FINAL WATER RESOURCES MANAGEMENT PLAN 2014

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FINAL WATER RESOURCES MANAGEMENT PLAN EXECUTIVE SUMMARY

Portsmouth Water has a long tradition of serving Portsmouth and the surrounding area since the Company was established in 1857. Through amalgamation, the area has expanded beyond Portsmouth to supply the towns and cities of Gosport, Fareham, Havant, Chichester and Bognor Regis in the South East of Hampshire and West Sussex.

Long-term planning for the provision of public water supplies is a vital aspect of maintaining the security of supply to customers whilst respecting the needs of the environment. Water resource planning has been a regular activity for water companies for many decades and the Government has introduced legislation that requires companies to prepare Water Resource Management Plans on a formal basis and for public consultation to be carried out. The plans are prepared in accordance with the statutory guidance issued by the Environment Agency; *the Water Resources Planning Guidelines (WRPG; Ofwat, Environment Agency and Defra, 2012d)* following a strict timetable, legislation and regulations.

The Need for this Plan

The purpose of the Final Plan is to set out how the Company will maintain the balance between the demand for water from its customers and the resources available to it over the next 25 years.

Since publication of the Draft WRMP for consultation, Portsmouth Water has produced a Statement of Response to the representations that were made. The Company has also produced an addendum to the Statement of Response. This sets out further information requested by Defra following the submission of the first statement.

The Content of this Final Plan

This Final Plan looks to assess the Company's ability to maintain the security of supplies to its customers for the next 25 years or 'planning period'. A Baseline Supply/Demand Balance is produced which compares the availability of supplies with forecast demands in dry, but not drought years from 2015-2040. Where deficits occur during this planning period, the Company evaluates the financial, social, and environmental and carbon costs of various options to identify a sustainable Final Planning Solution through the Least Cost Planning Appraisal.

The Plan provides further justification for the Final Planning Solution which balances the needs of the environment whilst minimising the financial impacts of the proposals on its customers.

The Background to the Plan

Throughout its 150 year history as a public water supply undertaker, the Company has ensured the provision of adequate water resources to meet the needs of its customers. It has not imposed a hosepipe ban since 1976 and its customers are not accustomed to restrictions. Regular research reveals that security of supplies is important to customers. Portsmouth Water customers also enjoy high standards of water quality and customer service whilst enjoying the lowest water supply charges in England and Wales.

The Water Resources Plan 2014

Water Resources Plans have been at the heart of the Company's work for many years and more recently the Company has published Water Resources Plans on a five yearly basis. The last plan, published in 2011, included a commitment for further work to inform this plan. This included a reappraisal of options, an analysis of the Company's critical planning period, reassessment of deployable output and other areas of further work.

Policies and Strategies Influencing the Final Plan

There are a number of policies and strategies which have been used to inform certain elements of the Final Plan, these include:

- **Government White Papers** such as the Natural Environment White Paper and the Water White Paper which include an expectation that companies would set goals for reducing average water consumption.

- **Water Stress Classifications** which requires companies to consider compulsory metering, if it is deemed in an area of water stress.

- **Environment Agency Strategy** which looks at setting objectives such as creating a better water environment and sustainable planning amongst other goals

- **National Environment Programme (NEP)** a list of sustainability schemes agreed with the Environment Agency

- **River Basin Management Plan (RBMP)** a plan for the implementation of the Water Framework Directive

Supply

The supply side forecast was reassessed for the Draft Plan. This included a reassessment of deployable output, consideration of sustainability reductions as a result of studies currently being included by the Company; an assessment of climate change, outage and treatment works losses and the potential impacts from bulk supplies to other companies.

The reassessment of the Deployable Output (DO) included a commitment to investigate the impact of levels of service on source yields. Portsmouth Water appointed URS consultants to carry out a full DO assessment in addition to assessing outage and headroom.

Portsmouth Water has undertaken a new assessment of Climate Change based on the latest methodology which utilises the UKCP09 data with Consultants HR Wallingford. The initial results indicated Portsmouth Water's vulnerability to climate change was medium and therefore in line with guidance a full assessment of climate change was carried out.

Outage, defined as a temporary loss of deployable output at source works was also reassessed with outages being lower than the previous plan due to the removal of several risks by actions taken during the intervening period.

Portsmouth Water has taken account of the outputs from Water Resources in the South East and included bulk supplies in its plan where these have been agreed in principle with neighbouring companies.

Demand

Portsmouth Water gave a commitment in its 2009 WRMP to undertake a review of its demand forecast by March 2013. The Company has reviewed the demand forecast including the consumption monitor and development of a new micro-component household demand forecast.

Experian were appointed by a group of eight water companies in the South East to develop detailed property and population forecasts. The results indicate that whilst the Company's supply area will see an increase in both properties and population over the planning period, the growth is not as high as estimated in the previous plan.

Additionally a recalculation of occupancy has led to an increase in the estimate of the number of people living in a household, leading to a drop in the per capita consumption (PCC) estimate. The PCC is used to predict consumption in households, and is calculated through micro-components and supported by the consumption monitors.

To meet the commitments set out in the statement of further work from the previous plan, a micro-component forecast has been developed in line with the guidance. This forecast uses a mixture of customer survey data, a review of existing literature and educated assumptions to obtain a PCC of the Company's unmeasured and measured customer base. The results show that, in line with the Government's aspirations, the Company's PCC will fall over the planning period.

The micro-component forecasts are supported by both an unmeasured and measured consumption monitor and adjusted to represent a normal year through previous demand analysis. The existing unmeasured consumption monitor was updated with the latest information, whilst a measured consumption monitor was created using billing data and occupancies acquired from a customer survey.

Through statistical analysis of previous demands and further in depth analysis into different commercial activities, a new non-household forecast was created that built on previous work. The results indicate that non-household demand will continue to fall over the planning period.

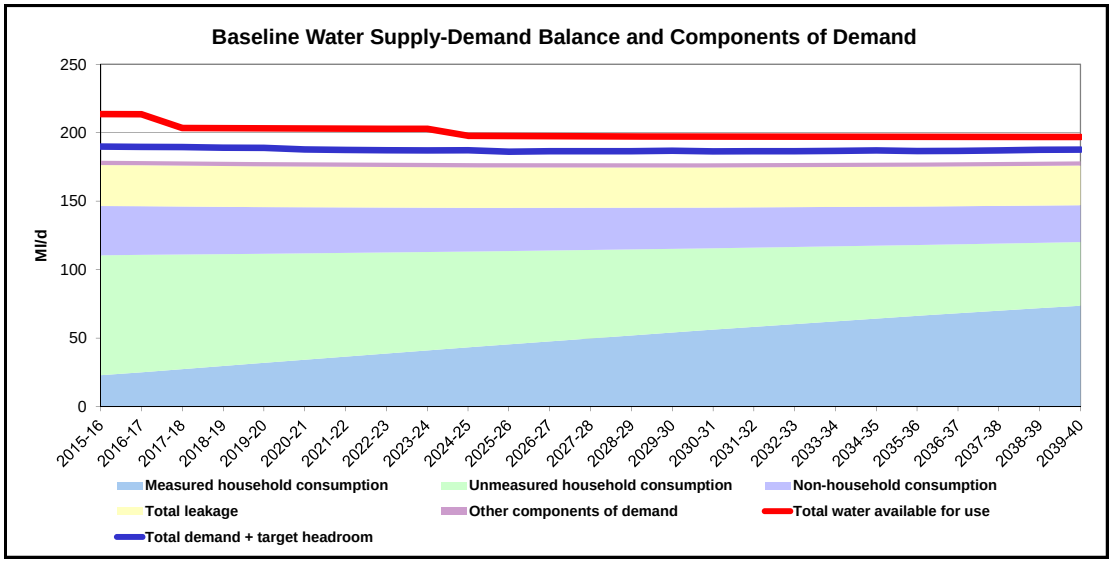
Another commitment to further work for the Company was to undertake the development of a Sustainable Economic Level of Leakage (SELL). The most recent assessment concluded that the central estimate of SELL is 31.4 Ml/d within the range of 28-34 Ml/d. The Company has assumed a leakage projection of 30 Ml/d based on this assessment, which is also consistent with the current leakage target. Leakage is forecast to reduce over the planning period as a result of falling supply pipe leakage resulting from the increasing meter penetration from the take up of Optional Meters.

Baseline Supply/Demand Balance

The baseline deployable output has to be compared with the baseline demand forecast to assess Portsmouth Water's security of supply. Target headroom is the buffer between supply and demand and allows uncertainty and risk to be considered. Re-assessments were carried out by URS consultants taking into account various uncertainty factors and have concluded that the headroom profile for the company will be higher for this plan than the previous plan for both the annual average and the peak period.

The Water Available for Use (WAFU) is calculated by deducting allowances for outage, process losses and climate change from the deployable output. The WAFU is then compared to demand and headroom to determine if there is a surplus or deficit across the planning period.

The graph below shows a representation of this calculation for the Baseline Annual Average and shows that the WAFU (Red line) stays above the Total demand + headroom (Blue line) which means the company is in surplus for the whole planning period, presenting further opportunities for bulk supplies to neighbouring companies. A surplus also exists for the Baseline Peak Week and the Baseline Minimum Deployable Output scenarios.



The Appraisal of Demand Management and New Water Resource Options

Portsmouth Water recognises the need to identify sustainable options which will deliver long-term solutions if any deficits are forecast during the 25 year planning period.

The Company conducted its Options Appraisal in accordance with the WRPG and enlisted environmental consultants AMEC to assist in the process. Firstly an 'unconstrained list' of options for balancing a supply demand deficit was produced. These options are technically feasible but not constrained by environmental permits or planning issues. The initial list of options was then screened against eight criteria including yield uncertainty, social impacts and technical difficulty by an expert panel made up of Portsmouth Water representatives, the Environment Agency and consultants from AMEC. This process took the list from 132 unconstrained options to 35 feasible options. Each feasible option was then assessed for costs on a financial, social, environmental and carbon basis. The risk of delivery and yield was also assessed. This allowed Average Incremental Social Costs (AISC's) to be calculated which is used to assist in ranking the options.

The Final Plan

Portsmouth Water's baseline supply demand balance does not forecast a deficit over the planning period for Average, Peak and Minimum Deployable Output scenarios. Therefore the Company is not seeking to promote any resource options.

Portsmouth Water believes its plan is in line with Government Policy Priorities, customers' expectations and meets the requirements set out in the WRPG.

- The Company is forecasting a falling per capita consumption over the planning period
- Leakage is projected to fall over the planning period as a result of reductions in supply pipe leakage
- The Company is supportive of the Water Resources in the South East modelling work by accommodating requests from neighbouring companies for bulk supplies
- Takes account of the longer term supply challenges including rising population and climate change
- Meets the commitment to further work set out in the last Water Resources Management Plan

The Company notes that its Final Plan provides further opportunities for bulk supplies to neighbouring companies.

Testing the Sensitivity of the Plan

The Company undertook analysis to test its plan to ensure that it was robust to the assumptions. The Company investigated how changes to assumptions for supply and demand changed the outcome of the Plan. This analysis demonstrated that the Plan was robust.

Non-Technical Summary

A shorter, non-technical summary has been produced. This will be available on the Company website, with links from the home page and links to the technical detail.

1 INTRODUCTION AND BACKGROUND

The Company has a duty as a water undertaker is to ensure that it meets its customer's expectations in terms of the provision of public water supplies in a sustainable manner. The Company undertakes Water Resources Planning to ensure that the Company will be able to meet this duty both now and in the future.

In developing Water Resources Management Plans the Company recognises the need to balance the provision of secure water supplies with the needs of the environment and the affordability of customer's bills.

The Company has a long tradition of serving Portsmouth and the surrounding area. The Company was first established in 1857 and has only once imposed a hosepipe ban, during the National Drought in 1976. In 2004 a bulk supply was made available to a neighbouring company as a result of taking a regional view of Water Resource Planning. This bulk supply has supported the recipient company during recent droughts. Over the last few years the Company has also pro-actively varied a significant number of their abstraction licences to offer increased protection to the environment.

The preparation and review of Water Resources Management Plans became a statutory requirement in April 2007, under the Water Industry Act 1991 as amended by the Water Act 2003 (HM Government, 2003). The Water Resources Management Plan Regulations 2007 (HM Government, 2007) and the Water Resources Management Plan Directive 2012 (Appendix 16; HM Government, 2012b) provides further detail on the process and further matters a water company must address when preparing its plan.

The Final WRMP has been prepared to meet the following levels of service:

- Temporary Bans 1 in 20
- Ordinary Drought Orders 1 in 80
- Emergency Drought Orders 1 in 300

The actions required to meet these standards are set out in the Final Drought Plan 2013 (Appendix 28).

1.1 Characteristic of Portsmouth Water

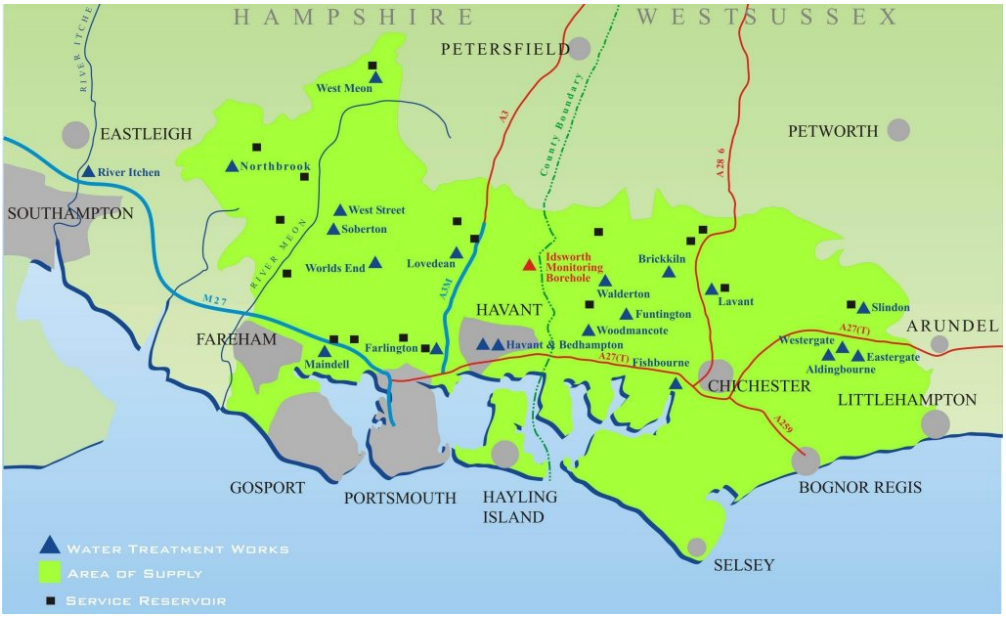
Portsmouth Water supplies an area of 868 square kilometres with a population of around 700,000 across West Sussex and Hampshire. The area of supply includes a large expanse of coastline with numerous important habitats that have been designated under European Directives including South Downs National Park. As a statutory undertaker, Portsmouth Water has due regard to the purposes of the national park. The Company abstracts an average of around 180 Ml/d from boreholes, natural springs and one river abstraction. The Company has no significant raw water storage and consequently is reliant on the recharge of groundwater over the winter period.

Within Portsmouth Waters supply area there are a series of ephemeral and perennial chalk streams and rivers. In addition to their global rarity, chalk streams are diverse ecosystems which support a wide range of native wildlife. Their special status has been recognised by the European Commission's Habitats Directive, which makes provision for chalk rivers and streams in Annex I

of the Directive, the UK Biodiversity Steering Group Report, which prioritised chalk rivers as a key habitat, and the UK's Biodiversity Action Plan, which highlights them as a priority habitat for conservation. The integrity of chalk stream habitats relies upon both water quality and water flows being of a high standard.

The map below gives an overview of the sources Portsmouth Water abstract from. A number of sources are subject to "group licences" where the licence conditions are limited between sources. The group sources are listed below.

- Havant and Bedhampton Springs
- Northbrook and Lower Upham
- Soberton and Newtown
- Eastergate Group (Aldingbourne, Eastergate, Westergate and Slindon)
- Walderton Group (Fishbourne, Funtington, Lavant, Brickkiln, Walderton and Woodmancote)

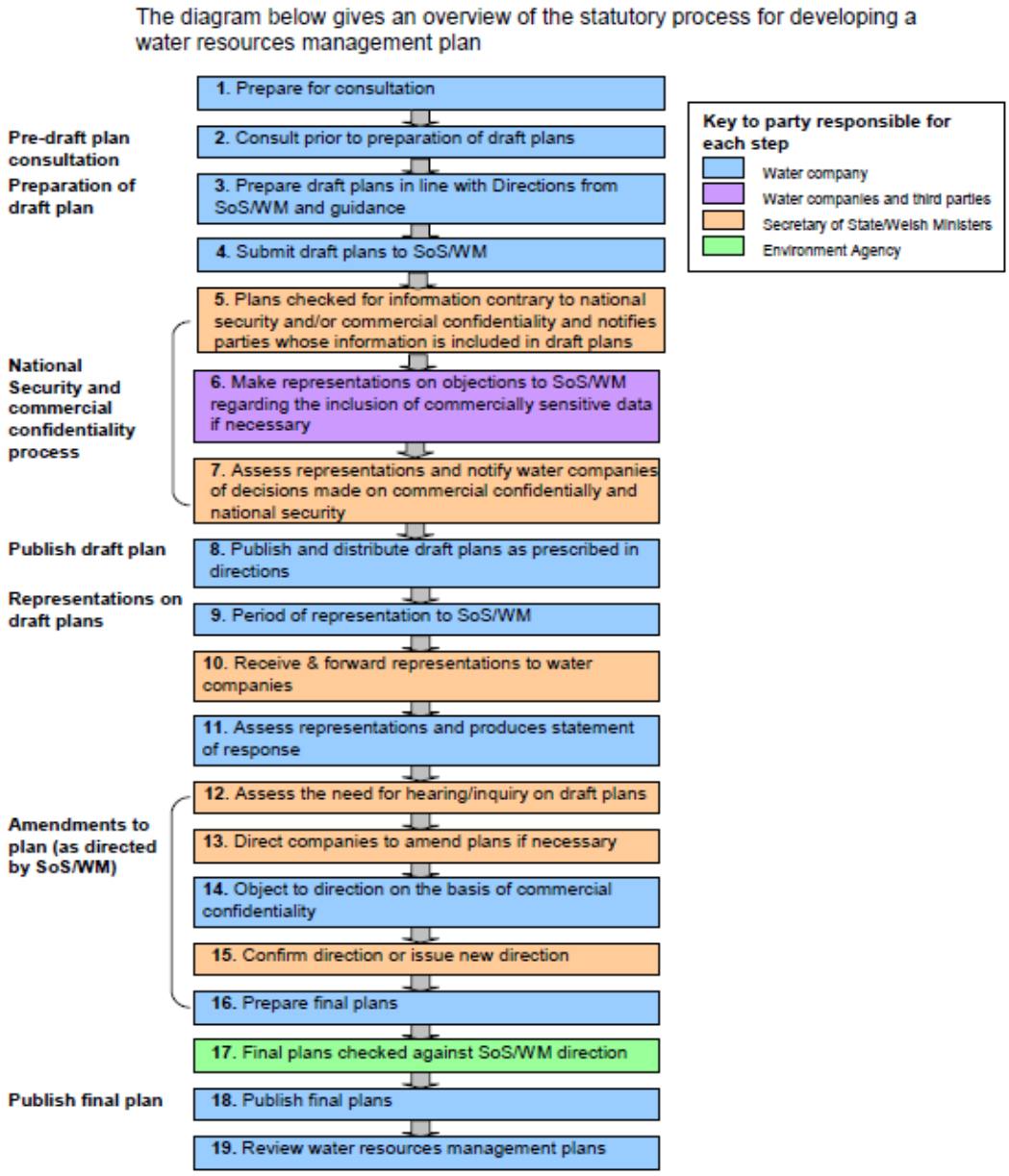


Portsmouth Water, over the last few years has undertaken a number of infrastructure reinforcement projects which has resulted in improved connectivity between sources. As a result Portsmouth Water now has a single Water Resource Zone. The justification for the single zone is set out in Appendix 7.

1.2 Water Resources Management Plan Statutory Process

Water Resources Management Plans are statutory documents and the procedure and timetable which must be followed is set out in legislation and regulations.

The steps of the statutory process are set out below, which is reproduced from the Water Resources Planning Guideline (Appendix 17 WRPG; Ofwat, Environment Agency and Defra, 2012d).



The Company must undertake a period of pre-consultation prior to the preparation of its Draft Plan. The process of pre-consultation ensures that companies take account of the views of the statutory consultees[1]. Once the Draft Plan has been prepared it is vetted to ensure there are no security issues and when approved is published for public consultation. All representations to

[1] Statutory Consultees are the Environment Agency, the Secretary of State, Ofwat and any licensed water supplier in the Company's area of supply.

the public consultation are reviewed and a statement of response is prepared for the Secretary of State which sets out how the Company will reflect the representations in its plan. The Secretary of State determines if the plan should be published, requires modification or if an examination in public of the plan is required.

The water resources planning process runs in parallel to the process for setting Water Company price limits. The two processes are linked and the Company has taken an integrated approach to the two processes to ensure a consistent approach between the plans. This is particularly important to ensure the Outcomes that reflect what customer's value are aligned with the WRMP. The Company has provided regular updates to the Portsmouth Water Customer Challenge Group.

1.3 Components of the Supply Demand Balance

The Company builds a forecast of its supply and its demand by considering the individual elements. The section below sets out the key building blocks that are considered in developing the forecasts.

1.3.1 Supply Side Components

Deployable Output Assessment – The deployable output assesses how much water a supply source will yield. This assessment takes into consideration that the yield of sources will vary both from year to year and also within a year.

Outage Assessment – The Company must make an allowance for the time that treatment works are unavailable to supply water.

Treatment Work Losses – Treatment works that have filtration as part of their processes use water to wash the filters. The supply assessment must take account of this requirement as the water will not be available to supply customers.

Climate Change – The Company needs to take account of how its sources may be impacted as a result of the changing climate.

Sustainability Reductions – Where companies abstractions have the potential to damage the environment, then it is possible that these abstractions may have to be reduced to protect the environment. Any reductions that have been agreed with the Environment Agency should be reflected in the supply forecast.

Bulk Supply Imports – If the Company is the recipient of bulk supplies from its neighbours this will also be reflected in the supply forecast.

1.3.2 Demand Side Components

Household Consumption – The Company builds a household consumption forecast taking account of changes to population and properties forecast for its area of supply. The forecast also takes into account how water use will change over the planning period and the impact of metering policy.

Non-Household Consumption – The Company must make an assessment of the demand for water from commercial activities.

Leakage Forecasts – The demand forecast needs to take account of water that will be lost through leaks in the piped network.

1.4 Previous Water Resources Management Plan

The Company published its previous WRMP in September 2011. The Company originally consulted on their Draft Plan in May 2008 and published its Statement of Response in January 2009. Defra wrote to the Company in August 2009 advising that a Public Hearing was required to consider the Company's Draft Plan. Following submission of the documents for the Public Hearing Defra then advised that a Public Inquiry would be required. The Company then agreed with the Secretary of State that a new consultation could be carried out, as a number of changes had been made to the Plan as a result of ongoing dialogue with stakeholders. The Company began the consultation on the Updated Plan on the 26 November 2010 and responded to them in a Statement of Response published on 3 March 2011.

The Secretary of State then directed the Company to publish its Final Plan by 5 September 2011 and to incorporate further commitments in the Plan.

1.4.1 Commitment for Further Work

In Section 6.4.2 of the Final WRMP the Company as directed by the Secretary of State gave details of the commitment of further work. This would be undertaken by March 2013 to inform the next plan.

The commitment was to undertake the elements of further work detailed below and to include stakeholders in a dialogue of this further work.

- A complete reappraisal of both demand management and supply options
- Analysis of the Company's critical planning period
- A reassessment of the deployable output of all of the existing licensed sources together with the opportunities for improving outputs and optimising for conjunctive use benefits
- The scale of the impacts upon both yield assessments and demand forecasts of revised "Levels of Service"
- The consideration of new resource options such as effluent re-use, desalination and winter storage reservoirs
- The relationship of each option to the dry year annual average and critical period supply/demand balance
- The consideration of the opportunities for the sharing of existing resources and future resource options with neighbouring companies
- The development of a Sustainable Economic Level of Leakage including review of marginal cost across the planning period. This may have implications for baseline leakage and final planning options
- Development of the base year demand data in accordance with the WRPG
- Revision of the baseline household demand forecast
- Reaching a better understanding of the peak factors during peak demand and a reassessment of the critical period

The Company since the publication of the previous plan has undertaken a number of work streams to ensure that the commitment in the last plan was met.

The Company believes that it has met the undertaking for further work set out in the last plan. The Company sets out in each chapter how the chapter relates to the commitment for further work.

1.5 Government Policies Influencing this Plan

1.5.1 Government White Papers

In the preparation of its WRMP, Portsmouth Water has taken account of Government Policy. This is reflected in the Natural Environment White Paper (HM Government, 2012a) and the Water White Paper (Defra, 2012). The Water White Paper emphasises the importance of the water resources management planning process. In particular it expects companies to:

- Reflect the longer term supply challenges
- Reflect the cost of abstraction to the environment
- Set goals for reducing average water consumption
- Consider the scope for improved water connection
- Make full use of opportunities for water trading

Portsmouth Water agrees and support the aims set out and has developed the Final WRMP accordingly

1.5.2 Water Stress

Prior to the preparation of the previous WRMP, the Company's area of supply was designated by the Government as "an area of serious water stress". During 2012 the Environment Agency consulted on a new methodology to determine if a company was in an area of water stress. A number of questions relating to the data used to undertake the calculation were raised with the Environment Agency and the Environment Agency is currently working to resolve these queries.

The status of "water stress" places a requirement on companies from the Water Resources Planning Regulations (Appendix 16; HM Government, 2007 and 2012a) to consider the economics of the implementation of compulsory metering. Accordingly the Company has considered a number of options for metering programmes as a result of the EA's original designation as being 'seriously' water stressed.

Since the writing of the Draft WRMP, the new methodology was published and the EA recently re-evaluated Portsmouth Waters current water stress position, it has been concluded that Portsmouth Water is in an area of moderate water stress and therefore unable to pursue compulsory metering.

1.5.3 Environment Agency Strategy

The Environment Agency published its Water Resources Strategy for England and Wales in March 2009 (Environment Agency, 2009b). In addition to the Strategy there is a list of actions for the South East Region for the Agency and other stakeholders. The Strategy was based on the Government's own water strategy document "Future Water" (Defra, 2008).

The Strategy looks to 2050, which is beyond the Water Resources Management Plan requirements, which is 25 years and this was done to consider the

implications of climate change. This ties in with the Environment Agency's overall vision for the environment:

"A better place for people and wildlife for the present and for future generations"

To achieve this vision the Strategy set out the following objectives:

- Adopting to and mitigating against climate change
- Creating a better water environment
- Sustainable planning and management of water resources
- Ensuring that water and the water environment are valued

Although the Strategy has not been updated to reflect the Government's latest document "Water for Life" (Defra, 2012) it still covers the majority of the current policies initiatives. Further information is contained in the Water Resources Planning Guideline – "Guiding Principles" (Appendix 17; Ofwat, Environment Agency and Defra, 2012c).

The Strategy contains four future scenarios which cover a range of possible outcomes:

i Sustainable Behaviour

ii Innovation

iii Local Resilience

iv Uncontrolled Demand

The Environment Agency produced forecasts for each of these scenarios but did not select a "Most Likely" option. The Water Resources Management Planning process does not allow for this degree of uncertainty. Water companies have to select a baseline forecast and consider whether there is a surplus or deficit. The resulting plan is subject to sensitivity testing in terms of uncertainty about population forecasts, deployable output and the requirements of other companies in the South East.

1.6 Environmental Legislation

Portsmouth Water in recent years has undertaken a significant number of Environmental Studies to determine if its abstraction of water results in an adverse impact on the environment. As a result of these studies Portsmouth Water has varied a number of abstraction licences as a result of these studies to ensure the environment is protected. The most recent of these variations relates to the River Itchen, where Portsmouth Water has agreed a hands-off flow condition which seeks to safeguard the river.

Portsmouth Water is currently studying a number of sites and the outcomes of these studies are now reflected in the Natural Environment Programme. Further details are given in Section 2.3.5.

1.7 Water Resources Planning Guideline (WRPG)

The Environment Agency produced the WRPG in June 2012 with revisions in October 2012.

The WRPG provides a framework for water companies to follow in developing and presenting their water resources plans. It helps companies show how they intend to maintain a balance between demand for water and the supply. Companies are expected to follow the guideline to ensure their plans cover the requirements specified in the Water Industry Act 1991 (HM Government, 2003).

1.8 Legislative Framework

The Water Industry Act 1991 (as amended by the Water Act of 2003) set out the requirements for water companies to prepare and maintain a WRMP.

Further detail on process and requirements on matters to be addressed in the Plan are set out in the Water Resources Management Plan Regulations 2007 (HM Government, 2007) and the Directions for the 2014 Water Resources Management Plans (Appendix 16; HM Government, 2012b).

1.9 Stakeholder Engagement

Portsmouth Water recognises the importance of effective engagement with its stakeholders to ensure that the Plan has broad support. The Company used a number of mechanisms outlined below to engage with a variety of stakeholders.

Portsmouth Water's process of stakeholder engagement formed the basis of the pre-consultation on its Draft WRMP. Through the mechanisms outlined below, Portsmouth Water shared details on the approach to preparing their Draft WRMP and was able to consider issues raised by stakeholders.

1.9.1 Water Resources Management Plan Stakeholder Group

A WRMP Stakeholder Group was established and organisations were invited to join the group who had made representations or expressed an interest in the Company's previous plan. These consisted of the Consumer Council for Water (CCW), Environment Agency, Ofwat, Natural England and Partnership for Urban South Hampshire (PUSH) representing local authorities. The Company also held a number of bilateral meetings with organisations to discuss specific detailed aspects of the Plan. The Company is grateful for the time and effort these organisations have contributed to the Water Resources Planning process.

1.9.2 Portsmouth Water Customer Challenge Group

The Water Services Regulatory Authority (Ofwat) has determined that customers should be placed at the heart of the price review process. Companies are required to form a Customer Challenge Group which will provide a report to Ofwat on their view of how well the Company engaged with their customers throughout the price setting process and if the Business Plan reflects the views of customers. Water resources are obviously a key element of this process and have been a standing agenda item at meetings, allowing a dialogue to take place on the various issues arising from the Company's Water Resources Plan. The Customer Challenge Group has been used to inform the business planning process. In terms of the Water Resource Management Plan, the key results from the market research have been set out in Section 1.9.3.

1.9.3 Customer Research

Portsmouth Water has undertaken a programme of customer research to inform their Business Plan and outcomes for the PR14 process. This research consists of a qualitative phase based around a number of focus groups and quantitative research used to derive values customers place on elements of service. This research has helped Portsmouth Water to understand customer views with

regard to water resources and to take account of them in the preparation of the Plan. The research has covered issues such as:

- Biodiversity.
- Hardness
- Carbon Footprint
- Leakage
- Public Amenities and Community Support
- Water Efficiency
- Customer Enquiries
- Hosepipe Bans (Planned levels of service)
- Interruptions to Supply
- Customer Funded Subsidies

The key results of the market research, in terms of water resources, were:

- Support for reduced leakage
- Support for hosepipe bans
- Support for increased water efficiency
- Support for better wildlife habitat

As a result of the customer research, the following concerns have been addressed:

- Sustainable Economic Level of Leakage (SELL) has been re-calculated and an action plan developed to reduce leakage to the new target.
- More information has been provided about the Drought Plan, which has been added as an appendix.
- Water efficiency is included in the demand forecast and the Company will work closely with the Wildlife Trust and National Park Authority
- New sustainability reductions have been included.

The customer research summary is now included in appendix 27

1.9.4 Local Authority Engagement

Portsmouth Water engages with Local Authorities in its area of supply with the aim of developing a consistent set of assumptions between Portsmouth Water's WRMP and Local Authority core strategies.

1.9.5 Contact Plan and View of Need

Portsmouth Water recognises the importance of giving due consideration to potential bulk supplies and possible solutions to deficits that may be delivered by third parties. Portsmouth Water has developed a Contact Plan to explore these opportunities. This Contact Plan has involved publishing a view of need setting out the likely surplus water Portsmouth Water are forecasting over the planning period. The Company has worked closely with other water companies in the region both through Water Resources in the South East (WRSE) and through bilateral meetings.

1.9.6 Water Resources in the South East (WRSE)

The WRSE Group comprises six water companies, the Environment Agency, Ofwat, Defra, the Consumer Council for Water and Natural England. The WRSE Group was set up to determine a regional water resources strategy comprising a range of strategic options to find the best solution for customers and the environment in the South East of England.

Portsmouth Water has been an active participant of WRSE providing data to enable the work to take place and contributing to the development of the modelling approach.

The results produced by WRSE have been published on the WRSE website and a copy of the report is in Appendix 23.

Portsmouth Water has considered the results of the WRSE results for the preparation of their WRMP.

1.9.7 Response to Pre-Consultation

Companies are under a statutory obligation to formally pre-consult on their plan and Portsmouth Water wrote to the statutory consultees on 4 January 2013 to seek their views. A copy of the pre-consultation letter and response received are contained in Appendix 24.

Portsmouth Water received three written responses to their pre-consultation from Defra, the Environment Agency and Natural England. In addition Ofwat contacted Portsmouth Water to discuss elements of the Plan.

The Environment Agency, Natural England and Defra noted that they expected the Company to take account of the:

- Requirements set out in the Water Industry Act (HM Government, 2003)
- Water Resources Management Plan Directive 2012 (HM Government, 2012b)
- Water Resources Planning Guideline (WRPG)
- Government Policy priorities
- To give due consideration to the WRSE results

The Company's Plan has been prepared giving due consideration to these elements. The Company has included in Appendix 16 a table setting out the requirements of the Water Resources Planning Directive 2012 and which sections of the Plan demonstrate compliance with the directive.

The Environment Agency raised a number of technical points in its response. The Company through further meetings and provision of information has sought to address these issues.

The Environment Agency also noted that they believed the Company should produce a Contact Plan which sets out how the Company engaged with third parties in developing its plan. The Company has included in Appendix 25 a copy of their Contact Plan.

Natural England made reference to the engagement through the Water Resources Management Plan Stakeholder Group, Portsmouth Water's Customer Challenge Group and Water Resources in the South East. Natural England stated that the issues discussed at these meetings should be taken into account when the Company prepares its plan.

Natural England also noted that they had provided feedback on information the Company had shared with them relating to a Strategic Environmental Assessment and Habitats Regulations Assessment which are discussed below.

1.9.8 Habitats Regulations Assessment and Strategic Environmental Assessment

In preparing its plan, the Company undertook a Strategic Environmental Assessment and a Habitats Regulating Assessment. These processes formed an integral part of the Plan and further details are given in Section 5.4.7.

2 SUPPLY

2.1 Introduction

The projections of output available from our sources of supply were revised for the Final WRMP 2014. It now reflects a detailed re-assessment of source yields and the variation of deployable output with return period. The key assumptions included in the supply side forecast are outlined briefly below with more detail in the following sections:

- Deployable Output Assessment
- Sustainability Reductions
- Climate Change
- Outage Assessment
- Treatment Works Losses
- Bulk Supply Imports

2.1.1 Deployable Output Assessment

The assessment has been totally revised for the Final WRMP 2014 using the latest UKWIR guidance (Environment Agency and UKWIR, 2000). The Consultant, URS, has reviewed the return period of drought events to help identify the deployable output from our sources for the design event which is the "Dry Year".

The impact of recent licence variations has been included and a series of scenarios developed to cover impacts on the River Itchen. In addition to the annual average deployable output, two further "Critical Period" scenarios have been investigated. These are "Peak Week" which is assumed to occur in June or July and "Minimum Deployable Output" which is assumed to occur in October, November and December.

2.1.2 Sustainability Reductions

Portsmouth Water has recently completed a comprehensive investigation into "Post Implementation Monitoring" (PIM) of Habitats Directive sites and an investigation into "Water Framework Directive" (WFD) catchments at risk. The conclusions of the PIM/WFD investigations were published in March 2013 and options appraisals were completed for the River Ems and River Hamble in August 2013.

No sustainability reductions were included in the Draft WRMP but the EA have now published the National Environment Programme (NEP). This includes two WFD schemes for Portsmouth Water with an estimated DO impact of 6.0 Ml/d.

2.1.3 Climate Change

Following publication of the UKCP 2009 scenarios, and further guidance from the Environment Agency, Portsmouth Water carried out a "Vulnerability Assessment" (see Appendix 4) of climate change impacts. The results showed the Company has a medium vulnerability and so further climate change studies were commissioned from URS/HR Wallingford.

The impacts of climate change on flows in the River Itchen and on groundwater sources have been investigated. Impacts on demand are included in the micro component forecast and this is covered in Section 3.

The future risk of climate change is included in headroom both in supply and demand.

2.1.4 Outage Assessment

Companies need to take account of the reduction in deployable output that results from treatment works being unavailable.

The outage assessment has been completely revised for the Final WRMP 2014. It is based on data from 2007/08 to 2011/12 and therefore does not cover the previous outage problems resolved by capital investment. Events longer than 90 days are excluded where further intervention will resolve the problem prior to 2015.

The current outage data is seasonal with higher outage in the winter and lower outage in the summer. This is to be expected as the Company schedules maintenance at periods of lower demand. This is reflected in the figures for Peak Deployable Output (PDO) and Minimum Deployable Output (MDO). The outage allowances at both times are lower than those used in the previous WRMP.

2.1.5 Treatment Works Losses

The allowance of treatment works losses is based on water used for cleaning filters from the more complex sites such as Farlington and the River Itchen Works. It has been assumed that 5% of water is lost at peak demand. The Farlington Washwater Recovery option is designed to reduce treatment works losses and has the additional benefit of reducing discharges to the combined sewerage system.

2.1.6 Bulk Supply Impacts

WRSE modelling has been used to identify possible bulk supplies of water between companies. Although several of the bulk supplies are potentially bi-directional Portsmouth Water has not formally been offered any bulk supply imports or any third party supplies.

The existing bulk supply to Southern Water's Sussex North Zone, via Whiteways Lodge, is subject to an agreement that expires in 2014. However this bulk supply is likely to be renewed.

2.2 Deployable Output (DO) Assessment

In the final version of the WRMP 2009 Portsmouth Water gave an undertaking to reassess the deployable output of all the existing sources (Section 6.4.2). In addition there was a commitment to investigate the impact of "Levels of Service" on source yields.

To comply with these requirements, Portsmouth Water appointed URS to carry out a full DO assessment in addition to an assessment of outage and headroom. URS had produced the "Reliability of Public Water Supplies" report for the Environment Agency (2011) and had developed the "Unified Methodology" for DO assessments.

2.2.1 Previous Deployable Output Assessments

As part of the WRMP 2009 Portsmouth Water submitted a DO assessment which was largely based on previous work. These previous assessments were:

- Southern Water Authority 1984
- Portsmouth Water 1997

These studies used operational data from 1973 and 1976 which were considered to be the worst drought periods in the last 100 years.

The surface water assessment for the River Itchen was based on groundwater modelling data for the period 1970-2002 which was provided by the Environment Agency.

2.2.2 Current Guidance on Deployable Output Assessment

The Water Resources Planning Guideline (WRPG) sets out the procedure for assessing deployable output and this refers to the recent UKWIR report "WR27 Water Resources Planning Tools" (2012). In addition the WRPG refers to the Environment Agency and UKWIR "Unified Methodology for the determination of Deployable Output from Water Services" (2000).

The first report sets out a five step process to follow:

Step 1 – Choose a DO Assessment Framework
Step 2 – Assess Vulnerability to Climate Change
Step 3 – Establish DO Assessment Data Set
Step 4 – Calculate DO with a Confidence Table
Step 5 – Report DO Assessment

This work has been undertaken by our Consultant URS who worked with the Environment Agency on their "Reliability of Southern Region Public Water Supplies" (2011) project.

The full report from URS is included in Appendix 1 and this includes summaries of the data used.

2.2.3 Drought Conditions

The WRMP is based on a "Dry Year" with a return period set by the level of service for temporary use restrictions (hosepipe bans). For Portsmouth Water the current level of service is 1 in 20. Events rarer than this are covered by the Drought Plan and the Emergency Plan.

The current Drought Plan contains four key actions that affect levels of service:

Temporary Bans 1 in 20

Ordinary Drought Orders 1 in 80

Termination of Bulk Supplies 1 in 200

Emergency Drought Orders 1 in 300

The level of service for Hosepipe Bans was considered as part of the market research and the figure of 1 in 20 (5% risk) was considered reasonable by the majority of customers. The rarer events, which are covered by ordinary Drought

Orders (ODO) and Emergency Drought Orders (EDO), are included in the Statutory Drought Plan.

The current Drought Plan contains four scenarios which relate to the following key actions.

Scenario "A" Temporary Bans (1 in 40)

Scenario "B" Drought Directions (1 in 80)

Scenario "C" Drought Permits (1 in 120)

Scenario "D" Three Year Drought (1 in 200)

An additional scenario needs to be added to the Drought Plan to reflect the imposition of Emergency Drought Orders. This could be called Scenario "E" which would have a return period of around 1 in 300. The return period of very rare events is uncertain because they have not occurred in recorded history.

To determine the deployable output of rare events it is necessary to look at historic records and to apply a statistical approach. Groundwater levels are available at a number of locations in our catchment over long periods:

Idsworth Well	1932-2012
Chilgrove	1836-2012
Chalk Dale	1913-2012

Using a frequency analysis of spring flows at Havant and Bedhampton suggests that 1990 was a 1 in 40 year drought and 1973 was a 1 in 140 year drought.

Although flow records exist for the River Itchen from 1958 until the present day this is not sufficient to comply with the WRPG. The WRPG states that data back to at least 1920 should be used to produce a reliable result. Rainfall data is available for much longer periods and URS used a recharge and run-off model (CATCHMOD) to convert this data into river flows. Simulated data from 1880 up to 2005 has been used for the DO assessment.

2.2.4 Planning Scenarios

The WRMP is based on a dry year forecast which is defined in Section 3 of this Plan. The guideline requires companies to complete tables for the "Annual Average" scenario and, if appropriate, a "Critical Period". In the past Portsmouth Water completed tables for annual average and peak week.

For this plan we have considered the possibility that the period at the end of the groundwater recession (when deployable output is at a minimum) is the critical period for Portsmouth Water. Tables have been produced for ADO, MDO and PDO and were compared to determine the critical period.

The final scenario is "Normal Year" but this is used for least cost planning and revenue forecasting. Normal year is not used for the deployable output assessment. Normal operations relate more to the average licence and the ability to cope with planned maintenance and actual outages.

2.2.5 Peak Weak – Peak Deployable Output (PDO)

Portsmouth Water was historically a peak driven company because of its groundwater supplies and lack of raw water storage. Previous yield assessments concentrated on drought deployable output recorded during events such as the summer of 1976. Recent licence variations have often retained peak week abstraction capacity at the expense of annual average licence totals.

For this deployable output assessment the sources have been considered individually and as part of the current group licences. The published methodology is based on daily abstraction with a 7 day running mean over a 5 week period either side of the peak week.

Operational data is no longer available for years such as 1976, so water level data has been collected for recent years. This data is summarised in the main URS report which is included as Appendix 1.

To represent the worst drought on record, and a series of events with shorter return periods, curve shifting has been used. The degree of shift in rest water levels is calculated from observation borehole records and produces scaling factors that can be applied to each source. A "signature" borehole is allocated to each source and represents the appropriate part of the aquifer.

Weekly flows are available for the Havant and Bedhampton Spring source for the period 1908 to 2012. The method for calculating PDO is similar to that used for the groundwater sources.

The River Itchen source at Gaters Mill is linked by its licence to the Environment Agency's gauging station close by at Riverside Park. A suite of de-naturalised flow records has been developed but it is important to consider the impact of Southern Water's abstractions which are upstream of ours.

Portsmouth Water recently varied its abstraction licence on the River Itchen as a result of the site action plan put in place to comply with the Habitats Directive. The site action plan also requires Southern Water to vary their abstraction licence. At present Southern Water have not varied their abstraction licence, so Portsmouth Water has considered three deployable output assessment scenarios:

- Scenario 1 – Worst case where Southern Water does not apply the proposed "Hands Off Flow" (HOF) or summer licence constraints.

- Scenario 2 – This scenario assumes that the 198 Ml/d HOF is applied but no additional summer constraints are enforced.

- Scenario 3 – Assume that the 198 Ml/d HOF and the summer constraints are applied to Southern Water's abstraction.

All three scenarios assume a dry weather flow from Southern Water's Chickenhall Waste Water Treatment (WWTW), which is upstream of our abstraction a HOF constraint at Riverside Park (the tidal limit) and a stepped licence profile for Portsmouth Water.

The PDO has been assessed for a peak period of mid July for the worst drought in the flow record. A series of other return periods are then calculated to inform the "Levels of Service" (LOS) related assessment.

For Portsmouth Water, the current LOS for temporary restrictions to demand is 1 in 20. This is a 5% risk of this occurring compared to a risk of 1% or less for the worst drought on record.

2.2.6 Minimum Deployable Output

In previous yield assessments, Average Deployable Output (ADO) actually referred to reliable yield, during the worst drought, when water levels were at their lowest. This is now referred to as "Minimum Deployable Output" (MDO).

Operational water levels are not available for the worst droughts in 1973 and 1976. Curve shifting has been used to estimate the deployable output for other return periods.

Weekly flows are available for Havant and Bedhampton Springs for the period 1908 to 2012. A four weekly running mean has been used for this deployable output assessment.

The River Itchen Source MDO has been based on the minimum available flow within the most severe drought. The flows have been simulated using the Environment Agency's Regional Groundwater Model and a separate recharge and run-off model (CATCHMOD) developed by our Consultants URS.

The River Itchen Works is not truly a stand alone source because it is located on a groundwater dependent river. Conjunctive use with groundwater is considered within a "Resource Zone Model".

2.2.7 Source Constraints

Deployable output can be constrained by a number of factors:

- Licence Constraints
- Environmental Constraints
- Source Works Constraints
- Distribution Constraints
- Deepest Advisable Pumping Level

The following table sets out the licence constraints following the implementation of the Habitats Directive Review of Consents. It is important to note that the Environment Agency's "Catchment Abstraction Management Strategies" (CAMS) were not updated in 2009 and some of the assessment that they contain have been superseded and many of the actions completed.

Source Works	Abstraction Licence (Ml/d)	
	Average	Peak
River Itchen	45.50	45.50 (41.1 in July)
Northbrook and Lower Upton	20.51	31.50
West Meon	0.46	0.46
Soberton and Newtown	9.02	15.00
West Street	9.12	13.64
Maindell	6.83	7.96
Worlds End	22.73	25.20
Lovedean	11.37	13.64
Havant and Bedhampton	98.00	137.00
Walderton Group	65.04	94.60
Eastergate Group	28.38	41.00
Company Total	**316.96**	**425.46**

The Gaters Mill surface water abstraction, on the River Itchen, is subject to a Hands Off Flow (HOF) condition of 198 Ml/d. This was set as part of the Habitats Regulation Review of Consents Site Action Plan. Portsmouth Water has fully implemented this requirement as a Licence Variation (September 2011).

Havant and Bedhampton Springs also have a Hands Off Flow (HOF) condition where the Company can no longer abstract water if the fresh water flows to the harbours fall below a prescribed level. The main part of this condition relates to the Brockhampton Mill Lake which has a HOF of 6.0 Ml/d. The second part relates to the Langstone Mill Stream which has a HOF of 1.3 Ml/d (February 2010).

The groundwater sources that were assessed as part of the initial Habitats Regulations Review of Consents were subject to a group licence condition. The Walderton Group includes six source works and has additional seasonal abstraction conditions at Fishbourne. The outcome of the Habitats Regulations – Post Implementation Monitoring (PIM) Investigation may require further group licences.

The current group licences are:

- Havant and Bedhampton Springs
- Northbrook and Lower Upham
- Soberton and Newtown
- Eastergate Group (Aldingbourne, Eastergate, Westergate and Slindon)
- Walderton Group (Fishbourne, Funtington, Lavant and Brickkiln, Walderton and Woodmancote)

The Walderton Group licence was the first licence to have a Hands Off Flow (HOF) condition included in the licence. The Walderton licence also has a further condition associated with a compensation flow that must be provided to the River Ems when the flow in the river falls below 2.7 Ml/d.

Source works constraints have been considered in the preparation of the assessment forms and diagrams (see Appendix 1). Pump capacity and pump depth are considered and a pump cut out level of 3m above pump depth has been assumed.

Only Havant and Bedhampton Springs are constrained by treatment works capacity. When the licence was revised at Havant and Bedhampton the annual total was set at 98.0 Ml/d. This is sufficient to allow Havant Thicket Reservoir to be filled should it be developed but is also the nominal maximum treatment capacity at Farlington Works.

Portsmouth Water only has a single Water Resources Zone and this implies that there is sufficient mains capacity to allow abstraction to be distributed across the Company's area. A high level assessment was undertaken for the WRMP 2009 and no significant changes have been made since then.

At present "Deepest Advisable Pumping Water Levels" (DAPWL) have not been calculated for Portsmouth Water sources. Additional CCTV surveys and geophysical logs would be required to establish critical flow horizons.

2.2.8 Source Assessment Results

The published UKWIR methodology UKWIR (2012c) suggests a grading system for groundwater and spring yield assessments. An Option "B" assessment has been carried out for Havant and Bedhampton Springs because full flow records are available. The grades refer to the quality of the data available to undertake the assessment.

Assessment forms and summary diagrams have been drawn for all the well and borehole sources (see Appendix 1). For this reason all the assessments are classed as Option "B" as set out on the following table:

Source Name	2012 Assessment Grade
Gaters Mill	-
Havant & Bedhampton Springs	B
Northbrook	8B
Lower Upham	2B
West Meon	4B
Soberton	4B
Newtown	2B
West Street	8B
Maindell	4B
Worlds End	8B
Lovedean	8B
Woodmancote	8B
Lavant	6B
Brickkiln	6B
Walderton	8B
Funtington	8B
Fishbourne	8B
Eastergate	4B
Westergate	4B
Slindon	4B
Aldingbourne	6B

The use of additional operational data and constraints has improved the characterisation of the sources and the estimates of deployable output Option B assessments have now been done for:

- West Meon
- Maindell
- Woodmancote
- Fishbourne
- Slindon

Previously these sources had not undergone this level of assessment.

The following table sets out the current abstraction licences and the 2009 and 2012 assessments.

Source Deployable Output (Ml/d)

	Abstraction Licences (Ml/d)		2009 Assessment		2012 Assessment	
	Average	**Peak**	**ADO**	**PDO**	**ADO**	**PDO**
Gaters Mill	45.50	41.12	35.40	45.50	37.30	41.12
Havant & Bedhampton Springs	98.00	137.00	53.50	63.00	52.50	71.00
Northbrook	20.51	31.50	20.51	28.00	20.51	28.00
Lower Upham	-	-	-	3.50	0.50	2.70
West Meon	0.46	0.46	0.46	0.46	0.46	0.46
Soberton	9.02	15.00	9.02	9.50	9.02	12.40
Newtown	-	-	1.90	3.80	1.90	3.80
West Street	9.12	13.60	9.12	9.12	9.00	10.60
Maindell	6.83	8.00	3.00	6.50	5.20	7.00
Worlds End	22.73	25.20	12.00	16.00	12.30	14.10
Lovedean	11.37	13.64	11.37	12.10	10.60	12.10
Woodmancote	-	-	3.00	3.70	2.90	3.80
Lavant	-	-	15.00	20.80	16.00	17.00
Brickkiln	-	-	5.00	6.00	5.20	6.60
Walderton	65.04	94.60	26.16	35.25	26.14	35.23
Funtington	-	-	5.00	5.30	6.80	7.00
Fishbourne	-	-	10.00	10.30	10.00	10.00
Eastergate	28.38	41.00	12.6	12.6	12.0	13.0
Westergate	-	-	15.80	16.40	12.50	14.00
Slindon	-	-	2.50	2.50	2.50	2.50
Aldingbourne	-	-	10.00	10.00	8.10	8.80

The zonal assessment is based on a dry year with a return period of 1 in 20. All previous assessments were based on the outputs recorded in droughts such as 1973 and 1976. These had much longer return periods and some of the current deployable outputs, such as Havant and Bedhampton Springs, are now higher than previously shown. The deployable output at Gaters Mill is also affected by the revised licence. This has a stepped profile designed to protect the ecology in the river at times of low flows:

Month	Licensed Quantity	
May	45.46 Ml/d	
June	44.33 Ml/d	
July	41.12 Ml/d	(assumed peak week)
August	40.65 Ml/d	
September	39.17 Ml/d	
October	45.46 Ml/d	

2.2.9 Deployable Output Assessment Results

A resource zone model was developed by URS to calculate the deployable output for various levels of service. The resource zone model includes a time series of abstraction rates for each source. The model sums these time series, applies group licence constraints, and gives a total available abstraction rate. The introduction of a demand profile allows the critical period to be identified and a customer "Level of Service" (LOS) analysis to be undertaken.

The WRPG requires companies to relate deployable output to levels of service. As a minimum, the Environment Agency expects companies to assess baseline DO (without climate change) for the following levels of service:

- No Restrictions
- Company Level of Service
- Reference Scenario Level of Service

In the WRMP 2009 it was decided to plan for a 1 in 20 year level of service for hosepipe bans (Temporary Restrictions of Water Use). This was based on customer research which is now included in Appendix 27. The reference level of service was set by the regulators as 1 in 10. To plan never to have restrictions would require significant investment in water resources to ensure that temporary restrictions were not required.

The impact of return period on deployable output is calculated by increasing the demand profile to generate failures in the supply/demand balance. For a 1 in 20 year level of service, demand is increased until six failures occur (see Appendix 1 Figure 26). These would have occurred in 1934, 1973, 1976, 1992, 1997 and 2005. The first five failures in the hundred year time series (1908-2010) represent a 1 in 20 year level of service.

Portsmouth Water considered a range of return periods for deployable output as set out in the Guideline in Section 2.9.1. The same guidance states that "unrestricted demand remains the basis of the supply demand balance". Portsmouth Water produced a balance on the basis of a dry year with a return period of 1 in 20. This sets the peaking factor for demand and the deployable output for supply. The WRP tables in Appendix 26 were populated on this basis and the header page specifically refers to the chosen level of service.

Alternative drought scenarios were set out in the Drought Plan and compared with restricted demand. The following table sets out the Water Available for Use (WAFU), demand and the resultant surplus or deficit.

Farlington washwater recovery was included in the Business Plan as a quality scheme. To avoid washwater being discharged into the harbour it will be recycled. This has the additional benefit on increasing deployable output which improves the supply/demand balance.

The WAFU figures include our best estimates of drought deployable output. Portsmouth Water has undertaken to carry out further work on these figures during 2014/15. The results will be published in the first Annual Review of the 2014 Water Resources Management Plan due in June 2015. This will allow time for the bulk supplies to be modified if required.

Supply Demand Balance (Ml/d)

WAFU						
	EA	**WRMP**	**A**	**B**	**C**	**D**
	1 in 10	**1 in 20**	**1 in 40**	**1 in 80**	**1 in 120**	**1 in 200**
ADO	227	224	222	200	190	185
PDO	323	318	235	216	210	206
MDO	275	264	207	184	174	164

Demand						
	EA	**WRMP**	**A**	**B**	**C**	**D**
	1 in 10	**1 in 20**	**1 in 40**	**1 in 80**	**1 in 120**	**1 in 200**
ADO	177	179	173	166	158	158
PDO	223	230	210	192	179	179
MDO	165	166	161	152	144	144

Farlington Washwater						
	EA	**WRMP**	**A**	**B**	**C**	**D**
	1 in 10	**1 in 20**	**1 in 40**	**1 in 80**	**1 in 120**	**1 in 200**
ADO	2.7	2.7	2.5	2.3	2.1	1.9
PDO	3.2	3.2	3	2.8	2.6	2.4
MDO	2.7	2.7	2.5	2.3	2.1	1.9

Bulk Supply Required						
	EA	**WRMP**	**A**	**B**	**C**	**D**
	1 in 10	**1 in 20**	**1 in 40**	**1 in 80**	**1 in 120**	**1 in 200**
ADO	20	20	19	18	17	16
PDO	25	25	23.8	22.6	21.4	20.2
MDO	25	25	23.8	22.6	21.4	20.2

Dry Year Surplus						
	EA	**WRMP**	**A**	**B**	**C**	**D**
	1 in 10	**1 in 20**	**1 in 40**	**1 in 80**	**1 in 120**	**1 in 200**
ADO	32.7	27.7	32.5	18.3	17.1	12.9
PDO	78.2	66.2	4.2	4.2	12.2	9.2
MDO	87.7	75.7	24.7	11.7	10.7	1.7

Under the “Dry Year” scenario, used in the Water Resources Plan, a surplus is maintained at average demand, peak demand and under minimum deployable output conditions. Under this scenario the critical period is average demand.

Under the rarer “Drought” Scenarios demand is suppressed and the benefits of the Farlington Washwater Scheme are reduced. Southern Water have now agreed a “Pain Sharing” clause for the bulk supplies which will see the quantity reduce by 5% for each additional drought management scenario.

The Gaters Mill source is modelled with the impacts of Southern Water's abstractions and discharges upstream. In addition the DO is influenced by the stepped licence profile which is designed to protect the environment. A number of scenarios had to be considered in relation to Southern Water's abstractions:

- Scenario 1 – Worst case where Southern Water does not apply the proposed Hands Off Flow (HOF) or summer licence conditions from the Habitats Directive Review of Consents
- Scenario 2 – Assumes that the 198 Ml/d HOF is applied but no additional summer constraints
- Scenario 3 – Assumes that the 198 Ml/d HOF and the summer constraints are applied to Southern Water's abstraction

Portsmouth Water has assumed that Scenario 3 will apply and that the flows derived from the Environment Agency Regional Groundwater Model are used for consistency.

Under all the scenarios Portsmouth Water now has sufficient water to meet the sustainability reductions from the NEP and the agreed bulk supply volumes. The existing bulk supply to Southern Water is currently being re-negotiated. An additional bulk supply to Southern Water is now being progressed. Both bulk supplies will be resilient to droughts up to 1 in 200 return period.

There is a degree of uncertainty about the figures used in the tables. The supply/demand balance in droughts depends on the effectiveness of demand restrictions, the implementation of Drought Permits and the application of the pain sharing agreement.

2.2.10 Confidence Table

The UKWIR methodology (UKWIR, 2012c) sets out a confidence labelling system, which considers the availability of data and the length of the record.

URS assessed the data availability as "B" and the length of the record as "A" giving a combined confidence grade of "BA".

2.2.11 General Recommendations

For the next WRMP, the Consultant recommends the following improvement to data and process.

- Abstraction data prior to 1989 is analysed.
- Detailed abstraction data is obtained for sources that were not operational in 2012.
- Borehole logs, CCTV and geophysical logs are obtained to evaluate DAPWL.
- Manual dipping of boreholes is undertaken at least once every six months.
- Consideration should be given to the use of Chilgrove and Chalk Dale as critical period observation boreholes.
- Groundwater models should be used to test the impact of increased demand on groundwater levels.

- Drought Plan trigger levels should be cross-referenced to the resource zone model.

2.2.12 Future Reviews of Deployable Output

In addition to linking the deployable output from the WRMP with the drought planning scenarios, it would be sensible to co-ordinate work on the River Itchen. The use of the Environment Agency groundwater model and Southern Water's sustainability reductions will need to be reviewed for the next plan.

With the requirement to plan for rarer droughts it will be necessary to do further work on deepest available pumped water level. This will indicate if pumps can be dropped under drought conditions to retain the deployable output. In some cases, the pump level will be constrained by the presence of audits and critical fissures. Portsmouth Water will undertake to carry out this work in time for the next Drought Plan/WRMP.

2.3 Sustainability Reductions

Reductions in deployable output can occur as a result of environmental investigations which determine that abstraction has an adverse impact on the environment.

2.3.1 Previous Sustainability Reductions

The first sustainability reductions to affect the Company resulted from investigations into the impact of abstraction in the Bishop's Waltham area in the 1990's where, it was determined that Hoe Water Treatment Works impacted on the Moors SSSI. An options appraisal led to the closure of Hoe in August 2003 and the development of Lower Upton and Newtown sources. These satellite boreholes were developed in the confined chalk where there were no significant impacts on surface water features.

The Habitats Directive Review of Consents was carried out by the Environment Agency in AMP5 (2000-2005). As a result of the review Portsmouth Water made changes to the following licences:

- Walderton
- Woodmancote
- Funtington
- Fishbourne
- Brickkiln
- Lavant
- Havant and Bedhampton
- Gaters Mill

2.3.2 Post Implementation Monitoring

Following the completion of the Habitats Directive Investigations, and having complied with the Site Action Plans, Portsmouth Water was required to carry out "Post Implementation Monitoring" (PIM) at a number of sites. This involved further studies of harbours and estuaries in its area of supply. The work was

carried out by our Consultants AMEC who produced a Final Report in March 2013. They were asked to study:

- Hamble Estuary
- Titchfield Haven
- Hill Head Harbour
- Fareham Creek

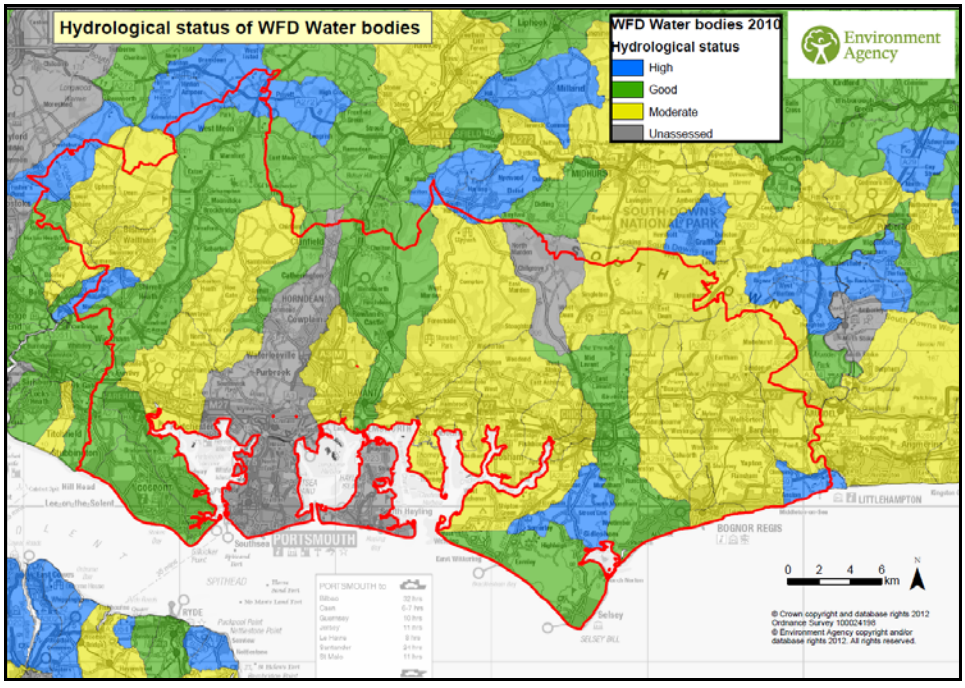
AMEC concluded that there were no adverse effects from abstraction on the Hamble Estuary. There were no adverse effects on Titchfield Haven, but the site is sensitive to water level management and habitat management. Freshwater flows to Hill Head will always be maintained, due to the operation of tidal flaps, and this will satisfy the requirements of the Special Protected Area (SPA) designated for bird species.

Fareham Creek is impacted by abstraction at Maindell and this "adverse effect" will require some form of mitigation to be implemented by April 2015.

All Habitats Directive investigations have now been completed and the threat of time limited licences should now have been removed.

2.3.3 Water Framework Directive

The Water Framework Directive (WFD) has become the main driver for sustainability investigations. The Environment Agency published the River Basin Management Plan (RBMP; Environment Agency, 2012a) for the South East in December 2009 which aims to return all water bodies to "Good Ecological Status" (GES) by 2015. Where this is not practical for economic reasons further deadlines have been set for 2021 and 2027. Below is a map of the Portsmouth Water operating area which shows the water bodies and their hydrological status.



High level information regarding these water bodies can be found in Appendix 28 (Drought Plan).

In 2010 Portsmouth Water asked AMEC to investigate the impact of abstraction on four water bodies:

- River Hamble
- River Wallington
- River Ems
- River Lavant

An additional water body, Aldingbourne Rife, was added to the list in 2011 and the Environment Agency chose to investigate three further water bodies:

- River Meon
- Bosham Stream
- Fishbourne Stream

As part of the investigation Portsmouth Water set up a "Stakeholder Group" which consisted of the following regulators and NGO's:

- Environment Agency
- English Nature
- CC Water
- Hampshire County Council
- Hants and Isle of Wight Wildlife Trust
- Sussex Wildlife Trust

The Stakeholder Group has been fully involved in the investigations over a two year period and has recently received the Consultant's Final Report. AMEC concluded that the River Hamble was in relatively good condition but abstraction from Northbrook will impact on the North Pond in Bishop's Waltham and the water body just downstream. Options for increasing flows in this section of river should be considered.

The Upper Wallington has little or no connectivity with groundwater at times of low flow. The impact of abstraction on the ecology of the river is considered to be minor. The Lower Wallington would only be impacted under "Fully Licensed" conditions and then only in the area of the tidal limit. Low flows are supported by discharges and leakage within the catchment. Channel straightening in Fareham will have had a negative impact on ecology in the past. No further work is proposed but mitigation for impacts under the Habitats Regulations (birds in the harbour; HM Government, 2010) may improve low flows at the bottom of the catchment.

AMEC concluded that the River Ems is impacted by abstraction but the current augmentation scheme goes some way to mitigate this at low flows. It is recommended that the location, and volume, of the augmentation flow should be reconsidered.

The River Lavant is naturally "ephemeral" with periods of no flow in most years. The overall ephemeral nature and extent is not affected by abstraction. The ecological data shows relatively little sensitivity to the duration of wetting and drying with rapid recovery once flow commences. No further work is required.

Abstraction within current licenses is sustainable under the Water Framework Directive. A large number of licences have been varied and conditions set to protect the environment. Since the 1980s overall abstraction has fallen significantly due to leakage reductions and the impact of recession in manufacturing. Bulk supplies will not return abstraction to previous levels and will not require any relaxation of environmental constraints. Under drought conditions the need for "drought orders" or "drought permits" has been carefully considered. The environment will only be impacted during rare events when many features would naturally be dry. Under extreme events the Secretary of State will determine what license conditions can be overturned in the interest of public water supplies.

The PIM and WFD investigations were completed in March 2013 but the subsequent options appraisal process was not completed in time for the Draft Plan. The options appraisal was carried out for the River Ems and for the River Hamble. The results were submitted to the EA in time to influence the next stage of the NEP process. This was published in August 2013 and contained the following proposals:

- Consider changes to the location and volume of augmentation on the River Ems,
- Undertake river restoration to ensure that the benefits of increased augmentation are maximised,
- Agree a license variation for Walderton and Woodmancote to alter the augmentation details,
- Consider resilience measures on the Bishops Waltham Ponds and further river restoration works downstream.

Further work is required on the River Meon at Tichfield Haven where the effects with other abstractors will need to be considered.

Portsmouth Water has proposed a license variation for Maindell source to comply with the Habitats Regulations at Fareham Creek. This was not included in the NEP because the solutions should be in by April 2015.

No further work is required on the River Lavant, the rest of the River Meon, the Bosham Stream or the Fishbourne Stream. Impacts of abstraction on Aldingbourne Rife are also considered to be secondary to the water quality issues.

The final round of the NEP was published in December 2013 and this confirmed what has been included in the Business Plan submitted to Ofwat in November 2013.

The outcomes from the PIM/WFD Investigations were considered in the WRSE Modelling (see Section 2.3.4). Portsmouth Water think that further sustainability reductions are "likely" and this should be reflected in headroom. Unfortunately the guidance does not allow the uncertainty over sustainability reductions to be included despite it being part of the methodology.

2.3.4 Water Resources in the South East

Portsmouth Water has been involved in Water Resources in the South East (WRSE) for many years. This is a joint initiative to identify potential "Regional Solutions" such as bulk supplies between companies. WRSE undertook a modelling exercise, producing a base line solution and a number of scenarios. Although the Baseline model only contains confirmed and likely sustainability reductions other scenarios were considered. Scenario "C3" included the Company's view of further sustainability reductions and the Environment Agency's view of the possible constraints on supply schemes.

Since the WRSE model was run the EA have published the National Environment Programme (NEP). The sustainability reductions have been reduced from an estimated 13 Ml/d to 6 Ml/d. The lower figure has been used in this Final WRMP but the recent re-runs of the WRSE model have not included sustainability reductions for Portsmouth Water.

2.3.5 National Environment Programme

The National Environment Programme (NEP) has been set up by the Environment Agency to ensure compliance with environmental legislation. In August 2012 the Environment Agency published a list of "confirmed" and "likely" schemes based on the evidence available at that time. With the PIM/WFD Investigations not due to report until March 2013 there was no new evidence for any new schemes for Portsmouth Water. All of the existing obligations had been met with licence variations prior to the 2015 deadline. (See Appendix 2)

With the publication of the PIM/WFD Investigations it was possible for the Environment Agency to update the NEP programme. The Environment Agency published the National Environment Programme (NEP) in August 2013. This reflected the outcomes of the PIM/WFD investigations carried out by the Environment Agency. The impact of abstraction on Titchfield Haven and Fareham Creek need further work. Sustainability reductions are in the process of being agreed for the Maindell source which impacts on Fareham Creek and a Water Level Management Plan is required for Titchfield Haven.

There are new "Catchment Partnerships" which will oversee implementation of the WFD schemes. These partnerships aim to encourage collaborative work with local stakeholders over all of England's catchments to deliver an improvement in water quality and meet the UK's water targets under the European Framework Directive by creating more ambitious river basin management plans. Successful management schemes would involve joint working with NGO's and the regulators.

2.3.6 Sensitivity Tests

The planning guidance requires companies to consider scenarios to test the Plan. In addition to the "Alternative Plan" Portsmouth Water has considered the sensitivity of the Plan to even lower deployable output. This could be due to further sustainability reductions or to greater than expected climate change impacts.

Section 7 considers a scenario where deployable output is reduced by a further 10% of the end of the planning period. This is consistent with one of the scenarios tested in the WRSE modelling.

2.4 Climate Change

In previous periodic reviews Ofwat challenged the reliability of the climate change predictions used by the Company. For the Draft WRMP 2014, Portsmouth Water has completely revised the assessment and the data on which it is based. The WRMP requires companies to use UKCP09 data and the methodology set out in the UKWIR report "Climate Change and Water Resources Planning" (2012).

2.4.1 Vulnerability Assessment

The first stage of the methodology is to assess the vulnerability of the Company to climate change impacts. Portsmouth Water employed URS to do the overall deployable output assessment and they were assisted by HR Wallingford (HRW) for the climate change work. The vulnerability assessment is based on information already available from previous WRMP's and Drought Plans.

HRW produced a vulnerability assessment summary table (see Appendix 4) and this concluded that the overall sensitivity was medium. This implied that a full climate change assessment was required and URS/HRW were commissioned to do this in January 2013.

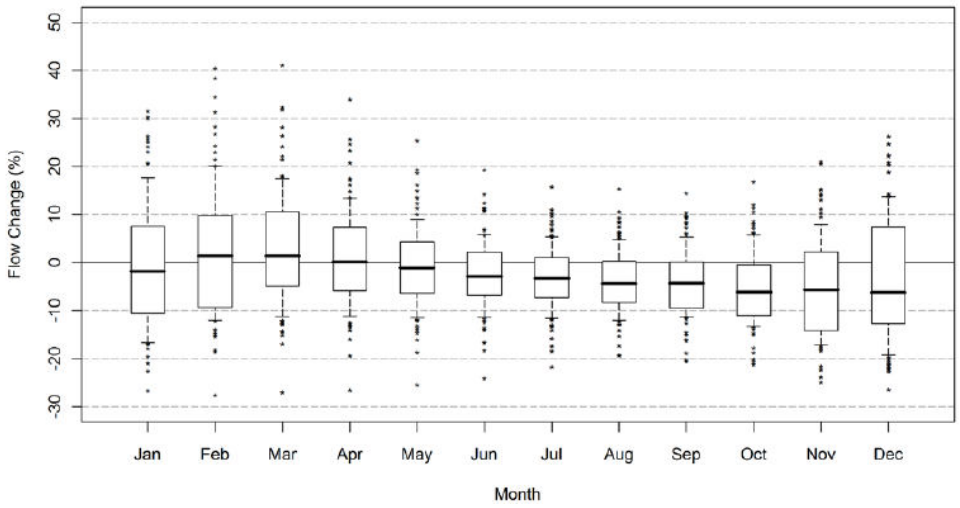
2.4.2 Climate Change Impacts on Surface Water

In the WRMP 2009 Portsmouth Water were only able to make an assessment of the impact of climate change on surface water. This work was based on the UKCIP02 factors and the results of a water resources optimisation model called "MISER". The reduction in deployable output, assumed to apply in 2025, was as follows:

Planning Scenario	"Mid" Projection Reduction
Average	12.75 Ml/d
Peak	16.96 Ml/d

For the Final WRMP 2014, HRW have used the UKCP09 projections of climate change impacts. The full set of data contains 10,000 projections but a sub set of 100 results represents the full range of uncertainty. HRW have set out how the sampling approach works and what the results look like for the South East of England (see Appendix 4).

To apply the climate change projections to surface water flows the consultants used a CATCHMOD surface water model developed for the River Itchen at Gaters Mill. The Environment Agency provided baseline daily rainfall, potential evaporation and temperature data from 1880 to 2005. This data was "perturbed" using the monthly UKCP09 factors for the 100 selected samples and the model was run 100 times. A set of 100 river flow time series were generated for the flow gauging sites at Allbrook and Highbridge (which are both upstream of our abstraction) and these were then transposed to Riverside Park using a regression relationship. Riverside Park is the gauging point at the tidal limit which is used to control abstraction at Gaters Mill.



2.4.3 Climate Change Impacts on Groundwater

In the WRMP 2009, Portsmouth Water was unable to include an assessment of climate change on groundwater because it was inconsistent with the results for surface water. The methodology predicted increased groundwater levels which implied increased groundwater yields.

For the Draft WRMP 2014, URS have produced a "Groundwater Level" model which allows groundwater impacts to be assessed in more detail. The sub set of 100 climate change projections is used to perturb Idsworth Well levels. Portsmouth Water uses this well to measure the level of groundwater. The 100 groundwater levels are inserted into the "Resource Zone" model, which calculates the abstraction rate at each source works. This relatively simple approach to climate change impacts on groundwater has produced consistent results this time. Climate change causes groundwater levels to fall and therefore groundwater yields to fall. The reductions are small but the variability contributes to headroom.

2.4.4 Combined Climate Change Impacts

When the surface water impacts at Gaters Mill are added to the groundwater impacts the combined impact in the "medium" term is -1.9 Ml/d at average and -2.6 Ml/d at peak. This is assumed to represent the 2030's and specifically 2035. Assuming that the impact is zero in the base year of 2012, these two figures can be interpolated and extrapolated into a profile for the whole planning period.

In table WRP1a this is represented as an annual percentage change. For average demand this is equivalent to 0.03% of deployable output per year. The figure for peak demand is also 0.03% per year.

Climate Change Impacts

Year	ADO (Ml/d)	PDO (Ml/d)	Year	ADO (Ml/d)	PDO (Ml/d)
2013	-0.10	-0.14	2027	-1.50	-2.05
2014	-0.20	-0.27	2028	-1.60	-2.19
2015	-0.30	-0.41	2029	-1.70	-2.33
2016	-0.40	-0.55	2030	-1.74	-2.38
2017	-0.50	-0.68	2031	-1.77	-2.43
2018	-0.60	-0.82	2032	-1.81	-2.47
2019	-0.70	-0.96	2033	-1.84	-2.51
2020	-0.80	-1.09	2034	-1.87	-2.56
2021	-0.90	-1.23	2035	-1.90	-2.60
2022	-1.00	-1.37	2036	-1.93	-2.64
2023	-1.10	-1.51	2037	-1.96	-2.69
2024	-1.20	-1.64	2038	-2.00	-2.73
2025	-1.30	-1.78	2039	-2.03	-2.77
2026	-1.40	-1.92			

The requirement to set out the water balance for drought events, in the Water Resource Plan, means that the impact of climate change on rare events needs to be considered. This was not done for the Drought Plan 2012 because it was considered to be an "operational plan" and specifically excluded climate change. It is likely that climate change will impact on rare events and more work needs to be done on this.

2.4.5 Headroom Allowance

The statistical approach to climate change produces a central forecast and a range of uncertainty. This can be used to calculate the contribution of climate change to overall headroom. Risk factor S8 represents the impact of climate change on deployable output and in the WRMP 2009. This factor used Environment Agency groundwater modelling for the River Itchen.

For the Final WRMP 2014, URS have used the uncertainty data from HRW to populate the Monte Carlo simulation. The guideline and the table definition require the climate change element of headroom to be separated out. Headroom is described more fully in Section 4 and in Appendix 8.

2.5 Outage Assessment

Outage is defined as a temporary loss of deployable output at a source works. It can relate to planned or unplanned events and covers a wide range of influences from power failure to pollution incidents.

2.5.1 Previous Outage Assessment

The outage assessments are based on the UKWIR methodology "Outage Allowances for Water Resources Planning" (1995). For the 2009 Plan, data was analysed for the period 1998-2006. This period included significant outages for incidences of cryptosporidium in the community, nitrate pollution and oil pollution. These problems have now been largely resolved with capital investments, such as membrane treatment and nitrate blending schemes.

For the Final WRMP 2014, the assessment is based on data from 2007-2012 which is more relevant and up to date. This approach ensures that the outage is relevant for the following five year time step. Over a longer period outage will continue to be influenced by power failure, system failure and pollution incidents.

2.5.2 Current Guidance

The current guidance requires companies to pre-consult on the outage methodology if it is different from the UKWIR methodology. Portsmouth Water did not need to pre-consult with all the stakeholders but has shared the Draft Report with the Environment Agency. They raised some concerns about how future oil pollution incidents would be treated, with the links to headroom.

2.5.3 Methodology

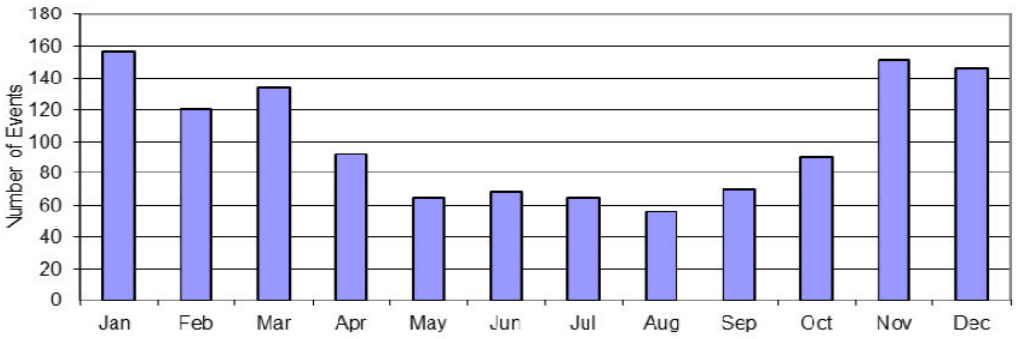
The methodology is set out in the report produced by URS and complies with the UKWIR approach (see Appendix 6). Historical data has been split into outage categories with magnitudes and durations recorded. A Monte Carlo simulation is used to simulate outage in the future having justified which events are "legitimate". URS used a model called @ RISK to carry out the simulation and have commented on the seasonal distribution of outage and the repeatability of results. The risk percentiles and the relative contributions are set out in the appendix.

2.5.4 Analysis of Recorded Data

Since 2007 Portsmouth Water's operational staff has been maintaining a new record system for actual outage. The outage register is in the form of a spreadsheet which records:

- Start and end date and time
- Site reference
- Percentage of deployable output lost
- Planned or unplanned events
- Short term or long term shutdown
- Classification and fault code

Seasonal Distribution of Recorded Outage



Over the five year period there were 1,214 outage events of which 68% were planned and 32% were unplanned. Less work is planned in the summer months when peak demands are likely to occur.

2.5.5 Outage Assumptions

The analysis of future outage is based on events that are considered to be "legitimate". As in previous assessments, if an event lasts for more than 90 days it is not included in the calculations. This is because the works may have shut down because it was not needed to meet demand rather than because of an actual outage event. In addition events that have lasted for long periods, such as a shutdown to reduce the risk of cryptosporidium, have been resolved by capital investment prior to the next planning time step.

For the current assessment the following events have been excluded:

- 145 day event at Woodmancote caused by cryptosporidium risk (new start up procedures).
- 365 day event at Woodmancote caused by turbidity (new start up procedures).
- 112 day event at Funtington caused by turbidity (new start up procedures).
- 136 day event at Worlds End due to oil pollution (transferred to a general risk in headroom).

Most outage events at Portsmouth Water are considered to be 100% of deployable output at each site. This is because works shut down on alarms and are only re-started when supply staff visit site.

Planned events are not included in the analysis of the critical period because maintenance is not carried out in the peak week.

Significant outages related to Cryptosporidium have been reduced with the provision of membranes at certain works. There remains the risk of Cryptosporidium at Woodmancote, Maindell, Eastergate and Westergate. These sites may require further work to reduce the risk in the future.

Oil pollution has been included as a generic risk in headroom because it is considered to be randomly related to individual works. Past pollution incidents at Worlds End, Northbrook and Lovedean do not mean that these sites will be involved in the future.

The turbidity events can be linked to the risk of cryptosporidium risk because turbidity can mask the presence of crypto oocysts. Cryptosporidium risk can be seasonal because it is linked to lambing and surface run off.

The algae category has been dropped from the analysis because the problems at the River Itchen works have been resolved. There is no algae risk at the groundwater sources.

The Monte Carlo simulation now involves 10,000 iterations rather than the 1,000 used previously. This improves repeatability of the results when simulations are re-run.

2.5.6 Results

Outage allowances have been calculated for three scenarios:

- Annual Average
- Critical Period (Peak Week)

- Minimum Deployable Output

A probability of 95% has been used and the results compared with the previous Plan.

Outage (Ml/d)

Scenario	WRMP 2009	WRMP 2014
Annual Average	14.2	9.3
Critical Period	9.3	4.6
Minimum Deployable Output	-	10.8

Outages are lower than the previous plan because some of the risks have been minimised or removed. In terms of future reductions the average outage figure is now only 3.8% of deployable output. It would not be prudent to assume that outage will fall further in the future.

Outage has been calculated for each works but the figures are not cumulative. The combined probability distributions are provided in the detailed report (Appendix 6).

2.6 Process Losses

Treatment works losses only apply to sources with more complex processes such as rapid gravity filtration and membrane filtration. Portsmouth Water has two works with full conventional treatment and three works with membranes for cryptosporidium removal. At one works there is a compensation water condition and this raw water loss is included in process losses for a dry year.

In general, complex treatment works have losses of around 5% with more modern membrane works reducing this to 1% of deployable output. At Farlington there is a supply option to recover the washwater.

The following table summarises the process losses assumed for a dry year:

Process Losses

Source Works	Treatment	Average (Ml/d)	Peak (Ml/d)
River Itchen	Complex	1.9	1.9
Farlington	Complex	4.4	4.9
Soberton	Membrane	0.1	0.1
Lovedean	Membrane	0.1	0.1
Fishbourne	Membrane	0.1	0.1
Total		**6.6**	**7.1**

Portsmouth Water does not include treatment works losses in the calculation of deployable output. Treatment works losses and raw water losses are entered as separate lines in the WRMP Tables. The tables then combine these to give the overall process loss.

The River Ems augmentation flow has been removed from the process losses because it will be provided by raw water from 2015. The augmentation is

included as a sustainability reduction and has the effect of reducing deployable output under certain circumstances.

2.7 Bulk Supply Imports

The guidance requires companies to consider a wide range of supply options including bulk transfers from other companies and third party suppliers. Portsmouth Water has been fully involved in the WRSE modelling programme which included bi-directional flows in the existing Southern Water bulk supply and potential bulk supplies from South East Water.

2.7.1 Whiteways Lodge (Southern Water)

The existing bulk supply from Portsmouth Water to Southern Water has a nominal flow of 1.0 Ml/d and a peak capacity of 15.0 Ml/d. Water is pumped from Slindon Works to Whiteways Lodge and then gravitates to Hardham Treatment Works. It would be possible to pump water from Hardham to Whiteways Lodge and for the water to gravitate to Slindon. From here it could be pumped to Littleheath Reservoir using the existing booster pumps.

An option to transfer water from Hardham was included in the WRSE model but it was not selected. It is likely that the current bulk supply agreement will be renewed in 2014 and that water will continue to flow to Hardham when required.

2.7.2 Clanfield (South East Water)

An option to transfer water from the Tilmoor Service Reservoir in Petersfield, to Clanfield Service Reservoir was included in the WRSE model. This would include high lift pumps of Tilmoor and a pipeline across the South Downs to Clanfield. A route was selected that would minimise the pumping head and minimise the environmental impact on the chalk downs and ancient woodland.

This option was not selected by the model and South East Water did not offer a bulk supply to Portsmouth Water. The “View of Need” was published in September 2012 but Portsmouth Water did not receive any offers of a bulk supply. This is not surprising given that the Company has the lowest charges in the industry and remains in surplus for water supply.

2.7.3 Third Party Supplies

No third party suppliers have contacted Portsmouth Water but there are possible private supplies, such as the Southwick Estate, who might be interested in making an offer. Portsmouth Water already has two housing developments where a third party delivers the water to the end user. In these cases, Portsmouth Water is retained as the bulk supplier and there is no net increase in supply. It would be possible for a developer to install effluent re-use and therefore create a nominal surplus for Portsmouth Water to use elsewhere.

2.7.4 Bulk Supply Exports

Portsmouth Water already has a bulk supply export to Southern Water (as explained in 2.7.1) which is likely to be renewed in 2014. This is not a supply option and is covered in more detail in Section 6 Final Planning.

3 DEMAND

3.1 Introduction

To comply with the commitment for further work detailed in the WRMP09, the demand forecast has been completely revised for the Draft WRMP 2014. The base year demand data has been developed using both consumption monitors and a more comprehensive micro-component approach, whilst the household and non-household demand forecasts have been revised to meet the expectations outlined in the Water White Paper (Defra, 2012). The Company have also used statistical techniques to reach a better understanding of the peak factors during peak demand. The key elements in demand forecasting are:

- Forecasting Properties and Population
- Baseline Metering Policy
- Household Demand
- Non-Household Demand
- Leakage Forecasts
- Bulk Supply Exports

The key assumptions included in the demand forecast are outlined briefly below with more details in the following sections:

3.1.1 Forecasting Properties and Populations

The property and population forecast is based on work undertaken by Experian for water companies in the South East. This work is based on the revised methodology published by the Environment Agency (2012c).

3.1.2 Baseline Metering Policy

Portsmouth Water has a low level of meter penetration. Since 2005, the Company has encouraged optional metering and metered new properties. This is the baseline position for the Final WRMP 2014.

3.1.3 Household Demand

Household demand is calculated as the product of per capita consumption and population forecast. Base year demand is calculated for a dry year based on data collected from consumption monitors and regular surveys of customer behaviour. Demand is split into unmeasured and measured consumption by its micro-components.

3.1.4 Non-household Demand

In previous plans Portsmouth Water used econometric in the past models to predict future non-household demand. This approach has proved very reliable but the current uncertain economic position makes this more difficult. Consequently a statistical approach has been used for the Plan based on historic data and a view of the impacts of climate change and competition.

3.1.5 Leakage Forecasts

Portsmouth Water engaged consultants to undertake a full Sustainable Economic Level of Leakage Appraisal (SELL) (Appendix 14).

3.1.6 Bulk Supply Exports

Bulk supplies to other companies contribute to the overall reduction in deployable output. They are not supply options and are therefore detailed under the demand section.

3.2 Properties and Population

To develop a consistent view in household and population forecasts across the South East, water companies (Portsmouth Water and 8 other companies) commissioned Experian, to develop a set of forecasts in line with the Method of Estimating Population and Household Projections (Environment Agency, 2012c) report.

Experian based the forecasts of property and population on data devised from Local Authority Plans. These are based on the 2011 Census data that has now been released.

For the "Population, Household and Dwelling Forecasts for WRMP14" study, Experian prepared three different scenarios:

- Plan based – using information provided by local authorities
- Trend based – using the latest information from official statistics
- Most likely – Experian's best view on likely outcomes based on the information available

For each of these scenarios, Portsmouth Water used the following data provided by Experian for each financial year between 2010/11 and 2039/40:

- Total Population
- Household Population
- Communal Population
- Total Households

The forecasts were based on the best available data at the time. Further detail on this study, its methodology and its assumptions is included in Appendix 9.

3.2.1 Base Year Domestic Properties and Population

In using the Experian data to forecast the number of properties, the Company had to re-write the starting point to the number of properties on the Company's billing system. To achieve a reliable reconciliation the Company had to account for a single billing record in the Company's billing system representing multiple properties. For example, a block of flats may have a single bulk meter and consequently only one billing entry, but the Experian data includes the actual number of flats.

There was no need to adjust the Experian population figures, as they had already been proportioned into household and communal (domestic non-household) as part of the Experian study.

Base Year - 2012/13		WRMP09 Estimate	Final WRMP14
Properties	Unmeasured	222,969	221,939
	Measured	71,885	60,284
	Company	**294,854**	**282,283**
Population	Unmeasured	532,896	570,192
	Measured	133,855	117,699
	Company	**666,751**	**687,891**
Occupancy	Unmeasured	2.39	2.57
	Measured	1.86	1.95
	Company	**2.26**	**2.44**

The new Experian data is showing a drop in property growth due to the economic downturn compared to the WRMP09 estimate. This is expected, due to the drop in house prices and the difficulty in securing a mortgage.

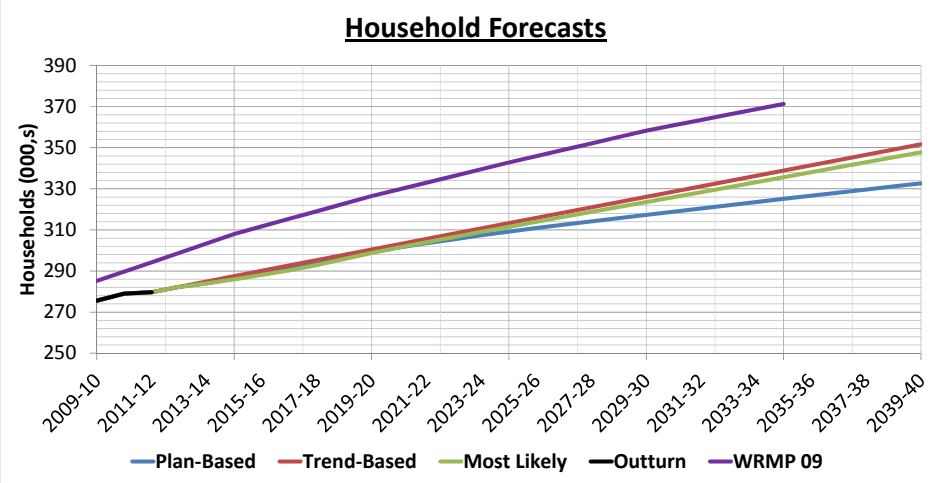
Interestingly, the population within the Company's supply area is above the previous prediction. This shows that whilst housing construction may be struggling, people are still staying within the area and net inward migration is expected for the Company's area of supply.

The forecasted rise in population combined with a lower property forecast results in an increased occupancy level compared to the last plan. This can be explained by:

- More house sharing between young professionals to save on the cost of rent.
- Young adults living with their parents for longer as they are unable to afford a mortgage.
- Young adults moving back in with parents due to economic problems.

3.2.2 Property and Population Forecasts

The property forecast assumes that there is no significant change in the number of non-household properties over the planning period. In contrast, household properties are assumed to increase in line with the Experian forecast.



The Experian forecasts for this plan are considerably lower than in the previous plan. As mentioned in the previous section, the recent economic downturn has slowed housing construction. Whilst the rate of housing construction is predicted to improve, it is believed that this recovery will be gradual and housing levels will not reach the WRMP 09 forecast levels.

The plan-based forecast is based on data collected from each of the local authorities covered in the Portsmouth Water supply area. 67% of local authorities replied directly to Experian when asked to supply data. Where information was not supplied by the local authority, it was collected from alternative sources including Local Authority Plans. For this data collection, a hierarchical system was used, with the most recent sources given preference. The plan-based scenario is predicting that the rate of increase in properties and population will fall over the next 25 years.

The trend-based forecast is based on the most up-to-date estimates from the Office of National Statistics (ONS). The trend-based forecasts are approximately 5.4% higher than the plan-based forecast by the end of the planning period.

Following the same trend as households, the population forecasts for both the plan-based and trend-based forecasts are also lower than in the WRMP09, reflecting a predicted lower level of migration into the area.

Experian also produced a most likely forecast, where they reviewed a number of options before producing this scenario. These included population trends, trends in household occupancy and dwelling completions. The methodology chosen was created using a three stage process:

- Select the most-likely trend-based population projection,
- Control the plan-based household forecasts for each local authority to Experian's regional household completions forecast,
- Adjust the controlled forecast to the difference between the plan and trend based projections in the medium to long term.

By ensuring that the number of households forecast is in line with Experian's forecasts of new dwellings, the most-likely projection takes into account economic conditions and other factors facing house builders over the short to medium term.

The most-likely forecast also considers not only what local authorities are planning for but also underlying trends that may be above or below what is being

planned for in the medium to long term. This is important as most Local Authority Plans do not cover the full 25 years defined as the WRMP period and many assume slower growth in the long term, whilst at the same time population trends suggest many more houses will need to be built than are currently planned for.

The most-likely forecast therefore seeks to find a compromise between the two over the full 25 year period and for that reason Portsmouth Water believes Experian's most likely forecast for households and population are the most appropriate to use. This profile shows the lowest increase over the first 5 years of the planning period, followed by an increase that is between the plan and trend projections. The Company believe that this seems to be the most realistic scenario for our supply area considering the current economic climate.

The most-likely forecast is also being used by Southern Water. This ensures consistency between company boundaries in both the water resource plans and sewerage plans. Experian's approach complies with the methodology set out by the Environment Agency and the detailed assumptions are set out in Appendix 9. The issue of the 'most likely' scenario and the guidelines recommendation to use the plan based approach was discussed with both the Environment Agency and other stakeholders at pre-consultation meetings. Experian have explained that there is little evidence that population growth is not going to follow the current trend.

Difficult economic conditions have resulted in reduced housing supply and significant changes in the number of people sharing a home. Over the past 5 years the trend of falling household occupancy has slowed and even reversed in some areas. Occupancy rates are now modelled by Experian. The re-evaluation of occupancy has lead to a higher occupancy figure in the base year than forecasted in the previous plan.

Water Resources Management Plan	Occupancy - 2015/16	Occupancy - 2034/35
WRMP 09	2.26	2.11
WRMP 14	2.44	2.34

As housing construction improves, occupancy is expected to fall in line with previous social trends. This trend can be explained by:

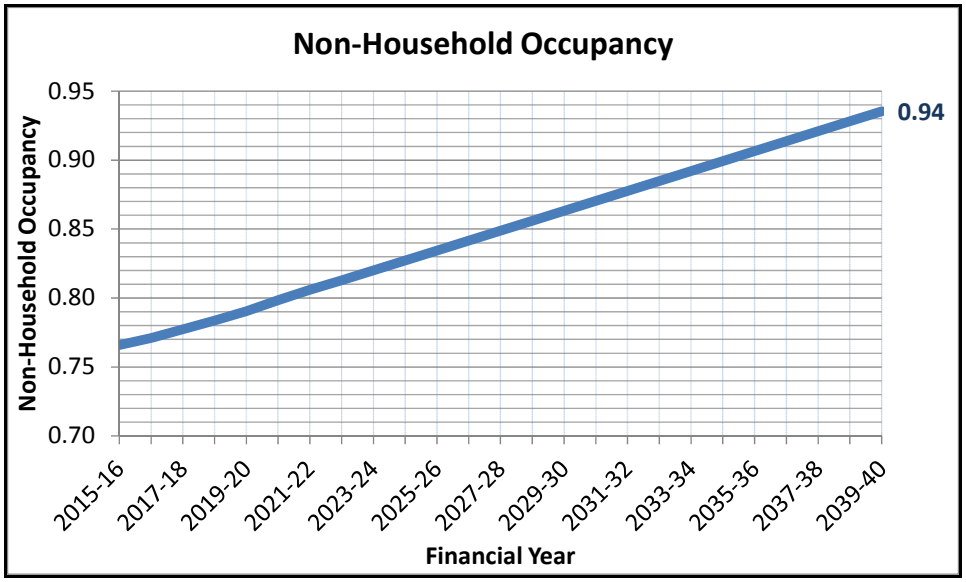
- Rising divorce rates resulting in more single parent families.
- Longer life expectancy resulting in many widows/widowers living alone for longer.
- Couples marrying later and living independently for longer periods.
- Smaller family sizes.

As part of the requirements for the WRMP14, the property and population forecasts are broken down into metering type. These results, along with their associated occupancy, are detailed in Section 3.3.

3.2.3 Base Year and Forecast Non-Household Properties and Population

Portsmouth Water in the base year (2012/13) had a total of 18,562 non-household customers. The total number of non-households is not expected to change significantly over the planning period.

The majority of non-household customers are charged on a measured tariff. The properties that remain on an unmeasured tariff are typically of minimal use and/ or are difficult to meter.



The Experian project forecasts a non household population, which accounts for people living in communal accommodation such as nursing homes. This forecast predicts that the number of residents that are living in properties classified as non-household will rise over the planning period. This can be explained through the building of more communal accommodation such as flats, where there will be a residency of at least 1. This will lead to a rise in the amount of water used by the domestic non-household sector. Further detail is included in Section 3.5.

3.3 Baseline Metering Policy

Portsmouth Water has a low level of domestic meter penetration compared to other companies in the England and Wales. A secure water resources position in earlier plans meant that there was little incentive to promote metering and the Company chose to levy a licence fee for all new properties built between 1990 and 2005 in order to maintain charges at a low level, rather than meter as almost all other companies did. The low charges offered little financial incentive for customers to opt to change to a metered tariff.

Since 2005, Portsmouth Water has recognised the need to promote water efficiency through metering, deciding to meter all new households and promote the availability of free meter optants. This policy has led to domestic meter penetration of 21% by the end of 2012/13, through 48,822 customers opting for a measured tariff and 11,462 new properties connected after 2005 being metered. This policy did not include change of occupier metering or compulsory metering, as these options were too costly to be included in the WRMP09 final solution.

The company are unable to implement compulsory metering but are keen to promote optional metering amongst customers. The Environment Agency, as well as the Wildlife Trust, Natural England, South Downs National Park and other environmental organisations, can help Portsmouth Water promote optional metering by agreeing to work collaboratively on publicity campaigns. Supporters of environmental organisations are more likely to opt for a meter on the grounds of protecting the environment rather than just saving money.

There is also no selective metering in the Draft Final Plan. Portsmouth Water considered metering customers with high discretionary use as an option in the

planning process. This option was considered to have an unacceptably high risk of not delivering any yield. More on this can be found in section 5.8.1 and in Appendix 21 (C002).

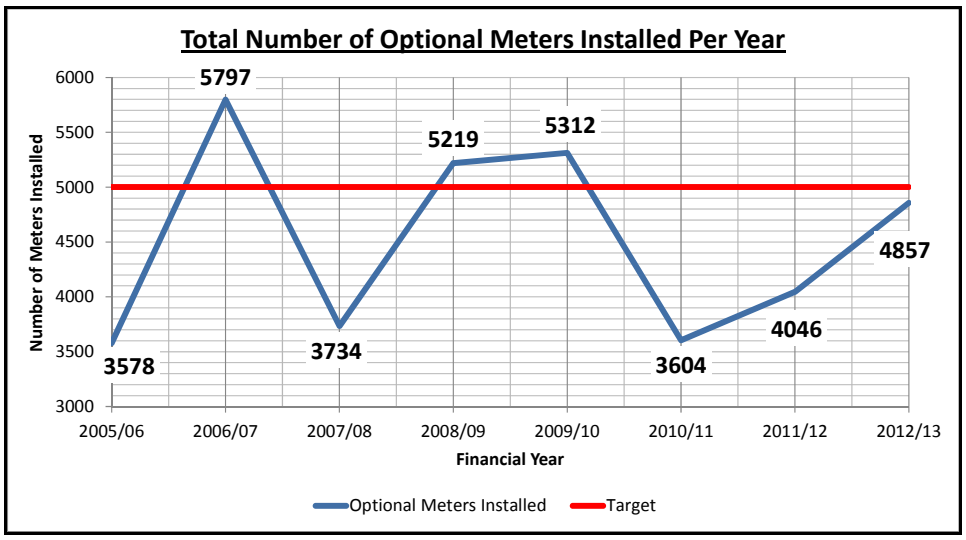
3.3.1 Meter Optants

In 1999 the Government introduced legislation to enable domestic households to request a meter 'free of charge' (HM Government, 1999). Due to the low price of water, few of the Company's customers initially switched to a measured tariff. The uptake level did increase, however, with 3,578 meter options installed in 2005/06, 5,797 in 2006/07, 3,734 in 2007/08, 5,214 in 2008/09 and 5,362 in 2009/10.

In the WRMP09, Portsmouth Water's metering policy included 5,000 meter optants per year throughout the plan. Ofwat allowed for 25,000 meter optants over the following 5 years in their Final Determination.

The Company has tried to meet the 5,000 meter optants per year target. 3,604 meter optants were installed in the first year (2010/11), compared with 4,046 in 2011/12 and 4,857 in 2012/13. The reasons for the fluctuations are not clear but there is anecdotal evidence that it is linked to the level of the Southern Water tariff increases which have a greater impact on customers.

The level of metering has been steadily increasing as a result of new properties which are all metered, as well as the promotion of optional metering. The optional metering numbers have been reported in a previous June Return to OFWAT and in the Annual Review of the WRMP 2013. These numbers are represented in the following graph:

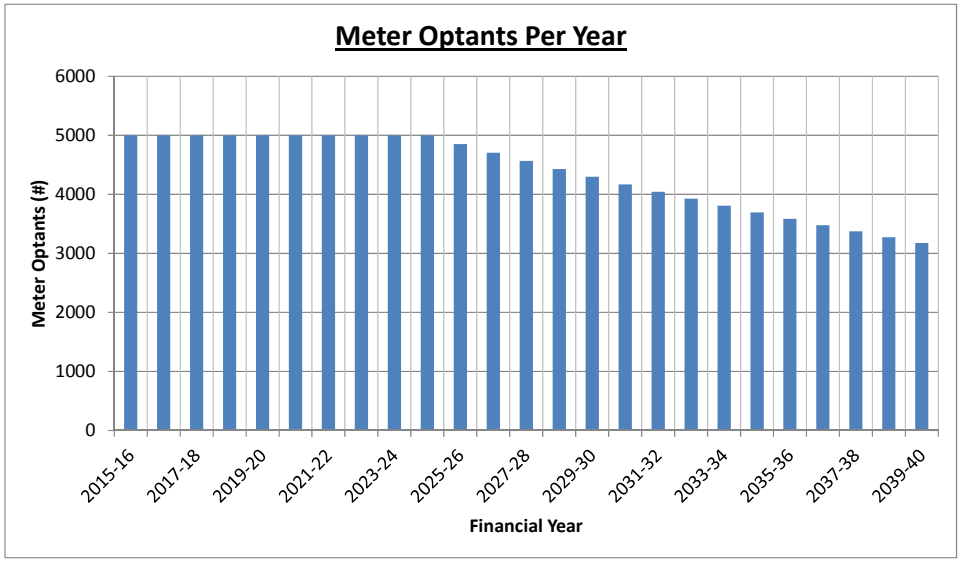


The lower optant uptake rate has led to Portsmouth Water adopting a more proactive approach to promoting meter options, emphasising the environmental benefit of reducing water consumption by the use of newsletters, the introduction of a new leaflet and through the Company website. The results of this campaign have seen an increase in optant uptake, with the Company achieving just fewer than 5,000 meter optants in 2012/13. In light of this, and in order to make up the current deficit in the meter optant target, further campaigns are planned in 2013, 2014 and in the early years of the WRMP14.

Further campaigns will include water efficiency advice and be run in conjunction with organisation such as the Wildlife Trust and the National Park Authority. Supporters of these organisations will already be predisposed to protect the environment and therefore likely to consider optional metering as a good thing.

The progress of optional metering has been set out in the WRMP 2009 annual review 2013. Supply pipe leakage is linked to metering activity and supply pipe leaks will be detected by Portsmouth Waters existing system. Metering mainly influences supply pipe leakage at the time of fitting when smaller background leaks are found. Water efficiency and leakage are also covered in this report which is available on the Company website.

Portsmouth Water has started working jointly with commercial customers. Water efficiency and leakage control will provide benefits which are included in the non-household demand forecast. Several new initiatives have been included in the Business Plan.



In forecasting the number of meter optants, Portsmouth Water expects that a number of factors will have to be considered. This includes the fact that Portsmouth Water has a number of shared supplies to properties where it is not practical to install a meter.

It is believed that a primary driver for customers opting for a meter is financial, where customers with lower consumption or living in properties with a high rateable value can often save money by opting for a meter. Over time the number of customers who can save money by opting for a meter will drop and consequently it is reasonable to expect the number of meter options to fall.

It is reasonable to expect a 5,000 optant meters per year until 2024 given Portsmouth Water's current level of meter penetration. However from 2024/25 the Company is expecting the level of meter optants to reduce as the unmeasured base diminishes.

3.3.2 New Properties

Since April 2005 Portsmouth Water has metered all new properties where it is practical and economical to do so. This policy is consistent with other water companies and the aspirations of the Environment Agency.

As stated in Section 3.2.1, the economic recession has led to a slump in the housing construction sector, which has led to a drop in new properties from the WRMP09 prediction. The household projections predict a growth in households throughout the Plan and the results can be seen in the Experian report Appendix 9.

3.3.3 Compulsory Metering

Portsmouth Water, unlike most of the South East, is not designated as an area of 'Serious Water Stress'. The Water Industry, through the Water Resources Management Plan Direction 2012 legislation (Appendix 16), empowers water companies within areas of 'Serious Water Stress' to carry out compulsory meter fitting to help manage demand where it can be economically justified. Portsmouth Water, however, are unable to compulsory meter its customers. Whilst compulsory metering is not in the Plan, Portsmouth Water has evaluated the benefits of conducting a programme of compulsory meter installations as one of the options for identifying a solution to any shortfall in supplies.

3.3.4 Sub-Divisions of Household Projections

Based on the baseline metering assumptions in this section and the Experian most likely household and population projections, the Portsmouth Water household and population projections are split into unmeasured and measured. The measured customers are then further split into new properties and meter optants.

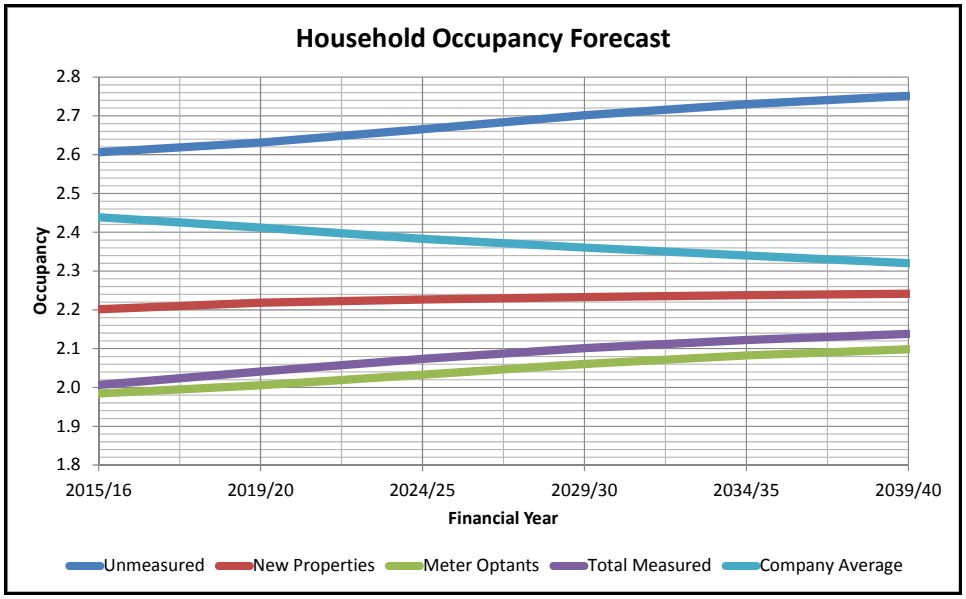
The split in household metering type is required to predict per capita consumption (Section 3.4), as it is assumed that a customer who has opted to move onto a meter would use less water than a customer who became measured by moving house.

Households

Properties	**2015/16**	**2019/20**	**2024/25**	**2029/30**	**2034/35**	**2039/40**
Unmeasured	207723	187723	162723	139872	120230	103346
New Properties	8058	18672	31377	43489	55601	67670
Meter Optants	72369	92369	117369	140220	159862	176746
Total Measured	80427	111041	148746	183709	215468	244416
Portsmouth Water	288150	298764	311469	323581	335694	347762
Meter Penetration	**28%**	**37%**	**48%**	**57%**	**66%**	**70%**

Population	**2015/16**	**2019/20**	**2024/25**	**2029/30**	**2034/35**	**2039/40**
Unmeasured	541436	493940	433774	377881	328227	284361
New Properties	17739	41423	69861	97110	124436	151668
Meter Optants	143602	185247	238561	288910	332894	370881
Total Measured	161341	226670	308422	386021	457330	522550
Portsmouth Water	702777	720609	742196	763902	785557	806911

It is expected that by 2024/25, just under half the domestic properties supplied by Portsmouth Water will be on a measured tariff, with this number rising to 70% by the end of the planning period (2039-40). The number of new properties is a cumulative total that begins in the base year (2012/13).



3.3.5 Occupancy of Properties

In forecasting the demand for water, the occupancy of households is important. To develop an accurate forecast, the Company has considered occupancy for unmeasured, new properties and meter optants separately.

The base year population of new properties and meter optants was calculated using occupancy figures from a recent customer survey. At the base year, the meter optant occupancy figure is below the Company's average occupancy, calculated from the Experian data.

The lower occupancy in meter optants is expected as it is low water users (such as single occupants and couples) who would financially benefit from switching to a measured tariff. As more customers moved onto a meter, it is expected the occupancy of meter optants will gradually rise towards the Company's average.

In addition, there is a lower occupancy rate for new properties compared to the Company's average. The Domestic Consumption Monitoring database has revealed that recently built properties have a lower occupancy than existing ones. This is believed to be due to the significant number of smaller 'affordable' homes built in recent years. These households are also presumed to be occupied by single people, couples and families with fewer children.

3.4 Household Demand

Household demand is calculated through per capita consumption (PCC). PCC is the amount of water each individual uses per day and in this plan is measured in litres/head/day (l/h/d). The PCC varies between households and can be influenced by a number of factors depending on the demographics of an area. These include the type of property, the numbers of persons occupying the property and the number of water-using appliances that are in the property. The PCC is then proportionally averaged out and multiplied by the population provided by Experian (Section 3.2), to predict daily consumption for the Company's area.

The Secretary of State commented that there was inadequate justification for household demand in the previous plan. Under the commitment for further work in advance of the next Water Resources Management Plan, it was agreed that Portsmouth Water would revise its demand methodology, developing base year

demand in accordance with the WRPG and revising the baseline household demand forecast.

3.4.1 Base Year Household Demand

For the WRMP14, the Company is required to use the annual average of a dry year as base year demand. The WRPG recommend that this base year household demand should be produced using outturn data, which is then adjusted by a dry year factor to become representative of a dry year. Portsmouth Water then compares its base year demand against the Company's micro-component analysis in order to fully understand its customers' use of water within the house.

3.4.2 Consumption Monitors for Base Year Demand

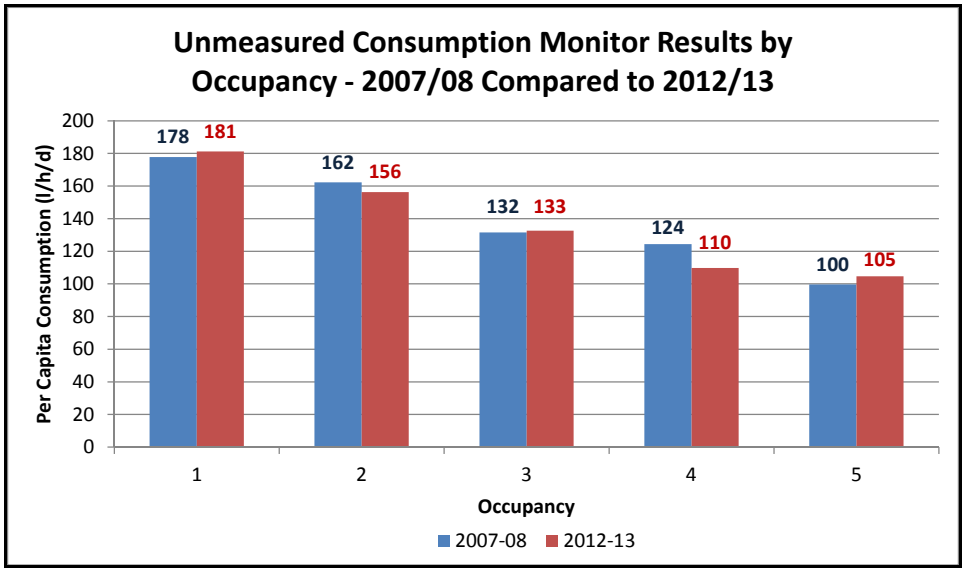
Water companies use consumption monitors to obtain outturn household per capita consumption. In 1997, in order to help forecast future changes in consumption, the Company set up its first unmeasured consumption monitor, which included over 500 representative households. Questionnaires were sent to householders in order to determine occupancy rates and meters were fitted to monitor consumption, though the householders remained on the Company's unmeasured tariff. Since then analysis of the data obtained has enabled the Company to understand the potential impacts of demographic changes for its longer term forecasts, with 739 properties used in the latest monitor.

As part of Portsmouth Water's commitment to improve the base year demand data, the Company has also developed a measured consumption monitor. Using occupancy data collected through telephone calls and the most recent micro-component survey (Appendix 12) and combining this data with recent consumption data for the billing system, it was possible to obtain the PCC for 559 measured properties.

It is acknowledged that both of these consumption monitors are currently below the recommended size of 1,000 properties. Work has already begun to improve the sample size and to find other ways of calculating PCC. This work will be used to inform the annual reviews of WRMP and subsequent plans.

Through the use of regular surveys of the properties, Portsmouth Water has been able to identify the factors that have influenced unmeasured PCC and monitor the differences over time. Recent analysis of the unmeasured consumption monitor shows a clear variation of PCC when households are split by occupancy. This is comparable to the WRMP09 and shows that there has been no change in the way households with different occupancy's use water.

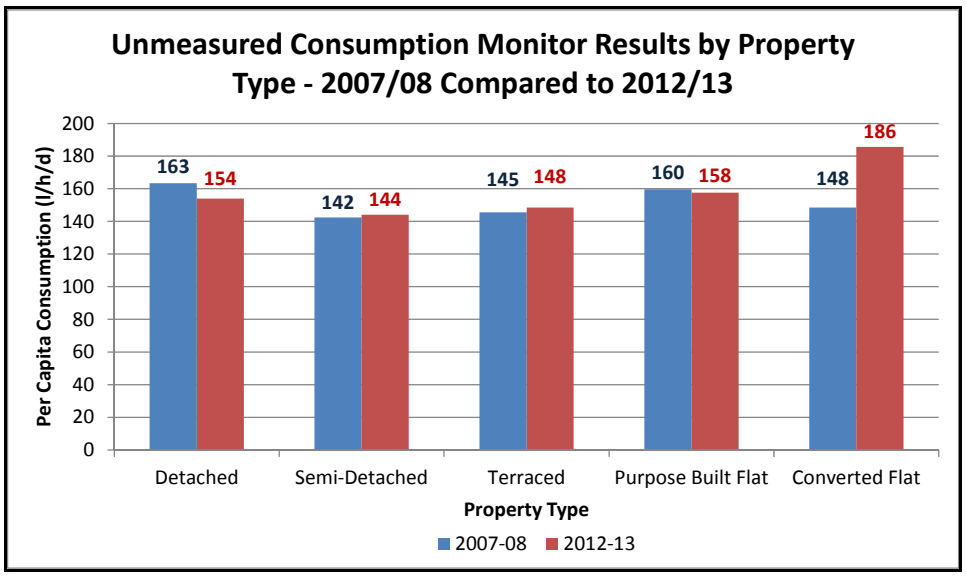
Since the Draft Plan, Portsmouth Water has undertaken an external review of its leakage calculation. Within this review, minor changes were made to the internal consumption monitor methodology and this has lead to a recalculation of unmeasured PCC for both the base year and in the forecast. To ensure that previous unmeasured PCC is comparable, the unmeasured consumption monitor from 2007/08 to 2011/12 has also been re-calculated.



Comparing PCC by occupancy shows that households with less people use more water per person. This is expected and can be explained by two factors. Firstly some water-using activities, such as garden watering, can be defined as a household use rather than a use that changes depending on the amount of people within a household. Secondly, low occupancy households may not fill some water-using appliances before use, such as a washing machine or dishwasher. This means that the water is not being used as efficiently as possible.

The Company's average unmeasured PCC for 2012/13 was 145 l/h/d, compared to 151 l/p/d in 2007/08. The drop in PCC is because there was less overall demand for water in 2012/13 and this is explained in more detail in Section 3.4.3. When combined with the population estimate from Experian (Section 3.2.1), an average unmeasured PCC of 145 l/h/d leads to an unmeasured demand around 83 megalitres per day (Ml/d).

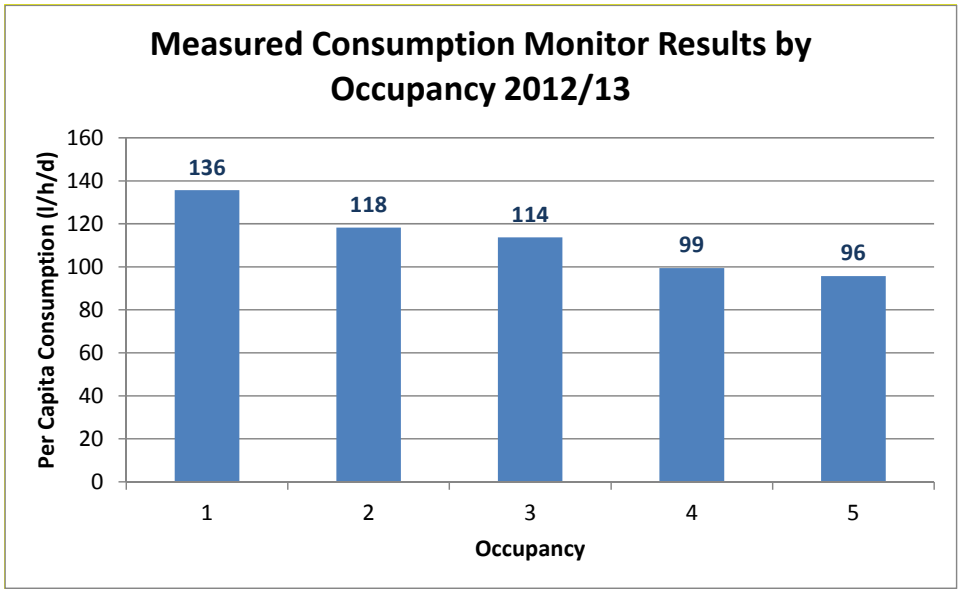
The Company has also sought to categorise the properties in its monitoring database to enable it to provide background data on the consumption from different types of property.



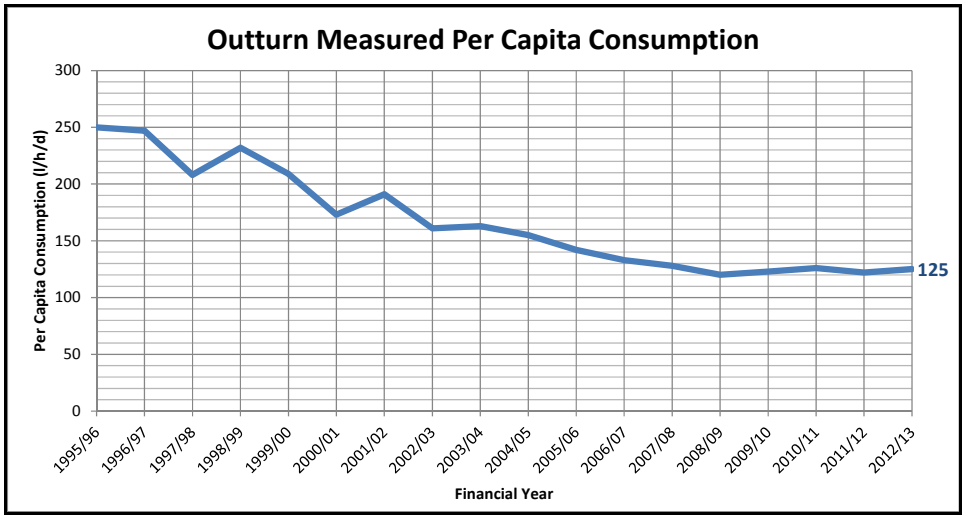
Interestingly the results reveal that that there has been a slight increase in PCC in semi-detached and terraced housing, with the overall fall in PCC down to a significant drop in consumption in detached houses. The affluence and garden size of detached property owners could explain why they have a higher PCC when compared to other home owners. The possible increased use of water for activities such as garden watering and car washing would also explain the fall in consumption in 2012/13, where the wet summer would have negated the need for as much outdoor water use.

With the exception of the detached properties, the difference in PCC between property types can be explained by the occupancy. Semi-detached has the lowest PCC (144 l/h/d), but the highest occupancy (2.53 hd/prop); whilst the PCC of terraced houses is slightly higher, whilst their occupancy is slightly lower (2.32 hd/prop). The higher PCC of flats can be explained by lower occupancy of 1.96 (hd/prop) in purpose built flats and 1.75 (hd/prop) in converted flats. More detail on the unmeasured consumption monitor can be found in Appendix 10.

The measured consumption monitor is a new approach but based on methodology which is very similar to the unmeasured monitor. Data on the property type has not yet been collected and therefore the results could only be segmented by occupancy.



Unsurprisingly, the pattern of measured PCC by occupancy is similar to the unmeasured consumption monitor, albeit with lower demand. These results emphasise the strong relationship between PCC and the number of people living within a property, and therefore justifies the use of occupancy as the segmentation method in the micro-component analysis (Section 3.4.4).



The measured consumption monitor results show that the Company's average PCC for measured households in 2012/13 is 125 l/h/d. This is a fall in consumption compared to the previous year and can be explained by the wet summer of 2012. However, this is above the low in 2008/09 due to the proactive approach to finding meter optants (Section 3.3.1), meaning that customers with a low unmeasured PCC (but higher than the measured average) are moving across to a metered tariff. The Company are also finding that some customers who use a higher amount of water are switching to a metered tariff for environmental reasons and therefore we expect the average measured PCC to rise further. More detail on the measured consumption monitor is in Appendix 10.

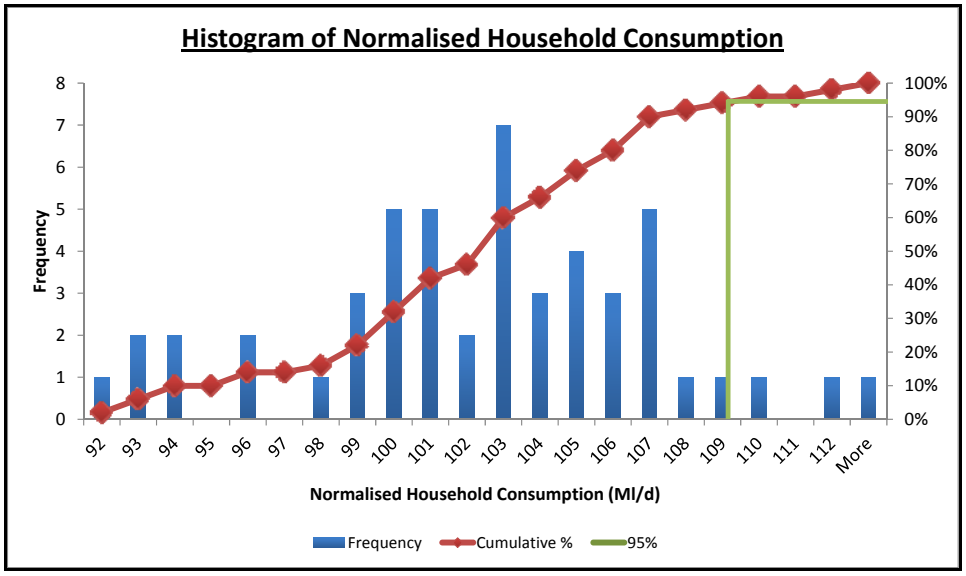
When combined with the population estimate from Experian (Section 3.2.1), an average measured PCC of 125 l/h/d leads to a consumption of 14 megalitres per day (Ml/d), resulting in a total household consumption of 97 Ml/d.

3.4.3 Applying the Dry Year Factor to the Base Year Demand

It must be recognised that household demand will vary from year to year according to the prevailing weather conditions. Thus in years when long dry periods are experienced during summer months, demands will increase as more water is used in the garden and for personal washing. These years are called 'dry years'.

For the purpose of water resource planning, it is important to identify the unconstrained demand during a dry year and use this as the baseline consumption in the Plan. With such variations in demand, the water resources management process must plan in order to avoid deficits in supply in dry years. The base year of 2012/13 was not a dry year and therefore for this plan, the demand for that year needs to be adjusted.

To calculate a dry year, Portsmouth Water normalised the average daily household consumption from the past 50 years and created a histogram of the results. The normalisation process took into account changes in leakage and the increased per capita consumption seen in the past half century. The variations in normalised demand are then considered to be a result of variations in weather.



For the Final WRMP14, Portsmouth Water is using a level of service of 1 in 20 years for temporary bans (Section 1). This means that there is a 5% risk of each year being dry, or put another way, that a dry year will occur on average once every 20 years. Taking this into account, the results of the analysis predicts that the consumption for a dry year will be 109.5 Ml/d, whilst a normal year is when demand is at 102.2 Ml/d (Appendix 11).

With an outturn base year (2012/13) consumption of 97.3 Ml/d from the consumption monitors, an increase of 12.2 Ml/d is needed to adjust this to a dry year.

The outturn base year consumption is below what has been defined in the analysis as a normal year. This is expected due to the unsettled weather in the summer months of 2012, resulting in a lower demand than normal over this period.

3.4.4 Baseline Micro-Component Per Capita Consumption

In an effort to better understand our customers' water use, Portsmouth Water has carried out extensive micro-component analysis following the methodology outlined in UKWIR's 'Customer Behaviour and Water Use - A good practice manual and roadmap for household consumption forecasting' (2012a).

This report recommends that water companies should use a variety of customer survey results, literature figures and educated assumptions to find the per capita consumption (PCC) of a number of water-using appliances within the household. It is suggested that the water-using appliances are grouped into 6 categories:

- Toilet (WC) flushing.
- Personal Washing - bath, shower and hand basin use.
- Clothes Washing - washing machine and hand washing.
- Dishwashing - dishwasher and hand washing.
- Miscellaneous indoor use - cleaning, plumbing losses and any other indoor use.
- External use - Garden watering, car washing and any other external use.

Data on the ownership, frequency-of-use and volume-per-use of each micro-component are collected for both measured and unmeasured customers, with ownership and frequency-of-use further split by occupancy. The micro-component data collection and analysis was completed by Portsmouth Water and more on the methodology, data sources, calculations and results of the micro-component analysis can be found in Appendix 12.

Normal Year Micro-Components – Measured Per Capita Consumption (l/h/d)	**2012/13**
WC Flushing	29.45
Personal Washing	51.07
Clothes Washing	16.65
Dishwashing	6.56
Miscellaneous Indoor Use	11.60
External Use	11.29
TOTAL	**128.97**

Normal Year Micro-Components – Unmeasured Per Capita Consumption (l/h/d)	**2012/13**
WC Flushing	39.79
Personal Washing	61.66
Clothes Washing	15.84
Dishwashing	6.31
Miscellaneous Indoor Use	14.00
External Use	15.28
TOTAL	**153.04**

The results are calculated by multiplying the ownership of a water-using appliance with the frequency-of-use per person per day and with the volume per use of the appliance. The results are shown in litres per head per day (l/h/d) and are based on an average use throughout the year.

The results show that the largest water use in the household, at roughly 40% for both measured and unmeasured households, is for personal washing. The high use of water for bathing can be explained by the difficulty in reducing water use through water efficiency campaigns. Showers were introduced to save water compared to baths, but lead to the frequency of bathing increasing. Low flow showerheads were introduced to save the water used in a shower, but, it is believed, this has lead to longer showers being taken.

On the whole, meter optants and customers in new properties use less water per person than customers on an unmeasured tariff. In particular, measured households will:

- Have more low flush and dual flush toilets
- Be less likely to own or use a bath, choosing to shower instead
- Be more likely to have a water efficient water-using appliances

Interestingly, the results show that the water used per person for clothes washing and dishwashing is higher for measured customers. This is due to the lower occupancy in measured households. It is likely that for convenience, measured customers will still use a washing machine and dishwasher nearly as frequently as unmeasured households, even when is it not full.

The results created by the Micro-component model are based on a survey which asked for the typical consumption of water per day. This means that the final PCC can be used to justify consumption for a normal year. Analysis of previous household demand (Section 3.4.3), showed that Portsmouth Water's normal year consumption is 102 Ml/d. When the micro-component results are multiplied out by Experian's population data (Section 3.2) the outcome is roughly the same.

In September 2012, WRc produced a group compendium summarising micro-component data (2012a). In this project, peak period micro-component data was compiled, comparing winter and summer consumption in measured and unmeasured households. This data was analysed and then used to create dry year factors for each micro-component category.

Dry Year Micro-Component Factors	Unmeasured	Measured
WC Flushing	1.00	1.03
Personal Washing	1.00	1.04
Clothes Washing	1.00	1.01
Dishwashing	0.97	1.06
Internal Tap	1.02	1.08
Miscellaneous Indoor Use	1.01	1.01
External Use	1.57	2.00

The results of this analysis show that, as expected, the largest increase in water use during a dry year is in external use. This can be explained through more garden watering and recreational water use during longer spells of hotter, drier weather.

The increase in water use for a dry year is proportionally higher for measured customers. As measured households pay for the amount of water they use, rather than a flat rate, these customers are careful with usage during a normal year. However it is believed that during a dry year, measured customers may feel that extra money can be expended for the wellbeing of themselves and their house.

Dry Year Micro-Components – Measured Per Capita Consumption (l/h/d)	2012/13
WC Flushing	30.23
Personal Washing	55.30
Clothes Washing	16.93
Dishwashing	6.97
Miscellaneous Indoor Use	11.68
External Use	22.58
TOTAL	**141.85**

Dry Year Micro-Components – Unmeasured Per Capita Consumption (l/h/d)	2012/13
WC Flushing	39.92
Personal Washing	61.84
Clothes Washing	15.80
Dishwashing	6.26
Miscellaneous Indoor Use	14.12
External Use	23.94
TOTAL	**162.06**

By using the dry year micro-component factors, a dry year base year micro-component estimate is calculated. This leads to a dry year factor of 1.06 for unmeasured households and 1.12 for measured households. When combined with Experian's population data (Section 3.2), the PCC results in a consumption of 109.1 Ml/d, which is very similar to the dry year consumption calculated through analysis of previous household demand in Section 3.4.3 (109.5 Ml/d).

3.4.5 Household Demand Forecast

Predicting the change in per capita consumption (PCC) is a key element in demand forecasting. It involves making a number of assumptions around how water will be used in the future. These assumptions can include an increase in water use from:

- Changes in social habits, for example:
    - More emphasis on cleanliness and hygiene
    - Increased popularity in gardening and domestic agriculture
- An increase in ownership of power showers
- An increase in water-using recreational activity due to climate change

In contrast, water can be saved through water efficiency measures such as:

- Replacement of water-using devices with newer, more efficient versions
- Encouraging customers to opt for a meter
- Further promotion of water efficiency campaigns and water saving devices. (More on Portsmouth Water's "Water Efficiency Plan" Section 3.4.7)

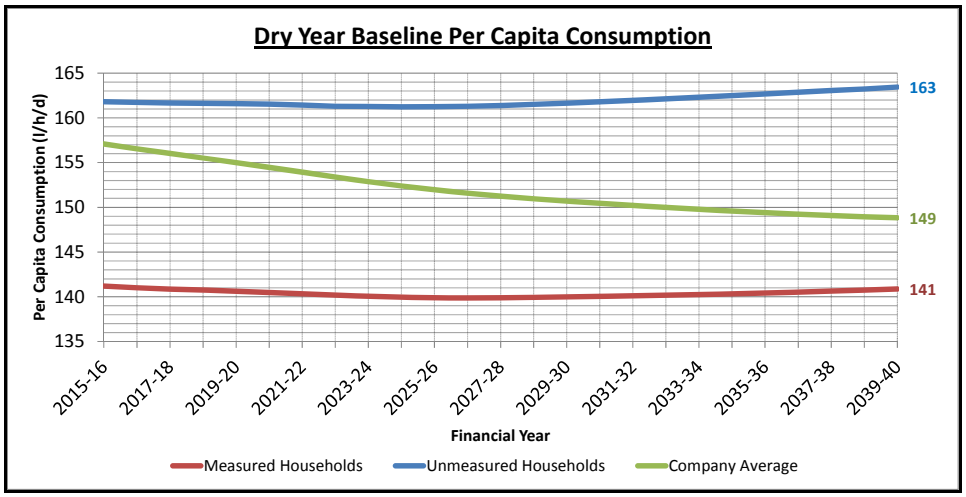
The recommended WRPG approach for developing a household forecast is to use micro-component analysis. This method allows the Company to take into account rises in water use through additional frequency-of-use, as well as the drops in water use through predicting the rate in which customers purchase or replace water-using appliances. The results of this micro-component analysis are in Appendix 12, along with justification for the assumptions used.

In the baseline forecast, measured households are split into new properties and meter optants. Survey results show that water use behaviour between meter optants and customers in new properties is very similar. These PCC's in the table are for a dry year, with both meter optants and new property normal year PCC coming out at roughly 125 l/h/d.

Measured PCC (Dry Year)	**2012/13**	**2015/16**	**2019/20**	**2024/25**	**2029/30**	**2034/35**	**2039/40**
New Properties	140.0	139.5	139.1	138.7	139.0	139.5	140.2
Meter Optants	142.3	141.7	141.1	140.4	140.4	140.7	141.2

There is little change in the per capita consumption of new properties. It is argued that whilst efforts have been taken to measure consumption within new homes, such as the 'Water Consumption of Homes Built to Part G and Code for Sustainable Homes Standards' portfolio produced by WRc, (2012b) there is no substantial evidence to support the view that new property demand is as low as the 'Code for Sustainable Homes' is predicting. Instead, the Company has used its micro-component survey data to produce a PCC estimate.

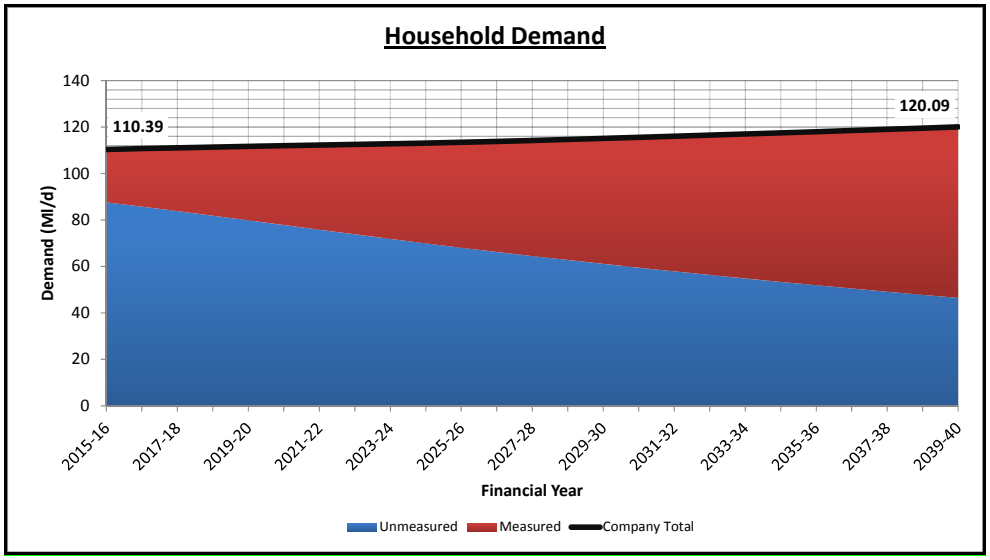
The results show that over the planning period, the Company's dry year PCC is falling. This matches the government's aspirations outlined in the 'Water White Paper', for falling PCC (Defra, 2012). Portsmouth Water's baseline metering strategy (Section 3.3) is predominately the reason for this fall. It is assumed that the majority of customers that opt for a meter do so for financial reasons and through water efficiency campaigns and replacements of water-using appliances, therefore customers will lower their PCC. This will make it financially sensible for these unmeasured customers to move onto a measured tariff.



As customers opt for a meter, their lower than average unmeasured PCC is removed from the unmeasured forecast and joins measured forecast. This effect, know as "customer churn", leads to a relatively flat average measured and unmeasured PCC over the planning period, whilst the Company's PCC falls. This is because as low water using unmeasured customers switch to the measured tariff, they become a higher than average measured customer and leave only the higher unmeasured users remaining.

The dry year baseline PCC shows that the Company's PCC will continue to fall throughout the planning period, reaching 149 l/h/d by 2039/40. This equates to a normal year PCC of 135 l/h/d, which whilst still higher than the government's normal year aspirations of 130 l/h/d by 2030 (Portsmouth Water are forecasted to reach 138 l/h/d by 2030), it is a significant drop from the current Company average PCC of around 149 l/h/d.

PCC is influenced by climate, affluence and the cost of water. The South East of England is hotter and more affluent than the rest of the UK, whilst Portsmouth Water has the lowest water bill in the country. This leads to making it difficult to reach the government's aspiration, which is a target for the country as a whole. Additionally climate change and economic growth may increase in the coming years, which may consequently have a negative effect on customer behaviour and must be taken into account when forecasting.



The result of Portsmouth Water's falling PCC means that whilst there is a significant rise in population through the WRMP14, there is only a small rise in the overall dry year household demand (109.10 Ml/d in 2012/13 compared to 120.09 Ml/d in 2039/40). The forecast also shows that by the end of the planning period, the majority of water use will be paid for on a measured tariff.

It is noticeable that from 2025 onwards in the dry year baseline PCC graph, the Company's PCC begins to level out and both the unmeasured and measured PCC begin to slowly rise. This leads to a slight increase in the demand for water over the planning period and can be explained through a number of factors. These include an increase of water used due to climate change and the difficulty in continuing to save the same amount of water through water efficiency measures each year. These effects are explored in more depth in the following sections.

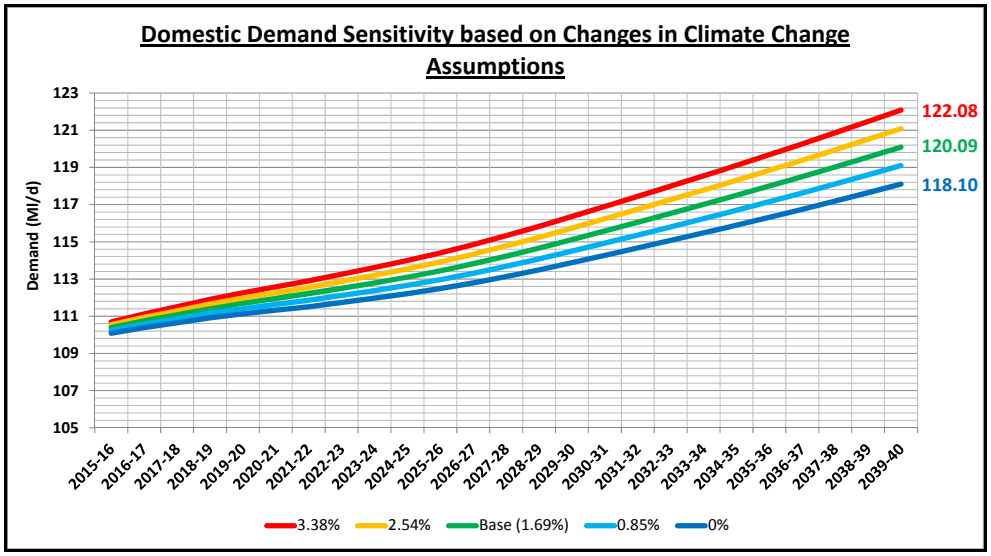
3.4.6 Impact of Climate Change on the Demand for Water

Portsmouth Water used the Climate Change and Demand for Water (Downing et al, 2003) and Climate Change Approaches in Water Resources Planning (CL04B; Environment Agency, 2012b)) reports to guide its assessment of climate change. Through the recommendations of these methodologies, the Company used a micro-component based approach to climate change to arrive at a litre per head per day figure that is in line with the CCDeW estimate. This estimate states that climate change will result in an increase in demand of 1.69% over the planning period.

Climate change is a gradual process; there is a need to progressively increase the impact on water use over time. Portsmouth Water used a linear increase, starting with 0% in the base year and increasing regularly to 1.7% in 2039/40.

Climate change will also only significantly affect the amount of water used within certain micro-components. Whilst hotter weather will increase the amount of water used for personal washing and outdoor use, it will have a much smaller affect on dish and clothes washing. This means that it is necessary to segregate the impact of climate change. Portsmouth Water has used an increase of 2.5% for personal washing and 3.5% for outdoor use, whilst there is only an increase of 0.25% in the other micro-components.

The result of this method show that climate change will increase the unmeasured per capita consumption (PCC) by 2.70 l/h/d and the measured per capita consumption by 2.34 l/h/d by the end of the planning period.



Further exploration by Portsmouth Water into the effects of climate change show that climate change has a moderate effect on demand. Doubling the effect of climate change to 3.38% by the end of the planning period (through increasing personal washing to 5%, outdoor use to 7% and the other micro-components to 0.5%), has lead to an increase of just under 2 megalitres per day in household consumption. Conversely, removing climate change dropped consumption by a similar amount. The results of this analysis are used in creating Portsmouth Water's Final WRMP headroom (Section 6).

3.4.7 Water Efficiency and its Impact on the Demand for Water

Alongside its water supply duties, the Company has developed a 'Water Efficiency Plan' which promotes the efficient use of the water it supplies. The Plan contains numerous policies of which the key policies cover:

- The control of peak demands
- The control of leakage
- Reductions in the volume of water used for toilet flushing
- Advice to customers on Water Audits
- Education of the public on water efficiency
- Commitments to research the impact of water efficiency initiatives

Over a number of years, Portsmouth Water has carried out detailed research into water efficient fittings and produced water audits and educational talks for schools, businesses and domestic customers. This activity is regularly reported in the Risk and Compliance Statement to Ofwat (formally known as the June Return).

In addition to this, Portsmouth Water has been involved in initiatives with many other interested parties such as the Hampshire Water Partnership and the Integrated Water Management Strategy for the Partnership for Urban South Hampshire (PUSH) region, a partnership of the unitary authorities of Portsmouth and Southampton for sustainable growth and regeneration of South Hampshire. The Company has worked with Hampshire County Council and the George Staunton Country Park to develop a water efficiency related education facility in

Havant. At Staunton, Portsmouth Water funds an Educational Officer at the Country Park to run educational tours for local schools with an overall water efficiency message as part of the programme.

Waterwise has published a summary of the large-scale water efficiency research projects carried out by the Water Industry (2010). The report attempts to apportion overall water efficiency savings to different micro-components of the domestic demand forecast.

In the second part of the report, Waterwise set out some costed scenarios for water companies to consider. Portsmouth Water has utilised this research in developing an option which considers the retro-fitting of ecoBETAs devices into Housing Association properties.

Portsmouth Water promotes water efficiency to customers through a Water Efficiency Officer and encouraging staff to volunteer with a variety of activities including:

- Hampshire Water Festival – Portsmouth Water is an active participant in this event and uses it to promote water efficiency.

- Staunton Country Park Education Centre – Portsmouth Water supports an education centre at a local country park which promotes water education though water efficiency.

- School Based Visits – Portsmouth Water promotes water efficiency through school visits and as part of the Annual EBP Science Fair.

- Customer Communication – The Company takes every opportunity to promote water efficiency to its customers by holding 'Water Efficiency Stands' at local shopping centres, through messages on newsletters and on the Company website.

- Interactive Website Tools – As an addition to the Company website, there is an Interactive Water Calculator for customers to calculate water usage and a water efficiency micro site where customers can request water efficient devices free of charge, including, save-a-flush bags, shower timer, shower regulators and tap aerators.

- Partnership with other Organisations – Portsmouth Water has external partnerships with other organisations such as PUSH and Educational facilities to promote water efficiency messages.

Portsmouth Water has utilised water efficiency assumptions which are consistent with the Ofwat Risk and Compliance Statement. The key assumptions are:

- New "Save-a-flush" bags can save up to 1.2 litres per toilet flush.

- EcoBeta interruptible flush devices save up to 47 litres per property per day.

- Initiatives such as supplying free water saving packs and subsidised water efficient devices. Alongside this, the Company runs a "Water Saving Challenge" which is designed to encourage customers to change their behaviour regarding water use.

In 2008, Ofwat consulted on the establishment of ''Water Efficiency Targets'' for Water Companies. The proposed target was split into two elements:

- Base Service Water efficiency (BSWE)

- Sustainable Economic Level of Water Efficiency (SELWE)

Some companies accepted voluntary targets for 2009/2010 and all companies were asked to trial the new approach for BSWE in the 2010 June Return. Formal ''Base Service'' targets have now been set and represent a total saving of 0.29 Ml/d for Portsmouth Water for each of the first five years of the planning period (A total saving of 1.45 Ml/d over the five years). This target is expected to be reached every year for the next five years when the methodology will be reviewed. For the 2011/12 year, the Company recorded a saving of 0.36 Ml/d, 0.03 Ml/d above the annual target. Should current trends continue, the Company is expected to exceed the 1.45 Ml/d target for the five year period.

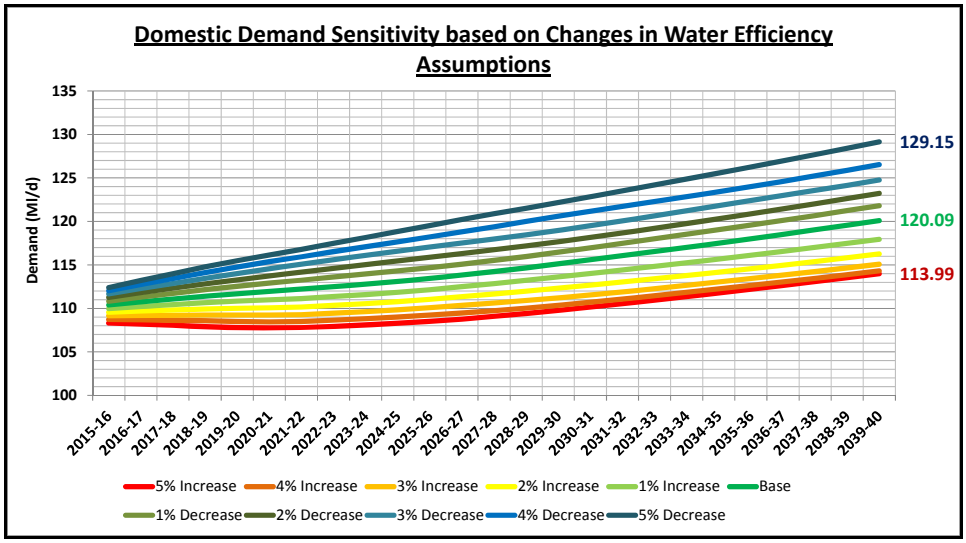
In new households, the Company anticipates that Level 1 of the Code of Sustainable Homes will be achieved (125 l/h/d). Whilst building regulations have been amended to make this a mandatory requirement for all new houses, the Company's domestic water use survey shows that demand is currently higher in these properties (Section 3.4.5). To reduce water in both new and existing households, further water efficiency initiatives are considered as part of the options appraisal process in Section 5. If these are adopted they will become part of the ''Sustainable Economic Level of Water Efficiency'' (SELWE).

The Company has not directly included the BSWE target in the per capita consumption forecast for each year of the full 25 year planning period. Instead, a replacement rate is assumed for each water-using appliance, meaning that any water savings from water efficiency will be nullified after the appliance has been replaced. Additionally, the base year data includes the savings in consumption made from previous water efficiency campaigns, meaning that any short term water savings from "Save-a-Flush" bags and EcoBeta devices are already within the forecast.

However, it is possible that extra water efficiency could be gained through a number of external promotions. These can include government initiatives, neighbouring water company's efficiency campaigns and additional efficiency programmes and inventions in the retail industry which may lead to water-using appliances being replaced more regularly than currently expected. However, as Portsmouth Water's bills are comparatively low in relation to overall household expenditure, it is also possible that the Company's water efficiency campaigns may be diluted.

To ensure that the Company are doing all it can to reduce demand in the short and long term, a more ambitious Water Efficiency Plan has been created in relation to commercial customers and optional metering. Portsmouth Water can no longer compulsory meter its customers as it is no longer classified as being in an area of 'serious water stress'.

Through retail competition in the water industry's commercial sector, additional savings in leakage will be found and enhanced water efficiency services will be offered to larger customers. In addition, domestic customers will be targeted through a new metering and water efficiency campaign. This will be promoted via the company's website and through joint work with other organisations such as the National Park Authority and Wildlife Trusts. These promotions will automatically involve the issue of additional water saving devices and the issue of water efficiency advice.



The importance of continuing with water efficiency can be demonstrated through sensitivity analysis. The impact of water efficiency, and by that Portsmouth Water mean the is far more than climate change, with a 5% increase in water efficiency leading to just over almost a 6 Ml/d fall in household consumption by the end of the planning period. Comparatively, consumption would increase by just under 10 Ml/d with a 5% drop in water efficiency.

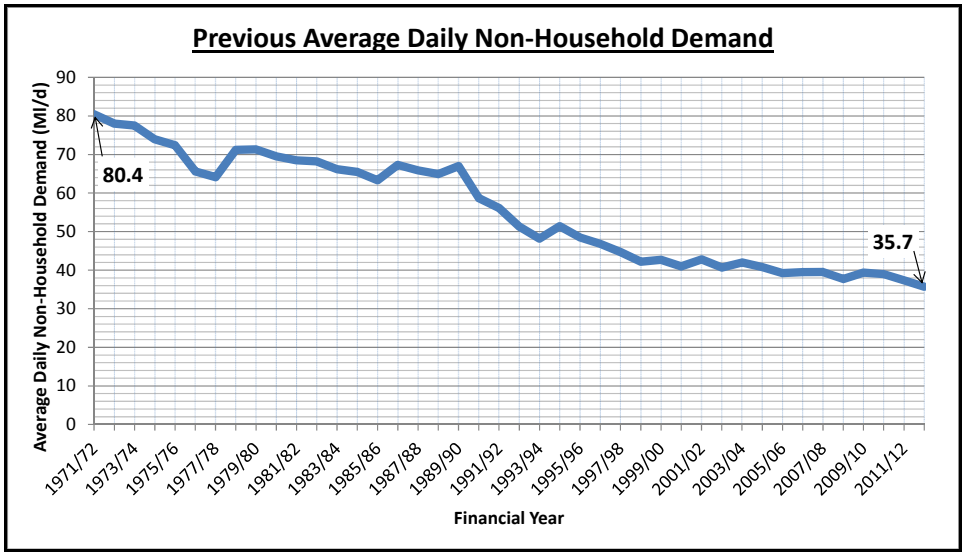
Further work on all sensitivity analysis, including changes in property and population trends, changes in the number of meter optants per year, changes in the micro-component assumptions and more on climate change and water efficiency are in Appendix 13.

3.5 Non-Household Demand

Over the past 40 years, Portsmouth Water has seen a decline in overall non-household demand within its supply area. There are several contributions to this reduction which include:

- The transition of the local economy from manufacturing towards service orientated industries.
- Initiatives by larger commercial customers to reduce water consumption.
- The promotion of water efficiency initiatives and leakage reduction services in commercial businesses by Portsmouth Water.

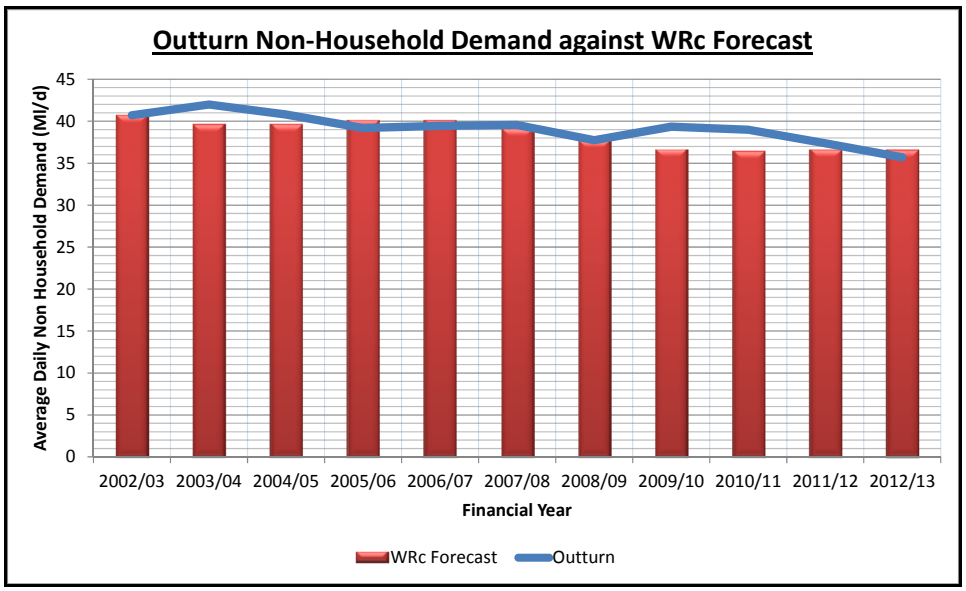
The total non-household consumption has fallen from 80.4 Ml/d in 1971/72 to 35.7 Ml/d in 2012/13. This total includes supply pipe leakage.



3.5.1 Previous Non-Household Demand Forecast

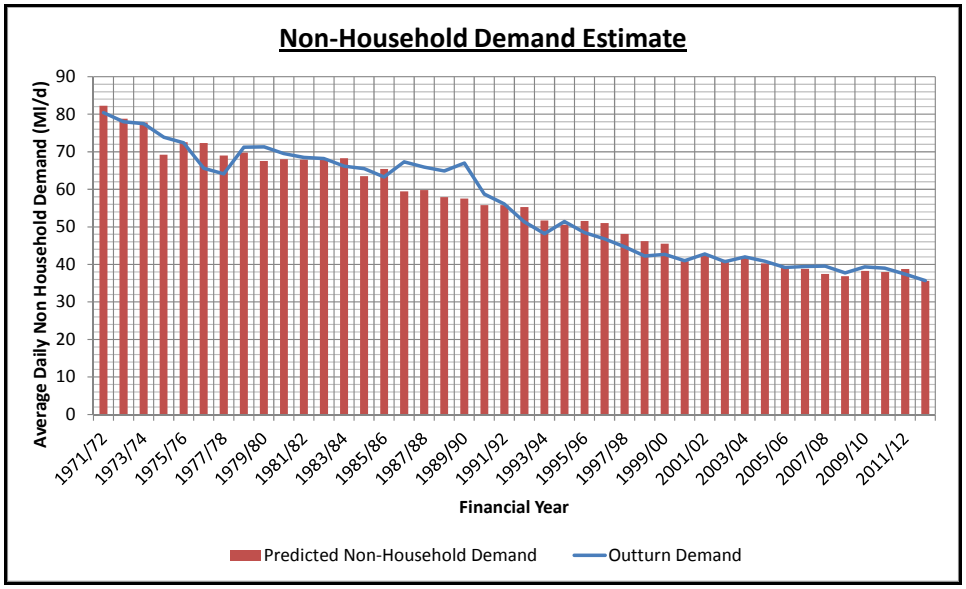
In February 1999, Cambridge Policy Consultants produced a demand forecast based on expected changes in economic activity. The forecast also took account of water efficiency in the workplace as a result of cost pressures.

In December 2003, WRc produced a revised demand forecast based on Government statistics and a view of likely water efficiency savings and possible climate change impacts. Since 1998/99, the outturn non-household demand has closely matched the Cambridge Policy Consultants forecast and WRc revision, leading to this forecast being used for the WRMP04 and the WRMP09.



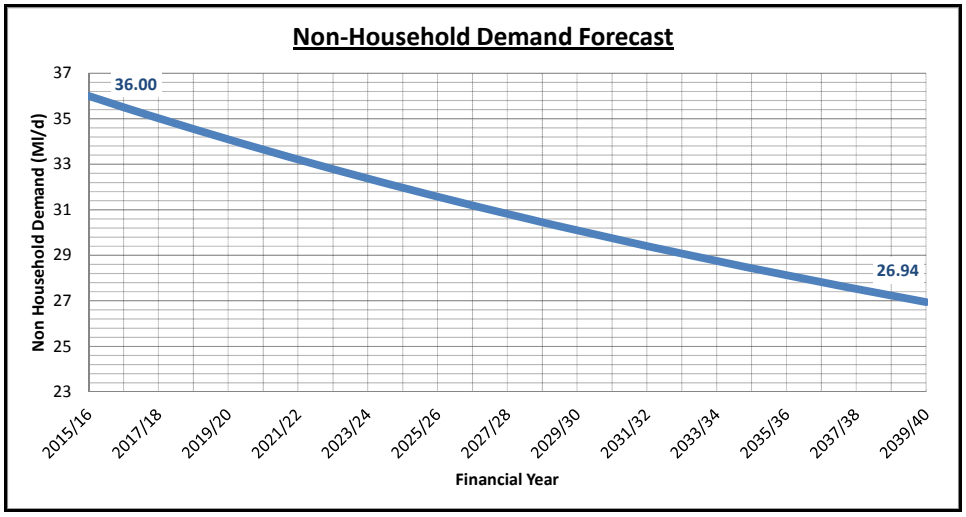
3.5.2 Revised Non Household Forecast

Responding to an increase in the disparity between the outturn data and the econometric forecast over the past few years since the economic downturn, Portsmouth Water has undertaken separate statistical analysis of its annual non-household demand, and this analysis is based on the Environment Agency and UKWIR methodology “Forecasting water demand components – best practice manual” (1997).



Portsmouth Water has experienced a reduction in the non-household demand for water from the 1970s to present day. The Company has used historical data which has revealed a relationship between the local areas gross domestic product (GDP), total rainfall throughout the financial year and non-household demand. The rainfall accounted for the variance per year as demand fluctuates with weather.

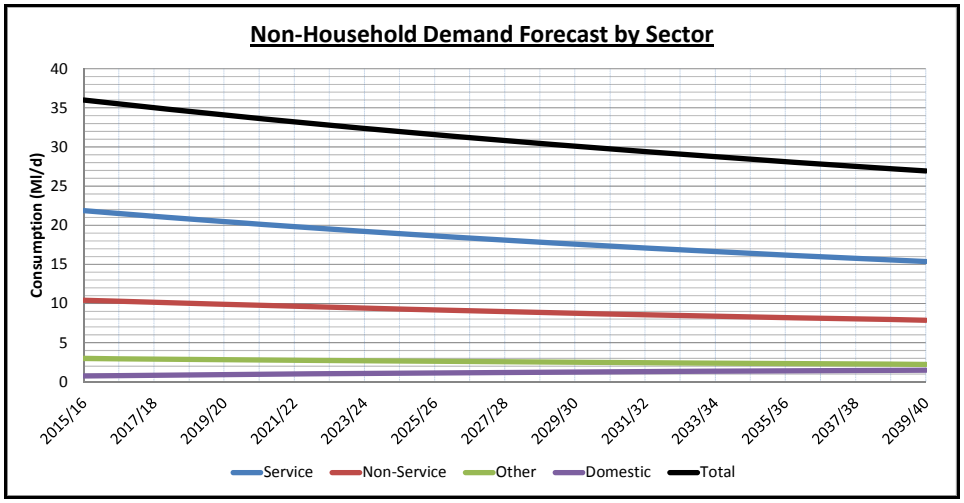
The Company used this relationship to forecast future non-household demand which has resulted in a forecast of falling non-household demand over the planning period.



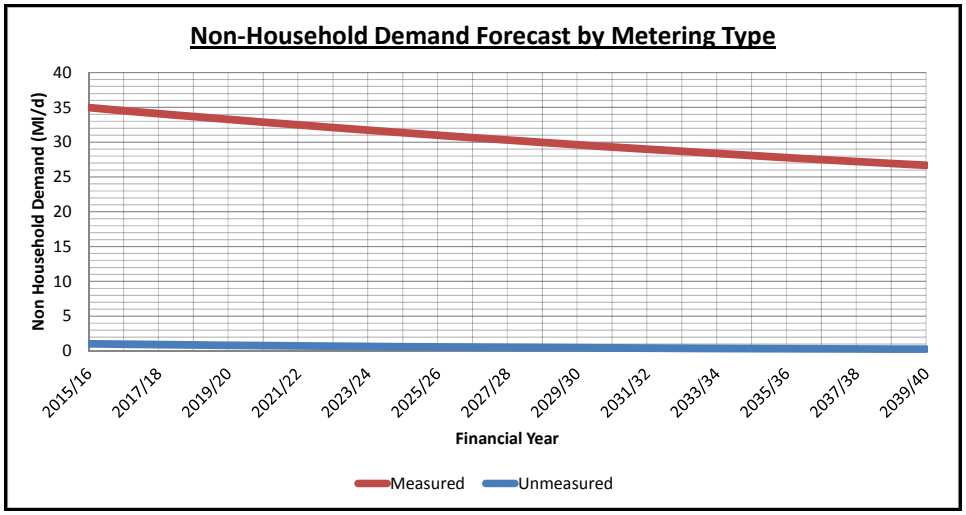
As well as calculating the variance, the use of rainfall also means that climate change is included in the historical data analysis. As outturn data is used, supply pipe leakage is included in the non-household demand analysis.

In an attempt to more fully understand the use of non-household demand, Portsmouth Water has continued with its statistical approach at a Standard Industrial Classification (SIC) Code division level. Using billing data, relationships were found between the annual demands for water within each SIC Code division and a mixture of economic and weather parameters. The results of this

analysis were proportioned into the overall non-household demand forecast. More on the statistical methods, data and assumptions used, along with more detailed results of the analysis undertake can be found in Appendix 15.



The results show a further drop in demand over the planning period. The most significant fall is in the service industry and is due to the possible water efficiency savings attributed to the market reforms for business customers. Portsmouth Water has experienced significant falls in measured consumption from their large non-household customers. The Company believes this trend is likely to continue.



In Appendix 15, Portsmouth Water shows the split between measured and unmeasured commercial customers. This split is used to proportion out the non-household demand into metering status. As more customers switch to a metered tariff, the demand for unmeasured businesses will fall to 0.3 Ml/d by the end of the planning period.

3.5.3 Impacts of Competition

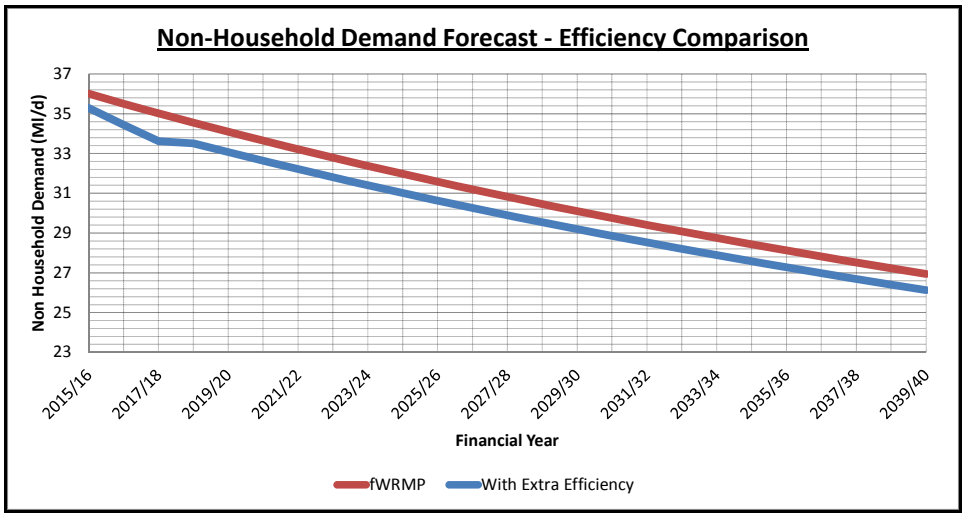
The Government recently lowered the threshold from 50 Ml to 5 Ml of consumption at which point customers are eligible to switch suppliers. This means that whilst the water will be still be supplied by Portsmouth Water, a business within the Company's supply area can opt for a third party to take over responsibility for billing and other administration tasks.

Portsmouth Water has a commercial strategy that will target saving its business customers water.

This saving in water will be achieved through:

- Promoting water efficiency products.
- Advising businesses on ways to save water.
- Real-time consumption monitoring, which:
  - enables leaks to be found and fixed quicker
  - allows businesses to target inefficient use better
  - leads to more accurate and concise billing

The results of the commercial strategy could have the effect of reducing the non-household demand forecast by an additional 0.8 Ml/d more than originally forecasted by the end of the planning period.



3.6 Leakage

Leakage, water abstracted and treated but not delivered to customer's taps is of significant concern to the Company and its customers. The amount of water lost through leaks in customer's pipes ideally would be zero. However the reality is that the majority of water lost is as a result of leaks that occur on underground pipes without the water rising to the surface. The leaks that do result in water being visible on the surface are easy to identify and consequently are repaired quickly and are not a significant proportion of the leakage reported by companies.

Leakage reduction activities involve companies' identifying and reporting the "non-visible" leaks through various techniques. These include reducing the pressure in the system which reduces the flow of water from leaks, which stops new leaks developing and replacing old pipes which have recurrent failures. The Company seeks to balance the cost of leakage reduction activities against the cost of the water lost through the leaks. In assessing both of these costs, the Company considers externalities such as the carbon cost of pumping and treating water, and the benefit to the environment of not abstracting the water. The point at which the costs of the water lost through leakage is equal to the cost of reducing leakage further is known as the sustainable economic level of leakage (SELL). The Company's leakage should not rise above this point, however the Company should consider if their leakage forecast should be below

the SELL, for example if customers place a value on this and would be willing to pay for a lower level of leakage.

3.6.1 Undertaking for Further Work

The Company made a commitment to undertake further work from the previous WRMP; this includes a commitment to produce a Sustainable Economic Level of Leakage including a full review of the marginal cost of water. The Company engaged Tooms Moore Consulting Ltd to undertake this study. The information set out in the following sections demonstrates the Company has met this undertaking.

3.6.2 Current Leakage Performance

The Company in response to the new approach to regulatory compliance introduced by Ofwat undertook an internal review of a number of compliance procedures. This review identified an error in the operational leakage calculation. The Company instructed an independent review of the leakage calculation which confirmed the error. As a result of the error the Company had been under reporting their leakage. The Company informed Ofwat at the earliest opportunity of the error. The Company has set out a Leakage Action Plan that details how the Company will reduce leakage to meet the target. The costs of implementing the Leakage Action Plan will be met by the shareholders and not borne by customers. The WRMP has been prepared on the basis that the Company will be meeting their leakage target in the first year of the Plan. (2015/16)

The Company experienced a mild winter in 2013/14 and has already met the 30 Ml/d target. The reduction in leakage has resulted from further pressure management optimisation, increased find and fix activity and improved leakage targeting data. The Leakage Action Plan aims to maintain leakage at 30 Ml/d for the reporting year 2014/15. The Company has assumed that the base year position is 30 Ml/d.

3.6.3 Leakage Assessment for the Last Plan

For the last WRMP, Portsmouth Water commissioned Mouchel Parkman to carry out an Economic Level of Leakage (ELL) assessment using their MELT model. The assessment included a recalculation of the policy minimum updating of the marginal cost of water to reflect increased power costs and consideration of allowance for unquantifiable benefits arising from a lower level of leakage. The result of the model gave an ELL of 30 Ml/d which the Company used in their WRMP. The Company forecasted that leakage would maintain constant over the planning period. The Company forecasted a reduction in supply pipe leakage over the planning period, but believed that this would be offset from leakage arising from new connections, resulting in a stable leakage forecast.

3.6.4 Current Leakage Assessment

The current leakage assessment was undertaken at the same time as a review of leakage management was being undertaken by Portsmouth Water. The Company engaged Tooms Moore Consulting to undertake a full SELL appraisal which included a full review of the marginal cost of water. Tooms Moore are also the consultants undertaking the independent leakage review and this allowed them to understand the uncertainty in the leakage calculation and appropriately deal with uncertainties on the leakage data. The report on the SELL is included in Appendix 14.

3.6.5 Scope of Current Leakage Assessment

The scope of the project was to deliver an SELL based on industry best practice.

Overall the methodology was developed to meet the requirements set out in the main guidance and best practice documents. The key documents are:

Document	Summary of relevant content for SELL
Economics of Balancing Supply and Demand, EA, 2003	Sets out how options for maintaining the supply-demand balance (including leakage reduction options) should be appraised
Water Resources Planning Guideline, Ofwat/EA/Defra, 2012	Describes the water resource planning requirements and sets out how leakage options should be assessed and reported for the Water Resource Plan
Review of SELL, EA/Ofwat/ Defra, 2012	Makes a number of pragmatic recommendations for how SELL should be assessed
Best Practice Derivation of Leakage Cost Curves, UKWIR, 2011	Provides guidance on the assessment of leakage cost curves, but concentrating on active leakage control. It also describes an alternative method, which is a development of a Method B approach
Managing Leakage 2011-Report 3: Setting Economic Leakage targets, UKWIR, 2011	Set out principles of SELL
Tripartite study: Best Practice Principles for Economic Level of Leakage Calculation, EA/Ofwat/Defra, 2002	Now partially superseded. This report provides guidance on principles of SELL, including the idea of Method A and Method B approaches
Best Practice Guidance on the Inclusion of Externalities in the ELL Calculation, Ofwat, 2007	Covers the calculation of externalities. Partially superseded by the Review of SELL (2012)

The project delivered:

- A baseline leakage level that minimises costs (including external costs). This includes transition costs from the current leakage level.
- A cost vs leakage reduction relationship, which can be used as part of the input to the WRMP.

The activities that were assessed as part of the SELL were:

- Changing Active Leakage Control (find and fix) (ALC). - This could include changed detection technology, improvements in management systems, changes in the number of detection staff and reconfiguration of SMAs and DMAs to improve efficiency.

- Changing pressures by the use of control valves or pumps. - This will include pump control, changed PRV control, new PRVs and zone reconfiguration.

- Infrastructure renewal. - This includes mains, communication pipes, supply pipes and possibly service reservoirs. Activities are likely to be targeted on particular assets with known poor performance.

- Management of repairs. - This is mainly about shortening repair time for reported and detected leaks by changed systems and increased repair resources.

The Company in preparing the Final Plan updated the SELL assessment to take account of improved data that was available for the assessment.

The Company also undertook a further assessment of the approach to assessing policy minimum, the details of which are included in Appendix 14. This assessment identified the uncertainty associated with policy minimum assessment which is presented in the report.

3.6.6 Marginal Cost of Water

The marginal of cost of water was assessed as part of the project and took into account:

- Operating cost savings seen by the Company; typically power and chemicals costs.

- Capital deferral seen by the Company if supply-demand investment is required within the planning horizon. This component is excluded if the Company undertakes a least cost planning exercise to avoid double counting the benefit of deferral.

- Environmental benefit of reduced abstraction.

- Carbon cost saving, typically driven by the electricity saving due to less pumping.

3.6.7 Short Run SELL

The SELL assessment concludes that the SELL is in the range of 28 to 34 Ml/d with the central point being 31.4 Ml/d. The range in the SELL reflects the uncertainty in the underlying data.

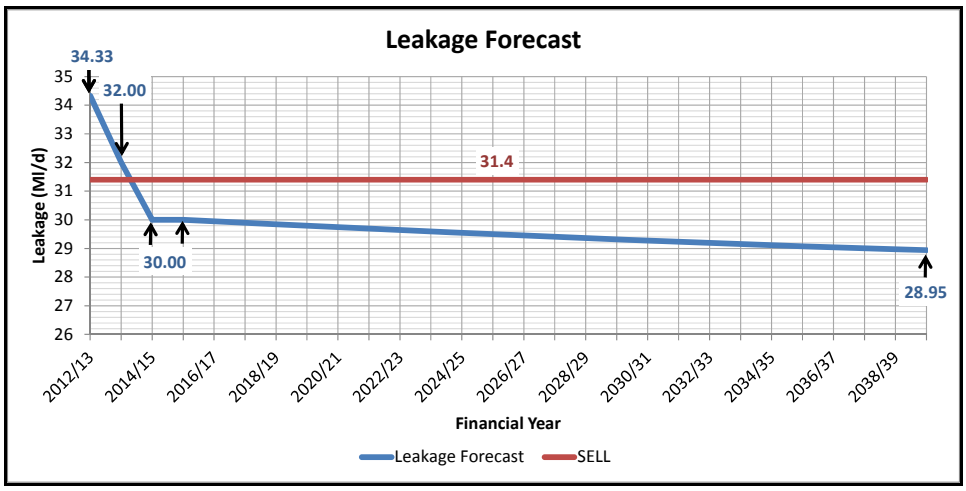
As a point figure is required for the WRMP, the Company has decided to set a leakage target of 30 Ml/d based on this SELL assessment. This is at the lower end of the range and is also consistent with previous leakage targets. Although this is below the SELL this is consistent with previous plans where the Company has set targets below the SELL.

3.6.8 Baseline Leakage Forecast

Over the planning period the level of leakage will change as a result of increased customer metering which can be expected to reduce supply pipe leakage. The Company is also expecting a growth in the number of properties over the planning period which is likely to result in an increase in the length of mains and the number of connections which will result in a rise in leakage. It is reasonable to expect that there will be improvements in efficiency and advances in leakage detection technology over the planning period and this is likely to result in a

reduction in the costs of leakage management and a corresponding fall in the SELL.

The Company has to take account of these factors when forecasting the baseline level of leakage. The Company believes that it is reasonable to expect the increase in leakage from growth in the distribution network to be offset by expected gains in efficiency and technology. It is reasonable to expect that the savings resulting in supply pipe leakage from the metering of customers to be reflected in the leakage forecast. The Company has allowed for this benefit in their baseline leakage forecast which results in a falling leakage forecast over the planning period. This is illustrated in the graph below.

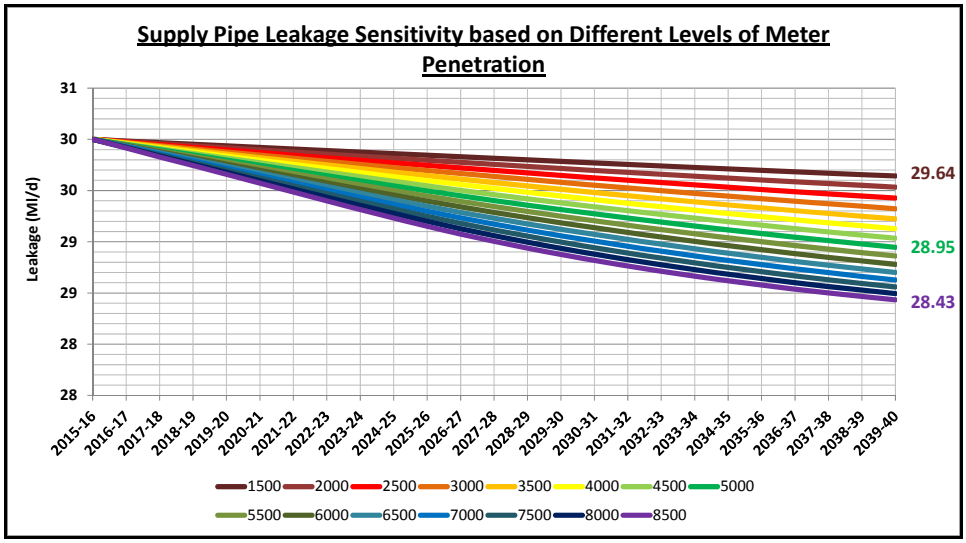


3.6.9 Customer Supply Pipe Leaks

The leakage figure reported by Portsmouth Water includes water that is lost through customers supply pipes. Portsmouth Water undertakes leakage detection activity to identify these leaks or customers sometimes become aware of the leaks themselves. Portsmouth continues to offer up to 2 free supply pipe repairs or a subsidised replacement of the supply pipe.

Supply pipe leakage tends to be lower on measured properties than on unmeasured properties. If a leak occurs on a measured property customers will notice the step change in the volume consumed. Also when a customer opts for a meter a check is undertaken on the customer's supply pipe. Consequently the leakage forecast falls over the period to take account of the reduction in supply pipe leakage as a result of the number of customers opting for a meter.

The graph below presents a sensitivity analysis demonstrating how the leakage level may be impacted for different numbers of optional meters installed. It can be clearly seen from the graph that the uncertainty relating to this element is not material to the Plan.



3.7 Bulk Supply Exports

Bulk supplies to other companies are included in Table WRP1 and contribute to the overall reduction in deployable output. They are not supply options and are therefore detailed under the demand section.

The bulk supply options have been assessed as having neutral or minor positive and negative effects against most of the SEA objectives. Four of the six options have been assessed as having significant negative effects against objective 5 (climate change) during the construction period, since these options require new infrastructure in the form of pipelines and pumping equipment, with associated embodied carbon. Five options have been assessed as having a significant benefit against objective 6 (economy) during the operation, with their yields equalling or exceeding 10 Ml/d and contributing to the economic growth of the region through sharing water resources. The largest of the 3 options (Option B5291 Farlington to Tilmoor transfer), has been assessed as having a significant positive effect on the economy during construction due to the employment opportunities that may arise from construction.

3.7.1 Southern Water Sussex North

Portsmouth Water has one existing bulk supply agreement which is with Southern Water and supplies their Sussex North zone. The bulk supply was constructed in 2004 and the agreement runs until 2014. There is the provision for a 1.0 Ml/d continuous flow in the pipeline and a break pressure tank at Whiteways Lodge. From that point, the pipeline is owned or operated by Southern Water.

The maximum transfer rate is 15.0 Ml/d and this was originally intended to be available in the peak week. Southern Water took the bulk supply for a much longer period in 2004 and into the winter of 2005. Portsmouth Water obtained a licence variation for the Eastergate Group to help service the bulk supply. This licence has constraints of the overall abstraction and a pragmatic limit of 4.45 Ml/d has been applied to the average bulk supply volume.

The existing bulk supply is available in a dry year with a return period of 1 in 20. For drought conditions the supply would be delivered on a “best endeavours” basis with the assumption that Southern Water had applied temporary demand restrictions and drought permits.

The current bulk supply is not bi-directional and this is reflected in Section 2.7. The agreement is due for renewal in 2014 and the Eastergate Group Licence will need to be reviewed at the same time. Southern Water originally requested a renewal of the bulk of 15 Ml/d at MDO, PDO and ADO and this was included in the Draft Plan. However, despite written confirmation at the pre-consultation stage, Southern Water chose to use a different flow at ADO for this bulk supply.

Portsmouth Water and Southern Water have since discussed the provision of bulk supplies in more detail, with Southern Water requesting the following:

- At ADO - 10 Ml/d from 2015/16 to 2039/40.
- At PDO and MDO - 15 Ml/d from 2015/16 to 2023/24, followed by 10 Ml/d from 2024/25 to 2039/40.

Southern Water has asked for these bulk supplies to be guaranteed for up to a 1 in 200 year event.

3.7.2 Southern Water Sussex Worthing

There is a cross connection between the bulk supply to Sussex North and an existing Southern Water main to their Sussex Worthing zone (Littlehampton). This connection provides operational flexibility but does not increase the total transfer capacity. When Southern Water is operating their Madehurst Source the main is not available as a bulk supply. As far as Portsmouth Water knows, Southern Water has no plans to up rate the main to Littlehampton.

3.7.3 Sussex North Duplication

Portsmouth Water has considered an option for duplicating the existing bulk supply to Sussex North. This would follow the same route to Whiteways Lodge and would require Southern Water to duplicate their main as well. Additional pumps would be required at Slindon but no allowance has been made for increasing the capacity of the break pressure tank. Southern Water has not formally requested this option, although they have asked for the existing bulk supply to deliver 15.0 Ml/d at all times.

If developed, this bulk supply would deliver an additional 15 Ml/d. In the WRSE Modelling Scenario C3 run, it is assumed that the duplicate bulk supply would deliver 15 Ml/d at average, peak and MDO conditions. The new bulk supply would be reliable in a dry year (1 in 20) but further licence variations may be needed to secure the necessary deployable output. This is not included in the baseline plan.

3.7.4 Southern Water Hampshire South

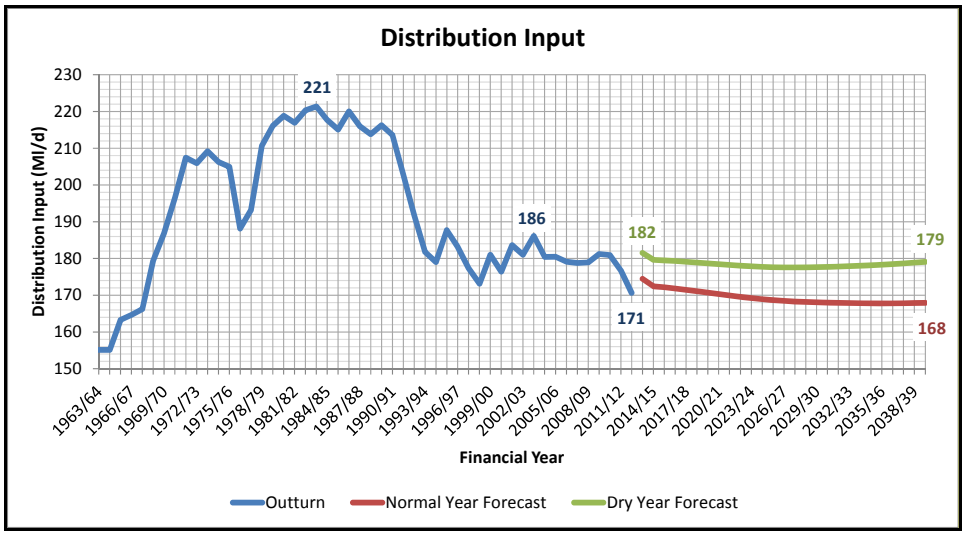
Only a very small length of this bulk supply main will be provided by Portsmouth Water. Southern Water has requested a bulk supply to their Moor Hill Reservoir which is close to Portsmouth Water's River Itchen Works. The initial proposal was for 10.0 Ml/d at average, peak and MDO. This can be provided without modifying the treatment process but will require new high lift pumps and surge vessel.

In the future, it would be possible to supply up to 30.0 Ml/d by pumping continuously. This would depend on Portsmouth Water obtaining supplies from new resources.

3.7.5 South East Water - Petersfield

South East Water has formally requested a bulk supply from Clanfield Service Reservoir to Tilmoor Reservoir in Petersfield. Construction of the bulk supply will be split between Portsmouth Water and South East Water. The route crosses the South Downs National Park but it is not expected that there will be significant lasting environmental impacts. The pipeline will be sized to supply 10.0 Ml/d and South East Water has requested to use this bulk transfer under dry year PDO conditions (1 in 20) from 2039/40.

3.8 Total Demand



Portsmouth Water's have records for average demand going back to the early 1960's. This allows the company to place its demand forecast for this plan into a large context.

The Company's average demand was around 160 Ml/d during the mid 1960s. It then rose rapidly during the late 1960s, before levelling out due to the oil crisis of 1973. There was then a dip in 1976 due to drought restrictions being placed on Portsmouth Water customers, before the economic recovery of the late 1970s and early 1980s lead to a further increase in demand. During this period, distribution input reaching a high of 221 Ml/d in 1983/84.

Through the reduction in manufacturing during the early 1990s, demand dropped to roughly 180 Ml/d. It then has roughly stayed the same through to the present day. Water efficiency schemes, improvements in leakage detection and optant metering have kept demand from rising, despite the increase in population during this time.

The distribution input in 2012/13 was 171 Ml/d. This is the lowest that Portsmouth Water has seen since 1967/68. Whilst the wet summer of 2012 can partly explain the reason behind the low figure, the Company believes that a change in customer behaviour and improvements to leakage are also factors.

These factors has been taken into account when creating the demand forecast, with the Company predicting a gradual fall in average demand over the planning period. This will be from 174 Ml/d in 2013/14 to 168 Ml/d in 2039/40. This forecast also states that by 2020, the average demand will be no higher than that experienced during the wet year of 2012/13.

There will also be a fall in the dry year demand forecast over the next 25 years. It is expected that this will not be by as much as an average year, due to the

impact of climate change on the use of outdoor water appliances during the drier summers.

4 BASELINE SUPPLY/DEMAND BALANCE

4.1 Introduction

In order to assess security of supply, Portsmouth Water has to compare the baseline deployable output with the baseline demand forecast. For this round of planning, it has been assumed that these will both have the same probability of occurrence or return period. This is related to the "Level of Service" (LOS) referred to in Section 2.2.3. In a "Dry Year", temporary demand restrictions are just avoided and the current LOS is 1 in 20 or a 5% risk of failure.

Any event rarer than 1 in 20 will either be dealt with as part of the Drought Plan (Portsmouth Water March 2013) or as part of the Emergency Plan. The Water Resources Management Plan only considers these rarer events in terms of resilience and climate change. Deployable output will vary with return period but demand will be influenced by restrictions and customer behaviour.

For the Final WRMP 2014, Portsmouth Water has decided to submit tables for Annual Average, Peak Week and Minimum Deployable Output. This is to ensure that the correct "Critical Period" is identified and to ensure that bulk supplies to other companies are correctly modelled. Normal year demands are only used for revenue forecasting and the supply/demand balance is based on the assumption every year is a dry year.

4.2 Headroom Assessment

Target headroom is a buffer between supply and demand and allows for uncertainty and risk. The demand forecast is based on the "Most Likely" outcome for the population numbers and a central forecast of per capita demand. Headroom takes account of the fact that these could be under estimated and that deployable output could be lower. Security of supply is maintained even if all of the headroom is used.

4.2.1 Methodology

Portsmouth Water employed URS to carry out the headroom assessment and asked them to use the "Improved Methodology". This is a probabilistic approach based on the 2000 UKWIR report and the guidance published by the Environment Agency. The Monte Carlo simulations were carried out using @ RISK software with 10,000 iterations. The higher numbers of iterations were used to improve repeatability of results.

4.2.2 Headroom Uncertainty Factors

The standard methodology includes thirteen uncertainty factors:

Uncertainty Factors

Factor	Name
S1	Vulnerable Surface water licences
S2	Vulnerable Groundwater licences
S3	Time Limited Licences
S4	Bulk Imports
S5	Gradual Pollution
S6	Accuracy of Supply-Side Data
S7	Single Source Dominance
S8	Impact of Climate Change on Deployable Output
S9	New Sources
D1	Accuracy of Sub-Component Demand Data
D2	Demand Forecast Variation
D3	Impact of Climate Change on Demand
D4	Demand Management Measures

A probability distribution is assigned to each uncertainty factor to represent a range of possible outcomes. The probability distributions are then combined using the Monte Carlo software to produce an overall curve that relates to a particular level of risk.

The level of risk can be set for each Monte Carlo simulation and a family of headroom graphs produced. The Water Resources Planning Guideline states that companies should accept a higher level of risk in the future. This is because the Regulators feel that the uncertainties that the industry will face in the future can be managed.

It is helpful to consider each of the uncertainty factors and their influence on the final headroom figure. More detail is contained in the URS Headroom Allowance Assessment Report (see Appendix 8).

4.2.2.1 S1 Vulnerable Surface Water Licences

Portsmouth Water only has one surface water abstraction which is from the River Itchen at Gaters Mill. The abstraction licence has been varied to comply with the Habitats Regulation Review of Consents. There are no additional abstraction issues for Portsmouth Water from the Water Framework Directive. No allowance has been included for this factor in the calculations.

4.2.2.2 S2 Vulnerable Groundwater Licences

The WRPG, published by Ofwat, the Environment Agency and Defra, say that it is not necessary to include this factor in headroom. Portsmouth Water remains concerned that sustainability reductions, as a result of the Water Framework Directive, are a key area of uncertainty for the future.

A headroom impact has been calculated on the basis of the sustainability reductions and used in scenario testing. This was based on the preliminary results from the PIM/WFD investigations. A combined reduction of 13 Ml/d was assumed, however S2 has not been included in the final headroom figures.

4.2.2.3 S3 Time Limited Licences

Time limited licences are a potential area of uncertainty for Portsmouth Water. The existing bulk supply to Southern Water relies on a licence variation that is time limited to 2016. The licences that have been reviewed as part of the PIM Investigation are theoretically time limited.

The guidance says that the impact of time limited licences should not be included in headroom. This is because the Agency will give notice of any proposed licence reductions and there will be enough time to "restore" the supply/demand balance. In the past, Portsmouth Water believed that this was a key area of uncertainty but did not include it in headroom.

The outcome of the PIM investigations indicates that the existing licences are sustainable and with minor variations they will not need to be time limited in the future. Portsmouth Water is unlikely to renew the bulk supply to Southern Water if the current licence is not reconfirmed. The additional WFD study on the Aldingbourne Rife will help to confirm that the licences are sustainable.

An allowance for time limited licences has not been included in the Final WRMP 2014.

4.2.2.4 S4 Bulk Imports

Portsmouth Water does not currently have any bulk imports of water and there are no such arrangements currently planned. This factor has been excluded from the headroom assessment.

4.2.2.5 S5 Gradual Pollution

There are three sources of gradual pollution in the Portsmouth Water area of supply:

- Nitrates
- Pesticides
- Oil Spillages

In the past, high nitrate levels have been managed by the introduction of blending schemes. In addition to blending, Portsmouth Water is now involved in catchment management through a partnership with the Environment Agency, Natural England and the South Downs National Park. With these measures in place it was decided not to include gradual nitrate pollution in headroom. Further nitrate blending schemes have been included in the Business Plan to address specific problems. Recent nitrate forecasting work, as presented to the Customer Challenge Group and raised by South Downs National Park Authority in their representation to the Draft WRMP, has shown that nitrates are continuing to rise in some areas. Despite catchment management, additional capital schemes maybe required to meet the deterioration of raw water quality. Portsmouth Water has worked with AMEC consultants to develop a new catchment management strategy and have included this into their budget for the Business Plan (PR14). If outages occur due to nitrate levels in the shorter term, these will be covered by the outage allowance.

Portsmouth Water is not aware of any significant risks to groundwater from either point source or diffuse pollution by pesticides. Once again, catchment management will help to reduce the risks in the future. No allowance has been made for gradual pesticide pollution.

In the recent, past Portsmouth Water has experienced outages due to oil spillages. These have occurred at:

- Northbrook 2005
- Lovedean 2011

- Worlds End 2011

These events represent a medium term loss of deployable output and a risk of further losses at other works in the future. In order to comply with the guidance, events that last longer than 3 months are excluded from the outage calculations. Portsmouth Water has decided to include oil pollution as a generic risk at all works.

4.2.2.6 S6 Accuracy of Supply Side Data

A small allowance has been included from the uncertainty in the accuracy of abstraction meters and the source yield assessment. This factor does not significantly influence the overall headroom figure as required by the guidance.

4.2.2.7 S7 Single Source Dominance

This factor is no longer included in the headroom assessment because Portsmouth Water only has one water resources zone.

4.2.2.8 S8 Impacted Climate Change on Deployable Output

The previous headroom assessment included all allowance for the potential impact of climate change on the deployable output of the River Itchen Works. No allowance was included for the impact on groundwater sources.

For the Final WRMP2014, a completely new assessment has been carried out by URS and HR Wallingford using the latest UKCP09 climate change scenarios. The assessment is based on a sub set of 100 scenarios selected from the full set of 10,000 scenarios in UKCP09. For each of the 100 scenarios, models have been produced for groundwater level, spring flow and river flow. These were inserted into a "Resource Zone Model" to give 100 possible outcomes for a 1 in 20 year return period event.

The model results give a statistical mean, minimum and maximum for average and peak demand periods. The variability of the results is used in the headroom calculation and the mean figures are included as the baseline reduction in deployable output in Table WRP1. In 2035, these figures are -1.9 Ml/d at average and -2.6 Ml/d at peak. These numbers are less than WRMP 2009 but the headroom allowance will be more due to the inclusion of groundwater impacts.

4.2.2.9 D1 Accuracy of Sub-Component Demand Data

A small allowance has been included for the uncertainty in the accuracy of distribution input meters. These meters are located at Service Reservoirs and are not the same as the meters located at source works. This factor does not significantly influence the overall headroom figure as required by the guidance.

4.2.2.10 D2 Demand Forecast Variation

In the previous plan, Portsmouth Water used an upper forecast for demand and there was no headroom allowance for demand forecast variation. This implied that the only uncertainty was that demand would be lower and it resulted in a very low headroom allowance at the end of the planning period.

In January 2013, Portsmouth Water provided three sets of demand forecasts to URS for the headroom calculations. The most likely or medium forecast was used for the WRSE modelling and forms the basis of the Final WRMP 2014 forecast. The low forecast assumes that per capita consumption is influenced by water efficiency and a greater concern for the environment. The high forecast

assumes that affluence, and a hardening of views on the environment, result in higher per capita consumption.

The demand forecasts were used to produce a range of uncertainty for each year and a triangular uncertainty distribution was assumed with zero as the most likely outcome.

4.2.2.11 D3 Impact of Climate Change on Demand

In the WRMP 2014, this factor was not included because the trend based demand forecast automatically included climate change in the approach. For the Final WRMP 2014, URS have included an allowance and Portsmouth Water has provided a separate line in Table WRP2 for the impact of climate change on the baseline forecast.

Portsmouth Water produced three climate change scenarios for measured and unmeasured household demand based on a micro component approach:

- No climate change impacts
- Most likely climate change impacts with increases of 3% in personal washing and outdoor use
- High climate change impacts with an increase of 6% in personal washing and outdoor use

Once again, the three forecasts give a "most likely" impact and a range of uncertainty. The triangular distribution used in the Monte Carlo simulations assumes the most likely value is zero (see Appendix 8).

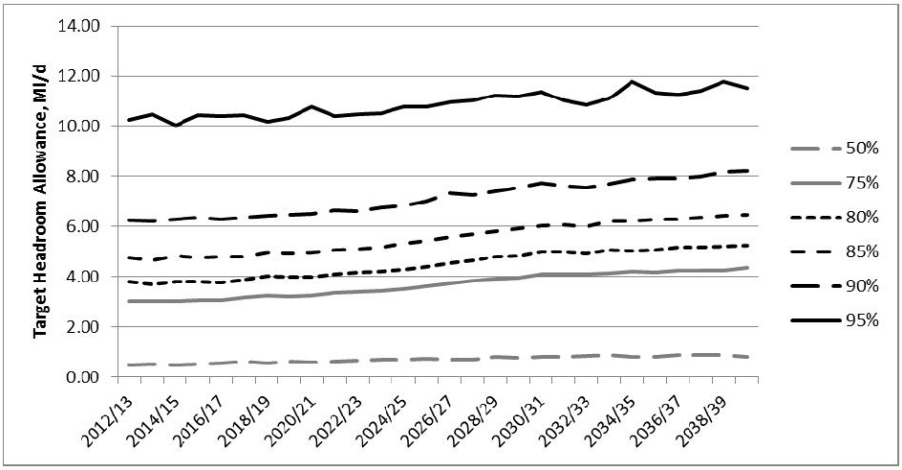
4.2.2.12 D4 Demand Management Measures

The baseline supply/demand balance does not include additional demand management measures. The baseline forecast does include the water efficiency targets set by Ofwat and these are a regulatory requirement. There is no uncertainty allowance for this factor.

4.2.2.13 Company Headroom Allowance

The results of the Monte Carlo simulation are presented in Appendix 8 and the initial inclusions are shown on the following graph for dry year annual average.

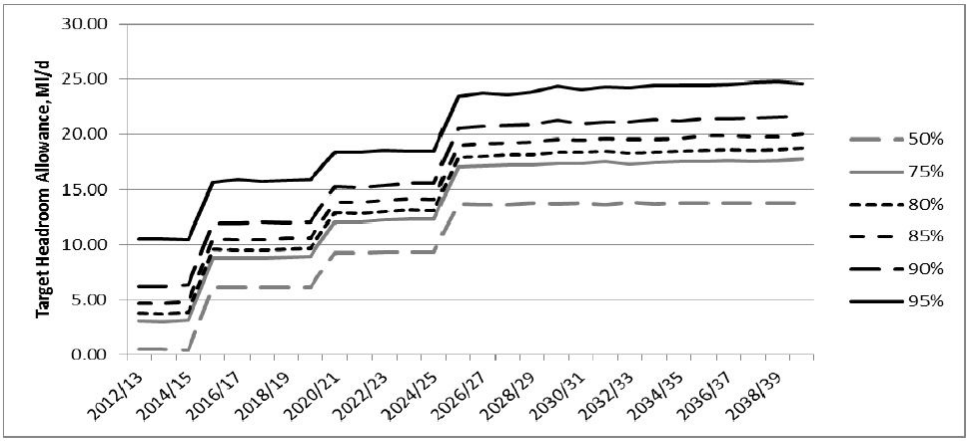
Headroom Allowance



This shows headroom increasing with time and the impact of selecting different risk assumptions. Within a 95% probability (5% risk of failure), headroom would be 10 Ml/d in 2012/13. If the probability was assumed to be 75% this would fall to 3 Ml/d.

If the S2 factor for vulnerable groundwater licences was included, the results would look very different.

Headroom Including Sustainability Reductions



Starting at 10 Ml/d in 2012/13, headroom would step up in 2014/15 when the PIM reductions were included and again in 2019/20 and 2024/25 when the WFD reductions were included. For the 95% probability (5% risk of failure), headroom would increase to 25 Ml/d by the end of the planning period.

This graph illustrates why Portsmouth Water has produced an "Alternative Plan" with the sustainability reductions included in deployable output. They have not been included in the baseline plan.

The WRPG states that companies should be prepared to take more risks at the end of the planning period. This is represented as a stepped reduction in probability starting at 95% in 2019/20. In the WRMP 2009, Portsmouth Water assumed that probability would fall by 5% for each 5 year time step. This is now considered to be too great a reduction because:

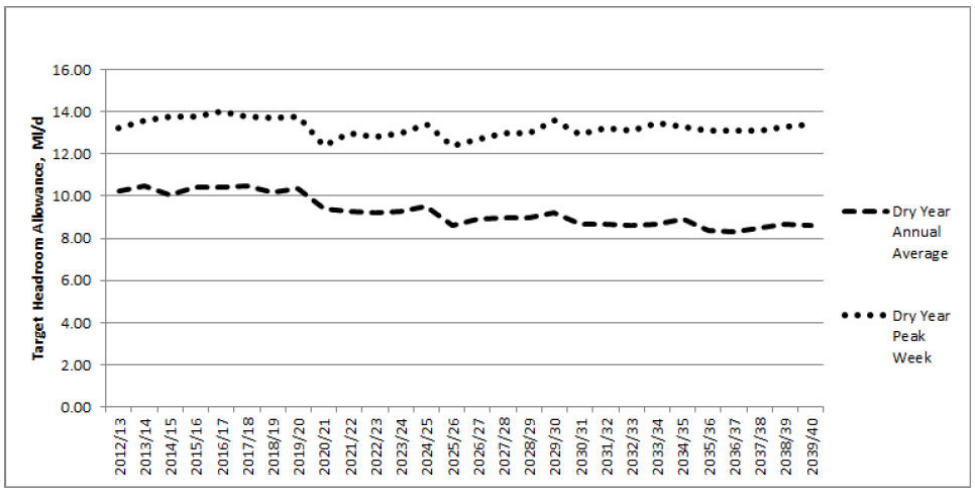
- Headroom only represents 6% of deployable output and stakeholders commented that the figure at the end of the planning period was too low
- There is a big fall in headroom between 95% and 90% this is due to the influence of S5 gradual pollution
- A small step in probability results in a smoother overall profile whilst still complying with the requirement to accept higher levels of risk

The risk profile adopted was:

Period	Risk	Probability
2015/16-2019/20	5%	95%
2020/21-2024/25	6%	94%
2025/26-2029/30	7%	93%
2030/31-2034/35	8%	92%
2035/36-2039/40	9%	91%

The results in the following headroom profile which has been used for the baseline and alternative plans.

Final Headroom Profile



The final headroom allowance can be compared with the previous plan for 2014/15:

Headroom Allowance

Scenario	WRMP 2009	WRMP 2014
Annual Average	8.4 Ml/d	10.0 Ml/d
Critical Period	10.9 Ml/d	13.8 Ml/d

The starting position is very similar but headroom does not fall to the very low figures predicted in the 2009 Plan.

Final Headroom Allowance

Year	Dry Year Annual Average	Dry Year Critical Period (Peak Week) (Ml/d)
2014/15	10.0	13.8
2019/20	10.3	13.8
2024/25	9.5	13.4
2029/30	9.2	13.6
2034/35	8.9	13.3
2039/40	8.6	13.4

4.3 Baseline Supply/Demand Balance

The "Baseline" supply/demand balance is a comparison of Deployable Output (DO) and Distribution Input (DI). It is based on unconstrained demand in a dry year with a 1 in 20 return period. At other times, such as a normal year, the Company will only experience problems if there is an unusual outage such as a pollution event. If the deployable output has a return period greater than 1 in 20, the demand will be constrained and the supply/demand balance will be determined by the Drought Plan (Drought Management Plan 2012).

The baseline balance is carried out for annual average conditions with reduction in DO for climate change, outage and process losses. The resulting volume is termed "Water Available for Use" (WAFU). After allowing for existing bulk supplies, and new bulk supplies resulting from recipient company requests, WAFU is compared with DI. This figure is called "Available Headroom" and this can be compared to the "Target Headroom" calculated in Section 4.1.

If Available Headroom is greater than Target Headroom, at any given time step, then there is a surplus. If there is a surplus until the end of the planning period (2039/40), then the plan balances and there is no need for any further actions. If there is a deficit then a further stage of options appraisal needs to take place.

4.3.1 Average Supply/Demand Balance

The supply/demand balance is shown in full in Table WRP1 with additional deployable output information drawn from Table WRP1a and additional demand data from Table WRP2. The balance can be represented as five year time steps to show the key periods within the Business Plan submitted to Ofwat.

Average Supply Demand Balance

Year	DO	Reductions In DO	WAFU	Bulk Supply	Total WAFU	DI	Available Headroom	Target Headroom	Surplus/ Deficit
2015/16	245.8	22.2	223.6	10.0	213.6	179.5	34.1	10.4	23.7
2019/20	245.8	22.6	223.2	20.0	203.2	178.7	24.5	10.3	14.2
2024/25	245.8	23.1	222.7	25.0	197.7	177.7	20.0	9.5	10.5
2029/30	245.8	23.6	222.2	25.0	197.2	177.6	19.6	9.2	10.4
2034/35	245.8	23.8	222.0	25.0	197.0	178.2	18.8	8.9	9.9
2039/40	245.8	23.9	221.9	25.0	196.9	179.1	17.8	8.6	9.2

At average demand, the existing bulk supply to Southern Water only provides a sweetening flow of 1.0 Ml/d. Southern Water is now asking for the 10 Ml/d at average throughout the planning period.

The average balance also includes a new bulk supply from the River Itchen Works to Southern Waters Moorhill Service Reservoir. For the Final WRMP 2014, Southern Water requested 10 Ml/d from 2017/18 to 2023/24 and 15 Ml/d from 2024/25 onwards. This bulk supply will be available at ADO, PDO and MDO.

In the table above, all the reductions in deployable output have been added together. These comprise of the following elements:

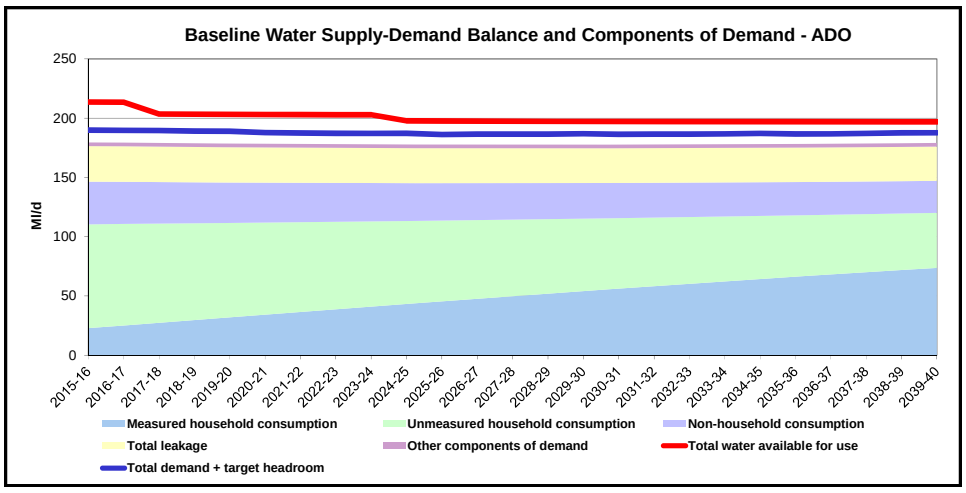
- Climate change
- Outage
- Process losses
- Sustainability Reductions

The Baseline Plan now includes additional sustainability reductions but the risk of further reductions has not been included in headroom. Reductions shown in the WRMP 2009 have already been implemented under the Habitats Regulations Site Action Plan.

4.3.2 Average Balance Graphical Representation

The WRMP Tables are included as an appendix to this report Appendix 26. As part of the tables, a graphical representation has been developed and this is shown below for the average dry year scenario.

Baseline Annual Average



The baseline graph for average conditions shows the significant impact of optional metering on overall demand. Non-household demand falls gradually over the planning period and leakage falls as a result of reductions in supply pipe losses. The blue line represents demand plus target headroom and it is these numbers that are compared with supply in the baseline balance. The red line represents total water available for use. Total WAFU is calculated from deployable output minus climate change, outage and process losses. In the baseline scenario, there are also further sustainability reductions of the magnitude of 6 Ml/d and bulk supplies to Southern Water. The reductions shown in the previous plan for 2014/15 have been brought forward and are already accounted for in DO.

The graph shows that the red line stays above the blue line which means that the Company remains in surplus for the whole planning period. This presents opportunities for providing further bulk supplies to other companies over and above what has already been requested.

4.3.3 Peak Week Supply/Demand Balance

Portsmouth Water has historically been a peak driven company due to slope of the demand profile and the lack of raw water storage. The critical period has always been the peak week which is assumed to occur in June or July. Some recent years have seen peaks occur in April or May. This is not considered to be evident of an earlier peak just the result of very unusual rainfall patterns.

A separate set of tables is included for the peak week and these can be summarised in five year time steps:

Peak Week Supply/Demand Balance

Year	DO	Reductions In DO	WAFU	Bulk Supply	Total WAFU	DI	Available Headroom	Target Headroom	Surplus/ Deficit
2015/16	330	12.1	317.9	15.0	302.9	230.4	72.5	13.8	58.7
2019/20	330	12.7	317.3	25.0	292.3	232.1	60.2	13.8	46.5
2024/25	330	13.3	316.7	25.0	291.7	234.4	57.3	13.4	43.9
2029/30	330	14.0	316.0	25.0	291.0	237.6	53.4	13.6	39.8
2034/35	330	14.3	315.7	25.0	290.7	241.5	49.3	13.3	36.0
2039/40	330	14.5	315.5	35.0	280.5	245.8	34.8	13.4	21.4

Southern Water have requested that the full 15.0 Ml/d to be available between 2015/16 and 2023/24 in peak and MDO scenarios, with 10 Ml/d available from 2024/25 onwards. This bulk supply agreement is due to be renewed in 2014 and the baseline plan assumes that this agreement will continue for the remainder of the planning period. There are no further sustainability reductions in the baseline plan.

As a result of the WRSE modelling project, an additional bulk supply has been requested from the River Itchen Works to Southern Water's Moorhill Service Reservoir. For the Final WRMP 2014, it has been assumed that construction will start in the AMP6 period and that the peak flow of 10 Ml/d will be available in 2017. This would then increase to 15 Ml/d in April 2024.

South East Water has also requested a new bulk supply from Clanfield Service Reservoir to Tilmoor Service Reservoir in Petersfield. For the Final WRMP 2014, it has been assumed that commercial terms will be agreed but the supply will not be needed until 2039/40. At peak demand, the flow would be 10 Ml/d which is the maximum amount available.

In the table above, all the reductions in deployable output have been added together but this figure represents:

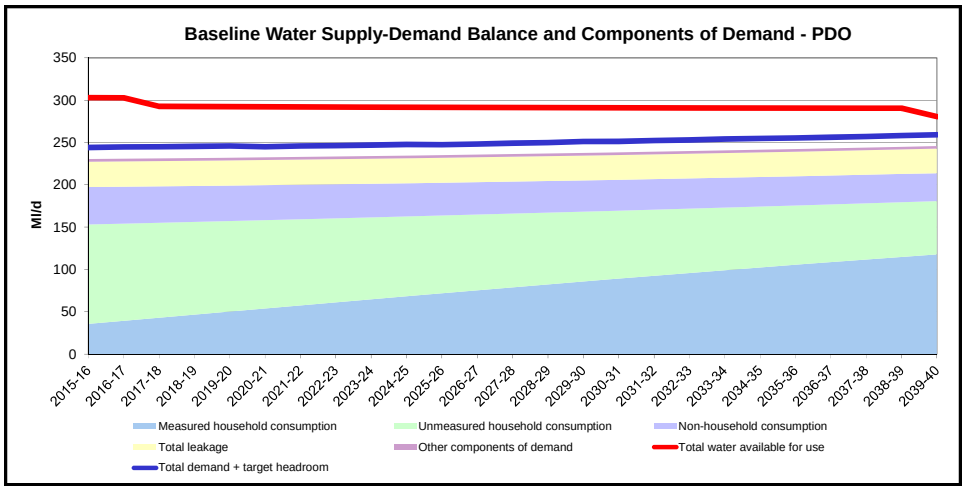
- Climate Change
- Outage
- Process Losses
- Sustainability Reductions

Compared to the WRMP 2009, deployable output has increased. This is due to the reassessment of source yields and the direct link to the return period of 1 in 20 years. If a lower level of service was selected, then the deployable output would be even higher. The combined reductions in deployable output are less than the previous plan and therefore the WAFU is greater. Even with higher target headroom, the surplus available at peak is much higher than previously and is higher than at average. This implies that the peak week is not the critical period.

4.3.4 Peak Week Balance Graphical Representation

The WRMP tables are included as an appendix to this report Appendix 26. The graphical representation of the data is shown below for the peak week dry year scenario.

Baseline Peak Week



The baseline graph for peak week conditions shows the impact of optional metering with a fall in demand compared to the previous plan. Non-household demand falls gradually over the planning period and leakage falls as a result of reductions in supply pipe losses. The blue line represents demand plus target headroom and the red line represents the total water available for use. In the baseline scenario there are no further sustainability reductions. The reductions shown in the previous plan for 2014/15 have been brought forward and are already accounted for in DO.

The graph shows the red line above the blue line for the whole planning period. This means that the Company remains in surplus and there are further opportunities for bulk supplies to other companies.

4.3.5 Minimum Deployable Output Supply/Demand Balance

In Section 2.2.6, the concept of "Minimum Deployable Output" (MDO) is raised in relation to planning scenarios. For a groundwater based company, with no raw water storage, it is possible that the critical period occurs when deployable output is at its lowest in the autumn.

URS have calculated a deployable output for the MDO scenario and this represents the conditions in September. At this time of the year, abstraction is restricted at Fishbourne and at the River Itchen Works. Demand is also suppressed in the autumn and this is reflected in the following table:

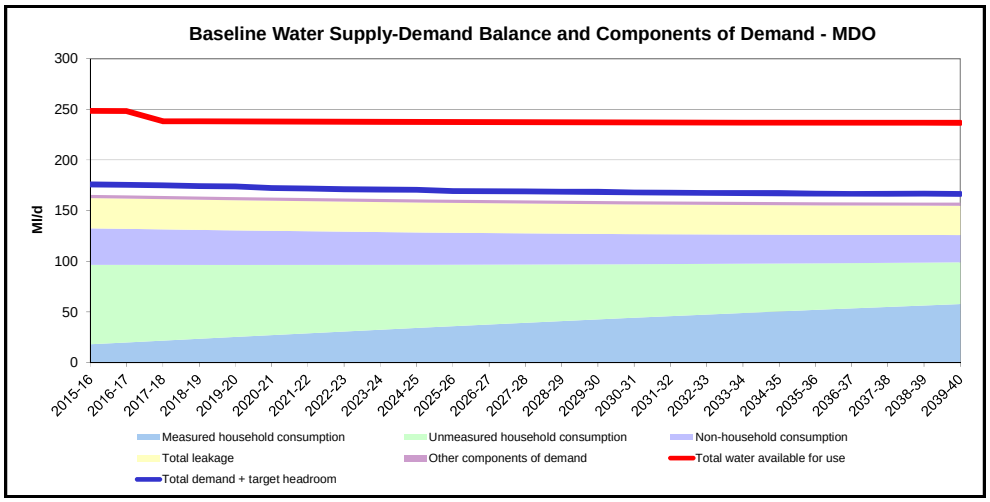
Minimum Deployable Supply/Demand Balance

Year	DO	Reductions In DO	WAFU	Bulk Supply	Total WAFU	DI	Available Headroom	Target Headroom	Surplus/ Deficit
2015/16	281.2	17.7	263.5	15.0	248.5	165.5	83.0	10.4	72.5
2019/20	281.2	18.1	263.1	25.0	238.1	163.5	74.6	10.3	64.2
2024/25	281.2	18.6	262.6	25.0	237.6	161.1	76.5	9.5	67.0
2029/30	281.2	19.1	262.1	25.0	237.1	159.5	77.6	9.2	68.4
2034/35	281.2	19.3	261.9	25.0	236.9	158.5	78.4	8.9	69.5
2039.40	281.2	19.4	261.8	25.0	236.8	158.0	78.8	8.6	70.2

At MDO, Southern Water has asked for 15 Ml/d from 2015/16 to 2016/17, with the bulk supplies then increasing to 25 Ml/d from 2017/18 onwards. In the baseline scenario there are no further sustainability reductions.

4.3.6 MDO Balance Graphical Representation

The MDO scenario is included as a separate set of tables in this report. A graphical representation of the data is shown below for the MDO in a dry year:



The baseline graph for MDO shows that under this scenario the Company remains in surplus for the whole planning period.

MDO does not appear to be the critical period for this plan.

5 OPTIONS APPRAISAL

5.1 Introduction

Having developed a baseline supply demand forecast, an assessment can be made as to which one of the following situations the Company is in:

i Take no further action – There is enough supply to meet demand over 25 years

ii Do the right thing – There is enough supply to meet demand, however the Company wishes to implement a series of measures to become more efficient, better for the environment and meet Government aspirations

iii Take action to address a deficit – There is not enough supply to meet demand, options need to be investigated.

When a water company has a deficit in its baseline supply demand balance (situation 3), supply side options can help to increase supplies, whilst demand side options can help to reduce demand. Implementing both options simultaneously would be deemed a 'twin-track' approach and may be the best, most robust way to remove the deficit.

Conversely, where a water company has surplus supplies (situation 1 or 2), surplus water can be used to help other water companies in a deficit, by providing a bulk supply.

The Options Appraisal process outlines the potential options on the supply and demand side to resolve a supply/demand deficit should this be the case. This process has many stages before a final planning solution can be sought. These stages include but are not restricted to:

- Unconstrained Options
- Feasible Options
- Economic Appraisal
- Programme Appraisal, Strategic Environment Assessment and Habitats Regulation Assessment
- Preferred Programme of Options

Unconstrained options are generated based on technical feasibility but tend not to be constrained by regulatory restrictions. These options are generated from past and present information available to the Company and take into account the core business functions and government aspirations.

Feasible options are those short listed from the original list of unconstrained options (Section 5.3.1). These are options considered to be technically feasible but are constrained by restrictions. The original list of unconstrained options is screened against marking criteria by an expert panel (including the Environment Agency) and a feasible options list is generated.

This feasible options list is then economically appraised by taking into account financial costs, social and environmental costs, carbon costs, yield and delivery uncertainties (Section 5.4.2).

An integral part of the process involves the assessment of the options potential negative and positive impacts on the environment and protected habitats (Section 5.4.7). To ensure that this process was as robust as possible, all feasible options identified were screened in line with national guidance. The completed assessments include;

- Strategic Environment Assessment (SEA) – Appendix 19
- Habitats Regulations Assessment (HRA) – Appendix 18

After all of these stages are complete, a final planning solution can be sought taking into account the results from all screening processes and whether options are needed to remove the deficit, or to do the right thing.

Engagement with the regulators and stakeholders has been paramount throughout this whole process to ensure statutory compliance and incorporation of industry expertise and would not be possible without the input of these outside parties.

5.1.1 Commitments for further work from the previous plan

Following a commitment from the previous plan to undertake further work as a result of a request from the Secretary of State to enable the Final 2009 Plan to be published by 5 September 2011, (more information in section 1.3), the following specific commitments relating to options appraisal were undertaken for this Final Plan:

- A complete reappraisal of both demand management and supply options
- The consideration of new resource options such as effluent re-use, desalination and winter storage reservoirs
- The relationship of each option to the dry year annual average and critical period supply/demand balance

5.1.2 Options Assessment for the Final Water Resources Management Plan

In order for Portsmouth Water to develop its assessment of options for the Final Water Resources Management Plan, the Company enlisted AMEC Environmental and Infrastructure UK Limited to assist in carrying out the Options Appraisal process. AMEC environmental consultants worked with the Company to review the process through which supply and demand side options are identified, appraised and selected for inclusion in this Final Plan.

Stakeholders were briefed and presented with a list of unconstrained options and were given a method for short listing these into a list of feasible options

5.2 Unconstrained Options

A generic list of options using the UKWIR WR27 Water Resources tools project (2012c), taken from the Economics of Balancing Supply and Demand (EBSD; Environment Agency and UKWIR, 2002)) report was used to develop a list of unconstrained options. These options are technically feasible but are not constrained by restrictions such as environmental permits and planning issues.

Portsmouth Water considered options which take into account customer management, distribution management, production management and resource management. These include but are not restricted to, water efficiency, leakage, resource sharing and options proposed by third parties.

An initial list of 132 unconstrained options was created based on:

- Portsmouth Waters 2009 Water Resources Management Plan
- 'Generic' options from the Economics of Balancing Supply and Demand Guidelines
- Consideration of other water companies supply demand balance by including bulk supply options
- Leakage management options as recommended in the Sustainable Economic Level of Leakage (SELL) methodology commissioned by the Environment Agency, OFWAT and DEFRA (2012a)
- Bids by third parties (including other water companies) for options

The unconstrained list included such options as:

- Various water storage options – Havant Thicket Winter Storage Reservoir being one
- Various desalination plants – Portsmouth Harbour Desalination Plant being one
- Recycling and re-use – Effluent reuse schemes and wash water recovery
- Sea tankering of water from Norway
- Various metering options – Metering on change of occupier
- Various water efficiency options – Subsidising of water saving devices

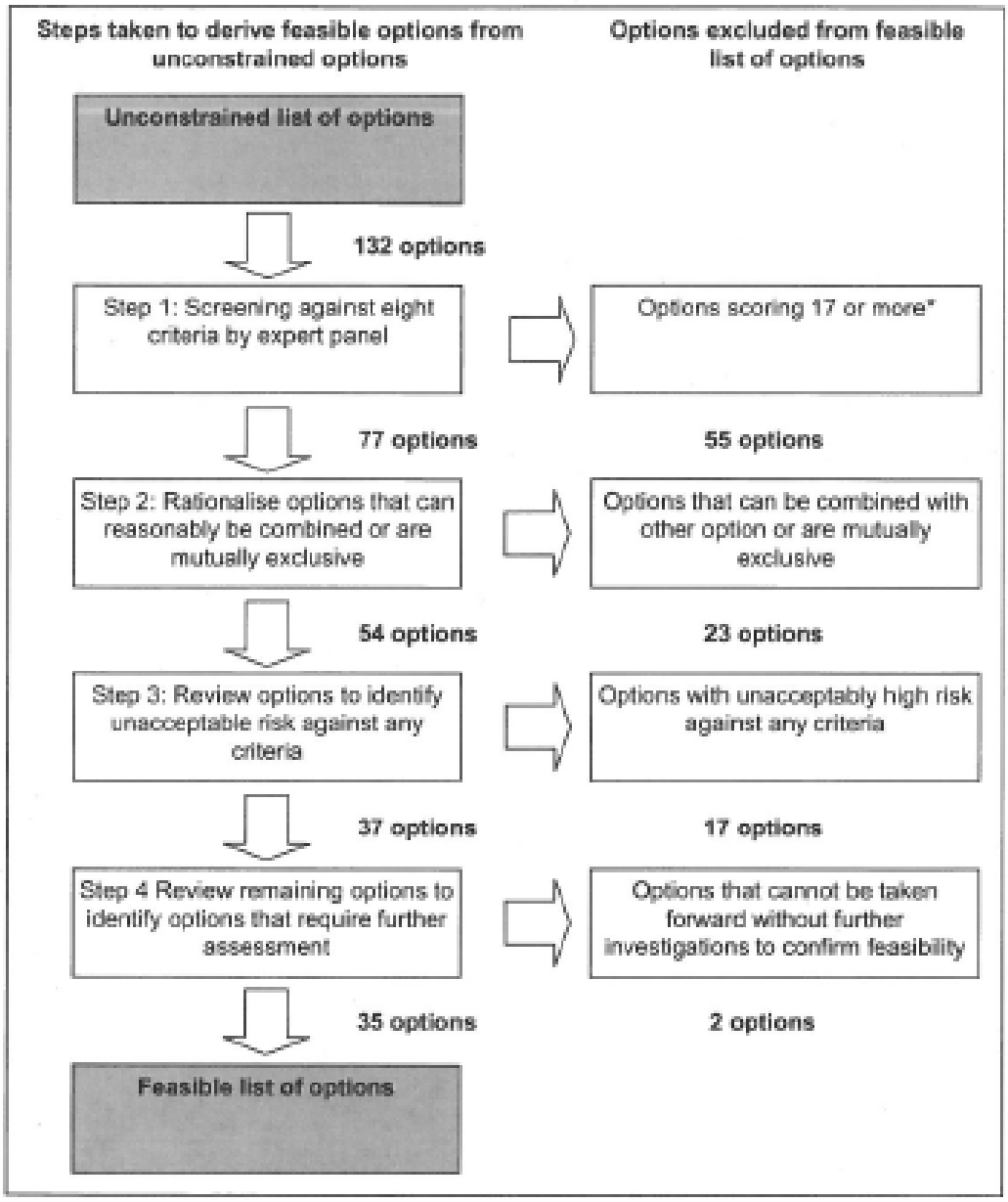
A full list of the unconstrained options can be found in Appendix 21.

5.3 Feasible List of Options

The Unconstrained Options List was then reduced down to 35 to create a feasible options list using a screening process involving stakeholder engagement (Section 5.3.3). Feasible options are considered to be technically feasible and capable of implementation within the current regulatory and legal framework. A full list of feasible options at this stage is included in Appendix 21.

5.3.1 Unconstrained Options Screening

From the list of unconstrained options, a list of feasible options was created as a subset of the unconstrained list. These options have a reasonable chance of implementation and do not have unalterable constraints or a high risk of failure. An expert panel including representatives from the Environment Agency, Portsmouth Water and AMEC attended a workshop held at Portsmouth Waters Head Office on 1 February 2012 to apply a screening process to the unconstrained list of options (below).



*Budds Farm Effluent Reuse scheme retained. Portsmouth Harbour Desalination Plant included in place of Arun Desalination Plant.

5.3.2 Changes to the Unconstrained List of Options

As a request from the Environment Agency, four options to maximise the output of existing groundwater sources were added to the list and the option to offer a subsidy on water efficient appliances was split into two. Several other clarifications and changes were made and can be found in Appendix 21.

5.3.3 Foundations for a Feasible Options List

This screening process used EBSD and WRPG and included the following criteria:

- The option does not address the problem

- The option breaches unalterable planning constraints
- Is not promotable
- Has a high risk of failure

The expert panel screened the options against eight criteria including:

- Yield Uncertainty
- Flexibility
- Conservation Impact
- Landscape and Heritage Impact
- Social Impact
- Sustainability
- Promotability
- Technical Difficulty

Each option was screened against the eight criteria and a score was assigned for each of the criteria on a 1-5 scale (1=good and 5=poor). The scores were summed up to give a total with the maximum score being 32 for the best performing options and a minimum score of zero for the worst performing options. Initially options with a score of 17 or more were excluded (56 options), whilst options with a score of 16 or less were included for further consideration (76 options).

Sense checking identified options which scored poorly but were considered appropriate to be included. This resulted in 77 options retained within the feasible list of options.

The next step in the screening process involved identifying options which can be combined and are mutually exclusive. With stakeholder agreement, many options including water efficiency, leakage, Havant Thicket Winter Storage Reservoir and metering were reduced in number and combined with similar options. This rationalisation resulted in a reduction in the total number of feasible options by a further 23 options.

The next stage identified options with an unacceptably high risk against any of the criteria.

Factors that cannot be fully reflected in the screening criteria are identified at this stage. For example, these options would be awarded a score of above four if the scoring criteria were to allow e.g. R054 Purchasing Madehurst Source (from Southern Water). In total, 17 options were seen to have an unacceptably high risk and were there for removed from the list

Finally, options where there was significant uncertainty to the viability of the option were removed. These options get ‘parked’ and may be added at a future date if they are proven viable. The removal of these two options resulted in a total of 35 options retained in the feasible options list. The comments and justification for not including particular options within the feasible options list can be found in Appendix 21.

5.4 Appraisal of Feasible Options for the Final Plan

Each of the feasible options has been appraised fully in line with the WRPG which refer to the key principles set out in the ESBD.

The Company is aware that climate change has the potential to impact upon the feasibility of the options identified to maintain the supply demand balance. This could range from changes in the patterns of water used by customers, the yield available from sources as rainfall patterns change, and increased risk of outage due to extreme weather events.

The Company is fully committed to cutting greenhouse gas emissions to reduce the effects of climate change as a result of the Climate Change Act (HM Government, 2008). The Company have taken this into account when producing carbon costs for feasible options and have utilised the latest government guidance on the cost of carbon the "Carbon Valuation in UK Policy Appraisal: a Revised Approach" (Department of energy and Climate Change, 2009).

The next stage in the process was to derive estimates of costs and yield for each scheme. These costs (or benefits) are split up into:

- Cost of building the scheme (The Capital cost or CAPEX)
- Cost of operating the scheme (The Operating cost or OPEX)
- Social and Environmental costs of the scheme
- Carbon costs of the scheme

The Company assessed each of the feasible options on an 80 year planning horizon for each of the following parameters.

All costs information can be found in the relevant appendices.

5.4.1 Financial Costs

Capital costs were assessed for all items associated in the creation of the asset which includes design, feasibility, planning, construction costs and initial operational requirements once implemented.

Operational costs such as labour, electricity, chemicals and abstraction charges were assessed. The change in operational costs can also be negative i.e. a cost saving. For example, demand reduction schemes can lead to the savings in electricity and chemicals through the reduced volume of water used. All financial cost information is included in Appendix 20 but this document is commercially confidential and is not included in the public version of this plan.

5.4.2 Social and Environmental Costs

A monetised assessment of the impacts upon the environment and the relevant population affected using the approach recommended by the WRPG. This assessment was also informed by the Benefits Assessment Guidance (BAG; Environment Agency, 2012a). All social and environmental costs information can be found in Appendix 20 but this document is commercially confidential and is not included in the public version of this plan.

5.4.3 Carbon Costs

A whole life carbon cost for each feasible option is assessed, this included embodied carbon resulting from the commissioning of the asset and the operational carbon associated with operating the asset. Carbon emissions have been monetised using the updated central short term traded carbon value for 2011 of £13 per tonne CO_2e. All carbon cost information can be found in Appendix 20.

5.4.4 Risk of Delivery and Yield

For each of the feasible options, an assessment of the risk of delivery and any practical difficulties that may prevent a solution being implemented. These can include engineering difficulties in delivering the solution or obtaining the necessary permissions such as planning permission or abstraction licences.

Each of the options was assessed for the risk associated with the yield; the risk differs from the risk of delivery in that a groundwater source could be commissioned, however, there is uncertainty relating to the output that may be achieved from the groundwater source. Similarly, a metering programme may be delivered but there will be uncertainty around the amount by which it reduces consumption.

A qualitative assessment of these risks is undertaken for each scheme and this assessment is carried out to inform the choice of the final planning solution, more information for which can be found in Appendix 20.

Yield information for all schemes can be found in the following tables and has been taken from the information found in Appendix 19.

5.4.5 Average Incremental Costs and Average Incremental Social Costs

The Average Incremental Costs (AIC) approach gave each scheme a cost in terms of pence per cubic metre of water delivered or saved. This enables each scheme to be compared with any other scheme on a sound financial basis. Schemes can then be ranked by cost to identify the options needed to maintain the balance between supplies and demand at lowest cost (AIC's do not take into account social and environmental costs). The Average Incremental Social Costs (AISC) includes social and environmental costs.

The AISC was calculated using the approach detailed in the Economics of Balancing Supply and Demand. The AISC's were developed over an 80 year planning period horizon. For each, option the following parameters were assessed:

Capital Costs – The capital costs associated with developing the option including capital costs that could be incurred in the future for example refurbishment of plant

Operational Costs – The financial costs associated with the operation of the option, for example power costs or labour costs to read meters. These costs may be negative i.e. a cost saving. For a demand reduction scheme, there will be a financial benefit to the company in terms of lowered power and chemical costs.

Social and Environmental Costs – A monetised assessment of the impacts of the option on the environment and the relevant population affected.

Water Available – This is the amount of water made available for the scheme, a value is calculated for both the peak and average scenarios. In this approach the

company used all water available by the scheme regardless of the size of the deficit.

The AISC's for each of the options are included in the following sections.

5.4.6 Assessment of Individual Options considered for this Final Plan

For each of the feasible options, a description is given, with an explanation of how each of the parameters described previously has been assessed.

The Company has undertaken a complete reappraisal of options for inclusion in this Plan since the Water Resources Management Plan in 2009.

For the purpose of representation, AMEC have given each option a specific code containing a letter and three numbers. In doing so, AMEC have categorised the options into segments. These segments such as Distribution options (e.g. D004) and Resource options (e.g. R013) have been used to describe the option and a table has been produced including the AISC's and yield for each option. Further information on the costs of the options can be found in Appendix 20.

5.4.7 Strategic Environmental Assessment and Habitats Regulation Assessment

The Strategic Environmental Assessment Directive (European Commission, 2001) requires a formal environmental assessment of certain categories of plans and programmes which are likely to have significant effects on the environment. The directive has been transposed into The Environmental Assessment of Plans and Programmes Regulations HM Government, 2004. The Company determined that the WRMP does fall within the remit of the SEA Directive and carried out the appropriate assessments. The environmental report produced as a result of the SEA process was published for consultation in parallel with the period of representation for the Draft Final WRMP.

The SEA considers the potential impacts of the options that could be included in the Draft Final WRMP against 10 objectives including; biodiversity, soil/land use, water quality/quantity, flood risk, effects on climate change, economic/social needs, protection/enhancement of human health, wise use of water and other resources, protecting/enhancing historic assets and landscape character. The assessment considered the nature of the effect, its timing and geographic scale, the sensitivity of the people or environmental receptor that could be affected, and how long any effect might last (short, medium or long-term). The objectives and approach to the assessment was set out in a Scoping Report which was issued for consultation on 19 March 2012. The approach taken was refined to address the feedback from the three regulators who responded (English Heritage, Environment Agency and Natural England).

The Company also determined that because of the proximity and potential for an impact on European Protected sites of some of the feasible options the plan needed to be assessed under the Conservation of Habitats and Species Regulations HM Government, 2010. Regulation 102 requires that competent authorities assess the potential impact of land use plans on the Natural 2000 network of European protected sites. The HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of the Plan's implementation (either on its own or 'in combination' with other plans or projects), and if so, whether these effects will result in any adverse effects on the site's integrity.

In accordance with accepted best practice, the HRA and SEA have been run as an iterative process alongside the plan development. All feasible options have been screened in accordance with national SEA and UKWIR guidance where appropriate (UKWIR, 2012b), in order to identify whether potentially significant

effects are likely to occur which would then require further assessment, or if serious enough the rejection of an option. The completion of the HRA had the added benefit of identifying options that might be high risk in terms of plan delivery if they were selected, as they were unlikely to meet the requirements of the Habitat Regulations (HM Government, 2010), or where further detailed assessment and studies would be needed before the option could be fully assessed.

Portsmouth Water has ensured that the Strategic Environmental Assessment (SEA) and Habitats Regulations Assessment (HRA) have been an intrinsic part of the options appraisal process. Information on the outcome from the HRA and SEA process is summarised below the description of each of the options. The HRA and SEA have been completed by environmental consultants at AMEC who specialise in this work. The full HRA and SEA can be found in Appendix 18 and 19, along with tables summarising the outcome of each assessment for all of the feasible options. The Post Adoption Statement has been included as Appendix 35.

5.5 Production Side Options

The Farlington Water Treatment Works treats spring water from Havant and Bedhampton through chemically assisted rapid gravity sand filtration process followed by a membrane filtration plant for cryptosporidium removal. Operational losses from both processes total 4.9 Ml/d. Production side options relate to altering the Farlington WTW to ensure more efficient use of the water which would currently go to waste through operational losses.

5.5.1 Farlington WTW Washwater Recovery Plant

There are two options relating to Farlington WTW Washwater Recovery Plant. One option would involve reducing the volume of wash water that is currently run to waste from Farlington Water Treatment Works. This would be achieved through the installation of a wash water recovery plant which would treat wash water to a standard to enable it to be put back into the works for treatment and use for public water supply (P001a).

The other option is linked to Havant Thicket reservoir (or an alternative) and differs from the previous option as it would involve recovering more water due to greater flows through the works (e.g. treating additional water from Havant Thicket) and would thus generate a greater yield (P001b).

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
P001a	Farlington WTW Washwater Recovery Plant (existing Farlington Works	33.91	3.6
P001b	Farlington WTW Washwater Recovery Plant Option B (with Havant Thicket)	36.04	4.8

Option P001a and P001b (Farlington Washwater Recovery) have been assessed as having minor positive and negative effects or neutral effects against all the SEA objectives.

Option P001b has been assessed as having a significant negative effect against objective 5 (Climate Change) during the construction phase. This is because the option requires a larger washwater recovery plant than option P001a, capable of

treating greater flows from Havant Thicket (or an alternative), taking it over the threshold of significance for a significant negative effect.

The Habitat Regulations Assessment concluded that construction works associated with the Farlington Wash Water Recovery schemes will not have any significant effects on any European sites, assuming normal best practice. The operation of both schemes will marginally reduce freshwater input to the Hilsea Creek, which is part of the Solent Maritime SAC, Chichester and Langstone Harbours SPA and Chichester and Langstone Harbours Ramsar; this reduction will be relatively small and any effects on the interest features of these sites will be minor and local to the outfall only, due to the character of the harbour (and hence limited exposure of the interest features to the likely effects), the tidal regime, and small scale of the change. It is considered that any changes will not significantly affect the interest features of these sites. The freshwater lost to Hilsea Creek will instead overflow from the Springs at Bedhampton via the Hermitage Stream in to Langstone Harbour and therefore there would be no significant overall reduction in freshwater input to the European sites (SAC/SPA).

5.6 Resource Side Options

Resource options relate to making better use of our existing resources to ensure resources are available for the future should they be needed. These options incorporate regulatory aspirations to include schemes which consider;

- The promotion of winter storage reservoirs to store excess water from the winter when it is plentiful for use in the summer when it is less so.

- Further resource sharing between water companies in surplus or deficit in the form of bulk supply imports or exports.

- New technology such as desalination of seawater to produce potable water, or the re-use of sewage effluent.

- Finally increasing abstraction and maximising deployable output of existing sources would mean better use of surplus yields of sources with more water available.

5.6.1 Havant Thicket Winter Storage Reservoir Option A – 'Standard Design' 23 Ml/d

Following a commitment to further work from the previous Plan, the Company have considered a number of winter storage options, with Havant Thicket Winter Storage Reservoir (HTWSR) being assessed and agreed with stakeholders as the most feasible reservoir option available to move forward in to the feasible options appraisal process. This option relates to the construction of a pumped storage reservoir at Havant Thicket. Water would be sourced from the Havant and Bedhampton Springs during the winter period (within the existing licence volume) and stored in the reservoir for use in the summer when necessary. Water would be abstracted using a draw off structure and transferred through a dedicated main to Bedhampton, where it would link to existing infrastructure for transfer to Farlington treatment works (R013). Depending on the final quality of the water some additional treatment may be required at Bedhampton.

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
R013	Havant Thicket Winter Storage Reservoir Option A – "Standard design" 23 Ml/d	31.69	23

The SEA process has identified the impacts of HTWSR as being largely neutral, minor or positive. During the construction phase, there would be significant negative effects against the climate change and landscape objectives of the assessment, due to embodied carbon in construction materials, and because this would be a large construction project visible to some extent from the South Downs National Park, Staunton Country Park and some residential properties. A significant positive effect is recorded against the economy objective due to the employment that will arise from this large construction project. The majority of the material used in the construction of the embankments would be sourced from the site resulting in only a minor negative effect assessment against the 'use of resources' objective.

During operation, the SEA records significant positive effects against the economy as the large yield from the HTWSR will support economic growth in the region and ensure the continuity of a safe and secure supply of drinking water. The associated green infrastructure will be of benefit to the existing community and help to support new housing growth, as this is a strategic project in the Partnership for Urban South Hampshire (PUSH) Green Infrastructure Strategy. The new paths, cycle ways, spaced play and water sports training facilities will provide a significant positive benefit in relation to the human health objective. Positive effects are also recorded in the longer term in relation to biodiversity and flood risk. Once constructed, the reservoir provides a conjunctive use scheme which anticipates the future effects of climate change to store excess water from the Havant & Bedhampton Springs in wetter winters, to be supplied to customers in drier summers. The new visitor centre will provide opportunities to explain and promote "water wise" messages and alternative energy solutions. Further information on the wider benefits of HTWSR, such as improving resilience of supply are described in Section 7.3.

The HRA concluded for the HTWSR site that construction works associated with this option will have no likely significant effects on the European sites (SPA/SAC/Ramsar) downstream of the reservoir, assuming normal best practice measures are adopted during construction. The analysis of operational impacts has concluded that there will be no significant effect on European sites (SPA/SAC/Ramsar) from; the additional abstraction within the existing licensed volume at the springs, potential changes in water quality, or emergency drawdown. In fact water quality modelling identified that there could be a small benefit to the quality of water entering the Langstone Harbour SPA/SAC as a result of reduced nitrogen load once the reservoir is operational.

5.6.2 Resource sharing

These options relate to the sharing of surplus resources with other companies in a deficit situation. Firstly the cessation of a bulk supply export to Southern Water 15 Ml/d at peak, 1 Ml/d at average would involve the termination of the existing bulk supply export to Southern Water from Whiteways Lodge. No new infrastructure is required to implement this option and Portsmouth Water would benefit from an additional 1 Ml/d (average) and 15 Ml/d (peak). This water could then be used to supply Portsmouth Water customers (R044).

The next option involves conjunctive use of resources, this would consider whether additional resource benefit can be gained by operating Portsmouth Waters existing resources in a different way to current. For example, whether operating certain sources during the winter period would result in greater resources remaining in the Chalk aquifer during dry or summer periods (R053). The Company again looked at possible conjunctive use options. However the hydrological characteristics of the area do not allow for any conjunctive schemes. Any water not abstracted from the aquifer will flow into the harbours and not be available in the future to abstract.

The third option involves having a share in new WRSE bulk transfer options. This would involve the import of water from regional sources developed through the Water Resources in the South East group. It is assumed that rather than dedicated mains being developed into Portsmouth Waters area (e.g. from an enlarged Bewl reservoir), the construction of new resources would enable benefits to be 'cascaded' through the South and East. This would enable existing bulk supply exports from Portsmouth Water to cease, and the resources could be used to benefit Portsmouth Water customers (R043).

The final option relating to resource sharing involves the import of water from Petersfield to Clanfield (10Ml/d). Under this scheme 10Ml/d from South East Waters sources in the Petersfield area would be transferred to Clanfield service reservoir and put into supply (R045).

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
R044	Cessation of bulk supply export from Southern Water 15 Ml/d at peak, 1 Ml/d at average	N/A	N/A
R043	Share in new WRSE bulk transfer options	N/A	N/A
R045	Import from Petersfield to Clanfield (10 Ml/d)	N/A	10

No significant effects against any SEA objectives were found for option R044, the cessation of the bulk supply export to Southern Water. This option requires no additional infrastructure, and will have neutral effects during construction against all objectives. The operational energy effects of option R044 are uncertain, hence the uncertain effects assessed against objective 5 (climate change). Water would no longer be exported over long distances, but energy would still be required to distribute this water to Portsmouth Water customers. The net effect has not been quantified, but is likely to result in a reduction in energy use.

5.6.3 Increase Abstraction and Maximise Deployable Output

These options involve variations to existing licences to increase deployable output. The first option relates to a River Itchen abstraction of 10 Ml/d. This new abstraction would involve moving the abstraction from its current location at Gater's Mill to the tidal limit (which would arguably reduce the impacts of abstraction on the river). This option would not increase the currently licensed abstraction (approx. 45 Ml/d) but would allow Portsmouth Water to increase the amount which can practically be abstracted by 10 Ml/d (from approx. 35 Ml/d to 45 Ml/d). This would remain within the terms of the existing licence. It would require the construction of a new intake works on the River Itchen, a new transfer main, a SWS bulk supply to Moor Hill and utilising the existing treatment capacity (R040).

The second option involves increasing abstraction from the River Itchen to 20 Ml/d. The same conditions are involved in this option as option R040, but this involves building a new treatment capacity for the extra 10Ml/d and this scheme would increase the currently licensed abstraction to approx. 55Ml/d in order to allow Portsmouth Water to increase the amount abstracted by 20 Ml/d (from approx. 35 Ml/d to 55 Ml/d) (R041).

The third River Itchen option involves increasing the abstraction to 30 Ml/d. Again the same conditions are involved in this option as options R040 and R041, but this scheme involves building a new treatment capacity for the extra 20 Ml/d and this option would increase the currently licensed abstraction to approximately 65 Ml/d in order to allow Portsmouth Water to increase the amount abstracted by 30 Ml/d (from approx. 35 Ml/d to 65 Ml/d) (R042).

The final option relates to maximising the DO of the Worlds End Group of sources. No changes to the current licence would be required, just the maximisation of the deployable output of the source within the existing licence. Some construction of additional boreholes and associated pipe work would be necessary, in order to provide the additional 9 Ml/d required, enabling the full benefit of the existing licences to be delivered. Water would be transferred to the existing on-site water treatment works for treatment (existing works capacity enlarged, no new building required). Recent studies as part of PIM/WFD work with the EA have demonstrated that the Worlds End source has little impacts on the River Wallington, as a result this option can now be considered a lower risk than when originally assessed (R022a).

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
R040	River Itchen abstraction 10 Ml/d	8.66	10.0
R041	River Itchen abstraction 20 Ml/d	8.57	20.0
R042	River Itchen abstraction 30 Ml/d	7.78	30.0
R022a	Worlds End Group – Maximising DO	4.95	9

The three options for abstraction on the lower River Itchen (Options R040, R041 and R042) are found to have similar effects against most of the SEA objectives, however, a greater number of significant negative and positive effects are recorded for the larger schemes (reflecting the increase in scale). All three schemes are found to have a potentially significant negative effects during construction on objective 1 (biodiversity), with the HRA determining that construction of the intake and pumping structure would be likely to have impacts on the River Itchen SAC, with uncertain effects on the individual interest features and Solent and Southampton Water SPA. During operation, the HRA determined uncertain effects on designated sites from the 10 Ml/d option on designated sites, and more likely effects from the 20 Ml/d and 30 Ml/d options. The 20 and 30 Ml/d options were found to have significant negative effects during construction and operation on objective 5 (climate change), due to the embodied carbon in materials required for the construction of the options (additional treatment infrastructure required), and the higher operational energy use for pumping. During construction, the largest of the three options R042 was found to have a significant positive effect against objective 6 (economy) due to the employment opportunities generated during construction. The 20 and 30 Ml/d options were both found to have a significant positive effect against the same objective during operation due to the yield, which would support economic growth in the region.

Option R022a which seeks to maximise the deployable output from the Worlds End Group within the existing abstraction licence requirements was not found to have significant positive or negative effects against any of the SEA objectives. This is a groundwater scheme, increasing the yield from an existing source in the confined aquifer. Minor negative effects were determined against three of the SEA objectives during the construction (soils, climate change and human health). During operation a minor negative effect was determined against climate change, with minor positive effects anticipated in relation to the economy and human health.

5.6.4 New Technology

As a commitment for further work from the previous plan, the Company have considered new resource options such as desalination and effluent re-use. The following last two options involve the use of new technology to acquire new sources of water to go into supply. The first options would involve the construction of Portsmouth Harbour Desalination Plant on Whale Island. Water would be desalinated using membrane treatment processes and pumped to Farlington Service Reservoir, through a new dedicated main, for blending before being put into supply. This option would require the construction of:

- A new pipeline to carry water from the new plant to Portsea Island, then on to Farlington Reservoir
- An intake pipe extending out into a deep water channel within Portsmouth Harbour; and
- An outlet pipe for effluent from the plant extending out into a deep water channel.

The outfall pipe would need to extend to a point further into the harbour where the discharge would not have any adverse impact on the desalination plant intake. The intake and outfall pipes may have some long term maintenance requirement (R027).

The last option would involve the construction of Budds Farm Effluent Reuse Scheme (Direct). This involves the direct reuse of treated wastewater effluent from Budds Farm Wastewater Treatment Works. Water would be treated using membrane treatment processes and pumped to a service reservoir for blending before being put into supply. This would reduce effluent inputs to the Solent (Budds Farm currently discharges to the Solent via a long sea outfall (LSO)) (R032).

Optiont Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
R027	Portsmouth Harbour Desalination Plant	22.55	25
R032	Budds Farm Effluent Re-use Scheme (Direct)	42.12	20

Significant negative effects were determined for the Portsmouth Harbour Desalination Plant (Option R027) against the biodiversity, climate change and use of resources SEA objectives during construction and operation. The HRA concluded that the option would have short and long term effects on Portsmouth Harbour SPA and Ramsar site (also designated SSSI) and uncertain effects on other designated sites due to construction activities within, and discharges of highly saline water to, a designated site. The use of large amounts of materials with high embodied carbon and limited opportunities for re-using materials led to

the significant negative effects against objectives 5 (climate) and 8 (resources) during construction, whilst the high operational energy use resulted in significant negative effects against the same objectives during operation. As with the Havant Thicket option, the construction phase of this option provided a significant positive effect for employment opportunities for objective 6 (economy), whilst the yield of 25 Ml/d during operation will support economic growth in the region. During operation, a further significant negative effect was recorded on objective 3 (water), due to the effects of discharging highly saline water on water quality within Portsmouth Harbour noted as having potential effects through the HRA.

In the SEA Option R032 Budds Farm effluent reuse was assessed as having significant negative effects against objectives 5 (climate change) and 8 (resources) during the construction and operational phase from the high embodied and operational carbon and energy use. As with the desalination and Havant Thicket options, employment opportunities arising from construction of the option and the 20 Ml/d yield were found to support economic growth in the region, resulting in a significant positive effect against objective 6 (economy).

5.7 Distribution Side Options

Along with supply side options, distribution side options are increasingly important to better manage the distribution network. A water company can also manage demand for water by enhancing leakage control, manage pressure effectively and replace mains when necessary to reduce the amount lost through leakage and excess pressure.

5.7.1 Leakage Management

The next set of options refers to leakage management options with an intention of suppressing leakage to reduce the amount of water used. The first option refers to the additional installation of additional district meters throughout the distribution network. The additional district meters would enable more detailed monitoring of flows within the distribution network and allow leakage to be identified more readily. This would result in an increase in the amount of leaks identified and repaired, reducing the amount of water lost through leakage (D005).

The next scheme refers to additional pressure management and would involve the installation of additional pressure reduction valves (PRV's) throughout the distribution network. The additional PRVs would enable greater control over pressure within the distribution network. This would reduce the amount of water lost through existing (undetected) leaks and also reduce the rate at which new leaks occur (due to reduced pressure within mains) (D006).

The next option refers to main replacement and would result in targeted replacement of the parts of the network with greatest leakage. Existing distribution mains would be excavated and replace with new mains, reducing leakage (D007).

The next two options refer to increasing our find and fix leakage control activity. The first is increasing leakage control on trunk mains and distribution mains. Additional leakage staff would be required to increase the amount of find and fix leakage control activity on trunk mains. This would result in an increase in the amount of leaks identified and repaired, reducing the amount of water lost through leakage (D002). The next find and fix related option refers to increasing find and fix leakage control activity on communication pipes. The same conditions are involved in this options but focuses on communication pipes (D003).

The final option involves the deployment of permanent noise loggers throughout the distribution network. The noise loggers would be linked through telemetry and would automatically identify when suspected new leaks occur within the distribution network. This would result in an increase in the amount of leaks identified and repaired, reducing the amount of water lost through leakage (D004).

These options are believed to be feasible, however at this stage the Company has been unable to make a robust assessment of cost and yield as a result of the issues relating to the current leakage assessment.

The Company expects to be in a position to assess robustly the yield and the cost of each option following the completion of elements of data review. The Company will undertake this work during 2013.

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
D005	Installation of district meters	N/A	N/A
D006	Additional Pressure Management	N/A	N/A
D007	Mains Replacement	N/A	N/A
D002	Increasing find and fix leakage control activity on trunk mains and distribution mains	N/A	N/A
D003	Increasing find and fix leakage control activity on communication pipes	N/A	N/A
D004	Deployment of permanent noise loggers	N/A	N/A

In the SEA the leakage options are assessed as having neutral or minor positive and minor negative effects against eight of the ten objectives. The exceptions to this are objectives 5 (climate change) and 6 (economy) in relation to mains replacement.

Option D007 (mains replacement) has been assessed as having a significant negative effect during construction against the climate change objective. Although the mass of materials and embodied carbon in these materials is not known at present, the option is likely to require the replacement of several tens of kilometres of mains, which would have significant embodied carbon. The same option has been assessed as having a significant positive effect against objective 6 (economy) as it will be a large scale construction project, and is considered likely to generate local employment opportunities.

5.8 Customer Side Options

Customer side options relate to the conservation of water through education of customers and promotion of water efficiency to allow other options such as metering to work more effectively.

5.8.1 Metering Options

The first metering option refers to rising block tariffs. This option involves varying the volumetric charge based on the volume of water consumed. Consumption between specific volumes (or blocks) would be changed at different rates. The unit charge for water would increase for increasing 'blocks' of consumption. The rationale behind this option is that increasing the volumetric charges would

encourage customers to use water more wisely, reducing demand. This option would require meters to be installed in domestic properties (C009).

The next option would involve charging customers only above a certain defined 'subsidence' level of use by varying the charge of water. A subsidence level of water would be free of charge or charged at a minimal rate. Consumption above this subsidence volume would be charged at a higher rate. The rationale behind this option would encourage customers to reduce their discretional water use, thus reducing demand (C012).

Another option relating to metering would be to meter remaining unmetered non households. A small number of commercial and public sector premises remain unmetered. This option would involve metering the remaining unmetered commercial and public sector properties (C001).

The next metering option would be to meter all households in a water stressed area. The whole of Portsmouth Waters supply area was previously assessed as being an area of 'serious water stress' by the Environment Agency. Therefore this option would involve metering all households in the Portsmouth Water supply area (C004). However, the EA recently re-evaluated Portsmouth Waters current water stress position, it has been concluded that Portsmouth Water are no longer in an area of 'serious water stress' and therefore do not need to pursue compulsory metering. Furthermore, customer research has discovered that our customers would not be happy with compulsory metering. All in all, although we will pursue our optional metering policy of 5000 meter optants per year and see a reduction in supply pipe leakage through leakage detection, we will not pursue a campaign of compulsory metering.

Metering on change of occupancy is the next option. This involves the metering of households on change of ownership. Meters would be installed when householders contact the company to inform of a change of ownership for billing purposes (C006). The new occupier would have no choice as to whether they were on a meter.

The final metering related option involves seasonal tariffs. This involves varying the charge for water at different times of the year. There are various mechanisms that could be used to implement this option. For example consumption during a 'winter' period would be charged at a lower rate than consumption during the 'summer' period. Automatic Meter Reading (AMR) would be required to implement this option, which would require the installation of meters in domestic properties. The rationale behind this option is that reducing charges in winter periods and having higher charges during summer periods would encourage customers to use water more wisely, reducing demand during periods when water availability is stretched (C010).

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
C009	Rising block tariffs	152.0	5.9
C012	Charging only above a defined "subsidence" level of service	168.81	5.2
C001	Meter remaining unmetered non households (Schedule 1-3)	101.27	0.2
C004	Meter all households within a water stressed area	297.36	2.9
C006	Metering on Change of Occupancy	224.0	3.1
C010	Seasonal tariffs	146.11	5.7

Portsmouth Water has considered metering customer with high discretionary use (such as swimming pool owners) during the options appraisal process. This option was considered as having a high risk of not delivering any yield as it was considered that customers are likely to require the same amount of water whether they are metered or not.

In the SEA the metering and tariff options were assessed by AMEC as having neutral or minor negative effects against seven of the ten objectives. The exceptions to this were;

- Climate change – significant negative effect during construction, positive during operation.
- Economy – significant positive effect during construction, neutral during operation.
- Human health – combination of positive and negative effects for tariff options. The use of tariffs to manage demand may impact on vulnerable customers, such as those on low incomes, or those with medical conditions that are dependent on using more water for treatment and personal hygiene.

The large-scale metering options (C004 and C006) and the tariff options have been assessed as having significant negative effects against the climate change objective during construction. This is due to the large number of meters being installed and the embodied carbon within the meters, and the emissions associated with their installation (vehicle movements). Following implementation, the same options are assessed as having a significant positive effect against the same objective due to the reduction in emissions from pumping, treating and distributing water and reduction in energy use from heating water in the home. These options are also assessed as having a significant positive effect against the economy objective during construction due to the large number of meters that would require installation, and employment opportunities that result. Options C006 and the tariff options were also assessed as having a significant positive effect against objective 8 (wise use of resources) as a result of the reduction in energy use (treatment, pumping, distribution and heating water in the home) during operation.

Demand side measures such as metering and water efficiency options were screened out and not considered further in the HRA. This was because collectively they are likely to have a positive effect on European sites by reducing water demand. The only potential mechanism for a negative effect would be through direct encroachment at the local level. For example, if a meter was installed in or near the SAC. Further information on why it was appropriate to screen out demand side measures is included in Section 3 of the HRA.

5.8.2 Water Efficiency Options

The core objectives of all these options are to ‘free up’ resources to make them available to meet supply demand deficits.

The first option relating to water efficiency is to target water efficiency advice to industrial/commercial customers/public sector customers and recreation facilities. This would include information leaflets informing customers about how they could reduce their demand and the potential financial benefits. A water audit would be undertaken by a qualified specialist to provide technical advice about water use. The rationale behind this option is that customers would be encouraged to reduce their demand (C016).

The second option is a household water efficiency programme with a partnering approach and home visits. This would involve a home visit by plumbers to install water efficiency devices in households and provide information on behavioural changes. The home visit would be delivered through a partnering approach involving other organisations such as the Energy Saving trust, Housing Associations or Local Authorities. The rationale behind this approach is that water efficiency devices would be installed by the qualified plumber and householders would be encouraged to change their water-using behaviour through water efficiency information, reducing demand (C045).

The next water efficiency option would be to install water saving devices (low flow showerheads) to household and non-household properties where a shower is currently installed. The rationale is to reduce the water used per shower by reducing the flow rate of the showerhead. (C028).

The third water efficiency option would be to install flush controllers for urinals. This would involve the installation of Passive Infra-Red controllers in non-household properties to control urinal flushing where no or alternative urinal flush control systems are installed. The rationale behind this option is to reduce demand for water used for urinal flushing. (C036).

The fourth option would be to retrofit existing toilets. The retrofitting of dual flush mechanisms in toilets in household and non-household properties would replace existing higher flush volume mechanisms. The rationale behind this option would be to reduce demand for water used for toilet flushing (C034).

The fifth option would be to retrofit spray fittings to existing taps in household and non-household properties. This would be applied to bathroom taps as kitchen use is often more volume driven whereas wash basin taps is often 'action' driven. Spray inserts are only suitable for taps with round flow diameters. The rationale behind this option is that spray fitting reduces the volume of water that passes through the tap each time it is used (compared to a tap that does not have a spray fitting) (C040).

The sixth water efficiency option refers to offering subsidies to customers who have purchased water efficient appliances. This option involves the introduction of a Portsmouth Water funded subsidy (i.e. vouchers) on water efficient washing machines and dishwashers. The rationale behind this option is to encourage wider uptake of water efficient appliances amongst customers (C026a).

The seventh water efficiency option is offering a subsidiary for customers for water efficient showers and toilets. The same principles apply for this option as C026a (C026b).

The last option refers to an appliance exchange programme for Portsmouth Water customers. This would include WC's, Showers, Dishwashers and Washing Machines. The rationale behind this option is to encourage customers to exchange less efficient appliances for more water efficient appliances and thus use less water. The cost of providing the efficient water appliances would be borne by Portsmouth Water (C025).

Water efficiency is included in the demand forecast in the form of falling average per capita consumption. This is a result of the impact of optional metering and changes in customer behaviour. Metering and water efficiency will be promoted via the company's website and through joint work with other organisations such as the National Park Authority and Wildlife Trusts.

Option Number	Option Name	AISC at Average Deployable Output (p/m^3)	Yield (Ml/d)
C016	Targeted water efficiency advice for industrial/commercial/public sector customers and recreation facilities	5.34	0.8
C045	Household water efficiency programme (partnering approach, home visit)	30.58	1.4
C028	Water saving devices – low flow showerheads	46.81	0.8
C036	Water savings devices – Flush controllers for urinals	36.71	0.2
C034	Water savings devices – retrofitting existing toilets	716.43	0.1
C040	Water saving devices – retrofitting spray fittings to taps	56.22	0.3
C026a	Subsidiary to customers that purchase water efficient appliances – washing machines and dishwashers	93.63	01
C026b	Subsidiary to customers that purchase water efficient appliances – showers and toilets	20.79	0.3
C025	Appliance exchange programmes	10.99	0.7

The water efficiency options were assessed by AMEC as having neutral effects against most of the SEA objectives during construction and operation. Minor positive and minor negative effects were recorded against three of the objectives (water, climate change and use of resources) reflecting benefits of water savings, and minor increases or decreases in energy use and carbon emissions during construction and operation.

The exception to this was for option C025 the appliance exchange programme, which was assessed as having a significant negative effect against the climate change objective due to the embodied carbon in appliances.

5.9 Current Operations

In undertaking the options appraisal Portsmouth Water has considered if any of the options identified should be implemented even if a surplus exists over the planning period.

The Company reviewed the AISC for each option; if a scheme was assessed to have a negative AISC then the conclusion would be the benefits of the scheme outweigh the costs. If schemes were identified then further consideration would be given to them. However as no schemes were identified with negative AISC the Company concludes there are no options that should be progressed on this basis at present.

6 FINAL PLANNING

6.1 Introduction

In developing the final planning solution, the Company has given due consideration to the issues raised by stakeholders throughout the pre-consultation and the formal consultation period.

In selecting the final planning solution, the Company has sought to balance the expectations of customers, the needs of the environment and Government policy priorities.

The baseline supply/demand balance does not show a deficit at average, peak week or minimum deployable output (Section 4.3). This means that the existing supply network can cope with future demands and all of the assumed uncertainties and risks. With no deficit there is no need to justify or proceed with any of the supply or demand management options.

The results of WRSE identify further bulk supplies from Portsmouth Water to neighbouring companies. Portsmouth Water has only included bulk supplies that other companies have agreed to include in their Final Plans even though others were identified.

6.2 Justification of the Final Plan

The baseline supply demand forecast does not have a deficit therefore the final planning tables are the same as the baseline tables. Although data is supplied for feasible options none of them are selected in Table WRP4 Preferred Scenario. Portsmouth Water has included all the bulk supplies that other companies have requested and have not received any offers of new supplies which might change the current plan.

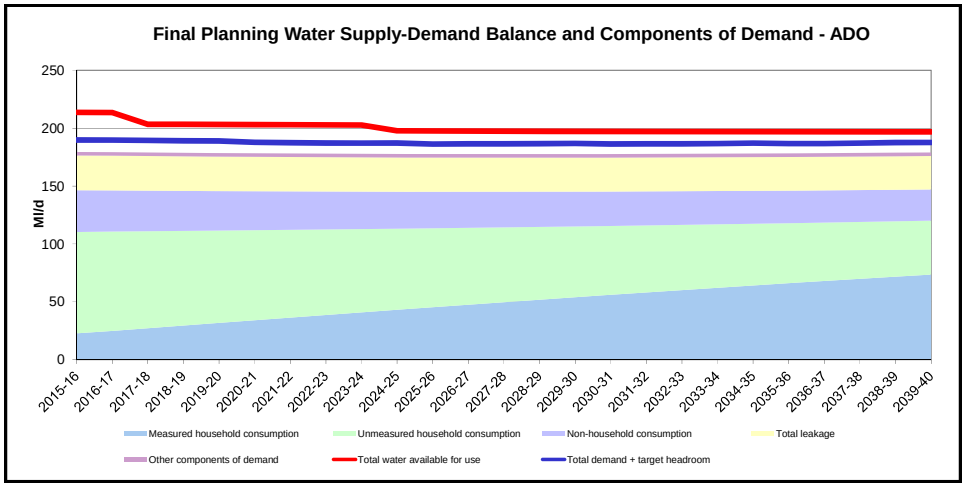
The final planning data for the average scenario has been summarised in five yearly steps and set out in the table below.

Average Supply Demand Balance (Ml/d)

Year	DO	Reductions In DO	WAFU	Bulk Supply	Total WAFU	DI	Available Headroom	Target Headroom	Surplus/ Deficit
2015/16	245.8	22.2	223.6	10.0	213.6	179.5	34.1	10.4	23.7
2019/20	245.8	22.6	223.2	20.0	203.2	178.7	24.5	10.3	14.2
2024/25	245.8	23.1	222.7	25.0	197.7	177.7	20.0	9.5	10.5
2029/30	245.8	23.6	222.2	25.0	197.2	177.6	19.6	9.2	10.4
2034/35	245.8	23.8	222.0	25.0	197.0	178.2	18.8	8.9	9.9
2039/40	245.8	23.9	221.9	25.0	196.9	179.1	17.8	8.6	9.2

This data can be shown graphically as well:

Final Planning Annual Average



The surpluses at average demand, peak week demand, and at minimum deployable output continue beyond the planning period.

In the previous plan the Company was forecasting a deficit at peak week and consequently this was the critical period for the Company. The current plan with no deficit does not have a critical period however it is now the dry year annual average scenario which has the smallest surplus.

Compared to the previous plan (WRMP 2009) overall demand is falling and the impact of climate change in later years is less. Despite higher headroom at the end of the planning period, and larger bulk supplies, a healthy surplus is maintained.

The Company has tested the assumptions used in the base plan through various sensitivity analysis and these are set out in Section 7.2.

The Company also notes that the annual review process provides an important assessment of the assumptions used in the plan and if any material risks were identified this would result in the requirement for a new plan to be developed.

6.3 Compliance with the Directions

As part of the water resources planning process Defra and the Environment Agency set out the "Guiding Principles" (Ofwat, Environment Agency and Defra, 2012c). Appendix 16 to this document sets out the "Directions" which the water companies must comply with. Portsmouth Water has added an assessment of what has been included in the WRMP2014 and where it is included. This detailed summary is included in Appendix 16 but some of the key issues are set out below:

- 25 year planning period
- How frequently demand restrictions will be imposed
- Options appraisal methodology including SEA
- Greenhouse gas emissions
- Climate change impacts
- Population and housing forecasts

- Compulsory metering options
- Optional metering options
- Implementation programme
- Cost implications
- Reasons for not using compulsory metering
- Statutory consultation process
- Statutory publication process

Portsmouth Water considers that they have complied with all the relevant directions in preparing the Final WRMP2014.

6.4 Government Policies Influencing this Plan

Portsmouth Water believes that the Final Plan meets the policy priorities set out by Government.

The plan considers the long term supply challenges from population growth and climate change.

The final planning solution has a forecast of falling average water consumption over the planning period as a result of a pro-active optional metering programme.

The final planning solution also includes a forecast reduction in leakage over the planning period as a result of reductions in supply pipe leakage delivered by the optional metering programme.

The Company is an active member of the WRSE Group; this has resulted in the inclusion of additional bulk supplies in its final plan.

6.5 Strategic Environmental Assessment and Habitats Regulation Assessment

The Strategic Environmental Assessment (SEA) on the Base Plan has assessed the impact on the water environment as neutral, as the proposed bulk supply exports to Southern Water and South East Water would be sourced from within existing abstraction license volumes, which would not require additional resource development and are considered unlikely to prevent Water Framework Directive objectives being achieved. The construction of the new bulk supply pipelines have been assessed as having significant negative effects during construction against the climate change objective due to carbon emissions during construction and embodied in materials. During operation, no significant negative effects have been identified. The cumulative effect of the options has been assessed as having a significant positive effect on the economy of the region as the additional yield generated by these options will help to meet the needs of economic growth in the region.

The Habitats Regulation Assessment of the Base Plan concluded that;

- The schemes will operate within existing abstraction license volumes and there will be no likely significant effects on any European sites as a result of the operation of these schemes, alone or in combination with other plans or projects

- No likely significant effects on any European sites have been identified, as a result of construction of the schemes, either alone or in combination with other plans or projects, assuming that normal best practice measures are taken. The timing of the works at the Itchen WTW should be programmed to avoid the salmon migration season, although excavations for the new pipeline will be located more than 250m from the River Itchen SAC, so effects on fish migration are not likely.

- The Base Plan will have no likely significant effects on any European sites as a result of its implementation, alone or in combination with other plans or projects

The complete SEA and HRA reports can be found in Appendix 18 and 19.

The SEA Post Adoption Statement has been included as Appendix 35.

6.6 Commitment to Further Work

The Company's previous WRMP set out a commitment to undertake further work. The Company believes it has met this commitment and this is clearly presented in the relevant sections of the plan.

6.7 Water Framework Directive

The WRPG recommends that companies should assess if the net changes in its operations as a result of the plan has the potential to cause a water body to deteriorate. The Company notes that its base plan includes three bulk supplies which may cause a net change in operations. For each bulk supply the Company sets out how it has considered the impact.

6.7.1 Bulk Supply from the River Itchen to Moor Hill Reservoir

This bulk supply will result in increased abstraction from the River Itchen compared to current levels. However the abstraction will still be within the current licensed volumes. The current licence was revised in 2013 to comply with the Habitats Directive and is considered sustainable therefore it is unlikely to result in a deterioration of water body status.

6.7.2 Renewal of Bulk Supply to Sussex North

The current bulk supply from Portsmouth Water to Southern Water ends in 2014. The renewal of the bulk supply has been included in the plan but at an increased volume at average deployable output. Although still within licensed volumes this would constitute a change in current operations. The current bulk supply relies on a licence variation for the Eastergate Group and the renewal of the bulk supply would be subject to this licence renewal. The Company would expect to address the issue of no deterioration as part of the licence renewal.

6.7.3 Bulk Supply to South East Water

The baseline plan includes a 10 Ml/d peak supply to South East Water due to be commissioned in 2040. The Company notes that the long lead in time for the scheme enables an assessment to be undertaken of the potential impact on water body status.

The Company have included the Southern Water bulk supply and the South East Water bulk supply and the SEA has been modified to include the impact of the bulk supply pipelines in both the South East and Southern Water's area of supply.

7 TESTING THE PLAN

7.1 Introduction

Portsmouth Water in order to demonstrate the robustness of its plan has undertaken a series of sensitivity tests around key assumptions in the base plan. The sensitivity analysis considers the uncertainty in inputs across the plan such as demand and deployable output.

7.2 Sensitivity of the Baseline Plan

The "Baseline Plan" remains in surplus for the whole of the planning period at average, peak week and minimum deployable output (see Section 4). This plan is based on the most likely scenario for population and per capita consumption and the estimated deployable output for a 1 in 20 year event. It includes the bulk supplies that other companies have requested as a result of the WRSE process.

It includes headroom for gradual pollution, accuracy of data, impact of climate change and demand forecast variation.

In Portsmouth Water's area of supply (see Section 1) nearly all the source works have been implicated, in some way or another, with the Habitats Directive Review of Consents or the Water Framework Directive River Basin Management Plans (Environment Agency, 2009a). A significant number of the licences have already been varied downwards as a result of the Review of Consents. The PIM/WFD Investigations have given rise to further sustainability reductions. This produces a downward pressure on deployable output.

7.2.1 Higher than Expected Demand

The WRPG suggests that the "main risks" should be identified and that these could include population changes and climate change. These two factors could increase demand and therefore change the supply/demand balance. The baseline plan has a significant surplus at average demand and this provides additional robustness to population and climate change. Both population uncertainty and climate change are already included in headroom which provides a buffer for uncertainty. A worse case scenario was considered for higher than expected demand. The uncertainty in each element of the demand forecast was considered and the largest of these impacts can be considered as worst case. The analysis shows that this has an impact of roughly 9 Ml/d, which ties in with the available surplus. Therefore further detailed analysis is not required, as the plan can be considered robust to the "worst case" of demand assumptions.

7.2.2 Lower than Expected Deployable Output

The uncertainty in the supply forecast has been considered with relation to the impact of climate change on deployable output.

The inclusion of climate change in the supply demand forecast has the impact of reducing the DO over the planning period. Consequently removing climate change would result in an increased surplus.

The uncertainty in DO over the planning period is already reflected in headroom and so further analysis runs the risk of double counting this uncertainty. A further reduction in DO of 5% over the planning period has been considered to see if this is material. A reduction in this order would still see the plan in surplus over the planning period with the exception of the final two years when the bulk

supply to South East Water commences. On this basis the Company concludes the plan to be robust.

8 NEXT STEPS

8.1 Publication Process

The formal process requires Portsmouth Water to publish this Final Plan following approval from the Secretary of State. This has been done on Portsmouth Water's website www.portsmouthwater.co.uk.

Letters have been sent to each of the stakeholders and a hard copy of the main report is available at the Havant Office.

A Strategic Environmental Assessment has been carried out in parallel with the production of the WRMP2014. The formal process requires Portsmouth Water to publish the "Post Adoption Statement" and this has been done on the website. In addition letters have been sent to the statutory consultees and a hard copy is available for interested parties at the Havant Offices.

8.2 Water Resources Management Plan 2019

Work has already started on the next Water Resources Management Plan. Portsmouth Water is committed to working with the Environment Agency and other stakeholders on a review of key assumptions. This will include further work on deployable output and the resilience of the Plan to drought and climate change.

9 TABLE COMMENTARIES

The WRPG states that "water resources planning (WRP) supply-demand tables" must accompany the plan. These tables have to be filled in for the dry year scenario. If a Company is in deficit, a critical period must also be completed. More detail on what is included within the tables is in the technical instructions (Ofwat, Environment Agency and Defra, 2012b), whilst the completed WRP tables are in Appendix 26.

Whilst Portsmouth Water is not in deficit, the Company has included tables for both the peak week and minimum deployable output scenarios, along with dry year annual average. Each workbook contains baseline tables based on current policies and final planning tables which represent the solution to any supply demand deficits.

The tables are based on the latest demand forecasts and the options emerged from the SEA process. Portsmouth Water only has one water resources zone and the level of service for a dry year is 1 in 20. There is a summary for each set of tables with graphs of baseline and final planning data.

The baseline and final planning graphs are reproduced in the main text with data from the 2015/16, up to the planning horizon of 2039/40.

9.1 Base Plan – Annual Average

Hard copies of the WRP Tables are provided for the dry year annual average scenario for the base plan. The tables have also been provided electronically with the file reference:

> WRP *Table – Base Plan -Dry Year Average – Portsmouth Water –Final Plan - 8.8.14 xls*

For the Base Plan there are now further sustainability reductions and there are entries in WRP1 – 8.2 BL. The impact of climate change on deployable output is shown as a separate line WRP1 – 8.1 BL and increases linearly from zero in the base year to -1.9 Ml/d in the mid 2030's. Headroom has an allowance for climate change but no allowance for the risk of further sustainability reductions.

The Base Plan is in surplus for the whole of the planning period. There is no supply/demand problem to solve and so the final planning tables are the same as the baseline tables.

9.2 Base Plan – Peak Week

Hard copies are provided of the WRP Tables for the Peak Week Base Plan scenario.

> *WRP Table – Base Plan - Peak Week – Portsmouth Water – Final Plan – 8.8.14 xls*

In the past, Portsmouth Water was peak driven with groundwater supplies and no raw water storage. The peak period occurs in June or July when deployable output is relatively high. Changes in outage and headroom now mean that the critical period is not the peak week. A surplus is maintained for the whole planning period and the surplus is greater than at average demand.

With no deficit there is no problem to solve and the final planning tables are the same as the baseline tables.

9.3 Base Plan – Minimum Deployable Output

Deployable output has been calculated for the MDO period at the end of the groundwater recession. A set of tables has been included for this scenario to show that it is not a "critical period".

WRP Table - Base Plan – MDO – Portsmouth Water –Final Plan – 8.8.14 xls

The surpluses of MDO are greater than at peak demand. MDO is therefore not the critical period for water resources planning.