for all the sources. This data will facilitate the outage assessment for future water resources management plans and provide valuable data on source asset serviceability, which will assist in planning future capital maintenance and investment.

2.4 Raw and potable water transfers and bulk supplies

The Company supply area is bounded by the English Channel to the South, the Southern Water supply area to the north and South-East Water to the north-west. In addition, the Company shares a short boundary with Southern Water on the Dungeness Peninsula in the south-west.

The Environment Agency in *Water for People and the Environment: Water Resources Strategy for England and Wales, 2008* encouraged the sharing of resources between areas of surplus and deficit through bulk supply transfers, subject to there being no adverse effects. The Company participated in regional water resources studies to specifically investigate cross-company transfers in the context of its supply/demand balance investment plans for business plan 2009 submission.

The Company has bulk supply import arrangements with both of its neighbours, but these are threatened by the competing demand for water from the forthcoming Sustainable Communities at Ashford and Thames Gateway South in those companies' supply areas. The existing agreements are time limited and both expire in the next ten years.

The Company had had a long standing import from South-East Water (BARI) arising from the transfer of customers from East Kent Water in the past. This arrangement was put on a formal footing in 1999 by means of an Ofwat Section 40 Order. The present supply of 2 Ml/d (throughout the year) was due to expire in 2009/10 but agreement has been reached to extend to 2014/15, and this forms part of the Company's WRMP.

Following recent discussions with South East Water, the two companies agreed to extent the agreement until 2019/20. For planning purposes, this import is included in the supply/demand baseline until the end of the planning period (2035). This approach is being mirrored by South East Water. The increase of the bulk supply from 2Ml/d to 4Ml/d is an option which the two companies are currently discussing.

During AMP3, the Company negotiated a further bulk supply from Southern Water (DEAI). The agreement is due to expire in 2012. This supply provides up to 4Ml/d over four months of the winter period. Consequently, it was considered as an average demand scheme

equivalent to 1.33 Ml/d, although this is dependant on hydrological conditions. For planning purposes, this import is included in the baseline supply/demand balance until the end of the planning period, ie 2035. This approach is consistent with that of Southern Water. An increase in the volume and period of availability of the bulk supply is an option under discussion between the two companies.

Further and/or extended bulk supplies may be available on a short-term basis, but are uncertain in the times of drought that form the Company's critical planning case. Reliable bulk supplies would require the donor companies to develop further resources to enable them to supply the Company as well as the proposed Sustainable Communities (Thames Gateway and Ashford).

In this context, the Company is active within the Water Resources for the South-East Group and is monitoring the development of regional resources and the potential benefits they may have for the Company.

The Company is currently liaising with its neighbouring companies: South East Water and Southern Water, in order to identify long-term regional solutions which would benefit customers of the South East area. SEW and SW have both confirmed they would be able to provide increased bulk imports from 2020 (Appendix 6). These increased bulk transfers may require resource developments within SEW and SW supply areas, and the Company will support its neighbours in doing so.

See also paragraph 8.4 - regional solutions.

2.5 Distribution and treatment works operational use and losses

Distribution losses and operational use

Distribution losses consist of water lost from trunk mains, service reservoirs, distribution mains and communications pipes, downstream of distribution input meters. The total distribution losses for 2006/07 are estimated to 5.69Ml/d (5.89Ml/d for 2007/08).

Distribution system operational use (DSOU) consists of water taken downstream of distribution input meters, knowingly used by the Company to meets its statutory obligations, in maintaining and enhancing water quality and distribution network infrastructure. The DSOU volume for 2006/07 is estimated to be 0.04Ml/d (0.04Ml/d for 2007/08).

Treatment works losses and operational use

Treatment works losses are made up of structural water loss and both continuous and intermittent over-flows; whereas treatment works operational use is the volume of water used during the treatment process (net loss that excludes water returned to sources water). The combined value for treatment works losses and treatment works operational use is estimated to be 1.1 Ml/d for 2006/07 (0.96Ml/d for 2007/08).

3 Water demand

3.1 Base year

Base year population and properties

The number of properties in 2005/06 has been derived from the Company's billing database for all of the property categories reported in the June Return. Historical June Return figures have been analysed to breakdown metered customers per customer type. Where there is no data, simple assumptions have been used to hind-cast estimated total numbers. The customer base per property type and population is split as shown in Table 8.

Billing Category	Households	Population
Measured Households	26,248	58,418
Unmeasured Households	39,956	93,439
Void Properties	580	0
Measured Non-households	4,447	4,232
Unmeasured Non-households	851	0
Total No. Billed	72,082	156,089

Table 8: Households and Properties by billing categories

Base year population in unmeasured non households has been determined from census estimates of communal establishment populations. No estimates have been made for population in other commercial premises not counted in the census.

Base year domestic consumption

Base year estimates on ownership, frequency of use and water volumes for the different components of water use were taken from relevant published literature as well as a comprehensive survey on water use. This was carried out in 2007 and 2,500 households in the Company area responded.

The survey strengthens the Company's specific understanding of base year water use, which was in turn benchmarked against the existing consumption monitor study. The number of replies received makes the results both representative and statistically significant for the Company as a whole.

Unmeasured PCC

The Company uses data from the Southern Area Group Monitor to derive the base year unmeasured PCC. This monitor complies with best practice for small area consumption monitors, and controlled areas are managed in accordance with the recommendations from the UKWIR report *Best Practice for unmeasured per capita consumptions monitors – 1999'* The PCC is used in conjunction with Company research data (survey) to calibrate the micro-component model in the base year.

Measured PCC

The measured base year PCC is calculated by dividing the domestic measured billed volume (minus supply pipe leakage) by the measured domestic population. The measured customer PCC projection is then forecasted forward from this figure.

Methodology

The Company undertakes customer surveys to better understand how water usage relates specifically to its customers. Historic surveys have included questionnaires sent out with the Company's billing booklet and online water audits located on the Company's website. These questionnaires have, however, often been light in content, focussing more on promoting water efficiency rather than producing robust information suitable for a micro-component model.

The most recent survey (2007) was a comprehensive questionnaire of metered and unmetered customers that returned over 2,000 responses. This questionnaire sought to strengthen the Company's specific understanding of base year water use that was in turn benchmarked against the existing consumption monitor study. The number of replies received makes the results both representative and statistically significant for the Company as a whole. Each respondent was asked to provide their postcode, which enables the Company to know what their socio-economic 'ACORN' background is.

The base year assumptions are:

Appliance	Base Year Ownership		Base Year Frequency/Person/Day	
	Metered	Un-metered	Metered	Un-Metered
Toilet Standard	0.681	0.760	4.813	5.440
Toilet Dual Flush	0.319	0.240	4.734	4.983
Bath (standard size)	0.893	0.893	0.289	0.316
Power Shower	0.170	0.095	0.875	1.000
Normal Shower	0.661	0.542	0.869	1.000
Hand Basin	1.000	1.000	2.500	4.220
Kitchen Tap (cooking / cleaning / drinking)	1.000	1.000	2.874	4.000
Washing Machine	0.933	0.872	0.253	0.247
Clothes Washing (by hand)	1.000	1.000	0.061	0.059
Dishwasher (post 2001)	0.346	0.349	0.274	0.319
Dish washing (by hand)	1.000	1.000	1.000	1.000
Water Softener	0.010	0.010	0.140	0.140
Car washing (Hosepipe & Trigger nozzle)	0.050	0.050	0.010	0.014
Car washing (Bucket)	0.225	0.218	0.019	0.015
Sprinkler	0.100	0.100	0.005	0.010
Hosepipe (watering)	0.150	0.150	0.019	0.019
Watering Can	0.250	0.250	0.020	0.026
Miscellaneous component	1.000	1.000	0.350	0.919

Table 9: Base year assumptions

The breakdown of micro-component PCCs for metered and unmetered households are displayed in Table 10.

Metered			Unmetered		
Component	**l/h/d**	**%**	**Component**	**l/h/d**	**%**
Toilet Use	37.7	28%	Toilet Use	43.5	27%
Personal washing	53.7	39%	Personal washing	69.1	42%
Clothes washing	13.8	10%	Clothes washing	12.7	8%
Dish washing	18.4	14%	Dish washing	19.0	12%
Outdoor use	1.7	1%	Outdoor use	2.2	1%
Other	8.6	6%	Other	12.0	7%
Miscellaneous	2.1	2%	Miscellaneous	5.5	3%
Total	**136.0**	**100%**	**Total**	**164.0**	**100%**

Table 10: Base year metered and unmetered household demand

3.2 Forecasting the potable water customer base

3.2.1 Population forecast[7]

The population served by the Company is set to increase over the next 25 years and beyond. The Company produces company-specific population forecasts to inform the supply demand balance and maintain continued security of supply. As discussed in the methodology and from what has been referenced in the appendix, the material available from which to evidence this forecast is considerable, although there will always be inherent uncertainties surrounding forecasts of this nature.

To ensure a consistent methodological approach when determining a company-specific forecast, Experian were commissioned to undertake a joint housing and population study for the South East on behalf of a number of water utility companies, including Veolia Water Southeast. From this work, three company specific forecasts were produced:

- The policy scenario forecasts a population increase of **26%** (33,016), from 152,090 in 2001 to 185,106 in 2040.
- The most-likely scenario forecasts a population increase of **30%** (45,289) from 152,090 in 2001 to 197,379 in 2040.
- The trend scenario indicates an increase of **33%** (50,453), from 152,090 in 2001 to 202,543 in 2040.

The Water Resources Management Planning Guidelines recommend that each water company forecasts the population supplied based on a policy-based projection. Recent revisions to the national population forecast made by the Office of National Statistics (ONS) have been incorporated into revised Experian forecasts in November 2008. The Policy based projection has been used for the final WRMP.

The main factors driving the population revision from the 2004 mid-year estimates (used in Experian's forecasts for the draft WRMP) to the revised 2006 mid-year estimates (used in

[7] Population forecast report – February 2009 (available upon request)

the final plan), are the amended birth rate, death rate and migration estimates. Recent trends have shown that birth rates and migration are higher than previously forecast with death rates being lower. When these revisions are applied, the resulting forecast projects a higher than previously envisaged population level by 6.3% above the 2004-based projections.

These forecasts are shown on Figure 3.

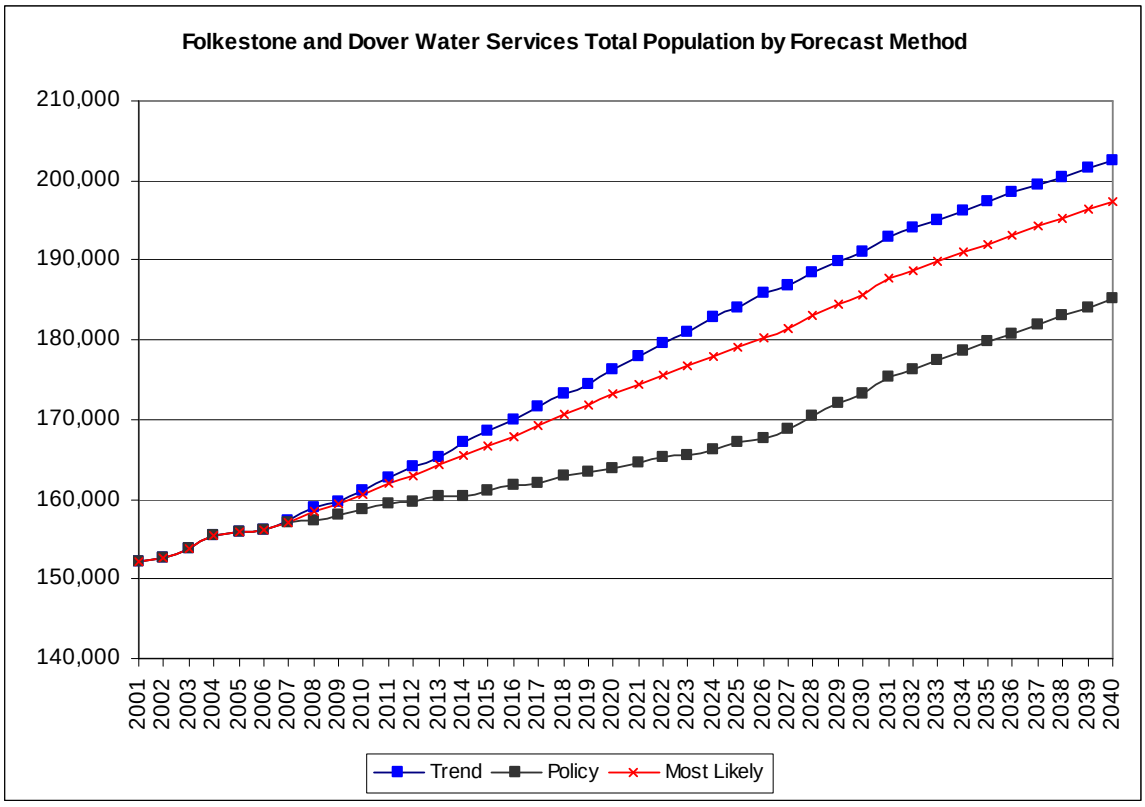

Figure 3: VWSE total population forecast

3.2.2 Housing forecast[8]

The demand for housing in the South East of England particularly, shows little sign of abating in the long term, despite a sharp economic downturn started in the autumn of 2008. The growing population and present housing stock shortfall is resulting in strong 'top-down' targets for new dwellings in order to meet this demand.

The Company produces company-specific housing growth forecasts in order to ensure a continued level of supply now and in the future. These forecasts use best available information from a national, regional and local scale.

Often site specific knowledge is also important, for example where planned developments occur close to a supply boundary. In these circumstances closer inspection is required to assess the precise housing numbers that fall within the Company's supply area.

[8] Housing forecast report – February 2009 (available upon request)

To ensure a consistent methodological approach when calculating the Company's housing forecast, Experian were commissioned to undertake a joint housing and population study for the South East. This study was carried out on behalf of a number of water utility companies, including Veolia Water Southeast.

The Company also undertook an internal review of housing build rates which further supports an understanding of expected growth.

From this work four Company-specific forecasts were produced:

- The policy scenario forecasts an increase in housing stock of **42%** (27,078 dwellings), from 64,362 in 2001 to 91,440 in 2040. This method aligns the trend-based estimates with the housing allocations, promulgated in regional plans.
- The policy scenario with economic downturn. The policy forecast has been amended to reflect the current economic conditions with a downturn in the cumulative households built from 2010, and recovering by 2022.
- The most-likely scenario forecasts a housing increase of **52%** (32,254), from 64,362 in 2001 to 97,616 in 2040. There is a divergence between the trend and policy projections. The most likely scenario is Experian's subsequent best estimate of household growth, given all the available information.
- The trend scenario projects a housing increase of **56%** (35,836 dwellings), from a 2001 level of 64,362 to 100,198 in 2040. This methodology utilises 2001 Census and the most up-to-date sub-national estimates and projections from the Office of National Statistics.

The forecasts have been updated following recent revisions to the national population forecast made by the Office of National Statistics (ONS) (which impact on all three scenarios), and proposed amendments to the South East Plan housing allocations.

In light of the very rapid changes and latest information on the recession, the Company decided to reflect the 'economic downturn' in its household forecast and created a Policy with economic downturn scenario. For this scenario, the build rate is reduced, compared to Policy without the downturn, for the years 2010 – 2013 inclusive, then increases above the Policy rate for the years 2014 – 2022. The average number of houses built in the last five years has been around 550 per year. Due to the severity of the economic downturn and the recent fall in number of applications for new connections, the Company estimates that between 2010 and 2013 250 new properties each year will be connected to the Company's water supply network.

The Company predicts a beginning of recovery from 2014 and estimates that 650 new properties per year would be connected in 2014 and 2015, then increasing to 823 properties per year between 2016 and 2022. In 2023, the total number of houses built is the same for the Policy forecasts with and without the economic downturn. From 2023 onwards, the number of households built every year is the same for the Policy forecast.

For the final plan, the Policy forecast (amended to account for the South East Plan housing allocations and the economic downturn) has been used as recommended in the Environment Agency's Water Resources Management Planning Guidelines.

These forecasts are shown on Figure 4.

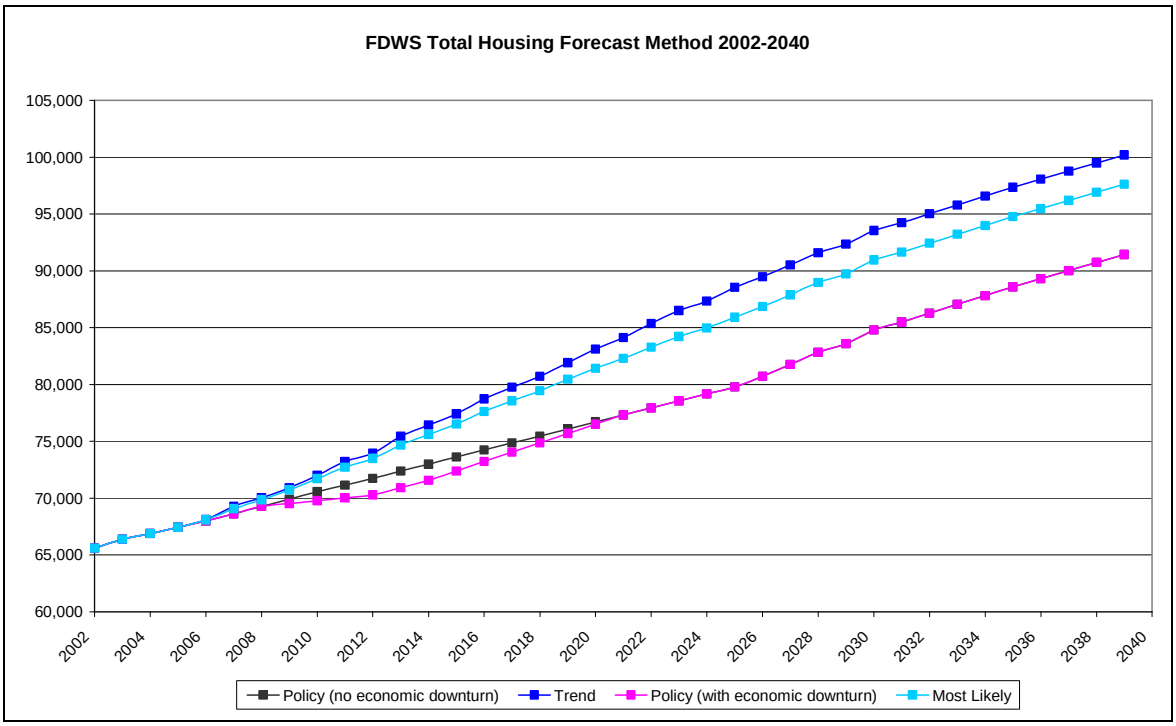

Figure 4: VWSE total housing forecast

3.2.3 PCC forecast[9]

Methodology

The micro-component model provides an understanding of how domestic customers use water, and how this use is forecasted to change in the future. The model identifies the main components of water use for a typical household. The following equation shows how the consumption figure for each component is calculated.

Ownership (O) * Frequency (F) * Volume (V) = Consumption (litres/person/day)

Example for a washing machine: an assumption is made as to how many homes own a washing machine, and how many times a day that machine is used. An understanding of the market penetration of certain models, and using best available national data, gives an average volume of water each machine consumes per use.

[9] Domestic micro-component forecast report – February 2009 (available upon request)

The specific equation may read as follows.

O (90% or 0.9) * F (0.3 uses/person/day) * V (50 litres/use) = 13.5 litres/person/day

Or **0.9 * 0.3 * 50 = 13.5 litre/person/day**

The full model is developed within Microsoft Excel, and is based on a simple concept as seen in the consumption equation above. In its most basic form, it is a series of O, F and V equations, summed to give a total PCC. This calculation is repeated year on year to produce a forecast, taking into consideration projected changes in the O, F and V estimates. The model is calibrated in the base year (2005/06) to the PCC calculated from the water balance, the Southern Area Study monitor and the known billed metered consumptions.

The measured PCC is derived from volumes from the Company's billing system and are re-apportioned from the measured population rate from the occupancy survey. The unmeasured PCC is derived from the Southern Area Group Study, reported at Company level.

The model is built around a series of spreadsheets including:

- Ownership of appliances (measured & unmeasured),
- Frequency of use of the appliances (measured & unmeasured),
- Volume of use for each appliance,
- Consumption of water (measured & unmeasured).

Assumptions

To account for the uncertainty around a central forecast, a low and high set of forecast assumptions were also produced. These used the same base year assumptions as the central forecast, highlighting the uncertainties behind the potential future behavioural changes.

- Micro-component categories assumptions

The following sections look at the assumptions made for each component and for each of the forecast types. The base year assumptions are:

Appliance	Ownership Growth Factor		Frequency Growth Factor	
	Metered	Un-Metered	Metered	Un-Metered
Toilet Standard	-0.046	-0.046	0.000	0.000
Toilet Dual Flush	0.046	0.046	0.000	0.000
Bath (standard size)	-0.002	-0.002	-0.003	-0.003
Power Shower	0.013	0.013	0.003	0.003
Normal Shower	-0.004	-0.004	0.000	0.000
Hand Basin	0.000	0.000	0.000	0.000
Kitchen Tap (cooking / cleaning / drinking)	0.000	0.000	0.000	0.000
Washing Machine	0.006	0.006	0.000	0.000
Clothes Washing (by hand)	0.000	0.000	0.000	0.000
Dishwasher (post 2001)	0.022	0.022	0.000	0.000
Dish washing (by hand)	0.000	0.000	-0.037	-0.037
Water Softener	0.000	0.000	0.000	0.000
Car washing (Hosepipe & Trigger nozzle)	0.000	0.000	-0.001	-0.001
Car washing (Bucket)	0.000	0.000	-0.001	-0.001
Sprinkler	0.000	0.000	0.000	0.000
Hosepipe (watering)	0.000	0.000	0.000	0.000
Watering Can	0.000	0.000	0.000	0.000
Miscellaneous component	0.000	0.000	0.000	0.000

- Volume assumptions

A decision was made to keep the volume assumptions constant over the forecast period. Base year micro-components were selected so that ownership and frequency can switch from existing models to more efficient versions if required.

The following table summarises the micro-components used in the model, and a brief summary of where the volume assumptions were derived from.

Micro-component	Volume (litres per use/event)	Evidence Base
Standard WC	9	The range in WC volumes range to >13l although MTP evidence suggests that 9l WC's have the greatest market penetration at the current time.
Low Flush WC	6	Low flush WC's also vary in volume. Since 2001 guidance has been that 6l is the maximum cistern volume permitted and as such is used as the assumed volume.
Bath	88/80	There are a range of bath volumes in the market place. With an increasing prevalence toward much larger than standard luxury baths. However, the Market Transformation Programme (MTP) report that a standard bath volume is 88l.
Power Shower	60	The volume a shower uses is a function of time spent and flow rate, both of which vary considerably. Evidence from the Code for Sustainable Homes and MTP suggest that a flow rate of 12l/min is standard and the EA suggests that average shower times are towards 10min. Therefore, for this reason and based on supporting literature research, the Company has chosen a 5min shower time. This equates to 96l/use.
Standard Shower	30	As per the power shower although flow rate has been reduced to 6l which equates to a volume figure of 30l/use.
Hand Basin	6	Assumes a 2 litre volume per operation. This figure is supported by MTP evidence
Kitchen Tap	3	Assumes 3 litres for washing vegetables drinking and cooking water.
Washing Machine	50	Volume per use of washing machines is a factor of their age and model type. The range is varied although an agreed figure of circa 50l is broadly agreed as standard.
Clothes Washing (by hand)	32	This figure assumes that each time clothes are washed by hand it takes one full sink of water (16l) to soap them and another full sink to rinse them. Evidence to support this further is light.
Dishwasher	30	A 2004 study by Moran *et al*. identified dishwasher consumption to be on average 30l per use. Pending further data and future penetration of more efficient designs this figure has been used.
Dish washing (by hand)	16	Assumes that on average a washing-up bowl of water (circa 8l) and approx. 1 minute 'rinse time' circa 8l per washing event.
Water Softener	12.5	An internal review of the current market penetration of washer softeners, each with varying rates of regeneration, provided an average figure of 16l per person per regeneration.
Car Washing (Hosepipe)	300	Date varies widely although a Waterwise figure of 300l per event correlated closely with an internal monitoring trial and so has been used.
Car Washing (Bucket)	35	Assumes 3-4 buckets per wash at circa 10l/bucket supported by both an internal trial and Waterwise data.
Sprinkler	1000	Waterwise data suggesting that when used a sprinkler is used for approximately 60 minutes. At 10l per minute flow rate this correlated to circa 1000l per use.
Hosepipe (watering)	300	At a flow rate of 10l per minute an average 'plant watering event' of 30 minutes would consume circa 300l of water.
Watering Can	8	The average volume of a watering can in 8l. This volume assumes that the watering can is filled to capacity and the water contained therein used completely.
Miscellaneous	6	Assumes a 30 second -1 minute unaccounted for daily tap run at circa 6-8l/min.

The assumed volumes are continually reviewed and amendments will be made where required.

Results

Modelling the domestic demand for water, using a micro-component approach, provides a useful guide to demand over the planning period. The model assumptions have been based on a comprehensive customer survey, of sufficient size to ensure that it was fully representative of the Company. This provided detailed base year assumptions on water use that were then added to the calculated unmeasured and measured PCC (Table 11).

	Metered PCC			Un-Metered PCC		
	Lower	Central	Upper	Lower	Central	Upper
2007	134.9	136.0	137.3	162.8	164.0	165.2
2008	133.4	135.3	137.7	161.1	163.5	165.8
2009	132.1	134.5	138.1	160.0	163.0	166.5
2010	130.7	133.8	138.6	158.9	162.5	167.1
2011	129.6	133.0	139.1	158.0	162.0	167.8
2012	128.5	132.3	139.5	157.1	161.5	168.5
2013	127.4	131.5	140.0	156.3	161.0	169.1
2014	126.3	130.8	140.5	155.4	160.5	169.8
2015	125.2	130.1	141.0	154.5	160.0	170.6
2016	124.1	129.3	141.5	153.6	159.6	171.3
2017	123.0	128.6	142.0	152.7	159.1	172.0
2018	121.8	127.9	142.5	151.8	158.7	172.8
2019	120.6	127.1	142.9	150.9	158.2	173.5
2020	119.4	126.3	143.4	150.0	157.8	174.3
2021	118.3	125.7	143.9	149.1	157.4	175.0
2022	117.8	125.6	145.1	148.3	157.1	175.9
2023	117.3	125.5	146.2	147.7	157.0	177.0
2024	116.8	125.5	147.4	147.7	157.5	178.7
2025	116.3	125.4	148.6	147.7	158.0	180.4
2026	115.8	125.4	149.8	147.6	158.5	182.1
2027	115.3	125.4	151.0	147.6	159.0	183.8
2028	114.7	125.3	152.1	147.5	159.6	185.6
2029	114.0	125.1	153.1	147.4	160.1	187.3
2030	113.3	124.9	154.1	147.3	160.6	189.0
2031	112.6	124.7	155.1	147.2	161.0	190.6
2032	112.5	124.5	156.2	147.7	161.5	192.3
2033	112.5	124.3	157.2	148.2	162.0	194.1
2034	112.4	124.7	158.2	148.7	163.1	195.8
2035	112.4	125.1	159.3	149.2	164.2	197.5

Table 11: PCC forecasts

PCC of metered customers is expected to fall from 136l/h/d in the base year to 125l/h/d in 2035 in the Central forecast. The Company expects to achieve 130 PCC by 2015 for its metered customers, which is in line with the Government aspirational target. Unmetered PCC is forecast to decrease from 164l/h/d in the base year to 157.0 in 2023, and then to rise to 164l/h/d in 2035.

Uncertainty bounds from these estimates indicate that metered PCC may be up to 12.7 l/h/d less or 34.2 l/h/day greater than the Central forecast by 2035. Unmetered consumption at the end of the forecast ranges from 149.2 to 197.5 l/h/day – an envelope of 48.3 l/h/day or 29% of the Central forecast.

The Company considers that given the accuracy of the data used to benchmark the base year, the Central forecast projects a sound basis from which to consider future demand. The Low and High forecasts are also considered solid outliers, from which to base the considerable uncertainty about a forecast of this type. The Central forecast is recognised as the most robust at this time. The Low and High forecasts use the same base year assumptions as the Central forecast, but include uncertainties around potential future behavioural changes. These forecasts are used in the headroom analysis.

The Company has also calculated the combined PCC for the Central forecast, as shown in Figure 5 below.

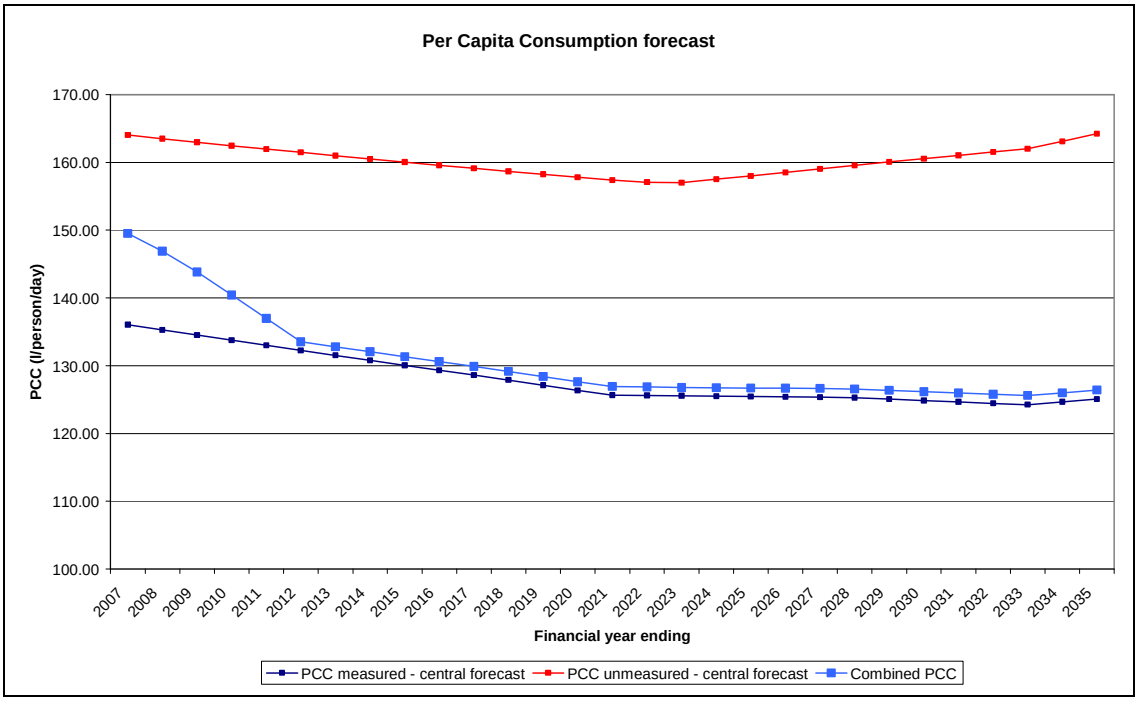

Figure 5: Central PCC forecasts

3.2.4 Commercial forecast[10]

The forecasting methodology that has been used is a two stage process. Firstly, regression analyses have been carried out to establish relationships between commercial demand and the relevant economic explanatory variables based on historic data for a period of 8 years from 1998/99 to 2005/06. Secondly, specific forecasts have been provided for some large users by the Company, and for the residual demand the economic relationships have been extrapolated forward to forecast future demand over a 30-year period to 2036/37 based on long-term forecasts of economic growth.

[10] Commercial demand forecast report – January 2009 (available upon request)

This proposed methodology follows industry best practice guidance as set out by UKWIR in *Demand Forecasting Methodology* (1995) and *Forecasting Water Demand Components - Best Practice Manual* (1997), and is similar to the methodology used by Atkins for PR04. Regression analyses have been carried out to explain the Company's commercial consumption as a function of UK regional data for both Real Gross Values Added (GVA) and Employment for the South East Region of the UK. This work has been carried out separately for all categories, Services, and Industry & Manufacturing.

The best relationships that have been established (based on the R-squared regression values) have then been used to forecast future demand through 2036/37 based on forecasts for the underlying economic factors.

The Company extracted the consumption data for large users from Hi-Affinity for 2006/07 and 2007/08 and an estimate was derived for 2008/09. For the following large users: British Energy, Magnox and Kent Salads, the Company was given specific consumption forecasts by the companies themselves.

The commercial forecast was revised between draft and final plans to reflect the impact of the economic downturn. The forecast is based on a reduction in GVA growth which was initially forecasted to stay constant at 3% per annum. The economic downturn impacts on yearly GVA growth.

The growth forecast is used to forecast the consumption at Company level. This allowed us to assess the % change in total consumption year on year. The % change is also used to calculate the consumption forecast of each large user.

Following the derivation of the central economic forecast of GVA growth of 3% per annum, the impact of changes in the economic outlook for the UK and the South East region in particular, have been assessed on the following basis:

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
GVA	-2%	0%	0%	3%	3%	3%	3%
% change	-6.3%	-8.9%	-4.9%	-0.1%	-0.1%	-0.1%	-0.1%

Table 12: GVA growth assumptions for economic downturn

There are significant step changes in the total consumption forecast over the periods 2006/07 to 2009/10 and 2018/19 to 2021/22. Figure 6 reflects the significant drops in demand at Dungeness A (2007) and Dungeness B (2020) as a result of projected closure dates, and at Kent Salads (2010) as a result of the implementation of a more water efficient mode of operation. Kent Salads have installed a water recycling plant on site, which will reuse 65% of the water. The plant should be operational in the autumn 2009.

In addition, a large leak was found on the British Energy's network in September 2008. The repair of the leak resulted in a 22% reduction of BE overall consumption, which had a significant impact on the overall demand forecasts. This has now been accounted for in the demand forecast.

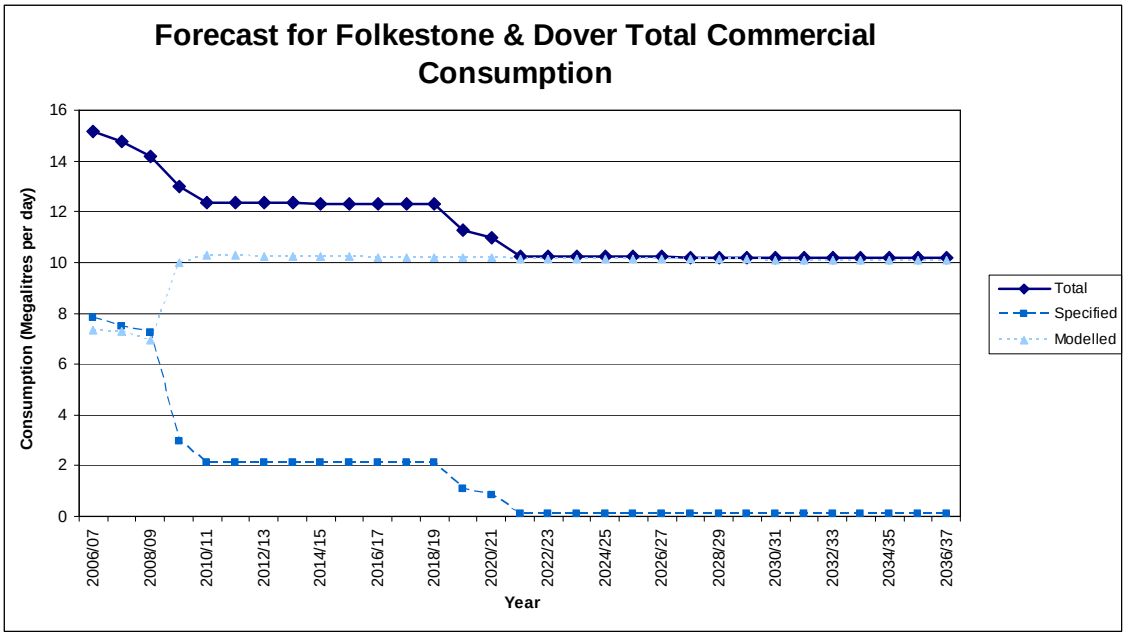

Figure 6: Total Commercial Consumption

3.3 Demand forecast model[11]

A number of work streams and technical reports form part of the demand forecast.

- Population forecast
- Household forecast
- Micro-component forecast
- Commercial forecast
- Sustainable Economic Level of Leakage

Those forecasts are transferred in the demand forecasting model, which comprises three core spreadsheets: demand forecast drivers, normal year and dry year sheets.

Demand forecast drivers contain the majority of the outputs from the above forecasts. Normal year contains the water balance for normal year average and peak and the same for dry year is in the dry year sheet.

Occupancy rates forecast are calculated for the previous year for new properties, optants, selective meters, un-metered and metered. These occupancy rates are used to calculate the next years' population according to the household forecast and metering programme.

Housing numbers influence the numbers of people in each customer category but generally have little impact on the demand forecast. There is a limited impact as a result of average supply pipe leakage in metered properties.

[11] Demand forecast report – February 2009 (available upon request)

Micro-component forecasts give the input numbers for the demand forecast. These are used in the demand forecast drivers sheet as annual increments in PCC. These are used in the calculation of water delivered for each customer category. According to a complex interplay of population, occupancy rate, metering estimates and the metering programme the PCCs are recalculated for each year. As a result, the final PCCs in the demand forecast do not match the PCCs in the micro-component report and WRP7 of the WRMP tables.

Metered commercial forecasts are entered directly into the demand forecast drivers sheet. No change is estimated for un-metered commercial.

Future changes in leakage are modelled against other scheme options in the economic modelling. Incremental changes in leakage are selected on economic grounds.

Zonal peak and dry year factors have been derived by making an assessment of historic peaks. A nominal increase has been predicted for commercial customers. Metered domestic customers are estimated to use 30% less in a dry year and in peak than un-metered customers. The unmetered factors are used to calibrate to the zonal peak factors. This methodology allows for savings at peak and dry year as a result of the metering programme to be hard wired into the demand forecast.

The baseline demand forecast used in the final plan is shown in Figure 7.

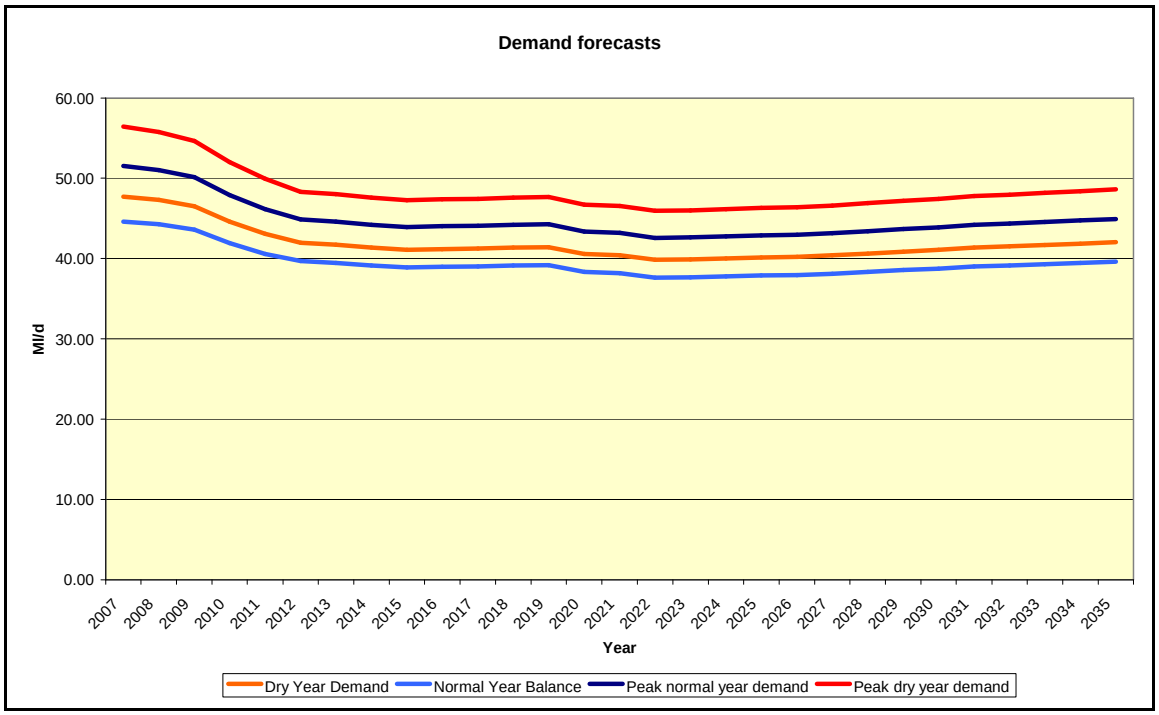

Figure 7: Demand Forecasts (Distribution Input)

For all scenarios, total demand is forecast to reduce to 2022 then increase slightly to the end of the forecast. Dry year average demand falls from 47.30 Ml/d in 2007/08 to 42.05 Ml/d by 2034/35; demand during the dry year critical period falls from 57.76 Ml/d in 2007/08 to 48.61 Ml/d in 2034/35.

3.4 Metering

The Company is acutely aware of the need to promote the efficient use of water by its customers and to conserve water resources. A policy of demand management to achieve this aim, through compulsory and subsidised optional metering, has been in place since 1993.

In 2000, the Company commenced a free meter option scheme for all households and introduced a policy of compulsorily metering all customers with swimming pools. All unmeasured commercial properties were also compulsorily metered.

The Company's strategy in its 2002/03 submission was to achieve 90% of all domestic properties paying for water by measured volume by 2015. This required the installation of a water meter to all unmeasured properties throughout the area of supply in a 10-year programme. Only properties with complex plumbing arrangements that would require significant alteration in order to be metered would not have a meter installed. Where meters are not able to be installed, the property would be transferred from the Rateable Value based tariff to the current Domestic Assessed Tariff that is based on occupancy.

The current strategy has been developed from the previous position, in the light of experience gained in the current period. Successful in its application for 'Area of Water Scarcity' status on 1st March 2006, the Company has moved from a change of hands strategy to a compulsory metering programme based on zonal metering. In addition, the Company is targeting a higher meter penetration of 96% (all properties excluding only the most complex plumbing arrangements), compared to 90%; and to accelerate metering delivery complete by April 2012, rather than 2015 as originally proposed. The Company consulted with customers on these changes as part of the development of the Strategic Direction Statement. Positive feedback was also obtained through responses to the consultation on the draft WRMP.

The change in strategy reflects a number of drivers:

- Support from customers who view metering as the fairest way of paying for water;
- The contribution earlier metering provided to the supply/demand balance;
- The benefits arising from reducing the environmental impacts of the Company's operation and empowering customers to do the same – an area the willingness to pay surveys showed strong customer support for;
- Demonstrating the Company's commitment to metering as part of a wider demand reduction strategy;
- Establishing full metering to provide a platform from which other water efficient measures can be delivered, such as stepped-tariff, but also other measures such as retrofit trials etc.

The Company metering strategy will be delivered through the following activities:

- Selective Metering: Operating a compulsory metering policy in line with the Company's status as an Area of Water Scarcity to deliver 96% metering by April 2012. Delivery of metering is on a zonal basis.

- Change of Hands: The Company no longer operates a change of hands metering policy as it is less efficient than selective metering.
- Meter Optants: the Meter Option scheme will continue to operate as it is a requirement under the Water Industry Act 1991.
- New Properties. All new properties will continue to be metered on connection.

The Company is currently ahead of its AMP4 metering targets and proposed to Ofwat to out-perform the AMP4 position as part of achieving its strategy of full metering by April 2012. A log-up application was approved by Ofwat in January 2009, and the final WRMP and Business Plan reflect the agreed outcome.

AMP4/AMP5 Metering programme – PR04 forecast

Table 13 and Table 14 show the metering programme for AMP4 and AMP5 as forecast in the Business Plan 2004.

PR04 forecast	2005/06	2006/07	2007/08	2008/09	2009/10	Total AMP4
New properties	693	605	619	735	692	3,344
Optants	1,168	1,016	887	776	681	4,528
Selective programme	1,672	2,443	2,567	2,688	2,804	12,174
Number of meters installed - TOTAL	**3,533**	**4,064**	**4,073**	**4,199**	**4,177**	**20,046**
Metering penetration %	**44%**	**50%**	**55%**	**61%**	**66%**	

Table 13: AMP4 metering programme – PR04 forecast

PR04 forecast	2010/11	2011/12	2012/13	2013/14	2014/15	Total AMP5
New properties	765	818	794	741	666	3,784
Optants	598	527	466	412	366	2,369
Selective programme	2,926	3,042	3,157	3,023	2,897	15,045
Number of meters installed - TOTAL	**4,289**	**4,387**	**4,417**	**4,176**	**3,929**	**21,198**
Metering penetration %	**71%**	**76%**	**81%**	**86%**	**90%**	

Table 14: AMP5 metering programme – PR04 forecast

AMP4/AMP5 Metering programme – Actual & PR09 forecast

Table 15 shows the actual number of meters installed in 2006, 2007 and 2008. The Company is currently planning to meet the overall AMP4 meters installed target, although the split between new properties, optants and selective may be different to that anticipated at PR04.

Between draft and final plan, the Company applied for a log-up on selective meters. This was approved and the final Business Plan reflects the revised position, as shown in Table 15.

PR09 forecast	2005/06 (actual)	2006/07 (actual)	2007/08 (actual)	2008/09	2009/10	Total AMP4
New properties	599	414	387*	741**	250***	2,391
Optants	1,441	1,731	911	591	592	5,266
Selective programme	2,115	3,387	2,883	2,909	7,669	18,963
Number of meters installed – TOTAL	**4,155**	**5,532**	**4,181**	**4,241**	**8,511**	**26,620**
Metering penetration %	**47%**	**55%**	**60%**	**66%**	**78%**	

Table 15: AMP4 metering programme – actual & PR09 forecast

* The Company highlighted that the figure of 250 reported for JR08 Table 7 excludes some 140 installed meters which were not yet in charge.
** 682 meters have been installed between 01/04/2008 and 21/01/2009. The Company estimates that around 60 properties will be connected to the supply area in February and March 2009.
*** Due to the current economic situation, the Company expects the number of new properties to be lower than in previous years.

In AMP5 and beyond, metering will continue to form an integral part of the supply/demand baseline and the Company will target an accelerated programme of meter installations to a level of 96% meter penetration of the domestic customer base by April 2012, as detailed in Table 16.

PR09 forecast	2010/11	2011/12	2012/13	2013/14	2014/15	Total AMP5
New properties*	250	250	250	650	650	2,050
Optants	500	250	0	0	0	750
Selective programme	6,000	6,350	0	0	0	12,450
Number of meters installed - TOTAL	**6,850**	**6,850**	**250**	**650**	**650**	**15,250**
Metering penetration %	**87%**	**96%**	**96%**	**96%**	**96%**	

Table 16: AMP5 metering programme – PR09 forecast

New properties forecast reflect the economic downturn. The Company estimates a start of recovery in the housing market in 2013/14.

The following benefits of the proposed metering strategy are identified:

- Minimum 1.5Ml/d savings in demand by April 2012.
- A strong metering policy supports the development of new resource projects required as part of the Business Plan. Whilst the savings attributable to the metering programme are not sufficient to significantly alter the introduction of major new resource schemes, the timing of such schemes may well be delayed. This 'twin track approach', therefore, provides benefits to the environment and is an essential component in the regulatory approval process.
- Metering strongly links to the widening of customers' awareness of the need for water conservation.
- Full metering is necessary for the roll out of the socially responsible stepped tariff scheme.

As can be seen from Figure 8 below, the target of 96% metered household base will be achieved by accelerating the rate of meter penetration to around 6,000 meters per annum over the first 2 years of the AMP5 period.

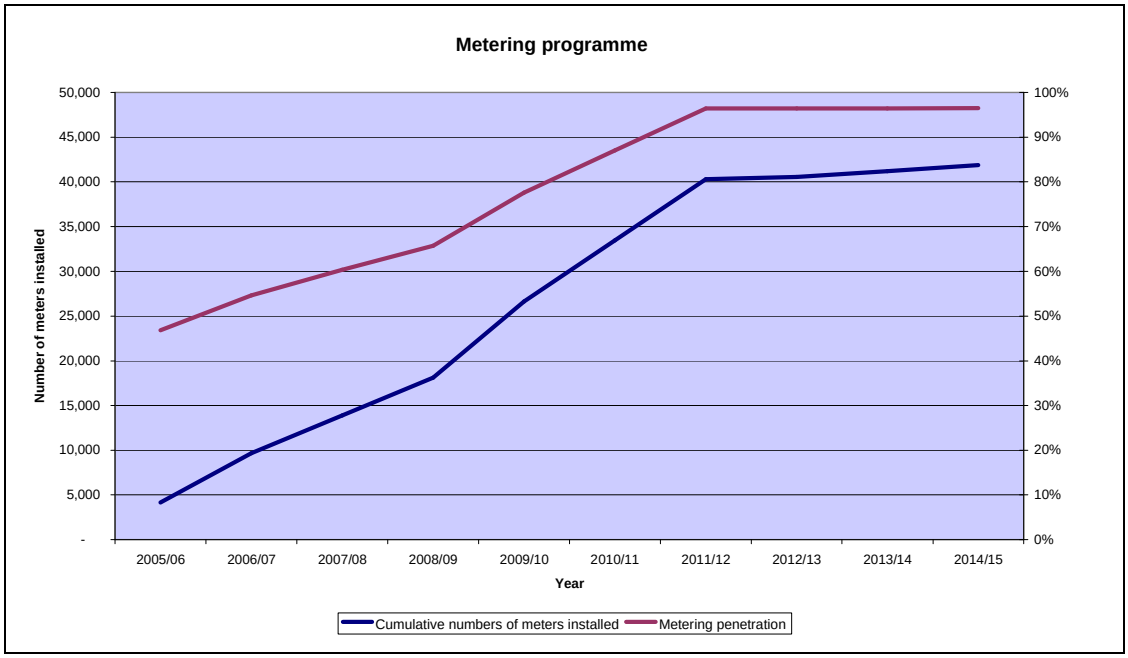

Figure 8: Metering programme AMP4 & AMP5

3.5 Water efficiency

The water efficiency programme has been defined according to Ofwat's assumed savings table presented in *Future water efficiency targets, 2007* report.

The Company has incorporated the 0.07 Ml/day/year Water Efficiency Target set by Ofwat into its final Business Plan projections. The water efficiency strategy and associated costs to achieve the annual target are detailed in the tables in this section and represent the Company's current plans at the time of final plan's submission. They are all based on the information given by Ofwat at that time.

The Company plans to carry out a variety of water efficiency activities during AMP5 with both commercial and domestic customers, with savings estimated for each activity in line with Ofwat's allowance table.

Table 17 identifies in each activity the number of devices that would be needed in order to achieve the target using just that one activity. This was the starting point for planning the water efficiency programme to achieve the target.

Type	Activity	Take up by	OFWAT Savings l/prop/day	OFWAT uptake	No. installed to meet Water Efficiency target of 0.07Ml/d per year
Shower	Shower Head Aerated	Fitted by customer	29.00	100%	2,414
Toilet	Hippo	Unsolicited	27.50	10%	2,545
Basin	Tap inserts	Fitted by customer	16.00	100%	4,375
Self Audit	Self audit - other eg. online	Unsolicited	10.00	10%	7,000
Garden	Water Butts 190	Bought and fitted by customer	3.12	100%	22,412
Garden	Water butts 100 litre	Bought and fitted by customer	1.64	100%	42,583
Garden	Pot plant gel crystals	Other	0.10	25%	700,000
Toilet	Hippo	Requested	27.50	70%	2,545
Toilet	Save a flush	Requested	11.00	70%	6,364
Toilet	Hippo	Distributed	27.50	20%	2,545
Toilet	Hippo COMMERCIAL FDWS	Fitted by company	50.00	100%	1,400
Commercial	Water Efficiency / Recycling advice / Schools	Company proactive approach	1000.00	100%	70
Self Audit	Self audit - request	Requested	10.00	70%	7,000
Toilet	Hippo	Company	27.50	100%	2,545
Basin	Cistern overflow repair	Fitted by company	20.00	100%	3,500
Toilet	Flush-wiser	Fitted by company	22.00	100%	3,182
Basin	Tap inserts	Fitted by company	16.00	100%	4,375
Basin	Retrofit Push Tap	Fitted by company	30.00	100%	2,333
Basin	Tap rewashering	Fitted by company	12.00	100%	5,833
Basin	Miracle Tap	Fitted by company	14.00	100%	5,000
Toilet	Eco-Beta flush break systems	Fitted by company	23.00	100%	3,043
Shower	Shower Heads Challis	Fitted by company	29.00	100%	2,414
Toilet	Save a flush	Fitted by company	11.00	100%	6,364
Self Audit	Self audit - welcome pack	Distributed	10.00	20%	7,000
Garden	Hose trigger gun	Requested	2.00	100%	35,000
Toilet	Save a flush	Unsolicited	11.00	10%	6,364
Toilet	Retrofit, dual flush systems	Fitted by company	23.00	100%	3,043
Toilet	Save a flush	Distributed	11.00	20%	6,364
Metering	Selective metering	Company	33.00	100%	2,121
Shower	Shower Timers	Distributed	5.00	23%	14,000
Garden	Hose trigger gun	Other	2.00	25%	35,000
Metering	Optant metering	Company	16.50	100%	4,242
Garden	Pot plant gel crystals	Requested	0.10	100%	700,000

Table 17: Number of items to be installed to meet the Water Efficiency target according to Ofwat savings

The cost of each form of activity was then evaluated and the potential limits on each form of activity derived taking account of previous similar activities to ensure no double counting of potential savings.

From the activity lists and taking on board limits on potential for each activity, the above activity list was created to minimise costs and maximise savings.

Table 18 identifies the specific activities and level of activity that will achieve the total annual Ofwat target for each year of AMP5.

Type	Activity	Take up by	Numbers 2010/11	Numbers 2011/12	Numbers 2012/13	Numbers 2013/14	Numbers 2014/15
Shower	Shower Head Aerated	Fitted by customer	0	0	0	0	0
Toilet	Hippo	Unsolicited	0	0	0	0	0
Basin	Tap inserts	Fitted by customer	0	0	0	0	0
Self Audit	Self audit - other eg. online	Unsolicited	1,000	1,000	1,000	1,000	1,000
Garden	Water Butts 190	Bought and fitted by customer	200	200	200	200	200
Garden	Water butts 100 litre	Bought and fitted by customer	150	150	150	150	150
Garden	Pot plant gel crystals	Other	0	0	0	0	0
Toilet	Hippo	Requested	100	100	100	100	100
Toilet	Save a flush	Requested	0	0	0	0	0
Toilet	Hippo	Distributed	6,000	6,100	0	0	0
Toilet	Hippo COMMERCIAL FDWS	Fitted by company	100	100	400	400	400
Commercial	Water Efficiency / Recycling advice / Schools	Company proactive approach	25	25	30	30	30
Self Audit	Self audit - request	Requested	50	50	50	50	50
Toilet	Hippo	Company	0	0	0	0	0
Basin	Cistern overflow repair	Fitted by company	20	20	20	20	20
Toilet	Flush-wiser	Fitted by company	0	0	0	0	0
Basin	Tap inserts	Fitted by company	0	0	50	50	50
Basin	Retrofit Push Tap	Fitted by company	100	100	100	100	100
Basin	Tap rewashering	Fitted by company	50	50	50	50	50
Basin	Miracle Tap	Fitted by company	100	100	100	100	100
Toilet	Eco-Beta flush break systems	Fitted by company	50	50	50	50	50
Shower	Shower Heads Challis	Fitted by company	0	0	100	100	100
Toilet	Save a flush	Fitted by company	0	0	500	500	500
Self Audit	Self audit - welcome pack	Distributed	0	0	0	0	0
Garden	Hose trigger gun	Requested	0	0	0	0	0
Toilet	Save a flush	Unsolicited	0	0	0	0	0
Toilet	Retrofit, dual flush systems	Fitted by company	0	0	0	0	0
Toilet	Save a flush	Distributed	0	0	0	0	0
Metering	Selective metering	Company	0	0	0	0	0
Shower	Shower Timers	Distributed	0	0	0	0	0
Garden	Hose trigger gun	Other	0	0	0	0	0
Metering	Optant metering	Company	0	0	0	0	0
Garden	Pot plant gel crystals	Requested	0	0	0	0	0
		TOTAL	**7,945**	**8,045**	**2,900**	**2,900**	**2,900**

Table 18: Company's water efficiency activities required to meet WE target

In reality, unforeseen opportunities may arise to make additional savings over and above those listed above and in that event the balance of water efficiency activities in that and subsequent years will be reviewed and adjusted to suit.

The Company is part of the WaterUK Water Efficiency Practitioners Group and is looking at optimising savings by using industry best practice wherever possible.

In addition, the Company is working with the EA and SEEDA on their *"Ensuring Water For All"* initiative. Although this covers much of the same ground as has been covered before, it is an alternative view on the topic and may provide some innovative solutions that can be introduced to gain more reliable savings from lower cost solutions.

Table 19 shows the relative level of water savings each of the various water efficiency initiatives proposed will achieve using the Ofwat estimates.

Type	Activity	Take up by	Savings Ml/d 2010/11	Savings Ml/d 2011/12	Savings Ml/d 2012/13	Savings Ml/d 2013/14	Savings Ml/d 2014/15
Shower	Shower Head Aerated	Fitted by customer	0	0	0	0	0
Toilet	Hippo	Unsolicited	0	0	0	0	0
Basin	Tap inserts	Fitted by customer	0	0	0	0	0
Self Audit	Self audit - other eg. online	Unsolicited	0.001	0.001	0.001	0.001	0.001
Garden	Water Butts 190	Bought and fitted by customer	0.0006	0.0006	0.0006	0.0006	0.0006
Garden	Water butts 100 litre	Bought and fitted by customer	0.0002	0.0002	0.0002	0.0002	0.0002
Garden	Pot plant gel crystals	Other	0	0	0	0	0
Toilet	Hippo	Requested	0.0019	0.0019	0.0019	0.0019	0.0019
Toilet	Save a flush	Requested	0	0	0	0	0
Toilet	Hippo	Distributed	0.033	0.034	0	0	0
Toilet	Hippo COMMERCIAL FDWS	Fitted by company	0.005	0.005	0.02	0.02	0.02
Commercial	Water Efficiency / Recycling advice / Schools	Company proactive approach	0.025	0.025	0.03	0.03	0.03
Self Audit	Self audit - request	Requested	0.0004	0.0004	0.0004	0.0004	0.0004
Toilet	Hippo	Company	0	0	0	0	0
Basin	Cistern overflow repair	Fitted by company	0.0004	0.0004	0.0004	0.0004	0.0004
Toilet	Flush-wiser	Fitted by company	0	0	0	0	0
Basin	Tap inserts	Fitted by company	0	0	0.001	0.001	0.001
Basin	Retrofit Push Tap	Fitted by company	0.003	0.003	0.003	0.003	0.003
Basin	Tap rewashering	Fitted by company	0.001	0.001	0.001	0.001	0.001
Basin	Miracle Tap	Fitted by company	0.001	0.001	0.001	0.001	0.001
Toilet	Eco-Beta flush break systems	Fitted by company	0.001	0.001	0.001	0.001	0.001
Shower	Shower Heads Challis	Fitted by company	0	0	0.003	0.003	0.003
Toilet	Save a flush	Fitted by company	0	0	0.006	0.006	0.006
Self Audit	Self audit - welcome pack	Distributed	0	0	0	0	0
Garden	Hose trigger gun	Requested	0	0	0	0	0
Toilet	Save a flush	Unsolicited	0	0	0	0	0
Toilet	Retrofit, dual flush systems	Fitted by company	0	0	0	0	0
Toilet	Save a flush	Distributed	0	0	0	0	0
Metering	Selective metering	Company	0	0	0	0	0
Shower	Shower Timers	Distributed	0	0	0	0	0
Garden	Hose trigger gun	Other	0	0	0	0	0
Metering	Optant metering	Company	0	0	0	0	0
Garden	Pot plant gel crystals	Requested	0	0	0	0	0
		TOTAL savings	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**

Table 19: Estimated savings per water efficiency activity

The Company continues to advise non-domestic customers on water efficiency activities and support their implementation. This involvement has materialised recently with one of the Company's large user installing a water recycling plant on site, which will enable 65% of the water to be recycled.

The Company also engages with planners and developers to ensure new housing and commercial developments meet requirements for water efficiency. The Company also works with schools to support the education of school children on water management, including the environment, waste and water efficiency.

The Company will publish its first report on the experiences and findings from the Lydd tariff trial before the end of 2009. In the meantime, the Company has started the last phase of the trial in Lydd: the retrofit of existing appliances with water efficient devices. 250 customers have replied positively to the Company's offer and work is currently under way. The Company would like to thanks Kent County Council for his support to the project.

3.6 Leakage

The Company's strategy is to reduce leakage levels in order to achieve the sustainable economic level of leakage over a 10-year period. The Company has also considered leakage reduction options as a part of the overall Economic Balance of Supply/Demand and least cost planning objective.

Current leakage strategy

The Company's current strategy consists of two parts: pressure reduction and find and fix. With regard to the latter, the Company has invested in new technology and supplemented Leakage Technicians with additional resource if leakage breakouts cannot be controlled. There is an element the Company hasn't yet introduced, but has planned to do so, which is more efficient monitoring of the DMA nightlines to enhance the awareness of changes from a weekly assessment to a daily assessment. This will allow more effective targeting and reduce run times of the larger breakout areas.

Currently, the Company is divided into 14 hydraulic zones, which in some cases are made up of a number of sub-zones. The Company currently produce a weekly leakage report which is a mixture of flow measurements from zones e.g. reservoir outlet meter (via SCADA) and flow from DMA meters (via telemetered loggers). This is consistent with the baseline demand forecast.

Approximately half of the properties in the Company's supply area are subject to pressure control. There are 124 PRVs, mainly Claval and JRG, installed across the supply area. Approximately, 2/3 of these are operating in order to reduce pressure to properties. The rest are used as control at zonal transfer points or emergency transfers.

AMP5 leakage strategy[12]

Economic Analysis

The economic analysis has been carried out using the WRc APLE™ model (version 5.04). Detailed company data on leakage levels, leakage costs, repair rates, and externalities values for 2007-08 were entered into the model. The APLE™ model has been configured to reflect the Company's water resource zone structure (one zone).

The APLE™ model uses the 'Method A' as detailed in the Tripartite report. It uses steady state costs and transitional costs, cost data is derived from company systems, it includes all costs associated with leakage control and it models the cost leakage relationship using fixed and variable costs.

This analysis uses the Marginal Operating Cost of Water approach. This approach compares the marginal cost of active leakage control with the marginal cost of water. The marginal cost of water is calculated by considering the cost of providing additional capacity from resource/treatment investment. The ELL is the point at which the marginal cost of active leakage control equals the marginal operating cost of water.

A key part of the analysis is the assessment of steady state conditions. The APLE™ model determines both the active leakage control (ALC) costs to maintain leakage at current levels and the costs associated with reducing leakage (or savings associated with allowing leakage to increase).

By incorporating leakage and leakage management externalities it is possible to produce a short run leakage assessment that may be regarded as the sustainable economic level of leakage (SELL).

[12] Economic level of leakage report – January 2009 (available upon request)

Externalities values were evaluated according to the *Best Practice Guidance on the Inclusion of externalities in the ELL calculation* (Ofwat, 2008). They were provided for use in the Company's calculation of SELL using the Marginal Social Operating Cost of Water (MSOC) approach using the APLE software[13].

The results of the assessment are displayed in Table 20 below:

Marginal Operating Cost of Water (p/m3)	Short-run Economic Level of Leakage (Ml/d)	Marginal Social Operating Cost of Water (p/m3)	Short-run Sustainable Economic Level of Leakage (Ml/d)
7.07	8.1	27.67	6.9

Table 20: ELL and SELL results

In 2007/08, the Company annual average level of leakage was 7.9Ml/d which is 1Ml/d (with rounding) above the MSOC-SELL of 6.9Ml/d and therefore further reductions in the short term would be socially economic.

Sensitivity analysis

The SELL assessment revealed that the Company has relatively high marginal environmental costs. This is due to a combination of the following:

- Significant costs associated with angling on reaches of the river Dour affected by Company abstraction (game fishing).
- Significant costs associated with biodiversity and non use at river reaches affected by abstraction sites (Dungeness).

Dungeness is of international conservation importance for its geomorphology, plant and invertebrate communities and birdlife. This is recognised and protected mostly through its conservation designations as a National Nature Reserve (NNR), a Special Protection Area (SPA), a Special Area of Conservation (SAC) and part of the Site of Special Scientific Interest (SSSI).

The marginal environmental costs associated to the abstraction at Dungeness are estimated to be £175.89/Ml, which is equivalent to 17.59p/m3.

The APLE model was run using a marginal social operating cost of water of:

- 7.07p/m3, the private Marginal Operating Cost (MOC) of water for the most appropriate source to use (SRAK).
- 3.02p/m3, the external (carbon and environmental) MOC of water for VWSE sources excluding Dungeness.

The MSOC-SELL using a marginal operating cost of water of 10.09p/m^3 is 7.8Ml/d.

As part of the Habitats Directive Review of Consents process undertaken by the EA, Denge abstraction licence has recently undergone a Medium Priority site Stage 4 assessment in relation to Special Area of Conservation (SAC) and Special Protection Area (SPA) habitats/species.

[13] Calculation of the sustainable economic level of leakage, RPS Report - November 2008

As a result of the Review of Consents process, the EA has indicated that it requires the Company to undertake further work to demonstrate what impact current and possible future operational abstraction patterns would have on the requirements of the Habitats Directive, and thus licence modification to the operational constraints on a number of abstraction wells. It is not expected at this point in time that there will be significant reductions in the Company's abstraction from Denge arising from this study.

Conclusion

As long-term abstraction at Dungeness is uncertain, the Company proposes to adopt the same leakage strategy as in the AMP4 period which consists of reducing leakage by 0.1 Ml/d every year, over the 5-year period. The leakage level to achieve by 2015 would be of 7.5Ml/d. This target would be well below the ELL and the SELL excluding Dungeness. At the end of AMP5, the outcome of the NEP Denge study can be known and the SELL will be reassessed.

The Company is proposing a 0.5Ml/d reduction over the AMP5 period (leakage target at 7.5Ml/d).

Supply pipe leakage

The Company expects supply pipe losses to reduce as metering and water efficiency awareness increase. The Company assumed that supply pipe leakage for measured households will remain at 15l/prop/d throughout the 25-year period.

Nevertheless, the Company remains concerned that savings in supply pipe leakage may not materialise as the cost of repair, which is the responsibility of the customers, may be high compared to the values of water lost. If customers do not repair leaks at a higher rate than they arise, then the average rate of supply pipe leakage will increase over time. This situation could also be adversely affected by the current recession.

4 Climate change

4.1 Supply[14]

The Company has no surface water resources, thus none needs to be evaluated for impacts of climate change.

The Company also imports water from Southern Water and South-East Water (previously Mid Kent Water). Both imports are based on groundwater sources. It has been assumed that the agreed import volumes will be upheld for the duration of the current agreements. The Company estimates that they will be entitled to take up to their full allowance, and that the other water companies will manage their other resources to enable this.

The impact of climate change on groundwater is a complex issue and does not lend itself to easy solution. Of critical importance is the amount of effective rainfall that occurs over the recharge period from September to April. Generally, summer rainfall does not contribute in significant volumes to recharge; therefore drier summers have little impact on recharge volumes, although rainfall may support water levels, allowing them to decline less rapidly.

As most climate models indicate wetter winters and drier summers, there should be more winter recharge, thus more groundwater availability than at present. However, variability is also a significant feature of climate change, and not all winters will be higher than average, and intense summer storms may provide significant summer recharge, as has happened in recent years. The increase in variability will make it more likely that an extended sequence of dry winters could occur.

From experience, we know that the Company groundwater sources are robust to one dry winter (dry being 75-80% of long term average rainfall). Two such dry winters result in significantly lower groundwater levels, reduced river flows and reduced outputs from vulnerable sources and the imposition of flow constraints/augmentation requirements. This is what the current drought Deployable Output (DO) scenario is based on. Three dry winters has not been experienced within the available records for groundwater levels, but has been recorded in rainfall terms in the 1890's.

Recovery of groundwater levels following a drought is totally dependant on the volume of rainfall during the recharge period. Historically, periods of very low groundwater levels have recovered to above average levels within one year (eg 1992, 1998), thus re-setting levels for the next summer recession period, but these have been above average rainfall events. With average winter rainfall, it may take several years for water levels to fully recover.

East Kent Groundwater Model

The Company, in association with Southern Water and South East Water commissioned Atkins to undertake a study of the possible impact of climate change on their groundwater sources in the East Kent area. This study focused on the implications of changes to their deployable outputs.

[14] Climate change report – February 2009 (available upon request)

Atkins used guidance from the *UKWIR CL/04/C* study (ENTEC 2007), and the Environment Agency (2007) and the East Kent Groundwater model, which had been recently developed by the Mott MacDonald for the EA and is considered to be the most suitable model for this area.

Forecasts of climate for the 2020s were made from a suite of general circulation models by perturbing the rainfall and evaporation sequences from the global circulation models, scaled down for the East Kent area. These revised meteorological sequences were then run through the recharge element of the East Kent model to produce new recharge inputs to the model. As the model was repeatedly run with the different climate sequences, a succession of water level fluctuations resulted for the entire modelled area. These water levels were then compared with the calibrated base line historic water levels in nodes where public water supply sources were present to look for additional declines in modelled water levels over those seen in the past. In turn, these water level changes were then applied to the source reliable output diagrams, by downshifting the drought response curve and re-evaluating any constraints, particularly the deepest advisable pumping water level, allowing a revised deployable output to be calculated both at peak and average conditions.

Whilst there are some uncertainties in elements of this analysis, it provides a good guide to potential future deployable outputs and highlights the vulnerability of individual sources to deeper pumping water levels.

Generally, nodal drought water levels in the mid range were reduced by between 0.1 and 1.78m. In the high impact scenario, the range was 0.3 to 7.35m. The low impact scenario actually produced rises in groundwater levels above those seen historically. The lowest level changes were observed at the costal sources, and are probably artificially low values due to the way the model boundary conditions with the sea have been set. Nevertheless, these values have been used in the subsequent analysis.

Equally, no allowance of saline intrusion has been made, as the model does not simulate water quality variations, only level and flows.

In the case of SLYE, Atkins did not allow for known process losses in their report, and this has been changed by 0.14Ml/d to reflect this. As the East Kent Model only covers the Chalk sources, Atkins did not evaluate water level changes for the Greensand sources. Only SSHE has a deployable output greater than zero and previous reports state this source is relatively unaffected by historic droughts, thus its deployable output has not been changed.

In the case of the Dungeness gravel aquifer, where no suitable model is available and where drought bounding curves for the individual sources do not exist, a different approach has been adopted. The Dungeness aquifer is sensitive to both decreases in rainfall (both summer and winter) and saline intrusion/sea level rise. In the case of this aquifer, summer rainfall does contribute to recharge as there is very little soil and the large cobbles have only a small capillary flux capability, thus once into the system, rainfall can only leave by lateral transfer to either the sea or the lakes or the Denge Marsh sewer. The exact change in DO cannot be calculated, but it was considered to be very sensitive. Thus by careful manipulation of the well field, sufficient abstraction to meet the demand of one of the Reverse Osmosis skids could be met, even with modest increases in salinity. This has been set as at 2Ml/d for average DO and 2.5Ml/d for peak DO.

The revised deployable outputs for all the Company's sources are shown in Table 21.

Folkestone and Dover Water Services

Impact of CC on DO

								RS 28/11/07		RS 13/08/08					
Source	Aquifer Type	Avg. Ann. Licence Ml/d	Max Daily Licence Ml/d	2007 Average DO Ml/d	2007 Peak DO Ml/d	Current Risk relative to DAPWL	Initial Drought Curve Analysis Average Values Ml/d	Initial Drought Curve Analysis Peak Values Ml/d	Atkins final Analysis Average, high impact	Atkins final Analysis Peak, high impact	Atkins final Analysis Average, mid range impact	Atkins final Analysis Peak, mid range impact	Atkins final Analysis Average, low range impact	Atkins final Analysis Peak, low range impact
SDNG	Gravel	9.04	15.00	4.65	5.58	high	2.00	2.50	2.00	2.50	2.00	2.50	2.00	2.50
				4.65	**5.58**		**2.00**	**2.50**	**2.00**	**2.50**	**2.00**	**2.50**	**2.00**	**2.50**
SOTT	Chalk	4.55	13.64	0.85	2.82	high	0.44	0.44	0.03	1.25	0.65	2.82	0.85	2.82
SSKE	Chalk	1.13	1.14	0.15	0.23	high	0.05	0.07	0.02	0.02	0.12	0.18	0.26	0.38
SWOR	Chalk	4.55	4.55	1.50	2.64	medium	1.40	2.40	0.70	2.64	1.25	2.64	2.00	2.64
SOTT Group		4.55	13.64	2.50	5.69		1.89	2.91	0.75	3.91	2.02	5.64	3.11	5.84
SLYE	Chalk	3.50	3.50	3.36	3.36	low	3.36	3.36	3.36	3.36	3.36	3.36	3.36	3.36
SDRE	Chalk	8.00	8.00	2.26	3.55	very high	1.00	1.00	0.00	0.00	1.10	2.30	3.00	5.40
SLOW	Chalk	-	-	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SLYE Group		11.50	11.50	5.62	6.91		4.36	4.36	3.36	3.36	4.46	5.66	6.36	8.76
SDEN	Chalk	-	-	1.89	2.10	low	1.89	2.10	0.07	1.20	1.89	2.10	1.89	2.10
STAN	Chalk	-	-	4.80	4.80	medium	4.80	4.80	2.50	2.75	4.80	4.80	4.80	4.80
SRAK	Chalk	-	-	2.40	2.40	low	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
SRAK Group		9.09	13.64	9.09	9.30		9.09	9.30	4.97	6.35	9.09	9.30	9.09	9.30
SSTO	Chalk	5.48	6.00	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SBRO	Chalk	2.28	4.54	2.28	2.69	low	2.28	2.69	2.28	2.69	2.28	2.69	2.28	2.69
SCON	Chalk	8.20	10.80	4.10	7.00	high	3.30	3.30	3.30	5.15	3.70	6.20	4.30	8.00
SSTM	Chalk	6.03	6.85	1.13	2.89	high	0.42	0.60	0.09	1.80	1.10	2.50	1.25	5.84
SLIG	Chalk	2.06	2.50	2.05	2.06	very high	0.75	0.75	1.85	2.06	2.00	2.06	2.06	2.06
SKIN	Chalk	3.17	3.70	3.00	3.00	very high	1.40	1.40	2.60	3.00	2.85	3.00	3.00	3.00
SPRI	Chalk	3.00	4.00	3.00	4.00	low	3.00	4.00	1.25	4.00	3.00	4.00	3.00	4.00
SPOU	Chalk	0.82	2.18	0.08	0.11	high	0.04	0.07	0.06	0.10	0.08	0.11	0.08	0.11
SHOL	Chalk	2.27	2.50	2.27	2.50	low	2.27	2.50	2.27	2.50	2.27	2.50	2.27	2.50
SDOV	Chalk	2.88	2.88	2.88	2.88	high	1.00	1.00	2.65	2.88	2.85	2.88	2.88	2.88
SBUC**	Chalk	4.00	4.00	4.00	4.00	low	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
SCOW**	Chalk	5.00	6.00	4.00	4.80	low	4.80	4.80	4.00	4.80	4.00	4.80	4.00	4.80
Individual		45.19	55.95	28.79	35.93		23.26	25.11	24.35	32.98	28.13	34.74	29.12	39.88
SSHE	LGS	4.55	9.09	0.50	1.68	high	0.50	1.68	0.50	1.68	0.50	1.68	0.50	1.68
SCHE	LGS	2.93	6.82	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSIL	Chalk	2.93	6.82	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSHE Group		4.55	4.55	0.50	1.68		0.50	1.68	0.50	1.68	0.50	1.68	0.50	1.68
SSEA	LGS	1.00	2.27	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SBLU	LGS	0.60	2.73	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSAL	LGS	0.41	0.45	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPOS	LGS	0.32	0.33	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SHYT	LGS	0.23	0.23	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SBLA	LGS	0.45	0.45	0.00	0.00	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSEA Group		2.01	6.46	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COMPANY TOTALS		**85.93**	**120.74**	**51.15**	**65.09**		**41.10**	**45.86**	**35.93**	**50.78**	**46.20**	**59.52**	**50.18**	**67.96**
				2007 Assessment										
						Difference between two Avearge	**10.05 Ml/d**		**15.22 Ml/d**		**4.95 Ml/d**		**0.97 Ml/d**	
						Difference between two Peak DO	**19.23 Ml/d**		**14.31 Ml/d**		**5.57 Ml/d**		**-2.87 Ml/d**	

Table 21: Revised deployable outputs

The above figures focus on the ability to maintain output from the Company's sources. If significant additional lowering of groundwater levels were to occur, there would be additional impacts on lowering river flows and other groundwater related wetlands, and even possibly some saline intrusion. The Agency may find that these impacts on the environment are so severe that they would either wish the Company to reduce or cease abstraction from some

sources, or for additional river support to be made available. No such comments have been received from the EA, but could significantly impact on the availability of water to meet customer demands should such reductions be required at a later date.

The high and low deployable output figures were used in the calculation of uncertainty in the headroom assessment, whilst the mid range values were used in the baseline supply demand/balance to predict future deployable outputs (Table 22).

Climate change estimates	Reduction at average	Reduction at peak
Atkins – High impact	15.22 Ml/d	14.31 Ml/d
Atkins – Medium impact	**4.95 Ml/d**	**5.57 Ml/d**
Atkins – Low impact	0.97 Ml/d	0 Ml/d

Table 22: Climate change estimates

The impact of climate change on the overall final supply/demand balance is shown in Figure 9.

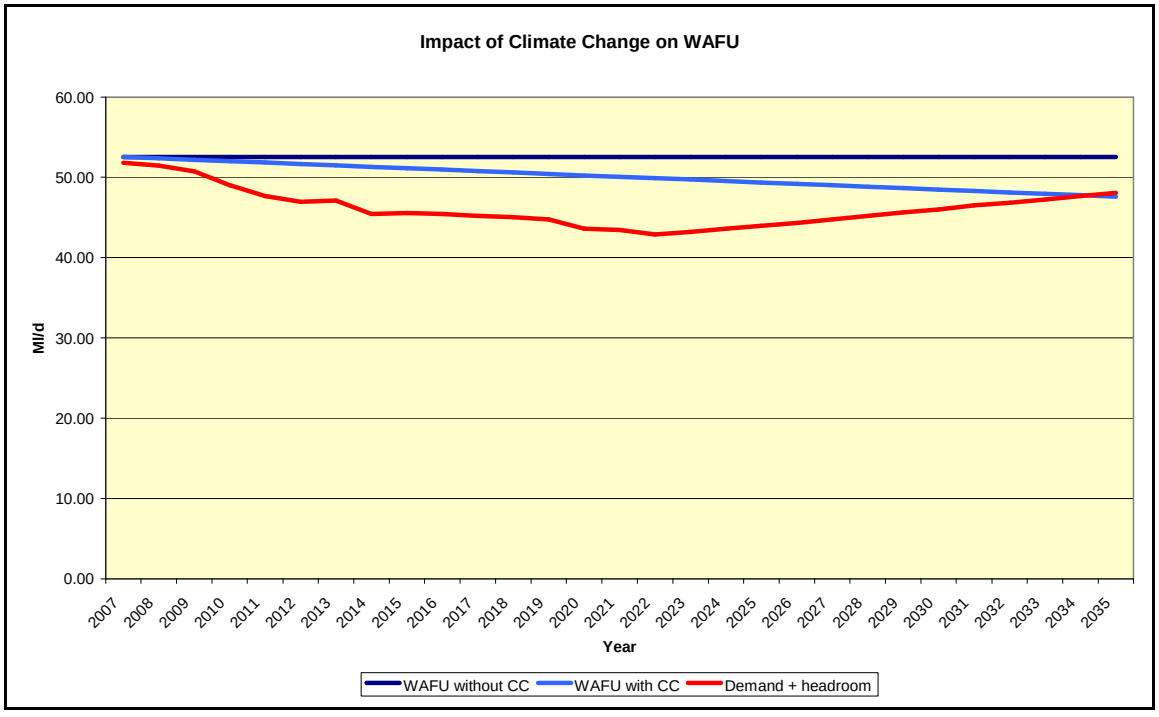

Figure 9: Impact of climate change on WAFU

4.2 Demand

Uncertainty of climate change on demand has been assessed by applying the demand increases outlined in the DEFRA funded *Climate Change: Demand for Water (2003)* project. This project forecasts a 1.45% increase in household consumption by 2020 and a 2.7% increase in industrial/commercial consumption by 2030. The impact of climate change on demand is included in the Headroom assessment.

4.3 Impact on supply/demand balance

Climate change impacts have been assessed using guidance from the UKWIR CL/04/C study (ENTEC 2007) and the Environment Agency (2007) and the East Kent Groundwater model, which had been recently developed by the Mott MacDonald for the EA and is considered to be the most suitable model for this area.

The Company's DO is reduced in 2035 by 10% for average conditions and 9% for peak conditions. Climate change has been included explicitly in the forecasts of deployable output in the plan. The headroom appraisal includes for the uncertainty around the climate change forecasts.

5 Target headroom[15]

Headroom is the safety margin that is maintained between supply (minus outage and allowing for imports and exports) and demand to cater for uncertainties in the overall supply/demand balance.

Headroom has been determined for the single company-wide resource zone, as agreed with the Environment Agency. The Denge Security main allows transfer of treated water from the Hills to the Denge supply areas, effectively merging these two areas into one integrated zone.

There are two recognised methods for examining headroom:

- *A practical method for converting uncertainty into headroom (UKWIR, 1998)*.
- *An improved methodology for assessing headroom – final report (UKWIR 2003)*.

5.1 Choice of method

For the final plan, the Company has undertaken a target headroom calculation using the 2003 methodology. A review of the 2002/03 headroom submission was undertaken and used as a base position, upon which changes could be evaluated.

The 2003 methodology determines a likely range of values for headroom, for selected years within the planning period. It requires the uncertainty for each headroom component to be defined as a probability distribution, and then combines these using Monte Carlo simulations.

The result is a range of possible values for headroom uncertainty at given probability. The Company then has to determine which level of uncertainty to adopt as Target Headroom. The key components of the headroom calculation are:

- S1 Vulnerable surface water licences
- S2 Vulnerable groundwater licences

[15] Headroom report – February 2009 (available upon request)

- S3 Time limited licences
- S4 Bulk transfers
- S5 Gradual pollution causing a reduction in abstraction
- S6 Accuracy of supply side data
- S7 Single source dominance and critical periods (old method only)
- S8 Uncertainty of climate change on yield
- S9 Uncertain output from new resource developments (new method only)
- D1 Accuracy of sub component data
- D2 Demand forecast variation
- D3 Uncertainty of climate change on demand
- D4 Uncertain outcome from demand management methods (new method only)

Of these categories the EA has advised that S1, S2 and S3 should not be included in headroom uncertainty, because:

i) There is a presumption of renewal of time limited licences so no uncertainty need be estimated.

ii) Where licences are vulnerable as a consequence of the National Environment Programme (NEP) for example the Habitats Directive Review of Consents, the EA will give sufficient notice of any amendments to licences, so that water companies can include supply reductions in their pans.

5.2 Risk and uncertainty in supply and demand

Supply side

S1 Vulnerable surface water licences

The Company currently has no surface water licensed abstractions.

S2 Vulnerable groundwater licences

No uncertainty was included for vulnerable groundwater licences following EA guidance, as described in the Section 3.1.

S3 Time limited licences

These are licences that either are now, or could at some time in the future be time limited. The EA can renew, revoke or modify a time limited licence and there is therefore inherent uncertainty in time limited licences. No uncertainty was included for this category following EA guidance as described in Section 3.1.

S4 Bulk imports

This category relates to the reliability of the imports, as discussed in Section 2. No uncertainty has been applied to bulk imports as these are dealt with explicitly in the supply demand balance.

S5 Gradual pollution

Data required:

- Magnitude of potential loss of DO (at average and peak conditions)
- The probability distribution of the potential loss

The risk of any of the groundwater sources being polluted from activities within each of the source catchment areas was considered. Risks identified were from petrol stations, salt intrusion and general urban pollution.

Dover Sources

The Dover Sources are SPRI, SCOW, SPUO, SHOL, SDOV and SBUC.

Of these, the SBUC source is very close to a petrol station and therefore, at risk from a possible petrol spillage. If a major spillage were to occur the source would be likely to be out of commission for several years while remediation solutions are considered and implemented. Deployable output at SBUC is 4Ml/d at average and peak conditions. For the headroom assessment, it was predicted that there was a 5% risk in any year that this would be reduced to zero, with a 95% likelihood that DO would be unaffected. A discrete distribution was used.

The remaining sources are located close to, or within the urban area of Dover and a general risk of urban pollution is present. The prediction made is that the most likely reduction in DO due to gradual pollution is zero, with a possible maximum reduction of 4% of DO. An exponential distribution was used. The total DO of these sources is 12.23 Ml/d at average and 14.29Ml/d at peak.

Denge Sources

Several linked sources close to the coast on the Dungeness Peninsula are at risk of inundation by a high storm surge. These sources have a DO of 4.65 Ml/d average and 5.58 Ml/d in the critical period. The sources supply the surrounding villages and the Dungeness Power Station (around 1.68Ml/d). The water abstracted from the sources is treated via a reverse osmosis plant in order to remove arsenic. However, the plant has the capability to remove salts if the sources were polluted with saline water. The plant would not be able to throughput more than the water supplied to the Power Station, so the DO would be reduced to 1.68 Ml/d at average and peak.

A study[16] commissioned by the Company to assess the risk of storm surge inundation estimated a 1 in 20 year risk i.e. a 5% probability that DO is reduced to 1.68 Ml/d and a 95% probability that no impact occurs. A discrete distribution was used.

No further risks of gradual pollution were identified.

[16] Flood Risk Assessment report - January 2009 (available upon request)

S6 Accuracy of supply side data

There is a risk that data inaccuracy or paucity renders any estimates of DO unreliable. This could for example cover the extrapolation of drought bounding curves where no flow/level data exists for a recognised drought period.

Data required:

- Most likely error in DO, in Ml/d
- Maximum possible error (positive and negative)

An assumption of +/- 2% of DO has been applied as the maximum possible uncertainty in DO, with the most likely uncertainty equal to zero.

S8 Uncertainty of climate change impact on DO

There is a risk that the impact of climate change on water levels will alter any estimate of DO. Assessments for PR09 indicate a significant net effect for climate change on source output. The recent UKCIP02 scenarios have updated the precipitation forecasts. In the 1998 scenarios spring and autumn became wetter, but the UKCIP02 scenarios suggest the seasons may become slightly drier. This reduction in rainfall in the recharge seasons is likely to change the balance of supply and demand.

Atkins were commissioned by Veolia Water Southeast, Southern Water and South East Water to assess the potential impact of climate change on yields of groundwater sources in the east Kent area, using guidelines produced by Entec in 2007[17] and the EA WRMP guidelines[18]. In Atkins' report [19] they produced results for high, mid and low climate change scenarios. The potential impacts on DO at 2035 were interpolated linearly from zero at 2006/07. The central or mid climate change impacts were included as an adjustment to WAFU in the WRMP The high and low scenario impacts relative to the mid scenario impacts have been applied as upper and lower uncertainty bounds in the headroom assessment. A triangular distribution was used. The impacts for the three scenarios are shown in Figure 10.

[17].Effects of Climate Change on River Flows and Groundwater Recharge: A Practical Methodology. Draft Guidelines for Groundwater Impact Assessment, Entec 2007
[18].Draft Climate Change Guidance – Supplement to Water Resources Planning Guidelines, Environment Agency, 2007
[19] East Kent Climate Change Impact Assessment, Final Report, Atkins, 2008

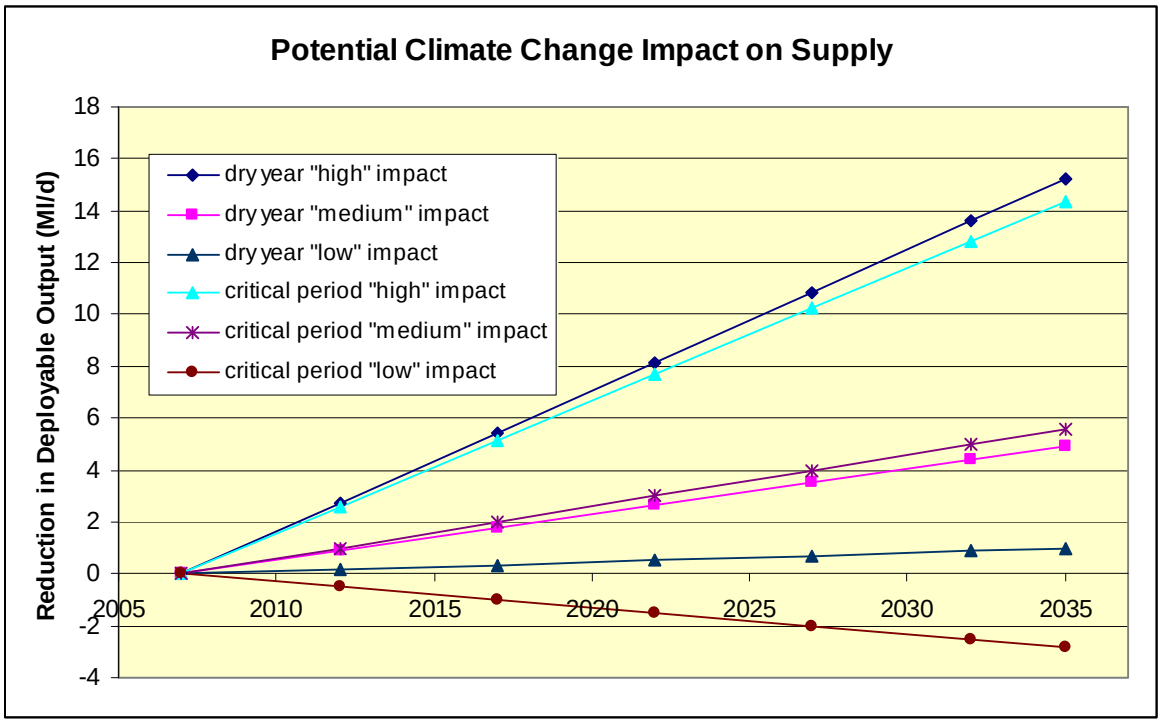

Figure 10: Potential impact of climate change on water supply

Demand side

For the demand side, the assessment of uncertainty occurs at resource zone level. The UKWIR project *Uncertainty and Risk in the Supply/Demand Balance*[20] describes a methodology for assessing uncertainty in the demand forecasts.

D1 Accuracy of sub component data

Accuracy of sub component demand data is assessed with reference to the closure error in the water balance of the base year for the demand forecast. Within the MLE process rebalancing takes place to redistribute errors in the water balance to other components. The sum of sub components was greater than the measured distribution input by 0.74 Ml/d for the Company area, and would therefore tend to overestimate demand by this amount.

Uncertainty was therefore modelled as a triangular distribution with a most likely value of -0.74Ml/d (implying a reduction in headroom) and a maximum possible value of zero. The same value was used for dry year and critical period.

D2 Demand forecast variation

This component is a measure of the uncertainty around the demand forecast, which tends to increase over the planning period. The headroom methodology suggests that the sensitivity of assumptions in the demand forecast can be tested to produce an upper and lower forecast, and hence an envelope of uncertainty.

[20] Uncertainty and Risk in Supply/Demand Forecasting, 03/CL/09/1, UKWIR 2003

The demand forecast spreadsheet developed for the WRMP was used. The assumptions which varied to produce the upper and lower scenarios are described below.

Population and household Forecasts

Experian produced household and population forecasts for the Company and this work is described in separate reports for the WRMP. For the final plan, figures have been revised (from those used in the draft plan, 2008) to account for the current and projected economic downturn. Three forecasts were produced – called "trend", "policy-based", and "most likely". The central demand forecast for the final WRMP used the "policy based" population and household forecasts. For the upper demand forecast for headroom the higher household and population figures from the "trend" based forecasts were used. These forecasts are shown in Figure 11.

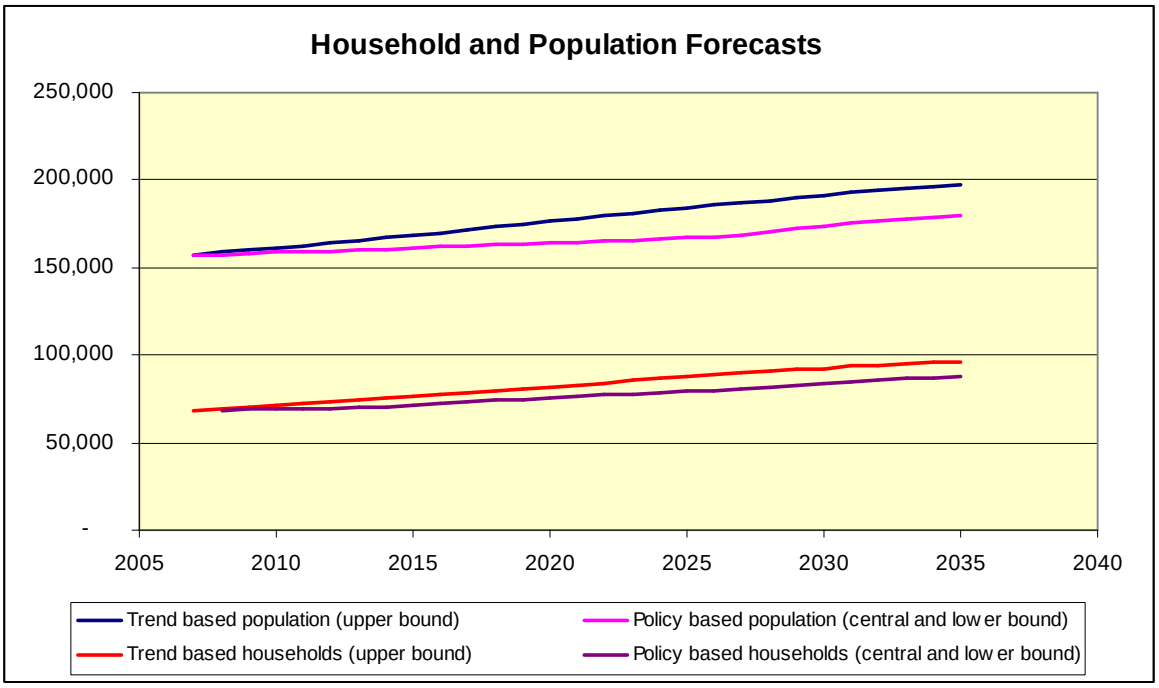

Figure 11: Household and Population Forecasts used for Demand Uncertainty

Per capita consumption

The Company developed a micro component model to determine forecasts of measured and unmeasured per capita consumption over the planning period. Upper and lower bounds were produced by altering the assumptions on frequency of use, and rates of change, for: bath and shower use, dish washing and clothes washing (manual and machine). The upper and lower forecasts used for the headroom assessment are shown in Figure 12.

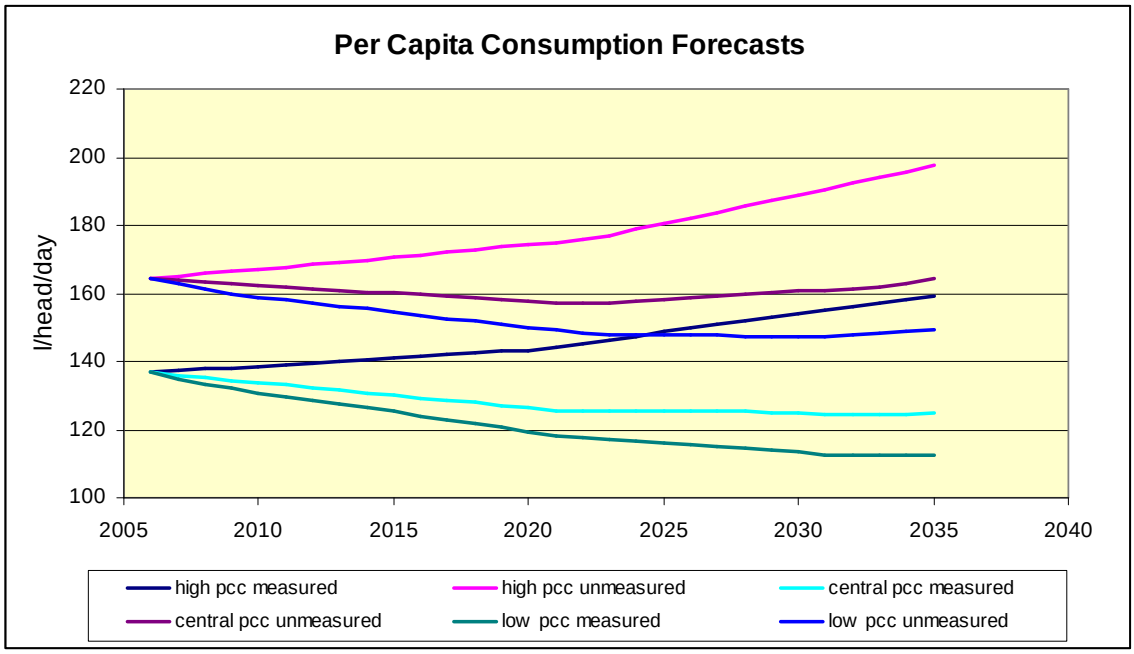

Figure 12: PCC Forecasts used for Demand Uncertainty

Non household demand

The non-household demand forecast was revised to reflect the current economic downturn (non household demand is 8% lower from 2011 to the end of the forecast), and these revised figures are used in the central demand forecast. For the upper bound of demand uncertainty used for headroom assessment, the pre-revision forecast was used i.e. reflecting an optimistic forecast and greater demand.

The upper and lower bounds of PCC, household and population figures and the non household demand were input to the Company demand forecast model and upper and lower bounds derived for Distribution Input. These are shown with the central forecast in Figure 13. A triangular distribution of uncertainty was used with the most likely value equal to zero and the maximum and minimum values as defined by the upper and lower bounds of DI.

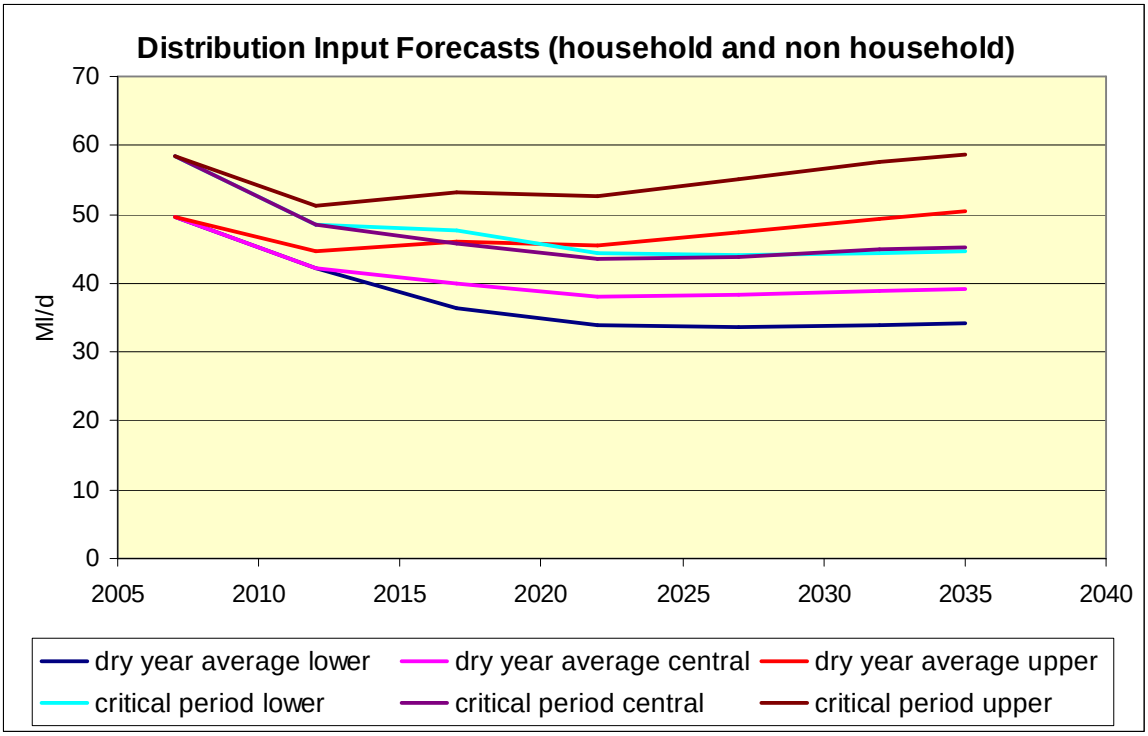

Figure 13: Envelopes of Demand Forecasts for D2 Uncertainty

D3 Uncertainty of climate change on demand

Uncertainty in the impact of climate change on demand was applied based on guidance in the CCDeW report, *Climate Change and the Demand for Water*[21]. Separate factors were applied to household and non household demand, taken from Table 3.9 and Table 4.1 of the report respectively, for the EA Southern Region. These figures are shown in Table 23 below, and are the percentage impacts relative to baseline demand in the mid 2020s.

	Impact on demand at 2025 (%)	
	Min	Max
Household demand	0.99%	1.45%
Non household demand	2.40%	2.80%

Table 23: Climate Change Impact on Demand

The factors were interpolated from zero at the start of the forecast to 2025 and extrapolated using the same trend to 2035, as outlined in the EA WRMP guidelines. They were applied to the central household and non household Distribution Input forecasts from the Company demand model. A triangular distribution was applied with the central value taken as the mid point between the values in Table 23.

[21] Downing, T.E, Butterfield, R.E., Edmonds, B., Knox, J.W., Moss, S., Piper, B.S. and Weatherhead, E.K. (and the CCDeW project team), 2003. Climate Change and the Demand for Water, Research Report, Stockholm Environment Institute Oxford Office, Oxford.

5.3 Results of the headroom assessment

Headroom values were derived for the dry year average and critical period cases. Crystal Ball software (version 7.2) was used to apply the Monte Carlo sampling, and a distribution of target headroom across the planning period was produced. As the new methodology is based on defining probability distributions, there are a range of outputs which relate to different percentiles, or probabilities of occurrence, as shown in Figure 14 and Figure 15.

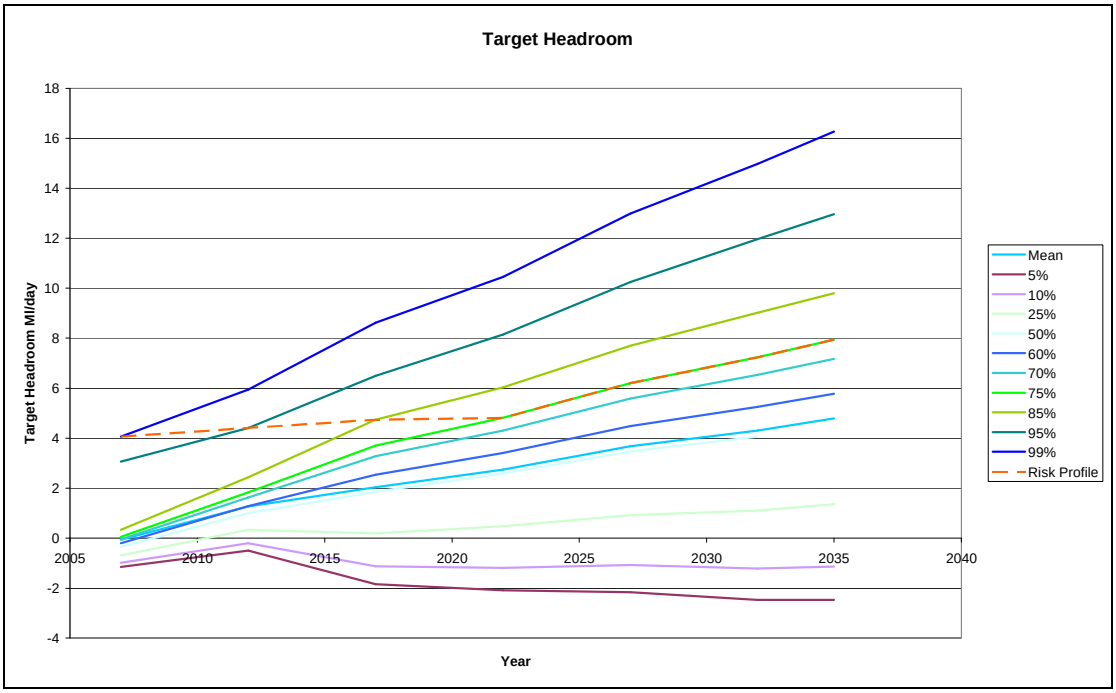

Figure 14: Headroom uncertainty – Dry year average

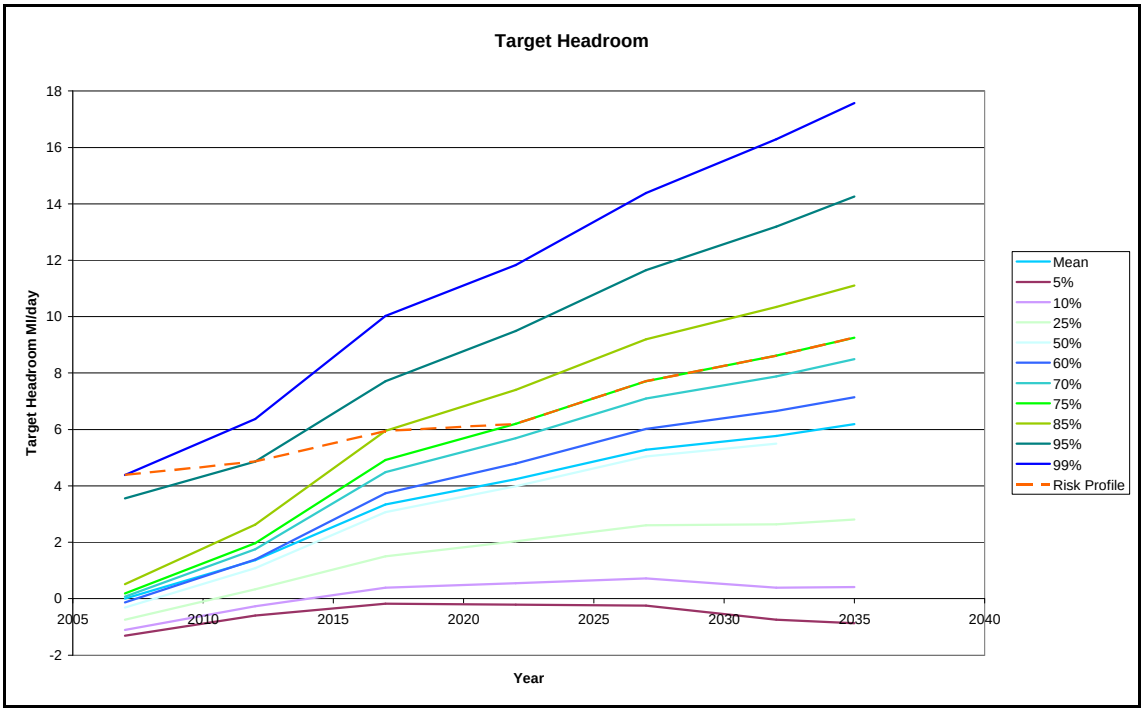

Figure 15: Headroom Uncertainty – Critical Period

The level of risk the business is willing to adopt is fundamentally a Company decision. Ofwat views headroom as "*an implicit estimate of the costs associated with increased security of supply and the valuation placed by society on the benefits of supply security (i.e. avoidance of supply interruptions).*" The final headroom assessment presented below has been discussed and agreed at executive management and board level. In arriving at a decision, consideration was given to the influencing factors and the range of potential levels of target headroom from Figures 13 and 14.

The Company has adopted a risk profile which accepts a greater risk to security of supply towards the end of the forecast period. That is on the basis that future uncertainties in supply and demand will be reduced over time and reflected in the next cycles of water resource planning.

Target Headroom Profile: 99% confidence from 2006/07
95% confidence from 2011/12
85% confidence from 2016/17
75% confidence from 2021/22 to the end of the planning period.

The final target headroom numbers used in the plan are shown in Table 24.

Headroom (Ml/d)	2006/07	2011/12	2016/17	2021/22	2026/27	2031/32	2034/35
Average conditions	4.06	4.41	4.74	4.81	6.20	7.23	7.95
Critical periods	4.39	4.86	5.95	6.20	7.71	8.62	9.25

Table 24: Target Headroom results

6 Baseline supply/demand balance

The baseline supply/demand forecast is based on the following position:

- The completion of the compulsory metering programme, which will bring nearly all domestic customers (96%) on to meters by the end of 2012.
- The renewal of bulk imports from South East Water and Southern Water until 2035.
- The revised outage allowance including flood risk.
- The revised climate change forecasted impact on DO.
- The revised Experian 'policy' forecasts for population and households (including allowance for economic downturn).
- The revised commercial forecast (including allowance for economic downturn).
- The consumption forecast of 130PCC by 2015.
- The revised headroom figures.

The supply/demand balance is showed in Table 25. Overall, there is no supply/demand balance deficit under average conditions, except for the last 4 years of the planning period. There is no supply/demand balance deficit under peak conditions.

WAFU - (demand + headroom)	2007/08	2009/10	2014/15	2019/20	2024/25	2029/30	2034/35
Company Average (Ml/d)	0.9	3.2	5.4	4.9	3.6	0.6	-2.4
Company Peak (Ml/d)	4.6	7.7	10.7	9.6	8.0	4.8	1.6

Table 25: Baseline supply/demand balance

Figure 16 and Figure 17 show the supply/demand balance throughout the 25-year period.

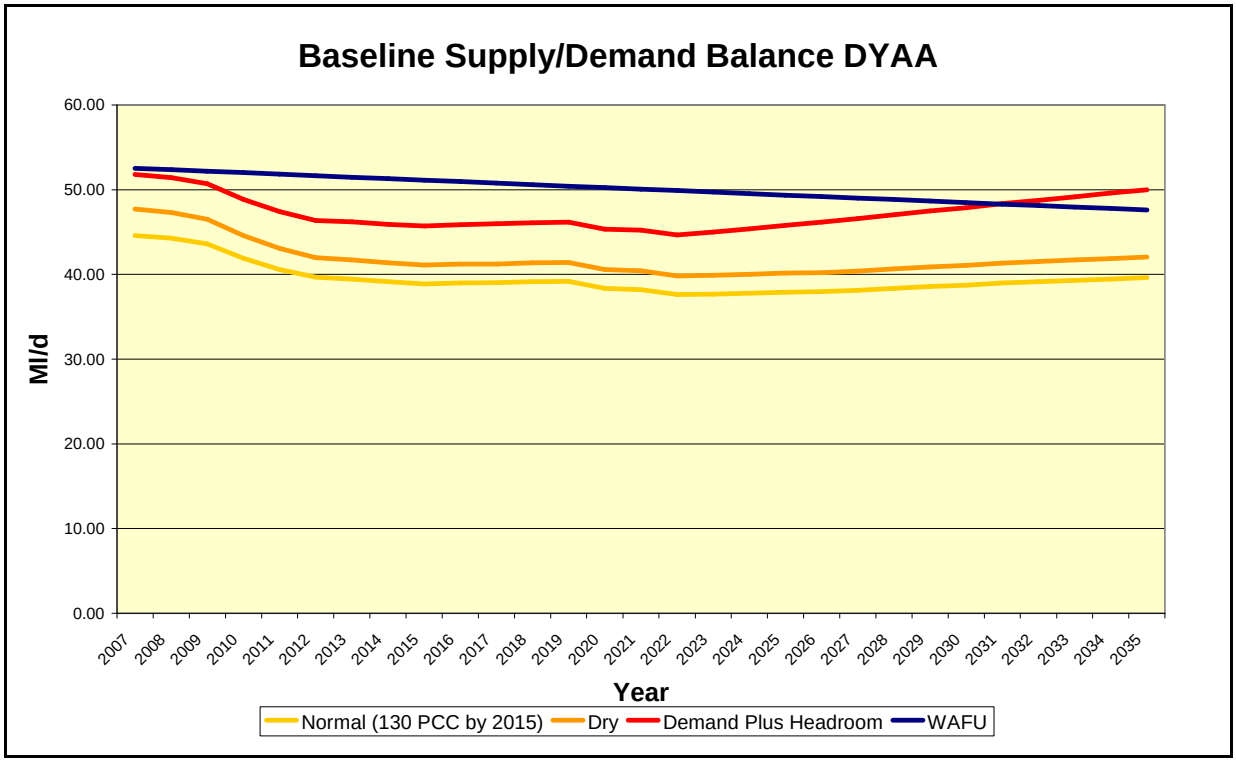

Figure 16: Supply/demand balance – average conditions

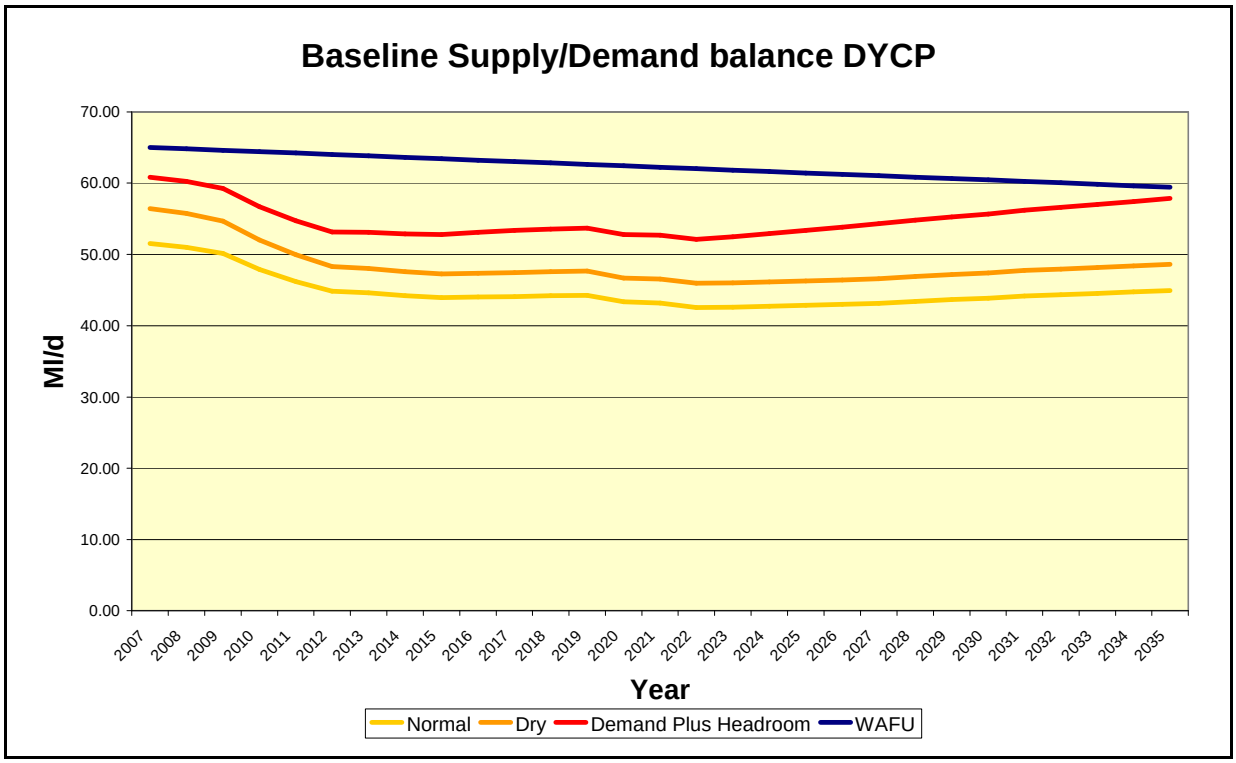

Figure 17: Supply/demand balance – critical period conditions

7 Option appraisal[22]

7.1 Approach for option appraisal

The Company is committed to the "twin track" approach of developing new sources in parallel with active management of customers' demand. A programme of supply/demand schemes is proposed to enable levels of service to be restored and maintained over the planning period 2010 to 2035.

The approach was guided by the *Economics of balancing supply and demand* (EA and UKWIR, 2002). The process comprises the following steps:

- Development of the unconstrained options list
- Development of the feasible options list
- Economic appraisal of options
- Development of the preferred options list through least-cost optimisation

7.2 Unconstrained options list

A range of options were identified and classified into the following categories drawing on the work from PR04 as well as new options developed during the subsequent operational period:

- Resource management
- Demand management
- Production management
- Customer side management

All options from previous plan have been considered along with the new options defined during this WRMP process (Appendix 7).

7.3 Feasible options list

The feasible options list was produced by applying a "screening tool" to the unconstrained list, and by screening out high risk schemes on the basis of a consistent and mutually agreed set of criteria. The screening tool enabled the consideration of technical and financial criteria, in conjunction with environmental and social criteria. In doing so, the tool ensured the feasible list of schemes will:

- Be capable of enhancing security of supply.
- Be technically feasible.
- Provide environmentally preferred outcomes.

[22] Options appraisal report – February 2009 (available upon request)

The tool was applied in two stages:

Stage 1 involved the transparent and quick application of pass/fail indicators to measure the performance of a scheme against set criteria. This first stage proved to be a straightforward, complete and efficient way of identifying and separating those schemes considered for the business plan 2009 that could go forward for funding under the supply/demand programme (note: being screened out at this stage does not mean that the scheme will be abandoned but merely that it will not be considered for funding under supply/demand).

A few examples that illustrate the use of the criteria could include, for instance: a scheme that is technically infeasible or will not add to the volume of the water supply is immediately screened out; a scheme that carries significant commercial as well as yield uncertainty is screened out; however a scheme whose only uncertainty lies in the area of public unacceptability will not be excluded on the grounds of this criterion alone.

The types of schemes considered were:

- Bulk Transfer (including Local Distribution and Security of Supply)
- Demand Management (including Reuse)
- Environmental Protection
- Leakage
- Metering
- Resource Development (including Treatment)
- Tariffs

Stage 2 involved the application of a more detailed set of indicators for an expanded set of criteria to the schemes that successfully passed the stage 1 screening.

Stage 2 is not a pass/fail but rather a scoring process. For each of the selected 26 technical/social/environmental criteria, a score was assigned on a range of -2 to +2 according to the relative impact of the schemes on the component examined.
Stage 2 was completed during a workshop with the Head of Capital Investment and Asset Management, where it was agreed that only the schemes with a score above 0 would constitute the Feasible Options List.

The final number of feasible schemes is 27 schemes. The screening results are presented in Table 26.

CATEGORY	Unconstrained List	Feasible List	% screened
Bulk Transfer	10	8	20%
Demand Management	8	5	38%
Environmental Protection	1	0	100%
Leakage	8	4	50%
Metering	1	1	0%
Resource Development	20	8	60%
Tariffs	1	1	0%
TOTAL	**49**	**27**	**45%**

Table 26: Results from the screening process

The unconstrained water efficiency schemes which were put forward are wide ranging, covering the different activity strands that make up the Company water efficiency strategy. The feasible list of water efficiency schemes compiled as a result of the screening process included both domestic and non domestic schemes, broadening the Company's current level of activities and incorporating a number of initiatives taken from the Ofwat good practice register for water efficiency.

The feasible list of options is distinct from the activities included in the baseline. All of the feasible schemes would result in new activities or a significant change to a current activity, setting them aside from the current baseline.

7.4 Options description and assessment

Each option **description** was reviewed in detail, and the information recorded was refined and updated throughout the process.

The **risk** of schemes was assessed, based on the interaction of the volume of yield/savings available and the uncertainty (% risk in achieving the benefit) associated with a given option. The following two factors combine the benefit incorporating risk for a particular scheme:

- Volume of water (yield or savings) per mega litre benefit per day.
- Percentage of Confidence in achieving the benefit, which is produced by assessing the political and technical risks associated with the project. The assessment accounts for both the risk of obtaining required permits or licences and also the technical feasibility of obtaining the deployable outputs.

The assessed risk of schemes is used in the economic appraisal of the least cost solution. Using individual scheme risks allows the Company to consider specific attributes of each scheme, rather than the more limited approach of applying an overall assessment of risk in headroom. This issue is discussed more fully below.

The options with the highest **environmental and social impacts** were screened out during the first stage. However, feasible options were reviewed and any opportunities for environmental enhancement and energy efficiency were looked at. The potential impact of each option against meeting the environmental objectives of the Water Framework Directive was also identified. For any option, which involves taking more water from a water resource management unit currently defined as over-abstracted or over-licenced, considered the potential impact it may have on Water Framework Directive ecological status, was considered.

The **delivery costs** were produced using the Company's Infrastructure and Non-infrastructure unit costs (CAPEX, OPEX and AIC master spreadsheets) produced for the business plan 2004.

Following discussions with principal engineers, suppliers and/or potential contractors, the scope was developed in greater detail, and the cost of each scheme was calculated using 2002-03 unit cost, uplifted with Construction Industry Price Indices (COPI) value.

Schemes, such as leakage, metering and water efficiency were examined in details, with tailored costs identified to meet specific requirements and identified as 'bespoke costing'.

Social and environmental costs were established for the 27 schemes using an approach developed by the consultants Jacobs. The approach used to quantify and value the social and environmental costs was based on the EA's latest (2003) guidance documents entitled "Assessment of benefits for water quality and water resources schemes in the 02/03 Environment Programme". This process involved completion of five excels spreadsheet tables for each scheme examined.

The approach developed by Jacobs to quantify the **carbon footprint** of the feasible schemes was based on their experience of doing the same for construction projects and for industrial processes. There was no explicit guidance on the calculation of carbon footprint from the EA or Defra, except for that on applying a shadow price of carbon. Carbon accounting was carried out for both Capex and Opex elements of the schemes.

Bulk Transfer

- The Company has had the benefit of a long standing bulk supply from a South-East Water source in the Barham area. This was terminated in 1992 following difficulties with source yields on South-East Water's behalf and only reinstated as a 2Ml/d continual supply in 1998. The terms of the bulk supply agreement were the subject of an Ofwat determination that is due to expire in 1st April 2009. The Company has agreed with South-East Water to extend the agreement a further 5 years to 2014.

  Following recent discussion with South East Water, both companies have agreed to renew the existing agreement until 2020. It has also been agree to include the current bulk transfer in the baseline supply/demand balance for the 25-year planning period.

  The Company is also looking at increasing the BARI import from 2 to 4Ml/d, as detailed in scheme 301. This scheme would be available from 2020.

- During AMP3, the Company invested in the necessary infrastructure to commission a new bulk supply arrangement with Southern Water (Deal High Level Reservoir). This is available at a rate of 4 Ml/d for four months from September to December. Clearly this is not available to meet peak (critical period) demands but it is available at an important time for the company to allow existing sources to be used more fully the rest of the year. In assessing the deployable output a prudent view has been taken, giving 1.33 Ml/d (the annual equivalent) at average and nothing available at peak.

  The agreement expires in 2012 and the Company proposes to continue the agreement with Southern Water. Both companies agreed to include the current bulk transfer in the baseline supply/demand balance for the 25-year planning period.

  With scheme 450, the Company is looking at the potential extension of the existing agreement from 1.33Ml/d to 2.67Ml/d over a year at average and from 0 to 2Ml/d at peak. This scheme would be available from 2020.

The two options put forward by the Company have all been discussed with the appropriate water companies (i.e. South East Water and Southern Water), and both companies have made provision for the extension of those bulk transfers.

Demand Management

Water efficiency options have been considered by the Company to build upon activity in AMP5. These are:

- Region school projects in partnership with Environment Agency
- (scheme 433)
- Proactive water efficiency retrofits trial (scheme 437)
- Join water efficiency promotions in partnership with Local Authorities
- (scheme 439)

Leakage

The leakage policy is based on monitoring district meter zones by telemetry, with sub zones monitored via SMS text loggers. Best available technology is employed in leakage with dedicated leakage detection and contract staff.

Between draft and final plans, the Company has commissioned Halcrow to review the current state of the network and identify any potential improvements. The findings have been used to update the scope and cost of each scheme. Each scheme (except from scheme 441) has now a specific location.

The leakage control options are:

- Optimisation of Enbrook Way DMA (scheme 361)
- Installation of new PRV at Guildhall Shellon DMA (scheme 362)
- Installation of new PRV at Cheriton High DMA (scheme 379)
- Service reservoirs (scheme 441)

Local Distribution

Three options have been proposed in order to remove network constraints. This would allow sources to be pumped, treated and fed into the network at the same time, or to pump sources up to licence. The schemes are:

- SBRO network improvement: remove network constraint which prevents SBRO and BARI to be discharged into the network at the same time (scheme 626). Peak scheme only.
- SWOR network improvement: the benefits of the scheme has been reviewed and the output has been revised to 0 (scheme 627).
- SRAK network improvement: The proposal is to install a new pump at SDEN in order to achieve licence output (scheme 628). Peak scheme only.

Metering

Scheme 637 would be to implement a SMART metering trial on internal and new meters with the benefit of:

- Develop vision for future customer service (internet, data..)
- Gaining a better understanding of *smart* metering technology and the opportunities it presents (potential Company-wide roll out);
- Understanding the technical issues involved in integration of *smart* metering with existing company systems;

- To assess customer reaction to *smart* metering, in particular any behavioural change resulting from improved access to consumption data;
- Exploring commercial tariff options which could arise from *smart* metering;
- Providing better data to support a more robust life cost benefit analysis on a company wide implementation.

This would see the installation of 3,286 *smart* meters between 2010 and 2015.

Resource Development

The Company has identified 7 feasible schemes. These are:

- SLYE licence recovery: this scheme is about negotiating with the EA the recovery of water loss to treatment through licence variation (scheme 629).
- Sources optimisation: the scheme is to relieve the existing network constraint downstream of the bulk import from Southern Water and SSTM, SKIN, SLIG sources towards DOWR. A new pipeline would be lay in order to increase the network capacity (scheme 314). This scheme is part of scheme 043, which means only one of them can be implemented (either 314 or 043).
- DOVN sources: remove DAPWL constraint on DO to able additional groundwater resource to be deployed and therefore increase output from existing boreholes (scheme 043). This scheme is part of AMP4 resource study work.
- Folkestone covered storage: construction of a 300Ml covered reservoir for long term storage of winter surplus for dry year peak. The new reservoir will be gravity fed from PADR at a daily rate of 1Ml/d. A booster pumping station will discharge stored water back to PADR at a daily rate of 5Ml/d.
- BROK regional reservoir: a new reservoir would be built at Broad Oak as a three-way venture by Southern Water, South-East Water and Veolia Water Southeast. It is estimated that the Company would have 20% stake in reservoir, and that the scheme would be available in 2023. Currently, the Company has assessed costs for 20% of total costs and for a direct raw water transfer pipeline from SEW new Ashford reservoir site to PADR (scheme 046).
- HYTW: the Company has investigated the use and the treatment of the brackish water pumped from the Beach Wells. The water will be treated by a RO plant and delivered to SALR (scheme 008).
- Full desalination scheme: the Company has investigated the use and the treatment of sea water. The water will be treated by a RO plant and delivered to SALR (scheme 309).

Reuse

The Company has considered the use of sewage effluent, which preferred use is in conjunction with an environmental protection scheme to maintain river flows. The Company has put forward 2 feasible options:

- BROB effluent reclamation: the effluent from BROB waste water treatment plant would be treated and delivered to the River Dour, in order to provide low flow compensation. The implementation of this option would require an agreement to be reached between Southern Water and the Company to have access to the effluent (scheme 294).

- HYWW effluent reuse: the effluent from HYWW waste water treatment plant would be treated to tertiary standard and injected into the Hythe Ranges. This will provide a barrier for saline intrusion into the shallow aquifer. The implementation of this option would require an agreement to be reached between Southern Water and the Company to have access to the effluent (scheme 605).

Security of Supply

Under scheme 459, the Company would build a new reservoir in addition to Hills reservoir, to ensure peak demand is dealt with.

Tariffs

The Company is progressively metering all its customers to secure a long term sustainable water supply in the area. Metered customers are more aware of their water usage, and the Company believes that alternative charges will provide an additional incentive for customers to use water wisely.

Under this new stepped charging structure an initial allowance of water to cover everyday household use will be charged at a rate below the current standard rate. Any water that is used in excess of this allowance will be charged at a higher than standard rate.

The essential use allowance is being set at 219 litres per property per day (equivalent to 80 cubic meters per property each year), and this is designed to cover day to day household needs including cooking, washing and laundry requirements. This allowance is based on a careful assessment of water needed in the average home for everyday living with non essential water use excluded. To further improve the equity of the level of household allowance provided under the stepped charges, larger families will be able to claim an additional volume of water to be charged at the low rate, as well as those with special medical requirements.

New Smart bills will replace standard bills and will show customers their water usage in detail, and allow them to compare this easily against average use. Meters will be read and bills sent out on a quarterly basis to allow customers to check regularly on their water use. This option would be implemented to the whole supply area in 2013.

Treatment

The Company has identified SDNG re-mineralisation of RO stream (scheme 630) as a feasible option. The SDNG water treatment plant consists of 2 streams:

- RO stream with a capacity of 3.6Ml/d
- Traditional stream (filtration) with a capacity of 7.2Ml/d.

The water from the RO stream is supplied to British Energy (1.8Ml/d at average, 2.4Ml/d at peak). The public water supply is a blend of the 2 streams with a ratio of 30% from RO stream and 70% from traditional stream.

The scheme proposes to upgrade the traditional stream with a RO plant of a capacity of 7.2Ml/d.

A description of each feasible scheme is provided in Appendix 8. Table 27 gives the following information for each feasible scheme:

- Output at average and peak,
- Confidence in achieving output (%),
- Construction period,
- Total Capex (at 07/08 prices),
- Total Opex (at 07/08 prices),
- Annual and one-off Social and Environmental costs.

Scheme number	Scheme name	Type of scheme	Description	Output at average (Ml/d)	Output at peak (Ml/d)	Confidence in output being achieved	Construc-tion period (years)	Total Capex (000's £)	Total Opex per annum (000's £)	S&E costs - one-off (000's £)	S&E costs - annual (000's £)
8	HYTW	Resource Development	Abstraction of brackish water with treatment through reverse osmosis plant. The water will be delivered to SALR.	5	5	25%	4	12,218	994	39.72	142.72
43	DOVN sources	Resource Development	Additional groundwater resource to be deployed from actual boreholes by removing DAPWL constraint on DO.	4.9	4.19	53%	2	1,445	138	10.19	19.53
46	BROK	Resource Development	A new reservoir to be built as a 3 way venture with Southern Water, South East Water and the Company. Scheme based on SEW information for MRF 160 Ml/d and 41.5m AOD. Assume VWSE 20% stake in reservoir. Scheme available in 2023.	5.52	11.08	45%	5	38,720	413	49.56	542.14
293	Folkestone covered storage	Resource Development	Construction of a 300Ml covered storage reservoir for long term storage of winter surplus water for dry year critical period.	0	5	35%	4	19,232	5.98	4.44	9.70

Scheme number	Scheme name	Type of scheme	Description	Output at average (Ml/d)	Output at peak (Ml/d)	Confidence in output being achieved	Construc-tion period (years)	Total Capex (000's £)	Total Opex per annum (000's £)	S&E costs - one-off (000's £)	S&E costs - annual (000's £)
294	BROB effluent reclamation	Reuse	Effluent from BROB is treated to enable it to be delivered to the River Dour in order to provide low flow compensation.	0	5	18%	4	15,953	444	35.02	57.21
301	BARI increase	Bulk Transfer	Option to increase import from SEW from 2Ml/d to 4Ml/d. Scheme available in 2020.	2	2	68%	2	2,271	182	33.81	0.00
309	Full desalination scheme	Resource Development	Treatment of sea water via reverse osmosis plant.	5	5	35%	4	11,144	1,618	46.34	344.74
314	Sources optimisation	Resource Development	Relieve existing network constraint downstream of the bulk import from SWS and SSTM, SLIG and SKIN sources towards DOWR.	0	0.81	53%	1	442	0	9.64	0.00
361	Optimisation of Enbrook Way DMA	Leakage	Redesign DMA by installing meter, booster and telemetry.	0.1	0.1	53%	1	30	0.65	83.53	-0.08
362	Installation of new PRV	Leakage	Install a PRV at Guildhall Shellon DMA.	0.1	0.1	53%	1	86	0.26	0.36	-0.28
379	Installation of new PRV	Leakage	Install a PRV at Cheriton High DMA.	0.1	0.1	53%	1	8	0.26	0.36	-0.28
433	Region School Projects	Demand Management	Joint project with EA and other water companies to carry out school audits and promote water efficiency measures.	0.01	0.01	25%	1	3	23	16.00	-0.01
437	Proactive Water Efficiency retrofit trial	Demand Management	Promote the use of retrofit dual flush systems within house through the installation of a number of subsidised devices.	0.2	0.2	25%	1	0	345	0.00	-0.54

Scheme number	Scheme name	Type of scheme	Description	Output at average (Ml/d)	Output at peak (Ml/d)	Confidence in output being achieved	Construc-tion period (years)	Total Capex (000's £)	Total Opex per annum (000's £)	S&E costs - one-off (000's £)	S&E costs - annual (000's £)
439	Join Water Efficiency	Demand Management	Work jointly with Local Authorities to promote water efficiency within LA buildings and to their customers	0.04	0.04	25%	1	0	178	0.00	-0.09
441	Service Reservoirs	Leakage	Drop tests will be carried out at reservoirs on a regular basis (2 per annum) resulting in a reduction in reservoir leakage.	0.01	0.01	75%	1	0	14.5	0.00	-0.03
450	DEAI extension	Bulk Transfer	Uprate the existing import for 1Ml/d for 2/3 of year (Jan-Aug) and for 4Ml/d for 1/3 of year (Sept-Dec), which is equivalent of 2Ml/d over a year. Scheme available in 2020.	1.34	2	68%	1	208	204	0.00	0.00
459	NEHI	Security of Supply	Ensure peak demand is dealt with at the critical pinch point in network: HIRE (150years old reservoir) by building a new reservoir in addition to the actual reservoir.	0	0.86	45%	3	4,642	0	14.55	0.00
605	HYWW effluent reuse	Reuse	Effluent from HYWW is treated to tertiary standard and injected into the HYTW Hythe Ranges. This will provide a barrier for saline intrusion into this shallow aquifer.	5	5	25%	4	14,943	1,063	75.89	116.05
626	SBRO network improvement	Local Distribution	BARI import and SBRO discharging together are constrained by the network downstream of SBRO. The scheme is to change the location where SBRO feeds into the network.	0	1.85	70%	1	945	8.7	11.75	8.40

Scheme number	Scheme name	Type of scheme	Description	Output at average (Ml/d)	Output at peak (Ml/d)	Confidence in output being achieved	Construc-tion period (years)	Total Capex (000's £)	Total Opex per annum (000's £)	S&E costs - one-off (000's £)	S&E costs - annual (000's £)
627	SWOR network improvement	Local Distribution	Network restriction is caused when SWOR works in conjunction SOTT supplying PADR. The scheme network improvement by laying a new pipeline to connect the existing main from SWOR to SRAK-PADR main. A new borehole pump and upgrading treatment process will also be introduced at SWOR.	0	0	0	0	0	0	0	0
628	SRAK network improvement	Local Distribution	The group of borehole sources (SDEN STAN STAS SRAN and SRAS) and is not achieving the licence output due to the wrong pump sizes. The proposal is to install a new pump at SDEN.	0	3.1	70%	1	287	7.6	0.00	1.10
629	SLYE licence recovery	Resource Development	Negotiation with the EA to recover the water lost to treatment through variation of the licence.	0.14	0.14	50%	1	13	0	0.00	1.10
630	SDNG re-mineralisation of RO stream	Treatment	SDNG treatment works consists of 2 streams: RO stream with capacity of 3.6Ml/d and a traditional stream (filtration) with a capacity of 7.2Ml/d. Upgrade is required to replace traditional stream with RO plant (capacity 7.2Ml/d). This would reduce the outage at SDNG treatment works.	0.02	0.06	53%	3	6,531	1,219	127.87	134.78

Scheme number	Scheme name	Type of scheme	Description	Output at average (Ml/d)	Output at peak (Ml/d)	Confidence in output being achieved	Construc-tion period (years)	Total Capex (000's £)	Total Opex per annum (000's £)	S&E costs - one-off (000's £)	S&E costs - annual (000's £)
632	CHOICE	Tariffs	New stepped charging structure where an initial allowance of water to cover everyday household use will be charged at a rate below the current standard rate. Any water that is used in excess of this allowance will be charged at a higher than standard rate. Scheme available from 2013.	1.4	1.4	45%	1	224.5	145	0.00	-1.29
637	Smart metering	Metering	Implement Smart metering trial with the benefit of gaining better understanding of Smart metering technology.	0.04	0.04	53%	5	280	5.7	2.83	0.00
638	BARI continuation after 2014/15	Bulk Transfer	The Company has an export agreement with SEW and this agreement expires in 2014/15. This option is for the continuation of this existing agreement.	2	2	In baseline	0	0	Base opex	0.00	0.00
639	DEAI extension after 2012	Bulk Transfer	The Company has an export agreement with SWS and this agreement expires in 2012. This option is for the continuation of this existing agreement.	1.33	1.33	In baseline	0	0	Base opex	0.00	0.00

Table 27: Description of the feasible schemes

7.5 Optimisation

The Company used the "least-cost optimisation" Dynamic Model developed by the consultants Jacobs, to define the preferred options list. The model has been designed to pull together the various components of the WRMP to produce an optimised least-cost development scenario for each water resource zone and allow the plan to be updated rapidly to respond to changes in demand forecasts, deployable outputs, risk and headroom etc; and take account of alternative climate change scenarios and sustainability reductions as these may become available.

The methodology adopted follows the procedures outlined in the *Economics of Balancing Supply and Demand (EBSD)*. The optimisation routine chosen is the dynamic programming (DP), which is probably one of the most robust optimisation techniques for determining a global optimum solution for a staged process such as the WRMP.

The 'least-cost optimisation' model includes provision for calculating the following economic costs:

- *AIC* - for each option is defined as the Net Present Value (NPV) of the combined CAPEX and OPEX, at a given *discount rate*, divided by the NPV of the expected output (yield) for that option.
- *AISC* - for each option is defined as the NPV of the combined CAPEX and OPEX, together with the estimated environmental and social costs added in, divided by the NPV of the expected output (yield) for that option.
- *NPV* – Net Present Value, of the range of options in a given scenario is the combined CAPEX and OPEX cost streams, together with estimated social and environmental costs (over time), discounted at a given *discount rate*, of all options included in that scenario.

The model calculates these economic costs for the feasible options list to arrive at an optimum selection of schemes and implementation sequence, that meets the projected supply/demand balance (including allowance for headroom) at a minimum NPV, for a given target level-of-service.

The Company's preferred methodology for the optimising calculation is to use individual scheme risk benefit values, as the Company consider this more effective and accurate when using a modelling approach that considers a large number of combinations of scheme options.

However, in order to comply with the EA guidance, the Company did not use individual scheme risk benefit value for the final WRMP. The EA's preferred approach has been used to define the proposed investment strategy.

8 Final water resources strategy

8.1 Justifying the optimum solution

The Company has taken full account of the views of stakeholders and customers in formulating its final water resources strategy.

In view of the Company's 'water scarcity' status and Governments views on 'water stress', maintaining the focus on demand management is an essential component of the plan. It is a priority for the Company and the long-term security of supply of customers that customers are supported in minimising their demand for water.

Demand management measures are a central plank in the investment plan for 2010 to 2035, and this means the Company will maintain a positive supply/demand balance if reduced consumption is sustained in the long-term. Accelerating the current metering programme is in direct response to these drivers. Further, introducing a socially-responsible stepped tariff for water charges as a low-cost scheme compared to the alternative of new resource development is being promoted by the Company. In promoting these demand driven solutions, the Company recognises the need to be sensitive to any issues of affordability that may affect customers, and appropriate safeguards are built into the plan.

As a consequence of being the first water company granted 'water scarcity status', the Company, Ofwat, Consumer Council for Water, Environment Agency, Waterwise, and Defra formed a strategic stakeholder group. The development of the tariff trial was undertaken with input from all these representatives and was formerly agreed by Ofwat. The involvement of all these stakeholders is essential in developing the company-wide stepped tariff. As a minimum, the Company would consult and communicate with all the parties listed above, as well as with its customers.

With this strategy, the Company does not have a supply/demand deficit and therefore does not need to implement costly resource schemes over the 25-year period.

8.2 Final planning supply/demand balance

The Company proposes to follow the strategy defined in its Strategic Direction Statement (SDS) and include in its supply/demand strategy:

- As detailed in its SDS, draft WRMP and Business Plan, the Company will roll out the stepped tariff scheme (currently trialled in the town of Lydd) to the whole supply area in April 2013. The tariff scheme will provide the Company and the water industry with valuable experience and data on how customers respond to tariffs in the short and medium term.

This scheme is key to achieving the Company's aspirational target of 120 PCC by 2015. However, there is considerable uncertainty around customers' response to demand management measures; therefore, the Company has decided to forecast demand based on a Per Capita Consumption of 130l/person/day. By modelling revenue based on 130 PCC rather than 120 PCC, the Company is seeking to appropriately balance the impact on customer bills against the uncertainty in demand and Company income. This position

has been approved by the Board as part of the overall strategy to achieve the right balancing between Company risk and the impact on customer bills.

If the target of 120 PCC is not achieved by 2015, the Company has the option to explore changes to the tariff mechanism to stimulate further customer reductions to achieve the 120 PCC target.

The Company will consult with customers and stakeholders in developing its tariff measures.

- The Company will continue its AMP4 leakage strategy, which aims to reduce leakage by 0.5Ml/d over the 5-year period. This will reduce the leakage level to 7.5Ml/d by 2015 and progress towards achieving the Sustainable Economic Level of Leakage over a 10-year period. This is consistent with the Company's SDS and energy efficiency target. The 'willingness to pay' survey highlighted strong support from customers for carbon reduction. Customers have also made it clear that leakage should be reduced further, if they are expected to reduce their consumption, and the Company is responding to that message by lowering leakage by a further 0.5Ml/d.

- The Company will also undertake three studies during AMP5.

The AMR trial will strengthen its position towards customer service and new technology by installing AMR meters in internal properties.

The Company is responding proactively to growth challenges around Dover, by undertaking further detailed design and network analysis for the Whitfield development. The Company will be in a position to propose detailed network solutions to the developers at the end of AMP5.

The Company continues to work with the EA and neighbouring companies on the Little Stour catchment.

- The Company has incorporated the 0.07Ml/d per year Water Efficiency Target set by Ofwat into its final Business Plan projections. The Company plans to carry out a variety of water efficiency activities during AMP5 with both commercial and domestic customers, with savings estimated for each activity in line with the information provided by Ofwat.

The Company's water resources strategy is made of a small number of schemes which are required to maintain a satisfactory supply/demand balance over the planning period. The schemes and studies to be implemented over the AMP5 period are shown in Table 28 below.

Scheme name	Implementation date	Output at average (Ml/d)	Output at peak (Ml/d)	5-year CAPEX (£k)	5-year OPEX (£k)
96% metering	April 2012	Baseline	Baseline	3,549	802
CHOICE	April 2013	1.4	1.4	225	290
0.5 Ml/d leakage reduction	2010-2015	0.5	0.5	86	0
AMR study	2010-2015			280	28
Little Stour NEP study	2010-2015			181	0
Whitfield study	2010-2015			175	0
Water efficiency target	2010-2015	Baseline	Baseline	0	209

Table 28: Investment programme

The result of the proposed investment programme is shown in Figure 18 and Figure 19 and demonstrates that the Company is able to maintain security of supply throughout the planning period.

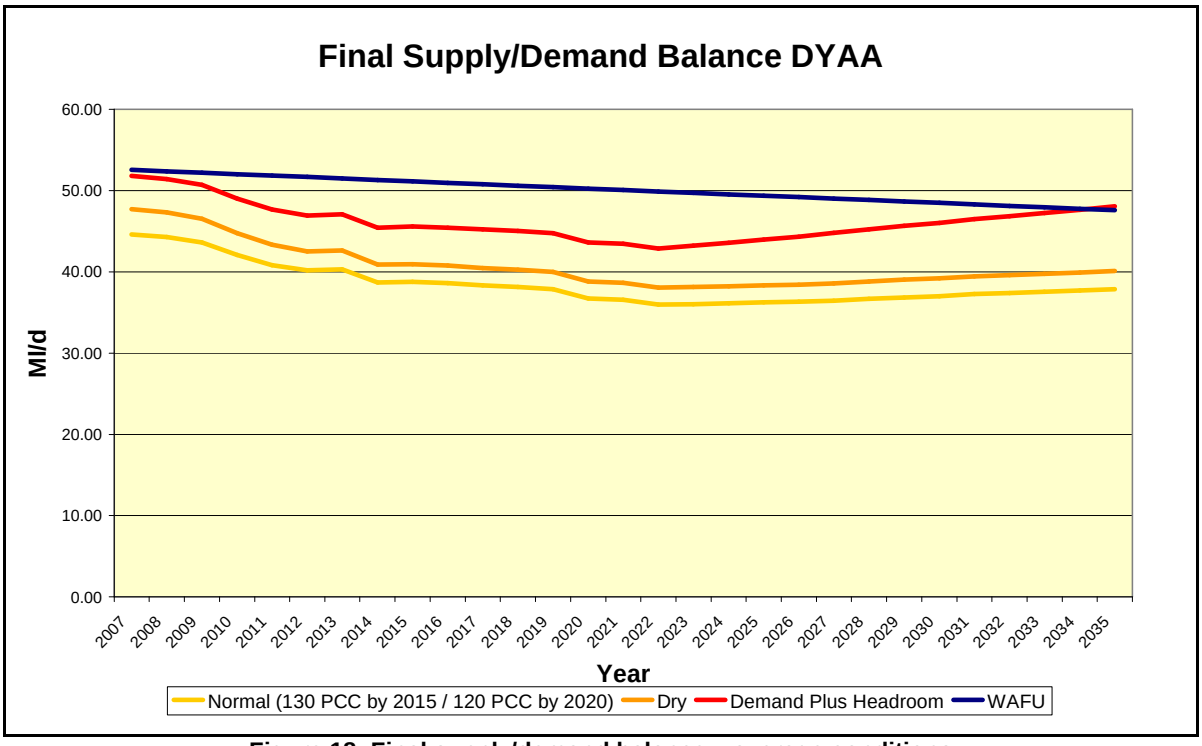

Figure 18: Final supply/demand balance – average conditions

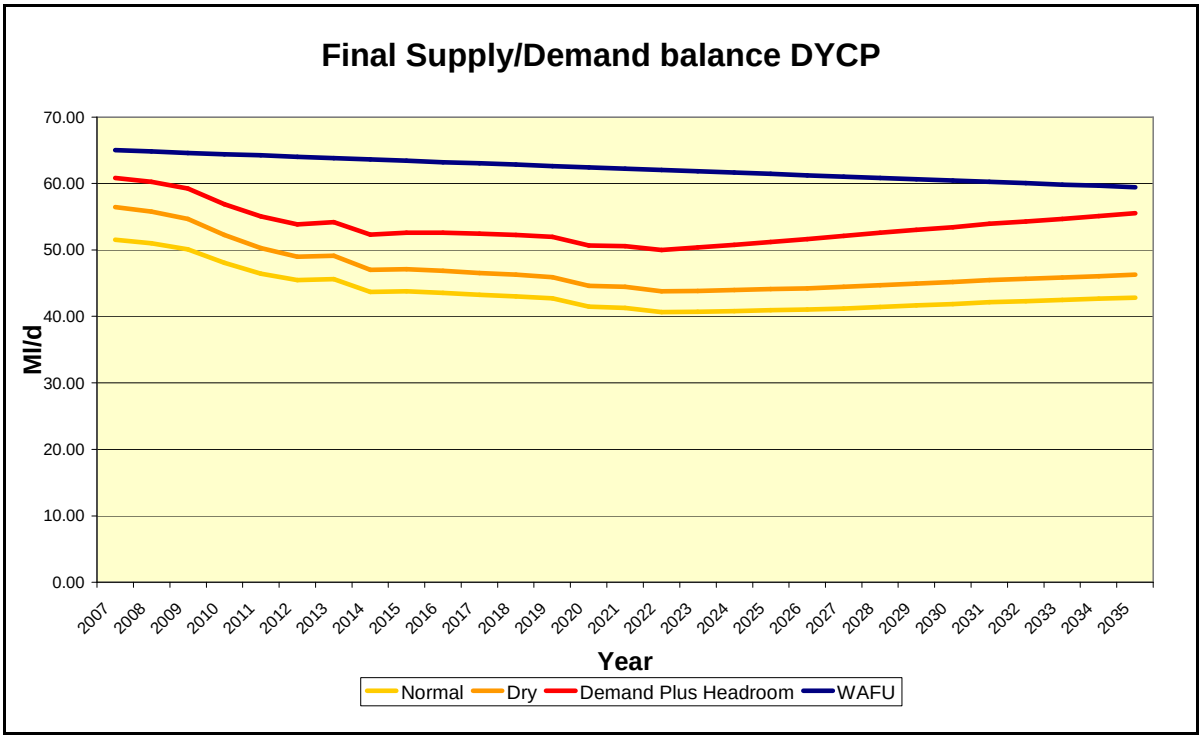

Figure 19: Final supply/demand balance – critical period conditions

8.3 Contingency plan / sensitivity analysis

The Company has run different scenarios to test the robustness of its supply/demand forecast. These scenarios are:

- High outage
- Loss of Denge DO from 2015
- Loss of licences through WFD
- High Climate Change impact
- High PCC
- Supply Pipe Leakage
- Commercial forecast based on 2007 consumption

While various sensitivity scenarios bring forward the supply/demand deficit in the planning period, none result in a deficit during 2010-2015.

The Company has identified from the sensitivity analysis which schemes would be implemented if the demand management strategy does not result in customers reducing their consumption as forecasted.

Indeed, it is customers who decide how much water they should use (in the light of the cost, if they are metered), and the Company has a statutory duty to supply domestic customers with the water they wish to use. It is, therefore, possible that demand may rise more quickly than predicted in the plan. To cope with this uncertainty, preparing for new resource schemes is important. The Company continues to explore with the EA and other water companies in the South-East the best ways of sharing resources. In this way, the

Company's plan will remain flexible and the Company can bring forward schemes if demand rises beyond that currently predicted. Further, uncertainty over whether reduced demand will continue in the longer term remains, and the Company expects to work with Ofwat to ensure that this risk can be reflected in the financing of the Company.

The Company proposes to bring forward the following schemes if demand was rising faster than predicted in the plan. These would be:

- Regional solutions - The Company has considered the results from the Water Resources in the South East modelling work and is closely working with its two neighbouring companies: South East Water and Southern Water, to secure augmented bulk imports. These bulk imports would provide an additional 3.34Ml/d at average and 4Ml/d at peak.
  - Scheme 301 – BARI increase from 2Ml/d to 4Ml/d at both average and peak conditions.
  - Scheme 450 – DEAI increase from 1.33Ml/d to 2.67Ml/d at average and from 0Ml/d to 2 Ml/d at peak. From recent conversation with SWS, it is understood that the increased bulk supply will not be available before 2020.

- Optimisation of output from existing sources - The Company is currently investigating the possible optimisation of the outputs from its operating DOVN sources by removing DAPWL constraint on DO. If the investigations are proved successful, the Company would have the possibility to use the additional water from 2013. This scheme would provide at best an extra 4.9Ml/d at average and 4.19Ml/d at peak.

8.4 Regional solutions

The Company agreed with the EA that options for supporting the supply/demand balance for its customers would be modelled in the WSRE programme using existing and extended cross border supplies only. The origin of water to satisfy those supplies and the means to make it available within water supply zones adjacent to the Company boundary would be considered in the wider context of a regional supply solution rather than linked to a single scheme. The Company's modelling was consistent with this approach.

It should be recognised that any increase in bulk supplies from neighbouring companies, such as those with Southern Water and South East Water are directly linked with the development of a regional solution, as these additional exports to the Company can only be met through additional resource development elsewhere. Therefore, the Company supports the development of regional solutions as these will be essential to provide the Company with additional imported water.

As part of the WRSE group, the Company is also leading on the writing of a public domain report signed up by all WRSE parties which will provide a clear factual overview of the regional modelling work undertaken by the WRSE group and which will be understandable by the public. The WRSE group intend to publish this report before the end of 2009.

The Company will continue to work closely with its customers, local stakeholders and neighbouring companies in order to ensure availability of water through demand management savings and regional resource developments.

8.5 Carbon emissions

The carbon footprint resulting from investment has been calculated for the planning period 2010-2035 based on the emissions required to meet the dry year annual average forecast demand in each of the next 25 years. Included in this calculation is the carbon impact resulting from the baseline metering strategy which is to reach 96% by 2012, and the implementation of the stepped tariff scheme.

Figure 20 illustrates that the resulting CO2 emissions from the plan decrease steadily between 2008 and 2020 due to the implementation of demand management measures, which is in line with the Company's commitment to reduce 1% annually energy carbon use until 2020 (as included in the Strategic Direction Statement). The Company forecasts a positive supply/demand balance until the end of the planning period. Therefore, no resource development schemes are required, and consequently, the level of CO2 emissions will remain constant between 2020 and 2035.

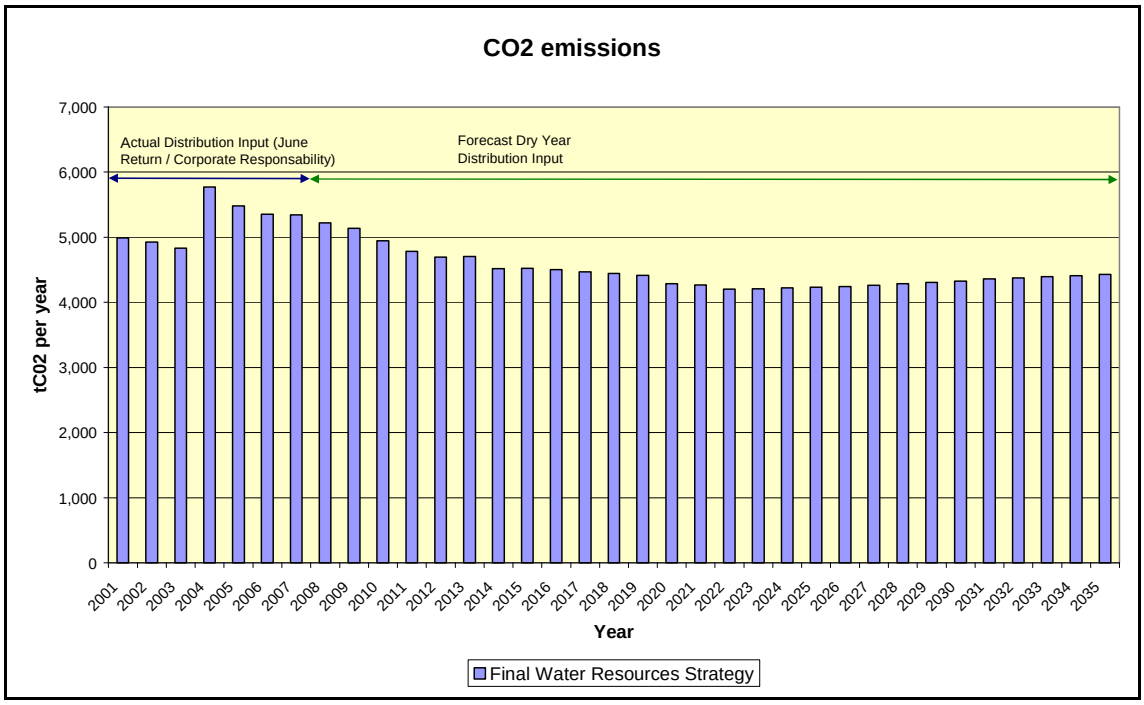

Figure 20: Carbon Footprint for 2010-2025

9 Conclusion

The Company has fully satisfied the WRMP Regulations and this has been confirmed by Defra.

The Company incorporated the comments received via the consultation process and improved the presentation of its final WRMP where required.

The reduced impact of climate change on the Company's water available for use and the renewal of bulk agreements with neighbouring companies resulted in a much improved baseline supply/demand position compared to the draft plan. Indeed, the Company does not have a deficit under average and critical conditions: only demand management schemes are being implemented, which are anticipated to delay the costly development of new resources.

The Company has received Ofwat's Draft Determination, which is consistent with the WRMP. Subject to Ofwat's Final Determination, the Company fully anticipates following the strategy outlined in this document.

The Company will continue to review this plan over subsequent years to ensure that new information is taken into account.

The Company would like to formally express its thanks to all those individuals, organisations and regulators who contributed to the Water Resources Management Plan and hope that they will consider, as the Company does, that the overall process has been worthwhile and that their contributions and comments have made a difference.

10 Tables