

Drought Plan 2019

Annex 3: Demand interventions

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Version 1



from
**Southern
Water** 



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Introduction

Southern Water has identified a number of key interventions to help reduce the demand for water in order to balance supply with demand during drought events. This section sets out the demand reduction interventions that Southern Water may implement during a drought event. Table 1 below summarises different interventions against the corresponding drought status under which they would be implemented.

Table 2 provides further details of the key interventions including estimates of the likely reduction in demand (in million litres per day) that would be achieved by each intervention, and the time between when a measure is triggered and then implemented. Ideally the times between the measures will be as long as possible in order to allow the previous measure to be effective before the next, more significant measure, is taken. However the measures must also be introduced in a timely way relative to the nature of the drought and its development and best management in respect of the balance between restricting water use and minimising environmental impacts of abstractions. To cover the process timelines and judgements involved, we've shown ranges of weeks in Table 2.

In extreme circumstances (more severe than an approximate 1 in 500 year frequency drought), the company could implement stand pipes and rota cuts via an Emergency Drought Order. We intend the need for these to only arise in conditions of civil emergency and as such our emergency plan covers this in more detail.

The trigger levels for the demand restrictions are slightly different for each water resource zone, given the characteristics of the resources, the forecast supply demand position and the prevailing demands.

Table 1 Generalised list of demand interventions and drought phasing

Normal conditions	Impending Drought	Drought (Impending Drought demand activities plus below)	Severe Drought (Impending Drought and Drought demand activities plus below)	
Water efficiency household audits and retrofits	Media campaigns to encourage water efficiency and to raise awareness of impending drought	Introduce demand restrictions (phase 1 Temporary Use Bans)	Introduce phase 1 of demand restrictions through a Drought Order	Introduce phase 2 of demand restrictions through a Drought Order plus phase 2 Temporary Use Bans
Water wise advice and talks to schools and community groups	Increase leakage monitoring and repair activity	Mains pressure reduction		

Normal conditions	Impending Drought	Drought (Impending Drought demand activities plus below)	Severe Drought (Impending Drought and Drought demand activities plus below)	
	Engage with partner organisations to ensure co-ordinated approach to interventions	Enhanced media campaign to publicise restrictions and encourage water savings		
	Initiate discussions with local authorities regarding watering regimes for public parks and gardens			

Table 2 List of demand interventions and triggers

Actions	Media campaigns to encourage water efficiency	Increased leakage control and repair	Temporary Use Ban (Phase 1)	Non-essential use ban Drought Order (Phase 1)	Non-essential use ban Drought Order (Phase 2) and Temporary Use Ban (Phase 2)
Trigger	Impending Drought	Impending Drought	Drought	Severe Drought (impending drought trigger demand activities plus below)	Severe Drought (impending drought and drought trigger demand activities plus below)
Demand saving (MI/d)	Unknown	Up to 2-3MI/d after a dry mild winter	9.6MI/d in the Western area (excl. IOW); 10.6MI/d in the Central area; 6.1MI/d in the Eastern area*	15.4MI/d in the Western area (excl. IOW); 17.0MI/d in the Central area; 8.2MI/d in the Eastern area*	Unknown
Demand saving (% on peak weekly demand)	Unknown	Up to 1.5%	5% in the Western (exc. IOW) and Central areas 3% in the Eastern area**	8% in the Western (exc. IOW) and Central areas 4% in the Eastern area**	Unknown
Location	Affected water supply area (Eastern, Central, Hampshire and IOW)	Affected water supply area (Eastern, Central, Hampshire and IOW)	Affected water supply area (Eastern, Central, Hampshire and IOW)	Affected water supply area (Eastern, Central, Hampshire and IOW)	Affected water supply area (Eastern, Central, Hampshire and IOW)
Timeline from trigger to implementation	1 week***	1-3 months***	Minimum 4-8 weeks after appeal for restraint***	Minimum of 8-12 weeks from Temporary Use Ban***	Minimum 4-8 weeks from phase 1 NEUB Drought Order***
Permissions needed / constraints	Inform the EA, NE, DWI, Defra, Fire Authority and Local Authorities of impending drought status	Inform the EA, NE, DWI, Defra, Fire Authority and Local Authorities of impending drought status	Inform the EA, NE, DWI, Defra, Fire Authority and Local Authorities of drought status. Advertise the TUB (Phase 1).	Inform the EA, NE, DWI, Fire Authority and Local Authorities of severe drought status. Consult with Defra and apply for a Drought Order	Consult with Defra and apply for a Drought Order. Advertise the TUB (Phase 2)

Risk associated	Uncertainty in the effectiveness of this measure - whether customers will collaborate conserving water or not	Time needed for training and resourcing staff may delay the implementation	Time for representations (objections) may delay the implementation. Large number of responses possible. Customer satisfaction: requires careful considerations for the right balance of water saving and minimum of inconvenience for customers	Objections from commercial water users. Financial costs to provide compensation against any impacted licence holders	Objections from commercial water users. Financial costs to provide compensation against any impacted licence holders
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*Demand saving percentages (referred to in row below from Appendix A) are applied to peak week baseline year (2017/18) for revised draft WRMP

**See appendix A for how these percentages were derived

***Although these timings apply for the majority of Drought Permit / Order options in the Drought Plan there are different procedural and timing intentions for the Drought Permit and Order options on the River Test and River Itchen. These are set out in a Water Resources Act Section 20 Operating Agreement (March 2018) between Southern Water and the Environment Agency. In particular the Drought Permit on the River Test will be needed as an early measure (applied for during Normal conditions and potentially implemented during Drought conditions). The Section 20 Agreement sets out the sequencing of applying for and implementing Drought Permits and Orders and the triggers for demand interventions which are linked to flows in the River Test and Itchen.

Levels of service

Levels of service set out the standard of service that customers can expect to receive from their water company.

The **target level of service** sets out what the company aims to achieve. There are two target levels of service relevant to water resource planning:

- **Customer target level of service** – which relate to the frequency and nature of restrictions on water use that customers may experience (in the form of Temporary Use Bans (TUBs) restricting different categories of water use, and Drought Orders on non-essential water use during drought conditions)
- **Environmental target level of service** – which relate to the frequency of Drought Permits and Drought Orders allowing modified abstraction regimes at some of Southern Water’s sources.

The company’s current target levels of service are set out in Table 3. These are the same levels as stated in our revised draft 2019 Water Resources Management Plan (WRMP).

Table 3 Target levels of service

Type of restriction or measure	Annual chance	Return period	Probability of at least 1 occurrence between 2019 and 2024
Customer target levels of service			
Advertising to influence water use	20%	1 in 5 year	63%
Temporary Use Ban on different categories of water use (Section 76) ³	10%	1 in 10 year ¹	39%
Drought Order (Non Essential Use Ban on different categories of water use) to restrict water use (Section 74(2)(b)) ⁴	5%	1 in 20 year ¹	22%
Emergency Drought Order to restrict water use (rota cuts and standpipes) (section 75) ⁴	0.2%	Only in a civil emergency (1 in 500 years)	1%
Environmental target level of service			
Application for Drought Permit/Order to increase supplies through relaxation of licence conditions, increase in licensed quantities, or other measures ²	5%	1 in 20 year	22%
Implementation of Drought Permit/Order to increase supplies through relaxation of licence conditions, increase in licensed quantities, or other measures ²	0.5%	1 in 200 year	2.5%

¹ Frequency of first implementation but would be introduced via a phased approach as laid out in Table 5

² In short term in our Western area there is a risk we will fail to meet our environmental target levels of service following the Section 20 Agreement reached at the Hampshire abstraction licences Public Inquiry in March 2018

³ The Water Industry Act, 1991, HMSO as amended by section 36 of the Flood and Water Management Act 2010 (FWMA 2010)

⁴ The Water Resources Act, 1991, HMSO and The Water Use (Temporary Bans) Order 2010, which is a statutory instrument (No. 2231) providing definitions of words and phrases and certain exceptions to the categories of water use specified in section 76 of the WIA 1991.

Western area

In our Western supply area, covering large parts of Hampshire and the Isle of Wight, we are at risk of having to introduce water use restrictions more often than target (planned) levels until at least 2029. This risk will persist until we secure new water supplies to replace those no longer available because of the changes to our abstraction licences on the Test and Itchen. The Test Candover and Itchen Interim Abstraction Scheme was implemented in March 2019 when the abstraction licences were changed following Secretary of State approval and covers a fixed period to allow new reliable water supplies to be delivered so that our target levels of service can be met again.

Since our draft Drought Plan was published, this risk of more frequent restrictions in Hampshire and the Isle of Wight has been reduced by the Water Resources Act Section 20 Operating Agreement (s20 agreement) reached between Southern Water and the Environment Agency in March 2018. The agreement provides a specific protocol around managing the need for Drought Permits, Drought Orders and water use restrictions for the River Test and River Itchen and associated supply areas, until new permanent water supplies are in place.

In the short term, until sufficient new permanent water supply resource is available, the expected changes to our Test surface water abstraction licence mean we will need to apply for a Drought Permit on the River Test up to four times in the next 10 years. However, we would only need to implement this permit if a drought of one in 10 to one in 20 years severity develops. There is a 40-60% chance of this in the next ten years.

We may also need to apply for a Drought Order for the Candover Augmentation Scheme as frequently as one to two times every 10 years on average, implementing it if a drought of one in 60 to one in 80 years develops (15% chance in the next ten years).

As such for the Test Drought Permit and Candover Drought Order we may not be able to meet our environmental target levels of service as set out in Table 3 until sufficient permanent water resources are available.

For the Test Drought Order and Lower Itchen sources Drought Order we should meet our environmental target levels of service i.e. we should not need to apply for these more frequently than 1 in 20 years on average. (There is around a 40% chance we would need to apply for these in the next ten years). We would expect to implement the Test Drought Order if a drought of between 1 in 150 and 1 in 180 years develops and there is around a 6% chance of this in the next ten years). We would implement the Lower Itchen sources Drought Order if a drought of between 1 in 200 and 1 in 300 years develops and there is around a 5% chance of this in the next ten years.

The s20 agreement allows that water use restrictions (TUBs) do not have to be implemented until the Test drought permit is implemented. Hence we should not need to implement TUBs more frequently than our target level of service of 1 in 10 years. There is around a 40% chance we would need to do this in the next 10 years.

The s20 agreement also assumes we would apply for a Drought Order to restrict non-essential water use (NEUB) when the Test Drought Permit is implemented. Hence we should not need to implement a NEUB more frequently than our target level of service of 1 in 20 years. There is around a 22% chance we would need to do this in the next ten years.

Provided our Drought Permits or Orders can be implemented, we will only need to resort to extreme water saving, such as rota cuts or standpipes in the street, once every 500 years on average. If the Drought Permits or Orders cannot be implemented, we will have enhanced risk of needing to resort to extreme water saving measures. The agreement provides reassurance that, subject to due

procedure, environmental monitoring and mitigation commitments, the Drought Permits and Drought Orders will be allowed when necessary.

Media campaigns to influence water use

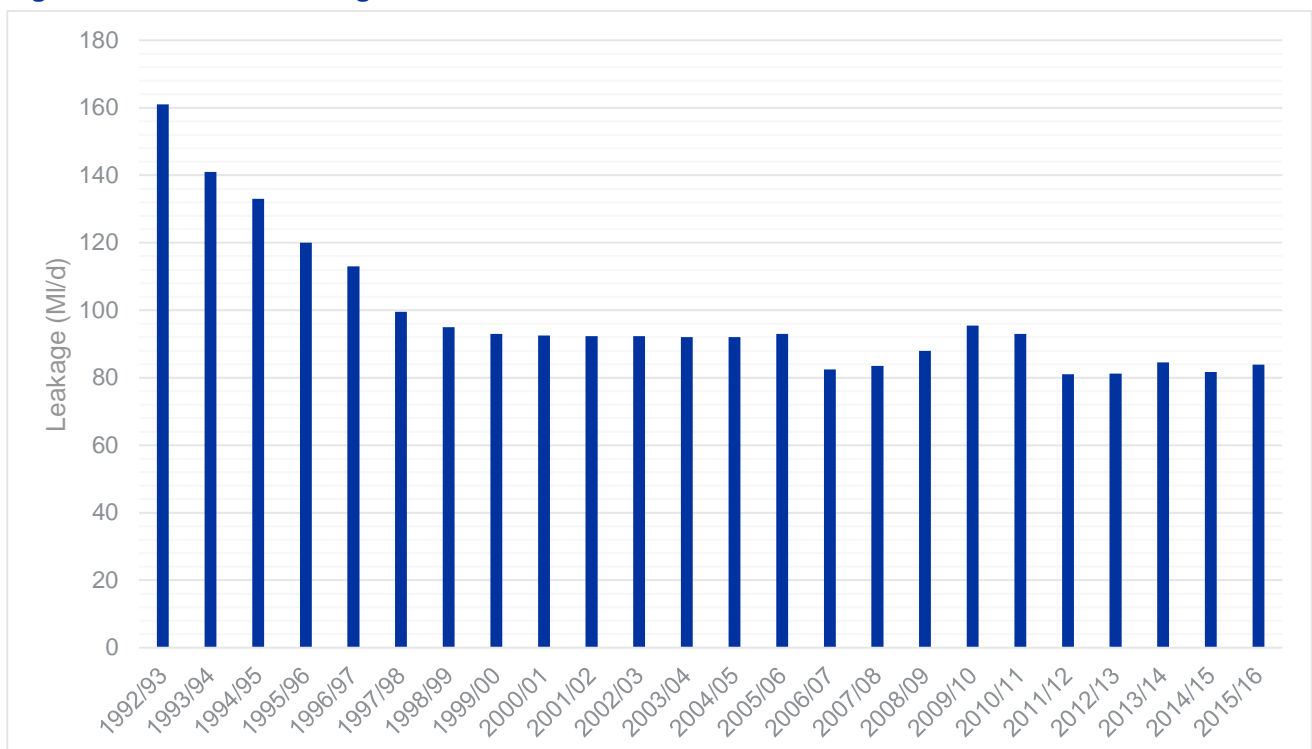
Campaigns to raise public awareness of water use can be carried out in a number of ways using a variety of different types of media. The central message is to urge customers to conserve water, especially during periods of drought. This message should be underpinned by an explanation of the prevailing water resource conditions and how the drought might continue to intensify. In addition, the company may promote an enhanced offer of its water efficiency programme. Media campaigns to influence water use are also explored in the Communications Plan, which is described in Annex 6 of this Drought Plan.

During the 2011-12 drought, water companies in the south east worked together to ensure that messages from companies to their customers were aligned. The media campaigns are aimed at changing the behaviour of customers so that they are making efforts to save water, especially during summer months. However this intervention may not deliver significant demand savings when compared with other measures.

Leakage control

As part of its normal operations, Southern Water has invested significantly in leakage reduction since 1992, which has yielded significant savings in water, as shown in Figure 1.

Figure 1 Historic total leakage for Southern Water 1992-2016



During a drought there is the potential for additional leakage control activity to reduce demand to conserve supplies for customers. The company regularly reviews its leakage performance, especially during periods of drought. It will prioritise leakage control activity in water resource zones

(WRZs) where supplies are most at risk from the effects of drought. The company also aims to reduce leakage repair times during a drought to conserve supplies. This might be achieved by recruiting additional resources and temporarily increasing staff overtime and night working.

Analysis commissioned by the company suggests that it may be possible to reduce leakage by 2-3MI/d across the supply area after a mild winter. However, there is a lead in time of approximately 3 months needed for training and resourcing staff to undertake additional leakage control activity. Thus, in a second consecutive mild winter, leakage reduction could be a useful tool during a drought.

A dry winter could be severe in temperature terms, and lead to increased leakage, however. If the winter were dry but severe in terms of the number and duration of periods of time when temperatures remained below zero continuously, then it is highly unlikely that leakage reductions of 2-3MI/d could be achieved.

There is also evidence suggesting that leakage may increase during a drought as a result of soils drying out, resulting in ground movement and the differential movement of pipework that can exacerbate leakage from joints. Therefore, without additional leakage detection and repair resources, leakage might otherwise be expected to increase during drought years.

During droughts the company will consider whether activity on leakage reduction should be enhanced by improving the detection and/or the repair time for all leaks to deliver higher water savings.

We will also include information on how we are managing leakage when we submit a drought permit application in line with the Environment Agency's briefing note *Applying for a drought permit and demonstrating control of demand through leakage dated 23rd November 2018*.

Mains pressure reduction / management

Mains pressure is already optimised across the water supply zones and therefore the ability for further reduction is limited. In addition to reducing leakage, pressure reduction also reduces demand by restricting flow rates from open-tap devices such as garden taps. Further pressure reduction during periods of drought could be implemented where appropriate, but not to such an extent that pressures fail to meet the level of service for water pressure. However, following extensive pressure management activity in recent years, the scope for further pressure reduction in Southern Water's supply area is considered to be minimal.

The Fire and Rescue Service has previously expressed concerns that low mains water pressure might reduce its ability to tackle fires, although under normal drought conditions the company would not expect pressures to fall below the DG2 reference level. Internal guidelines have been prepared for mains pressures to be further reduced under severe drought conditions where the supply-demand balance is breached, or is threatened to be breached. Should these circumstances arise, the company would need to ensure that it consulted extensively with the relevant Fire and Rescue Service.

Temporary Use Bans

Since 2010 there has been a significant change in legislation with regard to the implementation of restrictions on water use. This recent legislation, which significantly widened the scope of the previous hosepipe ban powers, is:

- Section 76 of the Water Industry Act 1991 (WIA 1991), as amended by section 36 of the Flood and Water Management Act 2010 (FWMA 2010)
- The Water Use (Temporary Bans) Order 2010, which is a statutory instrument (No. 2231) providing definitions of words and phrases and certain exceptions to the categories of water use specified in section 76 of the WIA 1991

Under section 76(2) of WIA1991 the widened range of uses of water that a water company can control without referring the decision to the Secretary of State are as set out below:

“Only the following uses of water may be prohibited—

- a. watering a garden using a hosepipe;*
- b. cleaning a private motor-vehicle using a hosepipe;*
- c. watering plants on domestic or other non-commercial premises using a hosepipe;*
- d. cleaning a private leisure boat using a hosepipe;*
- e. filling or maintaining a domestic swimming or paddling pool;*
- f. drawing water, using a hosepipe, for domestic recreational use;*
- g. filling or maintaining a domestic pond using a hosepipe;*
- h. filling or maintaining an ornamental fountain;*
- i. cleaning walls, or windows, of domestic premises using a hosepipe;*
- j. cleaning paths or patios using a hosepipe;*
- k. cleaning other artificial outdoor surfaces using a hosepipe.”*

Most water use prohibited under a Temporary Use Ban (TUB) applies to the use of water drawn through a hosepipe or similar apparatus.

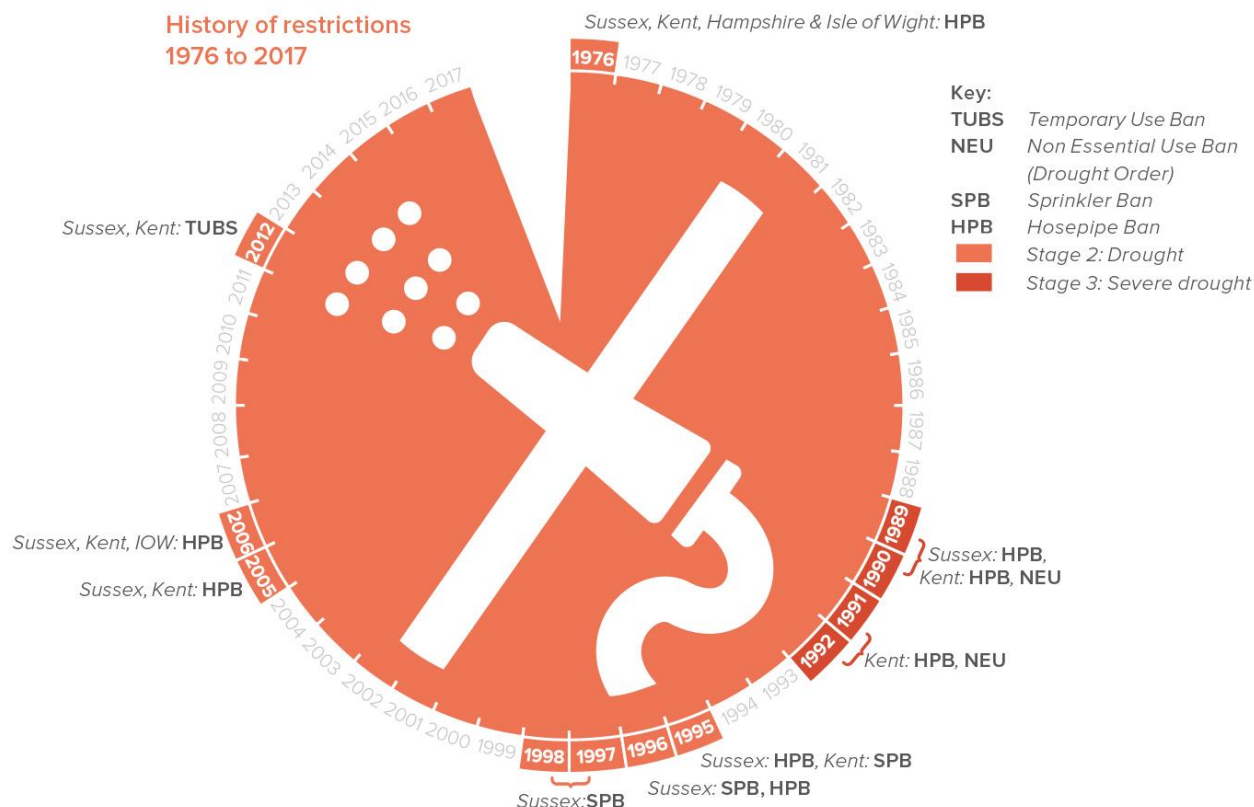
Also it should be noted that the aforementioned legislation, in WIA 1991 76(1), states:

“a water undertaker may prohibit one or more specified uses of water supplied by it if it thinks it is experiencing, or may experience, a serious shortage of water for distribution”.

Although this means there is no express link to drought when applying the above powers, a drought event is the most likely reason a company would experience a shortage of water for distribution.

Figure 2 below shows for each WRZ when we last imposed TUBs, previously known as hosepipe and sprinkler bans. Historically water resources have tended to be more vulnerable to drought in our Eastern and Central supply areas and this is reflected in the history of demand interventions. The Isle of Wight has a high summer population which, coupled with its small aquifer and reliance upon transfers from the mainland, have also made it vulnerable to droughts in the past. We have used data from the last imposition of restrictions in 2012 in Appendix A of this document to help indicate the likely water savings that resulted.

Figure 2 Showing when restrictions were last imposed on customers



Since the 2011-12 drought all water companies in England and Wales, including Southern Water, have signed up to the 'UKWIR Code of Practice and Guidance on Water Use Restrictions' (2013). The code of practice presents common standards and approaches to restrictions and exemptions to ensure consistent and coherent messaging and communications between companies and customers, stakeholders governments, regulators and the media.

The four principles are:

- Ensuring a consistent and transparent approach;
- Ensuring that water use restrictions are proportionate;
- Communicating clearly with customers and the wider public/users
- Considering representations in a fair way.

Under the 4th principle of the code of practice, we should apply an even-handed process for considering objections and representations from individuals or groups. The consultation on the draft Drought Plan provided customers with an opportunity to provide feedback and representations on its proposed phasing of restrictions, as outlined in Table 6 below.

The code also sets out five actions that should be followed by water companies in England and Wales:

- Companies, regulators and government to work together
- Coordinate communications
- Adopt a common phased approach, considering socio-economic factors
- Adopt a common approach to exceptions
- Promote understanding and good practice

By signing up to the code of practice we agree to follow the principles and actions mentioned above.

Exemptions

The types of exemptions to water restrictions that companies can offer can be defined as follows:

- Statutory: as defined in the legislation and granted by all water companies
- Discretionary Universal Exemptions offered by all water companies:
 - On the grounds of disability granted to those holding a blue badge
 - Customers use an approved drip or trickle irrigation system fitted with a PRV and timer;
 - Commercial customers that use hosepipes as part of their business for some TUB categories (e.g. hand car washing, window cleaning, and graffiti removal).
- Discretionary Concessional Exemptions are offered at the discretion of each water company on an individual basis. Customers must make a representation to receive this exemption.

Tables 4 and 5 summarise these exemptions for both Temporary Use Bans and Non Essential Use Drought Orders.

Table 4 Temporary Use Ban Exemptions

TUB Category	Statutory Exemptions	Universal Exemption	SWS Discretionary Exemption	Notes	UKWIR Suggested Discretionary Exceptions	
1	Watering a garden using a hosepipe	Using a hosepipe to water a garden for health and safety reasons. This includes "an area of grass used for sport or recreation" only in relation to the active strip/playing area, not the entire ground	Blue Badge holders on grounds of disability Use of an approved drip or trickle irrigation system fitted with a pressure reducing valve (PRV) and timer	Using a hosepipe to water an area of grass or artificial outdoor surface used for sport or recreation where this is required in connection with a national or international sports event	To align with previous approach (n.b a list of events considered to be exempt will be published on the Southern Water website)	Customers on the company's Vulnerable Customer List who have mobility issues but are not in possession of a Blue Badge
				Use of a bowser or lance due to health and safety (working at height and access to water on site)		As per 2012 Exception
				To water newly laid turf for first 28 days	To water food crops at domestic premises or private allotments	
2	Cleaning a private motor-vehicle using a hosepipe	1) A public service vehicle as defined in section 1 of the Public Passenger Vehicles Act 1981	Blue Badge holders on grounds of disability Use of an approved drip or trickle	Where this is undertaken as a service to customers or part of a business	Align with Thames Water	Customers on the company's Vulnerable Customer List who have mobility issues but are not in possession of a Blue Badge

TUB Category	Statutory Exemptions	Universal Exemption	SWS Discretionary Exemption	Notes	UKWIR Suggested Discretionary Exceptions	
		2) a goods vehicle as defined in section 192 of the Road Traffic Act 1988	irrigation system fitted with a pressure reducing valve (PRV) and timer		Taxis and minicabs are not considered to be public service vehicles and so are subject to bans	Use of specific low water apparatus such as pressure washers
3	Watering plants on a domestic or other non-commercial premises using a hosepipe	1) watering plants that are grown or kept for sale or commercial use	Blue Badge holders on grounds of disability Use of an approved drip or trickle irrigation system fitted with a pressure reducing valve (PRV) and timer	Watering of newly laid turf (<28 days old) using drip irrigation	Issued in 2012	Customers on the company's Vulnerable Customer List who have mobility issues but are not in possession of a Blue Badge
		2) that are part of a national plant collection or temporary garden or flower display				To water newly bought plants for the first 14 days
4	Cleaning a private leisure boat using a hosepipe	1) Cleaning any area of private leisure boat which except for doors or windows is enclosed by rook and walls	Commercial cleaning Vessels of primary residence Cases where fouling is causing increased fuel consumption Engines designed to be cleaned with a hosepipe	n/a	n/a	To remove graffiti
		2) using a hosepipe to clean a private leisure boat for health and safety reasons				To prevent or control the spread of non-invasive species
5	Filling or maintaining a domestic swimming or paddling pool	1) Filling or maintaining a pool where necessary in the course of its construction	None	n/a	Hot tubs are not classed as pools	Pools with covers used to minimise evaporative losses when not in use
		2) Filling or maintaining a pool using hand held container which is filled with water drawn directly from a tap				Pools with religious significance are not domestic pools

TUB Category	Statutory Exemptions	Universal Exemption	SWS Discretionary Exemption	Notes	UKWIR Suggested Discretionary Exceptions	
	<p>3) Filling or maintaining a pool that is designed, constructed or adapted for use in the course of a programme of medical treatment</p> <p>4) Filling or maintaining a pool that is used for the purpose of decontaminating animals from infection or disease.</p> <p>5) Filling or maintaining a pool used in the course of a programme of veterinary treatment</p> <p>6) Filling or maintaining a pool in which fish or other aquatic animals are being reared or kept in captivity</p>			Pools used by school pupils for swimming lessons should not be excluded, they are covered by Drought Order legislation	<p>Paddling pools at early stages of a drought</p> <p>Pools that are subject to significant repair and renovation</p> <p>Filling new pools</p>	
6	Drawing water using a hosepipe for domestic recreational use	None	None	n/a	n/a	<p>Pools with covers used to minimise evaporative losses when not in use</p> <p>Pools with water conservation and/or recycling systems approved by the water company</p>
7	Filling or maintaining a domestic pond using a hosepipe	Filling or maintaining a domestic pond in which fish or other aquatic animals are being reared or kept in captivity	Blue Badge holders on grounds of disability Use of an approved drip or trickle irrigation system fitted with a pressure reducing valve (PRV) and timer	n/a	Filling and topping up of a pond by fixed and buried pipes is not restricted.	Customers on the company's Vulnerable Customer List who have mobility issues but are not in possession of a Blue Badge
8	Filling or maintaining an ornamental fountain	None	None	n/a	n/a	To operate water features with religious significance

Wholesale Contract

Since the previous Drought Plan, a market reform process has been implemented in the water sector. This enables non-household customers to choose their retailer for water supplies.

To ensure that operational interactions between wholesalers and retailers work effectively a contract has been produced by Openwater (Wholesale Contract-Retail Code, 2016) which describes how the wholesaler and retailer will co-ordinate operational activities that are necessary for the wholesaler's provision of water services to the retailer.

The following steps are set out in this contract and will be followed as a drought develops and Southern Water imposes restrictions upon its domestic customers:

Step 1

The wholesaler and retailer may agree to follow any industry guidance or other code of practice regarding communications, including with non-household customers, in relation to drought or other dry weather conditions.

Step 2

Whether or not they are following any such guidance or code of practice, the wholesaler shall inform the retailer:

- when it considers a drought or dry weather conditions to be developing or escalating; and
- when it is giving particular consideration to any restriction on or reduction in water services.

The wholesaler shall also confirm to the retailer:

- the process by which it intends to manage the drought or dry weather conditions, including any lines of communication or planned discussions in relation to a potential restriction on or reduction in water services; and
- any reasonable message it wishes the retailer to convey to its non-household customers and the retailer shall convey such messages.

Step 3

In so far as it is able, the wholesaler shall respond to any question the retailer reasonably asks in respect of such plan or message and the wholesaler shall consider any information or representation which the retailer makes in respect of it.

Step 4

The retailer shall follow any reasonable instructions the wholesaler gives it in relation to a drought or dry weather event, for example by asking its non-household customers to reduce their demand for water. The wholesaler shall provide any information available to it that is reasonably requested by the retailer in relation to such instructions.

Step 5

If the wholesaler intends to issue a temporary ban on use under section 76 of the Water Industry Act 1991 which may be relevant to the retailer's non-household customers' activities, or to seek any Drought Order or Permit, it shall consult with the retailer.

If the wholesaler does issue any such ban or obtain any such Drought Order or Permit, it shall inform the retailer and keep it informed of any change to the terms of such ban, Drought Order or Permit.

Step 6

If the retailer becomes aware of any of its non-household customers breaching the terms of any temporary ban or Drought Order, it shall inform the wholesaler within one business day.

Step 7

The wholesaler shall inform the retailer whenever it considers a drought or other dry weather event to be subsiding and when any temporary ban, Drought Order or Permit has been lifted.

Representations

The company approach to handling representations, upon it giving notice of restrictions, is set out below. This is in accordance with section 76B (3) of the WIA1991, which states that “The notice must give details of how to make representations about the proposed prohibition”. The Environment Agency's Drought Planning Guideline states that “The Secretary of State/Welsh Ministers will expect water companies to allow an appropriate amount of time for representations to be received and considered prior to implementing any restrictions”.

Southern Water will publish a public notice in regional newspapers and the London Gazette as part of the process to introduce Temporary Use Bans. The notice will specify the method and timescale for customers to make representations and will normally be in writing to a named individual on the public notice. The timescale for responses, will be a minimum of seven days (which is the time period allowed for under a Drought Order to restrict water use, as set out in Schedule 8 of the WRA 1991). This notice will also be published on the company's website.

A telephone line dedicated to drought will be available to respond to customer's questions and record their formal representations. To deal with a large volume of customer enquiries, the company will produce frequently asked questions and a guide to activities covered by restrictions to aid customer service staff with responding to customers. These will include requests for exemptions, reports of misuse, general enquiries and lifting of restrictions. Individual responses will still be provided depending on the topic.

Any responses received are recorded and reviewed by the Drought Technical Group and the Drought Management Group.

Savings

For the purposes of this Final Drought Plan, the company has carried out analysis of the impacts of the demand restrictions that were applied by Southern Water during the 2005-06 drought, and estimated how this is likely to have changed as a result of increased metering. The 2012 event was not considered due to the exceptionally high rainfall that occurred almost immediately after the Temporary Use Ban was introduced and hence suppressed any benefit the ban may have had. This assessment has accounted for the universal metering programme the company has implemented. The detailed analysis is presented in Appendix A.

The estimated demand saving profiles for the company's Western (excluding the Isle of Wight) and Central areas are now in the order of 5% for TUBs. The Eastern area is expected to have a lower saving in response to TUBs, in the order of 3%.

Empirical models of household demand have been developed for Southern Water's Central area, Eastern area, and Western area (for both Hampshire and the Isle of Wight). The methodology applied broadly follows the recommended methods contained within the Environment Agency's Drought Demand Modelling Guidance, with a minor change surrounding the inclusion of time of year/sunshine hours as an explanatory factor. Furthermore, the models contain a significant enhancement to allow a quantified analysis of the impact of metering on summer peak demand. This incorporation of a demonstrably stable and accurate, but non-linear and multiplicative form of regression model meant that the impacts of metering on both underlying demand and demand

response to weather could be modelled. This has allowed the response of the current, mostly metered, customer base to restrictions to be quantified.

This modelling demonstrated that the ratio of summer demand to underlying (winter) demand has decreased as a result of the universal metering programme, with the relative size of the summer peak (as calculated relative to winter 'MDO' demand) now approximately 35% lower for the Western and Central areas and 60% lower for the Eastern area than it was in the early to mid-2000s. This will impact the effectiveness of demand restrictions because discretionary water use is clearly now smaller as a percentage of total demand. It is worth noting that there was no observable response to the 2005 hosepipe ban on the fully metered Isle of Wight.

The models were able to accurately estimate the impact of restrictions on demand during the 2005-06 drought event, and estimate how this is likely to have changed as a result of increased metering. The estimated profile for the effectiveness of demand restrictions for the Western (excluding the Isle of Wight) and Central areas are now in the order of 1% rising to 5% for TUBs (winter to summer profiles) and 3% rising to 8% for TUBs plus Non Essential Use (NEU) bans. The Eastern area is expected to have a much lower response, at 0% rising to 3% for TUBs and 1% rising to 4% for TUBs plus NEU bans.

Drought Order to restrict water use

Where the drought situation requires it, Southern Water may need to apply for a Drought Order to further restrict water use, particularly of commercial activities. However, before applying for a Drought Order to restrict water use, water companies are expected to have made full use of their powers under the WIA 1991, as stated in the Explanatory Memorandum to the Water Use (Temporary Bans) Order 2010:

“By extending the water uses that water undertakers may prohibit under section 76(1) of the Act [WIA 1991], water undertakers may be able to delay or avoid the need for drought orders under the Water Resources Act 1991”

The Drought Direction 2011 (which replaced the Drought Direction 1991) sets out the restrictions available under an Ordinary Drought Order, as allowed for under Section 73 of the Water Resources Act 1991 (WRA 1991). These are:

- Watering outdoor plants on commercial premises;
- Filling or maintaining a non-domestic swimming or paddling pool;
- Filling or maintaining a pond;
- Operating a mechanical vehicle-washer;
- Cleaning any vehicle, boat, aircraft or railway rolling stock;
- Cleaning non-domestic premises;
- Cleaning a window of a non-domestic building;
- Cleaning industrial plant;
- Suppressing dust; and
- Operating cisterns.

In order to grant a Drought Order under WRA 1991 73(2), the Secretary of State must be satisfied that:

“By reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened”

The potential timescales for introducing restrictions by recourse to a Drought Order are significantly longer than those for Temporary Use Bans under the WIA 1991, and the Secretary of State would require a public inquiry or hearing to be held if an objection were received.

Under Schedule 8, paragraph 3(c) of the WRA 1991, the company must publish a notice of its application for a Drought Order to restrict water use, which shall state that objections to the application may be made to the Secretary of State within seven days from the date on which it is served or published.

Table 5 Drought Order (Non Essential Use Ban) Exemptions

Drought Order Category		Statutory Exemptions	Universal Exception	SWS Discretionary Exception	UKWIR Suggested Discretionary Exceptions
1	Watering outdoor plants on commercial premises	None	None	Use of an approved drip or trickle irrigation system fitted with a PRV and timer	Use of an approved drip or trickle irrigation system fitted with a PRV and timer
				Watering newly-bought plants	Watering newly-bought plants
2	Filling or maintaining a non-domestic swimming or paddling pool	None	None	n/a	Swimming pools serving industrial training if considered justified
					Swimming pools with covers
					Pools with religious significance
					Pools fitted with approved water conservation or recycling systems
					Pools that are subject to significant repair and innovation
3	Filling or maintaining a pond	Blue Badge holders on grounds of disability	Blue Badge holders on grounds of disability	n/a	Customers on the company's Vulnerable Customer List who have mobility issues but are not in possession of a Blue Badge
4	Operating a mechanical vehicle washer	None	None	n/a	Washers which recycle water and thus use less than 23 litres per wash
					On biosecurity grounds
5	Cleaning any vehicle, boat,	Cleaning any vehicle, boat,	None	n/a	Low water use technologies

Drought Order Category	Statutory Exemptions	Universal Exception	SWS Discretionary Exception	UKWIR Suggested Discretionary Exceptions	
	aircraft or railway rolling stock	aircraft or railway rolling stock for health and safety reasons			Small businesses whose sole operations are cleaning of vehicles using hosepipes
					Those using vessels as a primary residence
					Cases where fouling of hulls causes fuel consumption
					To remove graffiti
					To prevent or control the spread of non-native and/or invasive species
6	Cleaning any exterior part of a non-domestic building or non-domestic wall	Cleaning any exterior part of a non-domestic building or non-domestic wall for health and safety reasons	None	n/a	Small businesses whose sole operations are cleaning of vehicles using hosepipes
					Low water use technologies
					To remove graffiti
7	Cleaning a window of non-domestic building	Cleaning a window of non-domestic building using a hosepipe for health and safety reasons	None	n/a	Small businesses whose sole operations are cleaning of vehicles using hosepipes
8	Cleaning industrial plant	Cleaning industrial plant using a hosepipe for health and safety reasons	None	n/a	To remove graffiti
9	Suppressing dust	Suppressing dust using a hosepipe for health and safety reasons	None	n/a	None
10	Operating cisterns on unoccupied buildings	None	None	n/a	None

Savings

Similarly to the discussion on savings from TUBs, the savings that can be expected from a Drought Order to restrict water use are influenced by the company's universal metering programme. This has reduced overall demand and has the potential to reduce the savings from a Drought Order to restrict water use. The impact of restrictions will also be dependent upon prevailing demands and weather conditions and the level of media attention the drought may have received prior to introducing restrictions. Finally, there has been a change in the powers that companies have to introduce Drought Order restrictions – with the Drought Direction 1991 being replaced by the Drought Direction 2011. There has not been any drought in which the new Drought Direction 2011 powers have been implemented by Southern Water, and so there is no direct evidence available to determine the impact that this may have.

Besides water savings from TUBs, the empirically based analysis that the company carried out on the impacts of the demand restrictions that were applied to Southern Water during the 2005-06 drought, also estimated the demand savings for NEU bans from Drought Orders. As previously mentioned in this report, the analysis takes into account both weather influences and the effect of metering.

In the Western and Central areas it is apparent that the effects of the publicity surrounding the drought were cumulative over the two year period, without any notable stepped change as a result of the Drought Order. This makes an exact evaluation of the impact of Drought Orders difficult, as it appears that a rapidly introduced ban might not have the same impact as the longer sequence of events and publicity generated during the 2005-06 drought. It concludes that the use of the Drought Order saves an additional 3% over the TUB in the Western and Central areas, to a total of 8%.

The Eastern area displayed very little response to the Drought Order. The reasons for this are not known, but are likely to be associated to different attitudes towards water saving. It concludes that it saves an additional 1%, to a total of 4%.

Compensation

Under the WRA 1991, Southern Water's customers are not entitled to compensation in respect of loss or damage sustained as a result of the implementation of Drought Permits or Orders. The circumstances under which payments may be made to customers are set out in the conditions attached to a water undertakers' Instruments of Appointment. The other conditions under which customers are entitled to compensation, for example interruption of supply to customers, remain unchanged.

Our commitment to household customers also applies during drought events and we will work to honour the minimum standards of service that our customers can expect.

Phasing of restrictions on demand

This section aims to set out an indicative phasing plan for introducing water use restrictions. However drought conditions can vary significantly from one event to another and so it is important for water companies not to be too prescriptive in setting out how they may apply restrictions. The precise order in which individual activities are implemented and whether implementation of each activity can be made, subject to qualifications, must be decided by the company at the time in light of all relevant circumstances including the supply demand situation. It may thereafter be reviewed in the light of experience or changing circumstances. Nevertheless, a summary of the indicative phasing of restrictions, covering both TUBs and a Drought Order to restrict water use, is provided in Table 6 below, as a guide. The metrics which trigger each phase of restrictions are presented in the figures in Annex 1.

Whilst water use restrictions to reduce demand are normally expected to be in place before Drought Permits and Orders to relax abstraction licence conditions are implemented, there may be circumstances when this would not be appropriate. The main reason would be when applying for a Drought Permit or Order to enhance supply availability during the winter when, unless water reuse restrictions are already in place, the imposition of them at this time of year would have a very small impact because discretionary water use is low. An example of this was when Southern Water applied for a Drought Permit to help refill Bewl Water reservoir in January 2018 but customer restrictions were not imposed.

With regard to the phasing of TUBs, it should be noted that “the variation of a prohibition is to be treated as a prohibition” (WIA 1991, 76B (4)). Hence the procedure for providing notice would need to be followed for each variation in prohibition, with the consequent time delay that would entail. This is important to consider when determining the number of phases the company might adopt.

Reducing garden watering with a hosepipe has higher benefit in demand reduction during the early months of a drought when compared with other activities such as washing cars, boats and domestic windows. It is during spring time that many plants start to grow or recover from winter, and it would be seen as unfair by many customers to restrict garden watering with a hosepipe, if the allowance of other uses continues. After careful consideration on phasing of temporary water use restrictions, Southern Water believes that introducing the majority of TUBs in a single first phase is the optimum approach. This has the benefit of providing a strong message for the need to conserve water (even where some restrictions would not necessarily be expected to provide a significant water saving in their own right) and is less confusing in terms of what restrictions may be in place at any given time. The company will, however, consider delaying certain TUB restrictions until a later phase, primarily to avoid the potential impact these can have on some small businesses. This consideration is based on experiences and findings from the 2004-07 drought.

Southern Water will work in partnership with neighbouring water companies, Water UK, Defra, Ofwat and the Environment Agency to co-ordinate as far as possible on messages, timings of announcements, restrictions, exceptions and concessions and stakeholder engagement. For example, in the recent drought Southern Water was signed up to the National Drought Management Group and participates in weekly meetings with the Strategic Drought Communications Group and Drought Communications Practitioners Group. These groups work to co-ordinate messages, information and updates going forward and develop group activities to keep customers better informed. However, it is also important to recognise that sometimes, depending on the nature of the drought, certain areas may have to have specific messages in key geographical areas. During an impending drought Southern Water will also initiate discussions with local authorities regarding watering regimes for public parks and gardens.

Although Southern Water would wish to have the power to implement a Drought Order restricting water use immediately after it is granted, the company will re-assess the circumstances at the time of the Drought Order being granted. It may be appropriate to implement a Drought Order through a phased approach taking into account future circumstances, the requirements for the protection of public water supplies and other relevant circumstances. Depending on the speed a drought develops, Southern Water may seek to apply for a NEU ban drought order whilst still under drought trigger conditions but not implement it until the severe drought trigger has been breached.

Our commitment to household customers also applies during drought events and we will work to honour the minimum standards of service that our customers can expect.

Table 6 Summary of indicative phasing of restrictions on demand

Restriction activity	TUB / Drought Order (DO)	Impending drought	Drought conditions	Severe drought conditions (Phase 1)	Severe drought conditions (Phase 2)
Watering a garden using a hosepipe (includes parks; gardens open to public; lawns; grass verges; areas of grass used for sport or recreation; allotment gardens; any area of allotment used for non-commercial purposes; and any other green space)	TUB		✓	✓	✓
<ul style="list-style-type: none"> Including national or international sports events; grass surfaces used for sport or recreation where watering is undertaken in relation to particular playing or other surfaces designated by the company, for no more than 2 hours a week and only between the hours of 1900hrs and 0700hrs 	TUB				✓
Cleaning a private motor-vehicle using a hosepipe	TUB		✓	✓	✓
<ul style="list-style-type: none"> Including businesses specialising in hand car-washing using hosepipes as part of their process 	TUB				✓
Watering plants on domestic or other non-commercial premises using a hosepipe	TUB		✓	✓	✓
Cleaning a private leisure boat using a hosepipe	TUB		✓	✓	✓
Filling or maintaining a domestic swimming or paddling pool	TUB		✓	✓	✓
Drawing water, using a hosepipe, for domestic recreational use	TUB		✓	✓	✓
Filling or maintaining a domestic pond using a hosepipe	TUB		✓	✓	✓
Filling or maintaining an ornamental fountain	TUB		✓	✓	✓
Cleaning walls, or windows, of domestic premises using a hosepipe	TUB		✓	✓	✓
<ul style="list-style-type: none"> Including small businesses using water-fed poles to clean domestic walls and windows; where the purpose of cleaning is the removal of graffiti 	TUB				✓
Cleaning paths or patios using a hosepipe	TUB		✓	✓	✓
<ul style="list-style-type: none"> Including small businesses whose sole operations are the cleaning of paths and patios; where the purpose of cleaning is the removal of graffiti 	TUB				✓

Cleaning other artificial outdoor surfaces using a hosepipe	TUB		✓	✓	✓
• Including small businesses whose sole operations are the cleaning of hard standings; where the purpose of cleaning is the removal of graffiti	TUB				✓
Watering outdoor plants on commercial premises	DO			✓	✓
• Including watering of newly bought plants and plants watered using certain water efficient apparatus such as drip- or micro-irrigation through perforated hosepipes and sprinkler irrigation systems	DO				✓
Filling or maintaining a non-domestic swimming or paddling pool	DO			✓	✓
Filling or maintaining a pond	DO			✓	✓
Operating a mechanical vehicle-washer	DO			✓	✓
• Including Washers that recycle water and as a consequence use less than 23 litres of mains water per vehicle	DO				✓
Cleaning any vehicle, boat, aircraft or railway rolling stock	DO			✓	✓
• Including where the purpose of cleaning is the removal of graffiti	DO				✓
Cleaning non-domestic premises	DO			✓	✓
• Including where the purpose of cleaning is the removal of graffiti	DO				✓
Cleaning a window of a non-domestic building	DO			✓	✓
• Including small businesses using water-fed poles to clean non-domestic windows	DO				✓
Suppressing dust	DO			✓	✓
Operating cisterns	DO			✓	✓
Cleaning industrial plant	DO				✓

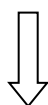
Notes:

“TB” refers to a temporary ban under the Water Industry Act 1991, as amended by the Flood and Water Management Act 2010

“Order” refers to a Drought Order to restrict water use under the Water Resources Act 1991 and in accordance with the Drought Direction 2011

Key to colours used:

Impending drought
Drought conditions



Worsening drought conditions

Appendix A: Effectiveness of Restrictions Technical Report

February 2017



from
**Southern
Water** 

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1. Introduction

This technical note provides an empirically based analysis of the impacts of the demand restrictions that were applied by Southern Water during the 2005-06 drought. The analysis is based on an empirical model of household demand that accounts for both weather influences and the effect of metering on demand. The 2012 drought event was not considered due to the exceptionally high rainfall that occurred almost immediately after the temporary use ban (TUB) was introduced.

2. Data used

The following data sources were used in the analysis:

- Daily Distribution Input (DI) data from 2001 to 2015 inclusive, aggregated according to Area*
- Monthly leakage calculations from 2001 to 2015 inclusive
- Annual average non-household demand based on regulatory return data ('Table 10') from 2001 to 2015 inclusive
- Daily rainfall for the Lower Itchen, Ditchling road, and Canterbury rain gauges from 2001 to 2015 inclusive
- Daily mean air temperature for the Wiggonholt site from 2001 to 2015 inclusive

**The analysis was originally going to be carried out at a Water Resource Zone (WRZ) level, however there are some clear data issues that meant the inter-zonal transfers are not reliably represented at this level, particularly post 2010. The aggregated Area data (Western, Central and Eastern) are reliable so this has been used in preference. The one exception to this is the Isle of Wight, where the separation in DI from the rest of Hampshire in the Western area was reliable. This allowed the Isle of Wight to be used as a 'control' data set, representing a WRZ where there have been very high levels of metering for some considerable time.*

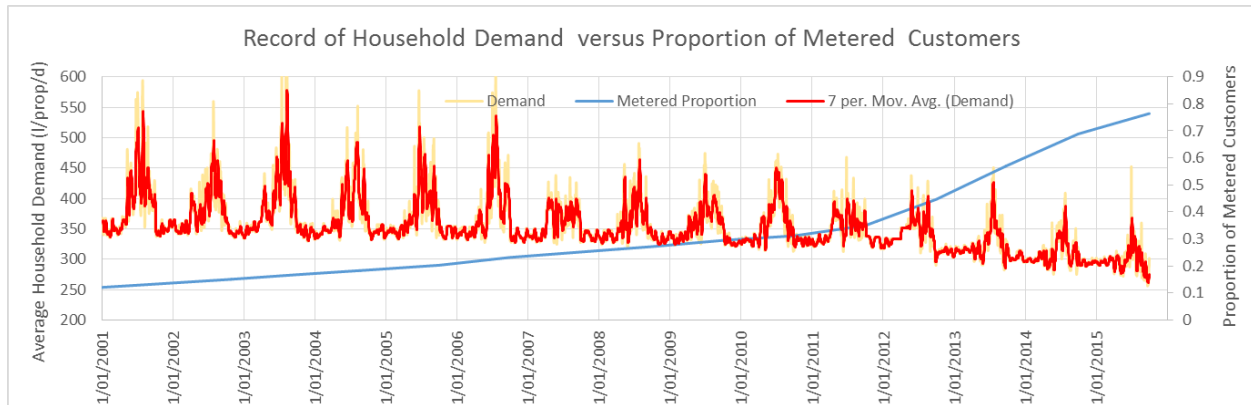
3. Methodology

The methodology that was used is broadly in line with the Environment Agency Drought Demand Modelling Guidance (i.e. additive multiple linear regression models based on temperature and household demand) although it contained two key enhancements that made the resultant models suitable for Southern Water's purposes:

- Rather than use sunshine hours, which generally act as a proxy for the time of the year and have a large degree of auto-correlation with temperature, three sub-models were set up to represent the October to March (winter), April to July (spring/early summer) and August to September (late summer) conditions. This was found to accurately emulate the inherently smaller response to weather that occurs within most of Southern Water's region during the August and September periods (presumably due to summer holiday effects that continue into September), and accounted for the clear difference in demand response observed between the late winter/early spring period and the 'spring growing season' (April and May).
- Because Southern Water has implemented a universal metering programme, the simple additive linear model proposed by the Environment Agency guidance was not able to reflect

the demand response seen at high levels of metering. In particular it is evident at the higher levels of metering (i.e. beyond 40%) achieved by the universal metering programme that there is a large reduction in the summer peak usage that reduces the peak to average demand ratio. This can be clearly seen in the output for the Eastern area, as shown in Figure 3.1 below. **This model therefore contained a non-linear response to metering that was accounted for in two ways; an additive component applied to the underlying demand and a multiplicative function that was applied to the weather response component of the model.**

Figure 3.1 Example demand versus metering behaviour (Eastern area)



Observed household demand was calculated for each day using the following equation:

$$HH \text{ Demand} = DI - NHH \text{ Demand} - \text{Leakage}$$

Where

HH Demand = household demand

NHH Demand = interpolated non-household demand figure based on mid-year to mid-year linear trend using the Table 10 data

Leakage = interpolated figure based on mid-month to mid-month operational leakage estimate

The regression analysis was carried out using standard good practice and a number of different model formats were tested. The preferred model format was derived based on graphical demand responses to individual explanatory factors followed by rapid testing in the miniTab statistical package. The following model format was found to represent both the best statistical fit and the most plausible explanation of the response to metering (which included the metering sensitivity response described later):

$$D = A + [Meter]^B + (1/[Meter]^C) \times ((D([Temp > 10]))^2 + E(\text{dry day}) + F(\text{lograin7}) + G(\text{lograin30}))$$

Where:

D = household demand (l/prop/d)

A to G are regression constants

Meter = proportion of households that are metered

Temp > 10 = number of degrees above 10 degC in each day (min = 0 at 10 degrees)

Dry day = no rainfall on that day stated as a binary 1 (no rain) or zero (some rain)

Log rain7, 30 = logarithm of the total rainfall over the last 7 or 30 days [14 days were tested, but not found to be statistically significant]

For each model in each area all factors were tested and those that were not statistically significant (i.e. $-2 > T \text{ stat} < 2$) were not included in the final model – for example the Central area winter model did not have a statistically significant response to any of the weather related components. A summary of the model coefficients that were derived is provided in Table 1. **N.B. 2005 and 2006 were excluded from the data set used to construct the model, as the model was designed to provide estimates of household demand without demand restrictions in place.**

Table 3.1 Summary of calculated model coefficients (zero values indicate the explanatory factor was not statistically significant so not used)

Area	Model (time of year)	A (underlying demand)	B (meter)	C (meter power)	D (meter weather response)	E (Temp)	F (dry day)	G (Log Rain7)	H (Log Rain30)
Isle of Wight	Summer	418.2	0.0	0.0	0.0	0.9	11.4	-11.6	-9.6
	Winter	385.4	0.0	0.0	0.0	0.0	0.0	-4.9	-9.6
Western	Spring/ Early Summer	422.5	-104.6	0.60	0.3	0.6	12.9	-15.0	-12.0
	Late Summer	387.6	-110.6	0.60	0.3	0.5	9.5	-12.0	-4.9
	Winter	390.0	-75.0	0.60	0.0	0.0	0.0	-2.1	-14.9
Central	Spring/ Early Summer	451.4	-116.3	0.40	0.2	0.6	2.7	-17.6	-17.3
	Late Summer	370.5	-77.3	0.40	0.2	0.4	7.7	-10.5	-0.2
	Winter	360.0	-55.0	0.40	0.2	0.4	0.0	0.0	0.0
Eastern	Spring/ Early Summer	473.0	-200.5	0.55	0.3	0.7	0.0	-23.2	0.0
	Late Summer	437.7	-180.4	0.55	0.3	0.7	0.0	-14.0	0.0
	Winter	405.0	-120.0	0.55	0.3	0.0	0.0	-9.1	0.0

The demand response in each area was then tested in two ways to derive the estimates of the effectiveness of demand restrictions:

- The empirical model outputs for 2005 and 2006 were compared against the actual recorded values to evaluate the differences that can be attributed to the restrictions that were in place. Any systematic bias in modelled versus actual by month was accounted for when making the comparison.

- The model was re-set to estimate the equivalent size that the 2005 and 2006 summer peak would have been if the proportion of measured properties had been 80% during that drought. Because there is clear evidence that the size of the summer peak relative to underlying demand has reduced as a result of metering, then the benefits of demand restrictions will have reduced accordingly. This analysis was carried out based on a comparison of the peak to average ratio across the whole of the summer period with the metering at the time and with current levels of metering.

4. Results and analysis

A comparison of the modelled versus observed demand for each month is provided in Figure 4.1 to Figure 4.4 below. As shown the model provides an excellent weekly fit in all Areas for periods of 'normal' (unrestricted) demand (covariance>0.99 and R²>0.82) and readily accounts for the impact of metering both on underlying demand and on the size of the peak. The impact of both the 2005-06 demand restrictions and the 2008-09 financial crisis are both evident in the mainland Areas. Data from the Isle of Wight indicate that there was no significant time based trend across this period, although it is notable that the Isle of Wight also demonstrated no response to either the 2005-06 drought publicity or the 2008-09 financial crisis. Although there may have been some shift in behaviour over time in the mainland Areas that was not reflected in the Isle of Wight, the evidence from this 'control' WRZ suggests that the trend based behaviour observed in the three mainland Areas is mostly associated with metering and specific events such as the demand restrictions during the droughts and the 2008-09 financial crisis, rather than a time based behavioural trend.

Figure 4.1 Observed versus modelled demand on the Isle of Wight

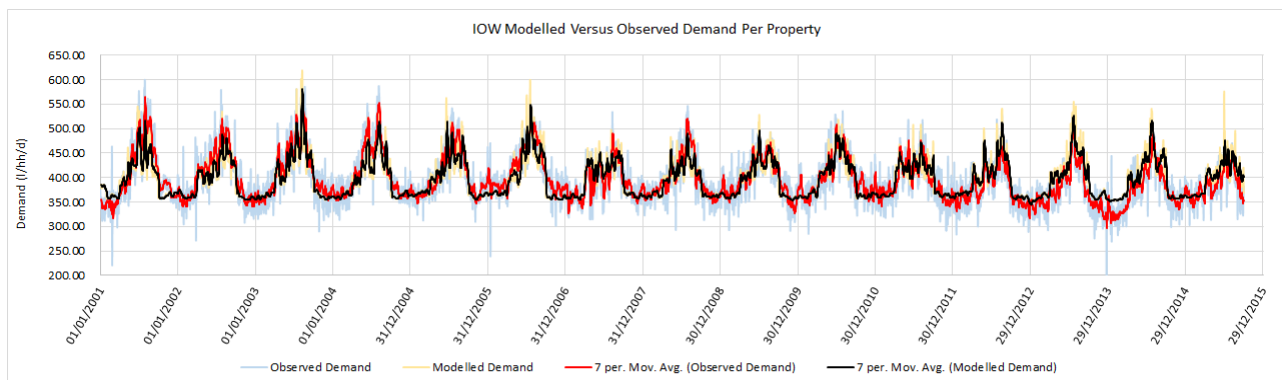


Figure 4.2 Observed versus modelled demand for Western area (excluding the Isle of Wight)

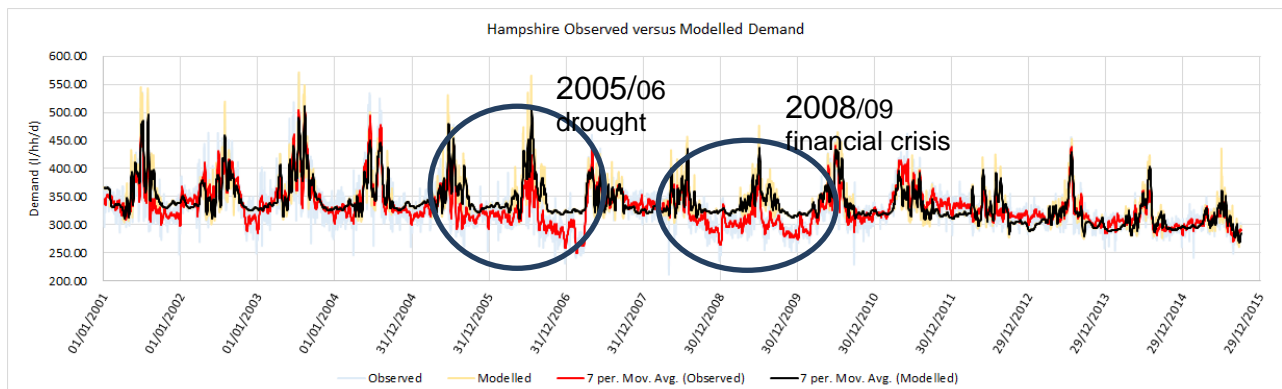


Figure 4.3 Observed versus modelled demand for Central area

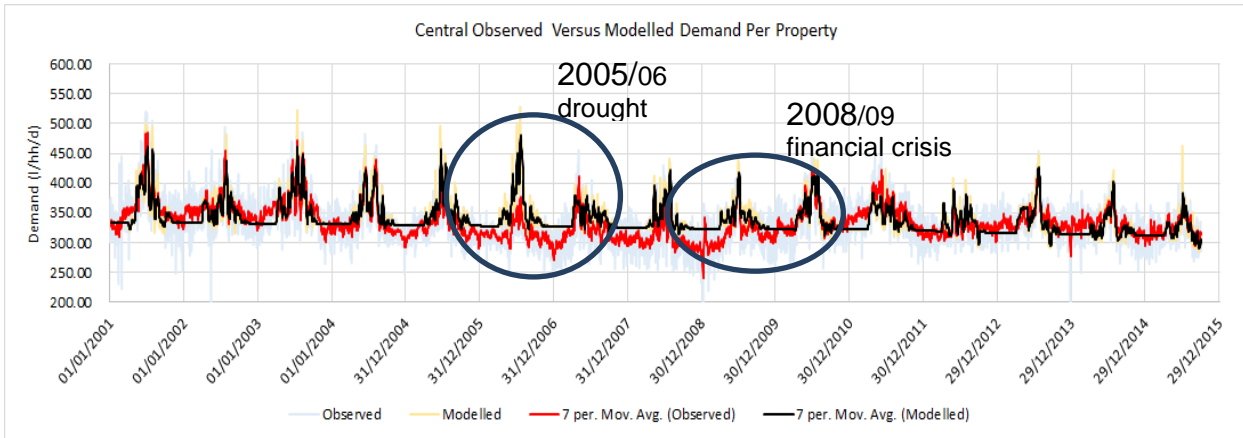
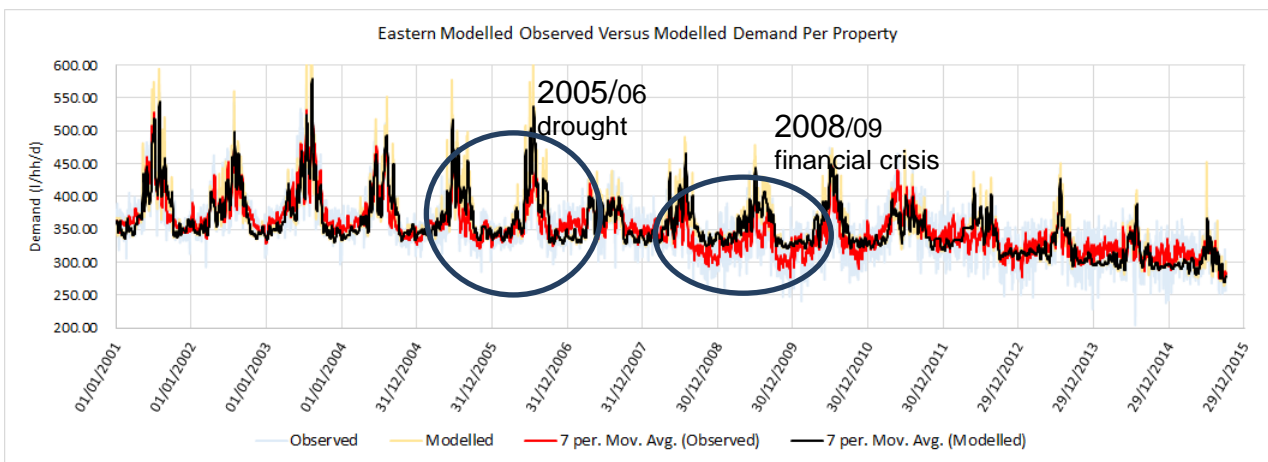


Figure 4.4 Observed versus Modelled Demand for Eastern area



An analysis of the amount of monthly bias from the model (if 2005-06 and 2008-09 are excluded) is provided in Figure 4.5 to Figure 4.7 below (bias = observed/modelled average for each month). As shown the models are accurate to within +/-3% for almost all months.

Figure 4.5 Model bias by month – Western area

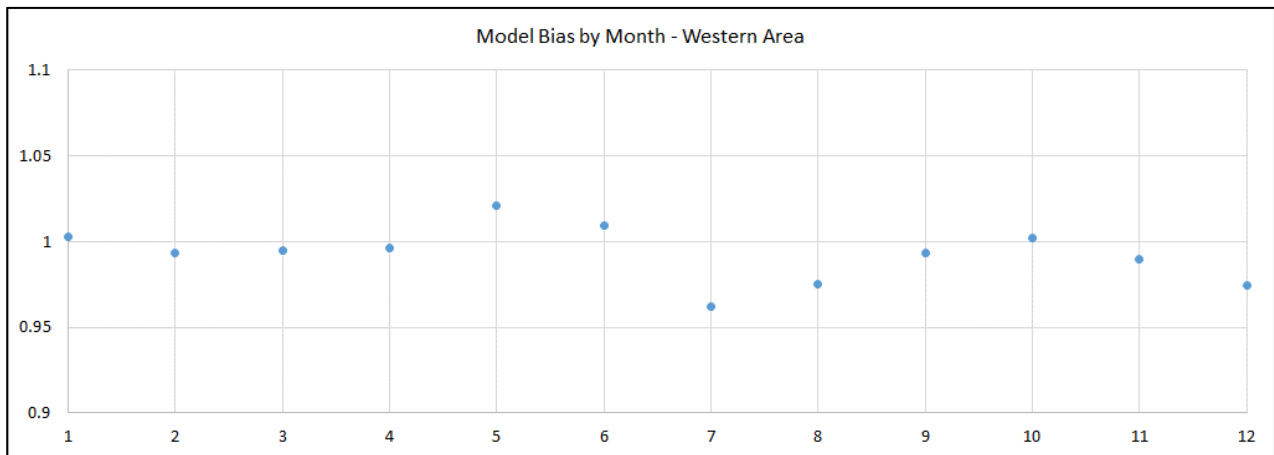


Figure 4.6 Model bias by month – Central area

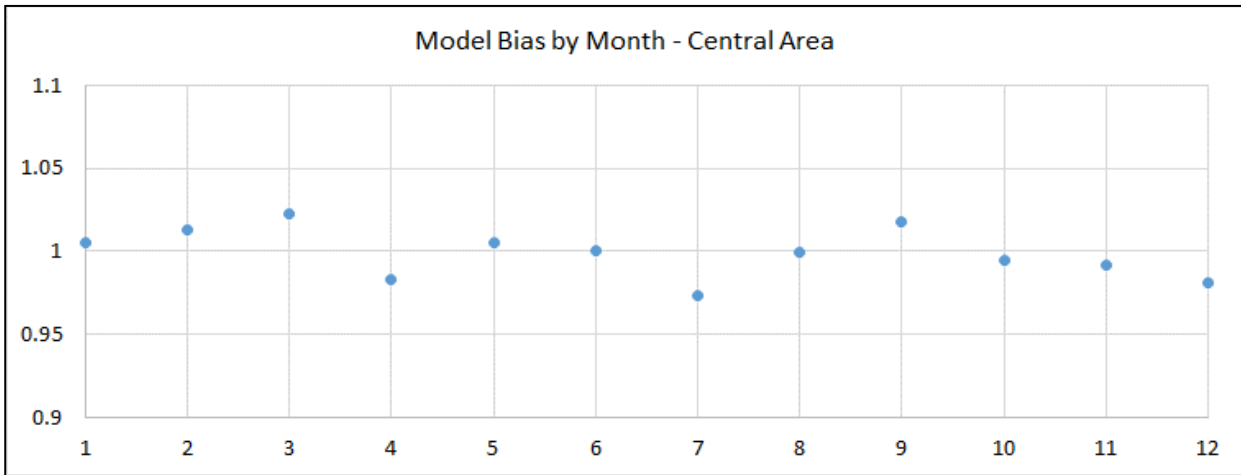
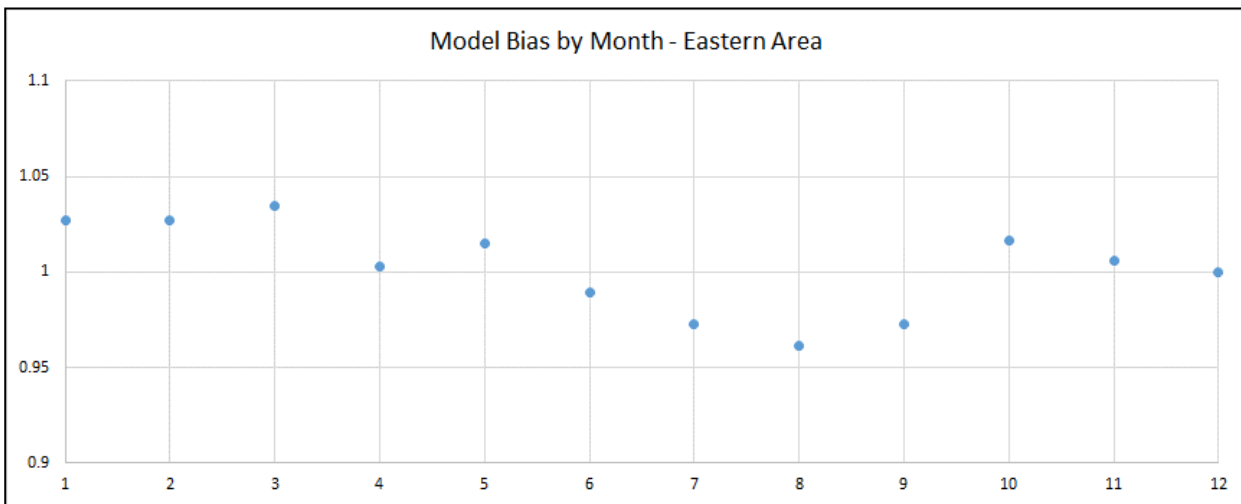


Figure 4.7 Model bias by month –Eastern area



An analysis of the modelled demand if metering was a constant 80% for the whole period across the three Areas is provided in Figure 4.8 to Figure 4.10.

Figure 4.8 Estimate of demand for a constant 80% metered population area – Western area (excluding the Isle of Wight)

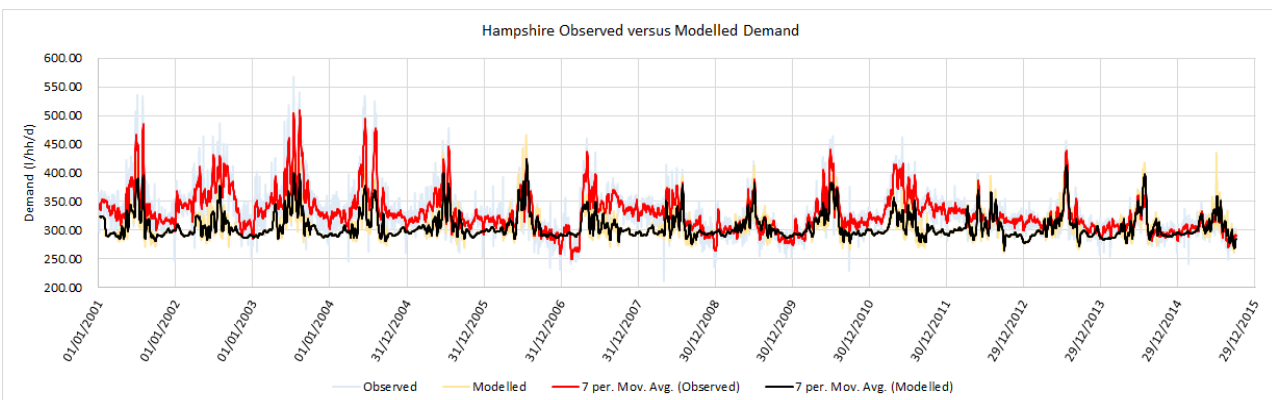


Figure 4.9 Estimate of demand for a constant 80% metered population area – Central area

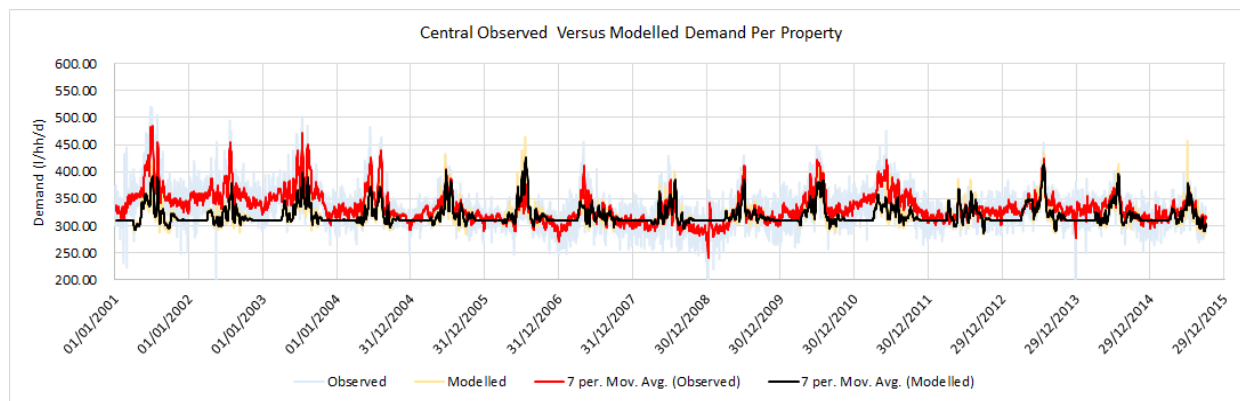
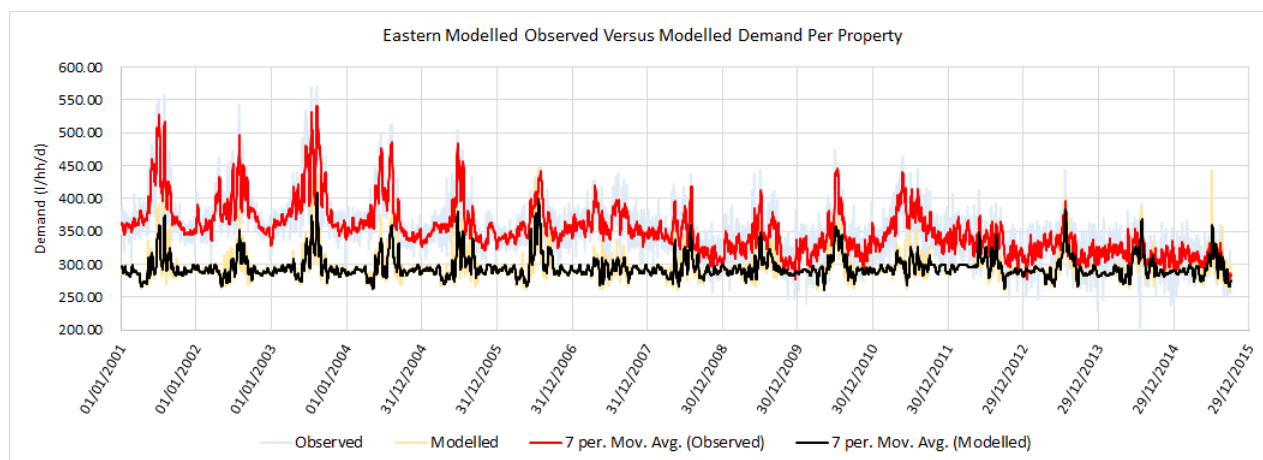


Figure 4.10 Estimate of demand for a constant 80% metered population area – Eastern area



Overall the above analyses show that:

- Metering seems to have had a much larger effect on the Eastern area than the other two Areas. As well as affecting the underlying demand more, the relative impact on the peak demand is also much higher when compared with the Central and Western area. In the Eastern area the overall summer peak for a 2005-06 style event (theoretical, without demand restrictions) has reduced by around 60%, compared with a 35% reduction in the Central and Western areas. A small amount of this is due to a smaller actual measured population at the time (circa 23% versus 26% in Western and Central areas at the end of 2006) but the majority represents a different behavioural response.
- The model format continues to provide logical results even when this high level of stress test is applied, even though there are non-linear and multiplicative terms within the model.

Figure 4.11 to Figure 4.13 show the expected versus modelled results with bias correction for the three Areas. The Isle of Wight is not shown as Figure 4.1 clearly demonstrates that there was no response to either the 2005 hosepipe ban or the publicity surrounding the 2006 Non-Essential Use (NEU) bans.

Figure 4.11 Estimate of demand restriction impacts during the 2005-06 event – Western area (excluding the Isle of Wight)

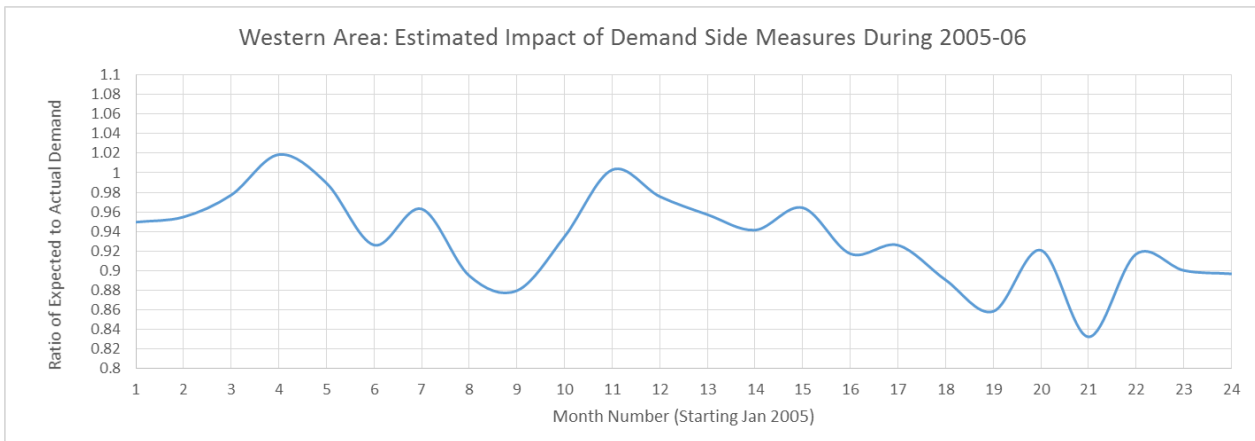


Figure 4.12 Estimate of demand restriction impacts during the 2005-06 event – Central area

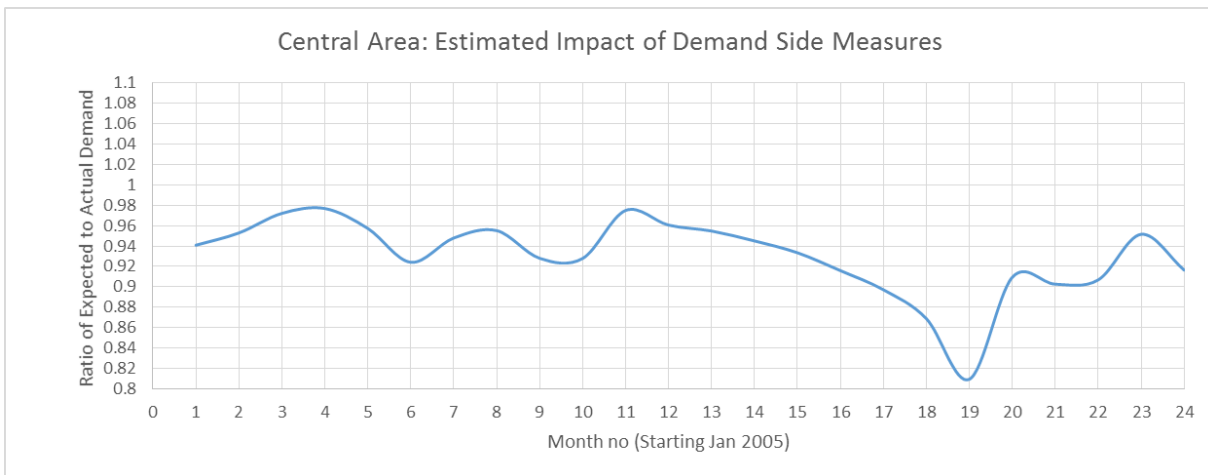
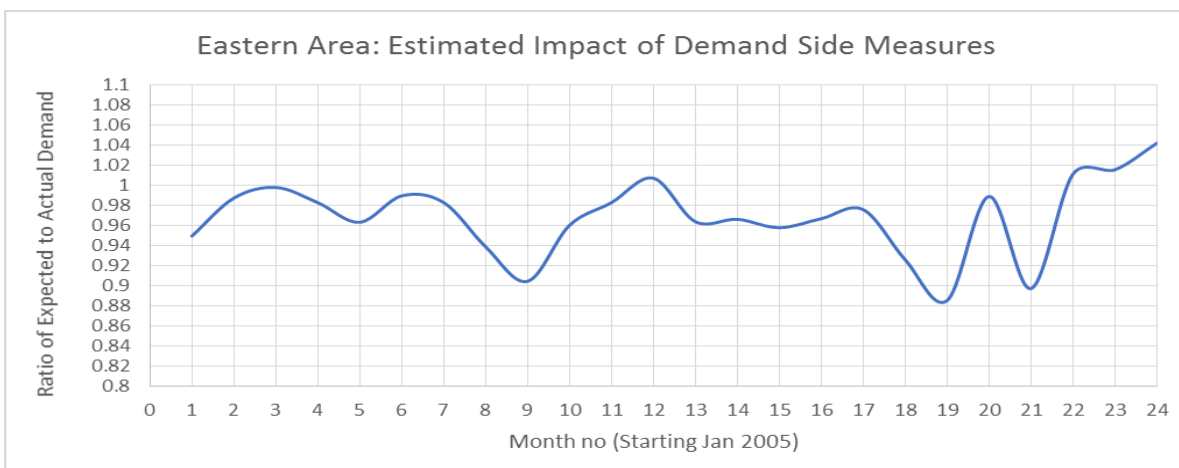


Figure 4.13 Estimate of demand restriction impacts during the 2005-06 event – Eastern area



These effectiveness of restrictions figures show that:

- The Western and Central areas demonstrate a continuous time based trend that was similar in magnitude, even though a NEU ban wasn't actually put in place in Hampshire.

The results for November-December 2006 in Western area (Hampshire) and December 2006 in Central area should be viewed with caution, as Figure 4.2 and Figure 4.3 indicate apparent demand measurement errors around that time (likely associated with leakage and/or non-household use fluctuations not accounted for in the simple trend based interpolations used in this analysis). However, even allowing for this it is apparent that the effects of the publicity surrounding the drought were cumulative over the two year period, without any notable stepped change as a result of the NEU ban. This makes an exact evaluation of the impact of NEU bans difficult, as it appears that a rapidly introduced ban might not have the same impact as the longer sequence of events and publicity generated during the 2005-06 drought.

- The Eastern area displayed similar levels of response to the Western and Central areas to the 2005 hosepipe ban, but very little response to the NEU ban. The reasons for this are not known, but are likely to be associated in some way with the different attitudes to water saving as demonstrated in the response to metering discussed previously.

Based on the demand responses observed at the time and the reduction in the summer peak volumes observed as a result of metering, a summary of the maximum, June-September (JJAS) and underlying demand ('MDO') that would be anticipated under current levels of metering is provided in Table 4.1 to Table 4.3 below.

Table 4.1 Estimated impacts of restrictions – Western area

	At the time	Current metering levels
2005 (HPB)	10% max monthly	7% max monthly
	6% JJAS	4% JJAS
	2% MDO	1% MDO
2006 (HPB with NEU) (NEU publicity only)	15% max monthly	10% max monthly
	10% JJAS	7% JJAS
	4% MDO	3% MDO

Table 4.2 Estimated impacts of restrictions – Central area

	At the time	Current metering levels
2005 (HPB)	8% max monthly	5% max monthly
	6% JJAS	4% JJAS
	3% MDO	2% MDO
2006 (HPB with NEU)	18% max monthly	12% max monthly
	13% JJAS	8% JJAS
	5% MDO	3% MDO

Table 4.3 Estimated impacts of restrictions – Eastern area

	At the time	Current metering levels
2005 (HPB)	10% max monthly	4% max monthly
	5% JJAS	2% JJAS
	1% MDO	Negligible MDO
2006 (HPB with NEU)	11% max monthly	5% max monthly
	7% JJAS	3% JJAS
	2% MDO	1% MDO

For the Central and Western areas the effects of hosepipe bans is similar, and the impact of NEU bans is seen to almost double the hosepipe ban effects. However, as noted previously a large proportion of this appears to be due to ongoing publicity that caused a time based trend over the course of the drought. Some caution is therefore advised in the Central area, where major droughts only have a critical period of 12-18 months, and this time based effect would not therefore occur in time to benefit the drought supply/demand balance. The 18% maximum monthly saving in July 2006 also appears to be an outlier and possibly represents a model over-response to the record breaking temperatures encountered in that month. This has been accounted for within the recommended profiles of demand restriction benefits discussed below.

As shown in Table 4.3, the impacts of NEU bans appear to be much smaller in the Eastern area than the other two. Because the loss of peak demand is also much larger this results in very small anticipated responses to both hosepipe bans and NEU bans within the Eastern area under current levels of metering.

Based on the above analysis, Table 4.4 to Table 4.6 provide the recommended profiles for the effectiveness of demand restrictions (EODR) within each of the three Areas under current levels of metering.

Table 4.4 Recommended EODR profile – Western area (excluding the Isle of Wight)

Month	TUBs	NEU
Jan-April	1%	3%
May-June	2%	4%
July-Aug	5%	8%
Sept	3%	4%
Oct-Dec	1%	3%

Table 4.5 Recommended EODR profile – Central area

Month	TUBs	NEU
Jan-April	2%	3%
May-June	3%	5%
July-Aug	5%	8%
Sept	3%	5%
Oct-Dec	2%	3%

Table 4.6 Recommended EODR profile – Eastern area

Month	TUBs	NEU
Jan-April	0%	1%
May-June	1%	1%
July-Aug	3%	4%
Sept	2%	2%
Oct-Dec	0%	1%

5. Conclusions

In broad terms the methodology described in this technical report followed the recommended methods contained within the Environment Agency Drought Demand Modelling Guidance report, with a minor change surrounding the inclusion of time of year/sunshine hours as an explanatory factor. However, the models that were used contained a significant enhancement to allow a quantified analysis of the impact of metering on summer peak demand. This incorporation of a demonstrably stable and accurate, but non-linear and multiplicative form of regression model meant that the impacts of metering on both underlying demand and demand response to weather could be modelled, allowing the response of the current, mostly metered, customer base to restrictions to be quantified.

This form of modelling demonstrated that the ratio of summer demand to underlying (winter) demand has decreased as a result of the universal metering, with the relative size of the summer peak (as calculated relative to winter 'MDO' demand) now approximately 35% smaller for the Western and Central areas and 60% smaller for the Eastern area than it was in the early to mid-2000s. This will affect the effectiveness of demand restrictions because discretionary use is clearly now smaller as a percentage of total demand (it is worth noting that there was no observable response to the 2005 hosepipe ban on the fully metered Isle of Wight).

The model used was able to accurately estimate the impact of restrictions on demand during the 2005-06 drought event, and estimate how this is likely to have changed as a result of increased metering. The estimated profiles for the Western (excluding the Isle of Wight) and Central areas are now in the order of 1% rising to 5% for TUBs (winter to summer profiles) and 3% rising to 8% for TUBs plus NEU bans. The Eastern area is expected to have a much lower response, at 0% rising to 3% for TUBs and 1% rising to 4% for NEU bans.