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Garden watering restrictions:

A review of hosepipe ban legislation

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In contract to Defra
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Waterwise is an independent, not-for-profit, nongovernmental organisation that promotes water efficiency in the UK. Our aims are to decrease water consumption in the UK by 2010, and to build an evidence base to support large-scale water efficiency initiatives. We are the leading authority on water efficiency in the UK. In England, we sit on the Environment Minister's Water Saving Group, and in Scotland, we convene the Saving Water in Scotland network.

To achieve our aims we work with water companies, governments, manufacturers, retailers, nongovernmental organisations, regulators, academics, retailers, consumers, the media, and other stakeholders.

We conduct our own research and occasionally undertake work as consultants. In addition to research, we are also involved in policymaking, advising, public relations, and other activities.

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Summary

The hosepipe ban is intended to reduce demand for water resources by enforcing a limit on consumption.

Shortcomings of the hosepipe ban include,

- Lack of clarity about the stages of drought planning and corresponding actions;
- Confusion about what is and what is not allowed, and cynicism about why certain activities are permitted and others not;
- Lack of flexibility for improvements in technology;
- Lack of concessions; and,
- Lack of consistency between companies allowing different interpretations, which is confusing for consumers.

Recommendations for addressing these shortcomings include,

- Clearly defined drought stages and associated actions to reduce non-essential use;
- Consistency of interpretation by water companies;
- Introduction of time-based bans both by day of week and by time of day to maximise effectiveness of water usage;
- Introduction of the ability to ban the use of water on hard surfaces and for the filling of swimming pools;
- Widening the scope of the ban on washing of motor vehicles to include other vehicles;
- Recognition of new technologies that minimise water consumption; and,
- Concessions for the elderly and disabled, and for newly landscaped gardens and turf.

The policing of hosepipe bans and other water usage restrictions is difficult to carry out and new ways should be investigated to make enforcement more effective. Clearer and more consistent restrictions may foster greater understanding amongst consumers and a greater willingness to voluntarily comply.

It must be recognised that there are costs associated with a hosepipe ban and any other restrictions on the use of water, and that these costs need to be balanced with the overall benefit of securing the long term delivery of water.

A time of consultation is necessary to help generate consensus on the benefits and the value of proposed amendments and establish a sense of involvement amongst all stakeholders, thereby assisting in creating commitment to its successful implementation.

Contents

1.	**Background**		**5**
2.	**Report objectives**		**5**
3.	**Climate change and water consumption**		**5**
4.	**Present laws regarding hosepipe bans**		**9**
5.	**The hosepipe ban**		**10**
	5.1	**What the ban is supposed to do**	**10**
	5.2	**What the ban actually does**	**11**
	5.3	**Shortcomings of the hosepipe ban**	**12**
6.	**Suggested amendments**		**15**
	6.1	**Stage**	**15**
	6.2	**Time restrictions**	**16**
	6.3	**Hard surfaces**	**19**
	6.4	**Swimming pools**	**19**
	6.5	**Vehicles**	**19**
	6.6	**Allotments**	**19**
	6.7	**New technologies in irrigation**	**20**
	6.8	**Concessions**	**21**
	6.9	**Communication**	**22**
7.	**Enforcement and policing**		**22**
8.	**Economic impacts**		**23**
9.	**Consultation**		**25**
10.	**Conclusions**		**26**
Appendix 1	**Water restrictions in Australia, Canada and the USA**		**27**
Appendix 2	**Hosepipe restrictions in New Zealand**		**40**

1. Background

Water companies are responsible for safeguarding water resources and maintaining supply to meet the needs of consumers while protecting the environment. They have a legal obligation to promote water efficiency and to encourage the adoption of appropriate water efficient practices by consumers.

Water companies have powers under section 76 of the Water Industry Act 1991 to prohibit or restrict the use of water drawn through a hosepipe for watering private gardens and washing private motor vehicles. These powers can be implemented at a time when water companies are of the opinion that a serious deficiency of water supplies exists or may soon exist. Restrictions come in two forms: sprinklers and unattended hosepipe bans, or full hosepipe bans. Usually a sprinkler and unattended hosepipe ban is first introduced and later extended to a full ban, although it is possible to go straight to a full hosepipe ban.

The current legislation governing hosepipe bans was drafted in 1945 and does not reflect many activities that are now part of modern lifestyles. The number of outdoor discretionary uses of water has increased substantially, beyond the watering of private gardens and the washing of private motor vehicles. There are no provisions in the legislation that account for changes in lifestyle or developments in technology. The outdated legislation appears to be inconsistent and has led to confusion amongst water undertakers as well as customers.

2. Report objectives

This report seeks to clarify the aims of introducing a hosepipe ban, and suggests amendments to the legislation that would make restrictions relevant to today's society and so be more effective in achieving the aims of a ban.

The impact of climate change and consumption patterns may have on the supply of water in the United Kingdom (UK) is briefly discussed, followed by outlining the current water situation in the UK and exploring the factors that have led to eight water companies imposing hosepipe bans by mid summer 2006. The shortcomings of the current legislation are assessed and finally amendments that could assist in creating a consistent approach to implementing restrictions during times of water shortages are proposed.

3. Climate change and water consumption

The latest climate change scenarios for the EU developed by the Hadley and Tyndall Centres for United Kingdom Climate Impacts Programme (UKCIP) predict high warming rates over the UK. By the 2080's scenarios of climate change are predicted to result in wetter winters and hot dry

summers with more intense and frequent winter rainfalls.[1] Climate change means that rainfall is becoming less frequent but more intense, leading to flooding and drier periods. During periods of decreased rainfall and increased evaporation water resource availability starts to become a limiting factor determining water supply capability and hence security of supply. The risk of security of supply is determined as the balance of supply capability during a drought and the demand that can be expected to be experienced during a drought year if not constrained by restrictions[2].

To further aggravate water shortages, water consumption has increased by one percent per capita since the 1930's to reach the 2004 level of 150 litres per capita per day. At the same time there is a shift in demographics to more single occupancy households and in population distribution leading to higher population growth in drier areas. The combination of a change in rainfall patterns, growth in consumption due in part to single occupancy and a shift in population is leading to water problems across the country.

With burgeoning water consumption and the heightened possibility of more dry periods it is essential that the plans and legislation in place to deal with water shortages are robust and have legitimacy in the eyes of consumers who must comply with the legislation for it to be effective. The action taken to counteract water shortages needs to be clear relative to the society in which we live in order increase compliance, to be vigorous and enable effective enforcement.

At the present, the south of England is currently experiencing the driest period since 1933, with low rainfall over the last two winters. Forecasts for the summer 2006 reveal further hotter and drier than average periods in parts of the UK (figures 1 and 2). There has been exceptionally low rainfall in many parts of the UK over the last two winters (figure 3), which has left groundwater storage levels low (figure 4).

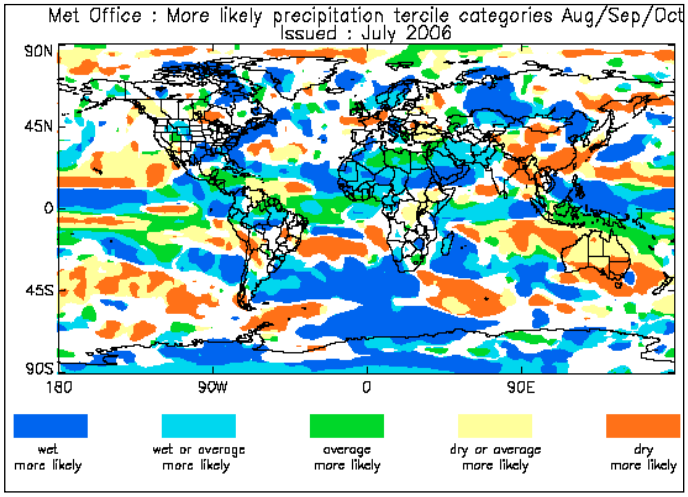

Figure 1. Rainfall predictions for August to October 2006. Further dry periods are likely in parts of the UK.[3]

1 Downing, T.E, Butterfield, R.E., Edmonds, B., Knox, J.W., Moss, S., Piper, B.S. Weatherhead, E.K. and the CCDeW project team (2003). Climate Change and the Demand for Water. Research Report. Stockholm Environment Institute Oxford Office. Oxford.
2 Thames Water Utilities London (2006) Application for an ordinary drought –order-London. Statement of Reason.
3 Met Office http://www.met-office.gov.uk/weather/seasonal/index.html

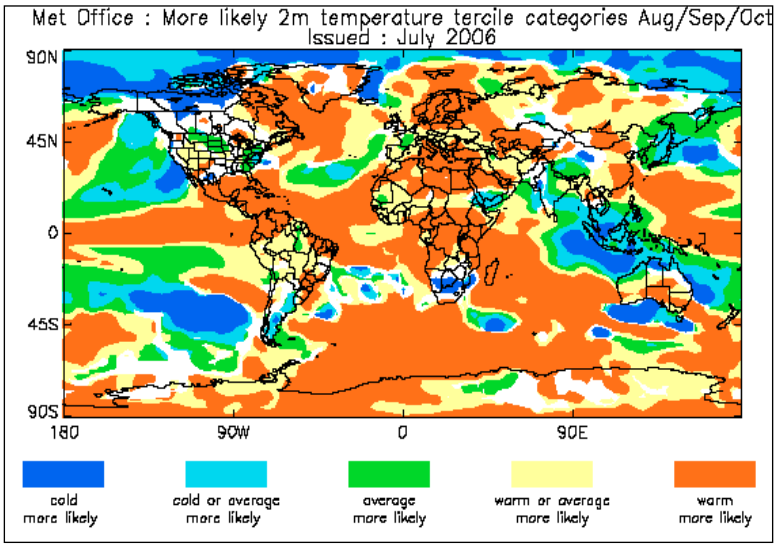

Figure 2. Temperature predictions for August to October 2006. Further warm periods are likely in parts of the UK.[4]

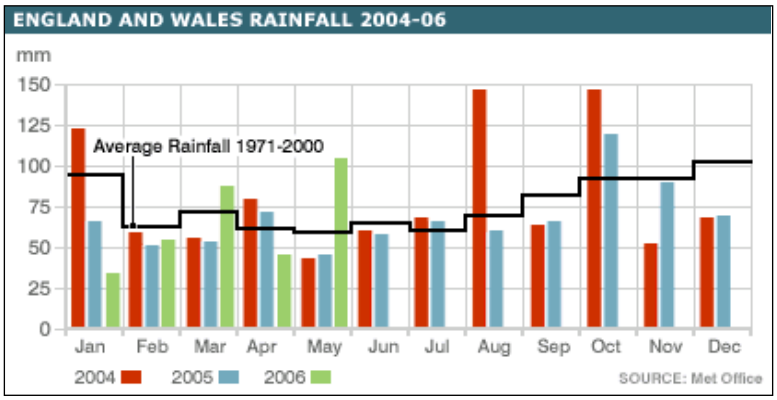

Figure 3. Rainfall in the UK during the years 2004, 2005 and 2006 as compared to the average rainfall between 1971-2000.[5]

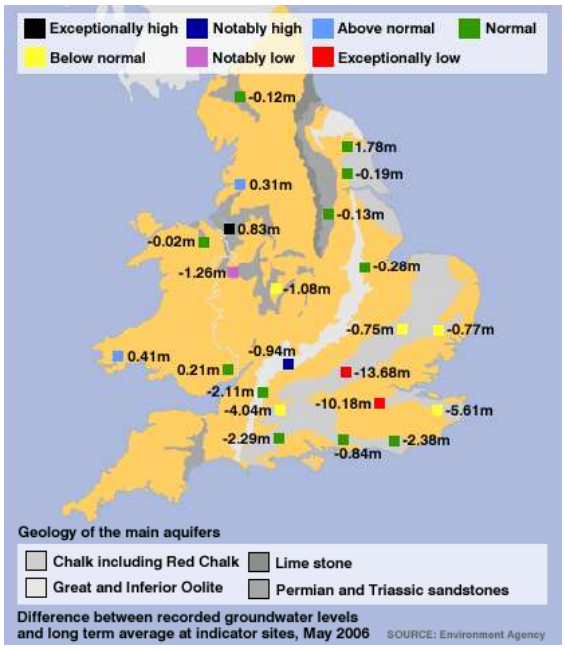

Figure 4. Difference between recorded groundwater levels and long term averages.[6]

[4] Met Office http://www.met-office.gov.uk/weather/seasonal/index.html.
[5] Met Office http://www.met-office.gov.uk/weather/seasonal/index.html.
[6] BBC http://news.bbc.co.uk/1/shared/spl/hi/guides/456900/456972/html/nn1page1.stm.

Groundwater levels that are already low in south-east England are continuing to decline, and are not expected to increase until the autumn.

Water companies have adopted measures to manage scarce water resources. One such measure has been to invoke the 1991 Water Industry Act to introduce hosepipe bans. Some water companies have also issued drought orders. Eight companies across south-east England have a full hosepipe and sprinkler ban in place. Nearly 13 million people are no longer allowed to use a hosepipe to wash their vehicles or water their gardens. Sutton and East Surrey Water have implemented Phase One of their non-essential use restrictions (table 1 and figure 5).

Table 1. Water companies who implemented hosepipe bans in 2005 and 2006.

Water Company	Date hosepipe ban introduced	Date drought order approved
Southern Water Kent, Sussex Isle of Wight	June 2005 March 2006	25 May 2006
South East Water Sussex and Kent North Hampshire Berkshire and Surrey	30 July 2005 3 April 2006	
Mid Kent Water	8 August 2005	25 May 2006
Cholderton and District Water	April 2006	
Sutton and East Surrey Water	1 March 2006	15 May 2006
Thames Water	3 April 2006	
Three Valleys Water	3 April 2006	
Folkestone and Dover Water	2 April 2006 (lifted on 2 October 2006)	

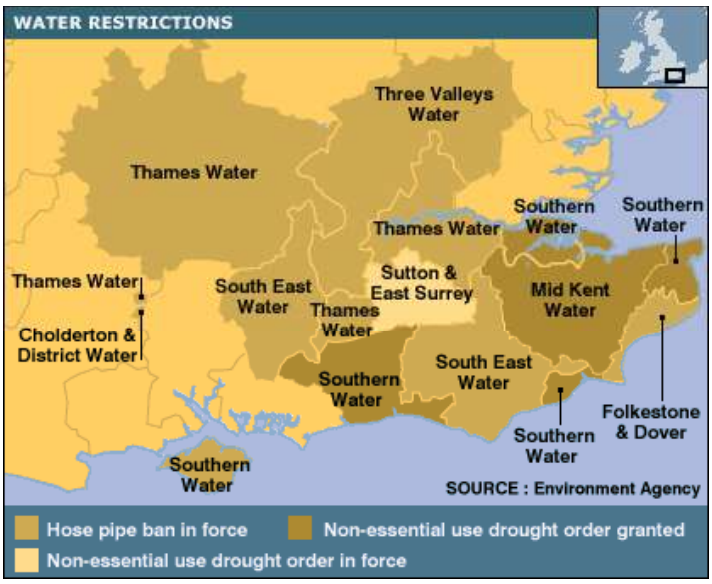

Figure 5. Diagram of regions under hosepipe ban restrictions.[7]

4. Present laws regarding hosepipe bans

The stages in water shortages according to the Environment Agency are: potential drought, drought and severe drought. Due to the varying nature of drought there is no rigidly defined set of triggers for changing drought stages. Drought triggers are used to identify whether drought actions need to be taken. The crossing of a drought trigger does not mean that the action is taken. The different regional drought teams base their decision on whether action is needed based on various factors, including present and forecast conditions and how effective the action taken would be.[8]

Water companies are required to compile Drought Plans that set out how each company will meet its duties to supply adequate quantities of water during drought periods. Depending upon the severity of the drought, water management measures may include campaigns to encourage reduced consumption by the public and/or hosepipe bans.

The Water Resources Act 1991, as amended by the Environment Act 1995 and the Water Act 2003, allows for three mechanisms for dealing with drought situations: ordinary drought orders, emergency drought orders and drought permits.[9] Before companies can apply for a drought permit or drought order they need to demonstrate to the Environment Agency that they have attempted to reduce demand by all reasonable measures that are possible given their powers. A hosepipe ban is one such measure. Under a hosepipe ban it is not permitted to water a private garden using a hosepipe, sprinkler, or any other automatic watering device, nor is it permitted to use a hosepipe to wash a car, caravan, trailer or any other vehicle drawn by a private motorcar.

[7] BBC http://news.bbc.co.uk/1/shared/spl/hi/guides/456900/456972/html/nn1page1.stm.
[8] Environment Agency. Environment drought plan for Anglian Region.
[9] Department for Environment, Food and Rural Affairs. 2005. Drought orders and drought permits.

Water companies may apply to the Environment Agency for a drought permit or, with the approval of the Environment Agency, to the Secretary of State for Environment, Food and Rural Affairs (Defra) for a drought order. Drought permits enable companies to take water from new sources or to alter restrictions on existing abstractions. Ordinary drought orders restrict the non-essential use of water. Permits and orders can only be approved if the Environment Agency or Secretary of State is satisfied that the need exists by reason of an exceptional shortage of rain.

Permits and orders are granted only for specified periods of time but may be renewed for further limited periods. Emergency drought orders can only be granted if, in addition to a serious deficiency of water supplies, the economic or social welfare of persons in the area is likely to be negatively affected. Such orders can provide for water to be supplied by standpipe.

Drought measures can be divided into supply side measures (measures that provide an increase in the amount of water available for supply) and demand side measures (measures that serve to control or influence the amount of water used). Drought permits are supply side measures and hosepipe bans and drought orders are short-term demand side measures.

During a drought water resource availability becomes the limiting factor in determining supply capability and, hence, security of supply. The risk to security of supply is determined by the balance between supply capability during a drought and the demand that can be expected to be experienced during a drought year, if not constrained by restrictions. A fundamental element of the supply-demand balance is the water available for use, which is the amount of water that can be provided to feed into the distribution system to meet demand during a drought. If the amount of water in the distribution cannot meet the demand without environmental risk or risking future availability, restrictions to the demand need to be applied. Restrictions are supposed to ensure that limited water resources are managed responsibly during drought conditions until rainfall replenishes the water supplies to balance supply and demand in the short term and for long term water sustainability.

5. The hosepipe ban

5.1 What the ban is supposed to do

The hosepipe ban in supposed to do the following:

- A short term demand management strategy, whose primary aim is to reduce non-essential consumption;
- Prevent the need to implement further restrictions;
- Increase water efficiency at the domestic level by encouraging ‘sensible’ use of water by consumers, in combination with a PR/media campaign;
- Increase consumers’ awareness of water shortages; and,

- Prove to the Environment Agency that the water company involved is taking measures to reduce consumption.

By restricting water use, water companies hope to avoid possible supply problems in the near future. Hosepipe bans can be put in place when water companies feel that water shortages are becoming severe and that without action the security of supply in the future will be threatened, as well as water shortages posing a threat to rivers and the species they support.

Hosepipe bans encourage consumers to reduce non-essential consumption by restricting water use. The hosepipe ban highlights the water situation to consumers and is an instrument to encourage more efficient water use, when accompanied by an awareness-raising campaign.

5.2 What the ban actually does

A hosepipe ban, as defined in the Water Industry Act, paragraph 76, does not ban all hosepipe use. The ban only applies to the watering of private gardens and to the washing of private vehicles.

Typically, the following are banned:

- Using a hosepipe to wash a private car, caravan or trailer; and,
- Using a hosepipe or sprinkler to water a domestic garden.

The following are typically not banned:

- Anything not explicitly banned, such as filling private swimming pools and hot tubs, hosing down patios and driveways, fountains, water cannons.

The legislation is inconsistent in that it bans the use of the hosepipe to water a private garden and to wash a private motor vehicle whilst allowing the use of a hosepipe for other purposes such as filling a swimming pool or cleaning driveways. The legislation does not reflect the society in which we live, where water is used for a variety of purposes outside the home.

Social norms and expectations shape and constrain behaviour. Moral social norms derive from concepts such as justice and fairness. People are found to be more willing to conform to expectations if they are perceived to be fair and just. [10] The ban in its present state, however, seems unreasonable. Consumers are less likely to abide by restrictions if they appear to be unfair. The hosepipe ban depends on the compliance of consumers; therefore, for it to be effective it is essential that the restrictions make sense to consumers and are clear and easily understood.

[10] Kaiser F. (2003) Ecological behaviour's dependency on different forms of knowledge. Applied Psychology: An international review. Vol. 52 pp 598-613 and Barr S. (2003) Strategies for sustainability: citizens and responsible environmental behaviour. Area. Vol. 35 (3) pp 227-240.

5.3 Shortcomings of the hosepipe ban

Lack of clarity about the stages of drought action plans

The Environment Agency state that the hosepipes ban is one of the steps that should be implemented by water companies to demonstrate that all reasonable steps have been taken to reduce water consumption before a drought order is granted. A Defra 2005 report on drought orders and drought permits suggests that along with hosepipe bans and decreasing leakage, the banning of nonessential water use is one measure water companies can undertake to demonstrate that steps are being taken to reduce water consumption. The banning of nonessential water use is, however, only a measure that can be taken once a drought order has been granted.

Thames Water identify hosepipe bans as a level three drought action (table 2) in their Application for an Ordinary Drought Order.

Table 2. Levels of drought and actions taken at each level. From Thames Water.[11]

Level	Implications
Level 1	Media campaign, water efficiency campaign, leakage and pressure optimisation.
Level 2	Enhanced media campaign, customer choice / voluntary restraint, sprinkler ban.
Level 3	Hosepipe bans, drought permits / orders, non-essential use bans
Level 4	Rota cuts / standpipes

Thames Water state that hosepipe bans were implemented as a pre-level 1 demand management measure.[11]

There does appear to be confusion regarding the different stages of a drought and which drought action should be implemented at what time (table 3).

[11] Thames Water Utilities (2006) Application for an ordinary drought –order-London. Statement of Reason. Thames Water use the term 'levels' when discussing the different grades of water shortages and actions taken at each point. Other water companies and regulatory bodies use the term 'steps' and still others use 'stages'. For the remainder of this document the term stage will be employed to allow for consistency.

Table 3. Stages of drought according to several stakeholders.[12]

Stages	Stakeholders						
	Environment Agency	Thames Water	BBC	CCWater	Three Valleys Water	South East Water	Anglian Water
Pre stage 1		**Pre level 1** Publicity campaign; water efficiency campaign.*		Publicity campaign.		**Below average** Prepare water efficiency campaign.	Publicity campaign.
Stage 1	**Potential drought** Publicity campaign; hosepipe ban; bans on non-essential use; leakage control; pressure reduction.	**Level 1** Publicity campaign; water efficiency campaign; leakage & pressure optimisation.	Hosepipe & sprinkler bans.	Hosepipe & sprinkler bans.	Hosepipe bans.	**Alert** Water efficiency campaign; voluntary restraint.	Publicity campaign; hosepipe ban; bans on non-essential use; leakage control & pressure reduction.
Stage 2	**Drought** Drought order non essential use ban.# Drought permit.	**Level 2** Enhanced media campaign; customer choice; voluntary restraint; sprinkler ban.	Drought orders; non-essential use drought order; drought permit.	Drought permits.	Drought order; non-essential use ban; drought permit.	**Moderate** Sprinkler & unattended hosepipe ban; full hosepipe ban; drought permit.	Drought order; non-essential use ban.
Stage 3	**Severe Drought** Emergency drought order.	**Level 3** Hosepipe ban*; drought permit & order; non-essential use ban.	Emergency drought order; rota cut; standpipe.	Drought order; non-essential use ban.	Emergency drought order.	**Serious** Drought order; non-essential use ban.	Drought permit.
Stage 4		**Level 4** Rota cuts; stand pipes.		Water scarcity status; water meters introduced.		**Severe** Emergency drought order; rota cuts; stand-pipes.	Emergency drought order.

Before granting a drought permit, the Environment Agency expects evidence that the water companies are reducing demand. One such method is a hosepipe ban; therefore, hosepipe bans are an action that needs to be implemented by water companies before drought orders and non-essential use bans are implemented.
* Although Thames Water place hosepipe bans as a Stage 3 action, they implemented hosepipe bans as a pre Level 1 action.

[12] Information taken from websites and Drought Plans.

Table 3 does not reflect the severity of the water shortages or drought at the various stages. The table does reflect how different parties view the priority or order of the steps that should be taken. The table shows the disparities between the various stakeholders.

Confusion as to why certain activities are exempt and others included

Beyond the lack of clarity as to the stages of drought and what stages of drought lead to the implementation of which actions, there is also a lack of clarity as to which activities are exempt from or included in the hosepipe ban.

There are differences between what water companies include in the hosepipe ban. Thames Water includes allotments in the category of private gardens, whereas other water companies claim allotments are exempt from the ban since they are not private. Certain water companies believe that filling a bucket with a short length of hose connected to the mains water supply in order to water a garden or wash a car is allowed; however, others believe that a hosepipe should not be used for this purpose under the ban.

There is also confusion amongst consumers as to which activities are allowed and which are banned, and why certain activities are either included or exempt. The anomalies in the ban are demonstrated by the following examples:

- The ban applies if a jet wash is used to wash a private car, but not for other uses such as washing windows and/or patios;
- People growing vegetables on council allotments in some areas can irrigate them with a hose, but gardeners who grow vegetables in their backgarden are not allowed to use a hose;
- The ban applies to using a hosepipe to water plants in a tub, but does not apply to filling a paddling pool, swimming pool or hot tub; and,
- Under a hosepipe ban it remains legal to pressure wash garden furniture on the lawn.

Inconsistencies in the hosepipe ban can be presented by the media as inconsistencies in the water companies' approach to drought management and illustrate a lack of a coherent strategy. This undermines the credibility of water companies. Integrity is an important attribute if water companies want to influence consumer behaviour, since a change in behaviour occurs more frequently when someone who is perceived as trustworthy advocates the new position. Consumers may accept the propositions if the message comes from a highly credible source, but may reject it without considering the merits of the argument if the source is perceived to lack credibility.[13] Consumers are less likely to comply with restrictions imposed by water companies if the companies appear to lack consistency and credibility in their drought management plans.

[13] Ajzen I. (1992) Persuasive communication theory in social psychology a historical perspective. Manfredo M. (editor) Influencing human behaviour. Sagamore Publishing. United States of America.

Lack of recognition of improvements in technology

Because the legislation governing the hosepipe ban was drafted in the 1940s, there are no allowances for improvements in modern technology. The restriction therefore applies equally to all irrigation systems. Some irrigation systems are more water efficient than others, but currently all fall under the classification of hosepipes and are therefore banned.

The impact of banning all irrigation equipment has a detrimental effect on the gardening industry. Landscapers, garden centres and horticulturists face a loss in profits due to a decrease in sales of hosepipes and watering systems. In August 2006, Hozelock, a watering and aquatics equipment firm, announced the closure of its two Aylesbury factories, resulting in the loss of 100 jobs. The Hozelock Group has had to contend with a difficult trading period in the UK as a result of hosepipe bans, and they cite the bans as an important factor in their decision to close the factories.[14]

Lack of Concessions

There are no concessions offered under the current legislation to elderly or disabled people who are unable to carry buckets or watering cans.

6. Suggested amendments

The present legislation is outdated and so does not reflect current lifestyles and technology.

Amendments to legislation regarding hosepipe bans need to ensure that the ban,

- Is explicit, i.e. clear and transparent;
- Is flexible;
- Enables the ban to be proportionate to the severity of water shortages;
- Enables the ban to be targeted at domestic and outdoor activities that consume the most water;
- Reflects modern lifestyles;
- Encourages water efficient practices;
- Makes allowances for advances in technology;
- Gives the ban consistency and increased credibility; and,
- Reduces consumption.

6.1 Stage

Under present legislation, the different stages that water companies must follow during water shortages are not clear and can cause confusion. A more logical and flexible approach could be implemented. The steps could be similar to those implemented in Australia, Canada and the

[14] Aylesbury Today http://www.aylesburytoday.co.uk/ViewArticle2.aspx?SectionID=789&ArticleID=1666658

USA (appendix 1). Different regions in England could have differing severity in the progression of restrictions, as is used in the USA. Drier regions such as El Paso and more populous areas like New York City have more stringent restrictions than areas that on average receive more rainfall and experience less demand. Under a clear three- or four-stage system water companies would also have more flexibility in applying restraints to hosepipe usage, such as time restrictions. At present in the UK the progression of the hosepipe ban is similar to that of regions in New Zealand where there is a sprinkler ban followed by a complete hosepipe ban with little flexibility within the system (appendix 2).

6.2 Time restrictions

Restricting the use of handheld hoses to the evenings and mornings prevents watering at times when evaporation is high, thereby avoiding high rates of water loss. Water not taken up by plant roots percolates into the soil, replenishing ground water stores rather than evaporating from the soil surface.

Further restrictions can be applied by implementing segregation on days when watering is allowed. In Queensland[15], residential restrictions have been set for each drought level:

- Level 1: restricted sprinkler times apply and watering is not permitted on Mondays;
- Level 2: total ban on sprinklers, but handheld hosing permitted on alternate days and during certain hours; and,
- Level 3: total ban on outdoor hosing and sprinklers, but washing/watering permitted with handheld buckets at any time.

Stages in hosepipe bans would encourage efficient water practices that consumers may continue when the water shortages are over. The stages at present are all or nothing, where either a complete hosepipe ban exists or no hosepipe ban at all. By implementing stages to hosepipe restrictions companies can gradually apply or remove restrictions.

In order to manage peak demand during alternate watering days and restricted hours, the alternate watering days could be staggered on the basis of house number or postcode. Alternate staggered day water restrictions have been used every summer for the past fifteen years in Hamilton, New Zealand. This has enabled the city to manage high summer water demand.[16] In Melbourne and New York City, odd-numbered houses can water on odd dates of the month and even-numbered houses can water on even dates, within the time restrictions. Under the Sydney water restrictions, odd-numbered properties can water their gardens within the specified time limits on Tuesdays, Thursdays and Saturdays, and even- and unnumbered properties on Wednesdays, Fridays and Sundays. Encouraging consumers to stagger their watering practices will ensure the peak demand is less than if all consumers were utilising hosepipes on the same days.

[15] WaterForever Let's watch every drop www.waterforever.com.au.

[16] In Hamilton New Zealand there are no time limits to watering, only alternate day restrictions according to house number. Hamilton has a two stage hosepipe restriction similar to that of the UK at present and other regions of New Zealand where a sprinkler ban is imposed followed by a complete hosepipe ban.

Considerations on permitted hours should be based on the timing of daylight hours, the potential impact on peak demand, enforceability and simplicity of understanding.

More consistency could be achieved by adding several domestic water uses (that can currently only be restricted under a non-essential use drought order) to the restrictions falling under the hosepipe ban. Water companies would need authority to implement certain nonessential water use bans before applying to the Environment Agency for a drought permit or the Secretary of State for a drought order. Those activities restricted under the drought permit and drought order would also need to be amended. A more consistent and comprehensive ban would in turn encourage more efficient water use by consumers. Non-essential water uses that may be implemented earlier include banning the watering of hard surfaces and the filling of swimming pools.

Table 4 is a proposed four-stage drought restriction plan similar to those in Australia and the USA.

Table 4. Proposed stages for water restrictions in the UK.

Level	Watering System	Sprinklers	Drip irrigation	Hand-held watering of plants	Using a bucket or watering can	Washing vehicles, including boats	Hosing hard surfaces	Filling pools	Concessions
Normal	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted, trigger nozzle	☑ Permitted, trigger nozzle	☑ Permitted	None
Stage 1	☑△ Permitted Restricted 8pm-8am	☑△ Permitted Restricted Alternate days and time limits 8pm-8am	☑ Permitted	☑△ Permitted Restricted Alternate days and time limits 8pm-8am	☑ Permitted	☑△ Permitted Restrictions Wed and Sun only. Time limits 8pm-8am Trigger nozzle	☒ Prohibited	☑△ Permitted Pool cover mandatory Can only fill to minimum level	Newly landscaped garden may be watered for 1 hour on day landscaped in time limit and for fourteen days thereafter
Stage 2	☑△ Permitted Restricted Alternate days Time limits 6am-8am and 8pm –10pm	☒ Prohibited	☑△ Permitted Restrictions Alternate days Time limits 8pm-8am	☑△ Permitted Restrictions Wed and Sun Time limits 6am-8am and 8pm –10pm Trigger nozzle	☑ Permitted	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions Wed and Sun Time limits 6am-8am and 8pm –10pm Pool cover	Newly landscaped garden may be watered for 1 hour on day landscaped in time limit and for fourteen days thereafter
Stage 3	☒ Prohibited	☒ Prohibited	☑△ Permitted. Restrictions: Wed and Sun. Time limits 6am-8am and 8pm – 10pm	☒ Prohibited	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered for 1 hour on day landscaped in time limit and for fourteen days thereafter Consumers who are over 70 or disabled can water garden with hose on Wed and Sun 3pm-4pm
Stage 4	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑△ Permitted Restricted Alternate days Time limits 6am-8am and 8pm –10pm	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered on day landscaped. Consumers who are over 70 or disabled are able to water garden with hose on Sun 3pm-4pm.

6.3 Hard surfaces

The ability to spray and wash hard surfaces should be restricted before the use of hoses in the garden, since water evaporates more rapidly from a hard surface than when sprayed on rutted surfaces such as flower beds. When watering the garden water percolates into the ground, decreasing the soil moisture deficit and increasing the ability of plants to take up water. Once field capacity has been reached, the excess water percolates further into the ground and can assist in replenishing groundwater stores. Runoff from watering the garden is less than the amount of runoff obtained when water is sprayed onto a hard surface. Runoff can have detrimental effects on the environment. Using water in situations that will create a lot of runoff is a highly inefficient use of (treated) water.

6.4 Swimming pools

Restrictions on the filling of swimming pools and hot tubs could also be applied at the same time as complete hosepipe bans. More people have private swimming pools now than in 1945, when hosepipe legislation was drafted, thus requiring more water overall to keep all pools filled. During times of water shortages, the use of pool covers, which decrease the amount of water lost through evaporation and thereby decrease the amount of water required to keep a pool filled to the minimum level, should be mandatory. What is classified as a 'pool' should be determined through public consultation. Definitions based on volume tend to be to confusing to the public, and so classifications such as 'swimming pools', 'free-standing pools', 'hot tubs' and 'paddling pools' should perhaps be used, and perhaps also based on depth of water. There should be exemptions for pools with recycling systems.

6.5 Vehicles

The definition of a vehicle could be extended to include other forms of transport, such as watercraft and land vehicles, including off-road and on-road. The washing of these vehicles could be subject to restrictions, provided that the prohibition is not construed to prohibit the reasonable use of water to clean windscreens or bilges on boats, for safety reasons.

6.6 Allotments

Allotments should be included in the definition of private gardens in the hosepipe ban. Local authorities rent allotments to individuals, and there is no general right of public access to these. In a similar way, rented homes have gardens that are included in the rental and have no right way of public access. Both should be included in a ban and water efficient practices should be encouraged.

An alternate view is that individuals grow fruits and vegetables on allotments and in areas within their private gardens to supplement grocery purchases. In order to encourage consumers to grow their own fruits and vegetables, thereby reduce outgoings on grocery shopping and supplying nutritious home-grown food, allotments and vegetable gardens could

be exempted from certain stages of water restrictions. Adopting these exceptions could, however, make enforcement of the water restrictions complicated.

6.7 New technology in irrigation

It is important that legislation recognises advances in irrigation technology and makes allowances for water efficient irrigation methods. Trigger nozzles, which stop the flow of water, are an example of a simple and effective device that prevents excess water loss. More complex water efficient irrigation systems include mist and drip irrigation.

Studies on subsurface drip irrigation have demonstrated significant increases in yield and water use efficiency in many crops. Drip irrigation has become a well established method for irrigating crops in regions where water resources are scarce, since less water is required for high crop yields. Reductions in applied water are a result of switching from inefficient irrigation to more efficient systems.[17] Although studies on drip irrigation are mainly aimed at the agricultural industry, field studies are often undertaken on a small scale and then extrapolated for large fields, but gardens and allotments are small scale and so require little extrapolation.

In drip irrigation the water emitted passes directly to the soil and down into the roots of the plants where it is most needed. Water loss through evaporation is minimal compared with any kind of sprinkler system. Advantages of micro-irrigation include greater control of applied water, resulting in less water loss through deep percolation, and reduced total water requirements.[18] Encouraging consumers to take up more efficient watering methods will assist in establishing long-term water efficient gardening practices.

Water efficient irrigation systems are, however, only efficient if installed and used correctly. It is important that clear information about correct installation and usage is given to consumers. In order to prevent leakage from irrigation systems, consumers need to adhere to care instructions. A study conducted in Britz, Mendota, California found that after ten years the drip tubing used on study plots was still in excellent condition with good uniformity, with the exception of one plot where the instructions for care had not been adhered to.[19]

A complete hosepipe ban does not encourage consumers to consider water efficient methods for gardening that available in the marketplace. The Climate Change and Demand for Water

[17] Ayars, JE, et al. 1999. "Subsurface drip irrigation in row crop: a review of fifteen years of research at the Water Management Research Laboratory." Agricultural Water Management, vol. 42, pp. 1-27. Also, International Symposium on Soils, Culture, and Hydroponics. 2004. International Society of Horticultural Scientists. Almeria, Spain. November 14-19, 2004. Also, Bryla, DR, et al. 2005. "Influence of irrigation method and scheduling on patterns of soil and tree water status and its relation to yield and fruit quality in peach." Hortiscience, vol. 40, pp. 2118-2124. Also, Knox, JW and EK Weatherhead. 2005. "The growth of trickle irrigation in England and Wales: data, regulation and water resource impacts." Irrigation and Drainage, vol. 54, no. 2, pp. 135-142. Also, Yaun, B, J Sun, Y Kang and S Nishiyama. 2006. "Response of cucumber to drip irrigation water under a rainshelter." Agricultural Water Management, vol. 81, pp. 145-158.

[18] See footnote 17.

[19] See footnote 17.

Project (CCDeW) developed a social simulation model to explore interactions between warmer climates, household choices of water-using technologies and the regulatory environment. The model revealed that an increased frequency of drought could provide the catalyst for the adoption of water saving technologies and associated reductions in demand.[20] These findings closely follow reports by the Horticultural Association of an upsurge in purchases of mulches and plants suitable to low watering regimes in response to recent publicity during the drought. Consumers who invest in water efficient irrigation systems during times of drought may adopt long-term water efficient irrigation.

Providing consumers with an incentive to invest in water efficient irrigation systems during a drought, for example by applying slightly more lenient restrictions to water efficient irrigation systems, would also encourage uptake of water efficient gardening devices that could be stocked by horticultural associations.

Any new legislation should also specifically cover greywater and rainwater use in the garden.

6.8 Concessions

The current hosepipe ban offers no concessions to those who have recently had a new garden landscaped, or for the elderly or disabled who cannot carry heavy buckets of water. Restrictions in Australia, Canada and New York City allow for concessions for both new landscaping and elderly/disabled persons.

Concessions for newly landscaped gardens in Melbourne Water's area stipulate that new gardens, lawns and landscaping may be watered for one hour only on the day of establishment by a handheld hose with trigger or twist nozzle. For fourteen days after the day of establishment, the garden may be watered for one hour daily but only before 7am and after 7pm and by attended hand-held hose with trigger or twist nozzle. After fourteen days from the day of establishment, the watering of new gardens and lawns with hand-held buckets or watering cans is permitted at any time. Receipt of installation is required as proof of date of establishment.

The Queensland Water Commission recently amended concessions available under the level three water restrictions to account for those groups that may not be able to adhere to restrictions for health and safety reasons. Residents over 70 years of age, those receiving a Disability Support Pension or that hold a Transport Disabled Parking Certificate (regardless of age), and residents who are able to provide other evidence, such as a medical certificate or letter from a general practitioner, that they have a medical condition or disability that prevents them from carrying a bucket or watering can to water their gardens, are permitted to use a hand-held hose to water their gardens during specified times. Proof of eligibility is required.

[20] Downing, TE, et al. 2003. "Climate change and the demand for water." Research Report. Stockholm Environment Institute, Oxford.

The difficulty in applying concessions for the elderly and those with disabilities is that the requirement for a medical certificate confirming eligibility for a concession would put additional pressure on doctors' surgeries and the National Health Service. Possibly the best approach would be for persons to register with their water company, placing their names on a special needs register and then receiving a window sticker that would indicate exemption from restrictions. The role of carers should also be addressed in the provision of concessions.

The issues of landscaping and the laying of turf are controversial. Restrictions in this area could lead to job losses, though some commercial landscapers use bowsers. One possible approach could be for landscaping companies to request permission from the water company.

6.9 Communication

At present, consumers are targeted with advice and information about drought and hosepipe bans by several sources; some of this advice can be contradictory, especially between different water companies. It is important that the information and advice consumers receive from government departments, water companies, horticultural societies and other parties is consistent. Clear information would make it easier for consumers to comply with the restrictions. Individuals appear willing to accept responsibility only for issues over which they have direct influence. Believing in the efficacy of one's actions can enhance pro-environmental behaviour.[21] Clear communication and encouragement needs to be ongoing, especially if legislation is amended.

7. Enforcement and policing

The enforcement of hosepipe bans is difficult since water companies do not use inspectors or patrols and only rely on consumers informing the company of breaches. This is the case in most countries, where consumers are relied upon to obey restrictions and be vigilant against those who flagrantly ignore them.

In Sydney, an on-the-spot fine applies for all breaches of Level Three restrictions by consumers, and is enforced. In England and Wales, water companies have the power to fine but do not do so. In addition, in Sydney Water Restrictions Patrol carries out random audits to ensure compliance with the restrictions in place. Auditing can be undertaken since all houses and businesses in Sydney are metered. This is not the case in the UK, and so in order to have audits all houses would need to be metered.

In Sydney, the Water Restrictions Team have patrols that regularly police residential areas to ensure that no one is breaching the restrictions. The Victorian Government in Australia has enlisted the support of 100 water authority workers to enforce Melbourne's water restrictions.

[21] Barr, S. 2003. "Strategies for sustainability: citizens and responsible environmental behaviour." Area, vol. 35, no. 3, pp. 227-240.

The officers report those in breach and give advice to consumers about how to better manage their water use. The implementation of such patrols in the UK would be an added expense to water companies.

To encourage compliance with restrictions, fines could increase as restrictions became more stringent, as is the case in Calgary, Canada:

- Violations during Stage One restriction results in a fine of CA$200;
- Violations during Stage Two result in a fine of CA$300;
- During Stage Three, CA$400; and,
- During Stage Four, CA$500.

8. Economic impacts

The costs of water restrictions can be divided into five categories[22]:

1. Direct costs – sustained as the direct and immediate result of water use restrictions;
2. Indirect costs - sustained where loss of water use in an activity has a negative effect on the well being of others;
3. Adaptive costs - sustained in an attempt to minimise the impact of continued or future water restrictions;
4. Costs to the credibility of water companies if restrictions are not introduced in a consistent manner and companies' water management strategies appear contradictory and their credibility is undermined; and,
5. Costs to the environment.

Direct costs

A loss of revenue to businesses may accrue if these companies have to reduce or suspend operations due to a water ban. Garden centres regularly suffer losses during hosepipe bans from a drop in sales of irrigation equipment and certain plant species.[23] The loss of revenue could be slightly stemmed by providing incentives for the uptake of water efficient irrigation systems and by applying slightly more lenient restrictions to water efficient irrigation systems that are used properly. Nurseries also suffer losses due to the cancellation of council amenity planting.

Direct costs to water companies due to hosepipe restrictions include advertising costs such as direct mailings as well as further advertising in the media.

[22] Thames Water. 2006. Application for an ordinary drought order. Statement of Reason. London.

[23] More than forty plant nurseries in Queensland were forced to close with the loss of almost 1000 jobs when Stage Four water restrictions had to be enforced. Refer to Roberts, G. 2006. "Harsh water bans for city." The Australian, September 6th.

Indirect costs

Indirect costs include any loss in consumer wellbeing, for example a loss in enjoyment of gardening.

Another indirect cost is the loss of welfare by businesses whose revenue is directly dependent on the activities of others, which may be restricted during bans, for example nurseries and horticultural supply firms.

During bans, consumers are encouraged to avoid buying water thirsty plants. Horticulturists growing such species to supply garden centres will experience a dip in sales. However, the early communication to nurseries about having to introduce may enable growers to diversify their crop range, thus can alleviating sales dips.

Encouraging the uptake of more water efficient garden systems could lessen the negative impact on horticultural supply firms and other gardening industries.

Water companies may lose metered revenue during times of water restrictions since customers are consuming less water. Companies may face increased legal costs if lawyers are appointed to unravel and assist in enforcing legislation.

There are also indirect costs associated with reductions in horticultural tourism, i.e. people attending flower shows or village floral displays. There are also losses to society in terms of the exercise and well-being associated with gardening.

Adaptive costs

Households may spend money to adapt their businesses or lifestyles to restrictions. Households may have to invest in rainwater butts and more water efficient gardening systems in order to avoid using mains water. Water companies could offer rebates to consumers for the purchase of such products. Rebates may be costly to water companies in the short term, but will encourage more sustainable water efficient practises over the long term.

Water company credibility

A difficult cost to measure is consumer trust of water companies, and the management of water resources. Trust is undermined by poorly defined and seemingly contradictory legislation. More logical and sensible measures in implementing water restrictions may increase consumers' confidence in water companies and compliance with restrictions.

Environmental costs

Any water restrictions that lessen emergency draws on raw water resources would be beneficial to the environment. Costs to the environment are less a result of water restrictions then the result of the drought itself. Restrictions are imposed to protect the environment.

However, it must be remembered that UK gardens are also part of the environment and play a significant role in maintaining biodiversity. If restrictions led to the introduction of more hard surfaces in gardens this would have a negative impact on biodiversity, aquifer recharge and flooding.

9. Consultation

There should be a period of consultation regarding amendments to the legislation governing water restrictions. It is important that consumers' views are taken into consideration through a discussion with them with CCWater. Due to recent controversies involving various utility companies, consumers' confidence in water companies has been undermined. Integrity is an important attribute if companies want to influence consumer behaviour, since a change in behaviour occurs more frequently when someone who is perceived as trustworthy advocates the new behavioural patterns.[24] Allowing all stakeholders to participate in a meaningful way will reassure consumers that the regulators and utility companies are accountable and trustworthy.

In order to ensure consultations are conducted in a meaningful, way the following should be adhered to[25]:

- The process of consultation should be transparent;
- All stakeholders should be given comprehensive and credible information;
- There should be an open discussion of possible problems and a wide public consultation;
- Stakeholders should be informed at the outset of the extent to which their preferences will be taken into account; and,
- Stakeholders should be able to provide input to decision making and genuine influence over the possible outcomes, rather then simply being expected to consider and endorse completed plans.

The benefits of stakeholder involvement are a follows[26]:

[24] Fishbein, M and M Manfredo. 1992. "A theory of behaviour change." In: Manfredo, M. (ed.) Influencing human behaviour. Sagamore Publishing, USA.
[25] Pollak, M. 1985. "Public participation." In: Otway, H, and M Peltu (eds.) Regulating industrial risks: science hazards and public protection. Butterworths, London. Pp. 76-93.
[26] Russell, S and G Hampton. 2006. "Challenges in understanding public responses and providing effective public consultation on water reuse." Desalination, vol. 187, pp. 215-227.

- Generates consensus on the benefits and value of the proposed amendments, establishing a sense of involvement and control;
- Assist in creating commitment to successful implementation;
- Help avoid objections at the time of implementation or lack of support or co-operation, thus reducing the time and effort spent dealing with individual objections and misunderstandings; and,
- Increase recognition amongst consumers of the value of water, and generates broader environmental awareness.

10. Conclusions

Benefits of amending the hosepipe ban legislation include,

- greater flexibility;
- a clearer and more sensible progression of restrictions;
- the reduction in flows into wastewater treatment facilities; and,
- greater confidence amongst consumers in water companies' water management strategies.

Increasing credibility of legislation may increase customer compliance. Individual water consumers can also benefit by saving money on their water bills when using water efficiently or when investing in water efficient technologies. Costs may be incurred by implementing a system of staged water restrictions; however, an effective water management programme may minimise the need to develop new supplies with associated costs of meeting expanding needs. Consultation with all stakeholders, particularly consumers, is necessary to ensure support and commitment to the successful implementation of the restrictions.

If a new system of restrictions is introduced that uses a matrix approach, it is essential that the changes are clearly communicated to the public and that a standard approach is adopted by all water companies. It is clear that in other countries there is a much larger emphasis placed on communicating with consumers; water companies in the UK could do a lot more to communicate restrictions to the public.

Appendix 1: Water restrictions in Australia, Canada and the USA

Melbourne, Australia

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Permanent water saving rules	☑△ Permitted Restrictions 10pm to 10am	☑△ Permitted Restrictions 8pm to 10am	☑△ Permitted Restrictions 10pm to 10am	☑△ Permitted Trigger nozzle	☑ Permitted	☑△ Permitted Trigger nozzle	☒ Prohibited Only in special circumstance Can wash annually	☑△ Permitted Restriction If over 2000l need permit	None
Stage 1	☑△ Permitted Restrictions Alternate days Time limits 12am to 4am	☑△ Permitted Restrictions Alternate days Time limits 6am-8am and 8pm-10pm if attended	☑△ Permitted Restrictions Alternate days Time limits 6am-8am and 8pm-10pm	☑△ Permitted. Trigger nozzle	☑ Permitted	☑△ Permitted Trigger nozzle	☒ Prohibited Only in special circumstance Can wash annually	☑△ Permitted Restriction Use hand held hose Attended If over 2000l need permit	Newly landscaped garden may be watered on day landscaped
Stage 2	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered on day landscaped
Stage 3	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered on day landscaped

Queensland, Australia

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering of plants	Using a bucket/ watering can	Washing vehicles including boats	Hosing hard surfaces	Pool filling	Concessions
Normal	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	None
Stage 1	☑△ Permitted Restrictions Alternate days Prohibited on Mondays	☑△ Permitted Restrictions Alternate days Time limits 5am-9am and 5pm-9pm Prohibited on Mondays	☑△ Permitted Restrictions Alternate days Prohibited on Mondays	☑△ Permitted Restrictions Alternate days Trigger nozzle Prohibited on Mondays.	☑ Permitted	☑△ Permitted. Trigger nozzle	☒ Prohibited	☑ Permitted	Newly landscaped garden may be watered on day landscaped even if Monday
Stage 2	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions: Alternate days Time limits 7pm-7am Trigger nozzle	☑ Permitted	☑△ Permitted Trigger nozzle	☒ Prohibited	☑△ Permitted. Restrictions: New pools need permit. Can fill pool to minimum only. Hand held hose.	Newly landscaped garden may be watered for 1 hour on day landscaped in time limit and for fourteen days thereafter incl Mondays
Stage 3	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Permitted	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions: Top up to minimum Alternate days Time Limits 7pm-7am.	New gardens same as Stage 2 Consumers over 70 or disabled are able to water garden with hose on specific days between certain hours

Sydney, Australia

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering of plants	Using a bucket/ watering can	Washing vehicles including boats	Hosing hard surfaces	Pool filling	Concessions
Normal	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	None
Stage 1	☒ Prohibited	☒ Prohibited	☑ Permitted	☑△ Permitted Trigger nozzle	☑ Permitted	☒ Prohibited. Boats permitted	☒ Prohibited	☑ Permitted	Can apply for exception
Stage 2	☒ Prohibited	☒ Prohibited	☑ Permitted	☑△ Permitted Restrictions Wed Fri Sun only Time limits 4pm – 10am	☑ Permitted	☒ Prohibited Boats permitted	☒ Prohibited	☑△ Permitted Restrictions Permit for pools over 10,000 litres	Can apply for exception
Stage 3	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions Wednesday and Sundays Time limits 4pm – 10am	☑△ Permitted Restriction: Wednesday and Sundays Time limits 4pm – 10am	☑ Permitted	☒ Prohibited Boats permitted	☒ Prohibited	☑△ Permitted Restrictions Permit for pools over 10,000 litres	Can apply for exception
Stage 4	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions time limits	☒ Prohibited	☒ Prohibited	☒ Prohibited	Can apply for exception

Calgary, Canada

Level	Watering System	Sprinklers	Drip irrigation*	Hand held watering	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Stage 1	☑△ Permitted Restrictions Once a week Time limits Up to two hours from 4am - 7am 9am -11am or 7pm to 10pm	☑△ Permitted Restrictions Once a week Time limits Up to two hours from 4am - 7am 9am -11am or 7pm to 10pm	☑△ Permitted Restrictions Once a week Time limits Up to two hours from 4am - 7am 9am -11am or 7pm to 10pm	☑ Permitted Trigger nozzle	☑ Permitted	☑ Permitted But asked to refrain	☒ Prohibited	☑ Permitted	Newly landscaped garden can be watered for 21 days
Stage 2	☑△ Permitted Restrictions Once a week Time limits Up to one hour from 4am - 7am 9am -11am or 7pm to 10pm	☑△ Permitted Restrictions Once a week Time limits Up to one hour from 4am - 7am 9am -11am or 7pm to 10pm	☑△ Permitted Restrictions Once a week Time limits Up to one hour from 4am - 7am 9am -11am or 7pm to 10pm	☑ Permitted Trigger nozzle Not permitted to water lawns	☑ Permitted	☑ Permitted But asked to refrain	☒ Prohibited	☑ Permitted	Newly landscaped garden can be watered for 21 days
Level 3	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden can be watered for 21 days
Level 4	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	

* You can apply to have your property certified by the City of Calgary as a Water Managed Site if you have water efficient irrigation systems. These sites must have efficient irrigation systems that can be correctly programmed. If outdoor watering restrictions are imposed, these sites follow less restrictive watering guidelines than other sites.

Capital Regional District, Canada

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can	Washing vehicles with hose	Hosing hard surfaces	Pool filling	Concessions
Stage 1 Mandatory from 1 May until 30 September	☑△ Permitted Restrictions* Time limits 4am - 10am and 7pm - 10pm	☑△ Permitted Restrictions* Time limits 4am - 10am and 7pm - 10pm	☑ Permitted	☑ Permitted Trigger nozzle	☑ Permitted	☑ Permitted Trigger nozzle	☑ Permitted	☑ Permitted	Newly landscaped can apply for permit to water outside permitted days Elderly or disabled can water garden on any two days for max. 9 hrs
Stage 2 Acute water shortages	☑△ Permitted Restrictions* Time limits 4am - 10am and 7pm - 10pm	☑△ Permitted Restrictions* Time limits 4am - 10am and 7pm - 10pm	☑ Permitted	☑ Permitted Trigger nozzle	☑ Permitted	☑ Permitted Trigger nozzle	☒ Prohibited	☑ Permitted	Same concessions as stage 1 for newly landscaped, no concessions for lawns. Same concessions as stage 1 for Elderly and disabled people
Stage 3 Severe water shortages	☒ Prohibited	☒ Prohibited	☑ Permitted	☑ Permitted Trigger nozzle	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Same concessions as stage 2

*For Stage 1 Lawn watering is only permitted twice per week within defined time limits other watering times apply to gardens, plants and shrubs
For Stage 2 Lawn watering is only permitted once per week within defined time limits other watering times apply to gardens, plants and shrubs
For stage 3 Lawn watering is banned

Coquitlam, Canada

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Stage 1 Mandatory from June to September	☑△ Permitted Restrictions* Alternate days. Time limits 4:00am -9:00am and 7:00pm - 10:00pm	☑△ Permitted Restrictions Alternate days. Time limits 4:00am -9:00am and 7:00pm - 10:00pm	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	Newly landscaped garden may be watered for 14 days after landscaped within time limits
Stage 2	☑△ Permitted Restrictions* Once a week. Time limits 4:00am -9:00am and 7:00pm - 10:00pm	☑△ Permitted Restrictions Once a week. Time limits 4:00am -9:00am and 7:00pm - 10:00pm	☑ Permitted	☑ Permitted Trigger nozzle	☑ Permitted	☑ Permitted Trigger nozzle	☒ Prohibited	☑ Permitted	Newly landscaped garden may be watered for 14 days after landscaped within time limits
Stage 3	☒ Prohibited	☒ Prohibited	☑ Permitted	☑ Permitted	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Same as stage 2
Level 4	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	

*Stage 1 Restrictions only apply to watering lawns. There are no restrictions for watering gardens, plants and shrubs.
*Stage 2 Restrictions only apply to watering lawns. There are no restrictions for watering gardens, plants and shrubs

Vancouver, British Columbia, Canada

Annual lawn sprinkling restrictions are in effect in the City of Vancouver from June 1 to September 30.

Lawn sprinkling is allowed:

- 4am to 9am and 7pm to 10pm only
- Even-numbered address: Wednesdays and Saturdays
- Odd-numbered address: Thursdays and Sundays

Eastern Municipal Water District, California, USA

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Non emergency restrictions; Normal, Drought Watch, Drought Warning	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑△ Permitted Nozzle hose only	☒ Prohibited	☑ Permitted Pools must have pool covers	None
Stage 1	☑△ Permitted Restrictions Time limits 12am-6am	☑△ Permitted Restrictions Time limits 12am-6am	☑△ Permitted Restrictions Time limits 12am-6am	☑△ Permitted Nozzle hose	☑ Permitted	☑△ Permitted Nozzle hose only	☒ Prohibited	☑ Permitted Pools must have pool covers	None
Stage 2	☑△ Permitted Restrictions Alternate days and Time limits 12am-6am	☑△ Permitted Restrictions Alternate days and Time limits 12am-6am	☑△ Permitted Restrictions Alternate days and Time limits 12am-6am	☑△ Permitted Nozzle hose only	☑ Permitted	☑△ Permitted Nozzle hose	☒ Prohibited	☑ Permitted Pools must have pool covers	None
Stage 3*	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions Only twice a week Nozzle hose	☑△ Permitted Restrictions Only twice a week	☒ Prohibited	☒ Prohibited	☒ Prohibited	Can apply for exemption

* Under stage 3 restrictions new landscaping is limited to drought-tolerant plantings as determined by the District. No new lawns/turf is permitted. No person or is allowed to implement any new landscaping.

El Paso, Texas, USA

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Non emergency restrictions; Normal, Drought Watch, Drought Warning	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	Permits for newly landscaped gardens. Can be watered for a 7 day period after landscaped
Stage 1	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	Permits for newly landscaped gardens. Can be watered for a 7 day period after landscaped
Stage 2	☑△ Permitted Restrictions Once a week Time limits 7pm-9am	☑△ Permitted Restrictions Once a week Time limits 7pm-9am	☑△ Permitted Restrictions Alternate days Time Limits 6pm-10am No watering on Monday	☑△ Permitted Restrictions Alternate days Time limits 7pm-9am	☑ Permitted	☑ Permitted	☒ Prohibited	☒ Prohibited	No landscape permits except for Xeriscapes which are drip irrigated.
Level 3	Prohibited	Prohibited	☑△ Permitted Restrictions Alternate days And time limits	☒ Prohibited	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	No landscape permits except for Xeriscapes which are drip irrigated.

Idaho, USA

Level	Watering System	Sprinklers	Drip irrigation	Hand held hosing of garden	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Non emergency restrictions; Normal, Drought Watch, Drought Warning	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑△ Permitted Hoses must have self closing nozzle	☑△ Permitted Hoses must have self closing nozzle	☑ Permitted	None
Stage 1	☑△ Permitted Restricted Alternate days and limited hours	☑△ Permitted Restricted Alternate days and limited hours	☑△ Permitted Restricted Alternate days	☑△ Permitted Restricted Alternate days	☑ Permitted	☑△ Permitted Restricted Alternate days	☑△ Permitted Restricted Alternate days	☑ Permitted	None
Stage 2	☑△ Permitted Restricted Alternate days and further limitations on hours	☑△ Permitted Restricted Alternate days and further limitations on hours	☑△ Permitted Restricted Alternate days and limited hour	☑△ Permitted Restricted Alternate days and limited hours	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped gardens may be watered on day landscaped
Stage 3	☒ Prohibited. Water rationing	☒ Prohibited Water rationing	☒ Prohibited	☑△ Permitted Severe limits day & hours	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped gardens may be watered on day landscaped

New York City, New York, USA

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering of plants	Using a bucket/ watering can	Washing vehicles including boats	Hosing hard surfaces	Pool filling	Concessions
Non emergency restrictions; Normal, Drought Watch, Drought Warning	☑△ Permitted Restrictions April 1- Oct 31 time limits 7pm-11am Rain sensor Prohibited Nov 1-March 31	☑△ Permitted. Restrictions April 1- Oct 31 time limits 7pm-11am Prohibited Nov 1-March 31	☑ Permitted	☑△ Permitted Restrictions Time limits 7pm-11am	☑ Permitted	☑△ Permitted Trigger nozzle	☑△ Permitted Trigger nozzle	☑ Permitted	None
Stage 1	☑△ Permitted Restrictions Time limits 7am-9am and 7pm-9pm	☑△ Permitted Restrictions Time limits 7am-9am and 7pm-9pm	☑ Permitted	☑△ Permitted. Restrictions: Time limits, low flow hoses only (less than 20l/min)	☑ Permitted	☒ Prohibited (can use borehole water)	☒ Prohibited	☑△ Permitted once a year	Newly landscaped garden may be watered on day landscaped
Stage 2	☒ Prohibited	☒ Prohibited	☑ Permitted	☑△ Permitted. Restrictions: Time limits, low flow hoses only (less than 20l/min)	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered on day landscaped
Stage 3	☒ Prohibited	☒ Prohibited	☑ Permitted. recycled water if possible	☑△ Permitted Restrictions Time limits, low flow hoses	☑ Permitted recycled water if possible	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered on day landscaped

Philadelphia, Pennsylvania, USA

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering of plants	Using a bucket/ watering can	Washing vehicles including boats	Hosing hard surfaces	Pool filling	Concessions
Non emergency restrictions; Normal, Drought Watch, Drought Warning	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted Trigger nozzle	☑ Permitted. Trigger nozzle	☑ Permitted	None
Stage 1	☑△ Permitted Restricted 8pm-10am	☑△ Permitted Restricted Alternate days and time limits	☑ Permitted	☑△ Permitted Restricted to certain days and time limits	☑ Permitted	☒ Prohibited Restrictions Specific days and number of times can wash	☒ Prohibited	☑ Permitted	None
Stage 2	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions Time limits	☑△ Permitted Restrictions Restricted to certain days and further time limits Trigger nozzle	☑ Permitted.	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions Only fill or top up if have state approved water supplier	Newly landscaped garden may be watered on day landscaped
Stage 3	☒ Prohibited	☒ Prohibited	☑△ Permitted Restrictions Further time limits	☑△ Permitted Restrictions Restricted to certain days and severe time limits. Trigger nozzle	☑ Permitted	☒ Prohibited	☒ Prohibited	☒ Prohibited	Newly landscaped garden may be watered on day landscaped

San Antonio, Texas, USA

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can	Washing vehicles	Hosing hard surfaces	Pool filling	Concessions
Non emergency restrictions; Normal, Drought Watch, Drought Warning	☑△ Permitted Time limits 8pm-10am	☑△ Permitted Time limits 8pm-10am	☑ Permitted	☑ Permitted.	☑ Permitted	☑△ Permitted Nozzle hose	☒ Prohibited	☑ Permitted.	
Stage 1	☑△ Permitted. Time limits 8pm-10am	☑△ Permitted Time limits 8pm-10am	☑ Permitted	☑ Permitted	☑ Permitted	☑△ Permitted Day and time restrictions Nozzle hose	☒ Prohibited	☑ Permitted Pool cover	Permit required to water newly landscaped garden
Stage 2	☑△ Permitted. Once a week Time limits 3am-8am and 8pm-10pm	☑△ Permitted. Once a week Time limits 3am-8am and 8pm-10pm	☑△ Permitted. Time limits 3am-8am and 8pm-10pm	☑△ Permitted Time limits 3am-8am and 8pm-10pm	☑ Permitted	☑△ Permitted. Once a week Time limits 3am-8am and 8pm-10pm	☒ Prohibited	☒ Prohibited	Permit required to water newly landscaped garden
Stage 3	☑△ Permitted Once a fortnight on Mondays Time limits 3am-8am and 8pm-10pm	☑△ Permitted. Once a fortnight on Mondays Time limits 3am-8am and 8pm-10pm	☑△ Permitted 3 times a week Time limits 3am-8am and 8pm-10pm	☑△ Permitted. 3 times a week Time limits 3am-8am and 8pm-10pm	☑△ Permitted. 3 times a week Time limits 3am-8am and 8pm-10pm	☑△ Permitted. Once a fortnight on Mondays Time limits 3am-8am and 8pm-10pm	☒ Prohibited	☒ Prohibited	Permit required to water newly landscaped garden

Appendix 2: Hosepipe restriction in New Zealand

Far North District Council

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can
	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted
Stage 1	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted	☑ Permitted
Stage 2	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted
Stage 3 **Action 1** **Action 2** **Action 3**	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted

Action 1 - Emergency Water Take Application
The Far North District Council may apply for an emergency water take from the Northland Regional Council in order to maintain supplies.

Action 2 – Imposition of water rationing.
Systems would be turned off for a period of time each day or night. Water could be tankered in from other communities if available and as required.

Action 3 – Use of Standpipes and tankered water.
Water supplies to affected areas would be turned off, and water would only be obtainable from standpipes connected to the system for certain periods of each day. The standpipes would be operated by Far North District Council. Water would be tankered in from other communities to supplement the standpipes, if available.

Caterton District

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can
	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted
Stage 1	☑△ Permitted Restrictions Alternate days	☑△ Permitted Restrictions Alternate days	☑△ Permitted Restrictions Alternate days	☑△ Permitted Restrictions Alternate days	☑ Permitted
Stage 2	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted Restrictions Alternate days	☑ Permitted
Stage 3	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted

Napier

Level	Watering System	Sprinklers	Drip irrigation	Hand held watering	Using a bucket/ watering can
	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted	☑ Permitted
Stage 1	☑△ Permitted Restrictions Alternate days	☑△ Permitted Restrictions Alternate days	☑△ Permitted Restrictions Alternate days	☑△ Permitted Restrictions Alternate days	☑ Permitted
Stage 2	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted Restrictions Alternate days	☑ Permitted
Stage 3	☒ Prohibited	☒ Prohibited	☒ Prohibited	☒ Prohibited	☑ Permitted

Note: Water restrictions in Napier have never reached Stage 3.

Index1

A

ability[1], 3
about[4], 2-3
abstractions[1], 10
academics[1], 2
accepts[1], 2
according[1], 9
account[1], 5
accuracy[1], 2
achieve[1], 2
achieving[1], 5
across[2], 6, 8
Act[5], 5, 8-9
acted[1], 2
action[4], 6, 9
actions[4], 2-3, 9
activities[4], 2-3, 5
actually[1], 4
addition[2], 2, 10
addressing[1], 3
adequate[1], 9
adopted[1], 8
adoption[1], 5
advising[1], 2
Affairs[2], 9-10
affected[1], 10
Agency[6], 9-10
aggravate[1], 6
aim[1], 10
aims[4], 2, 5
All[1], 2
all[2], 3, 9
Allotments[1], 4
allowed[2], 3, 8
allowing[1], 3
allows[1], 9
already[1], 8
also[2], 2, 8
alter[1], 10
although[1], 5

amended[1], 9
amendments[4], 3-5
amongst[3], 3, 5
amount[4], 10
analysis[1], 2
and[92], 2-10
Anglian[1], 9
Anne[1], 2
any[4], 2-3, 9
appears[1], 5
Appendix[2], 4
Application[1], 6
applied[1], 10
apply[2], 9-10
approach[1], 5
appropriate[1], 5
approval[1], 10
approved[2], 8, 10
April[5], 8
are[28], 2-3, 5-10
area[1], 10
areas[1], 6
assessed[1], 5
assist[1], 5
assisting[1], 3
associated[2], 3
attempted[1], 9
August[3], 6-8
Australia[1], 4
authority[1], 2
Authorship[1], 2
automatic[1], 9
autumn[1], 8
availability[3], 6, 10
available[2], 10
average[2], 6-7
averages[1], 7
awareness[1], 10

B

Background[2], 4-5
balance[4], 6, 10
balanced[1], 3
ban[23], 1, 3-5, 8-10
bans[12], 3-5, 8-10
base[2], 2, 9
based[3], 2-3, 9
BBC[2], 7, 9
bbc[2], 7, 9
become[1], 6
becomes[1], 10
becoming[1], 6
been[3], 2, 6, 8
Before[1], 9
benefit[1], 3
benefits[1], 3
Berkshire[1], 8
between[4], 3, 7, 10
beyond[1], 5
both[1], 3
Brian[1], 2
briefly[1], 5
build[1], 2
burgeoning[1], 6

but[2], 6, 10
Butterfield[1], 6

C

campaign[1], 10
campaigns[1], 9
can[9], 5-6, 9-10
Canada[1], 4
cannot[1], 10
capability[4], 6, 10
capita[2], 6
car[1], 9
caravan[1], 9
carry[1], 3
Catherine[1], 2
CCDeW[1], 6
Centres[1], 5
certain[1], 3
Change[1], 6
change[7], 4-6
changes[1], 5
changing[1], 9
Cholderton[1], 8
clarify[1], 5
clarity[1], 3
clear[1], 6
Clearer[1], 3
Clearly[1], 3
Climate[5], 4-6
climate[3], 5
combination[2], 6, 10
come[1], 5
commitment[1], 3
Communication[1], 4
companies[15], 2-3, 5, 8-10
Company[1], 8
company[1], 9
compared[1], 7
compile[1], 9
compliance[1], 6
comply[2], 3, 6
Concessions[2], 3-4
concessions[1], 3
Conclusions[1], 4
conditions[2], 9-10
conduct[1], 2
confusing[1], 3
Confusion[1], 3
confusion[1], 5
consensus[1], 3
Consistency[1], 3
consistency[1], 3
consistent[2], 3, 5
constrained[2], 6, 10
Consultant[1], 2
consultants[1], 2
Consultation[1], 4
consultation[1], 3
Consulting[1], 2
consumers[8], 2-3, 5-6, 10
consumption[11], 2-6, 9-10
Contact[1], 2
content[1], 2
Contents[1], 4

contents[1], 2
continuing[1], 8
contract[1], 1
control[1], 10
convene[1], 2
Copyright[1], 2
corresponding[1], 3
costs[2], 3
could[1], 5
counteract[1], 6
country[1], 6
creating[2], 3, 5
crossing[1], 9
current[3], 5
currently[1], 6
customers[1], 5
cynicism[1], 3

D

Date[2], 8
day[3], 3, 6
deal[1], 6
dealing[1], 9
decision[1], 9
decline[1], 8
decrease[1], 2
decreased[1], 6
deficiency[2], 5, 10
defined[2], 3, 9
Defra[2], 1, 10
delivery[1], 3
Demand[1], 6
demand[12], 3, 6, 9-10
demographics[1], 6
demonstrate[1], 9
Department[1], 9
Depending[1], 9
determined[2], 6, 10
determining[2], 6, 10
developed[1], 5
developments[1], 5
device[1], 9
Diagram[1], 9
Difference[1], 7
different[2], 3, 9
difficult[1], 3
Director[2], 2
disabled[1], 3
Disclaimer[1], 2
discretionary[1], 5
discussed[1], 5
distribution[3], 6, 10
District[1], 8
divided[1], 10
does[3], 4-5, 9
domestic[1], 10
Dover[1], 8
Downing[1], 6
drafted[1], 5
drawn[2], 5, 9
drier[3], 6
driest[1], 6
Drought[6], 9-10
drought[35], 3, 6, 8-10

dry[3], 5-6
Due[1], 9
due[1], 6
During[2], 6, 10
during[9], 5-7, 9-10
duties[1], 9

E

each[1], 9
East[3], 8
east[2], 8
Economic[1], 4
economic[1], 10
Edmonds[1], 6
effective[5], 3, 5-6, 9
effectiveness[1], 3
efficiency[5], 2, 5, 10
efficient[1], 5
Effort[1], 2
Eight[1], 8
eight[1], 5
elderly[1], 3
element[1], 10
email[1], 2
Emergency[1], 10
emergency[1], 9
enable[2], 6, 10
encourage[2], 5, 9
encouraging[1], 10
Enforcement[1], 4
enforcement[2], 3, 6
enforcing[1], 3
England[4], 2, 6, 8
ensure[2], 2, 10
Environment[12], 2, 6, 9-10
environment[1], 5
environmental[1], 10
essential[4], 3, 6, 8, 10
establish[1], 3
evaporation[1], 6
evidence[1], 2
exceptional[1], 10
exceptionally[1], 6
exist[1], 5
existing[1], 10
exists[2], 5, 10
expected[3], 6, 8, 10
experienced[2], 6, 10
experiencing[1], 6
exploring[1], 5
extended[1], 5
eyes[1], 6

F

factor[2], 6, 10
factors[2], 5, 9
feed[1], 10
Figure[5], 6-7, 9

figure[3], 6, 8
figures[1], 6
filling[1], 3
Final[1], 1
finally[1], 5
first[1], 5
flexibility[1], 3
flooding[1], 6
Folkestone[1], 8
followed[1], 5
following[1], 10
Food[2], 9-10
For[1], 2
for[35], 2-3, 5-7, 9-10
forecast[1], 9
Forecasts[1], 6
forms[1], 5
foster[1], 3
frequent[2], 6
from[1], 10
full[4], 5, 8
fundamental[1], 10
Further[2], 6-7
further[5], 2, 6, 10
future[1], 10

G

Garden[10], 1-10
garden[1], 9
gardens[4], 3, 5, 8
Gate[1], 2
generate[1], 3
given[1], 9
gov[3], 6-7
governing[1], 5
governments[1], 2
granted[2], 10
greater[2], 3
Groundwater[1], 8
groundwater[2], 6-7
Group[1], 2
growth[2], 6
guides[2], 7, 9

H

Hadley[1], 5
Hampshire[1], 8
Hard[1], 4
hard[1], 3
has[7], 2, 5-6, 8
have[10], 5-6, 8-9
heightened[1], 6
help[1], 3
hence[2], 6, 10
high[1], 5
higher[1], 6
Hooper[1], 2
Hosepipe[1], 4

hosepipe[31], 1, 3-5, 8-10
hot[1], 5
hotter[1], 6
households[1], 6
how[2], 9
html[5], 6-7, 9
http[5], 6-7, 9

I

identify[1], 9
impact[1], 5
Impacts[1], 5
impacts[1], 4
implement[1], 10
implementation[1], 3
implemented[3], 5, 8
implementing[1], 5
imposing[1], 5
improvements[1], 3
include[4], 3, 9
including[1], 9
inconsistent[1], 5
Increase[2], 10
increase[3], 6, 8, 10
increased[3], 5-6
Independent[1], 2
independent[1], 2
index[3], 6-7
Industry[2], 5, 8
influence[1], 10
info[1], 2
information[1], 2
initiatives[1], 2
Institute[1], 6
intended[1], 3
intense[2], 6
interpretation[1], 3
interpretations[1], 3
into[2], 10
introduce[1], 8
introduced[2], 5, 8
introducing[1], 5
Introduction[2], 3
investigated[1], 3
invoke[1], 8
involved[1], 2
involvement[1], 3
irrigation[1], 4
Isle[1], 8
issued[1], 8
its[2], 3, 9

J

Jacob[1], 2
July[1], 8
June[1], 8

K

Kent[3], 8
Kingdom[2], 5
Knox[1], 6

L

Lack[4], 3
landscaped[1], 3
large[1], 2
last[2], 6
later[1], 5
latest[1], 5
laws[2], 4, 9
leading[4], 2, 6
led[2], 5
left[1], 6
legal[1], 5
legislation[8], 1, 5-6
legitimacy[1], 6
less[1], 6
level[2], 6, 10
levels[3], 6-8
liability[1], 2
lifestyle[1], 5
lifestyles[1], 5
lifted[1], 8
likely[3], 6-7, 10
limit[1], 3
limited[2], 10
limiting[2], 6, 10
litres[1], 6
live[1], 6
London[3], 2, 6
long[3], 3, 7, 10
longer[1], 8
low[4], 6, 8
Ltd[1], 2

M

made[1], 2
maintaining[1], 5
make[2], 3, 5
manage[1], 8
managed[1], 10
management[2], 9-10
Managing[1], 2
manufacturers[1], 2
many[2], 5-6
March[2], 8
maximise[1], 3
May[3], 8
may[6], 3, 5, 9-10
mean[1], 9
means[1], 6
measure[2], 8-9

measures[10], 8-10
mechanisms[1], 9
media[2], 2, 10
meet[4], 5, 9-10
Met[3], 6-7
met[3], 6-7
Mid[1], 8
mid[1], 5
million[1], 8
minimise[1], 3
Minister[1], 2
modern[1], 5
more[7], 3, 5-6
Moss[1], 6
motor[3], 3, 5
motorcar[1], 9
must[2], 3, 6

N

nature[1], 9
Nearly[1], 8
necessary[1], 3
need[6], 3, 9-10
needed[1], 9
needs[2], 5-6
negatively[1], 10
network[1], 2
New[2], 4
new[3], 3, 10
newly[1], 3
news[2], 7, 9
non[3], 3, 8, 10
nonessential[1], 10
nongovernmental[2], 2
nor[1], 9
North[1], 8
not[9], 2-3, 5-6, 8-10
November[10], 1-10
now[1], 5
number[1], 5

O

objectives[2], 4-5
obligation[1], 5
occasionally[1], 2
occupancy[2], 6
October[3], 6-8
Office[4], 6-7
office[3], 6-7
One[2], 8
one[2], 6, 9
only[3], 10
opinion[1], 5
order[5], 6, 8-10
orders[10], 8-10
Ordinary[1], 10
ordinary[2], 6, 9
org[4], 1-2

organisation[1], 2
organisations[1], 2
other[8], 2-3, 9
others[1], 3
Our[1], 2
our[2], 2
out[2], 3, 9
outdated[1], 5
outdoor[1], 5
outlining[1], 5
over[3], 5-6
overall[1], 3
own[1], 2
Oxford[2], 6

P

Page[9], 2-10
page[2], 7, 9
part[2], 5-6
parts[4], 6-7
patterns[2], 5-6
peer[1], 2
people[1], 8
per[3], 6
percent[1], 6
period[1], 6
periods[9], 6-7, 9-10
permit[2], 9-10
Permits[2], 10
permits[4], 9-10
permitted[3], 3, 9
persons[1], 10
Phase[1], 8
phone[1], 2
Piper[1], 6
place[2], 6, 8
plan[1], 9
planning[1], 3
Plans[1], 9
plans[1], 6
please[1], 2
policing[2], 3-4
policymaking[1], 2
pools[2], 3-4
population[3], 6
possibility[1], 6
possible[2], 5, 9
potential[1], 9
powers[3], 5, 9
practices[1], 5
predict[1], 5
predicted[1], 5
predictions[2], 6-7
Present[2], 4, 9
present[2], 6, 9
presented[1], 2
Prevent[1], 10
primary[1], 10
private[6], 5, 9
problems[1], 6
profit[1], 2
Programme[1], 5
prohibit[1], 5
Project[1], 2

project[1], 6
promote[1], 5
promotes[1], 2
proposed[2], 3, 5
protecting[1], 5
provide[2], 10
provided[1], 10
provisions[1], 5
public[2], 2, 9

Q

quantities[1], 9
Queen[1], 2

R

rain[1], 10
Rainfall[2], 6-7
rainfall[7], 6-7, 10
rainfalls[1], 6
rates[1], 5
reach[1], 6
Reason[1], 6
reason[1], 10
reasonable[1], 9
recognised[1], 3
Recognition[1], 3
Recommendations[1], 3
recorded[1], 7
reduce[4], 3, 9-10
reduced[1], 9
reflect[1], 5
regarding[2], 4, 9
Region[1], 9
regional[1], 9
regions[1], 9
regulators[1], 2
relations[1], 2
relative[1], 6
relevant[1], 5
reliability[1], 2
renewed[1], 10
replenishes[1], 10
Report[3], 4-6
report[6], 1-2, 5
required[1], 9
Research[1], 6
research[4], 2
reserved[1], 2
resource[2], 6, 10
Resources[1], 9
resources[4], 3, 5, 8, 10
responsible[1], 5
responsibly[1], 10
restrict[2], 5, 10
Restrictions[2], 5, 10
restrictions[25], 1-10
result[1], 5
retailers[2], 2
reveal[1], 6

review[1], 1
reviewers[1], 2
rights[1], 2
rigidly[1], 9
risk[3], 6, 10
risking[1], 10
robust[1], 6
Rural[2], 9-10

S

safeguarding[1], 5
same[1], 6
satisfied[1], 10
Saving[2], 2
scale[1], 2
scarce[1], 8
scenarios[2], 5
scope[1], 3
Scotland[2], 2
seasonal[3], 6-7
Secretary[2], 10
section[1], 5
securing[1], 3
security[4], 6, 10
seeks[1], 5
sense[1], 3
sensible[1], 10
serious[2], 5, 10
serve[1], 10
set[2], 9
severe[1], 9
severity[1], 9
shared[2], 7, 9
shift[2], 6
short[3], 10
shortage[1], 10
shortages[6], 5-6, 9-10
Shortcomings[2], 3-4
shortcomings[2], 3, 5
should[1], 3
side[4], 10
Sims[1], 2
since[2], 6
single[2], 6
sit[1], 2
situation[1], 5
situations[1], 9
social[1], 10
society[2], 5-6
Some[1], 8
soon[1], 5
sources[1], 10
South[1], 8
south[3], 6, 8
Southern[1], 8
specified[1], 10
spl[2], 7, 9
sprinkler[3], 5, 8-9
sprinklers[1], 5
Stage[1], 4
stages[4], 3, 9
stakeholders[2], 2-3
standpipe[1], 10
starts[1], 6

State[2], 10
Statement[1], 6
stm[2], 7, 9
Stockholm[1], 6
storage[1], 6
straight[1], 5
strategy[1], 10
substantially[1], 5
successful[1], 3
Such[1], 10
such[2], 8-9
Suggested[1], 4
suggests[1], 5
Summary[1], 3
summer[2], 5-6
summers[1], 6
supplied[1], 10
supplies[3], 5, 10
supply[16], 5-6, 9-10
support[1], 2
supposed[4], 4, 10
surfaces[2], 3-4
Surrey[3], 8
Sussex[2], 8
sustainability[1], 10
Sutton[2], 8
Swimming[1], 4
swimming[1], 3
system[1], 10

T

Table[1], 8
table[1], 8
take[1], 10
taken[5], 2, 6, 9
team[1], 6
teams[1], 9
technologies[2], 3-4
technology[2], 3, 5
Temperature[1], 7
term[6], 3, 7, 10
Thames[2], 6, 8
than[1], 6
that[24], 2-3, 5-6, 8-10
The[20], 2-6, 9-10
the[117], 2-10
their[5], 8-9
There[2], 5-6
there[3], 3, 6, 9
thereby[1], 3
These[1], 5
these[2], 3
They[1], 5
they[2], 9
This[1], 5
this[4], 2
Three[1], 8
three[1], 9
through[1], 5
Time[1], 4
time[6], 3, 5-6, 10

times[1], 5
today[1], 5
Tompkins[1], 2
trailer[1], 9
trigger[1], 9
triggers[2], 9
turf[1], 3
two[3], 5-6
Tyndall[1], 5

U

UKCIP[1], 5
unattended[2], 5
Under[1], 9
under[2], 5, 9
understanding[1], 3
undertake[1], 2
undertakers[1], 5
United[2], 5
until[2], 8, 10
upon[1], 9
USA[1], 4
usage[2], 3
use[10], 3, 5, 8-10
used[2], 9-10
uses[1], 5
using[1], 9
Usually[1], 5
Utilities[1], 6

V

Valleys[1], 8
value[1], 3
various[1], 9
varying[1], 9
vehicle[1], 9
Vehicles[1], 4
vehicles[5], 3, 5, 8
vigorous[1], 6
voluntarily[1], 3

W

warm[1], 7
warming[1], 5
was[1], 5
wash[2], 8-9
washing[3], 3, 5
Water[25], 2, 4-6, 8-10
water[58], 2-6, 8-10
watering[13], 1-10
Waterwise[6], 2
waterwise[4], 1-2
ways[1], 3
weather[3], 6-7
Weatherhead[1], 6
week[1], 3

welfare[1], 10
well[2], 2, 5
wetter[1], 5
What[3], 4, 10
what[2], 3
when[1], 5
whether[2], 9
which[4], 3, 6, 10
while[1], 5
who[2], 6, 8
whose[1], 10
why[1], 3
Widening[1], 3
Wight[1], 8
will[1], 9
willingness[1], 3
winter[1], 6
winters[3], 5-6
With[1], 6
with[10], 2-3, 6, 9-10
without[1], 10
work[2], 2
would[2], 5, 9
wrote[1], 2
www[5], 1-2, 6-7

Y

year[2], 6, 10
years[1], 7

Z

Zealand[1], 4

Index1

```
Index report :
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```

Index1

A

ability[1], 3
about[4], 2-3
abstractions[1], 10
academics[1], 2
accepts[1], 2
according[1], 9
account[1], 5
accuracy[1], 2
achieve[1], 2
achieving[1], 5
across[2], 6, 8
Act[5], 5, 8-9
acted[1], 2
action[4], 6, 9
actions[4], 2-3, 9
activities[4], 2-3, 5
actually[1], 4
addition[2], 2, 10
addressing[1], 3
adequate[1], 9
adopted[1], 8
adoption[1], 5
advising[1], 2
Affairs[2], 9-10
affected[1], 10
Agency[6], 9-10
aggravate[1], 6
aim[1], 10
aims[4], 2, 5
All[1], 2
all[2], 3, 9
Allotments[1], 4
allowed[2], 3, 8
allowing[1], 3
allows[1], 9
already[1], 8
also[2], 2, 8
alter[1], 10
although[1], 5

amended[1], 9
amendments[4], 3-5
amongst[3], 3, 5
amount[4], 10
analysis[1], 2
and[92], 2-10
Anglian[1], 9
Anne[1], 2
any[4], 2-3, 9
appears[1], 5
Appendix[2], 4
Application[1], 6
applied[1], 10
apply[2], 9-10
approach[1], 5
appropriate[1], 5
approval[1], 10
approved[2], 8, 10
April[5], 8
are[28], 2-3, 5-10
area[1], 10
areas[1], 6
assessed[1], 5
assist[1], 5
assisting[1], 3
associated[2], 3
attempted[1], 9
August[3], 6-8
Australia[1], 4
authority[1], 2
Authorship[1], 2
automatic[1], 9
autumn[1], 8
availability[3], 6, 10
available[2], 10
average[2], 6-7
averages[1], 7
awareness[1], 10

B

Background[2], 4-5
balance[4], 6, 10
balanced[1], 3
ban[23], 1, 3-5, 8-10
bans[12], 3-5, 8-10
base[2], 2, 9
based[3], 2-3, 9
BBC[2], 7, 9
bbc[2], 7, 9
become[1], 6
becomes[1], 10
becoming[1], 6
been[3], 2, 6, 8
Before[1], 9
benefit[1], 3
benefits[1], 3
Berkshire[1], 8
between[4], 3, 7, 10
beyond[1], 5
both[1], 3
Brian[1], 2
briefly[1], 5
build[1], 2
burgeoning[1], 6

but[2], 6, 10
Butterfield[1], 6

C

campaign[1], 10
campaigns[1], 9
can[9], 5-6, 9-10
Canada[1], 4
cannot[1], 10
capability[4], 6, 10
capita[2], 6
car[1], 9
caravan[1], 9
carry[1], 3
Catherine[1], 2
CCDeW[1], 6
Centres[1], 5
certain[1], 3
Change[1], 6
change[7], 4-6
changes[1], 5
changing[1], 9
Cholderton[1], 8
clarify[1], 5
clarity[1], 3
clear[1], 6
Clearer[1], 3
Clearly[1], 3
Climate[5], 4-6
climate[3], 5
combination[2], 6, 10
come[1], 5
commitment[1], 3
Communication[1], 4
companies[15], 2-3, 5, 8-10
Company[1], 8
company[1], 9
compared[1], 7
compile[1], 9
compliance[1], 6
comply[2], 3, 6
Concessions[2], 3-4
concessions[1], 3
Conclusions[1], 4
conditions[2], 9-10
conduct[1], 2
confusing[1], 3
Confusion[1], 3
confusion[1], 5
consensus[1], 3
Consistency[1], 3
consistency[1], 3
consistent[2], 3, 5
constrained[2], 6, 10
Consultant[1], 2
consultants[1], 2
Consultation[1], 4
consultation[1], 3
Consulting[1], 2
consumers[8], 2-3, 5-6, 10
consumption[11], 2-6, 9-10
Contact[1], 2
content[1], 2
Contents[1], 4

contents[1], 2
continuing[1], 8
contract[1], 1
control[1], 10
convene[1], 2
Copyright[1], 2
corresponding[1], 3
costs[2], 3
could[1], 5
counteract[1], 6
country[1], 6
creating[2], 3, 5
crossing[1], 9
current[3], 5
currently[1], 6
customers[1], 5
cynicism[1], 3

D

Date[2], 8
day[3], 3, 6
deal[1], 6
dealing[1], 9
decision[1], 9
decline[1], 8
decrease[1], 2
decreased[1], 6
deficiency[2], 5, 10
defined[2], 3, 9
Defra[2], 1, 10
delivery[1], 3
Demand[1], 6
demand[12], 3, 6, 9-10
demographics[1], 6
demonstrate[1], 9
Department[1], 9
Depending[1], 9
determined[2], 6, 10
determining[2], 6, 10
developed[1], 5
developments[1], 5
device[1], 9
Diagram[1], 9
Difference[1], 7
different[2], 3, 9
difficult[1], 3
Director[2], 2
disabled[1], 3
Disclaimer[1], 2
discretionary[1], 5
discussed[1], 5
distribution[3], 6, 10
District[1], 8
divided[1], 10
does[3], 4-5, 9
domestic[1], 10
Dover[1], 8
Downing[1], 6
drafted[1], 5
drawn[2], 5, 9
drier[3], 6
driest[1], 6
Drought[6], 9-10
drought[35], 3, 6, 8-10

dry[3], 5-6
Due[1], 9
due[1], 6
During[2], 6, 10
during[9], 5-7, 9-10
duties[1], 9

E

each[1], 9
East[3], 8
east[2], 8
Economic[1], 4
economic[1], 10
Edmonds[1], 6
effective[5], 3, 5-6, 9
effectiveness[1], 3
efficiency[5], 2, 5, 10
efficient[1], 5
Effort[1], 2
Eight[1], 8
eight[1], 5
elderly[1], 3
element[1], 10
email[1], 2
Emergency[1], 10
emergency[1], 9
enable[2], 6, 10
encourage[2], 5, 9
encouraging[1], 10
Enforcement[1], 4
enforcement[2], 3, 6
enforcing[1], 3
England[4], 2, 6, 8
ensure[2], 2, 10
Environment[12], 2, 6, 9-10
environment[1], 5
environmental[1], 10
essential[4], 3, 6, 8, 10
establish[1], 3
evaporation[1], 6
evidence[1], 2
exceptional[1], 10
exceptionally[1], 6
exist[1], 5
existing[1], 10
exists[2], 5, 10
expected[3], 6, 8, 10
experienced[2], 6, 10
experiencing[1], 6
exploring[1], 5
extended[1], 5
eyes[1], 6

F

factor[2], 6, 10
factors[2], 5, 9
feed[1], 10
Figure[5], 6-7, 9

figure[3], 6, 8
figures[1], 6
filling[1], 3
Final[1], 1
finally[1], 5
first[1], 5
flexibility[1], 3
flooding[1], 6
Folkestone[1], 8
followed[1], 5
following[1], 10
Food[2], 9-10
For[1], 2
for[35], 2-3, 5-7, 9-10
forecast[1], 9
Forecasts[1], 6
forms[1], 5
foster[1], 3
frequent[2], 6
from[1], 10
full[4], 5, 8
fundamental[1], 10
Further[2], 6-7
further[5], 2, 6, 10
future[1], 10

G

Garden[10], 1-10
garden[1], 9
gardens[4], 3, 5, 8
Gate[1], 2
generate[1], 3
given[1], 9
gov[3], 6-7
governing[1], 5
governments[1], 2
granted[2], 10
greater[2], 3
Groundwater[1], 8
groundwater[2], 6-7
Group[1], 2
growth[2], 6
guides[2], 7, 9

H

Hadley[1], 5
Hampshire[1], 8
Hard[1], 4
hard[1], 3
has[7], 2, 5-6, 8
have[10], 5-6, 8-9
heightened[1], 6
help[1], 3
hence[2], 6, 10
high[1], 5
higher[1], 6
Hooper[1], 2
Hosepipe[1], 4

hosepipe[31], 1, 3-5, 8-10
hot[1], 5
hotter[1], 6
households[1], 6
how[2], 9
html[5], 6-7, 9
http[5], 6-7, 9

I

identify[1], 9
impact[1], 5
Impacts[1], 5
impacts[1], 4
implement[1], 10
implementation[1], 3
implemented[3], 5, 8
implementing[1], 5
imposing[1], 5
improvements[1], 3
include[4], 3, 9
including[1], 9
inconsistent[1], 5
Increase[2], 10
increase[3], 6, 8, 10
increased[3], 5-6
Independent[1], 2
independent[1], 2
index[3], 6-7
Industry[2], 5, 8
influence[1], 10
info[1], 2
information[1], 2
initiatives[1], 2
Institute[1], 6
intended[1], 3
intense[2], 6
interpretation[1], 3
interpretations[1], 3
into[2], 10
introduce[1], 8
introduced[2], 5, 8
introducing[1], 5
Introduction[2], 3
investigated[1], 3
invoke[1], 8
involved[1], 2
involvement[1], 3
irrigation[1], 4
Isle[1], 8
issued[1], 8
its[2], 3, 9

J

Jacob[1], 2
July[1], 8
June[1], 8

K

Kent[3], 8
Kingdom[2], 5
Knox[1], 6

L

Lack[4], 3
landscaped[1], 3
large[1], 2
last[2], 6
later[1], 5
latest[1], 5
laws[2], 4, 9
leading[4], 2, 6
led[2], 5
left[1], 6
legal[1], 5
legislation[8], 1, 5-6
legitimacy[1], 6
less[1], 6
level[2], 6, 10
levels[3], 6-8
liability[1], 2
lifestyle[1], 5
lifestyles[1], 5
lifted[1], 8
likely[3], 6-7, 10
limit[1], 3
limited[2], 10
limiting[2], 6, 10
litres[1], 6
live[1], 6
London[3], 2, 6
long[3], 3, 7, 10
longer[1], 8
low[4], 6, 8
Ltd[1], 2

M

made[1], 2
maintaining[1], 5
make[2], 3, 5
manage[1], 8
managed[1], 10
management[2], 9-10
Managing[1], 2
manufacturers[1], 2
many[2], 5-6
March[2], 8
maximise[1], 3
May[3], 8
may[6], 3, 5, 9-10
mean[1], 9
means[1], 6
measure[2], 8-9

measures[10], 8-10
mechanisms[1], 9
media[2], 2, 10
meet[4], 5, 9-10
Met[3], 6-7
met[3], 6-7
Mid[1], 8
mid[1], 5
million[1], 8
minimise[1], 3
Minister[1], 2
modern[1], 5
more[7], 3, 5-6
Moss[1], 6
motor[3], 3, 5
motorcar[1], 9
must[2], 3, 6

N

nature[1], 9
Nearly[1], 8
necessary[1], 3
need[6], 3, 9-10
needed[1], 9
needs[2], 5-6
negatively[1], 10
network[1], 2
New[2], 4
new[3], 3, 10
newly[1], 3
news[2], 7, 9
non[3], 3, 8, 10
nonessential[1], 10
nongovernmental[2], 2
nor[1], 9
North[1], 8
not[9], 2-3, 5-6, 8-10
November[10], 1-10
now[1], 5
number[1], 5

O

objectives[2], 4-5
obligation[1], 5
occasionally[1], 2
occupancy[2], 6
October[3], 6-8
Office[4], 6-7
office[3], 6-7
One[2], 8
one[2], 6, 9
only[3], 10
opinion[1], 5
order[5], 6, 8-10
orders[10], 8-10
Ordinary[1], 10
ordinary[2], 6, 9
org[4], 1-2

organisation[1], 2
organisations[1], 2
other[8], 2-3, 9
others[1], 3
Our[1], 2
our[2], 2
out[2], 3, 9
outdated[1], 5
outdoor[1], 5
outlining[1], 5
over[3], 5-6
overall[1], 3
own[1], 2
Oxford[2], 6

P

Page[9], 2-10
page[2], 7, 9
part[2], 5-6
parts[4], 6-7
patterns[2], 5-6
peer[1], 2
people[1], 8
per[3], 6
percent[1], 6
period[1], 6
periods[9], 6-7, 9-10
permit[2], 9-10
Permits[2], 10
permits[4], 9-10
permitted[3], 3, 9
persons[1], 10
Phase[1], 8
phone[1], 2
Piper[1], 6
place[2], 6, 8
plan[1], 9
planning[1], 3
Plans[1], 9
plans[1], 6
please[1], 2
policing[2], 3-4
policymaking[1], 2
pools[2], 3-4
population[3], 6
possibility[1], 6
possible[2], 5, 9
potential[1], 9
powers[3], 5, 9
practices[1], 5
predict[1], 5
predicted[1], 5
predictions[2], 6-7
Present[2], 4, 9
present[2], 6, 9
presented[1], 2
Prevent[1], 10
primary[1], 10
private[6], 5, 9
problems[1], 6
profit[1], 2
Programme[1], 5
prohibit[1], 5
Project[1], 2

project[1], 6
promote[1], 5
promotes[1], 2
proposed[2], 3, 5
protecting[1], 5
provide[2], 10
provided[1], 10
provisions[1], 5
public[2], 2, 9

Q

quantities[1], 9
Queen[1], 2

R

rain[1], 10
Rainfall[2], 6-7
rainfall[7], 6-7, 10
rainfalls[1], 6
rates[1], 5
reach[1], 6
Reason[1], 6
reason[1], 10
reasonable[1], 9
recognised[1], 3
Recognition[1], 3
Recommendations[1], 3
recorded[1], 7
reduce[4], 3, 9-10
reduced[1], 9
reflect[1], 5
regarding[2], 4, 9
Region[1], 9
regional[1], 9
regions[1], 9
regulators[1], 2
relations[1], 2
relative[1], 6
relevant[1], 5
reliability[1], 2
renewed[1], 10
replenishes[1], 10
Report[3], 4-6
report[6], 1-2, 5
required[1], 9
Research[1], 6
research[4], 2
reserved[1], 2
resource[2], 6, 10
Resources[1], 9
resources[4], 3, 5, 8, 10
responsible[1], 5
responsibly[1], 10
restrict[2], 5, 10
Restrictions[2], 5, 10
restrictions[25], 1-10
result[1], 5
retailers[2], 2
reveal[1], 6

review[1], 1
reviewers[1], 2
rights[1], 2
rigidly[1], 9
risk[3], 6, 10
risking[1], 10
robust[1], 6
Rural[2], 9-10

S

safeguarding[1], 5
same[1], 6
satisfied[1], 10
Saving[2], 2
scale[1], 2
scarce[1], 8
scenarios[2], 5
scope[1], 3
Scotland[2], 2
seasonal[3], 6-7
Secretary[2], 10
section[1], 5
securing[1], 3
security[4], 6, 10
seeks[1], 5
sense[1], 3
sensible[1], 10
serious[2], 5, 10
serve[1], 10
set[2], 9
severe[1], 9
severity[1], 9
shared[2], 7, 9
shift[2], 6
short[3], 10
shortage[1], 10
shortages[6], 5-6, 9-10
Shortcomings[2], 3-4
shortcomings[2], 3, 5
should[1], 3
side[4], 10
Sims[1], 2
since[2], 6
single[2], 6
sit[1], 2
situation[1], 5
situations[1], 9
social[1], 10
society[2], 5-6
Some[1], 8
soon[1], 5
sources[1], 10
South[1], 8
south[3], 6, 8
Southern[1], 8
specified[1], 10
spl[2], 7, 9
sprinkler[3], 5, 8-9
sprinklers[1], 5
Stage[1], 4
stages[4], 3, 9
stakeholders[2], 2-3
standpipe[1], 10
starts[1], 6

State[2], 10
Statement[1], 6
stm[2], 7, 9
Stockholm[1], 6
storage[1], 6
straight[1], 5
strategy[1], 10
substantially[1], 5
successful[1], 3
Such[1], 10
such[2], 8-9
Suggested[1], 4
suggests[1], 5
Summary[1], 3
summer[2], 5-6
summers[1], 6
supplied[1], 10
supplies[3], 5, 10
supply[16], 5-6, 9-10
support[1], 2
supposed[4], 4, 10
surfaces[2], 3-4
Surrey[3], 8
Sussex[2], 8
sustainability[1], 10
Sutton[2], 8
Swimming[1], 4
swimming[1], 3
system[1], 10

T

Table[1], 8
table[1], 8
take[1], 10
taken[5], 2, 6, 9
team[1], 6
teams[1], 9
technologies[2], 3-4
technology[2], 3, 5
Temperature[1], 7
term[6], 3, 7, 10
Thames[2], 6, 8
than[1], 6
that[24], 2-3, 5-6, 8-10
The[20], 2-6, 9-10
the[117], 2-10
their[5], 8-9
There[2], 5-6
there[3], 3, 6, 9
thereby[1], 3
These[1], 5
these[2], 3
They[1], 5
they[2], 9
This[1], 5
this[4], 2
Three[1], 8
three[1], 9
through[1], 5
Time[1], 4
time[6], 3, 5-6, 10

times[1], 5
today[1], 5
Tompkins[1], 2
trailer[1], 9
trigger[1], 9
triggers[2], 9
turf[1], 3
two[3], 5-6
Tyndall[1], 5

U

UKCIP[1], 5
unattended[2], 5
Under[1], 9
under[2], 5, 9
understanding[1], 3
undertake[1], 2
undertakers[1], 5
United[2], 5
until[2], 8, 10
upon[1], 9
USA[1], 4
usage[2], 3
use[10], 3, 5, 8-10
used[2], 9-10
uses[1], 5
using[1], 9
Usually[1], 5
Utilities[1], 6

V

Valleys[1], 8
value[1], 3
various[1], 9
varying[1], 9
vehicle[1], 9
Vehicles[1], 4
vehicles[5], 3, 5, 8
vigorous[1], 6
voluntarily[1], 3

W

warm[1], 7
warming[1], 5
was[1], 5
wash[2], 8-9
washing[3], 3, 5
Water[25], 2, 4-6, 8-10
water[58], 2-6, 8-10
watering[13], 1-10
Waterwise[6], 2
waterwise[4], 1-2
ways[1], 3
weather[3], 6-7
Weatherhead[1], 6
week[1], 3

welfare[1], 10
well[2], 2, 5
wetter[1], 5
What[3], 4, 10
what[2], 3
when[1], 5
whether[2], 9
which[4], 3, 6, 10
while[1], 5
who[2], 6, 8
whose[1], 10
why[1], 3
Widening[1], 3
Wight[1], 8
will[1], 9
willingness[1], 3
winter[1], 6
winters[3], 5-6
With[1], 6
with[10], 2-3, 6, 9-10
without[1], 10
work[2], 2
would[2], 5, 9
wrote[1], 2
www[5], 1-2, 6-7

Y

year[2], 6, 10
years[1], 7

Z

Zealand[1], 4

Index1

```
Index report :
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   Total number of pages failed to be indexed : 0
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Index creation date : 2013/08/30 13:19:23
```

Index1

A

ability[1], 3
about[4], 2, 3
abstractions[1], 10
academics[1], 2
accepts[1], 2
according[1], 9
account[1], 5
accuracy[1], 2
achieve[1], 2
achieving[1], 5
across[2], 6, 8
act[5], 5, 8, 9
acted[1], 2
action[4], 6, 9
actions[4], 2, 3, 9
activities[4], 2, 3, 5
actually[1], 4
addition[2], 2, 10
addressing[1], 3
adequate[1], 9
adopted[1], 8
adoption[1], 5
advising[1], 2
affairs[2], 9, 10
affected[1], 10
agency[6], 9, 10
aggravate[1], 6
aim[1], 10
aims[4], 2, 5
all[3], 2, 3, 9
allotments[1], 4
allowed[2], 3, 8
allowing[1], 3
allows[1], 9
already[1], 8
also[2], 2, 8
alter[1], 10
although[1], 5
amended[1], 9

amendments[4], 3, 4, 5
amongst[3], 3, 5
amount[4], 10
analysis[1], 2
and[92], 2, 3, 4, 5, 6, 7, 8, 9, 10
anglian[1], 9
anne[1], 2
any[4], 2, 3, 9
appears[1], 5
appendix[2], 4
application[1], 6
applied[1], 10
apply[2], 9, 10
approach[1], 5
appropriate[1], 5
approval[1], 10
approved[2], 8, 10
april[5], 8
are[28], 2, 3, 5, 6, 7, 8, 9, 10
area[1], 10
areas[1], 6
assessed[1], 5
assist[1], 5
assisting[1], 3
associated[2], 3
attempted[1], 9
august[3], 6, 7, 8
australia[1], 4
authority[1], 2
authorship[1], 2
automatic[1], 9
autumn[1], 8
availability[3], 6, 10
available[2], 10
average[2], 6, 7
averages[1], 7
awareness[1], 10

B

background[2], 4, 5
balance[4], 6, 10
balanced[1], 3
ban[23], 1, 3, 4, 5, 8, 9, 10
bans[12], 3, 4, 5, 8, 9, 10
base[2], 2, 9
based[3], 2, 3, 9
bbc[4], 7, 9
become[1], 6
becomes[1], 10
becoming[1], 6
been[3], 2, 6, 8
before[1], 9
benefit[1], 3
benefits[1], 3
berkshire[1], 8
between[4], 3, 7, 10
beyond[1], 5
both[1], 3
brian[1], 2
briefly[1], 5
build[1], 2
burgeoning[1], 6
but[2], 6, 10
butterfield[1], 6

C

campaign[1], 10
campaigns[1], 9
can[9], 5, 6, 9, 10
canada[1], 4
cannot[1], 10
capability[4], 6, 10
capita[2], 6
car[1], 9
caravan[1], 9
carry[1], 3
catherine[1], 2
ccdew[1], 6
centres[1], 5
certain[1], 3
change[8], 4, 5, 6
changes[1], 5
changing[1], 9
cholderton[1], 8
clarify[1], 5
clarity[1], 3
clear[1], 6
clearer[1], 3
clearly[1], 3
climate[8], 4, 5, 6
combination[2], 6, 10
come[1], 5
commitment[1], 3
communication[1], 4
companies[15], 2, 3, 5, 8, 9, 10
company[2], 8, 9
compared[1], 7
compile[1], 9
compliance[1], 6
comply[2], 3, 6
concessions[3], 3, 4
conclusions[1], 4
conditions[2], 9, 10
conduct[1], 2
confusing[1], 3
confusion[2], 3, 5
consensus[1], 3
consistency[2], 3
consistent[2], 3, 5
constrained[2], 6, 10
consultant[1], 2
consultants[1], 2
consultation[2], 3, 4
consulting[1], 2
consumers[8], 2, 3, 5, 6, 10
consumption[11], 2, 3, 4, 5, 6, 9, 10
contact[1], 2
content[1], 2
contents[2], 2, 4
continuing[1], 8
contract[1], 1
control[1], 10
convene[1], 2
copyright[1], 2
corresponding[1], 3
costs[2], 3
could[1], 5
counteract[1], 6
country[1], 6
creating[2], 3, 5
crossing[1], 9

current[3], 5
currently[1], 6
customers[1], 5
cynicism[1], 3

D

date[2], 8
day[3], 3, 6
deal[1], 6
dealing[1], 9
decision[1], 9
decline[1], 8
decrease[1], 2
decreased[1], 6
deficiency[2], 5, 10
defined[2], 3, 9
defra[2], 1, 10
delivery[1], 3
demand[13], 3, 6, 9, 10
demographics[1], 6
demonstrate[1], 9
department[1], 9
depending[1], 9
determined[2], 6, 10
determining[2], 6, 10
developed[1], 5
developments[1], 5
device[1], 9
diagram[1], 9
difference[1], 7
different[2], 3, 9
difficult[1], 3
director[2], 2
disabled[1], 3
disclaimer[1], 2
discretionary[1], 5
discussed[1], 5
distribution[3], 6, 10
district[1], 8
divided[1], 10
does[3], 4, 5, 9
domestic[1], 10
dover[1], 8
downing[1], 6
drafted[1], 5
drawn[2], 5, 9
drier[3], 6
driest[1], 6
drought[41], 3, 6, 8, 9, 10
dry[3], 5, 6
due[2], 6, 9
during[11], 5, 6, 7, 9, 10
duties[1], 9

E

each[1], 9
east[5], 8
economic[2], 4, 10

edmonds[1], 6
effective[5], 3, 5, 6, 9
effectiveness[1], 3
efficiency[5], 2, 5, 10
efficient[1], 5
effort[1], 2
eight[2], 5, 8
elderly[1], 3
element[1], 10
email[1], 2
emergency[2], 9, 10
enable[2], 6, 10
encourage[2], 5, 9
encouraging[1], 10
enforcement[3], 3, 4, 6
enforcing[1], 3
england[4], 2, 6, 8
ensure[2], 2, 10
environment[13], 2, 5, 6, 9, 10
environmental[1], 10
essential[4], 3, 6, 8, 10
establish[1], 3
evaporation[1], 6
evidence[1], 2
exceptional[1], 10
exceptionally[1], 6
exist[1], 5
existing[1], 10
exists[2], 5, 10
expected[3], 6, 8, 10
experienced[2], 6, 10
experiencing[1], 6
exploring[1], 5
extended[1], 5
eyes[1], 6

F

factor[2], 6, 10
factors[2], 5, 9
feed[1], 10
figure[8], 6, 7, 8, 9
figures[1], 6
filling[1], 3
final[1], 1
finally[1], 5
first[1], 5
flexibility[1], 3
flooding[1], 6
folkestone[1], 8
followed[1], 5
following[1], 10
food[2], 9, 10
for[36], 2, 3, 5, 6, 7, 9, 10
forecast[1], 9
forecasts[1], 6
forms[1], 5
foster[1], 3
frequent[2], 6
from[1], 10
full[4], 5, 8
fundamental[1], 10
further[7], 2, 6, 7, 10
future[1], 10

G

garden[11], 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
gardens[4], 3, 5, 8
gate[1], 2
generate[1], 3
given[1], 9
gov[3], 6, 7
governing[1], 5
governments[1], 2
granted[2], 10
greater[2], 3
groundwater[3], 6, 7, 8
group[1], 2
growth[2], 6
guides[2], 7, 9

H

hadley[1], 5
hampshire[1], 8
hard[2], 3, 4
has[7], 2, 5, 6, 8
have[10], 5, 6, 8, 9
heightened[1], 6
help[1], 3
hence[2], 6, 10
high[1], 5
higher[1], 6
hooper[1], 2
hosepipe[32], 1, 3, 4, 5, 8, 9, 10
hot[1], 5
hotter[1], 6
households[1], 6
how[2], 9
html[5], 6, 7, 9
http[5], 6, 7, 9

I

identify[1], 9
impact[1], 5
impacts[2], 4, 5
implement[1], 10
implementation[1], 3
implemented[3], 5, 8
implementing[1], 5
imposing[1], 5
improvements[1], 3
include[4], 3, 9
including[1], 9
inconsistent[1], 5
increase[5], 6, 8, 10
increased[3], 5, 6
independent[2], 2
index[3], 6, 7
industry[2], 5, 8
influence[1], 10

info[1], 2
information[1], 2
initiatives[1], 2
institute[1], 6
intended[1], 3
intense[2], 6
interpretation[1], 3
interpretations[1], 3
into[2], 10
introduce[1], 8
introduced[2], 5, 8
introducing[1], 5
introduction[2], 3
investigated[1], 3
invoke[1], 8
involved[1], 2
involvement[1], 3
irrigation[1], 4
isle[1], 8
issued[1], 8
its[2], 3, 9

J

jacob[1], 2
july[1], 8
june[1], 8

K

kent[3], 8
kingdom[2], 5
knox[1], 6

L

lack[4], 3
landscaped[1], 3
large[1], 2
last[2], 6
later[1], 5
latest[1], 5
laws[2], 4, 9
leading[4], 2, 6
led[2], 5
left[1], 6
legal[1], 5
legislation[8], 1, 5, 6
legitimacy[1], 6
less[1], 6
level[2], 6, 10
levels[3], 6, 7, 8
liability[1], 2
lifestyle[1], 5
lifestyles[1], 5
lifted[1], 8

likely[3], 6, 7, 10
limit[1], 3
limited[2], 10
limiting[2], 6, 10
litres[1], 6
live[1], 6
london[3], 2, 6
long[3], 3, 7, 10
longer[1], 8
low[4], 6, 8
ltd[1], 2

M

made[1], 2
maintaining[1], 5
make[2], 3, 5
manage[1], 8
managed[1], 10
management[2], 9, 10
managing[1], 2
manufacturers[1], 2
many[2], 5, 6
march[2], 8
maximise[1], 3
may[9], 3, 5, 8, 9, 10
mean[1], 9
means[1], 6
measure[2], 8, 9
measures[10], 8, 9, 10
mechanisms[1], 9
media[2], 2, 10
meet[4], 5, 9, 10
met[6], 6, 7
mid[2], 5, 8
million[1], 8
minimise[1], 3
minister[1], 2
modern[1], 5
more[7], 3, 5, 6
moss[1], 6
motor[3], 3, 5
motorcar[1], 9
must[2], 3, 6

N

nature[1], 9
nearly[1], 8
necessary[1], 3
need[6], 3, 9, 10
needed[1], 9
needs[2], 5, 6
negatively[1], 10
network[1], 2
new[5], 3, 4, 10
newly[1], 3
news[2], 7, 9
non[3], 3, 8, 10
nonessential[1], 10

nongovernmental[2], 2
nor[1], 9
north[1], 8
not[9], 2, 3, 5, 6, 8, 9, 10
november[10], 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
now[1], 5
number[1], 5

O

objectives[2], 4, 5
obligation[1], 5
occasionally[1], 2
occupancy[2], 6
october[3], 6, 7, 8
office[7], 6, 7
one[4], 6, 8, 9
only[3], 10
opinion[1], 5
order[5], 6, 8, 9, 10
orders[10], 8, 9, 10
ordinary[3], 6, 9, 10
org[4], 1, 2
organisation[1], 2
organisations[1], 2
other[8], 2, 3, 9
others[1], 3
our[3], 2
out[2], 3, 9
outdated[1], 5
outdoor[1], 5
outlining[1], 5
over[3], 5, 6
overall[1], 3
own[1], 2
oxford[2], 6

P

page[11], 2, 3, 4, 5, 6, 7, 8, 9, 10
part[2], 5, 6
parts[4], 6, 7
patterns[2], 5, 6
peer[1], 2
people[1], 8
per[3], 6
percent[1], 6
period[1], 6
periods[9], 6, 7, 9, 10
permit[2], 9, 10
permits[6], 9, 10
permitted[3], 3, 9
persons[1], 10
phase[1], 8
phone[1], 2
piper[1], 6
place[2], 6, 8
plan[1], 9
planning[1], 3
plans[2], 6, 9

please[1], 2
policing[2], 3, 4
policymaking[1], 2
pools[2], 3, 4
population[3], 6
possibility[1], 6
possible[2], 5, 9
potential[1], 9
powers[3], 5, 9
practices[1], 5
predict[1], 5
predicted[1], 5
predictions[2], 6, 7
present[4], 4, 6, 9
presented[1], 2
prevent[1], 10
primary[1], 10
private[6], 5, 9
problems[1], 6
profit[1], 2
programme[1], 5
prohibit[1], 5
project[2], 2, 6
promote[1], 5
promotes[1], 2
proposed[2], 3, 5
protecting[1], 5
provide[2], 10
provided[1], 10
provisions[1], 5
public[2], 2, 9

Q

quantities[1], 9
queen[1], 2

R

rain[1], 10
rainfall[9], 6, 7, 10
rainfalls[1], 6
rates[1], 5
reach[1], 6
reason[2], 6, 10
reasonable[1], 9
recognised[1], 3
recognition[1], 3
recommendations[1], 3
recorded[1], 7
reduce[4], 3, 9, 10
reduced[1], 9
reflect[1], 5
regarding[2], 4, 9
region[1], 9
regional[1], 9
regions[1], 9
regulators[1], 2
relations[1], 2
relative[1], 6

relevant[1], 5
reliability[1], 2
renewed[1], 10
replenishes[1], 10
report[9], 1, 2, 4, 5, 6
required[1], 9
research[5], 2, 6
reserved[1], 2
resource[2], 6, 10
resources[5], 3, 5, 8, 9, 10
responsible[1], 5
responsibly[1], 10
restrict[2], 5, 10
restrictions[27], 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
result[1], 5
retailers[2], 2
reveal[1], 6
review[1], 1
reviewers[1], 2
rights[1], 2
rigidly[1], 9
risk[3], 6, 10
risking[1], 10
robust[1], 6
rural[2], 9, 10

S

safeguarding[1], 5
same[1], 6
satisfied[1], 10
saving[2], 2
scale[1], 2
scarce[1], 8
scenarios[2], 5
scope[1], 3
scotland[2], 2
seasonal[3], 6, 7
secretary[2], 10
section[1], 5
securing[1], 3
security[4], 6, 10
seeks[1], 5
sense[1], 3
sensible[1], 10
serious[2], 5, 10
serve[1], 10
set[2], 9
severe[1], 9
severity[1], 9
shared[2], 7, 9
shift[2], 6
short[3], 10
shortage[1], 10
shortages[6], 5, 6, 9, 10
shortcomings[4], 3, 4, 5
should[1], 3
side[4], 10
sims[1], 2
since[2], 6
single[2], 6
sit[1], 2
situation[1], 5
situations[1], 9
social[1], 10

society[2], 5, 6
some[1], 8
soon[1], 5
sources[1], 10
south[4], 6, 8
southern[1], 8
specified[1], 10
spl[2], 7, 9
sprinkler[3], 5, 8, 9
sprinklers[1], 5
stage[1], 4
stages[4], 3, 9
stakeholders[2], 2, 3
standpipe[1], 10
starts[1], 6
state[2], 10
statement[1], 6
stm[2], 7, 9
stockholm[1], 6
storage[1], 6
straight[1], 5
strategy[1], 10
substantially[1], 5
successful[1], 3
such[3], 8, 9, 10
suggested[1], 4
suggests[1], 5
summary[1], 3
summer[2], 5, 6
summers[1], 6
supplied[1], 10
supplies[3], 5, 10
supply[16], 5, 6, 9, 10
support[1], 2
supposed[4], 4, 10
surfaces[2], 3, 4
surrey[3], 8
sussex[2], 8
sustainability[1], 10
sutton[2], 8
swimming[2], 3, 4
system[1], 10

T

table[2], 8
take[1], 10
taken[5], 2, 6, 9
team[1], 6
teams[1], 9
technologies[2], 3, 4
technology[2], 3, 5
temperature[1], 7
term[6], 3, 7, 10
thames[2], 6, 8
than[1], 6
that[24], 2, 3, 5, 6, 8, 9, 10
the[137], 2, 3, 4, 5, 6, 7, 8, 9, 10
their[5], 8, 9
there[5], 3, 5, 6, 9
thereby[1], 3
these[3], 3, 5
they[3], 5, 9
this[5], 2, 5
three[2], 8, 9

through[1], 5
time[7], 3, 4, 5, 6, 10
times[1], 5
today[1], 5
tompkins[1], 2
trailer[1], 9
trigger[1], 9
triggers[2], 9
turf[1], 3
two[3], 5, 6
tyndall[1], 5

U

ukcip[1], 5
unattended[2], 5
under[3], 5, 9
understanding[1], 3
undertake[1], 2
undertakers[1], 5
united[2], 5
until[2], 8, 10
upon[1], 9
usa[1], 4
usage[2], 3
use[10], 3, 5, 8, 9, 10
used[2], 9, 10
uses[1], 5
using[1], 9
usually[1], 5
utilities[1], 6

V

valleys[1], 8
value[1], 3
various[1], 9
varying[1], 9
vehicle[1], 9
vehicles[6], 3, 4, 5, 8
vigorous[1], 6
voluntarily[1], 3

W

warm[1], 7
warming[1], 5
was[1], 5
wash[2], 8, 9
washing[3], 3, 5
water[83], 2, 3, 4, 5, 6, 8, 9, 10
watering[13], 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
waterwise[10], 1, 2
ways[1], 3
weather[3], 6, 7
weatherhead[1], 6

week[1], 3
welfare[1], 10
well[2], 2, 5
wetter[1], 5
what[5], 3, 4, 10
when[1], 5
whether[2], 9
which[4], 3, 6, 10
while[1], 5
who[2], 6, 8
whose[1], 10
why[1], 3
widening[1], 3
wight[1], 8
will[1], 9
willingness[1], 3
winter[1], 6
winters[3], 5, 6
with[11], 2, 3, 6, 9, 10
without[1], 10
work[2], 2
would[2], 5, 9
wrote[1], 2
www[5], 1, 2, 6, 7

Y

year[2], 6, 10
years[1], 7

Z

zealand[1], 4

Index1

```
Index report :
   Total number of words indexed : 738
   Total number of words not found in the book : 0
   Total number of pages indexed : 10
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   Total time taken : (1) sec
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