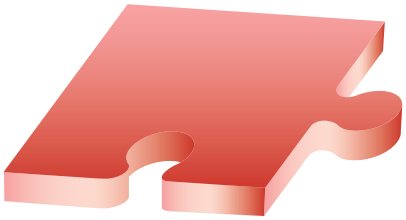
south east water



Water Resources Management Plan 2014

Appendix 4 : Demand Forecast

Executive Summary

1. For our WRMP14 we have set out an initial forecast of demand for water for 25 years to 2040, taking account of factors such as population and demographic changes and a changing climate. This forecast should incorporate Defra policy as well as any future changes in legislation.

2. This Appendix provides further information on the approach, principles and assumption of the demand forecast produced, and presents the information in greater detail than the discussion in the main report. It also explains further how our approach has met the requirements of the Water Resource Planning Guidelines (WRPG) and the Guiding Principles for developing a water resources management plan.

3. This "Guiding Principles" Document sets out a number of policies and aspirations which have been incorporated into the demand forecast. These key policy priorities from the Government which are required to be addressed with respect to the water demand forecast specifically are:
    - Taking a long term perspective.
    - Water trading, cross boundary solutions and third party resources
    - Reducing demand for water.

4. We believe that our demand forecast incorporates all these elements in that:
    - The forecasts are to 2040, beyond the immediate price review period, and include population growth, demand variations and climate change both as explicit components of the forecast and within the uncertainty reflected in the target headroom calculation.

    - Third party demands have been considered within the forecast, in particular the growing needs from agricultural and horticultural sectors, and these are reflected within the changing patterns of demands in the forecast.

    - Although the total demand in a dry year is projected to rise, the forecast of per capita consumption (PCC) in the Baseline Forecast is significantly downwards, declining from 173.1 l/hd/d in the base year to 148.7 l/hd/d by 2040. This reflects the benefits of a metering programme and the impact of the water efficiency programmes.

    - Sensitivity tests on each of the key components of the demand forecast confirm that our forecast represents a robust and balanced approach with reasonable assumptions.

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4B Population, Household and Dwelling Forecasts for WRMP14: Phase 2 Draft Final Report, Experian, June 2013
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4D SEW Water Efficiency Strategy v1, SEW, February 2013
4E The Impact of the Customer Metering Programme on Household Demand, October 2013

Overview to Forecast

Forecast Model

5. An integrated modelling system has been used to create demand forecasts for each of the Company's eight water resource zones (WRZ), based on the range of property types and consumption groups present in each WRZ, now and as forecast until 2040. This uses the latest available information on present and future population and property numbers and best estimates of individual, household and non-household water consumption to 2040. The analysis of baseline household consumption has been carried out using micro-component modelling (MCM) together with historical analysis of customer consumption for the base year estimate.

6. The model operates in a "bottom-up" mode, enabling analysis of individual components and micro-components of demand with the aggregation used to derive the overall water demand for each year, for each WRZ, and for the company as a whole. For the household consumption, the model uses the output of the MCM for each property type, metered type and each WRZ to build up an overall consumption profile and this is under the various scenarios discussed below.

7. The structure of the model allows a number of alternate scenarios to be tested and sensitivity runs to be explored which enhance the understanding of the criticality of components, and to provide confidence in the final results.

Forecast Scenarios

8. Demand forecasts have been prepared for the following scenarios:
    - Baseline Dry Year, Average and Critical Period
    - Baseline Normal Year, Average
    - Baseline Weighted Average
    - Baseline Utilisation, Average and Critical Period
    - Baseline Unrestricted Dry Year, Average and Critical Period
    - Final Planning Dry Year, Average and Critical Period.

9. For clarification purposes, this Appendix 4, and Section 4 of the main report, describes the Baseline Demand Forecast, which is the demand would we would expect to occur:
    - With the continuation of all current measures and policies to manage demand, including the current metering programme, water efficiency activities and leakage reduction programmes.
    - Taking account of changes in population, property numbers and property types across the company area;
    - Reflecting changes in lifestyle, social preferences, economic trends and environmental awareness insofar as these effect the demands for water by individuals, households and non-households;
    - Taking account of the effects of climate change on demand.

10. The Final Planning Forecast is presented within Sections 9 and 10 as part of the development of the preferred plan.

11. The average demand is defined as the annual average daily demand over the course of the 12 months from April to March the following year. For a Normal Year, this is defined by the

weather variables, typically temperature, sunshine hours and rainfall and is generally abbreviated to NYAA.

12. The Dry Year annual average is defined as a year in which temperatures are high, it is unusually sunny, and the rainfall is low such that demand may only just be met without the need for restrictions on water use in accordance with the company's level of service. This scenario is generally abbreviated to DYAA.

13. The critical period demand for the company is defined as the maximum demand over a 7 day period, which typically occurs during the May to August months of the year and represents the time when the balance between supply and demand is at its minimum. This peak demand scenario during a dry year is generally abbreviated to DYCP. In the main report we commonly refer to this scenario as Summer Peak.

14. The weighted annual average demand forecast is required as the basis of the Company's revenue forecast when the Regulator sets the price limits. The company has therefore developed a weighted annual average demand to reflect a mix of demand under dry years and normal years, as well as other types of year such as wet years, and this is further discussed below. This is generally abbreviated to WAAD.

15. The utilisation forecast estimates the amount that the company is most likely to use to meet the supply demand deficit. The company has therefore constructed a forecast which reflects the relative frequency of each year type based upon the guidance in Appendix 4 of the Guideline, and this is reported further below.

Base Year Demands

16. The forecast scenarios have been developed from the reported Annual Return 2012 figures (AR12) which are the audited returns to the Regulators for the population, property, consumption, leakage and water supply figures for the 2011/12 year.

17. Although the year was warmer than average there are other factors such as Soil Moisture Deficit and the extensive customer messaging campaigns which ensured that consumption was managed downwards. An analysis of the demand over the past 9 years indicates that the AR12 consumption figures are in line with the average over this period and consequently this return has been adopted as a reasonable representation of Normal Year consumption.

18. The Normal Year unmeasured PCCs and the measured billed volumes have therefore been derived directly from the reported and audited AR12 figures, as have the leakage and other minor component elements of the water balance. These data define the Base Year demand figures for the forecast. The population and occupancy rates figures have, however, been marginally revised using the more up to date survey by Experian discussed later and therefore result in a minor difference with the published AR12 figures.

19. The Dry Year property and population, leakage and minor component figures for this Base Year are with the Normal Year figures. The Dry Year consumption estimates for the Base Year, however, are different, and these have been derived from the micro-component analysis, recent customer surveys (discussed later) and historical analysis of patterns of consumption against weather conditions which are used to define a Dry Year consumption profile. This is discussed in 13.2 of Appendix 4A.

Forecast Demands

20. The total baseline demand for each year of the planning period to 2039/40 has been calculated as the sum of forecast consumption from Household (HH) and Non-Household (NH) customers, plus leakage from Company and customer pipes, under the assumed continuation of presently implemented leakage management, metering and water efficiency measures, including for the effects of climate change to 2040. Additional savings from new leakage, metering and water efficiency measures selected through the options appraisal process examined in Sections 8 and 9 are then incorporated into the baseline demand forecast presented in this chapter to give the final plan demand forecast presented in Section 10.

21. The Company's current metering and water efficiency measures are forecast to reduce the growth in net PCC, with its forecast dry year baseline household PCC declining from 173.1 l/hd/d in 2011/12 to 148.7 l/hd/d in 2040 with climate change included. The equivalent 2040 value for a normal year is 141.7 l/h/d. Coupled with the increase in property numbers and population planned for the Company's area, annual average household demand is forecast to rise from 373.1 Ml/d in 2011/12 to 380.7 Ml/d in 2039/40 under dry year conditions.

22. Non-household consumption is generally steady in most zones, although in some cases demand for horticultural purposes is increasing and this is included in the forecasts. Baseline Non-Household consumption is forecast to rise from 129.8 Ml/d in 2015 to 144.4 Ml/d by 2039/40.

23. Leakage has been substantively reviewed. The Company is operating below the sustainable economic level of leakage (SELL). Baseline leakage rates are forecast to reduce from 106.5 l/pr/d in 2011/12 to 82.3 l/pr/d in 2039/40, and total leakage is forecast to reduce from 94.5 Ml/d to 90.6 Ml/d over the same period, despite the planned increase in property development and the consequent increase in distribution input.

24. Baseline annual average Total Demand is forecast to rise from 583.2 Ml/d in 2011/12 to 604.1 Ml/d in 2039/40 (+4% over the period). Baseline demand in the peak week is forecast to rise from 706.6 Ml/d in 2011/12 to 775.8 Ml/d in 2039/40 (+10% over the period). Further demand management options to reduce both annual average and peak period baseline demand are considered in Section 8.

25. The forecast scenario of unrestricted dry year demands has been derived using a best estimate of higher PCC growth assumptions, and this scenario has been used in guiding the uncertainty range of the target headroom component.

26. Sensitivity tests on various alternative growth assumptions have been carried out and these are reported at the end of this Appendix.

Population and Property Forecast

27. The base information for property numbers is extracted from the company's own customer database system which has been developed and audited to classify and report all connections to the supply network in accordance with the regulatory definitions in the WRPG. The property data is reported annually to the regulators and has been rigorously audited. The database can provide detailed reports of property classifications – as household and non-household – by WRZ, and whether measured or unmeasured. Occupied and void properties can also be clearly identified and reported. These data form the basis of the base year property figures in the forecast.

28. Future forecast of population and property growth numbers have been provided by expert demographic consultants Experian, who were engaged by the company within a consortium of nine neighbouring water companies and included representation from the Environment Agency. Experian directly liaised with all the local planning authorities (LPAs) served by the company on our behalf, in accordance with the WRPG, and responses were been received from the majority of authorities at the time of the writing of that report. The Phase 2 report produced for the company by Experian is included in Appendix 4B.

    The Phase 2 report has been compiled by Experian as part of a project together with neighbouring companies includes the 2011 Census information and the most up-to-date forecasts from the LPAs. This supersedes the Phase 1 report which was used for the dWRMP14.

29. Experian have produced three sets of population and household growth projections in accordance with the WRPG and the Method of Estimating Population and Household Projections (EA, 2012) report. The three sets of forecasts produced are:
    - Plan based (using information provided by local authorities)
    - Trend based (using latest information from official statistics)
    - Most likely (Experian's best view on likely outcomes based on information available).

30. The company have adopted the Plan based projections from the Phase 2 report which the company considered to be the best forecasts available based upon the data available and align with the Guidelines. The Trend Based projections which were used from the original Phase 1 report in the dWRMP14 are very similar to the Plan Based projections from this updated Phase 2 report. We have assumed that the whole WRZ population is included within the supply area of the company for the purposes of the demand forecast model on the basis of our customer database which suggests 100% network coverage of the region and no notifications of separate supplies. No adjustment has been made, therefore, for non-connected properties.

31. The projection provides two important outputs which are incorporated into the forecast model:
    - Population totals by WRZ.
      These are allocated to the various property groups in accordance with the assessed occupancy rates from the company's recent surveys and historical audited figures such that the total population by WRZ matches the Experian figure from the base year and for each forecast year.

      The non-household population has been estimated using the occupancy rates by WRZ developed over the past years from company surveys and presented in the

audited annual returns. This includes both measured and unmeasured non-households, although the numbers in the latter category are very small.

- Household growth by WRZ.
  The base year household numbers are those already accounted for in the company's own customer database to match the regulatory classification of households and non-households, but the household growth figures from Experian are added to these to provide the growth forecasts. The forecast model classifies these properties as New Households and allows for different occupancy rates and PCC estimates, both of which tend to be lower than average, to calculate their consumption estimates. The total Plan Based property numbers included in the forecast model are shown in Table 1 below.

Table 1: Summary of total properties

Resource Zone	BaseYr11/12	2012/13	2013/14	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
RZ1	66692	67135	67523	67864	69619	71413	73298	75361	77530
RZ2	125947	127602	128532	129532	134446	139431	144336	149399	154665
RZ3	112696	113717	114396	115073	118402	120967	123320	125767	128307
RZ4	265202	268649	271114	274193	289003	301623	314327	327542	341291
RZ5	55754	55825	55911	56139	57490	58758	59880	60647	61305
RZ6	99044	98974	99791	100758	105831	109234	112013	114554	117225
RZ7	33807	33459	33671	33932	35368	36673	37965	39211	40494
RZ8	128788	128555	130366	132368	141858	151643	161967	172836	184346
TOTAL	887930	893917	901303	909860	952018	989743	1027107	1065317	1105164

32. From a property base of 887,900 properties in 2012, property numbers are expected to increase by 24% to 2040. Table 2 shows the growth in population over the planning period. Using the Experian Plan Based population growth figures, the population is forecast to increase by 19% from a starting position of 2.1 million population in 2012 to 2.5 million 2040.

Table 2: Summary of total population

Resource Zone	BaseYr11/12	2012/13	2013/14	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
RZ1	157095	158133	158784	159419	162885	166605	170359	174485	178918
RZ2	295170	296523	298235	299847	308189	316795	325489	334538	344139
RZ3	247367	247802	248899	250082	255001	258588	261585	264860	268407
RZ4	654111	657919	663008	669160	699108	724094	749111	775385	803039
RZ5	130882	130607	130968	131407	133926	136282	138189	139339	140271
RZ6	232750	232198	234787	236569	246025	251856	256440	260622	265259
RZ7	77264	76972	77898	78270	80652	82728	85035	87216	89505
RZ8	297081	297872	303565	307522	324556	342093	360822	380730	402132
TOTAL	2091721	2098026	2116144	2132276	2210344	2279042	2347030	2417173	2491670

33. Overall there is some concern that the economic climate may delay the new properties, but population is not reported as being affected by the economy, so population forecasts (at least in the short term) are likely to be robust. It is this population in any case that is driving demand, rather than property numbers and therefore this aspect of the forecast is not considered sensitive to the current slowdown in the economy. The company intends to

continue its ongoing dialogue with local authorities on their own projections and will try to incorporate changes where possible.

34. Sensitivity testing of the demand forecast to various property and population growth rates has been carried out and these are reported at the end of this Appendix. This includes the impact of the demand forecast if the Trend Based or the Most Likely forecasts of properties and populations are used.

Classification and sub-division of properties

35. The property classification applied to the model is presented in Section 4 of the report. This includes 5 primary metered household types and 15 property types for each of the 8 WRZs.

36. Metered properties are forecast to rise, both due to the addition of these new properties, and the continuation of the current metering programme (CMP). The CMP provides for over 175,000 properties to be metered to 2015 and a further 174,040 to 2020 which takes the Company to 90% metered by 2020. Adjustments are therefore made in the forecast to transfer these properties out of unmeasured households into metered households.

37. The forecast in the new plan includes a reduction in meter optants after 2015 as it is assumed that these will reduce as the CMP rolls out .The final total of CMP properties will depend upon the number of meter optants to 2020 such that 90% metering by 2020 is achieved whatever the optant number. For clarification, the number of metered properties reported is typically the mid-year estimate, and therefore, while metering of 90% of properties will be achieved by the 2020, the actual reported figure will be 6 months into the 2020/21 reporting year. Consequently it can appear that 90% is only achieved in the following year.

38. A minor increase in non-household properties is included in the forecast based upon historical assessment of the relationship between household and non-household growth, but this does not, in any case, drive the non-household consumption which is separately analysed. This increase only has an impact on the underground supply pipe losses for non-household properties which is minimal over the planning period.

Micro-component Analysis and Per Capita Consumption

39. As noted previously, the company has developed a comprehensive micro-component model (MCM) in line with the Guideline and this forms the basis of the household consumption forecast. A full report on the MCM and assumptions is included Appendix 4A and a summary of the PCCs forecast from the MCM at the company level is presented in Table 3.

Table 3: Summary of property type PCCs at company level (l/hd/d)

Prop Type PCC (l/hd/d)	2011/12	2014/15	2019/20	2024/25	2029/30	2034/35	2039/40
HHm New Props		125.4	123.4	121.1	120.6	120.7	120.9
HHm Optants		168.3	155.3	145.5	140.4	138.8	138.0
HHm CMP		143.4	145.4	143.7	142.8	141.7	141.0
HHm Base		151.1	157.9	152.1	151.0	150.5	150.5
HHm Average	157.8	156.7	156.3	151.4	149.3	147.8	146.8
HH um	182.4	178.0	171.1	167.0	166.7	166.3	166.0
HH Overall Average	173.1	165.0	158.2	152.8	150.8	149.3	148.3

40. An analysis of PCC for measured and unmeasured households was carried out to determine the PCCs in the base year 2011/12 so that the MCM could be properly calibrated. This is required as the MCM itself is built from a set of assumptions on ownership, usage, volume but only for the period of the survey. It is necessary, therefore, to calibrate the MCM against an historical top-level PCC, for both the Normal Year and the Dry Year PCC. The historical analysis provides an estimate of the 1 in 10 year unconstrained demand, taking account of the various property groups and make ups of the resource zones, so the final current estimate might not match a specific historic figure.

41. For Normal Year PCCs, the analysis provided PCC figures of 148.2 l/hd/d for measured households and 176.1 l/hd/d for unmeasured households. The equivalent Dry Year figures were 158 l/hd/d for measured households and 182.4 l/hd/d for unmeasured households. It was assumed that the primary difference in water use between Normal and Dry Years was miscellaneous use and the external use of water, and consequently these two components were used to calibrate the Dry Year MCM from the Normal Year MCM, with the remaining components held unchanged between the two forecasts.

42. The MCM forecast indicates a reduced household consumption in the future because existing appliances are being replaced with more efficient ones; new properties are being fitted with the latest, efficient models and there are behaviour changes leading to more efficient water use practices. The modelling shows reductions in volumes used from 2015 to 2040 for toilet flushing (37.2 to 31.2 l/h/d), clothes washing (16.1 to 12.1 l/h/d) and miscellaneous usage (42.5 to 30.9 l/h/d). The effect of these changes can be observed in the PCC values in table 3 above.

43. Assumptions regarding the appliances installed in new properties results in them having a PCC which is 20% below current average metered properties (see Table 3) averaging 125.4 l/hd/d in 2014/15. This aligns with Code for Sustainable Homes standards, Part G of the Building Regulations, and the UKWIR Good Practice report (2012), and also influences the reduction in overall PCC. Sensitivity tests on the PCC in new properties have been carried out and these are reported at the end of this Appendix.

Properties which are metered as part of the CMP show an average reduction of around 10% on PCC based upon metering impact studies both by ourselves and within the industry. This is applied at the individual property type level (detached, semi-detached, etc) and WRZ level so the average impact company wide is slightly different. The actual average impact on per property consumption (PPC) applied in our forecast is around 15%, making it an ambitious assumption which will require monitoring and assessment as the programme is rolled out. This is supported by recent analysis of our current programme as reported in Appendix 4E. Sensitivity tests on this assumption have been carried out and are reported at the end of this Appendix.

Climate change

44. The impact of climate change on household demand has been reviewed by HR Walllingford for the company who also were part of the delivery team for the equivalent UKWIR Project (CL04B, March 2013). Their central estimate is an impact of 1.3% on household demand from 2012 to 2035. The following Table 4 summarises HR Wallingford's estimates from the various methodologies and the previous PR09 work, with the adopted value highlighted.

Table 4: Range of Impacts of Climate Change on Demand

Impacts of climate change on Average Demand		Low estimate	Central estimate	Upper estimate	Confidence
WRMP 2009	UKWIR06 2020s	1.30%	2.60%	4.00%	Medium
Update (Method 1)	UKCP09 2030s	-4.40%	4.90%	16.70%	Low
DI analysis (Method 2)	UKCP09 2030s	0.70%	1.30%	2.20%	High
WRZ3 case study with lagged variable (Method 3)	UKCP09 2030s	0.10%	1.70%	3.50%	Medium
Average of Methods 1-3	UKCP09 2030s	-1.20%	2.60%	7.50%	

45. Adoption of the 1.3% impact results in the following impacts over the planning period on Dry Year in 2035:

192,000 unmeasured population x 1.86 l/h/d = 0.37 Ml/d
2,164,000 measured population x 1.95 l/h/d = 4.22 Ml/d

Non-household consumption

46. The non-household consumption review (see Appendix 4C) has analysed usage against industrial codes and annual resource zone data to derive the forecast and is in line with the Demand Forecasting methodology (UKWIR/NRA 1995) and UKWIR 1997 reports.

47. The consumption in the base year as reported in the AR12 has been adopted as reflecting the NYAA demand, while a review of the historic reported consumptions over the past 10 years has provided guidance on developing the DYAA consumptions in the base year. The analysis is presented in Appendix 4C.

48. The forecast of changes in non-household consumptions draws the industry analysis and trends, as well as a comprehensive study by HR Wallingford (June 2012) which specifically reviewed changes in the horticultural usage in the south east region of England. Overall, the demand is considered to be relatively flat, although there remain upward pressures, particularly from these agriculture and horticulture sectors, in certain resource zones. Dry year demand has been forecast to increase by 14.6 Ml/d from 2015 to 2040, a rise of 11%.

49. No allowance for any specific increase of climate has been included in the non-household forecast although the growth in agriculture and horticulture sectors is considered to include a component of growth from the impact from climate change.

50. The numbers of new commercial properties has been based on historical review of the past 10 years growth in each WRZ, a total of about 300 properties p.a.. This results in an increase of 7,500 properties over the period from 2015 to 2040, a rise of 12%. It should be noted, however, that this assumption has no impact on the non-household consumption which is developed from the industrial classification growth assumptions discussed above.

51. We recognise that our analysis of non-household customer usage requires updating before the next WRMP, and consequently we commit to undertaking a review of industrial categorisation codes and an update of our commercial forecast prior to the dWRMP19.

Baseline Water Efficiency Strategy

52. South East Water has a statutory duty to promote water efficiency to all our customers and for the period 2010-2015 the company has a strategy which meets the relevant targets set by Ofwat. This is an activity based target for all companies to achieve an assumed saving of 1l/prop/day for each year of the AMP. For South East Water this is equivalent to 0.84 Ml/d every year or a total of 4.2 Ml/d saving across AMP5. Refer to Appendix 4D for a summary of the strategy.

53. The core parts of the strategy include:

    a. Education: both in schools and direct to customers via the bill, website, community talks and other events and campaigns.
    b. Customer Metering: As already mentioned elsewhere, we plan to meter 90% of customers by 2020 as this has been shown to be the most cost-effective way of reducing household demand.
    c. "Hard measures" include the promotion of free cistern displacement devices (CDDs), water butts, shower regulators, etc.
    d. Partnership working to widen the delivery of water efficiency services across the region.
    e. Targeting Non-households by offering water audits and working with them to monitor leakage and provide advice.
    f. Ourselves: Installation and monitoring of water efficiency measures at our own sites.

54. The company has included the saving benefits of these activities during the planning period on the assumption that these will continue. These savings are reflected within the reductions

55. Additional water management opportunities have been costed and quantified within the options appraisal and, where selected as best value, will be included within the final WRMP14.

Leakage and SELL

56. The company is currently operating with a leakage level of 94.5 Ml/d in the base year 2011/12, significantly down on historic levels of over 140 Ml/d reported 15 years ago.

57. The publication by the Environment Agency, Ofwat and Defra of the report from SMC on the Review of the Sustainable Economic level of Leakage (SELL) in November 2012 is an important milestone for the developing industry approach to SELL. We have reviewed the report and have commenced the process to enhance our methodology where appropriate to include the relevant recommendations.

58. For the current WRMP, we have used updated information in our existing models to develop our SELL, and we are reviewing how to incorporate some of the changes from the recommendations in the Report over the next 5 years to update our approach to SELL for the next WRMP. In this context, the company is committed to working with the industry in developing the application of the approach, particularly with regard to the estimation of Background Leakage, to inform our modelling of SELL for PR19.

59. The current leakage level in the baseline forecast is that which is currently agreed with the Regulators and included within the leakage programme to 2020. This is mainly planned to be achieved through the delivery of the CMP, which assists in identifying leakage on supply and communications pipes which will be repaired earlier than otherwise would be expected resulting in reductions in underground supply pipe losses.

60. Total leakage in the baseline forecast falls from 94.5 Ml/d in 2011/12 to 90.6 Ml/d by 2020 and then remains constant despite the continuing increase in connections. Post 2020, although underground supply pipe starts rising again with new connections, the company remains committed to achieving reductions in leakage despite these new connections through other activities to manage losses such as pressure management. The final leakage will be adjusted to include the selection of further leakage reduction options which are shown to be economic. This is further reported in Sections 7 to 9.

61. The company is currently in the process of setting out its longer term leakage management strategy, which will define the components of the programme to be delivered over the next 5 to 25 years to achieve the current SELL and the declared leakage targets. This strategy document will be published by the Annual Return 2015.

Critical Period Demand

62. The dry year critical period (DYCP) demands, typically referred to as peak demands, are key drivers of the water resource developments in almost all the WRZs, with the exception of WRZ2 and WRZ7. These two zones, which have a high proportion of surface water supply, however, provide important support to neighbouring zones, so overall the three company regions are considered to have supply demand balances which are at their most critical in the period of peak demand. Demand forecast and supply demand balances have been produced, therefore, for the DYCP scenario for all eight of our WRZs and the analysis has been applied in accordance with the best practice methodology (UKWIR 06/WR/01/7).

63. The peak factor is the average day peak week demand (ADPW) divided by the average day demand across the whole of the year. These are difficult to analyse and to forecast given that they are highly variable from one year to another, and that the forecast requires a dry year peak factor which only occurs the equivalent of once every ten years.

64. Based upon operational experience and a review of the data, the company has assumed that the DYCP demands can occur simultaneously in all the WRZs and therefore the company total DYCP is the total of the individual zonal DYCP demands. Operational constraints are managed to minimise interruptions to supply during periods when the peak demands could occur with as much planned maintenance etc. scheduled for outside the peak months.

65. The overall peak factor is comprised of four separate factors:
    a. Unmeasured households – which increases from 1.25 to 1.38
    b. Measured households – which increases from 1.25 5o 1.35
    c. Non-households – which is about 1.28 and does not increase
    d. Leakage – which is held at 0.95 and does not change.

66. Household peak factors were analysed in the previous plan using two primary sets of data for unmeasured and measured households respectively. In both cases, the final peak factors adopted for all the various household groups are unchanged from that applied in the final WRMP09 as the company has not observed any dry year peak profiles since the last plan was produced. The current values are supported by analysis of peaks observed over the past 20 years by our customers, including notably high summer peak events that occurred during 1995 and 2003. The long term trends of peak factors suggest continual growth which we consider to be due to a number a influences on peak water usage, including:
    a. The increasing value of gardens and associated water use in summer periods;
    b. Reductions in baseline PCC as a result of more efficient appliances (e.g. toilets and washing machines) increasing the peak factor
    c. Increasing personal washing during hot periods.

67. The unmeasured household factors for the different property types have been derived from the company's own control areas while the measured household factors were calculated from the metered areas of Faversham, Canterbury and the Park Farm DMA, amounting to over 4,000 properties. Although the company has recorded peak factors for households exceeding 1.30, we have adopted a lower factor at the start of the plan (1.25) for all households, but have allowed this to growth in line with the long term growth trend over the period of the plan. This approach allows the company to course-correct over the planning horizon as more information on peak usage, and changes in peak usage, is available.

68. The non-household peak factors again are essentially unchanged from the final WRMP09, and these were determined through a calibration of the record of historic peaks taking account of other components.

69. The process of forecasting dry year peak demands has followed the same principles as previous plans. This applies the individual peak factors to each of the separate DYAA components of the water balance to derive the total DYCP demand for the WRZ which is summated to the company total DYCP.

70. Our overall peak factors are slightly lower than the previous plan as can be seen in the table 5 below. The reasons for increasing peak factors over the planning period is attributable to a number of factors including greater variability of weather and higher affluence leading to higher water use at peak periods. Increasing peak factors is attributable to a number of factors including greater future variability of annual weather patterns, higher affluence etc.

Table 5: Company level Peak Factors

	Peak Factors						
	2012	2015	2020	2025	2030	2035	2040
PR09 Average Peak Factor	1.22	1.23	1.24	1.25	1.27	1.28	
rWRMP14 Average Peak Factor	1.21	1.21	1.23	1.24	1.25	1.27	1.28

Weighted Annual Average Demand

71. We are required to calculate the components of our baseline weighted annual average demand (water delivered, water taken unbilled, distribution system use, and leakage) as set out in table WRP2b Weighted BL Demand. The weighted annual average demand (WAAD) should reflect a mix of demand under dry years and normal years, as well as other types of year such as wet years, etc.

72. For this WRMP14, the Normal Year Annual Average (NYAA) demand is considered equivalent to the WAAD, and consequently these two figures are the same..

73. A brief analysis of daily weather data has been carried out using data from the Metoffice from 1987. The station used for the early years is from Ulcombe and the more recent data has been derived from the East Malling Research Station. The data includes;
    a. maximum daily temperature
    b. Hours of sunshine
    c. Rainfall

    from which we have calculated soil moisture deficit.

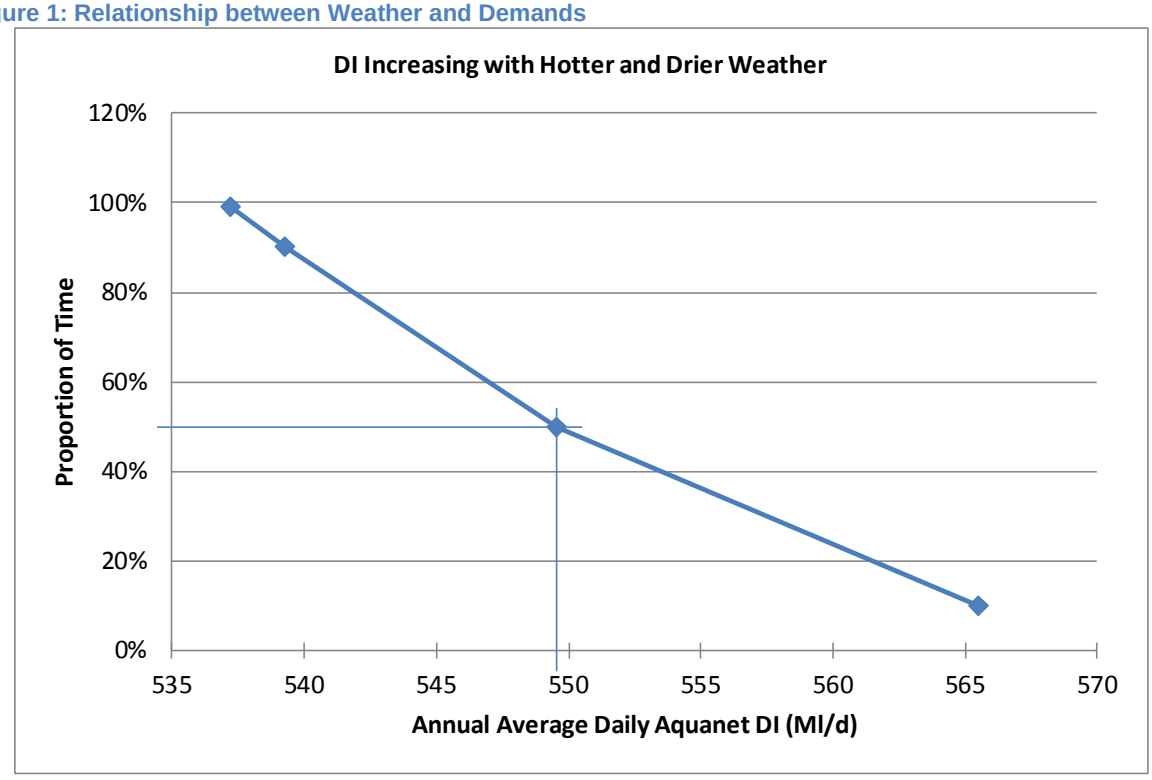
74. Algorithm modelling has been undertaken for Resource Zones 1-8, for the following Scenarios:

a. Average Weighted Demands
b. Annual Return 2012
c. 1 in 5 year return period
d. 1 in 10 year return period
e. 1 in 100 year return period

75. The models for each resource zone are based upon the actual demand dataset from 2008 to 2012. The models have been calibrated using local demand and weather data for each Resource Zone:
    a. Day of Week
    b. Month
    c. Seven Day Cumulative Rainfall (EA rain gauges)
    d. Daily Max Temperature (Met-Office datasets)
    e. Daily Sunshine Hours (Met-Office datasets or Boughton datasets)
    f. Temporary Use Bans (with or without)

76. Using these models, weather-demand relationships have been derived for each RZ. The following chart summarises the determined weather/DI relationship.

Figure 1: Relationship between Weather and Demands



77. This relationship shows that 2011/12 reported demand of 548 Ml/is very close to the average demand which would have been expected 50% of the time. Whilst overall, the year was one of the driest and warmest, the key demand periods of spring and summer were below average. This confirms that this base year is a reasonable representation of a Normal Year, which the company considers is equivalent to the WAAD.

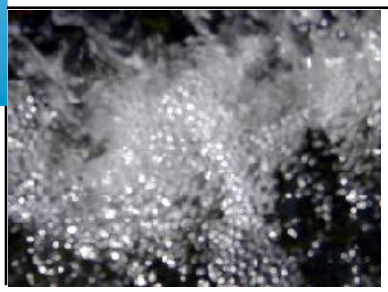
Summary of the Demand Forecast

78. Table 6 below shows the changes in the various components of the baseline demand forecast for the 5 year intervals to 2040. This is the demand expected before any additional water efficiency or leakage reduction schemes are adopted from the preferred plan options.

Table 6: Summary of DYAA and DYCP Baseline Demand Forecast by component

Values in Ml/d	Dry Year Annual Average (Ml/d)					
	2015	2020	2025	2030	2035	2040
Demand Forecast						
rWRMP14 Household	363.5	358.7	357.8	363.9	371.6	380.7
rWRMP14 Non Household	129.8	132.0	134.6	137.6	140.9	144.4
rWRMP14 Minor Components	7.8	7.8	7.8	7.8	7.8	7.8
rWRMP14 Total Leakage	93.1	90.6	90.6	90.6	90.6	90.6
rWRMP14 Demand	574.4	572.2	573.6	582.0	592.2	604.1
Values in Ml/d	**Dry Year Critical Peak (Ml/d)**					
	2015	**2020**	**2025**	**2030**	**2035**	**2040**
Demand Forecast						
rWRMP14 Household	454.2	454.7	462.2	477.4	494.8	514.6
rWRMP14 Non Household	165.8	168.9	172.5	176.6	181.0	185.8
rWRMP14 Minor Components	7.8	7.8	7.8	7.8	7.8	7.8
rWRMP14 Total Leakage	88.4	86.1	86.1	86.1	86.1	86.1
rWRMP14 Demand	697.5	701.4	712.1	730.7	752.0	775.8

Note: In Table 6 the total leakage number includes customer leakage already included in customer demand components. Therefore the figures will not total.



WRMP14

PROJECT NUMBER: 67951

SEW Customer Analysis and Micro-component Demand Forecasting
November 2012

	Name / Position	Signature	Date
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CONTENTS

1.0 EXECUTIVE SUMMARY

This report details the analysis that has been undertaken of South East Water Limited's (SEW) household customer base and their water use. The following process has been followed to provide a detailed understanding of the make-up of the customer base, their current water usage and how this is likely to change over the forecast period of the 2014 Water Resources Management Plan.

1. Establish which customer parameters held on the company's systems provide the best indication of water consumption and segment customers accordingly.
2. Survey a representative sample of the customer base to establish their water usage behaviour.
3. Check and weight responses to avoid any bias in customers who returned the survey.
4. Establish the ownership and frequency of use of the household water demand micro components for each customer group.
5. Collate volume per use data from Defra's Market Transformation Programme (MTP) and company and industry research and publications.
6. Determine forecast factors for the ownership, frequency of use and volume per use of each micro component.
7. Produce PCC forecasts for each customer group.

There are a large number of factors, including the following, which will have an influence on PCC:

- Household occupancy
- Proportion of time spent at home
- Personal interests and hobbies
- Range and age of water using appliances.

Therefore, there is no single parameter which provides a strong predictor of PCC, but based on our analysis we have selected to segment customers on the following basis:

- Charging basis
  - Metered
  - Unmetered
- Property type
  - Bungalow
  - Detached
  - Semi-detached
  - Terrace
  - Flat.

40,000 customers were selected for our customer survey, weighted in line with the customer proportions in the above ten groups and their split across the eight water resource zones. We received 10,609 correctly completed responses and these were from customers, in line with our sample selection. However, the respondents' households had a significantly higher proportion of people aged over 60 than that estimated for the South East region by the Office of National Statistics. The responses were therefore reweighted to remove this bias.

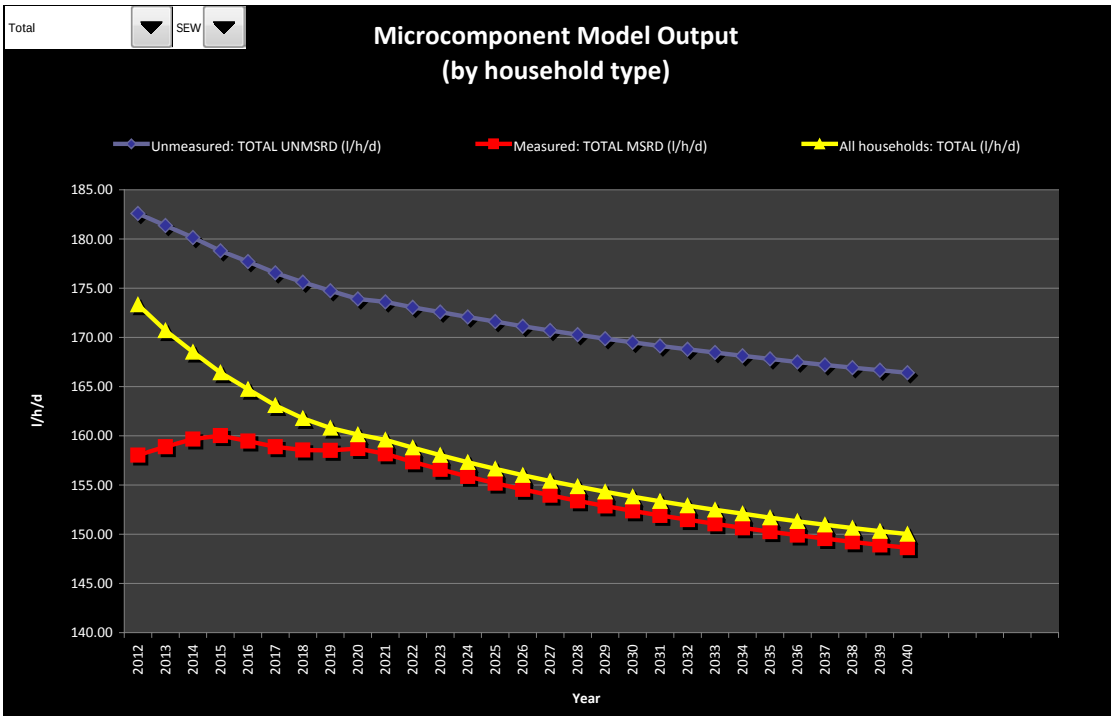
The responses were used to populate our micro component demand forecast model with base year ownership and frequency of use data for each of our ten customer groups across the eight water resource zones. Volume per use data for appliances

have been derived by drawing upon a wide range of data sources such as the MTP, Waterwise and WRc's Identiflow results.

Forecast factors for each of the micro components have been derived from MTP information and trends based on the comparison of the current survey results with those from a similar survey in 2007.

The micro component model then incorporates the impacts of the company's metering programme, property and population growth and hence occupancy changes to produce PCC forecasts for each customer group.

The model produces an overall, dry year PCC forecast that reduces from 173 l/h/d in 2012 to 150 l/h/d in 2040, as shown by the yellow line in the chart below.



2.0 INTRODUCTION

In line with the Environment Agency's Water Resources Management Planning Guidelines, South East Water has produced its household demand forecast using a micro component approach.

The guidance also recommends that customers are segmented in to groups that reflect water use variations and potential forecast variations. At 2011/12 South East Water had 804,400 billed household customers with 437,700 on unmeasured charging and 366,700 paying by meter.

This report outlines how we have obtained a detailed understanding of SEW's customers' water use habits and applied this information, along with information regarding trends in the ownership, frequency of use and volume per use of each of the micro components of household water consumption to produce the PCC forecasts for the 2014 Water Resources Management Plan.

3.0 CUSTOMER INFORMATION AND SEGMENTATION

From its systems, the company can readily identify which customers are metered or not, and this is used as the primary segmentation variable. To help better understand the variation in water consumption between households, SEW recently acquired the following customer data sets from Experian, a leading provider of consumer marketing data:

- *MOSAIC – 15 consumer groups based on a large number of demographic datasets*
- *Household composition – 12 groups reflecting single, low and high multi-occupancy homes*
- *Number of bedrooms – an estimate of the number of bedrooms in each property*
- *Residence Type 2011 – the most recent assessment of the type (bungalow, detached, semi-detached, terrace or flat) of each property.*

The large number of groups in the first two datasets make them relatively impractical as a basis for customer segmentation (on top of the measured/unmeasured split).

To test which parameter(s) were a good indicator of Per Capita Consumption (PCC), the 5,890 metered customers who responded to our survey were grouped by each in turn. These are the only customers for whom both consumption and occupancy are known and hence PCC can be accurately derived. By comparing the average and range of PCCs of each group we can see which parameters produce distinct variations and hence are appropriate segmentation variables.

The following charts show the output of the assessment of PCC variation by property type and Mosaic category.

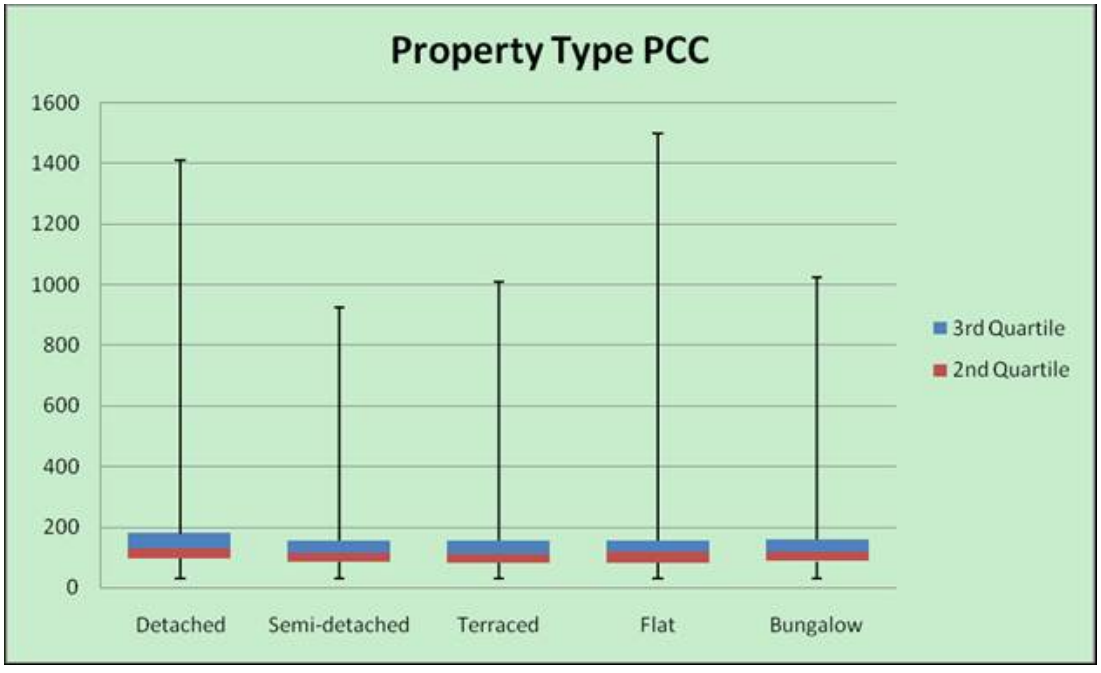


Chart 3-A Metered Survey Respondents' PCC Ranges by Property Type

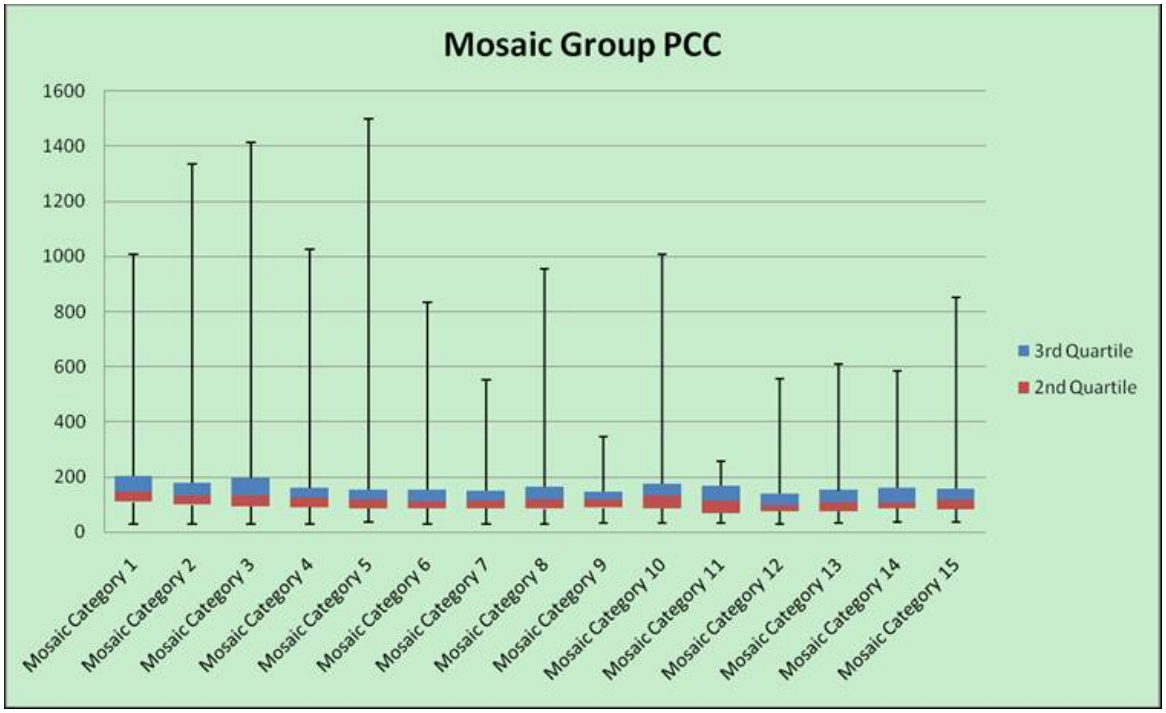


Chart 3-B Metered Survey Respondents' PCC Ranges by Mosaic Group

These charts are typical of all the parameters considered. In conclusion, there is no single parameter which provides a good predictor of differentiated PCC values. This is to be expected as there are a large number of factors including the following which will have an influence:

- Household occupancy
- Proportion of time spent at home
- Personal interests and hobbies
- Range and age of water using appliances
- Attitudes.

We therefore have considered the robustness of the individual property values in each dataset and also whether they logically reflect known, key drives of PCC, such as those above.

Mosaic is a demographic classification system, with values assigned by Experian based on a range of datasets they hold for customers. Its primary purpose is as a segmentation tool for retail marketing campaigns. These datasets are therefore not generally indicators of water use and the Mosaic groupings do not necessarily reflect how one would use them for grouping on the basis of water consumption.

Property type is generally considered to be an indicator of occupancy rates and also key water use variables such as external uses. As an externally visible, "physical" measure, the accuracy of the classification of each property is high, unlike parameters such as household composition where a classification is inferred using a range of other data sources. There are five classifications;

1. Bungalow
2. Detached
3. Semi-detached
4. Terrace
5. Flat.

This is a manageable number in terms of survey sample size and production of PCC forecasts and therefore was selected as the secondary segmentation criteria, to be used with the measured/unmeasured split to give ten customer groups in total.

The SEW region is made up of eight Water Resource Zones (WRZs) and each requires its own specific demand forecast. The following charts present the make up of the SEW customer base.

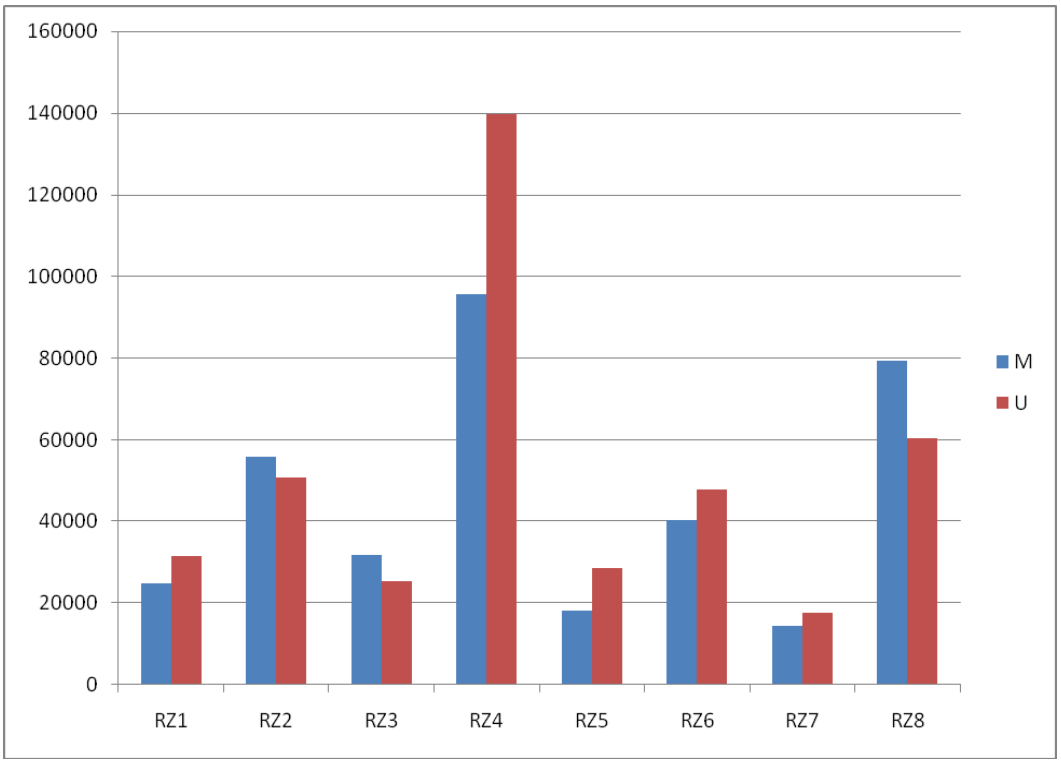


Chart 3-C Metered and Unmetered Customer Numbers by WRZ

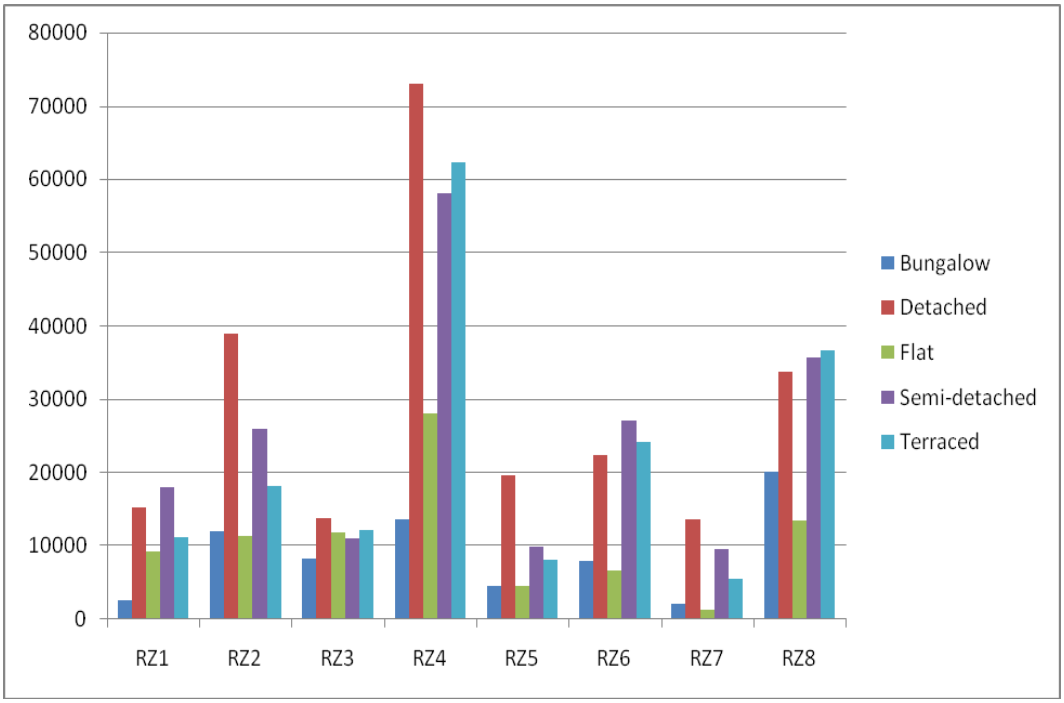


Chart 3-D Property Type Numbers by WRZ

The split of property types is fairly consistent across the zones, except for WRZ4 which has a very even distribution and WRZ7 which has a particularly low proportion of flats.

The following chart summarises the level of metering by property type.

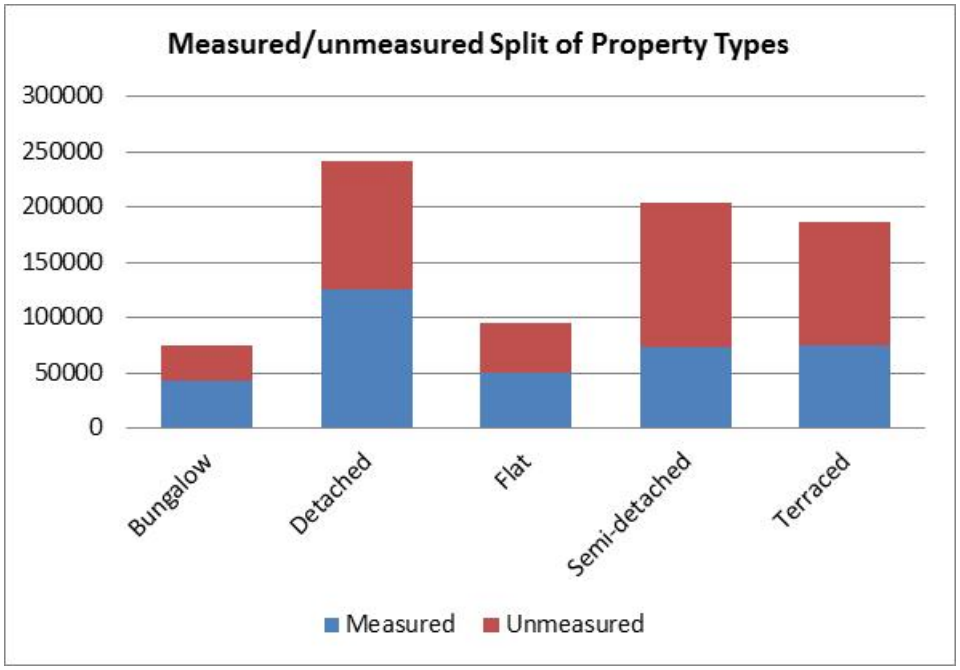


Chart 3-E Customer Numbers by Property Type and Metering

4.0 CUSTOMER SURVEY DESIGN AND SAMPLE SELECTION

4.1 The Questionnaire

The customer survey questionnaire was based on the one used in 2007 to enable comparison between the two. It asks customers about the people living in the house, their water using appliances and how often they are used. A copy of the questionnaire is provided in Appendix A of this report.

4.2 Sample Selection

An overall target sample of 40,000 was established on the basis of the 20% return rate from the same exercise in 2007 and the requirement for 8,000 responses to give a robust representation of customers across the eight WRZs and the ten customer groups identified in Section 3.

The 40,000 were selected by sorting all valid household customer records using the following criteria in order:

1st level	Metering	metered/unmetered
2nd level	Property type	det/semi/terr/flat/bungalow
3rd level	Mosaic category	high users/low users
4th level	WRZ	1 to 8

The Mosaic data tends to cut across other “physical” factors such as the presence of a water meter and what kind of building the customer lives in. It is described mostly in terms that are more “behavioural” in nature, where the strongest influencer on demand is taken to be whether or not the customers are at home during the day. If at work, then a large proportion of their toilet flushing, hand washing and other miscellaneous uses will not end up as domestic consumption. There are too many categories to use Mosaic for grouping customers and therefore we reviewed their definitions and allocated the categories to either high or low likely water use to ensure our sample selection picked an appropriate mix of customers.

In total, there were 761,878 valid customer records, containing data for all the above parameters. Therefore, in order to ensure a reasonable spread across all parameters, whilst maintaining a pseudo-random selection, every 19th entry was selected to survey.

$$\frac{761{,}878}{19} = 40{,}098$$

After rounding errors in the selection process, a total of 40,091 customers were selected for survey.

5.0 CUSTOMER SURVEY RESPONSE

5.1 Response Rate

There were a total of 10,609 correctly completed survey responses. The graph below compares response numbers across our ten customer groups with the company overall spread. The response rate was higher for measured customers than unmeasured, however it can be seen that there were over 1,000 respondents in most groups with only unmeasured flats and bungalows having less than 500.

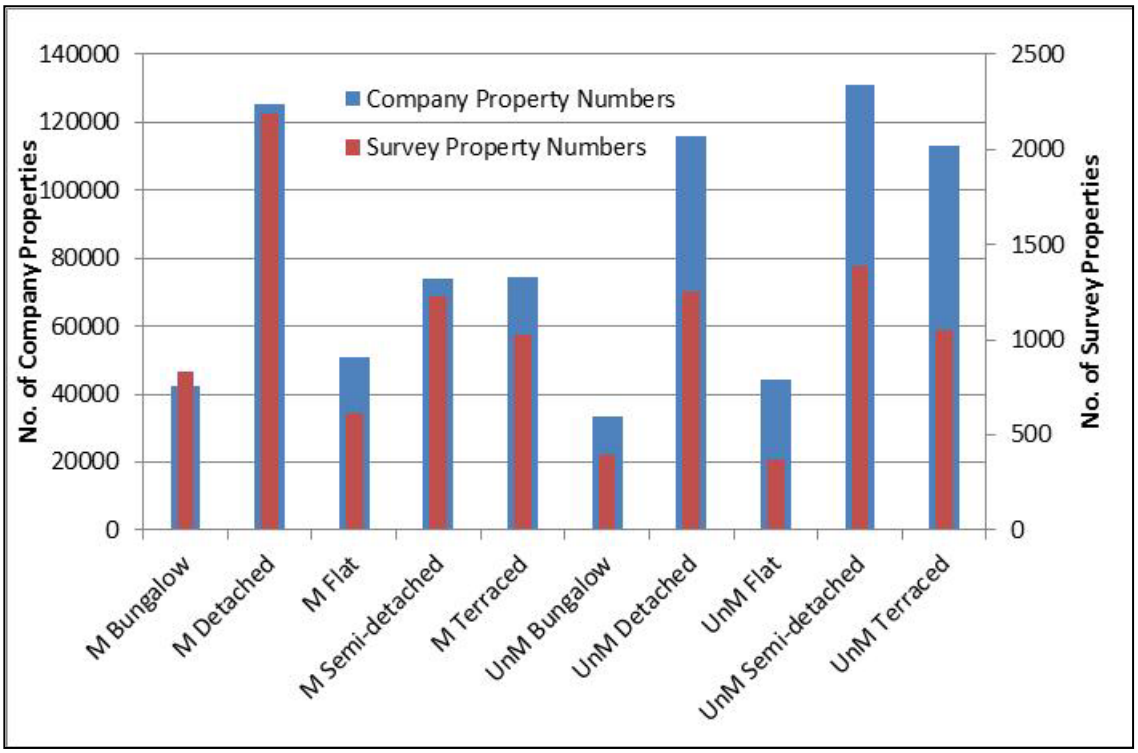


Chart 5 A Comparison of Customer Groups between SEW Total and Survey Respondents

In addition to providing information about their water usage, customers were asked to provide some details about the people living in the property. Comparing these responses with similar information for the regional population enabled us to identify any biases in the sample and adjust the results to compensate.

The population within the properties of our respondents contained 39% of people aged over sixty. The overall proportion of this age group in the South East of England, according to ONS 2011 data is 24%. Over representation of this customer group is common in such surveys and was seen in the 2007 survey. It is recognised that older customers are likely to have some water use differences from the younger population and therefore the overall results were adjusted to bring the influence of their responses in line with their presence in the wider population. This was achieved by taking the average of the results for each customer group using all valid responses and the results using data only from properties that did not have residents over sixty. This is the same approach as used at PR09.

The responses regarding the ownership and frequency of use of each micro component have been collated and averaged for each of the ten customer groups across the eight water resource zones for use in the model.

The following sections of this report provide the results for each micro component in turn along with the associated estimates of volume per use and forecast assumptions necessary to derive the per capita component forecasts for each customer group.

The survey results have been applied at the WRZ level, using the responses for each of the ten customer groups (2 billing types x 5 property types) for each zone. However, for presentation purposes we have provided the results in this report at the Company level, for each of these groups or for measured and unmeasured customers overall. Some data and forecast assumptions are applied at the company level, split between measured and unmeasured customers and these are shown accordingly.

South East Water is committed to metering all domestic customers, where reasonably practical, by 2020. The forecasts in this report, for metered customers, incorporate the impacts of unmeasured customers joining the measured population as well as customers who opt for a meter and new properties, connected during the forecast period. The micro component forecast assumptions and results for these customer groups are provided in section 12 of this report.

6.0 TOILET FLUSHING

6.1 Ownership detail

The survey asked customers for the age of their toilets. The overall split of ownership across the age bands for measured and unmeasured customers is shown in the graph below:

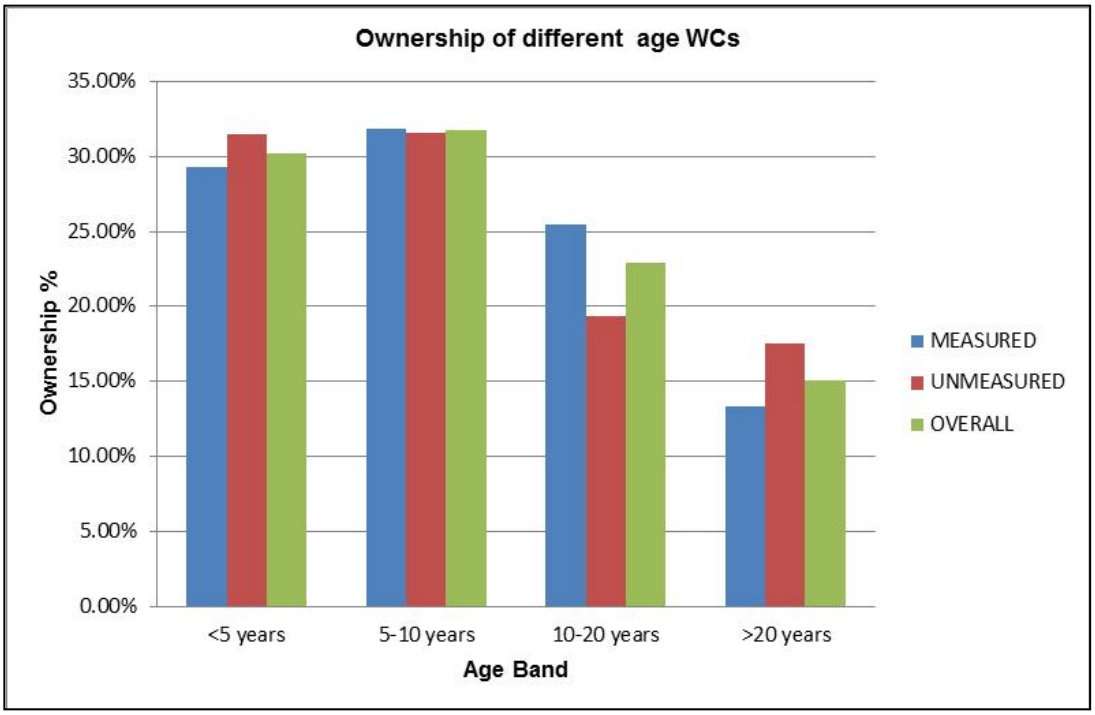


Chart 6 A ***Age Profile of Customer WC Stock***

6.2 Volume per Use and Frequency of Use

The four age bands were input in the micro component model as four generations with the following average volumes per flush:

Age Band	Generation	Volume (litres / flush)
>20yrs	1	12.5
10-20 yrs	2	9.5
5-10 yrs	3	7.0
<5 yrs	4	5.5

Customers were not asked to provide estimates of frequency of use as responses are typically uncertain due to the relatively high number of events across the household and data is available from a number of sources. We have adopted 4.71 flushes/person/day from Defra's MTP research.

Combining the survey data and the above assumptions produced the following volumes for the base year toilet usage:

Customer Group	Volume (l/h/d)
Metered	36.96
Unmetered	37.43
All	37.25

6.3 Forecast Assumptions and Results

It is assumed that the frequency of use of 4.71 flushes/person/day remains constant over the planning horizon. Therefore, the only variable is the change in the ownership profile across the four generations as customers replace old toilets and new properties are included with the latest models.

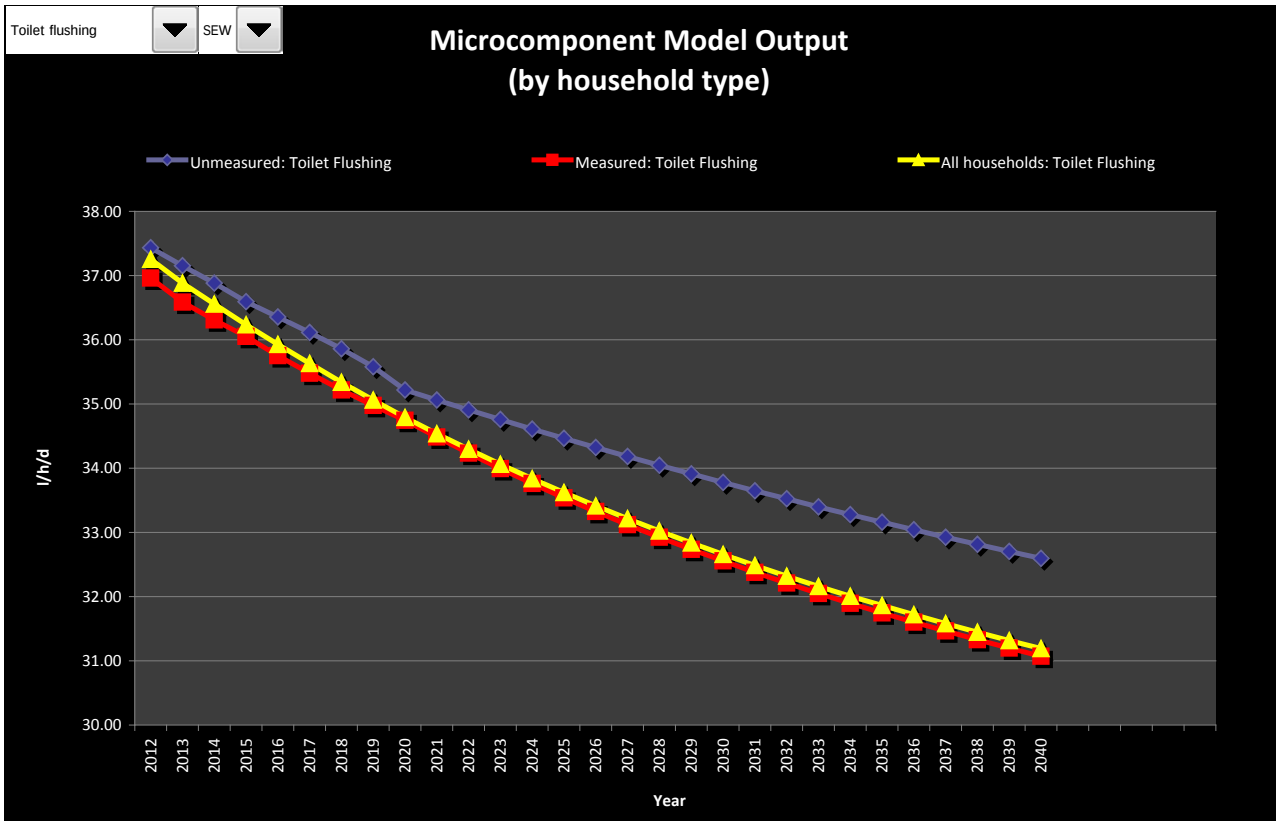


Chart 6 B Toilet Flushing Micro Component Forecast

7.0 PERSONAL WASHING

Within our micro component demand forecast model, personal washing is used to describe shower and bath use. All other washing is covered within the miscellaneous component.

7.1 Ownership Data

There exists a wide range of shower types and baths with varying water volumes. Accurately establishing ownership proportions of each of these sub option types however is very difficult as customers inevitably adopt a range of interpretations of the associated descriptions. We have therefore established three appliance categories that have sufficiently different assumed average volumes to warrant their separation. These are baths, normal showers and power showers.

Most properties have a combination of baths and showers and therefore, rather than just establishing the ownership levels, it is necessary to understand the proportion of personal washing events that use each type. The following chart summarises the proportion of personal washing events that are showers for each of our ten customer groups and by property type overall.

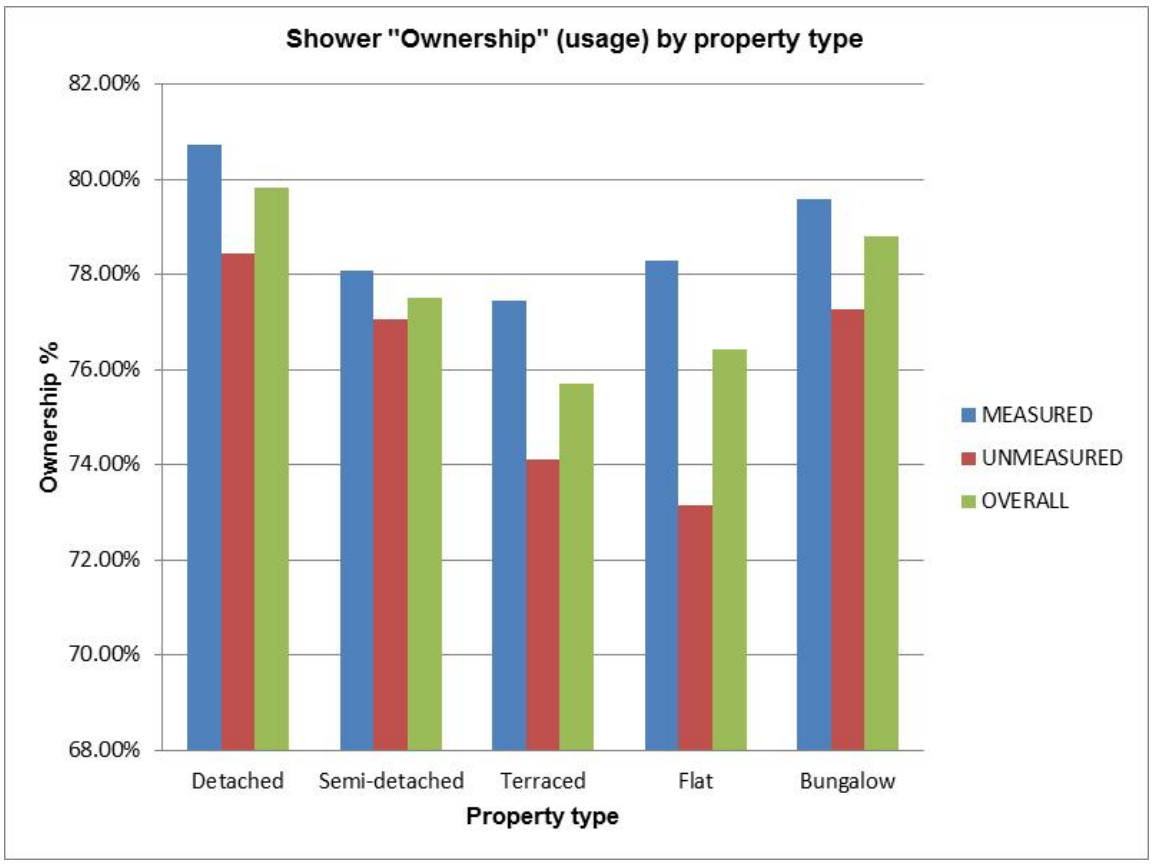


Chart 7-A Proportion of Personal Washing Events Taken as Showers

According to the survey responses, just over three quarters of personal washing events are showers (normal or power) with the residual being baths.

The proportion of showering events which are power showers is shown below, with the residual being normal showers:

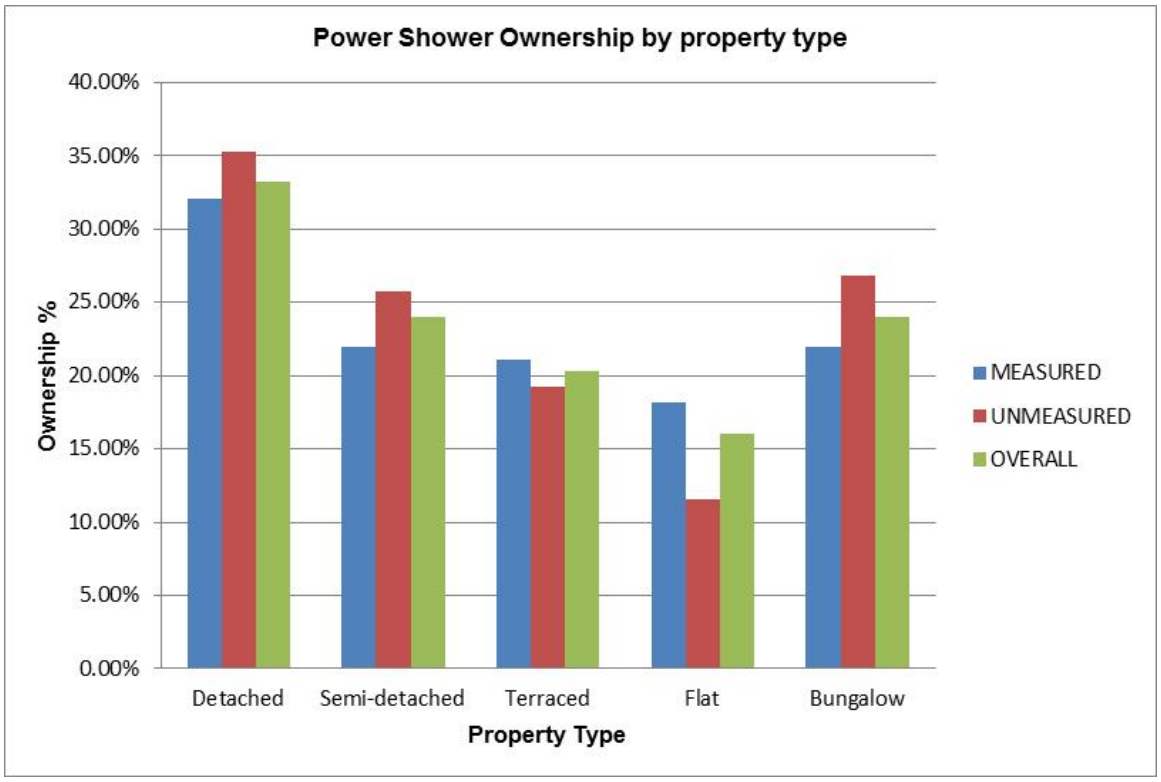


Chart 7-B Proportion of Shower Events that Use a Power Shower

The overall proportion of 22% is in line with the range of 20 to 25% from Defra's Market Transformation Programme Briefing Note on Showers.

7.2 Volume per Use and Frequency of Use

Defra's MTP briefing note on the split of the UK's installed shower stock in 2010 provides a range of flow rates for various electric showers, gravity fed showers and pumped (power) showers. The reported weighted average flow rate of power showers is 12 litres/minute and this has been used in the model. The average flow rate of electric showers is 5 litres/minute and the average of gravity showers is 7 litres/minute and therefore a flow rate of 6 litres/minute has been used for normal showers.

A common shower duration of 7 minutes has been used for all shower types across all customers. This is based on surveys undertaken by the company and results published from recent results by schools in the region.

Combining the flow rates with the duration gives a power shower volume per use of 84 litres and a normal shower volume of 42 litres.

All baths have been assumed to have an average volume of 80 litres.

The frequency of personal washing has been derived from the survey with the following results:

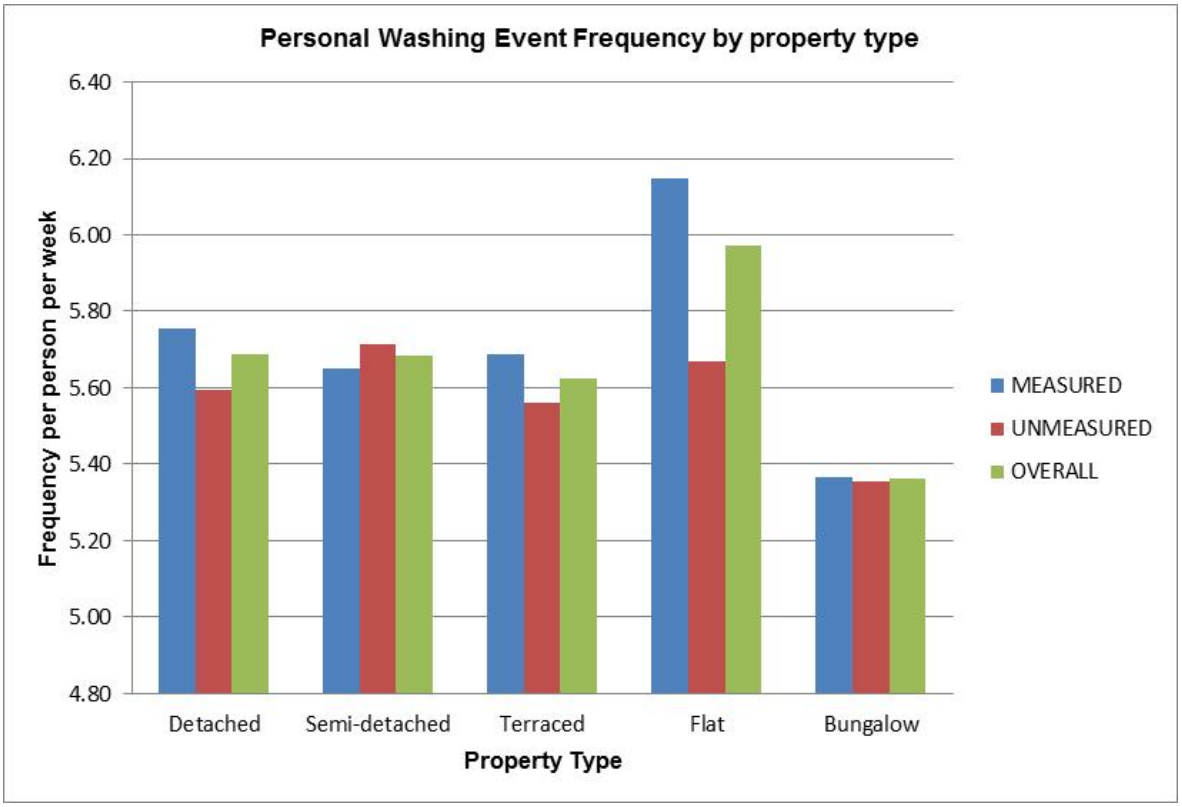


Chart 7-C Personal Washing Frequency

Combining the frequency of use data with the volumes per use gives the following base year consumption figures for the personal washing micro component in litres/person/day.

	Normal Showers	Power Showers	Baths	Total
Measured	20.22	13.94	13.63	47.80
Unmeasured	19.22	13.26	15.00	47.49
Overall	19.60	13.52	14.49	47.61

7.3 Forecast Assumptions and Results

The average duration of all showers of seven minutes remains constant over the forecast period as there is no basis for predicting any change. The bath volume and flow rates of normal and power showers also remain constant over the period. Therefore the forecast variables are the change in the overall frequency of personal washing and the proportions of which are normal showers, power showers and baths.

The rate of increase of personal washing events is based upon the frequency increase between the 2007 and 2012 surveys. The overall average number of events has risen to 5.65/person/week from approximately 5.25 in 2007. The specific annual rates of change for measured and unmeasured customers have been used in the model up to a cap of 6 personal washing events/person/week. The cap is hit for most metered and unmetered customers by 2020.

There has been a major rise in the proportion of showers between the two surveys, to the current overall proportion of 77%. It is considered that the overall increase in washing frequency has been driven by the switch from baths to showers and that therefore future frequency growth will be limited to six events/person/week because the majority of the potential transfer from baths to showers has already occurred.

The switching from baths to showers is assumed to continue until a maximum proportion, 96%, of events are showers. This level is achieved by 2020 for most customer groups. The proportion of showers which are power showers grows in line with the MTP forecast from the base of 22% to approximately 25% by 2040.

The overall personal washing micro component forecast for metered and unmetered customers is shown below. This shows the demand reduction to 2020 as customers continue to switch from baths to showers and then a minor increase thereafter as the overall proportion of power showers continues to rise.

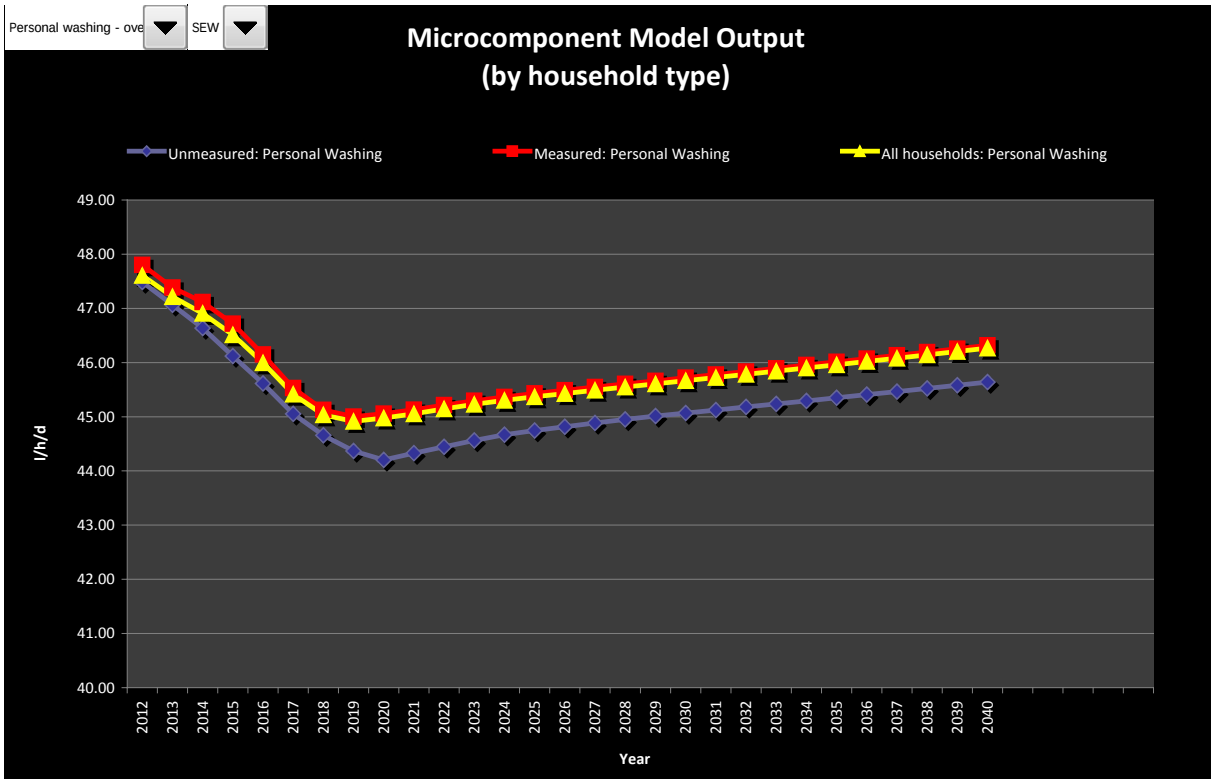


Chart 7-D Personal Washing Micro Component Forecast

8.0 CLOTHES WASHING

Clothes washing is made up of three activities:
1. Clothes washing in a washing machine
2. Clothes washing using a washer-dryer machine
3. Washing clothes by hand.

8.1 Ownership Data

As part of the customer survey, customers were asked which of the three clothes washing activities above they used and also how old any appliances were. The following charts summarise overall ownership levels and the age split of appliances.

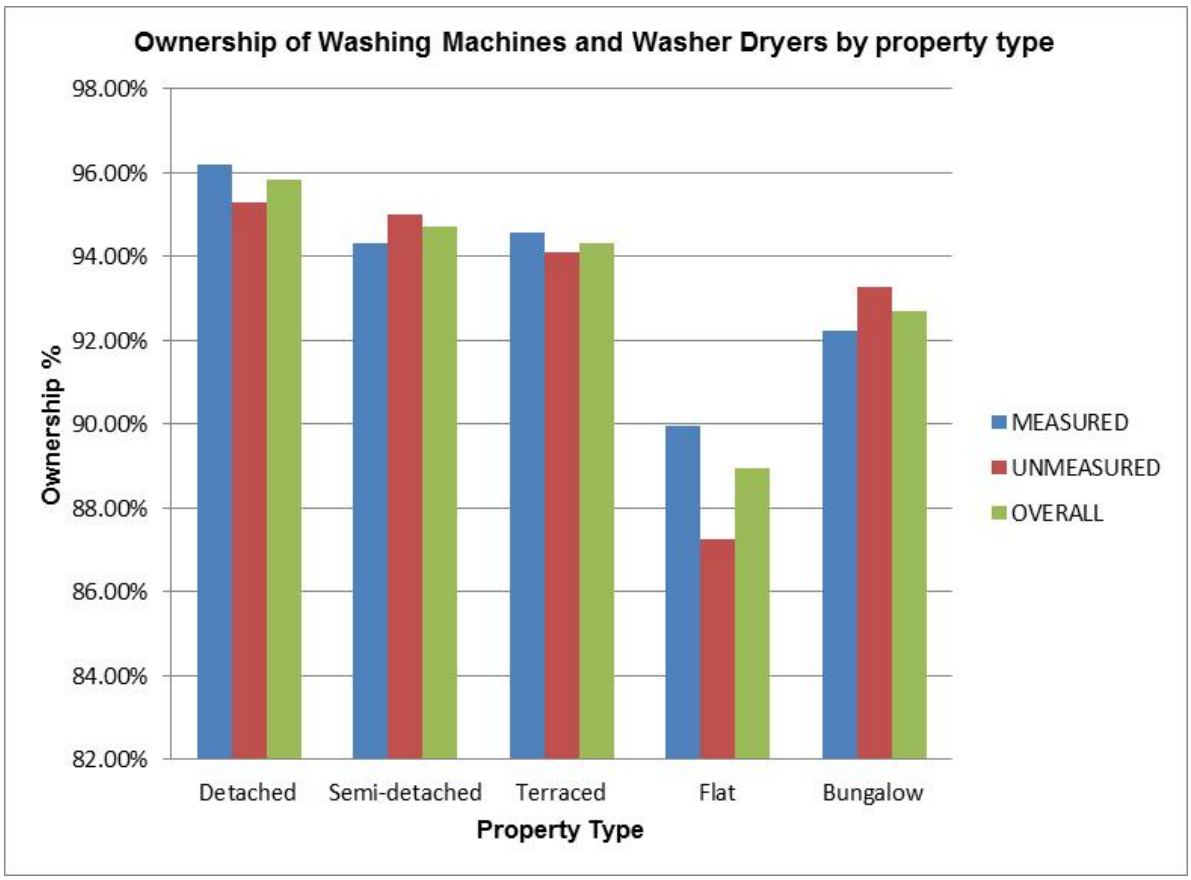


Chart 8-A Washing Machine or Washer Dryer Ownership

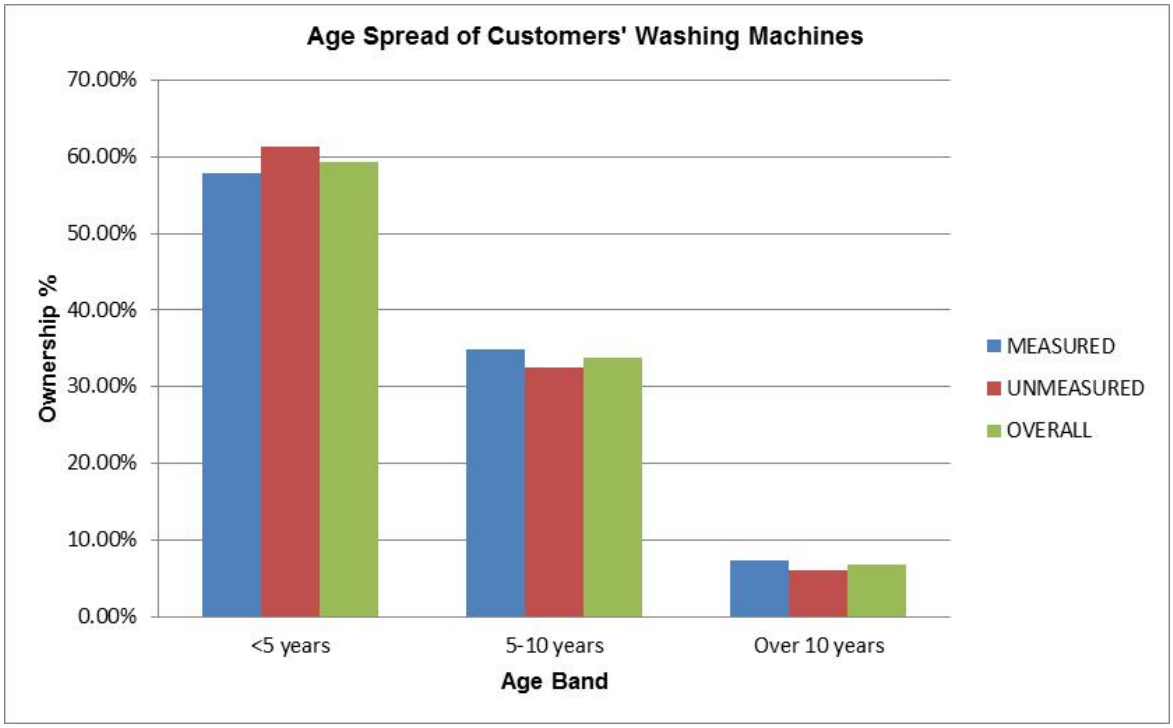


Chart 8-B Age Split of SEW Customer Washing Appliance Stock

These graphs show an overall ownership level of just under 95%. This is consistent with Defra's MTP national ownership estimate of 94% for 2012. MTP states that the lifespan of a washing machine is 12 years. Our results show that over 90% of appliances are ten years old or less, and with nearly 60% of appliances less than five years old suggests that the average life of machines is just over 4 years old.

As part of our survey we also asked customer whether they washed clothes by hand and the following chart summarises the proportions who responded that they do.

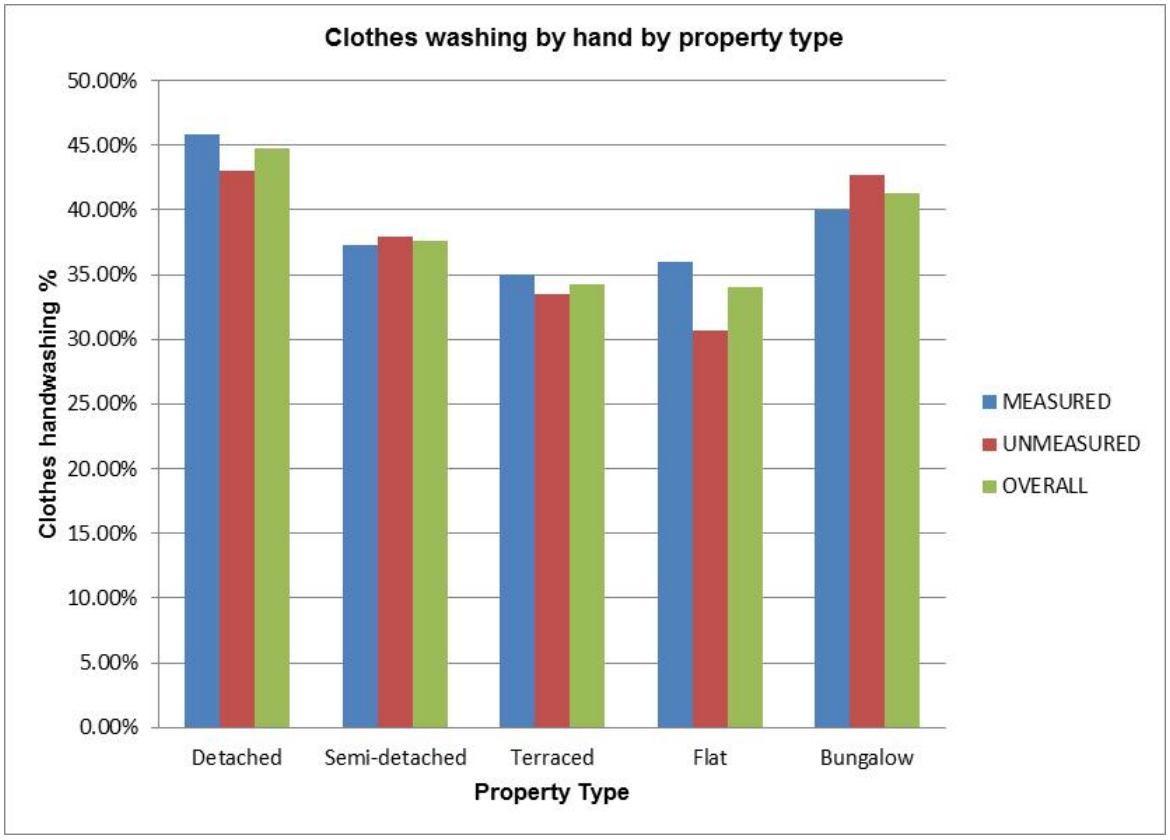


Chart 8-C Proportion of Customers that Wash Clothes by Hand

8.2 Volume per Use and Frequency of Use

The three age bands have been entered in to the model as different generations with the following average volumes per use for washing machines and washer-dryer machines.

Age Band	Generation	Washing Machine Volume (litres / use)	Washer-Dryer Volume (litres / use)
>10yrs	1	92.50	203
5-10 yrs	2	70.00	135
<5 yrs	3	50.00	90

We have estimated that unmetered customers use 35 litres on average for each hand washing event and that measured customers use 25 litres.

Our customer survey asked how many times per week the washing machine or wash-dryer is used and also how many times per month clothes are washed by hand. The following charts summarise the results.

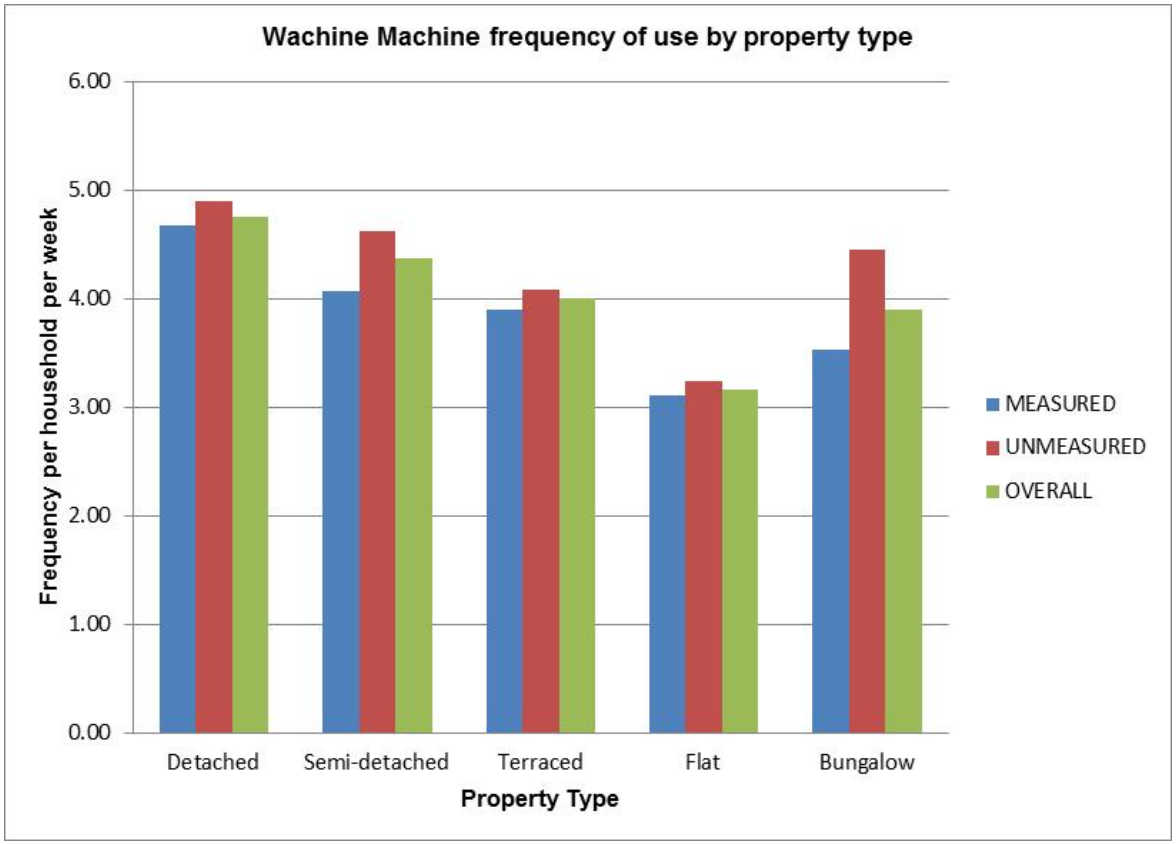


Chart 8-D Frequency of Washing Machine Use

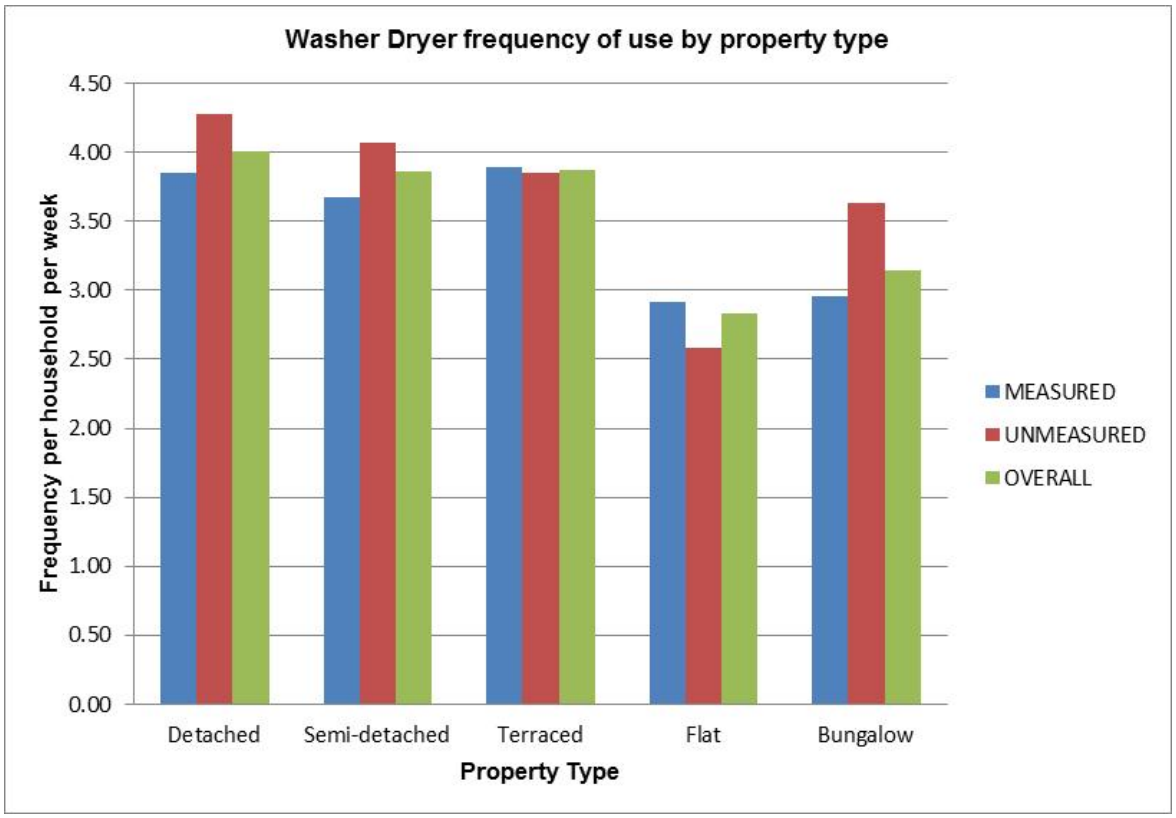


Chart 8-E Frequency of Washer Dryer Use

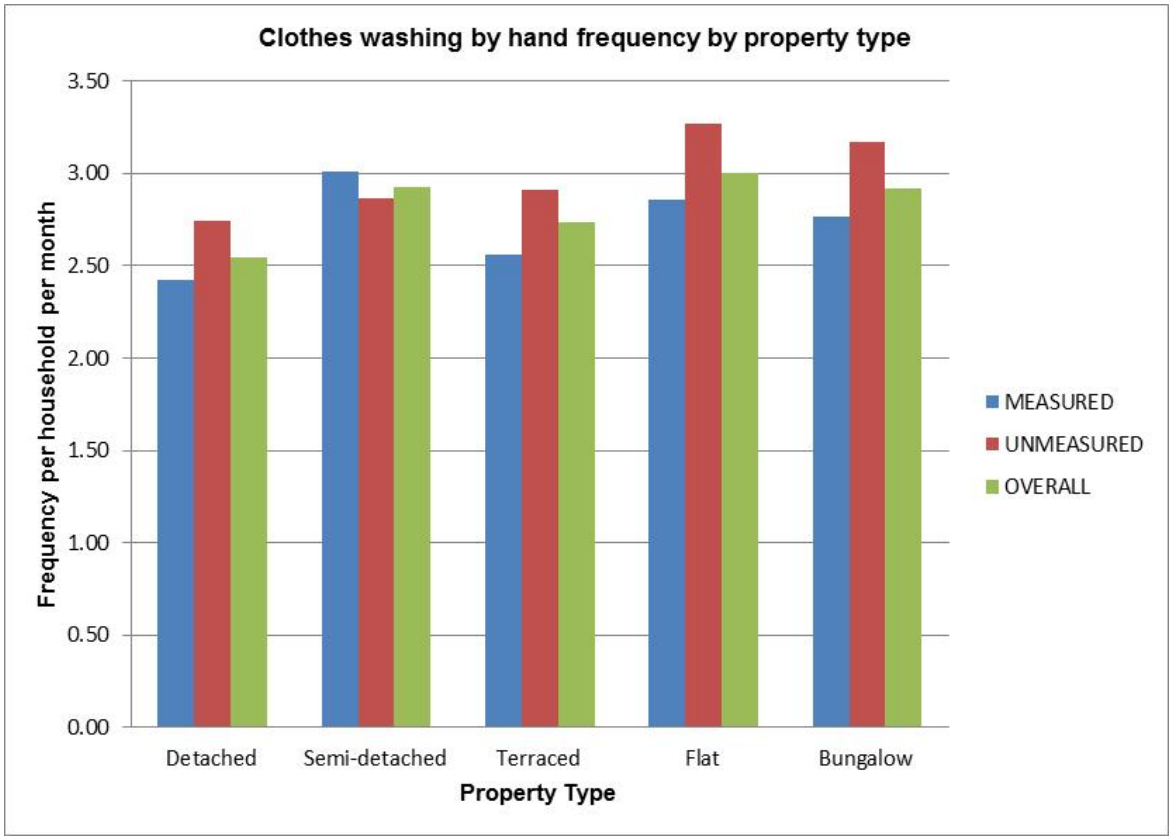


Chart 8-F Frequency of Clothes Washing by Hand

Combining the ownership, frequency of use data and volumes per use gives the following base year consumption figures for the clothes washing micro component in litres/person/day.

	Washing Machines	Washer - Dryers	Hand Washing	Total
Measured	14.22	3.88	0.18	18.27
Unmeasured	11.38	2.28	0.17	13.82
Overall	12.45	2.88	0.17	15.50

Clothes washing is a household activity rather than something that each member of the home does independently and therefore the above per capita values are sensitive to the assumed occupancy rates. As can be seen above, unmeasured properties have higher frequency of use, with similar levels of ownership and actually use more water clothes washing than metered properties. The lower unmeasured PCC component is due the higher occupancy rate than metered customers.

8.3 Forecast Assumptions and Results

The forecast clothes washing component of PCC is driven by changes in overall ownership of appliances, the replacement of old machines and the impact of changing household occupancies on frequency of use.

The current ownership level of just under 95%, overall, is forecast to increase by 0.25% per year to a maximum level of 99%. This level is achieved for most customer groups by the end of the forecast period.

Machines are assumed to be replaced with the most efficient model available. The forecast assumes that a new generation of washing machines and washer-dryers become available in 2022. They are assumed to have consumption values of 35 and 80 litres/cycle respectively.

The chart below shows how old appliances are replaced with more efficient models and that the new generation machines become dominant following their introduction in year 10 of the forecast. The overall increase is primarily driven by new properties as well as ownership rising from 95% to 99%. This profile is common across all eight water resource zones.

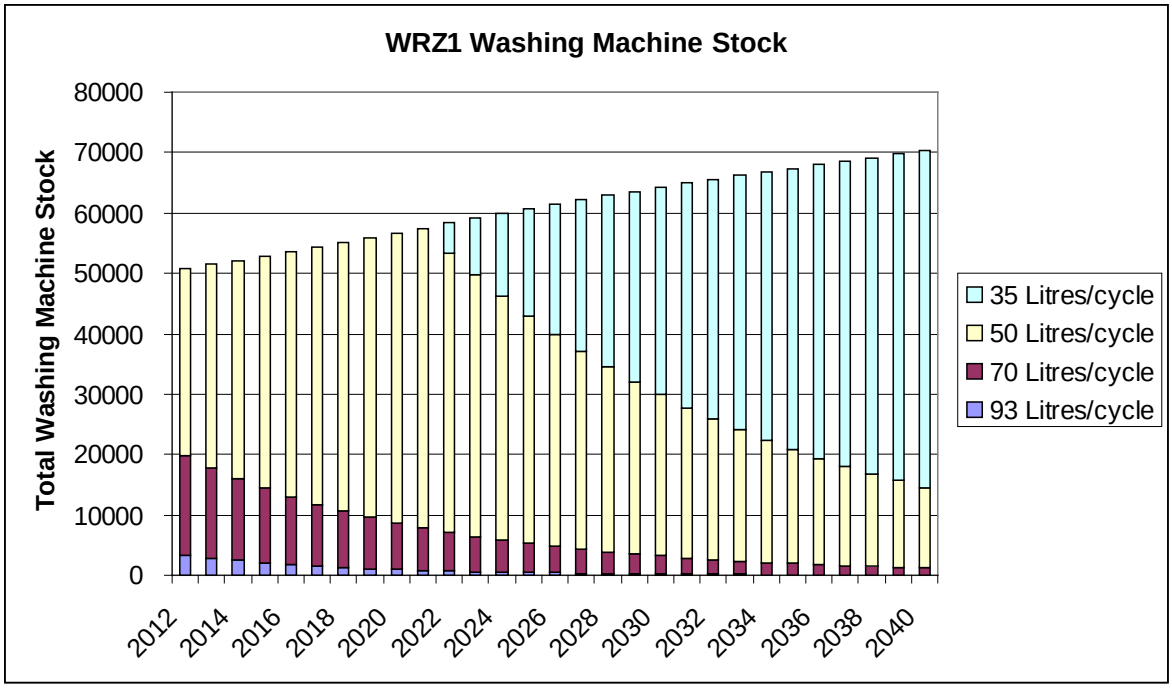


Chart 8-G Forecast of Washing Appliance Stock

Washing machine usage is considered a household activity, however, it is recognised that the amount of washing and hence frequency varies with the number of occupants. We have assumed that frequency varies by 25% of the proportional change in occupancy. If the average occupancy of a customer group were to reduce from 2.5 to 2.0 (20%) then we assume the household washing machine frequency of use will drop by 5%. The reduction in occupancy outweighs the reduction in frequency and therefore the per capita consumption of this component would therefore rise if everything else was constant.

The combined impacts of these forecast factors are presented in the chart below of the clothes washing micro component forecast.

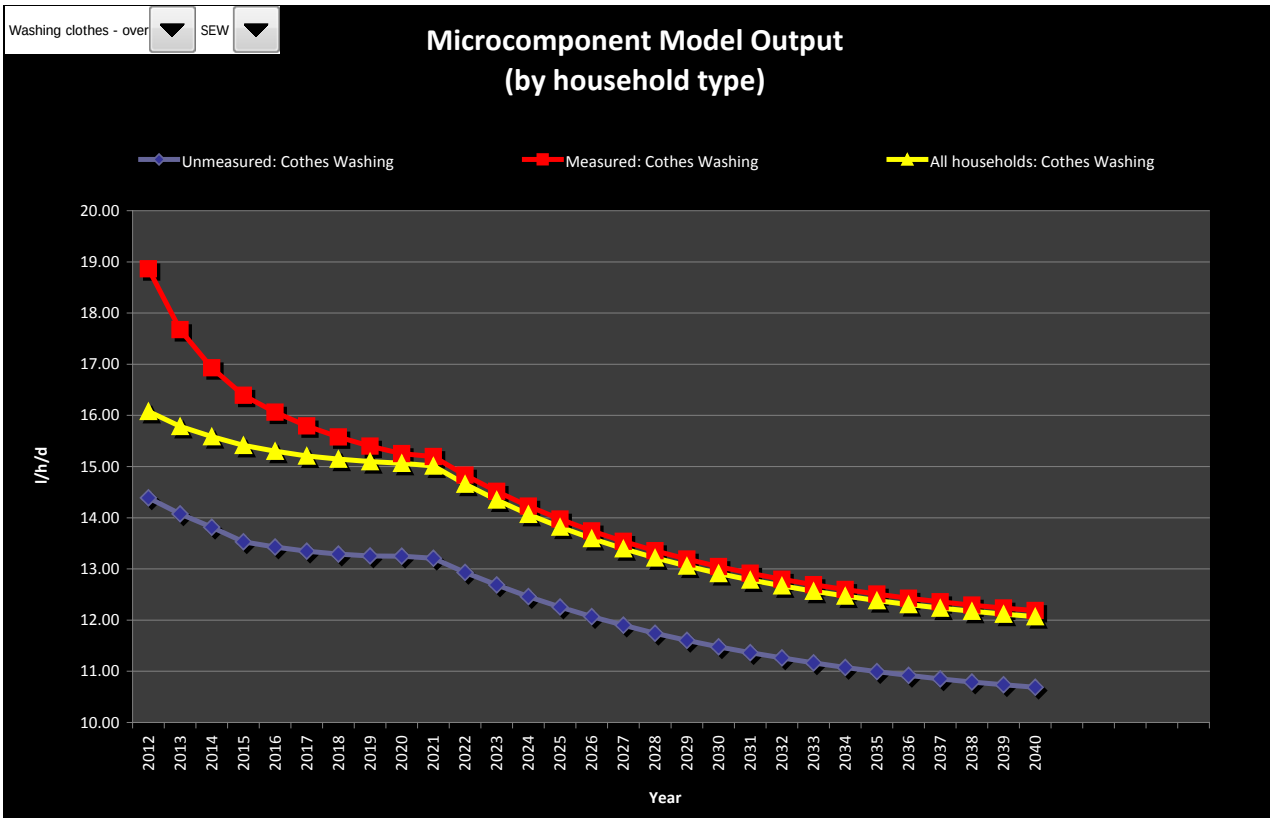


Chart 8-H Forecast of Clothes Washing Micro Component

9.0 DISH WASHING

The dish washing micro component covers washing up in the sink or a bowl and the use of dishwashers.

9.1 Ownership Data

As part of the customer survey, customers were asked if they owned a dishwasher and how old it was and whether they washed dishes by hand.

The following chart summarises the ownership of dishwashers by property type, for measured and unmeasured customers. There is a significant variation between the property types from 20% for unmeasured flats to 77% for metered detached houses, with an overall average of 51%. With the exception of flats, the ownership of dishwashers does not vary between measured and unmeasured customers.

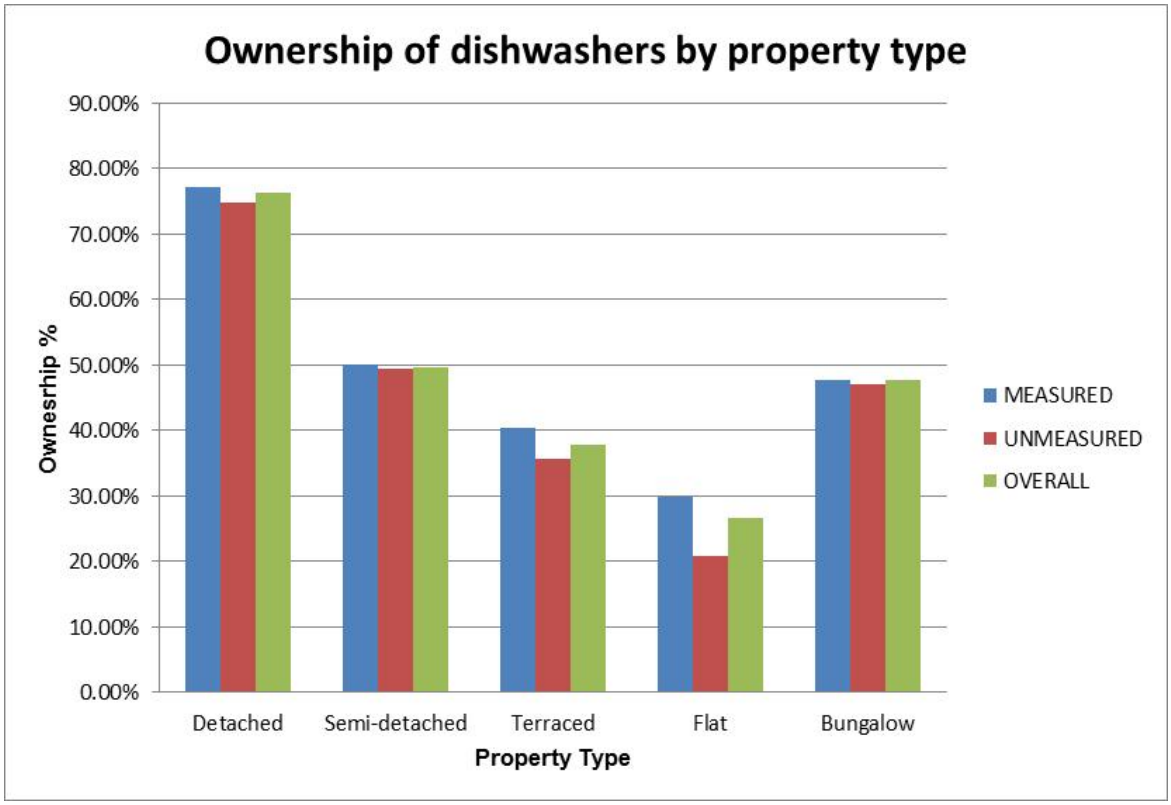


Chart 9-A Dishwasher Ownership by Property Type

The following chart summarises the age profile of dishwashers amongst measured and unmeasured customers. Again there is very little difference between the measured and unmeasured groups. Like the results for washing machines, the majority of appliances are less than five years old.

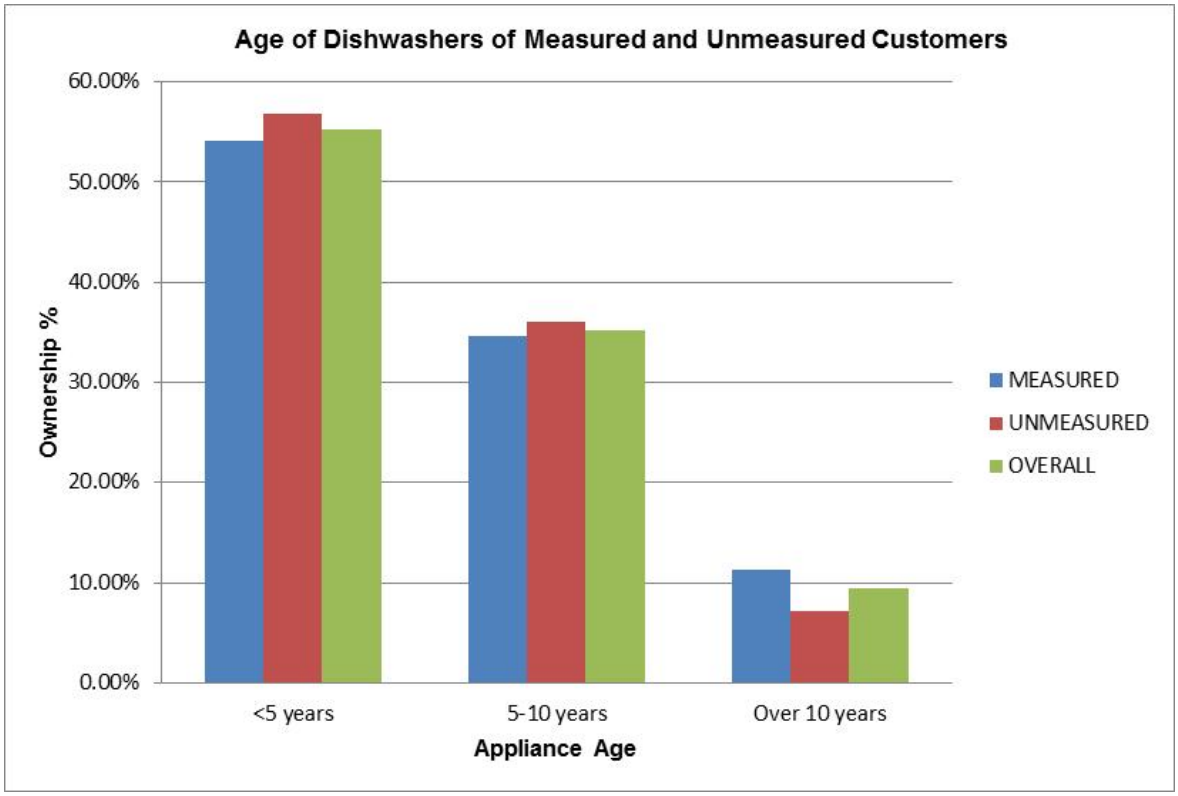


Chart 9-B Age Split of Dishwasher Stock

We also asked customers whether they washed dishes by hand. The following chart summarises the responses by property type.

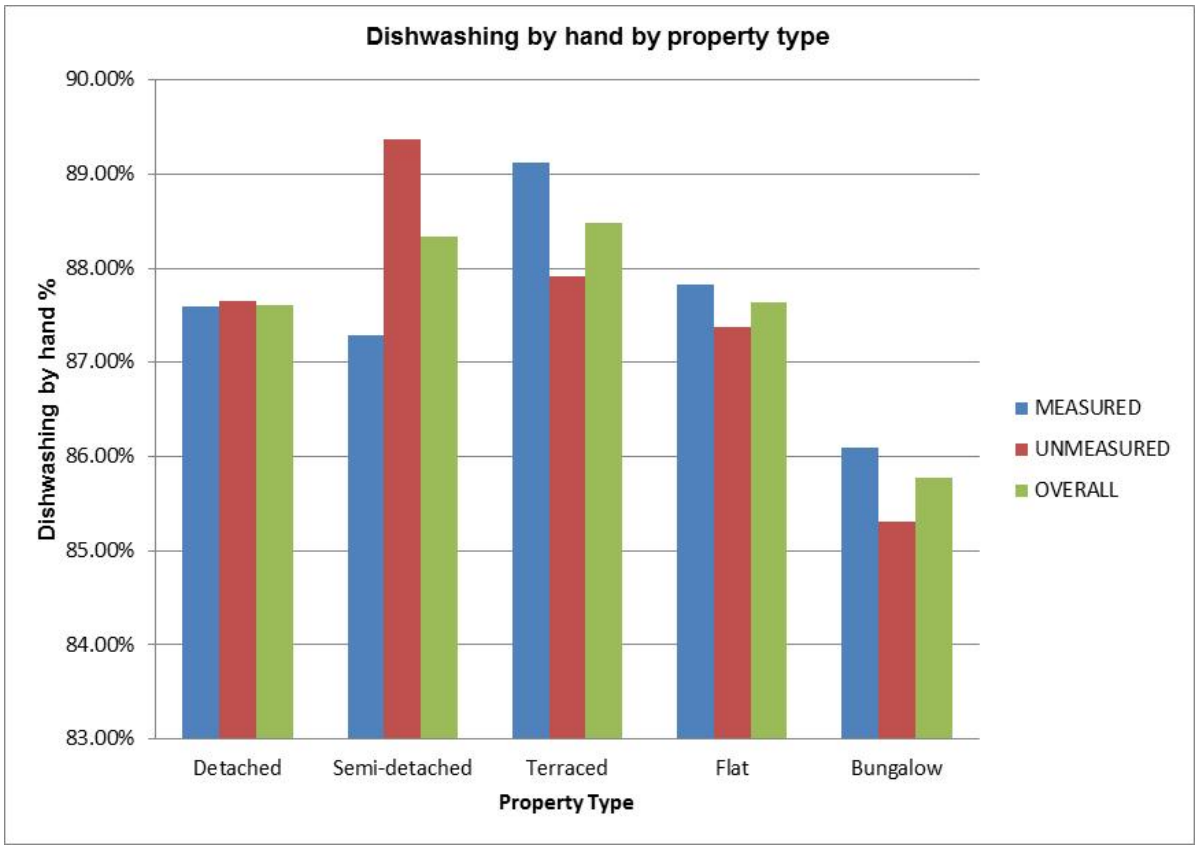


Chart 9-C Proportion of Customer that Wash Dishes by Hand

As can be seen in the chart, the responses are all very similar, with all customer groups having a response rate of 85 to 90%.

9.2 Volume per Use and Frequency of Use

The three dishwasher age bands have been entered in to the model as different generations with the following average volumes per use.

Age Band	Generation	Dishwasher Volume (litres / use)
>10yrs	1	25.00
5-10 yrs	2	18.00
<5 yrs	3	15.00

We have estimated that customers who own a dishwasher use 10 litres on average for each hand washing event whereas those who don't own one use 25 litres. This is on the basis that those with a dishwasher only use a single bowl of water with rinsing for a small number of items that are not machine compatible.

Our customer survey asked how many times per week the dishwasher is used and also how many times per week dishes are washed by hand. The following charts summarise the results.

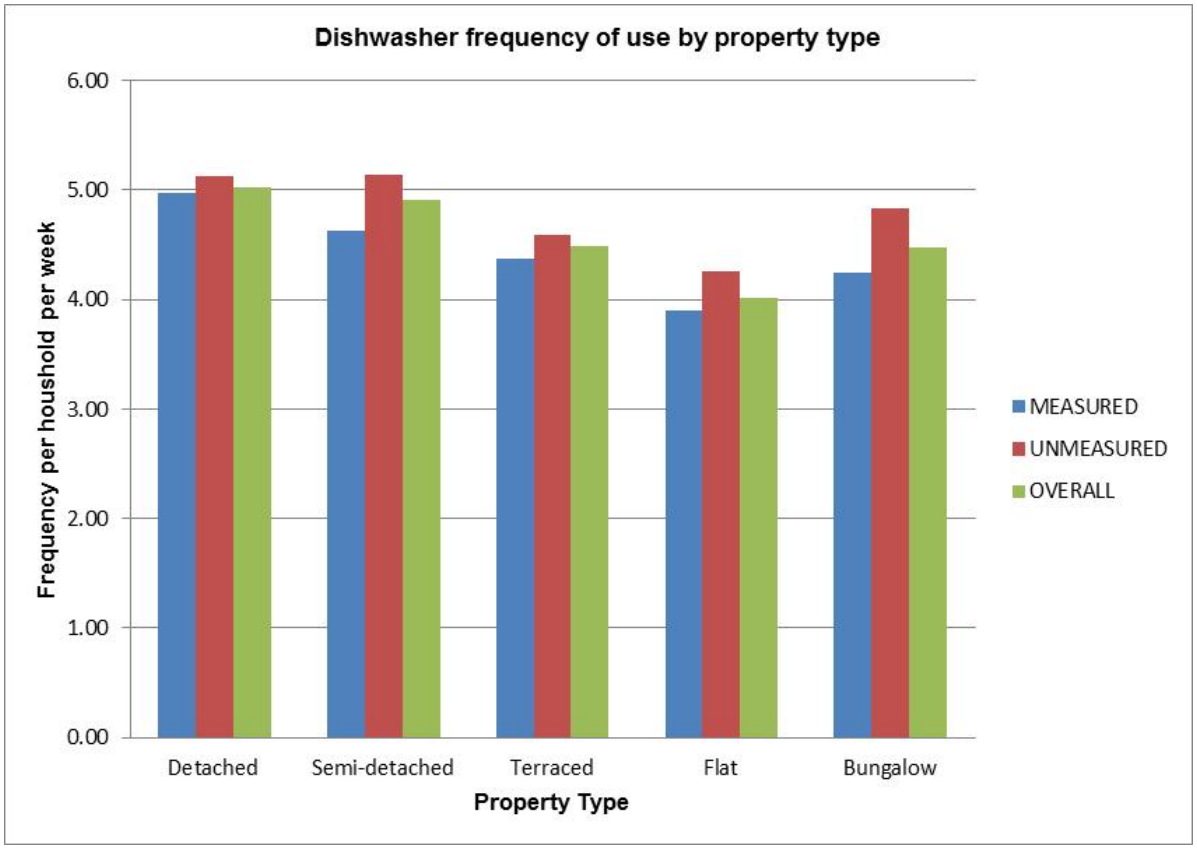


Chart 9-D Dishwasher Frequency of Use

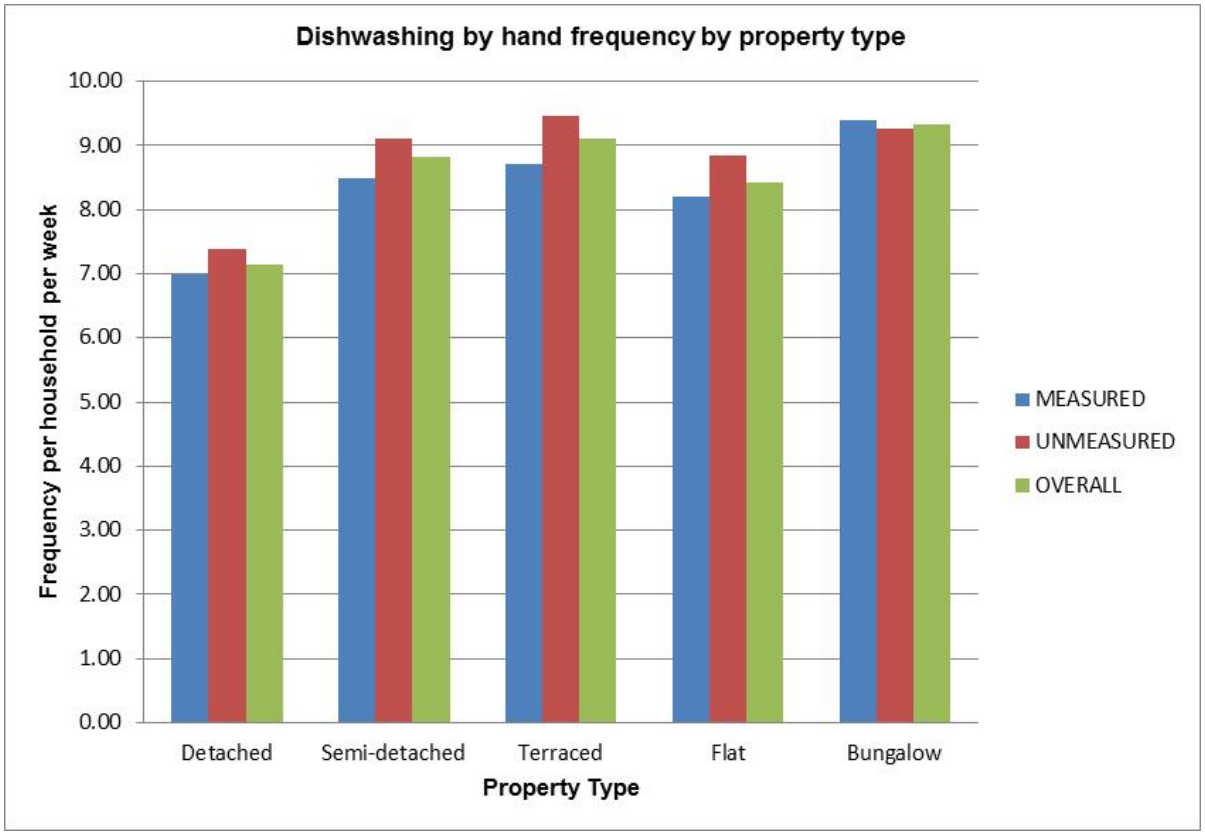


Chart 9-E Dish Washing by Hand Frequency

Combining the ownership, frequency of use data and volumes per use gives the following base year consumption figures for the dish washing micro component in litres/person/day.

	Dishwasher	Hand Washing	Total
Measured	2.98	9.39	12.38
Unmeasured	2.04	7.81	9.85
Overall	2.40	8.41	10.80

Like clothes washing, dish washing is a household activity rather than something that each member of the home does independently and therefore the above per capita values are sensitive to the assumed occupancy rates. The lower unmeasured PCC component is due the higher occupancy rate than metered customers.

9.3 Forecast Assumptions and Results

The forecast dish washing component of PCC is driven by changes in overall ownership of appliances, the replacement of old machines and the impact of changing household occupancies on frequency of use.

The current ownership level of approximately 51%, overall, is forecast to increase by 1% per year, resulting in overall average ownership reaching 79% by 2040.

Machines are assumed to be replaced with the most efficient model available. The forecast assumes that a new generation of washing machines become available in 2013. They are assumed to have a consumption value of 12 litres/cycle.

The chart below shows how old appliances are replaced with more efficient models and that the new generation machines become dominant following their introduction in year 1 of the forecast. The overall increase is primarily driven by new properties as well as ownership rising from 51% to 78%. This profile is common across all eight water resource zones.

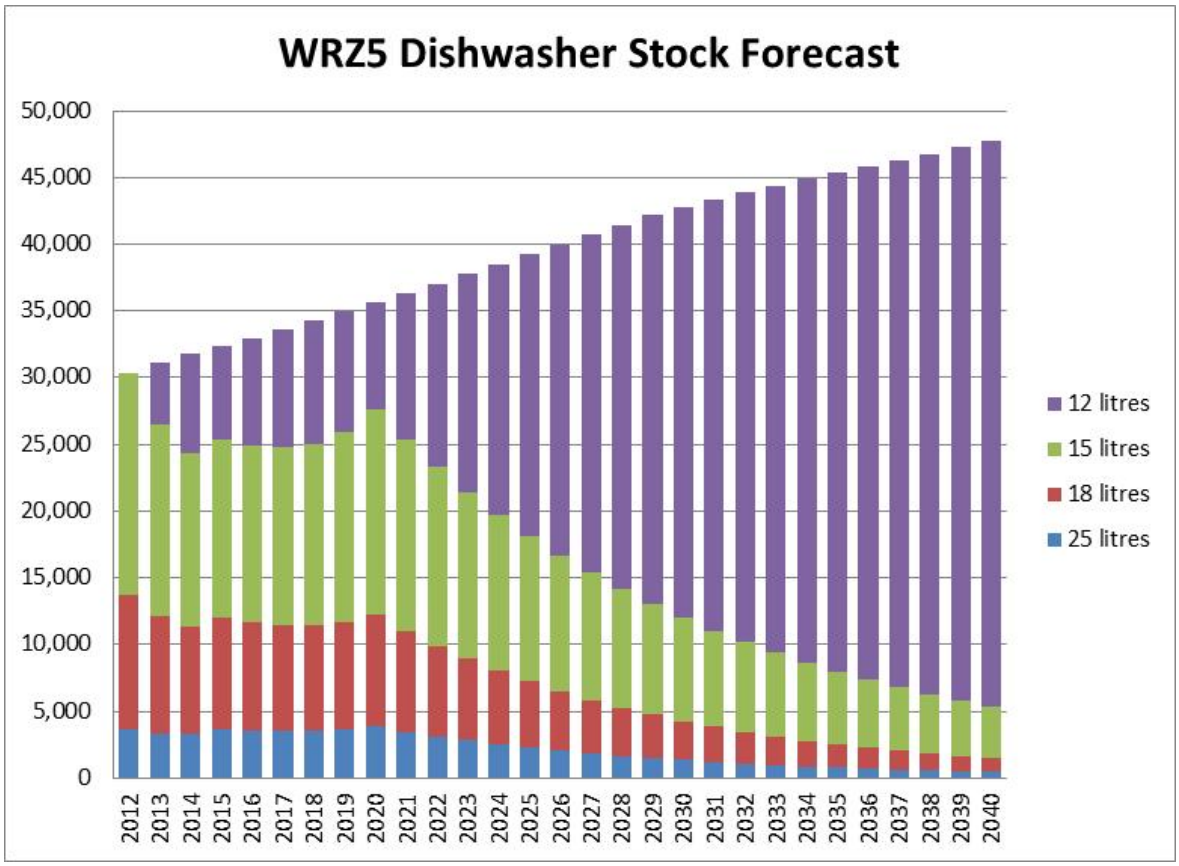


Chart 9-F Forecast of Dishwasher Stock

Dishwashing is considered a household activity, however, it is recognised that the amount of washing and hence frequency varies with the number of occupants. As with clothes washing, we have assumed that frequency varies by 25% of the proportional change in occupancy. This is the only assumed driver of frequency change and the impact of this and the above changes in stock produce the chart below of the clothes washing micro component forecast.

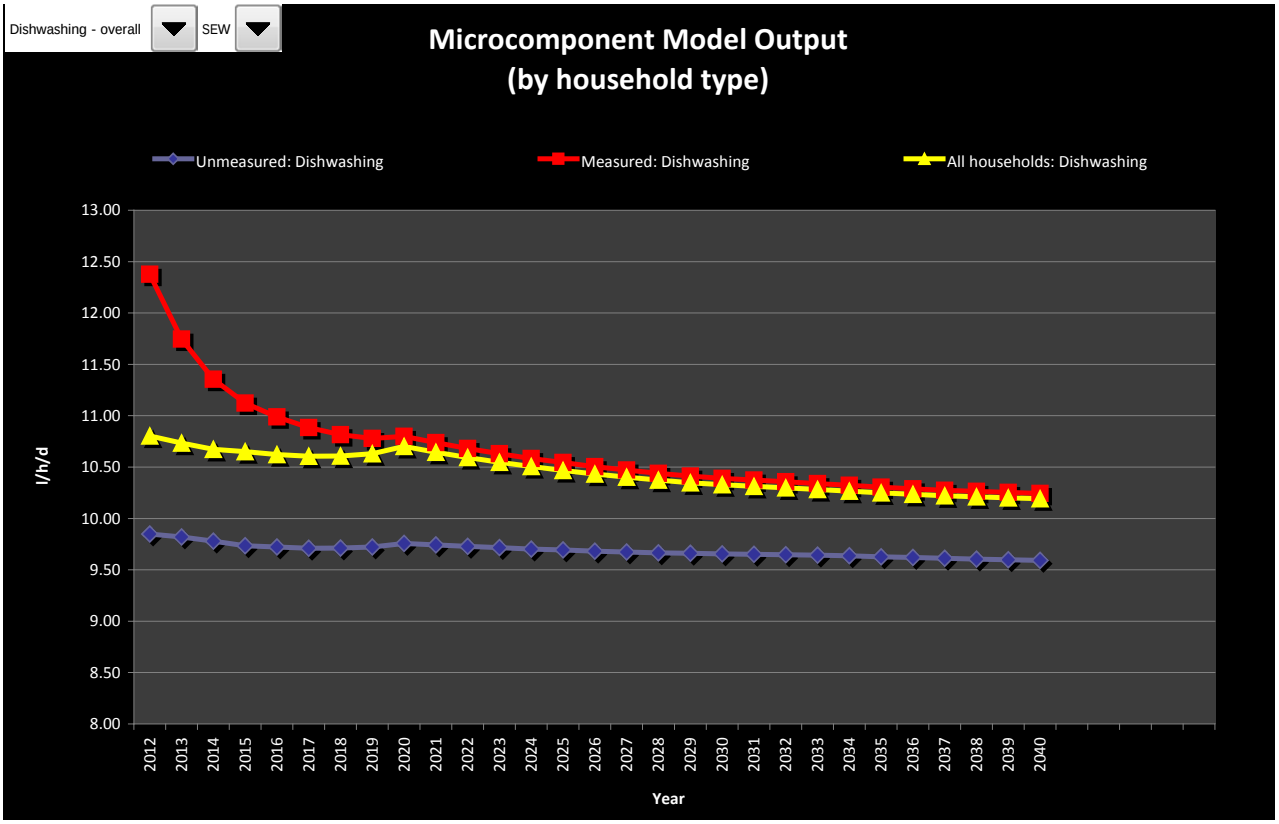


Chart 9-G Forecast of Dish Washing Micro Component

10.0 OUTDOOR WATER USE

The micro component covers all external water use for garden watering, car washing, ponds, pools and hot tubs and other miscellaneous uses such as bike washing and patio jet washing.

Customers were asked about their garden watering methods (hose, hose with trigger, sprinkler, watering can) frequency and duration. They were also asked how they wash their cars and frequency and whether they filled or topped up a pond, swimming pool or hot tub.

10.1 Ownership of External Devices

The following charts summarise the ownership of the various garden watering and other external appliances.

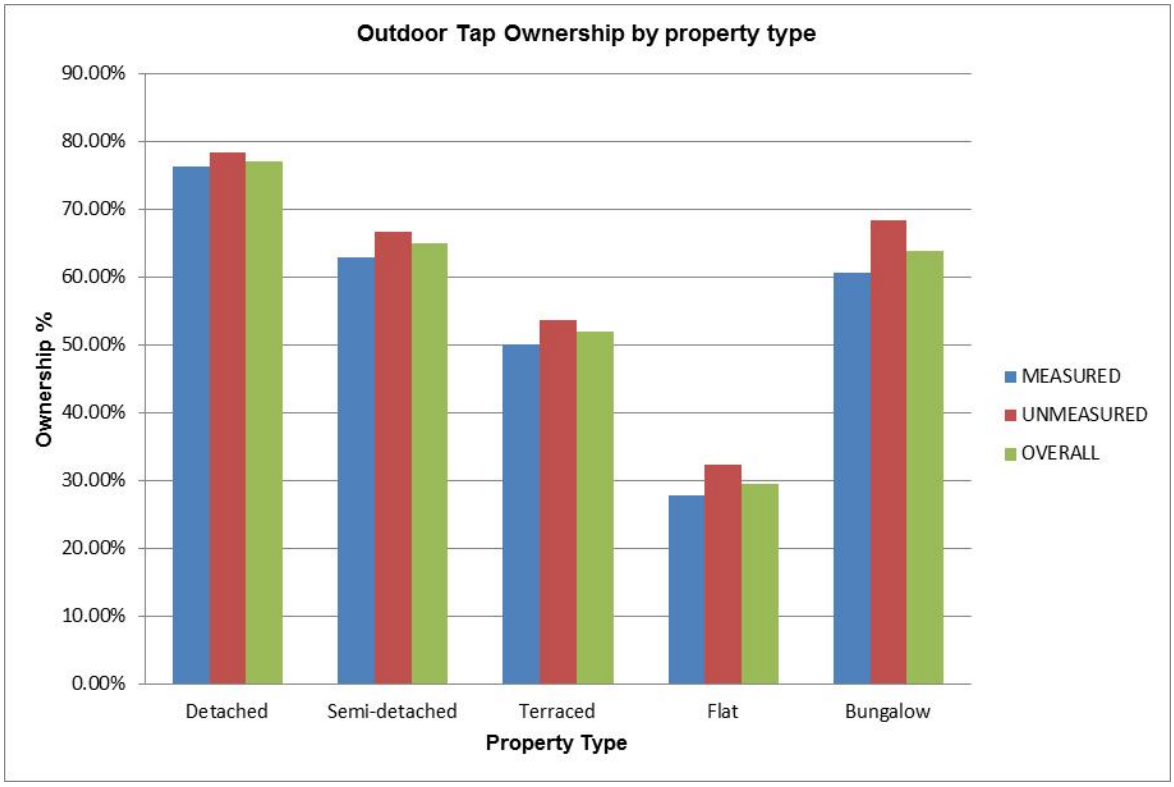


Chart 10-A Outdoor Tap Ownership by Property Type

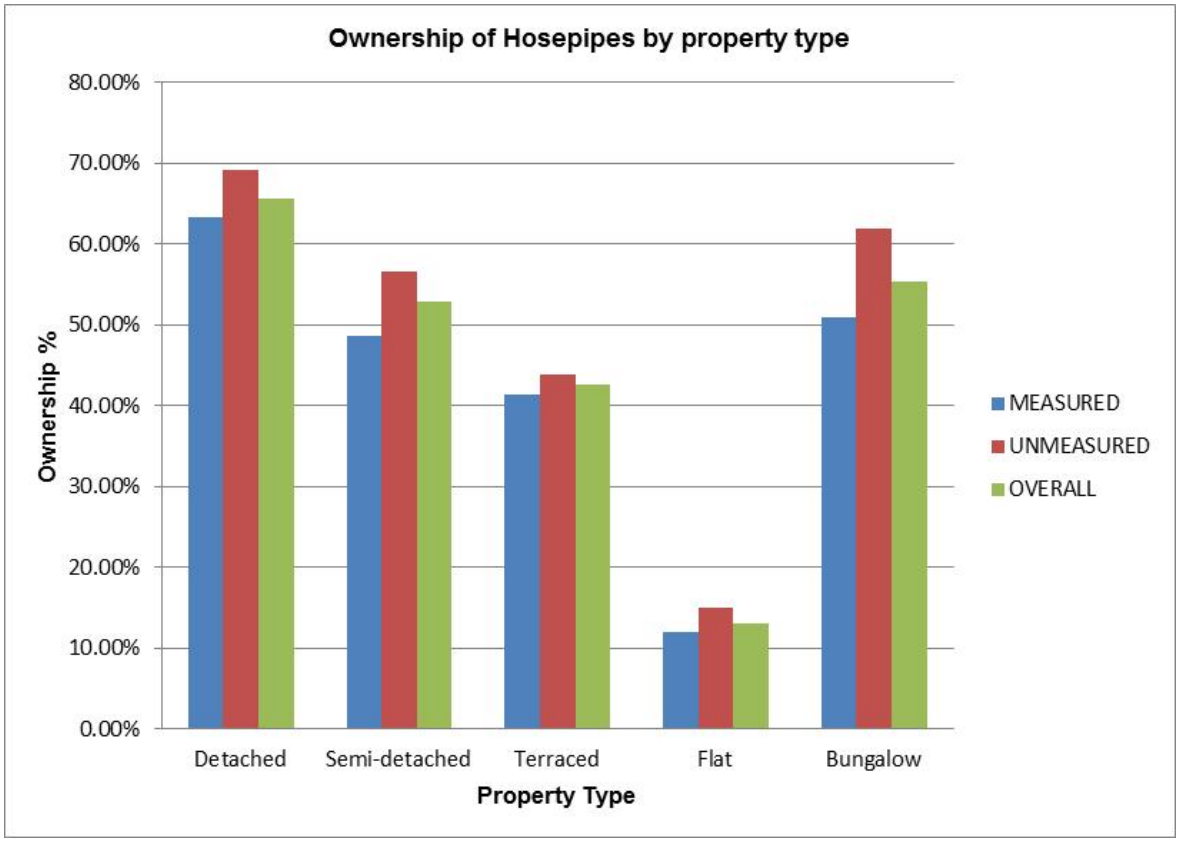


Chart 10-B Ownership of Hosepipes by Property Type

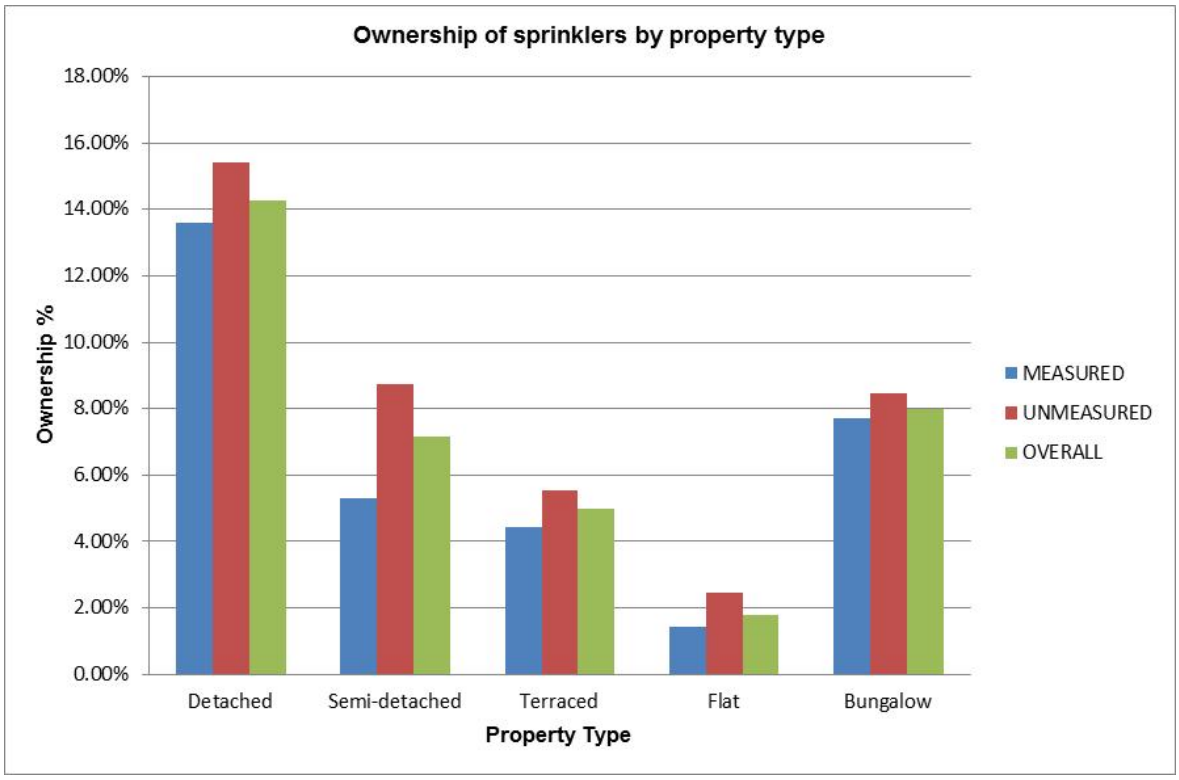


Chart 10-C Ownership of Sprinklers by Property Type

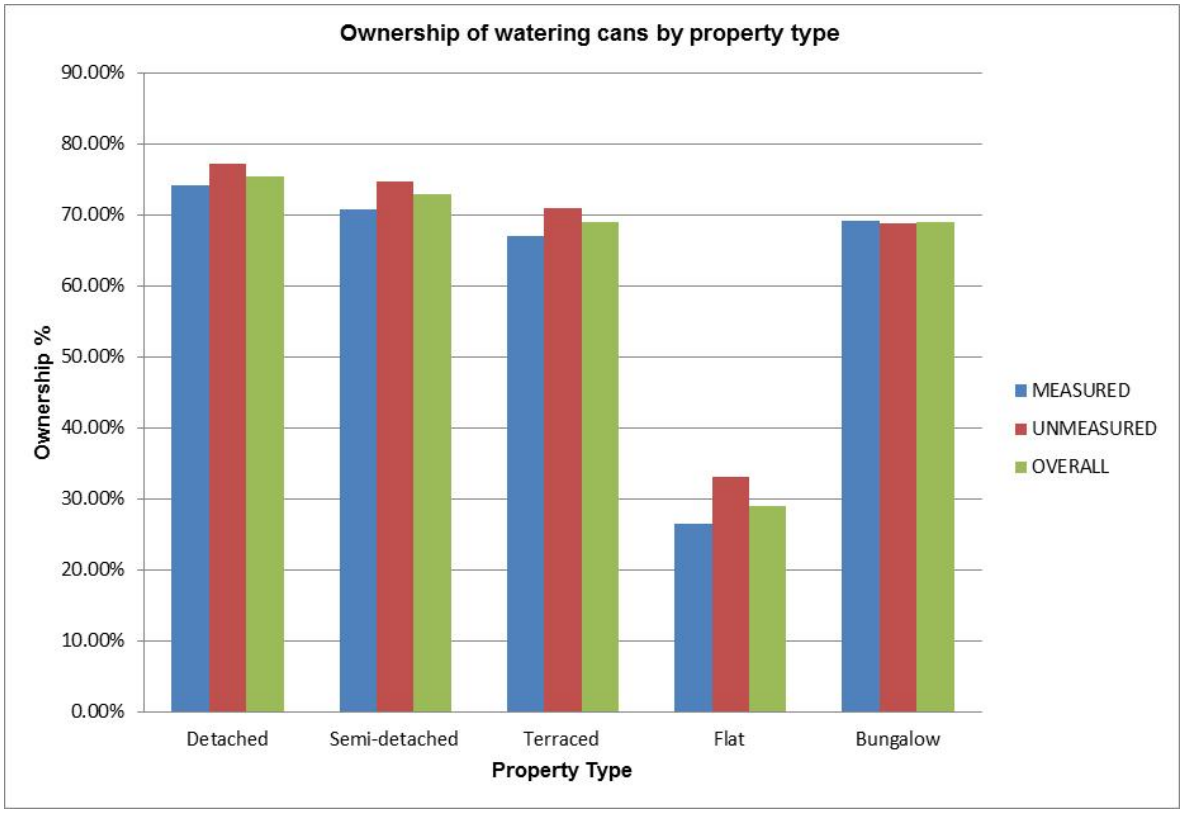


Chart 10-D Ownership of Watering Cans by Property Type

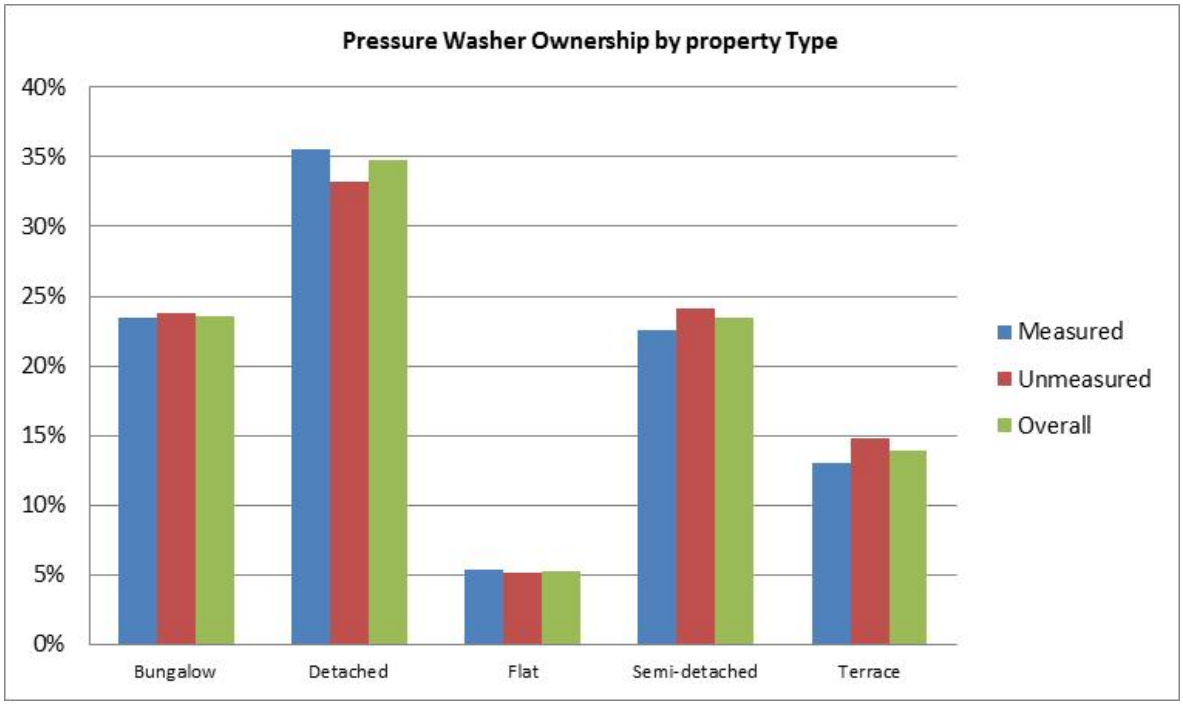


Chart 10-E Ownership of Pressure Washers by Property Type

For the purpose of understanding water usage and forecasting it was important to establish which of these appliances are actually used for what activities.

We therefore established from the survey, results of how customers water their gardens and wash their cars with the following results.

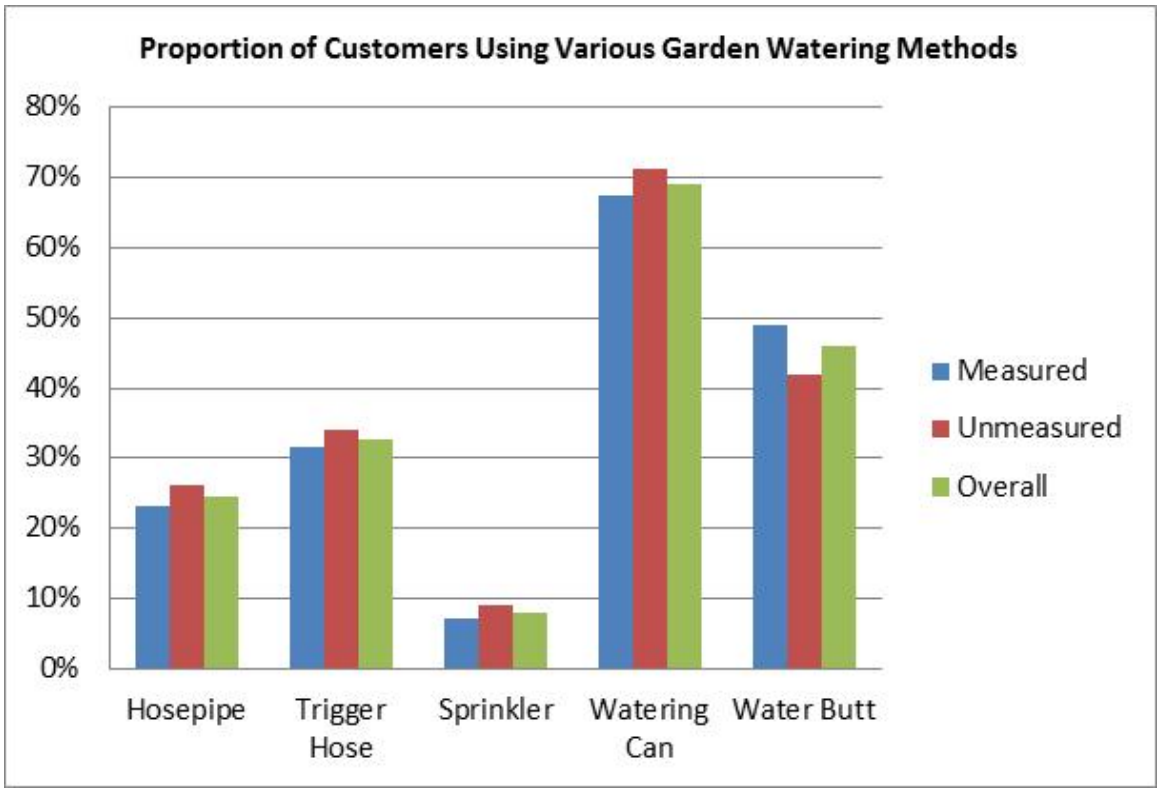


Chart 10-F Garden Watering Proportions

The sum of the types for measured and unmeasured customers is greater than 100%, indicating that customers use a range of appliances. Given the high proportion of customers using watering cans it is reasonable that this method is often used in addition to the other types, where present. Water butt usage is proportionally higher amongst measured customers.

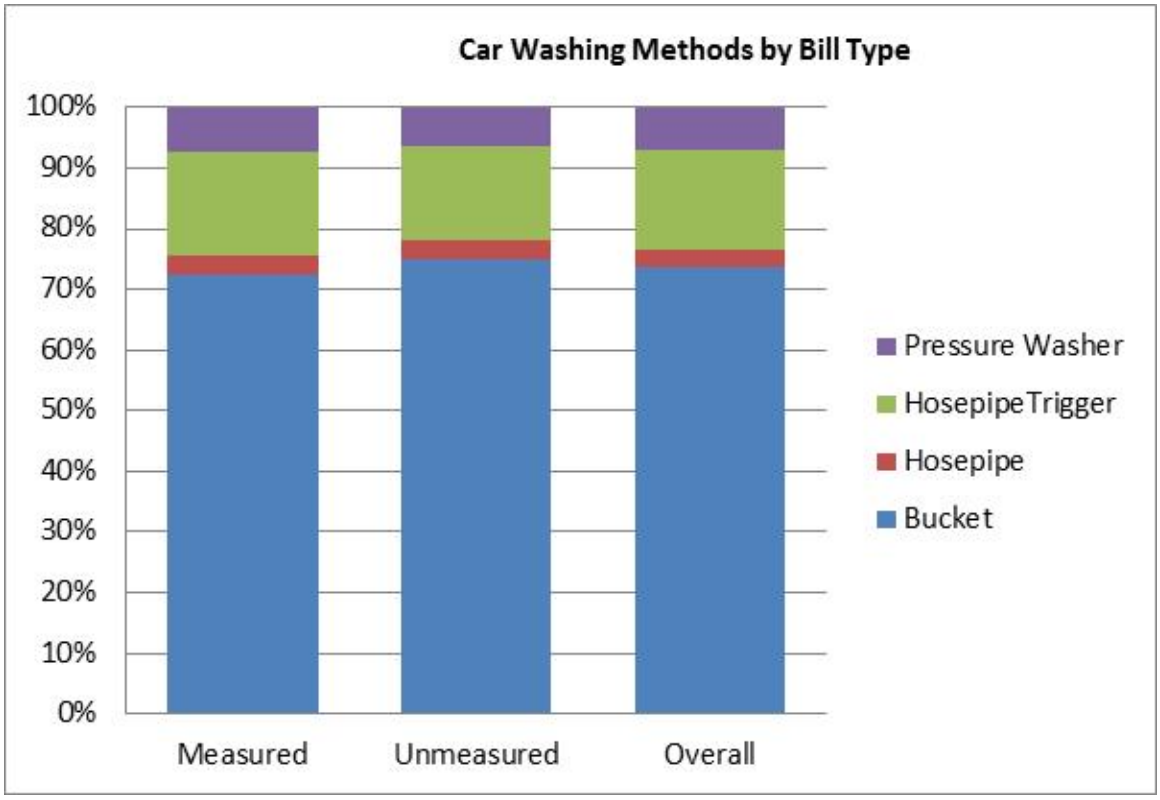


Chart 10-G Car Washing Methods

The results suggest that metering does not influence car washing method.

10.2 Volume per Use and Frequency of Use

External uses do not involve a pre-set, appliance cycle volume as seen with toilets, washing machines and dishwashers. For hosepipe activities we have established average event durations for each customer group and multiplied these by an assumed flow rate of 18 litres/hour. For watering cans and car washing by bucket we have assumed a number of fills and an average fill volume. For topping up of pools, ponds and hot tubs we have estimated typical volumes based on industry data regarding overall sizes and amounts of water that are replaced.

Garden watering activities with a hosepipe are entered in to the micro component model as a combined average number of minutes per event per customer group. Watering can events are modelled by a number of cans per event per customer group and an average can volume.

Customers were asked how often (daily, weekly etc) they did each garden watering activity over the summer period. The average values for each customer group have been converted to an average number of events per week over the year and the results are provided in the charts below.

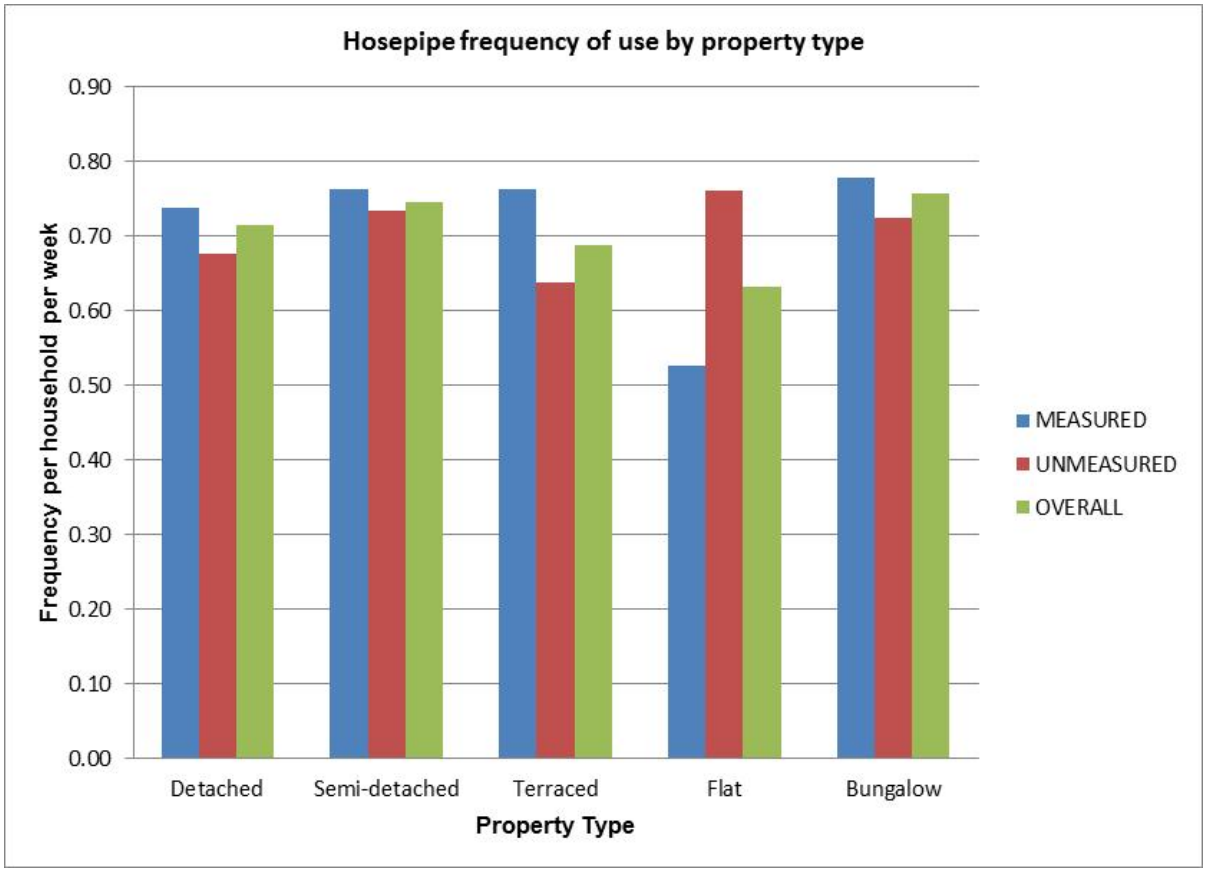


Chart 10-H Hosepipe Frequency of Use

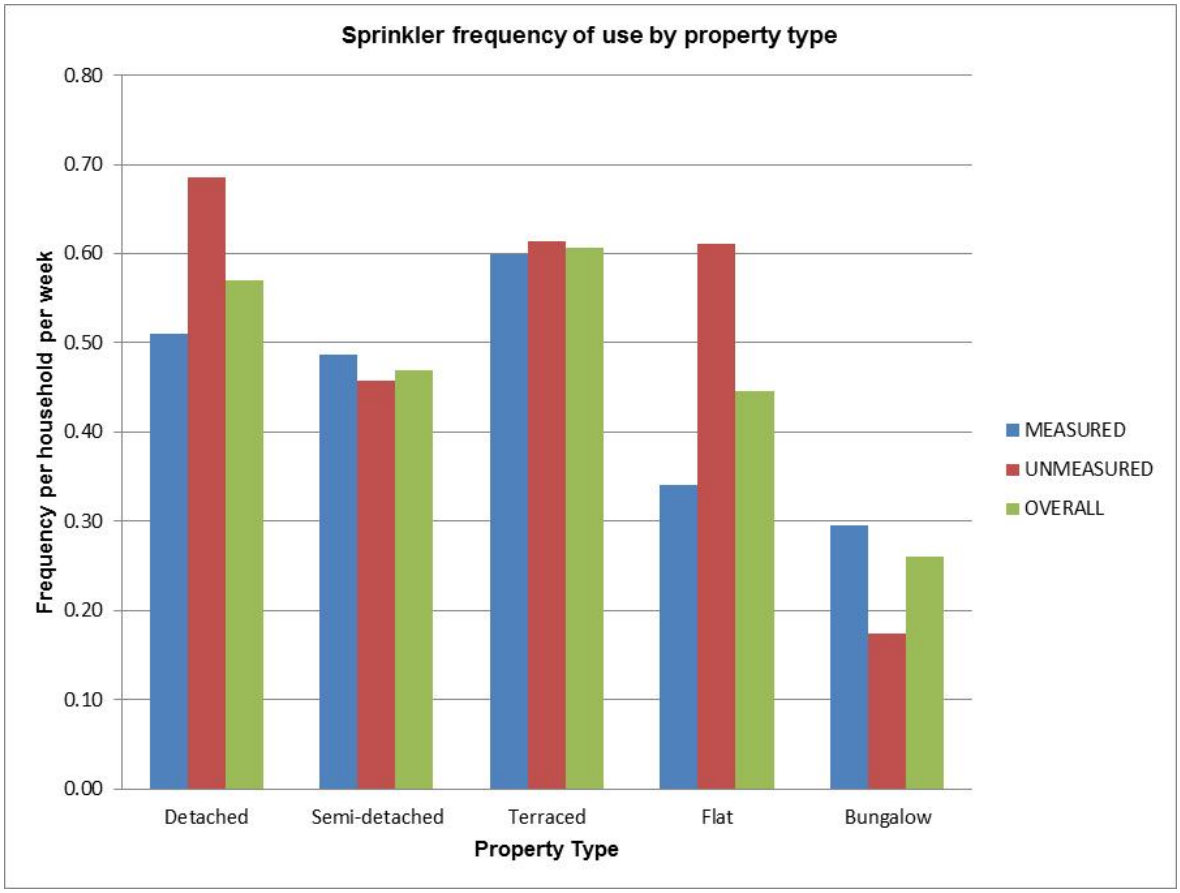


Chart 10-I Sprinkler Frequency of Use

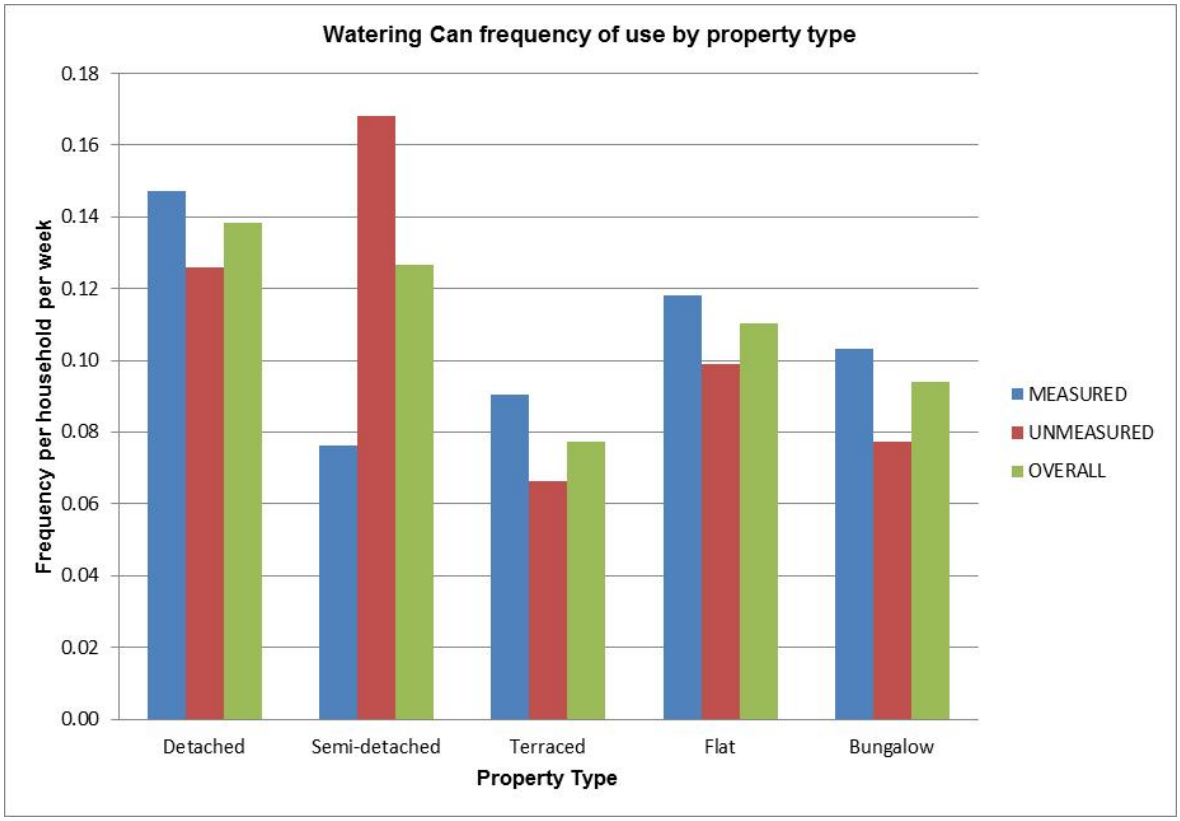


Chart 10-J Watering Can Frequency of Use

Car washing and pond and pool filling consumption estimates are relatively small and have been converted to an equivalent number of minutes of outside tap use, based on a flow rate of 18 litres/hour. This has been done for each property group using the relevant survey responses. A miscellaneous outside usage has been added to this component as a number of minutes. A higher value has been assigned to unmeasured than measured customers.

10.3 Forecast Assumptions and Results

Changes in external water use are forecast due to increasing ownership, duration and frequency of certain devices and activities.

The overall per capita forecast for measured and unmeasured customers of external water use is shown below.

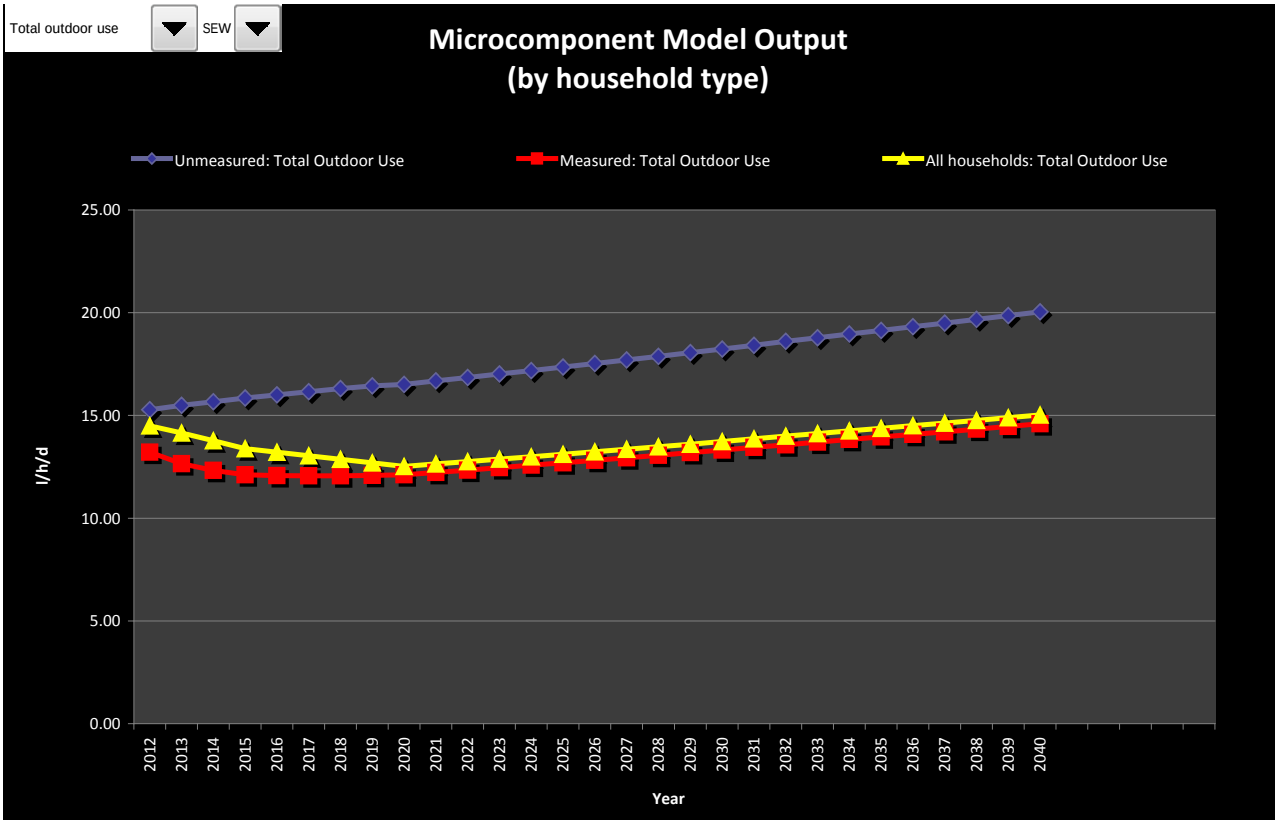


Chart 10-K External Use Micro Component Forecast

11.0 MISCELLANEOUS USE

The miscellaneous component represents all other domestic uses of water not covered by the standard micro components in the previous sections of this report. This covers uses such as:

- Cooking
- Cleaning
- Drinking
- Hand washing
- Teeth brushing.

The base year value for each customer group is set as the balancing item between the bottom up estimates of the other micro components and the overall, reported PCC values. The table below provides the measured and unmeasured values as part of the total base year PCC values.

	Unmeasured (l/h/d)	Measured (l/h/d)
Miscellaneous Use	52.0	19.0
Other micro components	124.4	129.0
Total Reported PCC	176.4	148.0

Miscellaneous use comprises a number of components that are discretionary in nature. Therefore, the forecast of this component incorporates an annual reduction to reflect growing awareness of the need for water conservation. For unmeasured customers, the reduction is 0.8%/year and for measured customers it is 1%/year.

The overall measured and unmeasured customer miscellaneous forecasts are shown in the chart below.

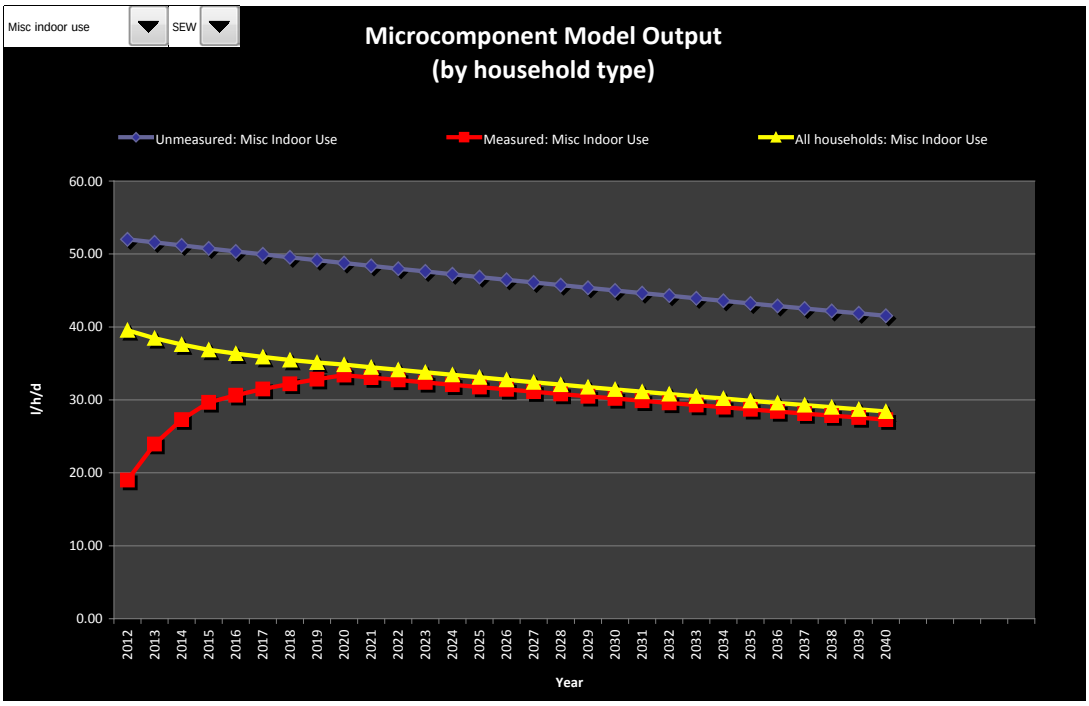


Chart 11-A Forecast of Miscellaneous Micro Component

12.0 THE IMPACTS OF METERING

The customer survey provided a robust insight in to the water uses of our existing metered and unmetered customers. South East Water is committed to metering all domestic customers, where reasonably practical, by 2020. The baseline forecast therefore incorporates the impacts of unmeasured customers switching to measured billing.

For both optant and universal metering programmes, it is assumed that the customers being metered in each year are "average" unmeasured properties with average occupancy and average consumption for their property type, in their WRZ.

On metering, it is assumed that customers change their consumption as summarised in the table below.

Micro Component	Impact of Metering
Toilet Flushing	0%
Personal Washing	-10%
Clothes Washing	-10%
Dish Washing	-10%
External Use	-10%
Miscellaneous Use	-20%
Overall Impact	**-10.5%**

Miscellaneous is given a larger reduction as many of the water uses therein may be considered as discretionary and hence more likely to be reduced when the customer's bill is consumption based. This is the micro component with the most significant base year PCC variation between measured and unmeasured customers.

The demand of new properties is derived through a bottom up summation of the micro components of measured customers, assuming that they have the latest, most efficient generation of appliances.

13.0 OVERALL MICRO COMPONENT FORECASTS

13.1 Normal Year Demands

The micro component model fully incorporates the population and property forecasts for each WRZ, along with the metering programmes, such that the PCC forecasts incorporate these influences.

The following chart summarises the unmeasured, measured and overall normal year PCC forecast for the company.

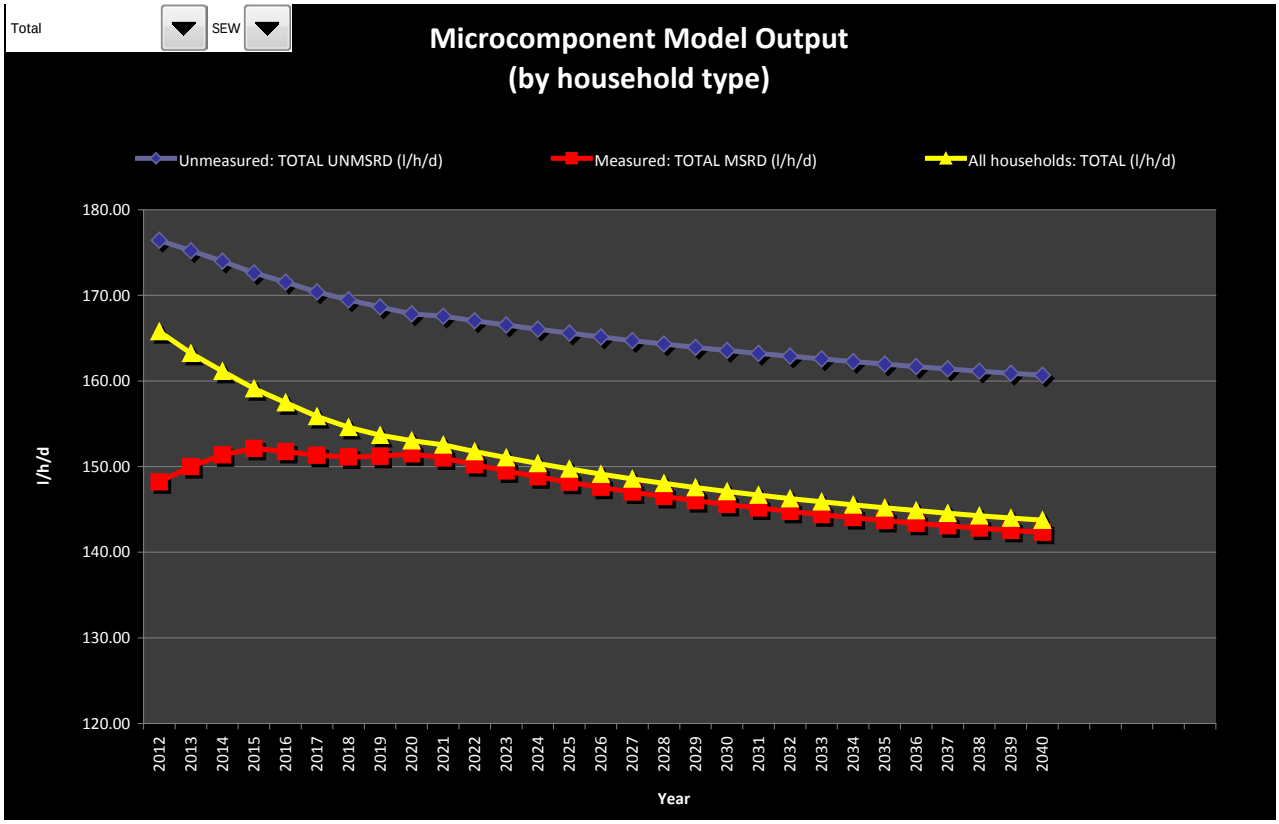
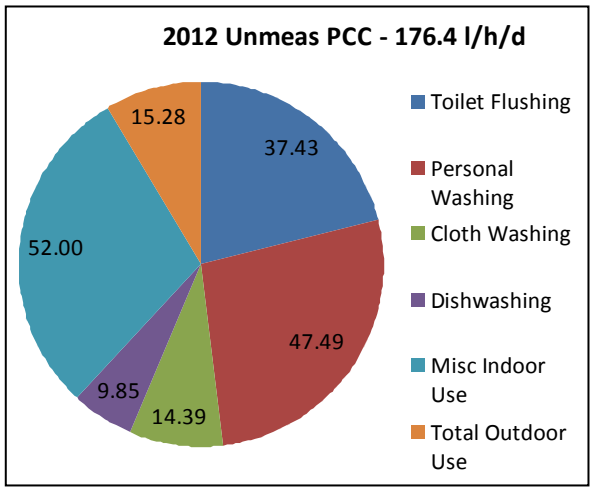
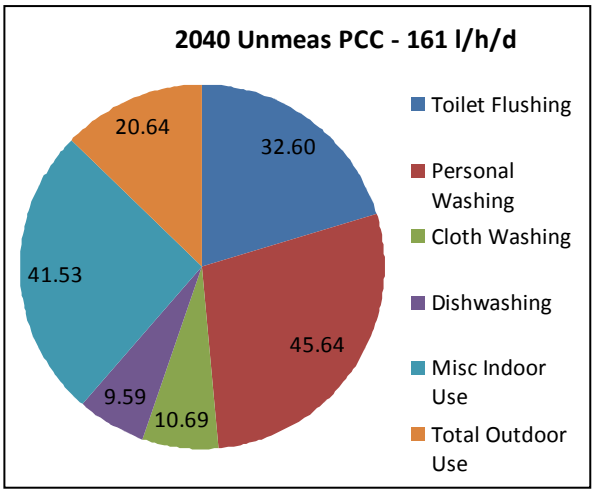
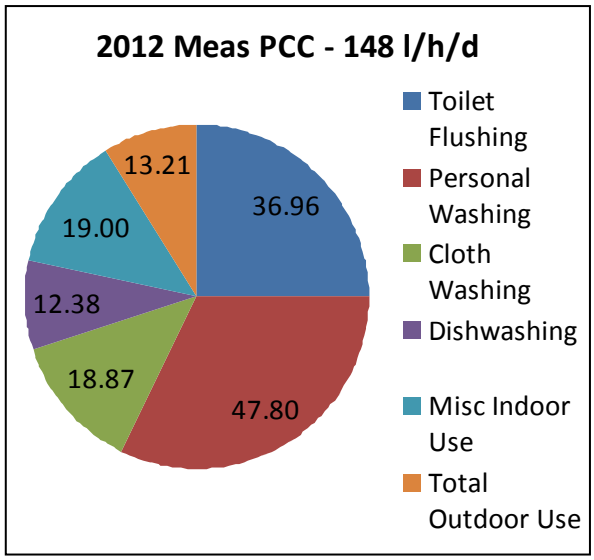


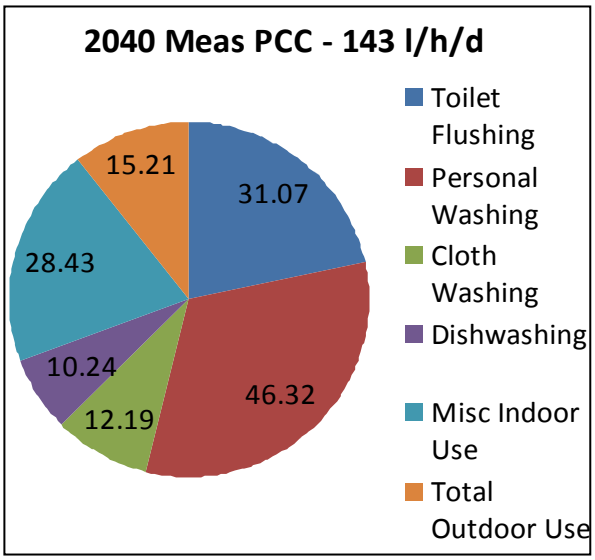
Chart 13-A Normal Year PCC Forecasts

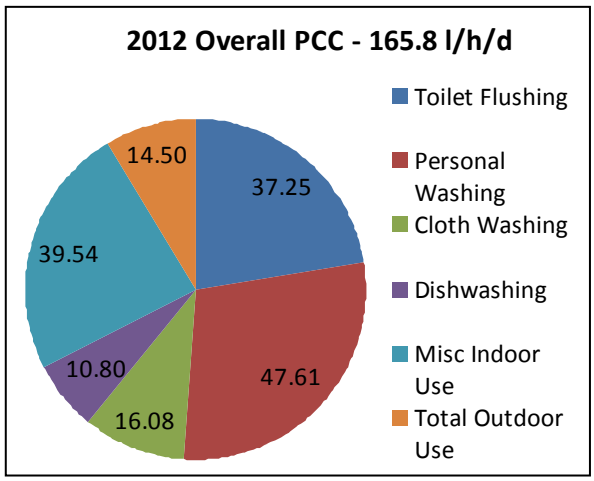
The micro component changes of the average unmeasured and measured customers and the overall average between the base year and 2040 are shown in the following pie charts.











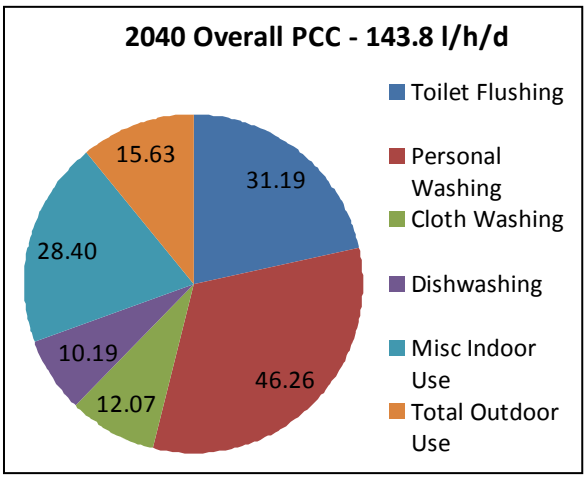


Chart 13-B PCC Micro Component Splits 2012 and 2040

The forecasts of average, normal year PCC for optant, universal and new metered customers is shown in the chart below. This shows that by giving new properties the most efficient appliances, their average PCC forecast is in line with the Building Regulations 17.K compliance requirement of a PCC of 125 l/h/d.

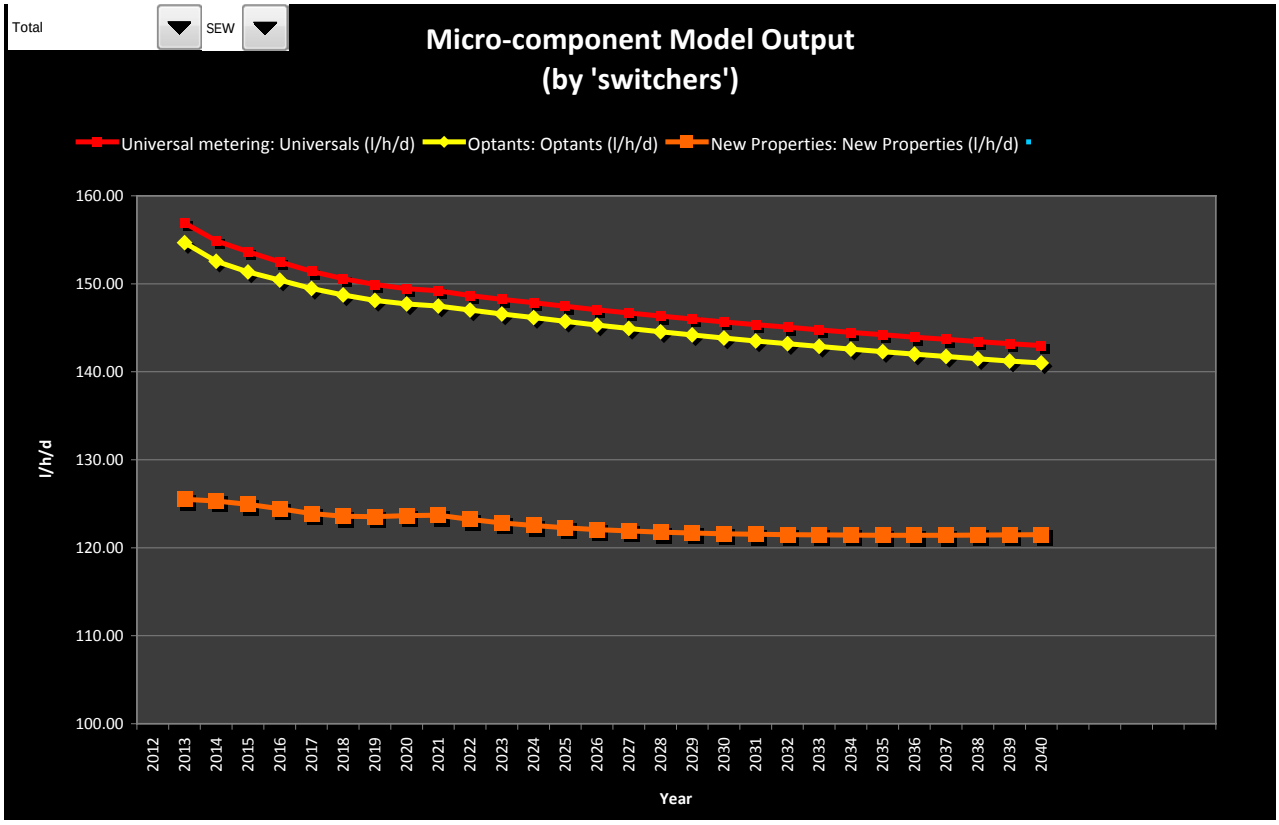


Chart 13-C Universal, Optant and New Metered PCC Forecasts

13.2 Dry Year PCC Forecasts

2011/12 is considered to be a normal year, based on the analysis of long term demands and weather parameters. The base year PCCs of 176.4 and 148 l/h/d for unmeasured and measured customers respectively have been inflated to 182.6 and 158 l/h/d as base, dry year values.

The increases have been applied to external use and miscellaneous use as per the table below.

	Unmeasured (l/h/d)	Measured (l/h/d)
Normal Year PCC	176.4	148
Miscellaneous Increase	1.7	5
External Use Increase	4.5	5
Dry Year PCC	182.6	158

The forecast variables for each micro component are retained as per the normal forecast. This results in a dry year overall PCC forecast reducing from 173 l/h/d in 2012 to 150 l/h/d in 2040 as shown in the chart below.

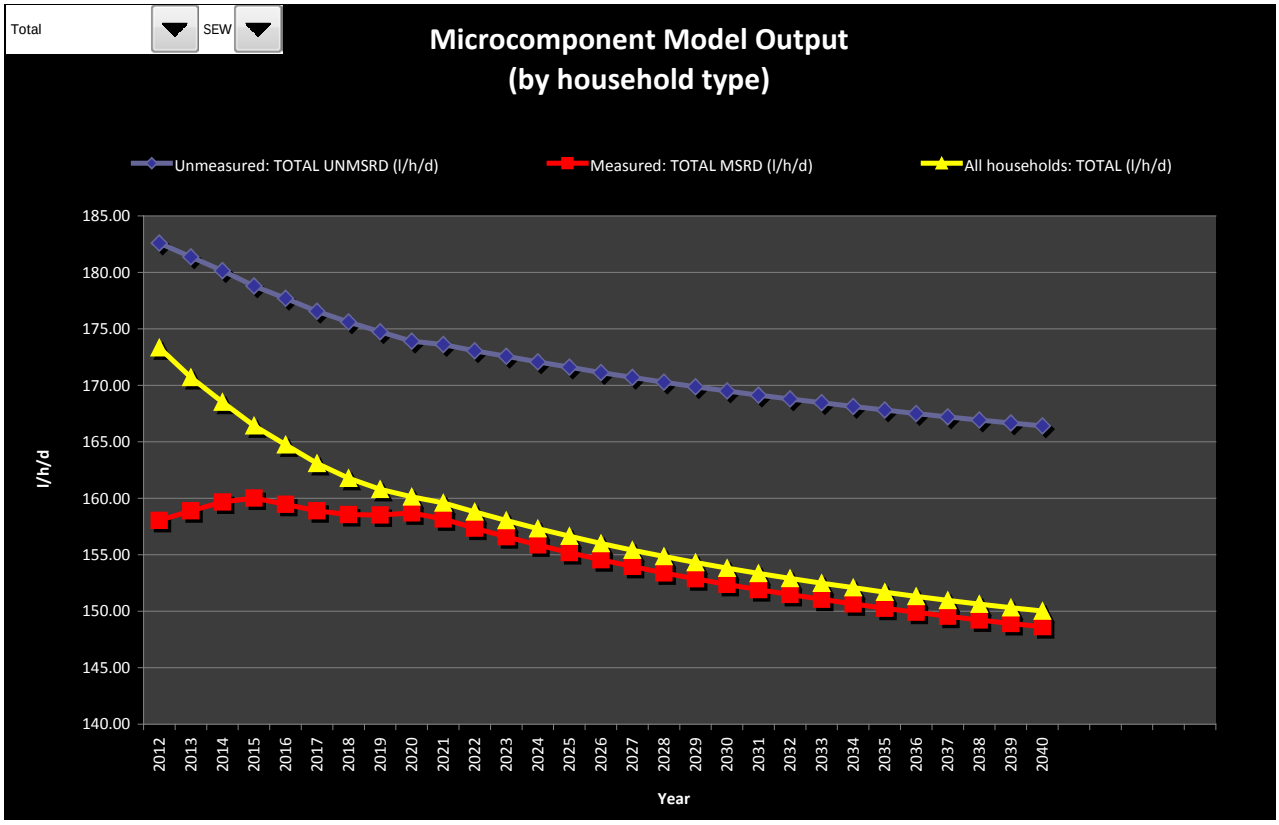


Chart 13-D Dry Year PCC Forecasts

Population, Household and Dwelling Forecasts for WRMP14: Phase 2 Draft Final Report

South East Water

June 2013

Population, Household and Dwelling Forecasts for WRMP14: Phase 2 Draft Final Report

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Contents

Introduction

This report updates the methodology used to produce a range of population and household projections for a group of water companies for WRMP14. This report includes the results from Phase 2 of the project which provides an update of the projections provided to companies in 2012 to include the latest available information, including the Census 2011. This report updates the relevant sections of the approach, results and the most-likely forecast to reflect the changes between Phase 1 and Phase 2.

The projections for Phase 1 and Phase 2 have been produced in accordance with Water Resource Planning Guideline (Joint Regulator, 2012) and the Method of Estimating Population and Household Projections (EA, 2012) report. The companies included in the study include:

- Southern Water
- Thames Water
- Wessex Water
- Sembcorp Bournemouth Water
- Portsmouth Water
- South East Water
- Sutton & East Surrey Water
- Affinity Water (Central, East and South East)
- Welsh Water

Three sets of forecasts have been provided each year in the period 2010/11 to 2039/40 for:

- Total Population;
- Household population;
- Communal population;
- Households;
- Household Occupancy;
- Dwellings

The three sets of forecasts are:

- 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 information available).

The **first section** of the report presents the methodology used to produce the projections whilst **section 2**, explains the rationale and approach for producing the most-likely forecast.

Section 3 presents the results of the forecasts for Phase 2 and compares them with Phase 1 for each company. **Section 4** provides an explanation of estimates of uncertainty associated with the forecasts for each company.

1 Approach

1.1 Outputs

Three sets of forecasts have been produced:

- 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 information available).

The forecasts have been produced at Census output area[1] and provided to each company at this detailed level and aggregated to entire (water and sewerage) supply area and Water Resource Zone (WRZ).

1.2 Data sources

A wide array of data has been used to produce the Phase 2 forecasts. The key data inputs for Phase 1 and Phase 2 and their vintage are detailed in the table below. Further details of these sources are provided in Appendix A.

Table 1: Summary of data sources for Phase 1 and Phase 2

Source	Phase 1	Phase 2
Local Plans	Local authority provided planned dwelling data and local authority plans	Local authority provided planned dwelling data and local authority plans
LA population projections	ONS 2010 sub-national population projections – Local Authority	ONS 2011-interim sub-national population projections - Local Authority
National projections	ONS 2010 National population projections, principal and variant projections	
Household projections	DCLG 2008 household projections – Local Authority	DCLG 2011-interim household projections
Mid-year population estimates	ONS indicative mid-year estimates 2006-2010 – Local Authority	ONS revised mid-year estimates 2002-2010 - Local authority
	ONS mid-year estimates 2001-2005 – Local Authority	
Small Area estimates	ONS mid-year estimates 2001-2010 – Lower Super Output Area	Census 2011
	Census 2001	
	Experian Output Area level datasets, 2001-2040	Experian Output Area level datasets, 2011 to 2040
Property pipeline information	Property Pipeline information supplied by Emap Glenigan (April 2012).	Property Pipeline information supplied by Emap Glenigan (April 2012).

1.3 Methodology

1.3.1 Collecting information for the plan-based projections

The first task was to update the information collected from each of the local authorities from Phase 1 that are covered by the company boundaries (water and sewerage) of the companies involved in this study. This involved confirming with local authorities whether the information provided for phase 1 was still up to date and relevant. For those local authorities that did not respond to the data request in phase 1 a data collection template was sent. Emails were sent to local authorities over a two day period from 12th to 13th March with a request for response by 8th April. Follow up emails were sent in the following days and weeks depending on the responses received.

The contacts list was generated from a combination of water company contacts, Experian contacts and contacts provided by DCLG.

[1] Experian have maintained the use of 2001 Census Output Areas. Further information is contained elsewhere in this document.

Information for London was taken from the London plan:

The London Plan Spatial Development Strategy for Greater London, July 2011
http://www.london.gov.uk/priorities/planning/londonplan

Some key points regarding the data collection exercise:

- Where authorities provided data for Phase 1 the relevant contacts were asked to update/ verify the data for Phase 2
- E-mails were targeted to individuals within the local authority where we had named contacts
- E-mails were tailored to each local authority (each e-mail was sent individually) so it was clear which water company we were collecting the information from (particularly important as some local authorities have 3 or more water companies operating in their area).
- Collaborative approach was extremely helpful to local authorities as the potential burden was greatly reduced.
- The data collection exercise will be re-run in full for Phase 2. We expect that data collection rates will be higher for phase 2, as we have developed a relationship with local authorities and more local authorities will have completed their local plans.
- A full log of contact for all local authorities has been produced and provided to the companies.

The table below shows the response rate achieved for each water company for Phase 1 and Phase 2. The response rates for South East Water improved from 54% for Phase 1 to 59% for Phase 2.

Table 2: Local authority response rates from Phase 1 and Phase 2 by company

	% of LAUAs responded	
Water company	Phase 1	Phase 2
Sembcorp Bournemouth Water	63%	63%
Portsmouth Water	67%	67%
South East Water	54%	59%
Southern Water	54%	74%
Sutton and East Surrey Water	36%	73%
Thames Water	54%	63%
Affinity Water Central	48%	70%
Affinity Water East	67%	67%
Affinity Water South East	40%	40%
Wessex Water	47%	65%

Where information was not supplied by the local authority directly, it was collected from alternative sources. A hierarchical system was used, with the most recent sources given preference if contact with an authority was not established:

1. Directly from each local authority
2. Directly from County Councils
3. From Local Authority Plans, Core Strategies, Local Development Frameworks or Annual Monitoring Plans – depending on availability and date of publication.

1.3.2 District and household level forecasts

In accordance with EA guidance, the starting point for our output area (OA) level population and household projections is to create a set of district level population and household targets, which are used as control totals for the subsequent OA level work.

1.3.2.1 Trend-based projections

The first set of household projections are trend based: they are neither a forecast of what analysts expect to happen nor a statement of policy. The Phase 2 trend based local authority district level population and household targets are based on the ONS 2011-based interim sub-national population projections and the 2011-based interim DCLG household projections. The ONS and DCLG projections only extend to 2021 – they have been extended to 2040 using a simple extrapolation of the last 5 years of the projection.

The DCLG 2011 household projections and ONS 2011-based interim sub-national population projections include results from the Census 2011.

The Phase 1 projections were based on the 2010-based sub-national population projections and the 2008-based DCLG household projections, neither of which included results from the Census 2011.

Trend-based projections are a key input to producing plan-based projections.

Further analysis of the trend based population projections is included in section 3.2.

1.3.2.2 Local authority plan-based projections

WRPG states that water companies should take account of local authority plans in their population and household projections. To account for planned future developments, local authority plan household and population projections are constructed. These take information from the local authority data collection exercise discussed in 1.3.1. Here annual dwelling figures from each of the plans from 2011 onwards are converted to households and added on to the base year to produce a plan-based household forecast.

Estimates of district level plan based population are recalculated by applying projections of average household size from the trend-based projections to the plan based household projections, above.

The local authority plans cover different periods of time – typically they only extend as far as 2025 but most are shorter. Once the plans finish there is a decision on the likely trajectory of the plan-based projections. Given the wide range of plans (and different statuses of plans) covered by this study, we have applied trend based assumptions to extend the plan-based forecasts. Here we apply the growth in household numbers from the trend-based forecasts to the number of dwellings. This is an option presented in the Environment Agency methodology report.

The Greater London Authority (GLA) produced population and household projections for London boroughs as part of the evidence base for the London Plan. A GLA controlled set of plan-based projections has also been produced as part of this project.

1.3.2.3 Most-likely projections

As part of the project specification there is a requirement to produce a most-likely forecast of population and households – which is what Experian think will be the most likely outcome given data available and our expertise.

Experian have revised the methodology used for creating the most-likely projections for Phase 2 in light of recent evidence and data availability. The approach selects the most appropriate population projection for each local authority based on analysis of recent trends. The most-likely household forecast is based on first controlling the plan based household projection to Experian's regional dwelling completions forecast and a second adjustment to account for underlying long-term growth. The approach for the most likely forecast is detailed in section 2.

1.3.3 OA population and household targets

The next task is to drill down below the district level targets to a more refined geographic area. Experian have used Census OAs (e.g. 33UGFY0003) for the analysis of small spatial areas. This is so that information from Census 2011, the key source of data for small area demographics, can be used. Moreover, it facilitates the incorporation of new property developments that are easily coded at OA level. Output areas figures can then be aggregated to the geographical levels required.

Experian have produced the OA projections using the Census 2001 output area boundaries. ONS have made small changes to the output areas for the 2011 Census but have provided a mapping between the 2001 and 2011 boundaries. Experian have used the 2001 boundaries to maintain consistency with Phase 1 and to incorporate Experian's output area forecasts which are currently based on 2001 boundaries. However note that the data includes the Census 2011 results for households, dwellings, household and communal population.

The various stages taken to construct the OA population and household projections are set out below:

1. Age forwards Census 2001 OA residents in households using a cohort survival approach (e.g. the number of 20_24 year olds this year is based on 4/5 times the number of 20_24 year olds in the previous year (i.e. 1/5 move up to the next age group) plus 1/5 times the number of 16_19 year olds the previous year (i.e. 1/5 move up to the 20_24 year olds from the 16-19 age group).

2. Births are estimated by applying district level fertility rates to its constituent OA level population of females aged 15_44. Death and migration rates at OA level are also estimated by applying district level rates.

3. Control the aged forwards OA figures from step 1 to Census 2011 values.

4. Source OA level counts of communal population from Census 2011. The counts are controlled to district level targets post 2011.

5. Calculate household population by subtracting communal population from total population.

6. Estimates of the number of households in each OA are taken from Census 2011 and pushed forward by combining the growth in OA household population (from Stage 5) with changes to average household size in its encompassing district.

7. Calibrate the OA household estimates to align with district level household targets for the trend-based, plan and most-likely. At this stage we have an initial set of household and population projections, 2011-2040, by OA. The methodology that we use to build residential property pipeline information into our demographic forecasts utilizes site level planning application and contract progress data that is sourced from Emap Glenigan. To utilize Emap Glenigans site level planning application and contract progress data in our demographic forecasts we first need to establish the likelihood that each site in the property pipeline has of being "built-out". To do this we use a procedure (developed in consultation) with Emap Glenigans that assigns "build out" probabilities according to the stage that each site has reached in the planning /contracting process and the insight (based on experience) that this information provides regarding the likelihood that the associated scheme will be completed (for more details, see appendix C).

8. All projects are assumed to start and be completed between 2011 and 2023. All developments are aggregated to OA level. This adjustment adds additional local flavour to the household projections by accounting for possible new developments.

9. Overall constraining procedures are applied to the OA household and population projections to ensure that they are consistent with our broader view of population and household projections at the district level for the trend-

based, plan-based and most-likely approach. Not every output area will have housing projects sourced from Emap Glenigans. As a consequence of the LAUAD constraint, those OAs without a new development will see a reduction in housing growth to balance developments elsewhere in the district for the LAUAD target to be achieved.

1.3.4 Bespoke spatial analysis

Experian's household and population calculations for each of the WRZs areas were carried out using Alteryx and Micromarketer, two spatial analysis programmes. The methodology follows the Environment Agency guidance and ONS postcode best fit approach to producing small area estimates.

Three inputs are fed into the calculations:

- Client supplied WRZ GIS boundaries
- Output Area (OA) boundaries
- Current year population and area (in sq km) for each OA and postcode

The Alteryx programme first identifies which OAs are located entirely within each boundary of a given WRZ. The sum of the total population of all of these OAs can then be derived and will account for the majority of each WRZs total population.

This leaves only areas around the borders of the WRZs for examination, areas which will not contain any complete OAs but will be made up typically of elements of a number OAs (the remainder of the OA falling into another WRZ or falling outside each water companies total area). For each of these OAs we calculate the proportion of cut OA population that is inside each WRZ as a proportion of the full OA population using Census postcode area level data. These rates are kept fixed in the forecast.

The proportions are then applied to the population and households of these OAs to give the population falling inside the given WRZs. For each WRZ these population shares can then be aggregated, and combined with the population calculated from the 'whole' OAs we reach a final figure for the WRZs total population.

An example of the Alteryx output is shown below for a small WRZ area in the East of England. The total population for this area is comprised of the sum of the seven OAs that fall entirely within the area boundaries plus the shares of an additional twelve OAs where the area boundary splits the OA boundary. Note that where the Output Area splits the area that the share values can range between 0% and 100%. Where the share is 0% the OA cut population is zero however some of the OA area falls within the area boundary. Where the share is 100%, the OA cut population equals the full population but not necessarily all of the OA area falls within the DMA boundary.

Table 3: Best-fit example

Output Area falls entirely within WRZ

WRZ	OutputArea	CutArea	CutPop	FullArea	FullPop	Share
Example X	00KFNA0015	0.016	276	0.016	276	100%
Example X	00KFNA0021	0.084	334	0.084	334	100%
Example X	00KFNA0023	0.017	298	0.017	298	100%
Example X	00KFNA0028	0.028	272	0.028	272	100%
Example X	00KFNA0030	0.020	305	0.020	305	100%
Example X	00KFNA0031	0.043	254	0.043	254	100%
Example X	00KFNA0032	0.022	186	0.022	186	100%

Output Area splits WRZ

WRZ	OutputArea	CutArea	CutPop	FullArea	FullPop	Share
Example X	00KFNA0006	0.313	266	0.316	266	100%
Example X	00KFNA0007	0.033	284	0.092	318	89%
Example X	00KFNA0012	0.008	0	0.031	213	0%

Example X	00KFNA0014	0.018	294	0.020	294	100%
Example X	00KFNA0017	0.018	293	0.028	293	100%
Example X	00KFNA0018	0.009	0	0.028	264	0%
Example X	00KFNA0022	0.020	300	0.023	300	100%
Example X	00KFNA0026	0.016	98	0.059	323	30%
Example X	00KFNA0029	0.030	85	0.044	250	34%
Example X	00KFNG0009	0.135	62	0.253	304	20%
Example X	22ULGD0005	0.045	47	0.273	327	14%
Example X	22ULGD0006	0.117	0	0.425	331	0%

2 Deriving a most-likely forecast

2.1 Background

The most-likely forecast is what we think is the most likely outcome for population and households based on our expertise and the latest information available. It was decided to review the methodology used to derive the most-likely forecast for Phase 1 in light of recent evidence of growth. This section presents the drivers, rationale and approach for the Phase 2 most likely forecast. The following drivers are considered:

1. Population trends
2. Trends in household occupancy
3. Dwelling completions

2.2 Population trends

For Phase 1 we found little evidence of population coming off trend and therefore decided that the ONS trend-based projections would be the most likely outcome for population growth at local authority level. The most-likely population projections were therefore the same as the trend-based projections for Phase 1. The release of the Census 2011 confirmed that ONS was underestimating population growth, with almost 500,000 additional people found in 2011 compared with previous estimates for the same year in England and Wales. However, this effect was not uniform across local authorities as shown in the table below. For example, the Census found that population in City of London population was 51% lower than previously estimated and the population of Isles of Scilly was 14.7% higher than previously estimated. From a regional perspective, the Census 2011 found that the population in London was 1.3% higher than estimated; in the South East it was 1% higher and 0.6% higher in the East of England. In Wales the population was 1.2% higher than previously estimated whilst in the South West, the Census 2011 is only 0.1% higher than previously estimated.

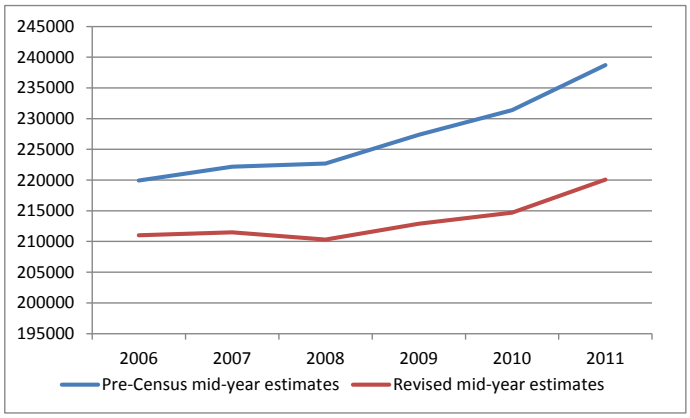
Table 4: Top 10 and bottom 10 differences between mid-year population estimates (MYE) and the Census 2011 based MYE

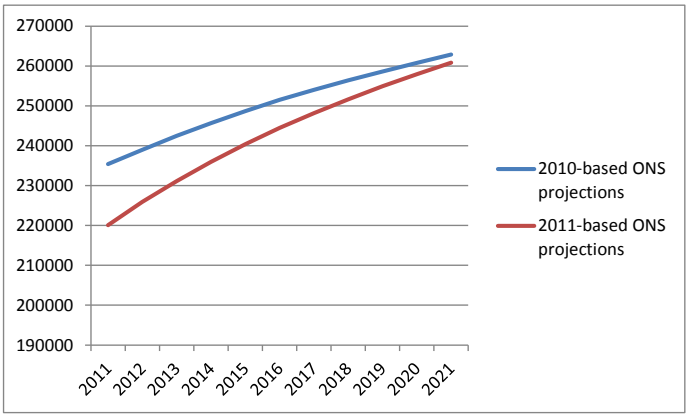
Top 10	Area	% difference (% of Census MYE 2011)	Difference (MYE - Census based MYE)		Bottom 10	Area	% difference (% of Census MYE 2011)	Difference (MYE - Census based MYE)
1	City of London	51%	3751		1	Isles of Scilly UA	-14.7%	-327
2	Westminster	12%	26877		2	Cambridge	-13.2%	-16237
3	Camden	8%	18626		3	Brent	-11.1%	-34783
4	Kingston upon Thames	8%	13476		4	Newham	-9.3%	-28794
5	Tendring	7%	10218		5	Waltham Forest	-8.6%	-22266
6	Runnymede	7%	5664		6	Watford	-8.0%	-7255
7	Welwyn Hatfield	7%	7582		7	Hackney	-7.9%	-19616
8	Oadby and Wigston	6%	3622		8	Leicester UA	-7.8%	-25639
9	Wokingham UA	6%	9018		9	Greenwich	-7.7%	-19735
10	Merton	6%	11421		10	Bournemouth UA	-7.4%	-13667

Since the release of the 2011 Census, ONS has published updated population projections which have been used to produce the Phase 2 trend-based projections. However ONS have created the 2011-based sub-national population projections by applying assumptions from the 2010-based projections to the 2011 Census results. The assumptions for the 2010-based projections were based on trends taken from the mid-year estimates prior to the release of the Census 2011. This approach has implications in some areas – particularly in areas where the Census 2011 results are significantly different to the previous mid-year estimates.

Figure 1a below demonstrates the issue for Camden in London, where the Census 2011 found that the population was 8.5% lower than previously estimated. The revised mid-year estimates show a shallower growth profile for the 5 year period that is used to inform trend-based growth projections. Figure 1b shows that when the assumptions from the 2010-based projections are applied to the 2011 Census point for Camden that growth is stronger than under the 2010-based projections and the growth profile compared with the mid-year estimates looks too strong. The opposite effect also occurs in areas where ONS underestimated the population and resulting projections will typically look too weak.

Figure 1a and 1b: Revised mid-year population estimates and the interim population projections, Camden



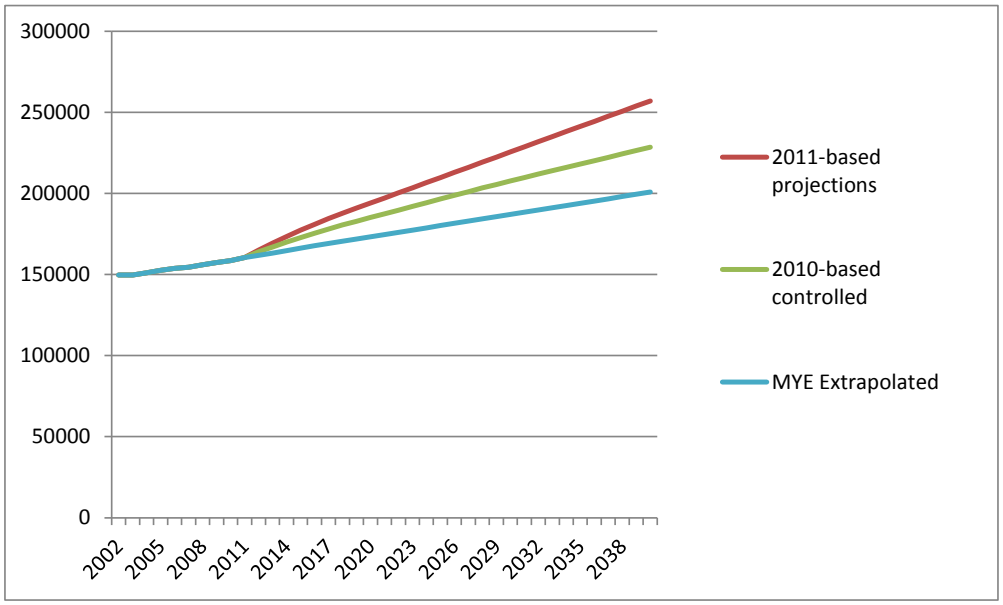


For the reasons outlined above Experian has selected the most likely projection for each local authority from the following set of projections:

- 2010-based sub-national projections (controlled to Census 2011)
- 2011-based interim sub-national projection
- Extrapolation of 2002-2011 revised mid-year estimates.

An example of these alternative projections is shown in figure 2 below for Kingston-upon-Thames. For this example, we have chosen the MYE extrapolated projection for the most-likely population forecast, since the 2011-based and 2010-based projections appear too strong given the trend between 2001 and 2011.

Figure 2: Alternative trend-based projections for Kingston-upon-Thames

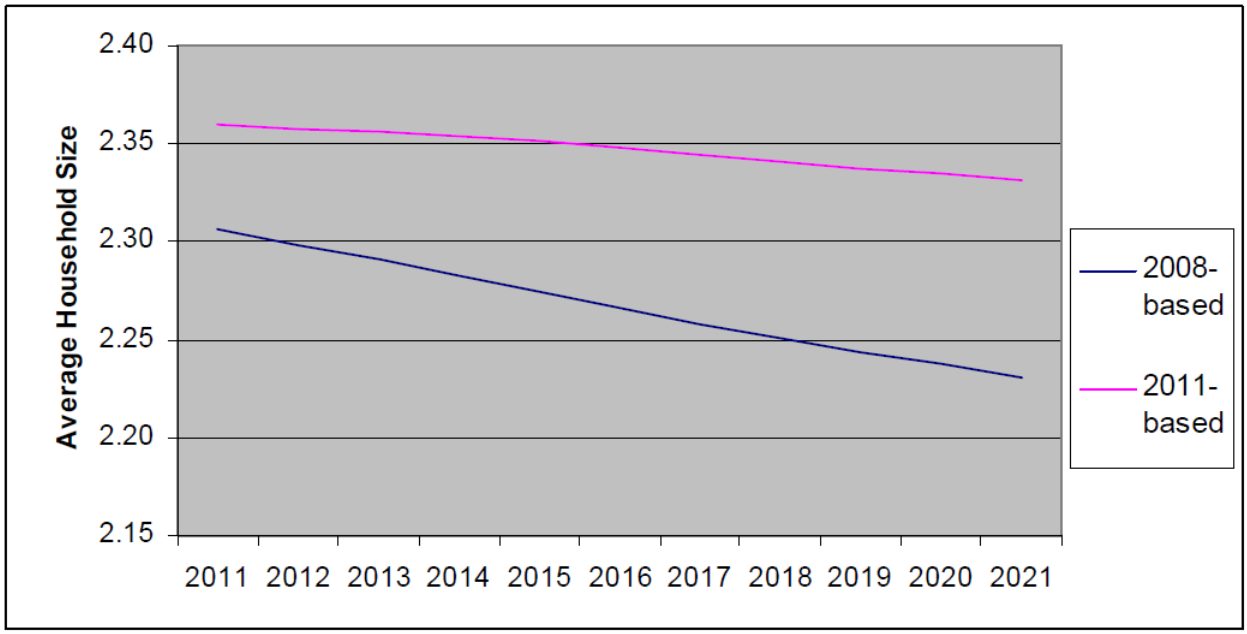


Further analysis of population growth is available in the Phase 1 report.

2.3 Trends in household occupancy

The results from the Census 2011 showed that household occupancy did not decline as rapidly as previously projected by previous official household projections. Results from the Census 2011 showed that in some areas – most notably in London – occupancy actually increased between 2001 and 2011. Figure 3 shows that the latest DCLG household projections capture the slowed decline in occupancy rates – although as these are long-term projections they do not capture short-term deviations to trend that may occur as a result of economic and policy changes.

Figure 3: Comparison between occupancy (average household size) projections from the 2008 and 2011 DCLG household projections

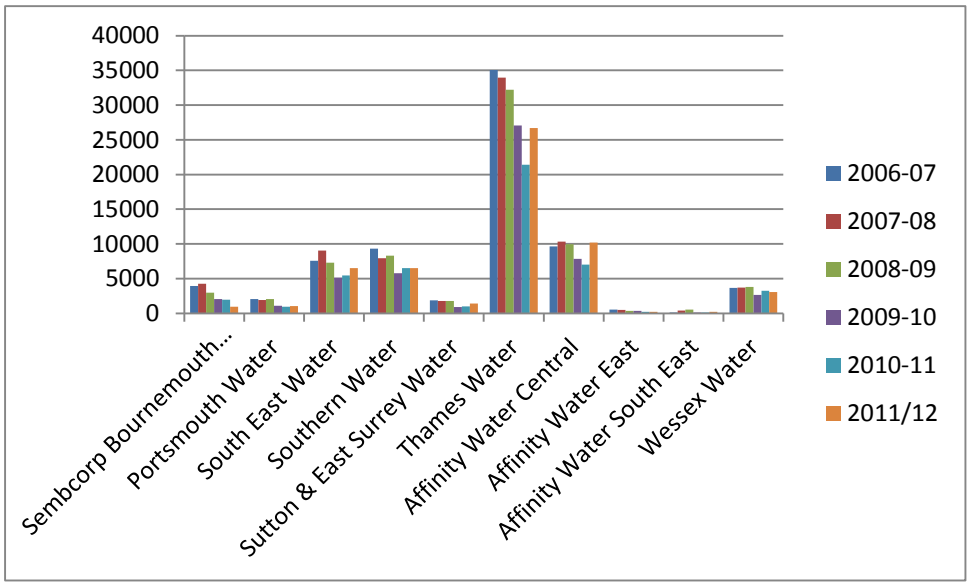


For Phase 1 our analysis looked at estimated changes in occupancy and under the most-likely forecast we derived adjustments to trend-based occupancy forecasts to account for the economic slowdown and drive our household forecast. In section 2.4 we find that the plan-based forecasts are much closer to our expectations of future growth than under Phase 1 and therefore are a good basis for use for the most-likely forecast rather than modelling occupancy directly. Changes to occupancy will be derived under the most-likely forecast when household population is divided by the number of households.

2.4 Dwelling completions

As a result of the weak economic conditions, dwelling completions have slowed at national level and these trends have also been prevalent in each water company area as shown in figure 4 below. In the South East Water area the slide in dwelling completions has been particularly notable – with an average of 8,000 new dwellings completed up to 2008/09 and then falling to around 5,700 per annum in 2009/10 and 2011/12. The pick-up in dwelling completions in 2011/12 could be an indication of an improvement in conditions – however new connections data for South East Water suggest that 2012/13 was down on 2011/12.

Fig 4: Net additions to dwelling stock by water company area



The plan-based forecasts produced for this project take dwelling targets from each of the local authority local plans.

For the targets in the plans to be achieved there will need to be an improvement in the volume of house building – which we expect to begin to come on stream in 2014. Figure 5 shows the annual dwelling targets for each of the water companies – figure 6 represents these targets relative to the levels delivered on average between 2004 and 2008 and 2009-2012. For South East Water the plans require annual build of around 7,000 dwellings per annum which is higher (125%) than recent trends but lower than levels achieved between 2004 and 2012. The plan-based target then appears realistic but is still challenging given market conditions.

Fig 5: Annual dwelling targets 2013-2018

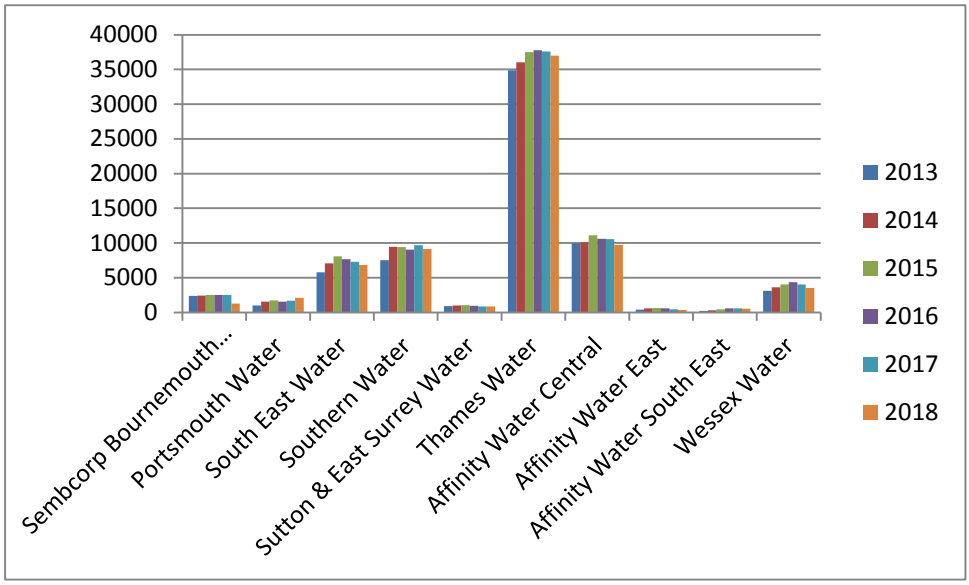
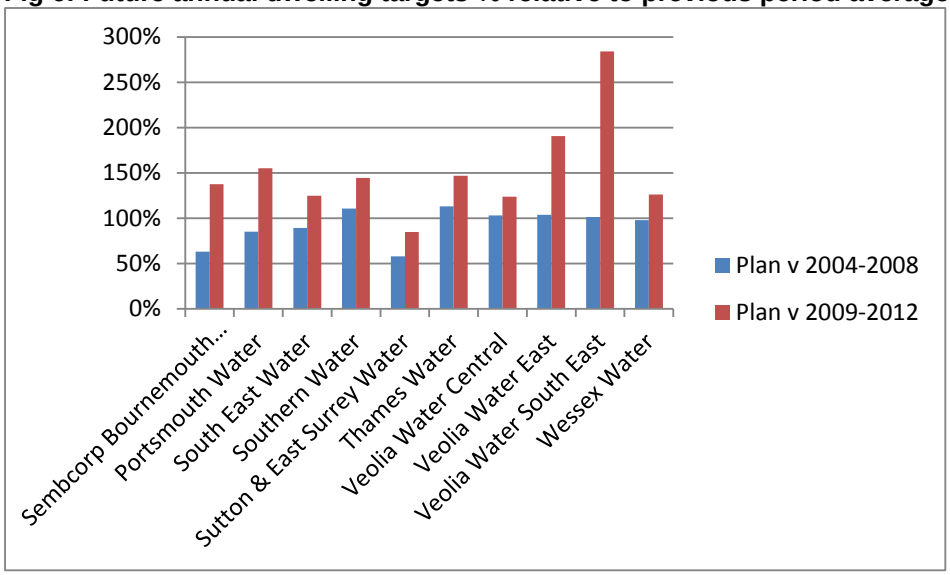
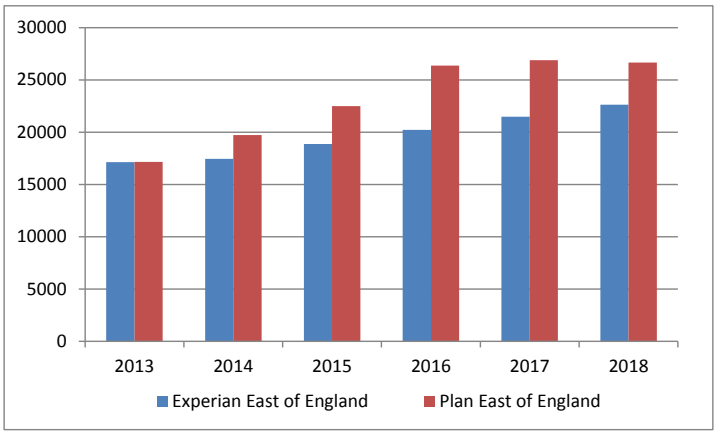


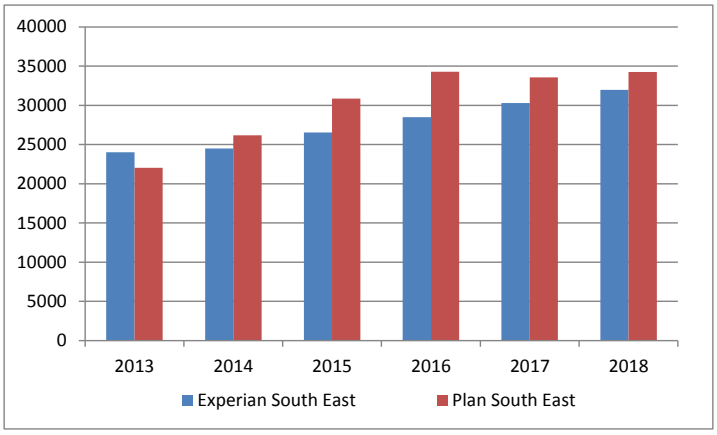
Fig 6: Future annual dwelling targets % relative to previous period average annual housing delivery

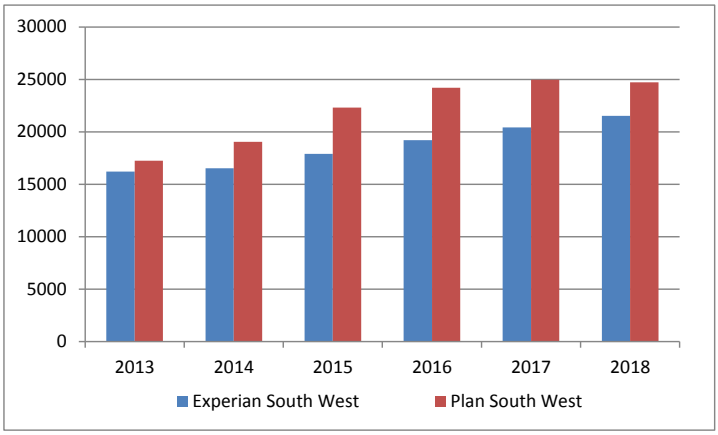


Experian's dwelling completion forecasts by region suggest that the plan based forecasts will not be achieved in the short-run as the market remains weak as shown in figure 7. The Experian forecasts for the South East are relatively close to the plan-based forecasts for the region.

Fig 7: Future planned dwellings and Experian dwelling completions forecasts by region







2.5 Most-likely forecast - approach

The most-likely forecast has been created using a three stage process:

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

The first step ensures that the number of households forecast is in line with our forecasts of new dwellings produced by Experian's construction futures team. This forecast considers economic conditions and other factors facing house builders over the short to medium term before assuming a trend.

The second step ensures that the most-likely forecast 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-run. Most local authority plans do not cover the entire 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 therefore seeks to find a compromise between the two in the long-run.

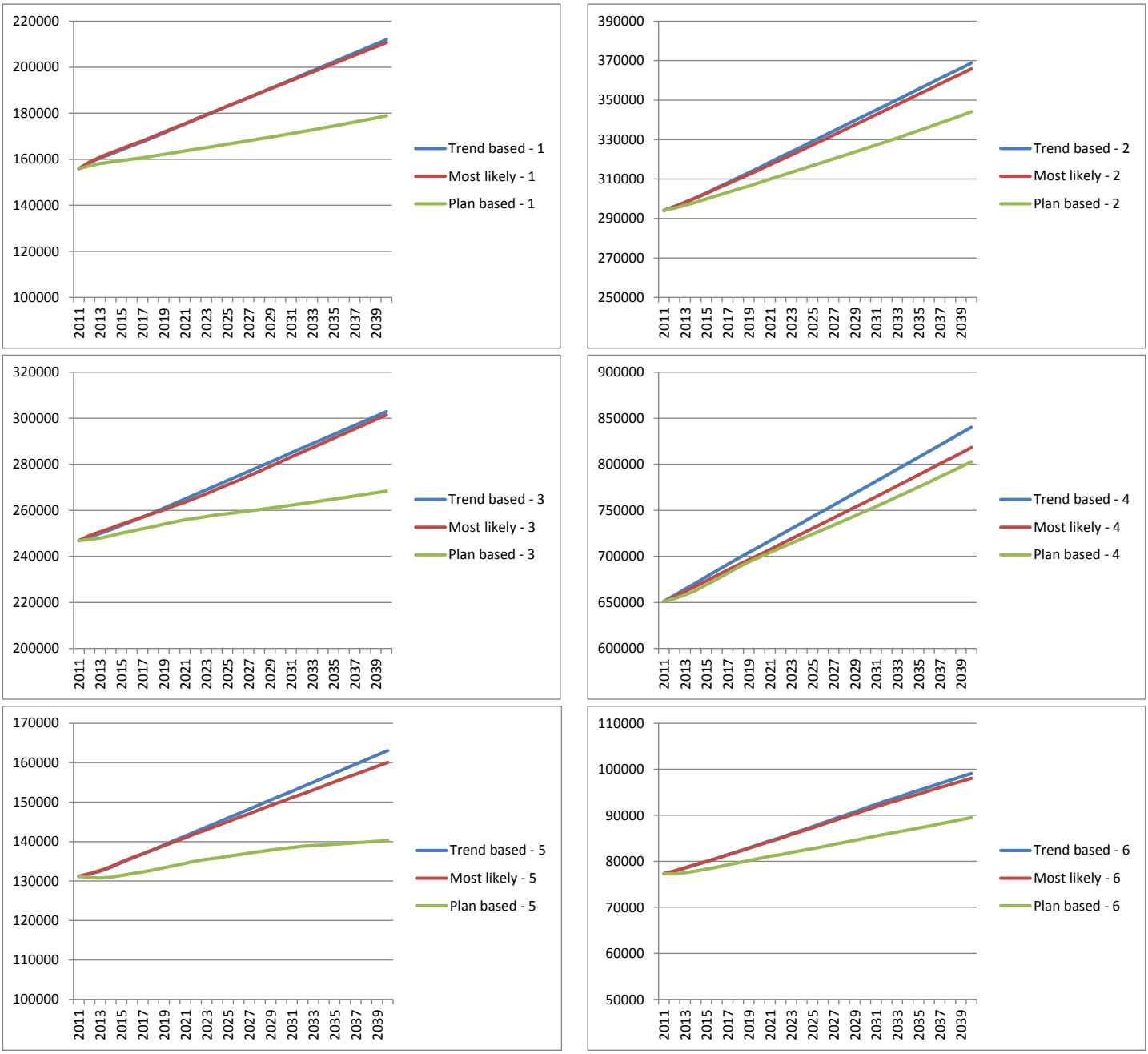
3 Phase 2 Results

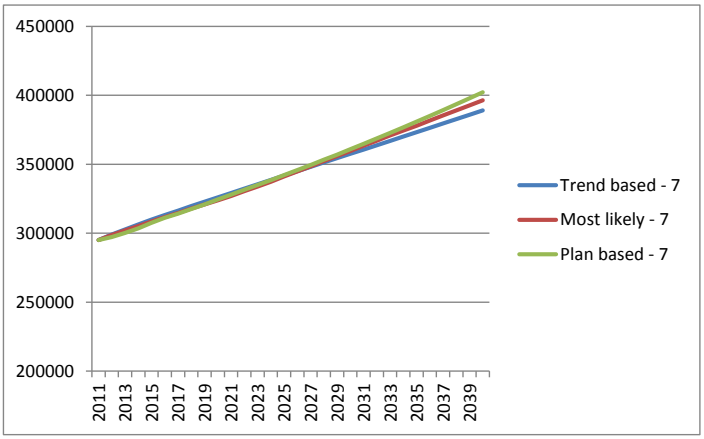
The Phase 2 results have been provided to each of the companies via Experian's FTP site. Results have been provided at output area level and aggregated to water resource zone level for each company taking part in the study. In this section we present the results and compare the plan, trend and most likely forecasts. We also explore how the forecasts differ to those provided for Phase 1. Analysis of the projections used for PR09 and the impact of the economic downturn is available in the Phase 1 report.

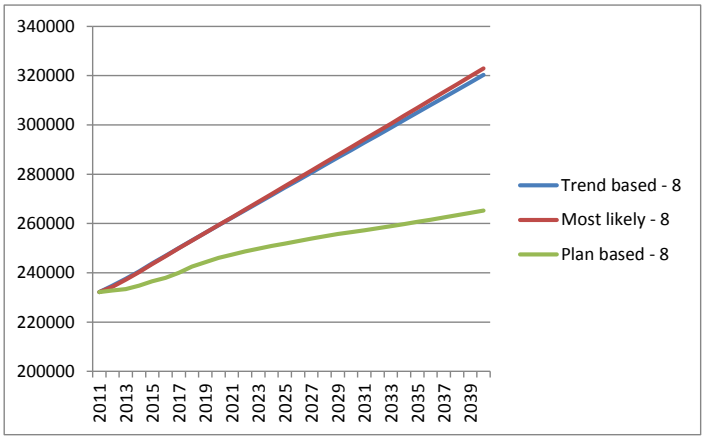
3.1.1 South East Water population projections

At the company level, the Phase 2 results show that the trend-based projections are stronger than plan-based and slightly stronger than the most-likely projections. This is reflected in most of South East Water WRZ's. The most-likely forecast tend to be the weakest of the projections, however WRZ 7 shows the most-likely and the plan overtaking the trend-based forecasts towards the latter end of the projection period.

Fig 8: WRZ population projections under trend, plan based and most-likely forecasts



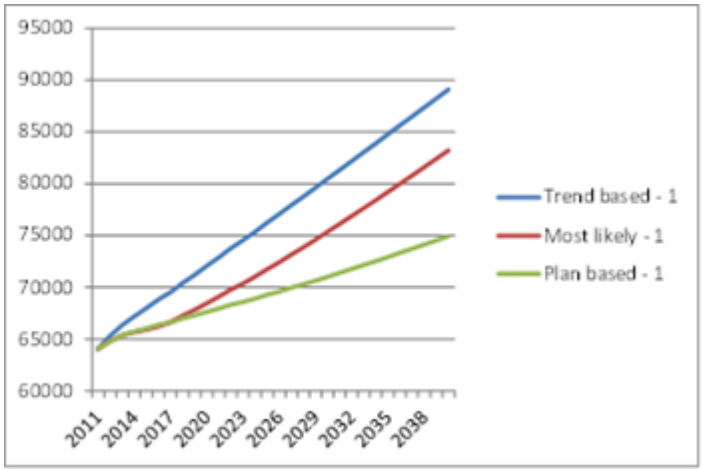


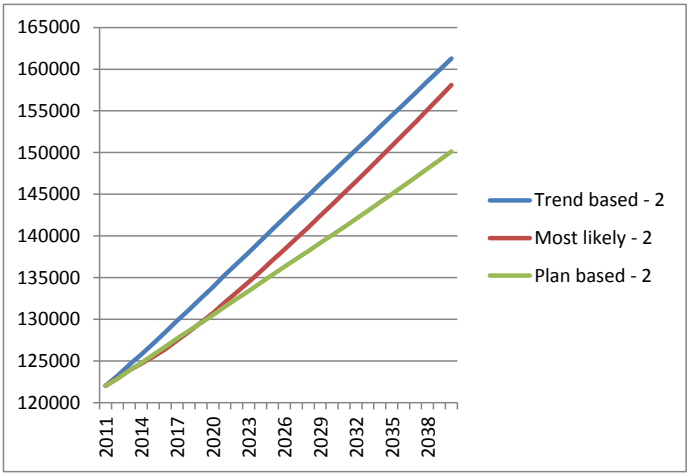


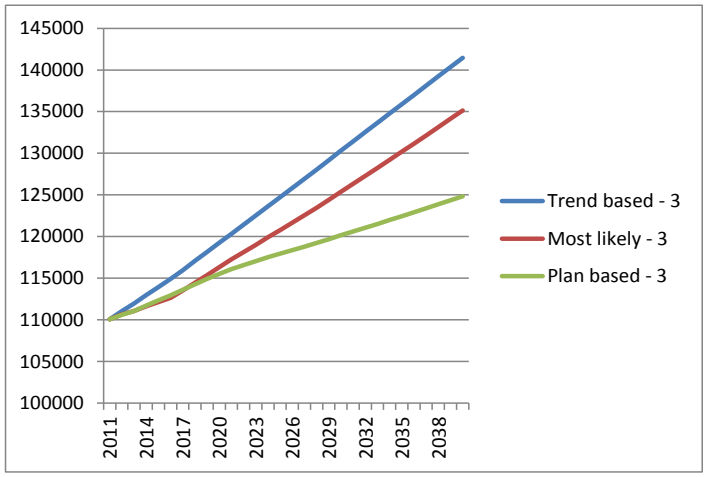
3.1.2 South East Water household projections

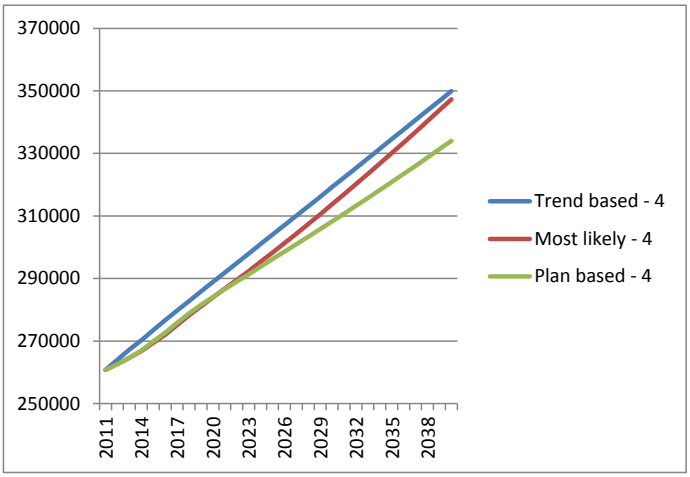
In line with the population projections, trend-based household projections are higher for the South East Water area than the plan and most-likely forecasts. At WRZ level the trend-based forecasts are above most-likely and plan in zones1-6 and 8. Similar to the population projections, zone 7 shows most-likely and plan surpassing trend-based forecasts by 2040.

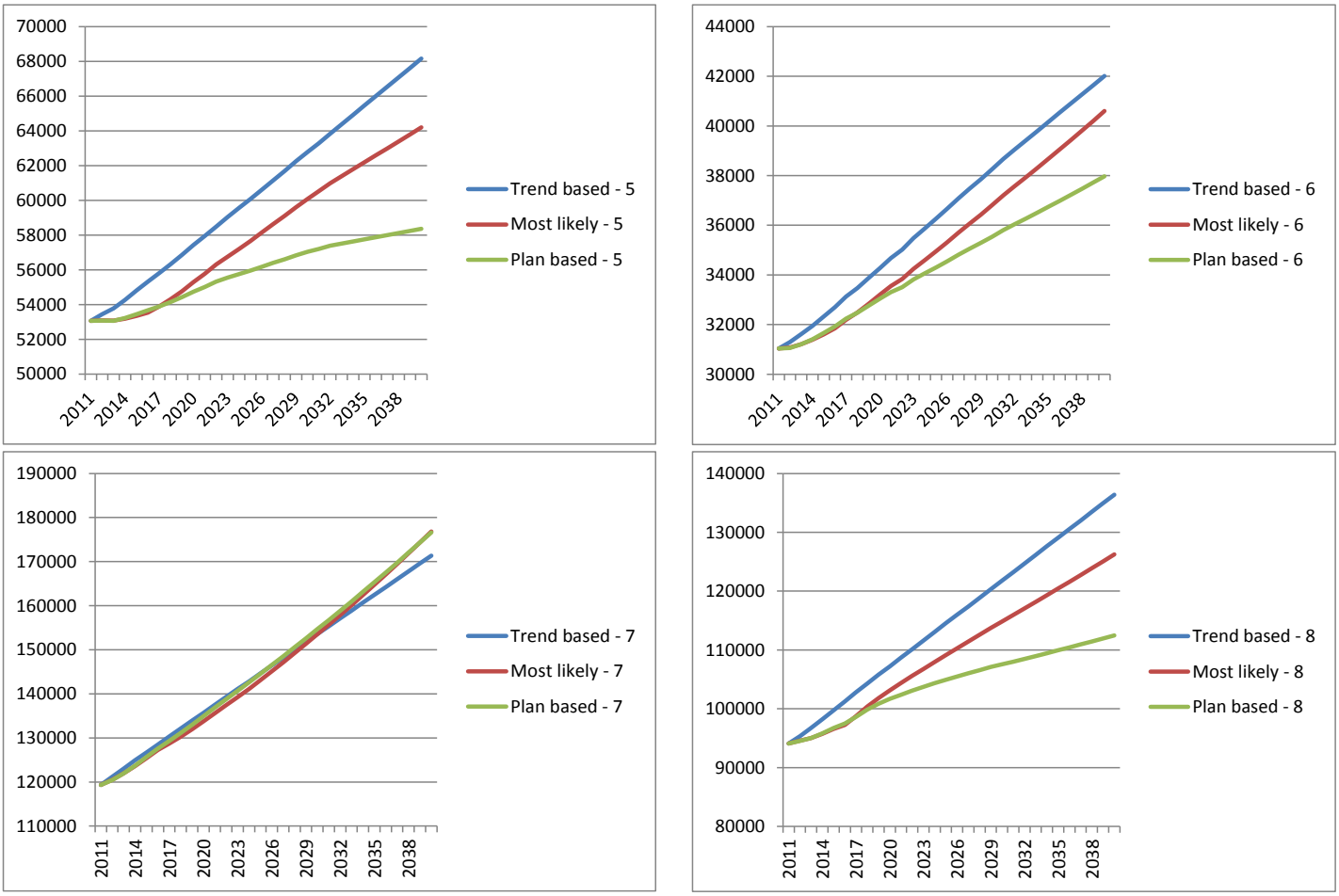
Fig 9: WRZ household projections under, plan based and most-likely forecasts







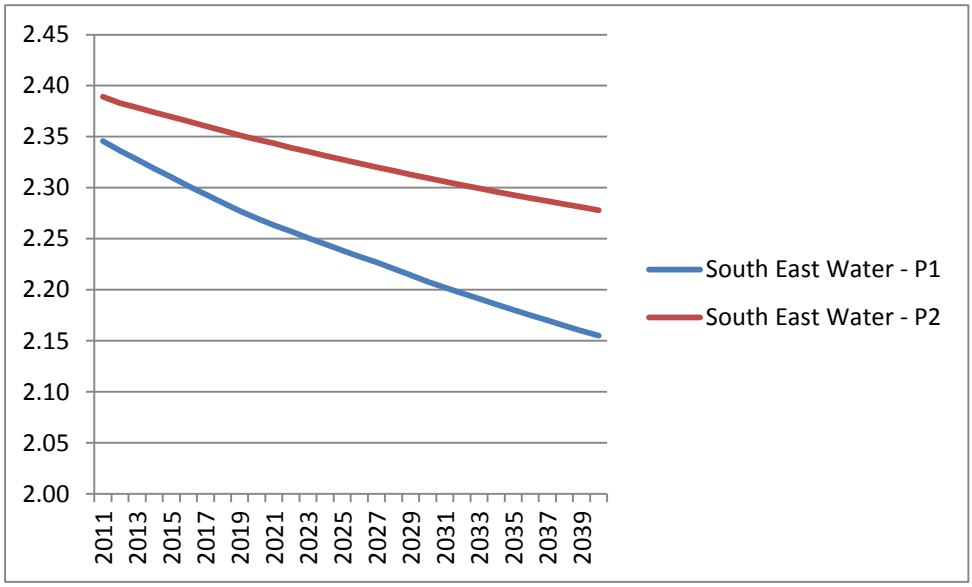




3.1.3 Comparison with Phase 1 projections

Figure 10 shows the change in occupancy projections between Phase 1 and Phase 2. The chart shows that at just shy of 2.4, occupancy was higher in the Census 2011 than 2.35 people per household estimated in Phase 1. The trend-based projection is for a slightly slower decline in household occupancy between 2011 and 2040. The trend-based occupancy projection is applied to the plan-based household projections to produce plan-based population projections.

Fig 10: Phase 1 and Phase 2 trend-based occupancy projections

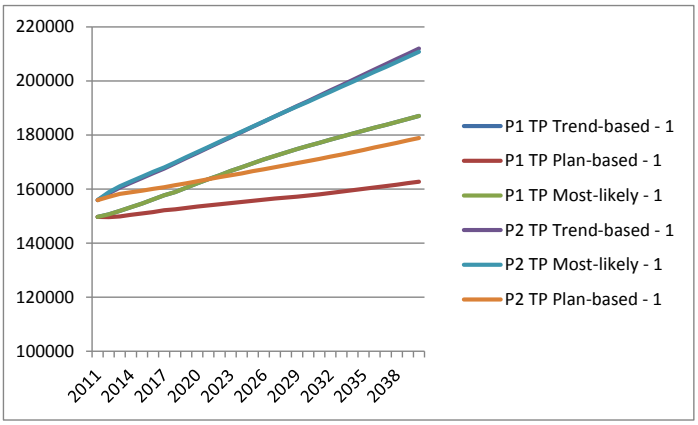


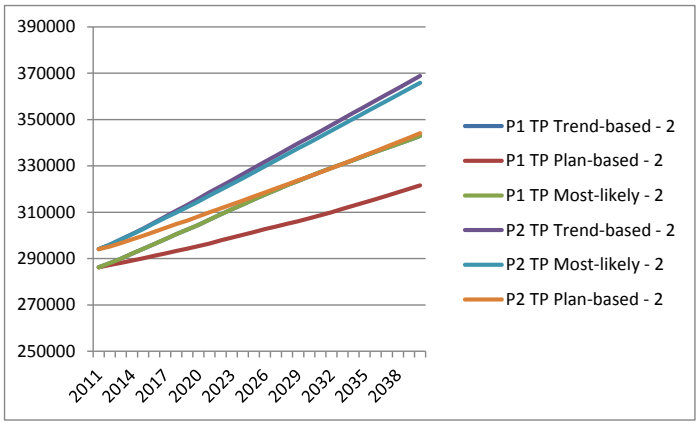
The population projections for Phase 2 include the results of the Census 2011. This has an impact on the level of population in 2011. At company level, the population is 35,200 higher in 2011 than estimated for Phase 1. The difference is not distributed equally across the WRZ's and is most notable in zones 1,2 and 4 - which combined account for over 60% of the difference. The differences are less marked in zones 5-7.

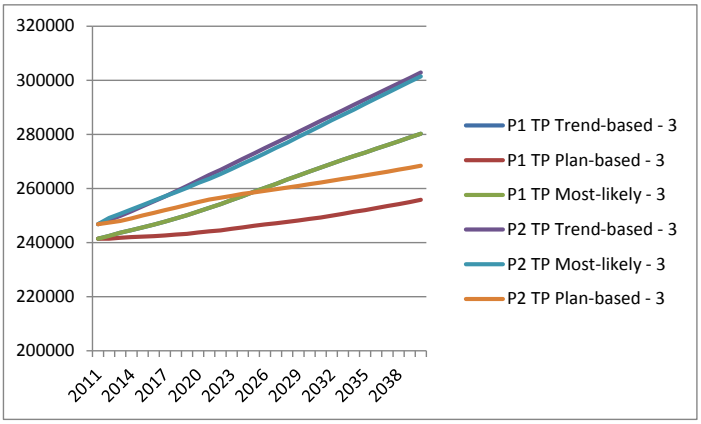
The population forecasts generally have a stronger profile for Phase 2 relative to Phase 1 across most of the WRZ's and projections. At company level the average annual growth for trend-based projections increased from 0.7% in Phase 1 to 0.9% in Phase 2 over the 2011/40 period. The stronger growth is due to the 2011-based ONS projections – as discussed in section 2. The plan-based projections are stronger than the Phase 1 plan-based projections. This is mainly due to the change in occupancy assumptions in the latest forecasts – with occupancy declining at a slower rate than under the Phase 1 projections.

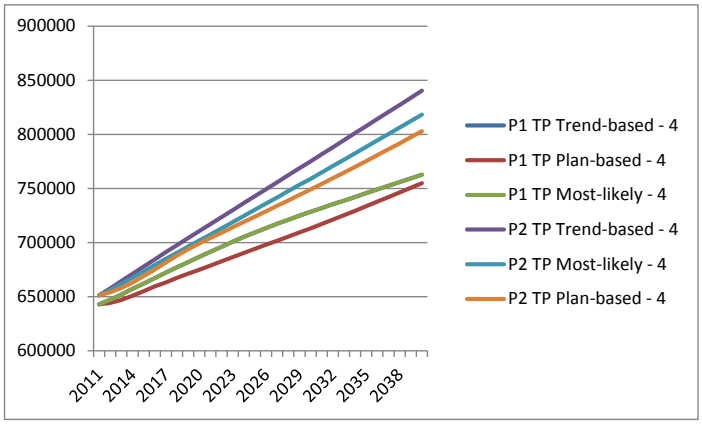
The Phase 2 most-likely forecasts use the most appropriate population projection given the information available – including the revised mid-year estimates. . The most-likely forecasts are lower than Phase 2 trend for most WRZ's – indicating that alternative projections were chosen for many local authorities across the South East Water area in place of the ONS 2011-based population projections.

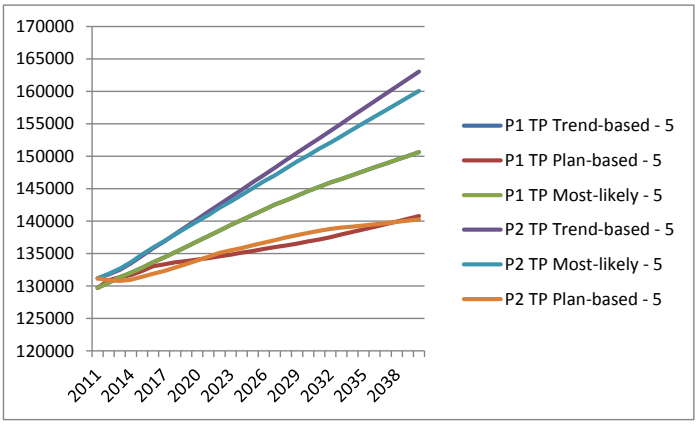
Fig 11: Comparing population projections for Phase 1 and Phase 2

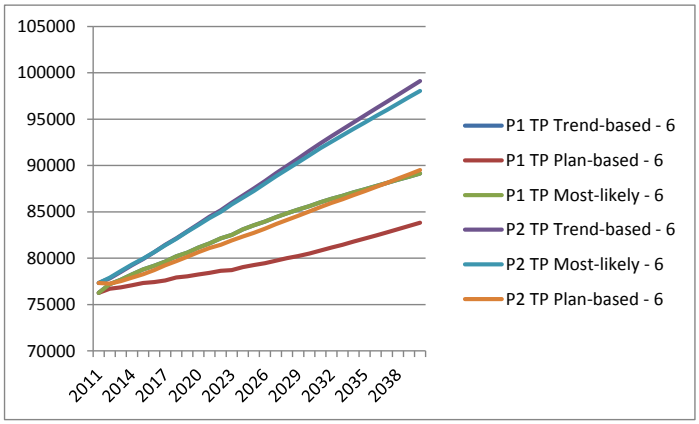


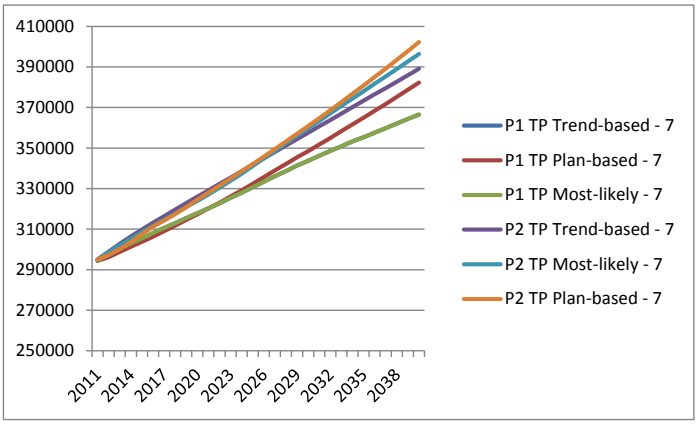


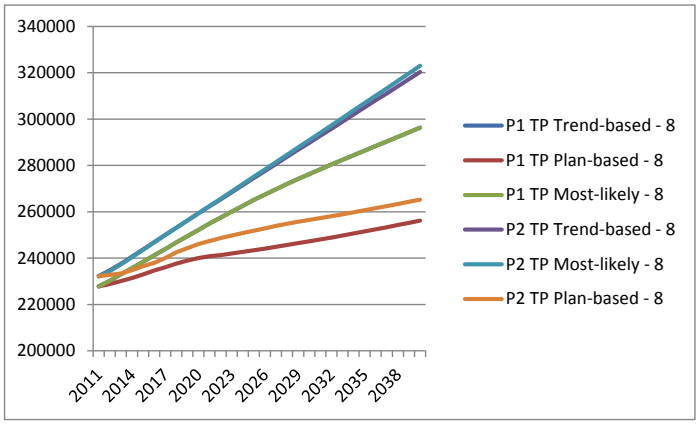






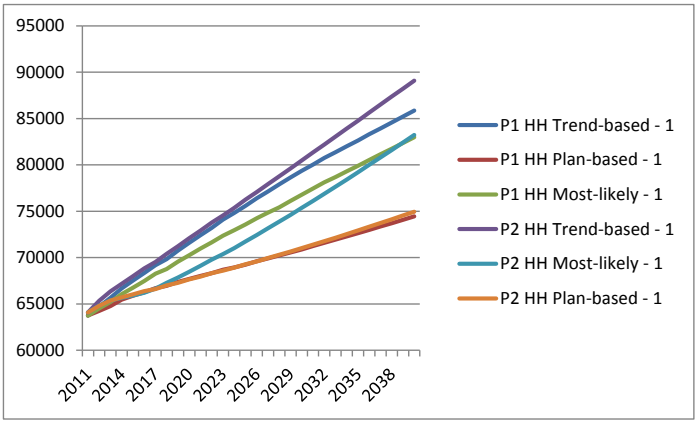


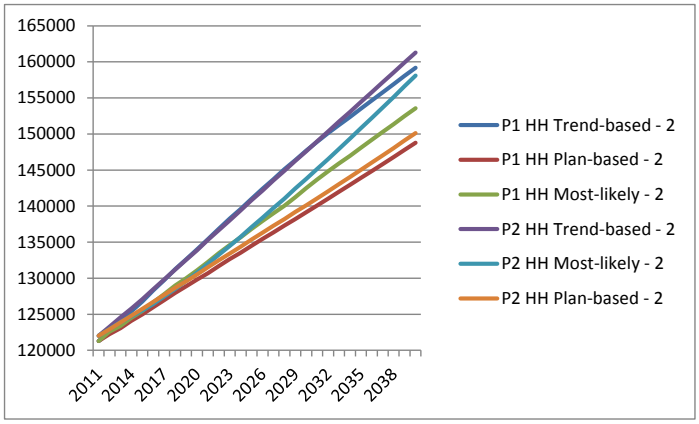


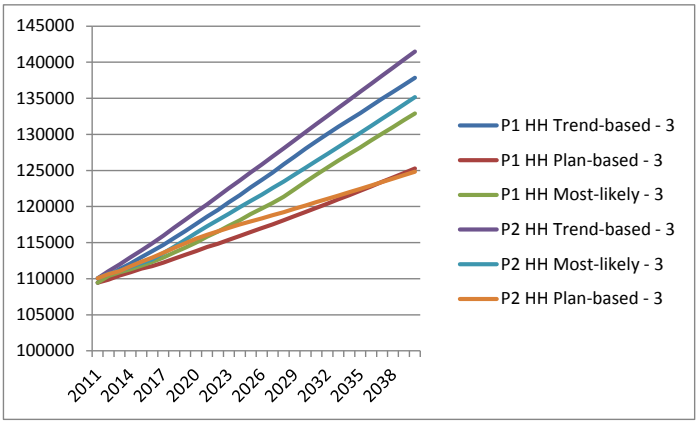


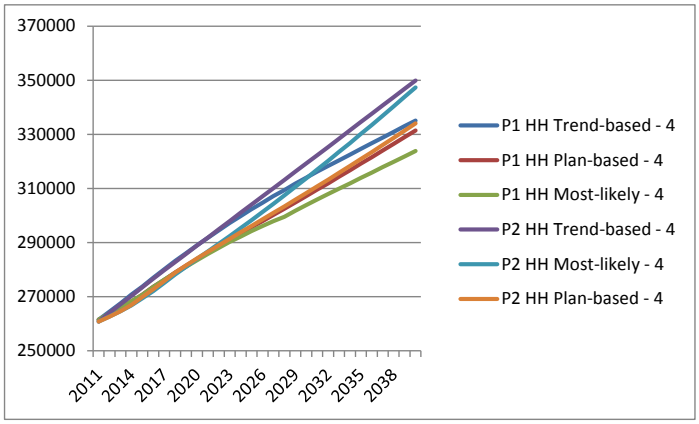
The trend-based household projections are stronger than both plan and most-likely forecasts at company level and are also reflected in most of the WRZ's. At company level, the Phase 2 trend-based household forecasts are higher than Phase 1, however for plan and most-likely Phase 2 forecasts are stronger towards the latter end of the projection period.

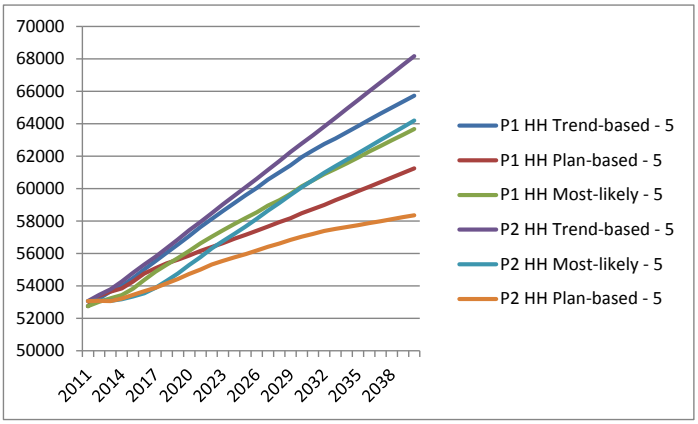
Fig 12: Comparing household projections for Phase 1 and Phase 2







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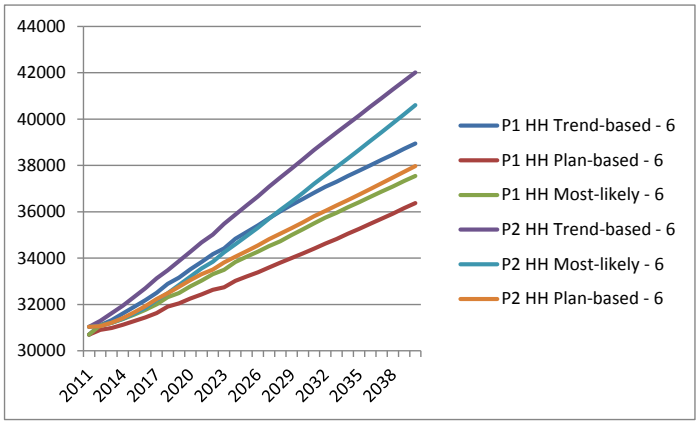
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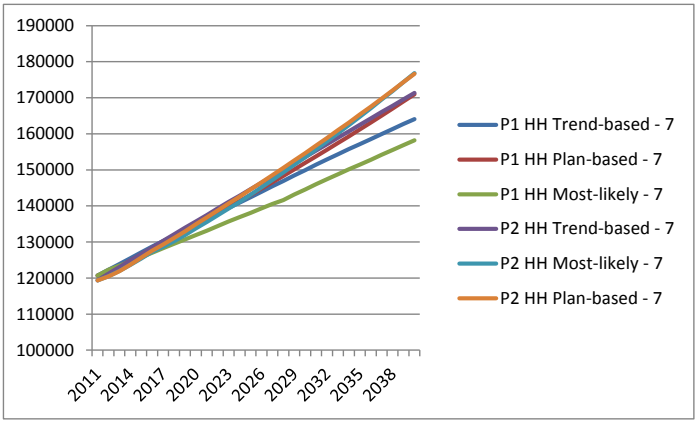
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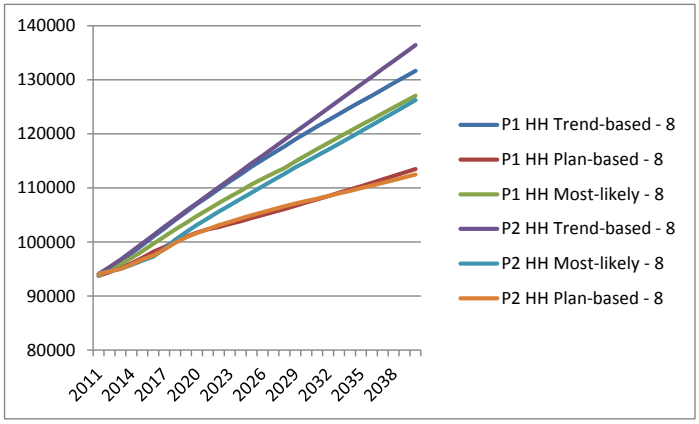
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4 Uncertainty analysis

4.1 Background

Projections become increasingly uncertain the further they are carried forward and long-term projections should be used with caution. The outputs from the project include estimates of uncertainty for the population and household projections. The three different forecasts are built from different assumptions and therefore recognise that the future is inherently uncertain.

There is no objective basis to put error bands around the plan based projections due to the recent changes in the planning system. Previous plans and the scale of housing development was set at the regional level, whilst the latest plans are produced at the local level. Measuring the accuracy of previous plans is also complicated by the economic downturn. Analysis for the most-likely forecast found that the plan-based forecasts are more credible for Phase 2 in many cases than they were for the Phase 1 forecasts, reflecting the fact that local authority plans are in a more advanced state than they were12 months ago. The plans also appear to factor in the current sluggishness in house building, with targets reduced for the next 5 years compared with under Phase 1.

One of the limitations of the traditional deterministic approach – used in the UK to produce the official population projections – is that no probabilities are attached to the principal projections, so users are given no information about the uncertainty associated with them or, with respect to the variants, are given no indication of how these compare to the principal projections in terms of certainty[2]. In theory it is possible however to produce a range of uncertainty around the trend-based population projections, based on comparisons with previous official projections against mid-year population estimates and we explore using this approach in this section.

ONS themselves do not produce measures of uncertainty around population projections. To help understand the uncertainty, a number of variant projections are produced based on alternative plausible demographic scenarios at national level. We have applied the assumptions to local authority projections to produce alternative scenarios at water resource zone level.

ONS have not produced variant projections for the 2011-based projections, however the assumptions used to create the 2011-based projections are the same as those used to create the 2010-based analysis so the scenario analysis using the old variants is still valid.

4.2 Stochastic analysis

For Phase 1 Experian undertook stochastic analysis which used differences calculated between previous ONS population projections and ONS mid-year population estimates to estimate confidence bands around current population projection. This analysis was limited for a number of reasons – mainly due to repeated methodological change and no actual values to compare against (see Phase 1 report for further details). The release of the Census 2011 and the revised of mid-year estimates for the intercensal years means that we can now compare estimates for 2011 (rolled forward from the 2001 Census) against actual population figures for 2011. It is then possible to apply the measured errors for 2011 to future time periods at local authority level and estimate confidence bands around future projections.

The analysis involved the following steps:

[2] ONS Chapter 6: Variants, 2010-based NPP Reference Volume, March 2012

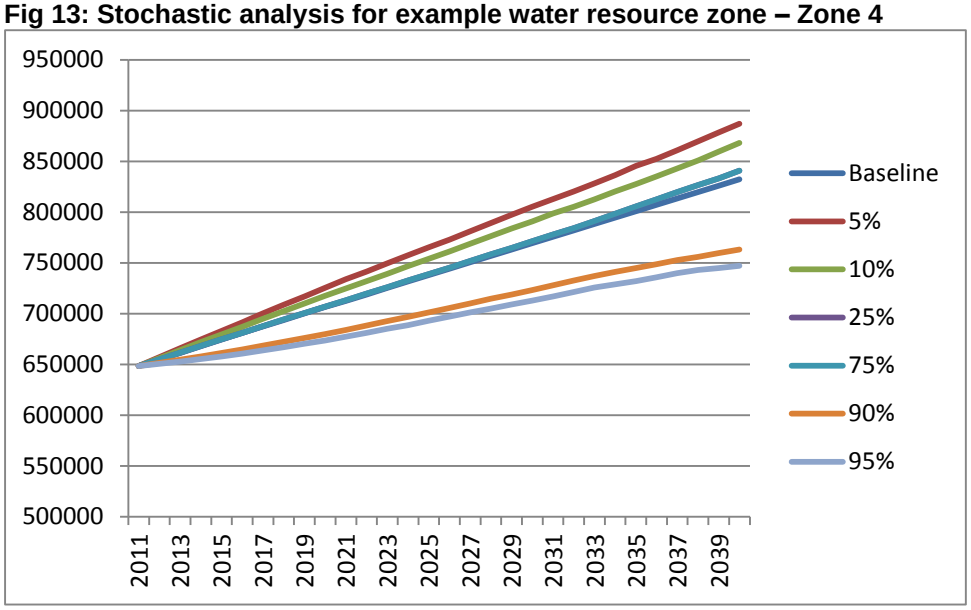
1. Calculate the percentage errors (and their direction) between estimates of population and actual population from the ONS data.
2. Fit a statistical distribution to the errors.
3. Generate a large number of scenarios in each of which:
    a. Each LADs population at future census points (2021 2031 2040) had an error applied to it from the distribution. Note that errors in 2031/2040 compounded on earlier errors.
    b. Adjusted and smoothed the growth profile between census points in order to reach these error points.
4. Calculated the confidence intervals from the resultant scenarios.

The results of the population stochastic analysis for Zone 4 WRZ are presented in Figure 13.

The first point to note is that the confidence intervals are not symmetrical – demonstrating that there is some bias on the downside as ONS underestimated population growth in many local authority areas. The second point to note is that the baseline (which is the trend-based population projection) falls within the 75% confidence interval.

The 90% probability interval (difference between pale blue line at 95% and red line at 5%) for the population is 750,000 - 890,000 in 2040 compared with the trend-based projection of 845,000 in 2040.

Fig 13: Stochastic analysis for example water resource zone – Zone 4



4.3 Scenario analysis

ONS do not produce measures of uncertainty around the population projections as it is not possible to do so using the deterministic approach used. Instead they provide a number of variant projections to demonstrate the uncertainty that different assumptions have on the population projections. However these variants are only produced at national level. Experian have applied the national variant assumptions from 8 scenarios to local authorities to simulate the variants at a lower geographical level that can then be applied to forecasts at water resource zone level. The variants chosen for this analysis:

- High fertility
- Low fertility
- High life expectancy
- Low life expectancy
- High net migration
- Low net migration
- High population (combining all the ‘high scenarios’ above)
- Low population (combining all the ‘low scenarios’ above)

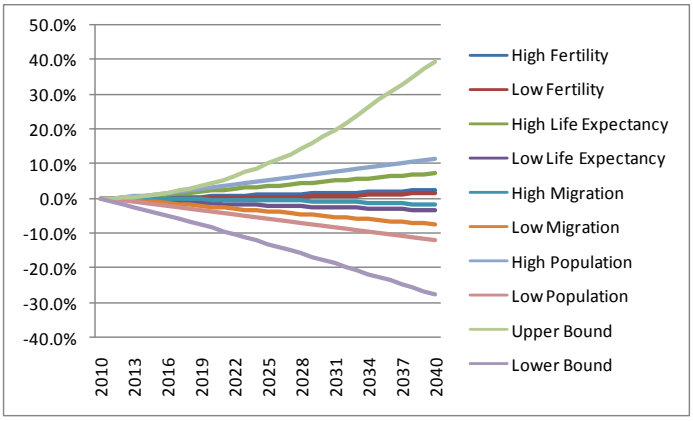
ONS have not produced variants for the 2011-based projections so we are unable to update our previous scenario analysis. However, the analysis from Phase 1 is still valid since ONS did not update the assumptions for natural change and migration for the 2011-based projections.

4.3.1 Scenario results

Results are presented in terms of percentage difference from the trend projection. In all cases the 'high population' and 'low population' scenarios represent the greatest difference from baseline – which at most is around +/- 10% compared with the baseline. However, it should be considered that the scenarios apply national assumptions and differences in migration flows particularly could have a much larger impact on population growth or decline at a local level.

The upper band and lower band uncertainty scenarios provide a maximum extent that the projections could fall within and therefore the bands are typically quite wide – especially on the upside. The upper and lower band scenarios can be interpreted as the outcome if average errors that have occurred at local authority level in the region continue and are compounded into the future. The results for South East Water suggest that in the past, ONS projections have tended to underestimate rather than overestimate the scale of population growth in the area.

Fig 14: Uncertainty scenarios for South East Water WRZs



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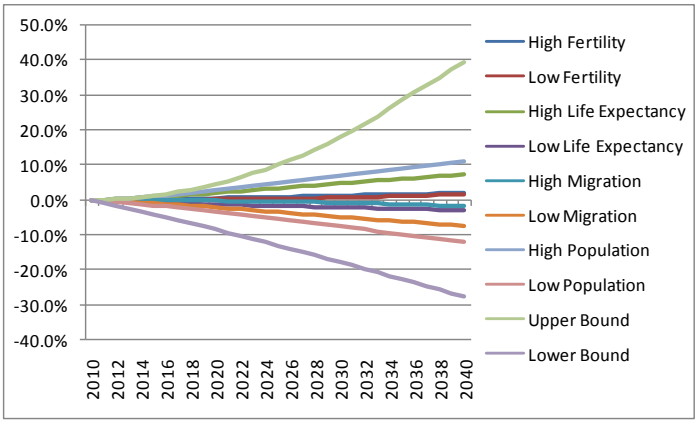

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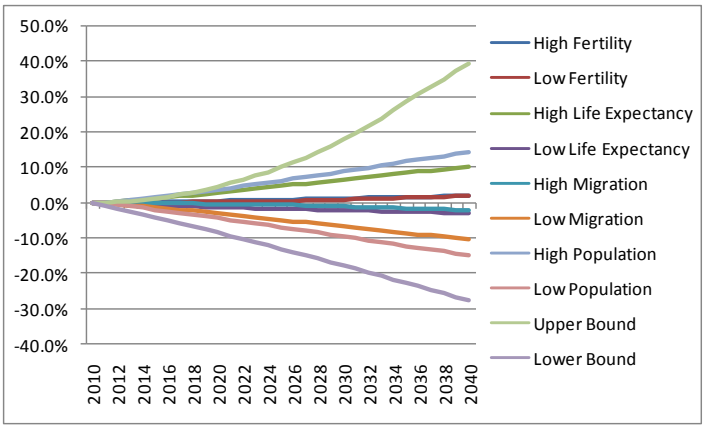
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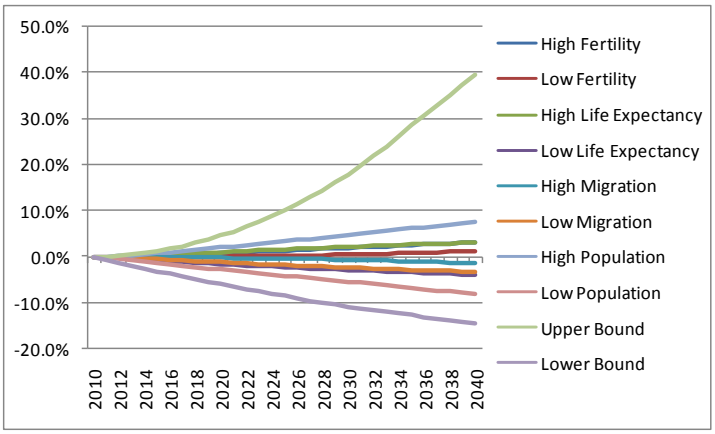
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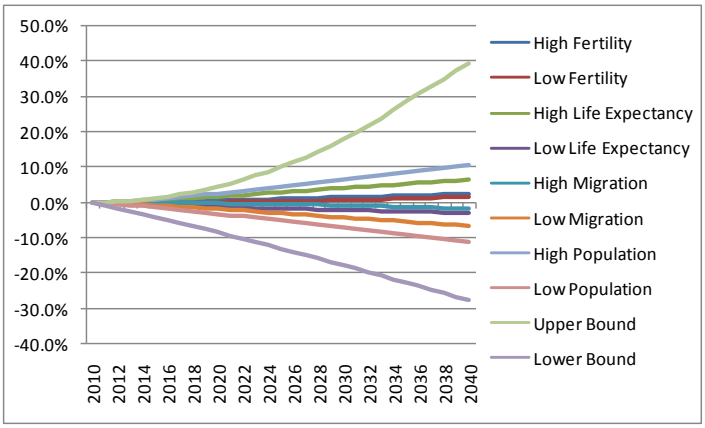
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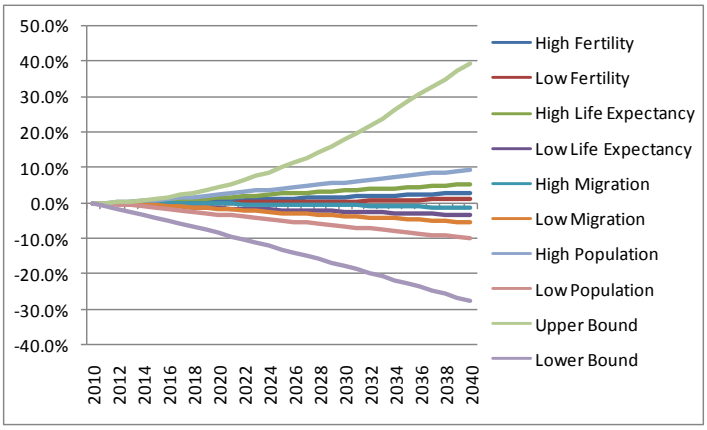
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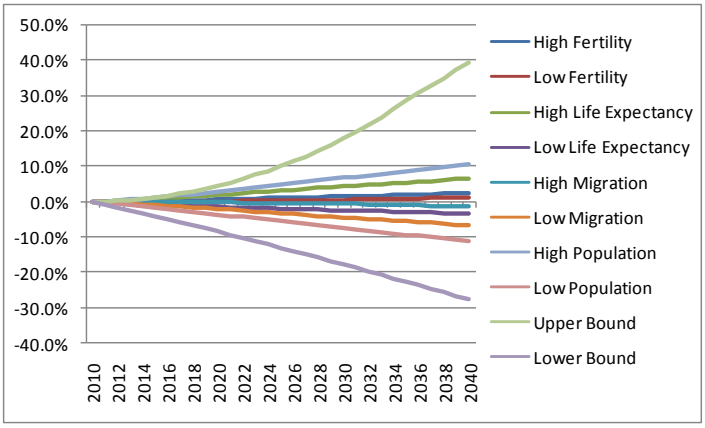
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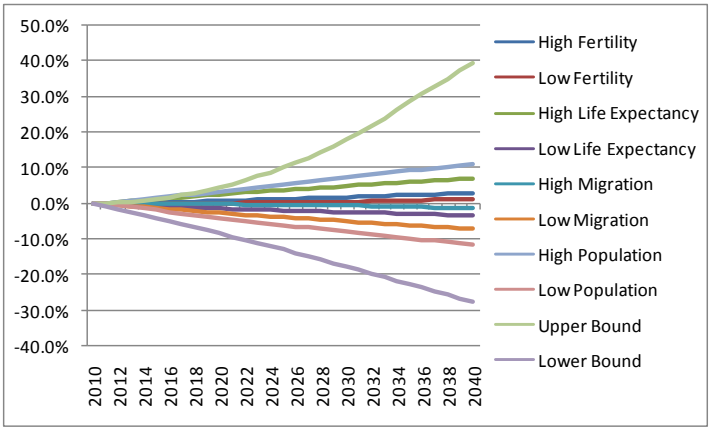
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Low Fertility
High Life Expectancy
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High Migration
Low Migration
High Population
Low Population
Upper Bound
Lower Bound

8

Appendix A: Phase 2 Data Sources

- Local authority provided planned dwelling data and local authority plans (see Contact Log)

- ONS 2011 interim sub-national population projections – Local Authority, released 28 September 2012 – projections used to produce the trend-based Phase 2 projections
  http://www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/Interim-2011-based/stb-2011-based-snpp.html

- ONS 2010 sub-national population projections – Local Authority, released 21st March 2012 – these were used to inform the Phase 2 most-likely projection and were the trend-based/ most-likely projection for Phase 1
  http://www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/2010-based-projections/stb-2010-based-snpp.html

- ONS 2010 National population projections, principal and variant projections, released 26 October 2011
  http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2010-based-projections/index.html

- DCLG 2011 household projections – Local Authority, released 9th April 2013
  http://www.communities.gov.uk/publications/corporate/statistics/2033household1110

- ONS revised mid-year estimates 2002-2010 – Local Authority, released 30th April 2013
  http://www.ons.gov.uk/ons/guide-method/method-quality/imps/improvements-to-local-authority-immigration-estimates/index.html

- ONS mid-year estimates 2001-2010 – Lower Super Output Area, released September 2011
  http://www.ons.gov.uk/ons/rel/sape/soa-mid-year-pop-est-engl-wales-exp/mid-2010-release/index.html

- Census of population, 2011, released January/ February 2013
  http://www.nomisweb.co.uk/census/2011/key_statistics

- Census of population, 2001, released 30 March 2004.
  http://www.nomisweb.co.uk/home/census2001.asp

- London Plan
  The London Plan Spatial Development Strategy for Greater London, released July 2011
  http://www.london.gov.uk/priorities/planning/londonplan

- GLA Population Projections 2011 Round, SHLAA, Borough SYA, released 16th December 2011
  http://data.london.gov.uk/datastore/package/gla-population-projections-2011-round-shlaa-borough-sya

- 2011 round SHLAA based household projections - standard fertility variant, released 16th December 2011
  http://data.london.gov.uk/datastore/package/2011-round-shlaa-based-household-projections-standard-fertility-variant

- Experian Output Area level datasets, 2001-2040, derived from Census 2001, and pushed forwards using information from the electoral role, PAF files and responses to household lifestyle surveys. Controlled to 2011 Census output area results (released Jan/ Feb 2013).

- Property Pipeline information supplied by Emap Glenigan (April 2012).

Appendix B: How property pipeline level data is built into the demographic forecasts

The methodology that we use to build residential property pipeline information into our demographic forecasts utilizes site level planning application and contract progress data that is sourced from Emap Glenigan. The approach adopted by Emap Glenigan involves weekly visits to the local planning authorities to gather information regarding new planning applications. In addition to this Emap Glenigan's information gathering approach features regular phone calls to "plan applicants" (undertaken by a dedicated team of around 40 people) in order to establish the planning application/contract progress stage that each site has reached. Accordingly, through Emap Glenigan we are able to access real time information regarding the country's residential property pipeline.

To utilize Emap Glenigan's site level planning application and contract progress data in our demographic forecasts we first need to establish the likelihood that each site in the property pipeline has of being "built-out". To do this we use a procedure (developed in consultation) with Emap that assigns "build out" probabilities according to the stage that each site has reached in the planning /contracting process and the insight (based on experience) that this information provides regarding the likelihood that the associated scheme will be completed. In particular the "build out" probability that is assigned to each site reflects the maximum of the probabilities that are shown in Table 2 regarding site planning and contract stages.

Table 2: Emap Glenigan Probabilities

Planning Stage	Probability
Planning Not Required	0.98
Plans Appr on Appeal	0.95
Detail Plans Granted	0.90
Reserved Matters Granted	0.85
Detailed Plans Submitted	0.80
Detail Plans Withdrawn	0.60
Detail Plans Refused	0.55
Outline Plans Granted	0.54
Circular 18/84	0.53
Outline Plans Submitted	0.52
Appr Reserved Matters	0.55
Listed Building Consent	0.48
Pre-Planning	0.45
Public Enquiry	0.40
Outline Plans Refused	0.30
Outline Plans Withdrawn	0.20

Contract stage	Probability
Start on Site	1.00
Contract Awarded	0.75
Preferred Bidder Appt	0.50
Bills Called	0.45
Tenders Returned	0.40
Tender Currently Invited	0.30
Applications to Tender	0.25
Pre-Tender	0.20

To calculate the population that is associated with each site in the residential property pipeline the "build out" probability is simply multiplied by the number of units that are planned for each site and then multiplied again by our estimate of the average occupancy rate in the relevant Output Area.

The final stage in the methodology that we use to build residential property pipeline information into our demographic forecasts requires us to estimate when each "potential" new development is likely to be completed. If start and completion dates are not available for a given site we take a conservative view that the site will be completed 4 years after the date at which we are making our forecasts (if the number of units in the project is less than one thousand). If the number of units exceeds one thousand, the project is given a completion date 12 years after the start date. Finally simple linear interpolation techniques are used to determine the speed at which each site is "built out" (and hence population accumulated) over the construction period.

Appendix C

About us

Experian

Experian is a global leader in providing information, analytical and marketing services to organisations and consumers to help manage the risk and reward of commercial and financial decisions.

Combining its unique information tools and deep understanding of individuals, markets and economies, Experian partners with organisations around the world to establish and strengthen customer relationships and provide their businesses with competitive advantage.

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Experian Group Limited is listed on the London Stock Exchange (EXPN) and is a constituent of the FTSE 100 index. It has corporate headquarters in Dublin, Ireland, and operational headquarters in Costa Mesa, California and Nottingham, UK. Experian employs around 15,500 people in 36 countries worldwide, supporting clients in more than 65 countries. Annual sales are in excess of $3.8 billion (£1.9 billion/€2.8 billion).

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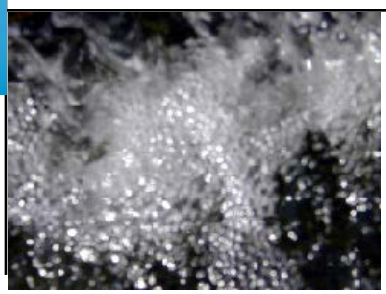


WRMP14

PROJECT NUMBER: 67951

SEW Non Household Demand Forecast
October 2013

	Name / Position	Signature	Date
Originated by:	Jacobs Engineering UK Ltd	NA	
Checked by:	South East Water		
Approved by:	South East Water		
Accepted by:	South East Water		

DOCUMENT RECORD SHEET

Revision Register

Version	Date	Changes

Document Issue Register

Version	Date	Changes
1	21 November 2012	
2	31 October 2013	

CONTENTS

1 EXECUTIVE SUMMARY

This report details the analysis that has been undertaken of South East Water's (SEW) non-household customer base and their water use. The following process has been applied to provide a detailed understanding of the make-up of the customer base, their current water usage and how this is likely to change over the forecast period of the 2014 Water Resources Management Plan.

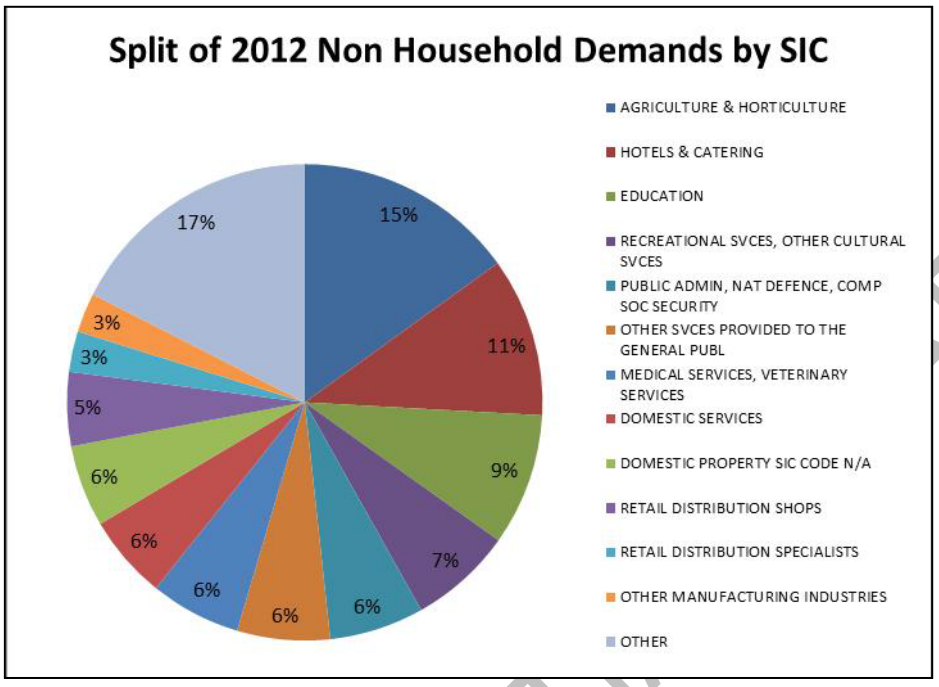
1. Update of the Standard Industry Classification (SIC) coding of each non-household customer.
2. Analysis of historical consumption by SIC and Water Resource Zone (WRZ).
3. Investigate relationships between demand and potential explanatory factors, such as weather and levels of economic activity.
4. Discussions with SEW Key Account customers regarding their future plans and water requirements.
5. Production of demand forecasts by sector and WRZ for Dry Year and Normal Year forecasts.

The analysis of demands against individual explanatory factors did not produce any significant correlations. This is consistent with our experience with other water companies and the fact that there are many, independent and often, conflicting, influences on demands. We have therefore, concluded that time based trends best reflect the mix of demand drivers and their likely changes over the planning period.

We recognise that our analysis of non-household customer usage requires updating before the next WRMP, and consequently we commit to undertaking a review of industrial categorisation codes and an update of our commercial forecast prior to the dWRMP19.

2 CUSTOMER SEGMENTATION

The following chart shows the split of the 2011/12 non-household total water delivered of 111 Ml/d, by SIC, with their proportions of the total. The final "Other" segment is a collation of approximately 50 smaller use sectors in the SEW region.

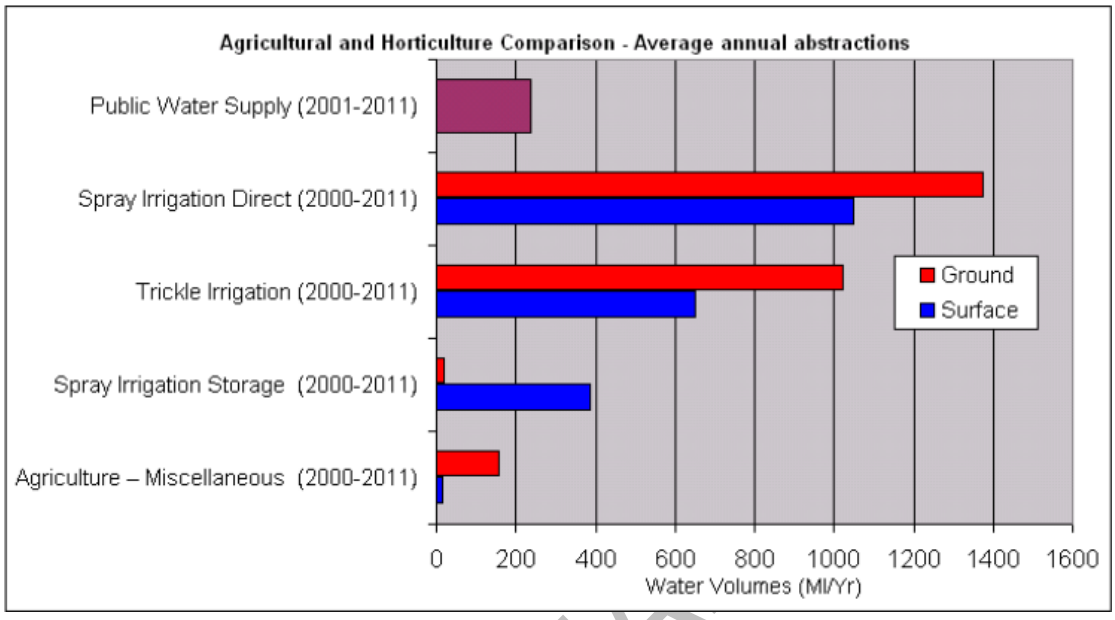


3 AGRICULTURE AND HORTICULTURE

This is the largest water use sector of SEW's non-household customers, representing 15% of total non-household demand. The proportion varies from just over 5% in WRZ4 to over 45% in WRZ7 as shown in the table below. The values are average daily consumption of metered customers in 2012 in but these do not take account of the under-registration of meters, adjustments for calibration against the water put into supply, and other minor readjustments. Consequently this figure is different to the final Water Delivered figure for the same year of 111 Ml/d noted previously.

WRZ	Agriculture	Total	%age of Total
1	435	6,058	7.2%
2	2,023	10,741	18.8%
3	1,646	10,682	15.4%
4	1,538	27,691	5.6%
5	1,059	5,629	18.8%
6	1,768	10,705	16.5%
7	1,669	3,633	45.9%
8	3,199	15,325	20.9%
Grand Total	14,118	93,669	15.1%

However, it is important to recognise that public water supplies (from SEW) represent a very small proportion of the total water used by the sector in Kent as shown below, in the extract from HRWallingford's presentation on Agricultural and Horticultural Water Use in Kent, as part of the UKWIR project CL04: Climate Change and the Demand for Water

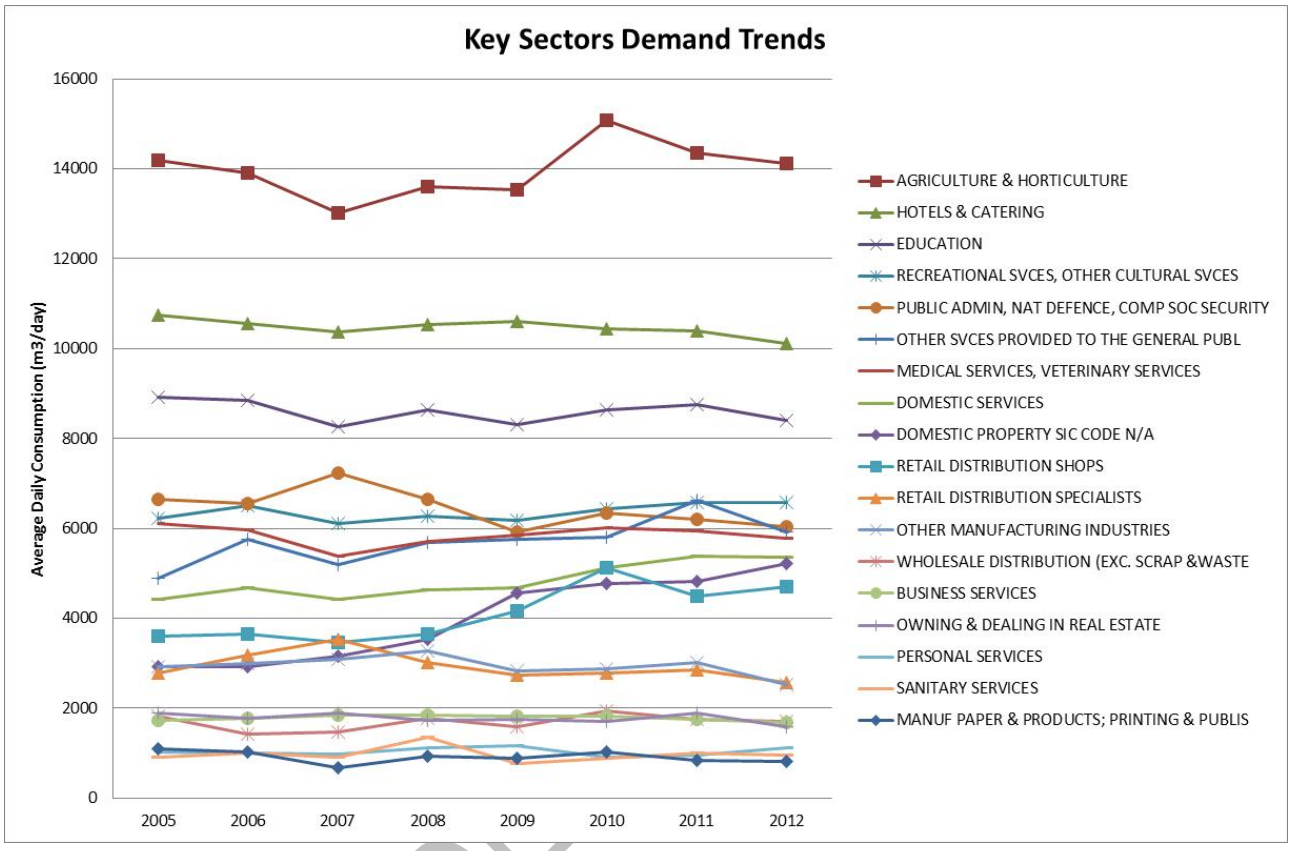


It is estimated that PWS represents 10 to 20% of the sector demand. This means that future PWS demands could increase or decrease dramatically with changes to the other sources of supply and policy changes within this sector.

We have held discussions with our key customers in this sector to understand their current and future crop production plans, the associated water requirements and how they propose to meet these. Many have expansion plans; in particular we are seeing the planting of large scale apple orchards in north Kent as well as more poly-tunnels. As part of these developments, some growers are investing in rainwater harvesting, reservoir storage and boreholes such that their planned additional PWS demands will be more carefully managed, although potentially on a larger scale. However, these capital investments are primarily only considered by a small number of large companies and hence there is likely to be an increased demand of the majority of our agricultural customers which will need to be met from the PWS.

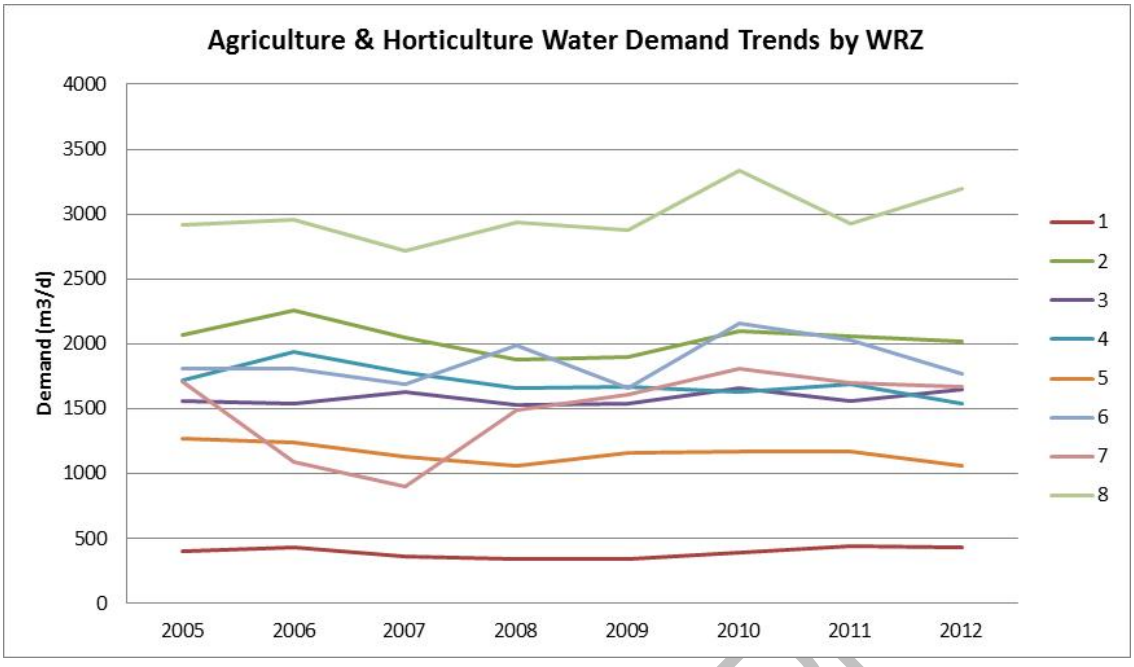
4 NON HOUSEHOLD DEMAND FORECASTS

Plotting the annual average daily demands from 2005 to 2012 of the key sectors produces the following chart. The weather has been highly variable over the period, with hot summers in 2005, 2006 and 2010.



This shows that demand in most sectors has been flat over the last eight years. There are no significant correlations between demands in any of the sectors and potential explanatory factors such as regional economic activity. We continue to see growth in the overall non-household customer numbers, however, their demands are typically replacing reduced activity or efficiency savings by existing customers. We have therefore adopted a flat demand forecast for all sectors with the exception of Agriculture and Horticulture.

The following chart shows the trends in Agriculture and Horticulture use in each WRZ over the last eight years. Annual variations arise due to a number of factors and therefore we have produced a two year, rolling average forecast from the company level data. This gives an overall annual increase of 0.95%, which, when applied to the AR12 Agriculture and Horticulture demand of 16.5 Ml/d, produces a 2040 normal year annual average demand of 21.5 Ml/d.



UKWIR Project CL04B: The Impact of Climate Change on the Demand for Water provides the following conclusion regarding the impact of weather on the various non household sectors' demand for water;

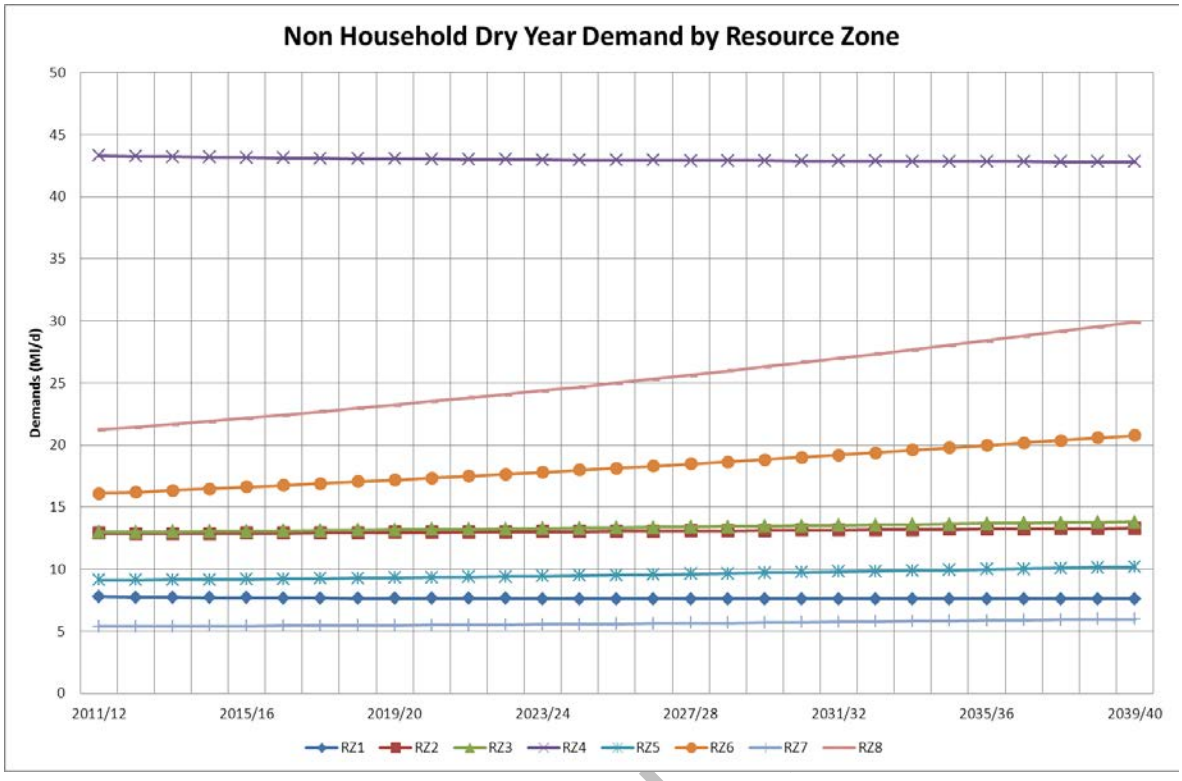
"It was concluded that, except in the case of agriculture and horticulture in South East England for which a robust demand-weather relationship was obtained, there was inadequate consistent evidence from this study to justify making any allowance for climate change impacts on non-household demand."

Based on this finding and our historical consumption analysis, it is assumed that the agricultural and horticultural sector has a dry year factor of 1.5, such that base year, dry year annual average (DYAA) demand is 16.5 x 1.5 = 24.8 Ml/d. Applying the 0.95% annual growth rate results in a 2040 DYAA Demand of 32.3 Ml/d.

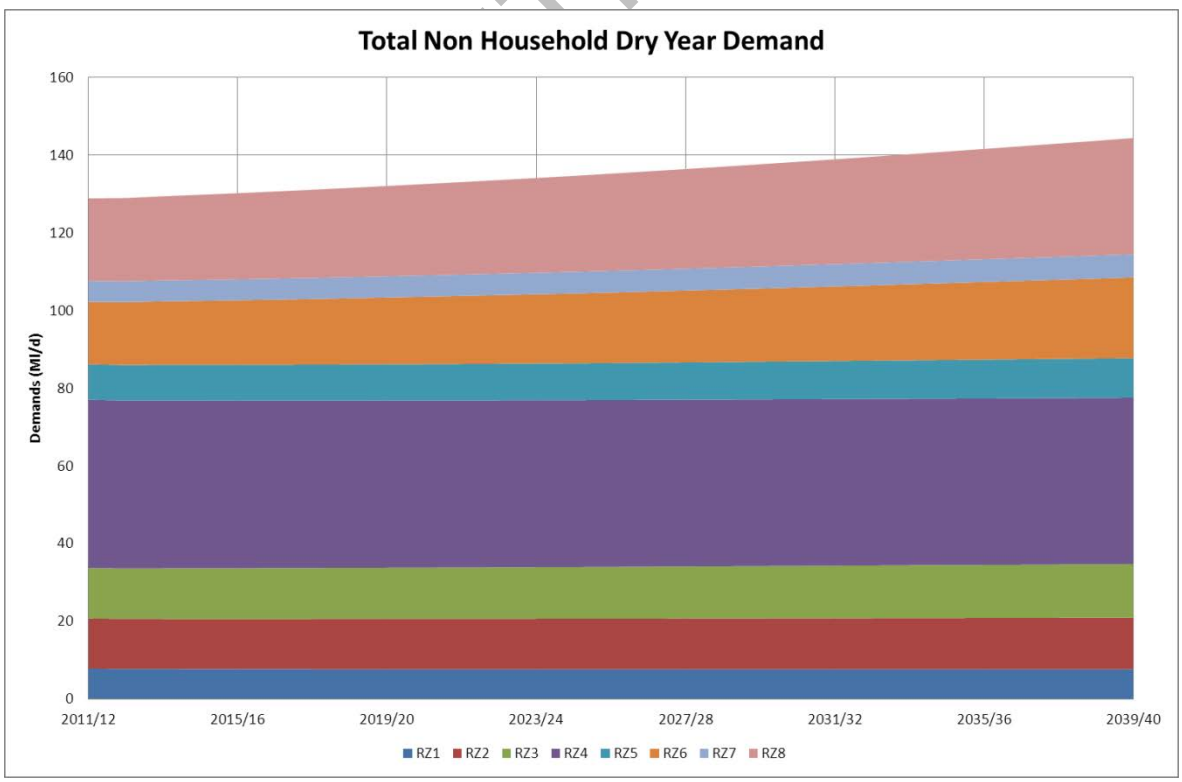
The DYAA demand of all other non-household customers has been assumed to rise by 0.2% per year, from 104.7 Ml/d in 2012 to 110.7 Ml/d in 2040.

The growth in total non-household DYAA demand, taking account of minor movements in underground supply pipe losses as unmetered properties are transferred, and new properties are built, is 15.7 Ml/d (12%) over the period from 2012 to 2040.

The allocation of the DYAA growth between the WRZs is shown in the forecast chart below. This highlights the impact of Agriculture and Horticulture in zones 6 and 8 in particular.



The following chart provides the overall, company level non-household DYAA water delivered forecast.



5 HYDRAULIC FRACKING

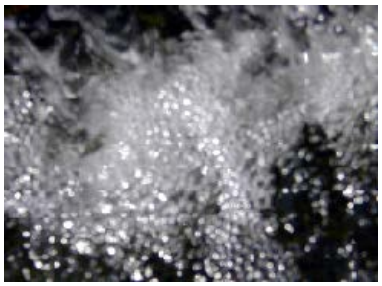
There has been a significant amount of interest in our region in connection with the potential developments of shale gas extraction for hydraulic fracturing (or fracking) in our area of operations. In particular, concerns have been raised regarding the amount of water that is needed for the process and the potential for contamination of water supplies.

With regard to the impact on water demand, the use of water for shale gas extraction would be classed as non-domestic supply.

A water company has a duty to provide water for non-domestic purposes under the Water Industry Act 1991 but this is subject to certain exceptions. We have a legal duty under this Act and we cannot make choices on who we supply, other than on grounds that relate to cost of the new supply, or the knock on effects to existing service e.g. increased risk to customers of low pressure.

If we were to receive a request to supply water for shale gas extraction it would have to be assessed on a case-by-case basis against these criteria.

In respect of contamination of water from fracking, South East Water is not a statutory consultee with regard to shale gas extraction but we are closely liaising with the Environment Agency on this subject.



Water Efficiency Strategy 2015-2040

VERSION NUMBER: 1.1

	Name / Position	Signature	Date
Originated by:	Gemma Avory – Water Resources Planner		
Checked by:	South East Water		October 2013
Approved by:	South East Water		October 2013
Accepted by:			

South East Water

CONTENTS

EXECUTIVE SUMMARY

There are a number of serious challenges ahead, as for all the companies operating in the South East of England; the biggest of these is to manage (reduce) present and future levels of water demand. The challenge comes in many forms, including: the effects of climate change; the growth in population in the south east; historical levels of customers' increasing water use; and conversely, the increasing regulatory and political will to reduce future water use, in particular per capita consumption (pcc).

We are committed to implementing ways to reduce the demand on water, and we will make our decisions based on what we believe is right for our customers and the environment particularly in the longer term.

To meet our ambitious demand forecast assumption of reducing pcc throughout the planning horizon 2015 to 2014, we believe needs a long term water efficiency strategy that encourages our customers to reduce their water use and changes behaviour so that we can sustain reduced demand as much as possible before relying upon new supplies. This strategy need also contribute to the following:

- We understand and improve our environment and reduce the impacts of continued water abstraction;
- Comply with all legal frameworks;
- Meet the levels of service required by law but also that expected by the customer;
- Encourage customers to reduce water conservation and therefore their 'footprint' in terms of water use and carbon;
- Increase the sense of responsibility to all our customers to reduce demand;
- Improve the trust by the public in the Company.

The water efficiency strategy is set out to ensure we meet our legislative requirements and the expectations of the Regulator, but also to provide innovative, appropriate and effective measures that will help to minimise the impact of supplying our consumers with the water they require.

South East Water has a statutory duty to promote water efficiency to all our Customers and for the period 2010-2015 we had new Water Efficiency targets set by Ofwat. This is an activity based target for all companies to achieve an assumed saving of 1l/prop/day; for South East Water this is 0.84 Ml/d every year or a total of 4.2 Ml/d saving across AMP5.

For the period 2010-2015 we expect to achieve assumed savings of 4.7 Ml/d, which will be exceeding our target. In order to make the savings a reality, and to the sustain them; we rely on a longer term shift in cultural behaviour around water use from our customers and within Government legislation and advice. Any savings will be achieved through following the strategy outlined in this document and enhancing the suggested activities year on year to adopt the most cost effective measures and activities while continuing to promote behaviour change to all customers.

The ambitious per capita consumption (PCC) reductions assumed in the WRMP will include the current and continuing water efficiency methods adopted by South East Water which

will include reductions in water use from people changing out their toilets to be more efficient low flush toilets, buying more efficient washing machines and dishwashers and taking shorter showers instead of baths etc. as outlined in our pcc micro component modelling. The assumed reductions also include savings from the proposed continuation of the metering programme which are not included in the assumed savings within the water efficiency strategy.

The activities presented within this water efficiency strategy include enhanced baseline assumed savings from providing customers with greater levels of water efficiency devices and associated education on behaviour change. These will lead to the changes proposed in water use such as shorter showers, only using the washing machine with full loads etc. which are assumed to lead to reductions in the overall pcc across the company. Delivering behavioural change through education and awareness is a necessary pre-requisite to achieving these savings.

Where possible we will monitor any savings from our water efficiency enhanced baseline activities. This will help develop the evidence base and ensure we are providing the most cost effective methods across our customer base to encourage and deliver real reductions in water use. It is not always possible to calculate deliverable savings from all activities, especially education, but we will carry out qualitative analysis where possible.

The following sections set out the Company's enhanced baseline water efficiency strategy for 2015-2040.

1 EDUCATION

Water companies often link with other organisations to promote water efficiency, including local schools, consumer groups, conservation bodies, gardening clubs etc. While the Government and industry can make it easier to save water and produce incentives', taking personal responsibility is at the heart of our water efficiency strategy.

The company takes its duty to promote water efficiency seriously and has operated an extensive programme of water efficiency initiatives that focus on education, advice and raising awareness, provision of free water efficient devices and working with key stakeholders to trial and pilot new technologies and initiatives to understand their potential benefits and risks.

Supporting customer behavioural change is central to any strategy relating to water efficiency. We believe that it is important to support and assist customers with these changes as they will hopefully lead to a cultural change in the way we use water and will be the main activity to meet the Government aspirations of a lower pcc in the longer term.

1.1 School Talks

We provide school talks to all schools across our area on request which includes a lot of information on water efficiency. South East Water staff have previously completed training on providing the talk, which includes information on the water cycle; water treatment processes and how they can save water at school and at home.

The pupils are provided a 'Sally Shower' 4 minute shower timer to take home and beat the challenge. They take the message home and encourage the rest of the family to beat the challenge of showering in under 4 minutes. We also ask for feedback from staff and pupils on the talk to allow us to continually update and improve the content.

We have an education zone on our website pages which will be reviewed and updated regularly to allow schools to log on and download student pledge sheets, measure their consumption and request further talks and/or information.

During 2010-2015 we will have delivered the school talk to over 9,000 pupils and we will continue to offer these talks to pupils and staff across the Company. We rely on feedback from staff and pupils to monitor how effective the talks are and using this qualitative data we improve the talks to include the most effective messages and content to enhance behaviour change from a young age.

During 2012 South East Water declared drought and imposed hosepipe bans across the company area. During this time, we employed Enact solutions to develop and present a more interactive paly relating to the importance of saving water. This was a very successful play and saw us interact with over 7000 school pupils. The feedback received was very encouraging and we feel this was vital in educating a large number of pupils on water efficiency and to take the messages home to parents other friends and family. We will carry out this activity during drought in future years.

1.2 Website

On our website we provide a number of pages providing information on water efficiency for domestic customers both in the home and the garden there are also a number of links to other sites where they can purchase discounted water butts, drought tolerant plants, siphons to recycle bath water and many other products. We also provide a link to a partner site with Save Water Save Money where a large range of water and energy efficient goods are available.

Also on our website is an online water and energy calculator provided by the Energy Savings Trust. This allows residents to calculate their water and energy use around the home and the associated utility costs associated with this. They are then provided with a full personalised report with simple ideas on how to reduce their consumption and therefore their bills.

During 2010-2015 around 15,000 customers will have completed the online calculator which provides each customer with a personal report encouraging simple behaviour changes and other tips such as fixing dripping taps and installing water savings devices to save them water and energy around the home. We will continue to promote the calculator and encourage customers to complete it by offering competitions and advertising wherever possible. This will hopefully encourage a longer term behaviour change to help reduce the water demand per person across the company.

South East Water has also set up a number of online pledges to encourage customers to sign up to saving water. This is done via the Sally Shower page which is aimed at children to beat the 4 minute shower challenge. There is also a different pledge where customers can sign up to do the following:

- turn off the tap when I'm brushing my teeth
- wash vegetables in a bowl instead of under a running tap
- only run the dishwasher and washing machine on a full load
- reduce my shower time by one minute
- reduce my shower time by two minutes
- reduce my shower time by three minutes
- take a four minute shower instead of a bath
- fix dripping taps
- keep a jug of water in the fridge instead of running the tap until it is cold

Over AMP5 the uptake of the online pledge has been relatively low with less than 500 people making the pledge. We will continue to promote the online pledge via bills and at events to encourage customers to consider their daily water use and making simple changes to reduce their demand over the next 25 years.

Monitoring savings from these activities is very difficult and we will therefore monitor their effectiveness by assessing how many people are using the calculator and signing up to the pledges. We will continue to improve on them using feedback from customers to ensure they are up to date and consider the customers' needs while encouraging them to reduce their consumption.

1.3 Water Audits

Customers are given other opportunities to complete simple self-audits to understand their water use and simple ways to reduce their consumption. They can do this when they apply for a meter as a self-assessment is available on the application form; at events and talks where they have time to complete one; and as part of the metering programme. Members of staff discuss water use with the customer and provide advice on where they can change habits to save water and money.

The highest savings that can be achieved from water audits are those attributed to audits carried out by the Company or agent as part of a home visit. This is also the most cost effective method suggested in the Evidence base for large scale water efficiency by Waterwise.

The most straightforward way of carrying this out is alongside the metering programme. Customer engagement is a vital part of the universal metering programme and each customer will receive a small pack (Hippo bag, shower timer, and leaflet with further information) to encourage water saving behaviour. Customers will also be given the opportunity to complete a simple in home water consumption assessment when their meter installation is checked.

Over AMP5 there will have been around 20,000 audits completed by customers at events, when applying for a meter and during CMP checks. We will continue to offer self-audits at events and during the metering programme. Where possible we will increase the number of audits in the home as part of metering and look at further options of installing water efficient devices and fixing internal leaks to encourage further reductions in water use.

1.4 PR and events

Where possible we attend local events and county shows with the South East Water trailer which allows customers to find out more about the company and provides them with information on water efficiency and the opportunity to talk to staff members on ways to save water. We also provide free bags containing leaflets, hippo bags, shower timers and stickers for children. At some events we also provide water saving crystals for plants and shower and tap inserts for customers to fit in their homes.

We attend a variety of events and expect to be out and about with the trailer more in drought years. On average we expect to attend 12 event days with the trailer per year. There will also be smaller events where it involves an information banner and some devices on offer to customers in village halls, community centres etc.

We do currently ask customers to sign for water efficient devices to ensure they understand what they are and intend to use them at home. Savings from the devices are covered under 'hard measures' section below.

1.5 Community talks

We provide community talks across the company area on request to all community groups. These are often tailored on a specific topic related to the local area, but where possible we will include water efficiency along with free devices such as hippo bags and shower timers.

During 2010-2015 we expect to have carried out community talks to over 500 people. We will continue to promote talks to the different communities across the company area via our website and literature sent to our stakeholders and other organisations. The talks will remain tailored to the specific area but will include enhanced water efficiency activity that can be carried out by the community such as behaviour change or commercial audits where appropriate.

1.6 Information with bills

Customers are given further information on water efficiency on their bills, including the top tips to save water in the home, information on water butt offers and where to find further information on water efficiency and the products we offer on our website. We also promote the water butt competition which encourages people to consider their water use by using the online water calculator and are in with the chance to win a water butt.

The longer term strategy will include water efficiency on future customer bills and on associated literature such as top tips, online information, water butt offers and offers and competitions.

1.7 National campaigns

South East Water is an active member of the Water UK water efficiency network group, and has publicly supported and continued to comment on the work being undertaken, particularly by the Water Saving Group and Waterwise. We have been involved in the national B&Q campaign, the 'Shower Power' campaign run by Talisman and other partners and the Defra love your river campaign. We also supported the 'big tap challenge' and the national smile month, both of which concentrated on turning off the tap when brushing teeth and also encouraging customers to fix dripping taps.

We will continue to work with other companies on such campaigns if they are cost effective. The national programmes are usually more effective in times of drought to educate customers on the key issues and how they can help, they are also likely to have increased support as more companies universally meter.

Although we will claim any savings attributed to our area of operation from any National Campaign, the main reason for participating in these would be the PR as the savings are generally low. As we do not know the scope of these activities no saving has been attributed to National Campaigns.

We are also working with a number of other partners on the South East England water for all partnership. This is looking to develop a regional water efficiency plan for both domestic and non-household customers along with a joint communications programme.

There are currently limited savings associated with these campaign as there is very little way of knowing who has acted on what and there is no way of identifying any quantifiable savings. However, they have seemed to be quite successful and we will continue to support those in our area.

2 ACTIVITIES AND DEVICES

Providing customers with free or subsidised water efficiency devices allows them to reduce their consumption and hopefully their bills if they are on a meter. Using devices alongside the educational measures enforces the message of saving water and allows the customers to sometimes 'fit and forget' the measures that will hopefully continue to make savings year on year.

Where possible we work with partners to offer in home assessments and the opportunity to leave or install fee devices such as Hippo bags, shower regulators, tap regulators and shower timers.

A summary of the hard measures South East Water will offer/use over the next 25 years along with their associated average assumed savings per year can be seen in Table 1 below.

Table 1: assumed savings for hard measures

Hard measures	Expected annual Savings (Ml/d)
CDDs (hhld and non hhld)	0.06
Water Butts	0.01
Shower timers	0.02
Tap and shower inserts	0.005
TOTALS (Ml/d)	**0.10**

2.1 Cistern Displacement Devices (CDDs)

South East Water support CDDs as we consider these to have a positive impact in empowering customers to save water. We advertise the free CDDs on our website, on the leaflets we send out to customers with bills, at shows/events and provide them free on request via customer services and the website.

Over the period 2010-2015 we expect to have given out over 20,000 CDDs to our customers via requests to our customer service team or at events and talks. We will continue to promote the devices at events, with bills, online and where we interact with non-household

customers. Where possible they will be fitted in homes as part of retro-fit programmes to assist customers in reducing the water demand in older toilets.

They are considered to be non-cost-effective in comparison with alternatives, but we continue to make them readily available on request to meet customer expectations, and value them as an important and integral tool to support the company's wider promotion of water efficiency, education and awareness programmes.

2.2 Water butts

We work with a water butt provider to ensure we can offer the best subsidised rates to our customers and these are available via the website and offers are outlined on customer bills. We also provide a number of water butts free as online prizes and donations to local groups for allotments, schools and community programmes.

During AMP5 we expect to have provided customers with nearly 10,000 water butts of varying sizes. This will be through promotions on the website and in bills or donations mad e by the Company. The strategy for the next 25 years is to continue to offer the best rates to our customers and provide them free of charge where possible to local community groups or schools or as prizes where appropriate.

However, the benefit of water butts during the summer months is potentially very limited. They do provide a positive impact as customers are likely to become more accustomed to considering their general water use and for this reason we hope they will help encourage a loner term behaviour change in outdoor water use and helping reduce demand over the planning period.

2.3 Shower timers

South East Water has been providing 4 minute shower timers to all school pupils spoken to since 2010. This is related to the education programme to encourage pupils to sign up to beat the sally shower challenge, in other words shower in less than 4 minutes. Shower timers are very popular with all customers and surveys have shown customers do use them.

During 2010-2015 we expect to have given out over 20,000 timers at school talks and events. We also provide shower timers to all newly metered customers and these are covered in the metering section below.

The longer term strategy is to continue to provide shower timers at school talks, at events, alongside metering and public talks where appropriate. The aim of the timers is to enhance longer term behaviour change by encouraging a shorter shower. Studies have shown there can be savings from providing timers, but the sustainability of any savings has been questioned. The responsibility lies with the customer to continue to take shorter showers over the planning period and to inspire the family to do the same. Our strategy will seek to instil permanent behavioural changes.

2.4 Tap and shower inserts

The Company expect to have provided around 1,000 tap insert kits and 1,000 shower inserts to our customers to help them reduce their water use. These are offered at events, as part of the metering programme and during retro-fit projects.

The precise savings of these devices are difficult to quantify as they are often provided as part of a package of devices and education. Results from some trials have shown that up to 30 litres a day for a property would be realistic for such devices, but the longer term savings are unknown. As they impact the flow of water customers can easily remove the devices.

We will continue to offer them as part of the water efficiency strategy where we are retro-fitting homes with partners. We will also work with other companies to monitor their long term effectiveness and costs as a future option.

3 METERING

Metering is an essential part of the water efficiency strategy. As the population and associated water use across our area increases, metering will become even more important in managing demand. Metering has the added benefit of improving our understanding of customers' use of water and will allow us to support our customers to reduce their bills by using less water.

We have adopted a customer metering programme as being part of the optimal longer term water resources management plan, and propose to meter 90% of our total domestic customer base by 2020. We have taken full opportunity to bring our water efficiency strategy alongside the metering programme and to use the programme as a vehicle to deliver greater levels of water use awareness, education and engagement with our customers, to ensure new habits and behaviours are formed to reduce their water consumption and in turn, bills.

The anticipated water saving from metering is 10% with or without additional water efficiency initiatives. However, further water efficiency savings are included in the baseline pcc demand forecast that relating to customer awareness and behaviour changes leading to reducing long term pcc into the future. It is assumed that these further water savings commence in part through water efficiency initiatives rolled out as part of the meter installation programme.

As part of our customer metering programme, we send all newly metered customers a free hippo bag, shower timer and information leaflet with their 'welcome to you meter' pack.
As we see the metering programme as an excellent opportunity to interact with customers, we also offer an in home water use assessment with the metered customers where they can discuss their current water use and staff can provide advice on how they can reduce their

wastage and help them save money. They also offer them a shower insert where suitable for the property. This approach will see us offer this approach to 50% of our customer base over the 10 year life of the metering programme

It is expected that all those metered will have their meter installation quality checked by South East Water staff and we have seen that around 6% of those visited complete a water use self-assessment with the agent and discuss other ways to save water and therefore money.

There are still expected to be a number of customers that choose to have a meter installed; these are the meter optants. As part of the long term water efficiency plan, all new optant customers will be sent a similar welcome pack as those as part of the CMP. This will include a hippo bag, a 4 minute shower timer and a leaflet with more information on the meter, leakage and water efficiency.

These packs will be sent to the customer with a personalised letter as they transfer onto a measured account. Reports will be run monthly with packs sent at the start of each month to all customers who transferred to a measured account in the previous month. This is to ensure the changeover is still fresh in the minds of the resident and more likely to impact any behaviour change to save money.

A number of optant customers will also have interaction with South East water staff when they check the meter installation or prior to fitting to check the supply. We have seen around 10% of all optants complete an in house water use assessment and will continue to monitor how effective they are.

The expected average assumed savings we have incorporated into our baseline demand forecast from the water efficiency packs sent to newly metered customers (both optants and CMP) and the in home assessments is outlined below in Table 2. The savings will vary year on year depending on the number of meters installed, but this is what we would expect to see on average every year.

Table 2: Average annual assumed savings from metering water efficiency activities

Metering	Expected annual Savings (Ml/d)
CMP welcome packs	0.57
Optant welcome packs	0.11
CMP in house assessments	0.02
Optant in house assessments	0.02
TOTALS	**0.72**

We will monitor the impact of metering using monthly meter reads from those on the CMP compared to those who are already metered and the optants. Any savings will be as a result of customers paying for their water and will, also include some of the water efficiency provided to the customers.

It will be difficult to quantify specifically the savings from the water efficiency advice alone, so customer surveys will be used to ascertain what they found effective and ineffective to help plan for future years. This way we can provide our customers with the most helpful information and devices to encourage a reduction in demand through behaviour change and water efficient devices.

4 SOUTH EAST WATER SITES

At a number of staff sites across the company area such as head office and smaller office sites we have installed water efficiency equipment to reduce our own water use. This includes low flow taps, dual flush toilets, waterless urinals, hot water heaters, solar heating, low flow showers and push button taps. We will also consider the newest available water efficient devices when offices are due to be refurbished in the coming years.

We encourage staff to take part in small trials and promotions to trial products before we offer them to customers. This ensures we are offering our customers the most effective devices while encouraging all our staff to take the messages home to their families.

4.1 Leakage Control

South East Water is active in leakage detection and control across its mains network, with dedicated full-time leakage control teams. Ofwat sets strict leakage targets, ensuring companies operate at an economic level. South East Water is committed to meeting or exceeding these targets and the plan is to reduce leakage from our mains from 81 litres per property per day to 75.2 litres per property per day by the end of AMP5.

State of the art electro-magnetic flow measurement equipment is to be installed at all pumping stations, reservoir sites and District Meter Areas (DMAs) to allow day-to-day and in many cases real time flow information to be monitored at the main control centre. This allows the Company to respond quickly and effectively to bursts as they occur, but also to identify system problems and leakage and get them repaired as soon as possible.

We also provide a leak allowance and detection service to our customers where they have a supply pipe leak. As part of the metering programme the meters will help identify customer side leakage and we can proactively communicate to ensure any leaks are fixed as quickly as possible.

4.2 Pressure Management

Over a number of years South East Water has put in place carefully designed pressure management measures which ensure customers receive sufficient pressure to meet their needs, within the regulations, but at the same time minimise unnecessary pressure on the mains system to help prevent bursts and minimise leakage.

4.3 Mains flushing

Inevitably it is necessary for mains to be flushed from time to time to ensure the public supply network is kept in good operational and hygienic condition. The use of water for flushing will be carefully managed and mains will not be flushed for longer than is necessary. Careful records are kept of water used for operational purposes including mains flushing.

5 PARTNERSHIP WORKING

Partnerships are very important in the water efficiency strategy as they can enforce technologies and regulations into new and existing homes on a larger scale. We aim to continue with the partnership groups mentioned above, but also to encourage more involvement from Local Authorities across the Company area. We will contact these stakeholders to develop new ways of working and to help them with meeting climate change targets.

The strategy is also to continue working with the groups we already have contact with on a regular basis to develop new projects to find the most cost effective ways to meet our targets, help others meet theirs and ultimately see some actual water reductions across the domestic market, in both new and existing homes and encourage more customers to take up the most acceptable technologies and behaviour changes.

South East Water will continue to work with partners and stakeholders such as Local Authorities and social housing providers to encourage them to incorporate water efficiency into all new buildings and all refurbishments. We will also work with them to integrate water efficiency measure into planning for all new homes and where possible to retro-fit existing homes to work towards water neutrality.

We will also work with other government bodies such as CLG (Communities of Local Government), Defra and the EA to encourage water efficiency into all new build regulations and to develop a water use labelling scheme to educate customers on what are the best products to buy. These partnerships could also be used to change the products available and hopefully ban or reduce the number of high water consuming technologies available to domestic customers.

Table 3 below shows the current partnerships we are involved with and some information on achievements to date.

Table 3: South East Water Partnerships

Name	Members	Past/current/future work
Kent Water Demand Management Group (KWDMG)	• SEW • Kent County Council • CC Water • Environment Agency • Affinity Water • Dover District Council • Sutton and East Surrey Water • Southern Water • Housing Association	• Savings on Tap project • Retro-fit project • Schools consumption • Public building water use • Lydd tariff trial • Green deal partnership • Metering • allotment water use
Sustainable Environment Ambition Group (SEAG)	• Royal Borough of Windsor and Maidenhead • National trust • Radian Homes • Thames Water	Working with their energy advisor to incorporate water efficiency in home visits.
Ashford water Group	• Ashford's' Future • KCC • EA • Southern water • Ashford Borough Council	Mainly looks at supply of water and waste water. • New energy and water efficiency project in 1000 homes in Ashford
Sussex water Partnership	• RSPB • Southern water • Crawley DC • EA • Mid Sussex CC • Chichester DC • Sussex Wildlife Trust • Horsham DC • East Sussex CC • South Downs Society • Brighton and Hove CC • West Sussex CC	New to SEW and have not met for a few months Some good work in the past from the group relating to education and events.
Bracknell Forest	SEW and Bracknell DC	Staff awareness days Local Green days Local campaigns and events Free save-a-flush bags
Hampshire water Partnership Planning Group	• Hampshire water Partnership • Southern water • Winchester CC • New Forest DC • Portsmouth water • EA • Portsmouth CC • Test Valley BC • Gosport BC • Eastleigh BC • Basingstoke and Deane BC	• Support local green events • Water efficiency in social housing • Staff awareness days • CSH in planning

	• Radian Homes • Hampshire Wildlife Trust • East Hants BC • Havant BC • Fareham BC • Hampshire CC	
Collaborative fund	• Water companies	The majority of water companies pay into one 'pot' to fund larger scale projects to understand the longer term savings from water efficiency projects – allows for a reduction in targets if a company supports this
Evidence base steering group	• Water companies • Defra • Waterwise • Environment agency • Ofwat	To steer the direction of the waterwise work Steer the projects selected as part of the collaborative fund Look at the wider methods of encouraging and analysing water efficiency projects
Water efficiency in buildings	• Defra • University of Brighton • A range of members from local communities to commercial customers	Set up to promote water efficiency research, knowledge exchange and transfer between academia and industry.

A South East England partnership has also been set up which will look at providing and delivering a regional water efficiency across the south east including a number of water companies and other stakeholders. This will include, communication programmes, working with non-households and partnership working to deliver water efficiency to a larger range of customers.

5.1 New builds

New build homes within the South East Water area are a significant part of planning for water efficiency. There are a large number of homes planned across the Company area over the next 25 years within the local Authority plans which are all included in the WRMP but must be considered within this strategy. With the right initiatives and good planning, the construction of new homes provides the best opportunity for achieving 'best-practice' water efficiency in the most cost effective way. However, this requires commitment for third parties which is beyond control of South East Water.

There are a number of initiatives that have been implemented and some that are still being developed targeting new homes such as;

- The Code for Sustainable Homes
- Amendments to building regulations
- KCC Kent Design Guide

South East Water has been active in supporting and consulting on each of these initiatives and will continue to do so as appropriate. We will work with the local authorities across our area to consult on their future plans and to include and monitor water efficiency where possible.

Case Study: 'Savings on Tap' – Highland Park, Ashford

The Savings on tap project is being run by South East Water, Environment Agency, Kent County Council and Hillreed Homes. The project has two key aspects, trialling water efficient equipment in new homes and trialling a 'seasonal tariff' in a number of homes. The first set of 60 control homes were occupied in 2006 and the remaining 200 homes will be a split of water efficient and water efficient and tariff homes, to be completed in late 2011.

South East Water sponsored a range of water efficient devices to be installed in all the new homes in order to measure their effectiveness and to encourage all developers to take them into consideration to meet the new building requirements. The water efficient homes had the following installed as standard:

- Dual low flush toilets (3l/4.5l)
- Flow restrictors on sink taps
- High performance aerated shower head
- A+ rated washing machine (8l/Kg water consumption)
- Water butts in all homes with gardens

The seasonal tariff homes have all the water efficient equipment mentioned above but will also have a higher rate of water used during the summer (May-August) and a lower rate during the winter months. The tariff is set in this manner to encourage decreased use in the summer months to help reduce peak demand and therefore the need to pump less of the already 'stressed' water supplies.

Monthly data has been collected from all the homes, along with annual surveys to understand occupancy and water use behaviours, which have shown the control homes, are using around 10% less water than our base measured properties and the water efficient and tariff homes are using around 20% less water than our base measured homes.

We have also asked WRc to carry out detailed micro-component analysis every year to understand how much water each device is actually using and if the residents are using the equipment in the most effective way.

5.2 Existing homes

Existing homes will always be the larger number of housing stock across any water company area and must therefore not be forgotten in water efficiency planning. The level of efficiency can be expected to improve over several decades as newer efficient technology is installed, but their demand is not likely to reduce without the help from water companies and other partners to change behaviour and install simple water efficient devices.

Achieving water efficiency in existing homes represents perhaps the greatest challenge, with the greatest savings if successful. Experience from other trials points to a key element of

any strategy being the need to educate customers about water efficient products; even if water efficient devices are installed, they must be used properly to achieve the greatest savings.

Case Study – 'Savings on Tap: Retro-fitting Existing Homes

South East Water has worked with Kent County Council, Environment Agency, Ashford's Future, Kent Wildlife Trust and the Energy Savings Trust to encourage around 500 domestic homes to have a water audit and some free water efficient devices installed into their homes.

Around 50% of the homes targeted agreed to take part in the project and had a visit from a Waterlink plumber for the following;

- A supply pipe leak check
- A full household audit to check for leaking taps and toilets
- A hose-pipe trigger gun
- A save-a-flush bag
- An Ecobeta
- tap inserts to reduce the flow
- Information on gardening and water efficient plants

The project also included some behaviour change follow up by means of a tea-towel and a help the environment leaflet. The participants were in general very happy with the work carried out and the devices installed.

The results from this have shown that although initial water savings were seen, a year after the project was completed saw an increase in water use, for some it was higher than those who did not take part in the trial. This show the importance of continued behaviour change and that retro-fit projects may not have the sustained savings over years to come.

Using partnerships we aim to deliver water efficiency to a wider range of customers by including water efficiency in refurbishments and where customers are already being visited for debt management, fuel poverty, energy advice and larger Government schemes such as Warm front and the Green Deal.

6 NON HOUSEHOLD

We offer water audits to all our non-household customers and provided them for free during the drought of 2012. We continue to work closely with all our key accounts to monitor for leakage and provide advice on how they can save water through their processes and operations. Further information is available through a dedicated section on our website and through our commercial customer's team. We promote our services via billing and thorough contacting the relevant companies when possible.

For a number of years we have worked with East Malling Research on developing new methods to save water in fruit growing. A number of our high using customers are related to the fruit growing business so we continue to fund trails using the expert equipment and methods to reduce water use for irrigation and will encourage more customers to spread this out more widely as the results are very encouraging. This work was runner up at the 2012 Waterwise and Environment Agency water efficiency awards for farming and horticulture.

We are also working with the Horticultural Trades Association and other organisations on developing an online web based training certificate to ensure their members are using the most water efficient practices and passing knowledge onto their customers.

We have provided funding for a few schools and scout groups to install rain water harvesting on their sites for toilet flushing and to educate children on the importance of water and ways to recycle the resource. We will continue to fund such projects when they arise.

Where possible we will monitor any associated savings from trials and projects to understand the full cost benefit of such water efficiency work. This isn't always feasible due to funding and resourcing, but we hope to see reductions form all the work through the wider customer demand data and on-going monitoring of total water use across the company.

7 RESEARCH AND TRAILS

Along with the partnerships mentioned above, we also currently sit on the WaterUK water efficiency network group to share information on projects, discuss the current issues and to work together on a range of regulatory issues and policies to ensure we all respond in the same manner in order to solve problems.

We will continue to work within WaterUK group to enhance our water efficiency methods to make sure we are offering the right devices and education to our customers and to ensure the Government and our regulators are taking the water efficiency message seriously and guide other partners to help us meet targets.

South East Water also aims to test new technologies or follow other projects to allow our customers the best, most cost effective methods available. We will also continue to work with Waterwise and other partners and water companies to get the Government to reduce the number of high water using appliances available on the market and to introduce a water use label to educate customers on the most water efficient products in a simple way.

7.1 Tariffs

South East Water is considering exploring different types of tariffs in AMP6 to a number of customers when universal metering is near completion to ensure no customers are discriminated against.

We are currently working with the Environment Agency and a number of other water companies on results from current tariff trials. South East Water shared the raw data we have on the Highland Park development, from both monthly reads across all properties and the micro-component data for a 4 year period taken from a small number of properties during the study..

The results from the study carried out by the Environment Agency showed that there is no statistical evidence to suggest that seasonal or block tariffs are showing any reductions in water demand at this time. This strengthens the need to explore fully way to achieve behavioural change through the overall water efficiency strategy wet out in this paper.

We will continue to collect data and carry out our own analysis during AMP6 to help with the evidence of using tariffs as an option in the future.

7.2 Gardening

South East Water are working with a Company called Spadework to discover the impacts of the following:

- Providing literature to their customers on water efficient gardening
- Labelling drought resistant plants
- Asking customers to complete forms/self-audits on gardening

Spadework is an independent training organisation, which undertakes tuition in a number of subject areas for Adults with Learning Disabilities. They provide training in Horticulture, Woodwork, Amenity Gardening, Catering, Retailing and computing with plans to extend this range of activities in the near future.

They also have a wide catchment area within mid-Kent which is catered for by their two sites: the headquarters site at Offham, West Malling and their sister site at Hildenborough, which lies between Sevenoaks and Tonbridge.

If this is successful we would hope to roll it out to the larger DIY stores and garden centres across our area. We will also ensure our website is up to date with current literature and useful tips along with a web shop to purchase drought tolerant plants.

7.3 Rainwater Harvesting

Rainwater harvesting has been tried, tested and rolled out in other countries around the world, particularly the wetter part of Germany. There are now more homes being built with community and single rainwater harvesting systems across the UK which we will continue to review with the possibility of installing some systems on our new operational sites.

It is suggested that they are very costly systems to retro-fit to existing homes and are better used in new homes, but even more cost effective in large commercial buildings such as schools and hospitals. With the introduction and wider roll out of the Code for Sustainable Homes more properties are expected to have rainwater harvesting systems fitted and where possible we will monitor these to measure how effective they are in reducing domestic demand, especially during drought or peak periods.

We will continue to work with stakeholders and other organisations to trial rainwater systems to understand their limitations, benefits and costs as part of the strategy. These systems were included as an option tested in our WRMP14.

7.4 Greywater Systems

Greywater systems are not widely accepted among customers, but improvements in technology and tighter standards mean this method of re-using water is gradually becoming more accepted. It could possibly be used in the future to reduce demand and is likely to be more effective during drought and peak periods than rainwater harvesting as waste water will continue to be produced.

Where possible we will identify properties or non-household sites with greywater harvesting installed so we can monitor their effectiveness. This could be a potential option in the future to roll out more widely if they are deemed to be cost effective. These systems were included as an option tested in our WRMP14.

Appendix 4E: The impact of the Customer Metering Programme on household demand

Our Customer Metering Programme (CMP) started in July 2011 aiming to install 200,000 water meters and ensure 70% of our household customers are metered by 2015 and 90% by 2020. It was driven by the need to reduce customer demand as determined by our previous Water Resources Management Plan (WRMP09).

This paper presents our initial assessment of the impact of the CMP on domestic water use across our supply area. It concludes that our findings align with assumptions in our 2009 and 2014 WRMPs. We will continue to monitor the demand impact of the CMP over time as more data becomes available and we continue to improve our understanding of our customer base.

Our approach

We compared daily household water use using historic 'control areas' to represent unmeasured consumption alongside analysis of billing data from six-monthly meter reads at homes metered by the CMP. Households previously metered by having a meter at the time of construction, opted for a meter, or moved into homes with an existing meter were considered as a benchmark.

To ensure a significant data set of CMP households, we used data from between April 2012 and September 2013. It is important to note that 2012 was not a typical year, given there were drought restrictions in place between April and July, and the very wet weather from April for most of the year which resulted in low summer demand.

Non-household data was excluded from the analysis, along with any results which either reported negative water consumption or exceptionally high consumption.

This initial analysis should be considered provisional. We will continue to monitor and analyse the impact of the CMP on demand to develop more robust data.

Initial results

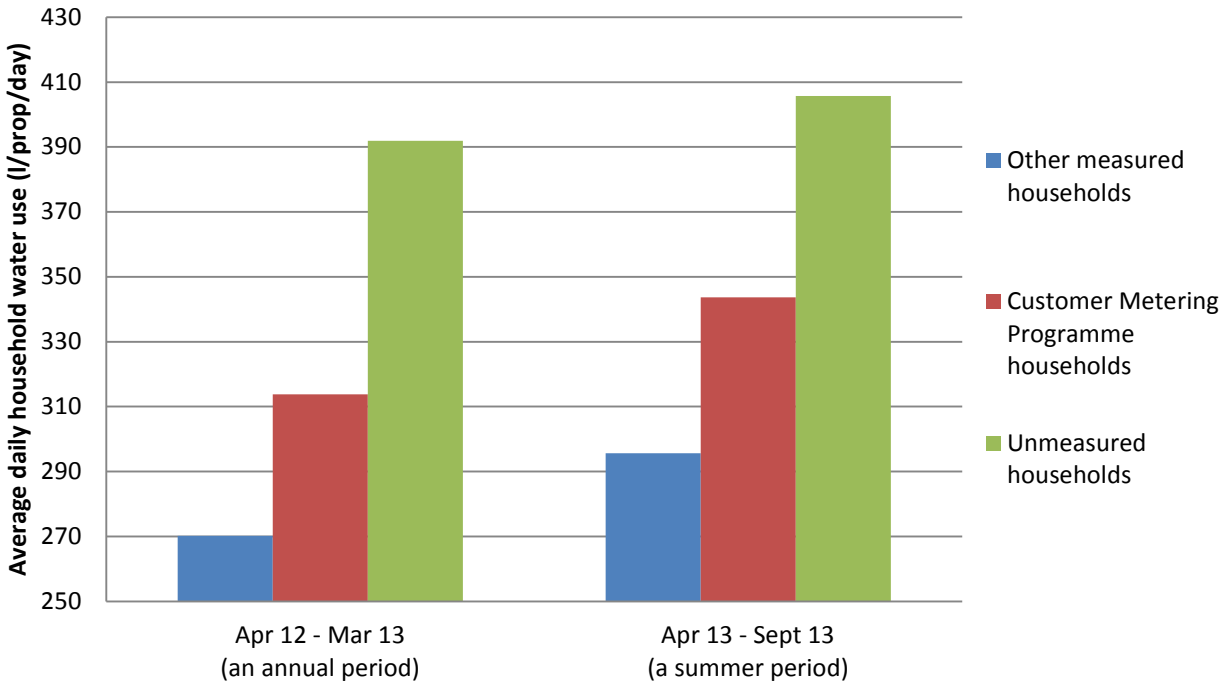
Initial results suggest that, on average, households metered by the CMP appear to use around 18% less water per property than our unmeasured households, but around 14% more than households that were already metered.

These results align with the assumptions made in our 2009 and 2014 WRMPs that equate to an average impact applied in our forecast of around 15% reduction in water use per property. This was calculated by applying the conclusions of metering impact studies by us and across the industry that compulsory metering programmes (like our CMP) can reduce individual customer's water use by an average of around 10% and applying it at the individual property type (detached, semi-detached, etc.) and water resources zone levels. Sensitivity tests on this assumption have been carried out and are reported further in our 2014 WRMP.

Water Resources Team
October 2013

CMP households are likely to include homes with older (less efficient) water use fittings and have a higher rate of occupancy than existing metered properties so could be expected to consume more water. There are a number of reasons for homes being metered independently from the CMP. All homes built since 1990 were fitted with a water meter as a result of Water Industry Act, and there have also been a significant number of customers opting to have a meter installed. Customers with lower than usual occupancy are more likely to make the biggest financial saving by being on a meter and so had more of an incentive to opt for a meter than households with a high occupancy. In addition, a number of households have been metered during a change of ownership over the past years and this has added to the total metered household base.

Average daily household consumption for metered and unmetered households over both an annual and summer time period



Time periods containing valid household consumption data

The graph above shows the average per property water use of CMP customers, unmeasured households and the remaining measured households over two different time periods;

- **April 2012 – March 2013 (an annual period)** This was not a typical year given the wet weather, low demands and the drought and restrictions in the first part of the year.

- **April 2013 – September 2013 (a summer period)** The first 6 months of 2013 saw long dry and warm periods with high demands over the summer months.

Going forward

These results are a best estimate at this stage given the quality and quantity of data available, and support the core assumptions of the WRMP14. Confidence in the results will be improved as we collect more data covering a longer time period and continue to improve our understanding of our customer base.

Water Resources Team
October 2013