



Drought Management Plan Appendices 2018

Affinity Water

November 2018

Security Notice

This document has been written in compliance with our security policy so that no redaction is required for publication. Codes have been used to preserve the security of our production locations.

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Appendix 1 Long Term Control Curves

A1.1 Long term control curves: Chalfont Centre, Lilley Bottom and Elsenham Nursery

This Appendix shows long-term measured water levels at the three observation boreholes used by us to evaluate the groundwater level conditions across our supply area. Their locations are shown on Figure 14 in the DMP. Onto the long-term measured water levels, five drought trigger levels have been super-imposed, which are based upon historical information relating to when publicity campaigns and hosepipe bans were used in the past. These relate to return periods, ensuring that Drought Trigger Zone 2 corresponds with a 1-in-5 year event and drought zone 3 corresponds with a 1-in-10 year event. Drought Trigger Zone 4 has been set just below lowest recorded levels. Of particular note is the 1996-1997 drought event, as we managed to maintain supply without having to resort to any drought permits, drought orders or standpipes and rota-cuts.

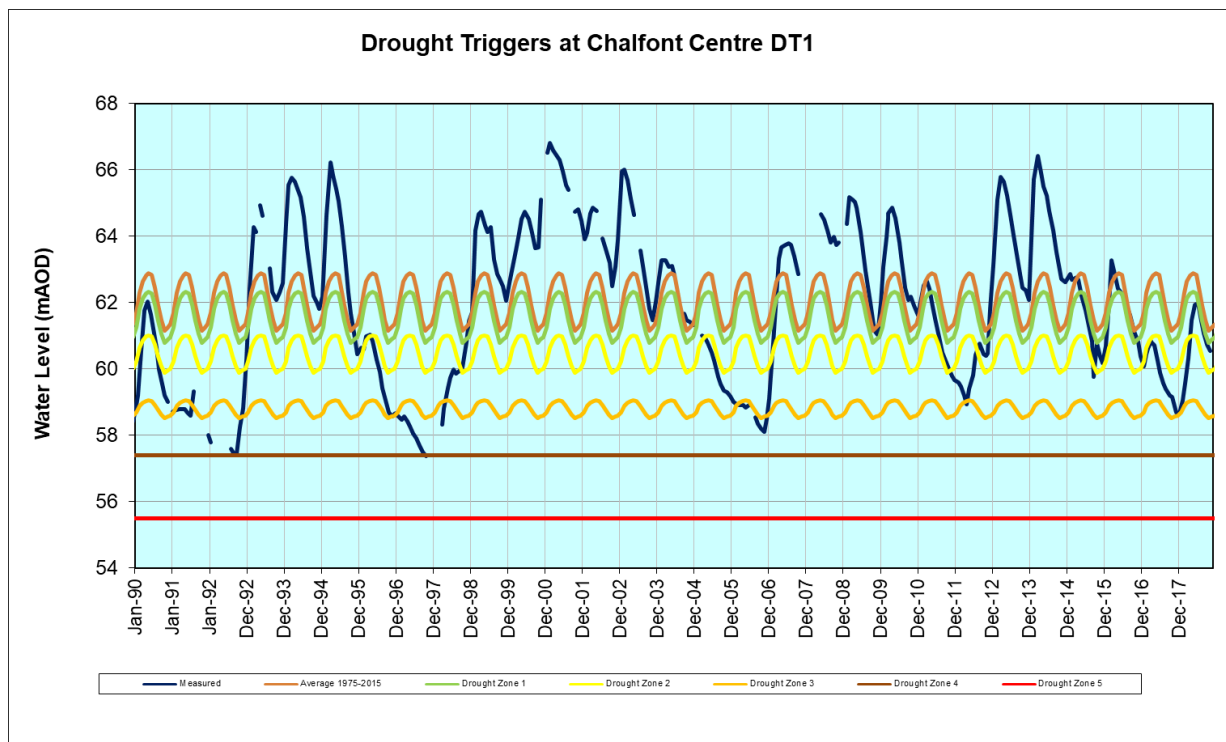


Figure A1.1: Long term control curve for Chalfont Centre

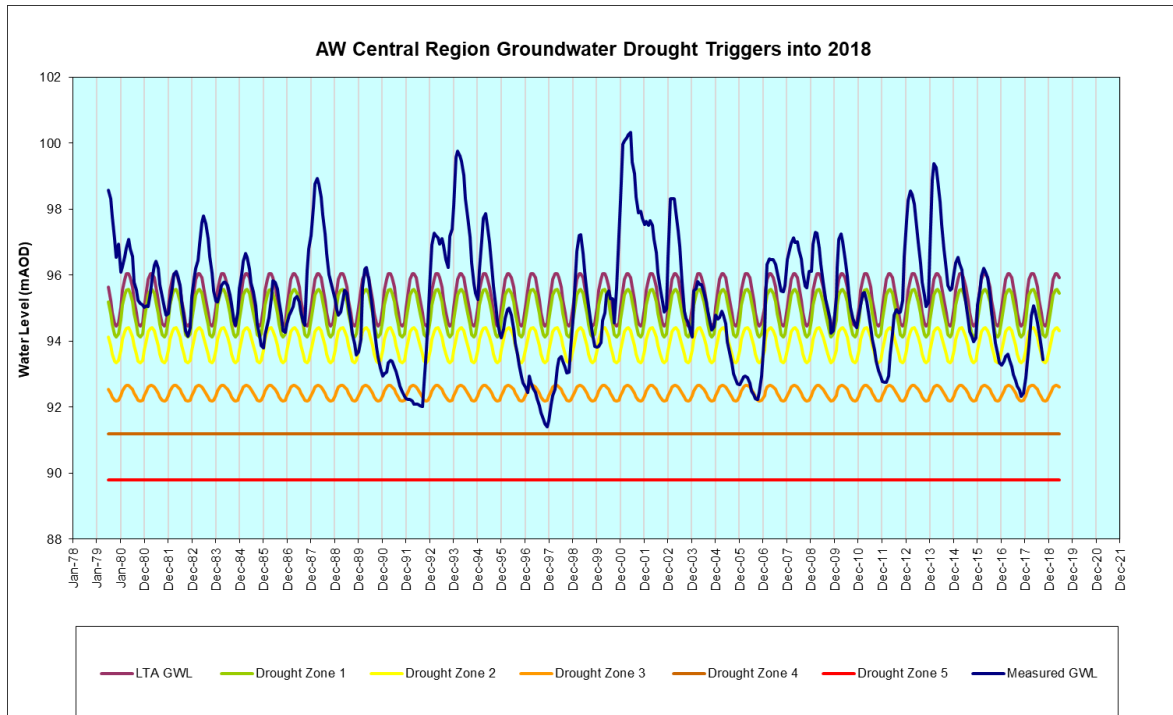


Figure A1.2: Long term control curve for Lilley Bottom

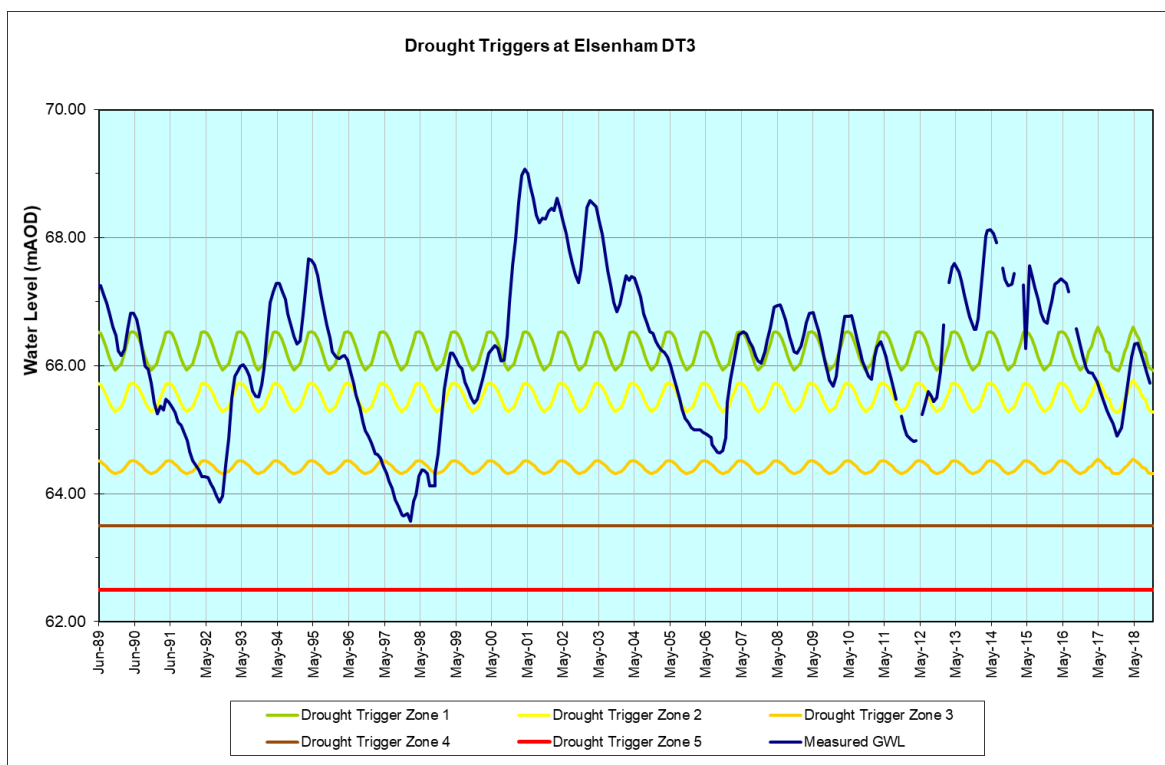


Figure A1.3: Long term control curve for Elsenham

Appendix 2 Short Term Control Curves

A2.1 Short term control curves: Chalfont Centre, Lilley Bottom and Elsenham Nursery

This Appendix contains graphs showing the same information as contained within Appendix 1, over a shorter timescale. The long-term control curves are used to produce the drought triggers based on historical information, those triggers are then transferred from a 20 year timescale to a two year one to enable us to monitor drought on a month by month basis.

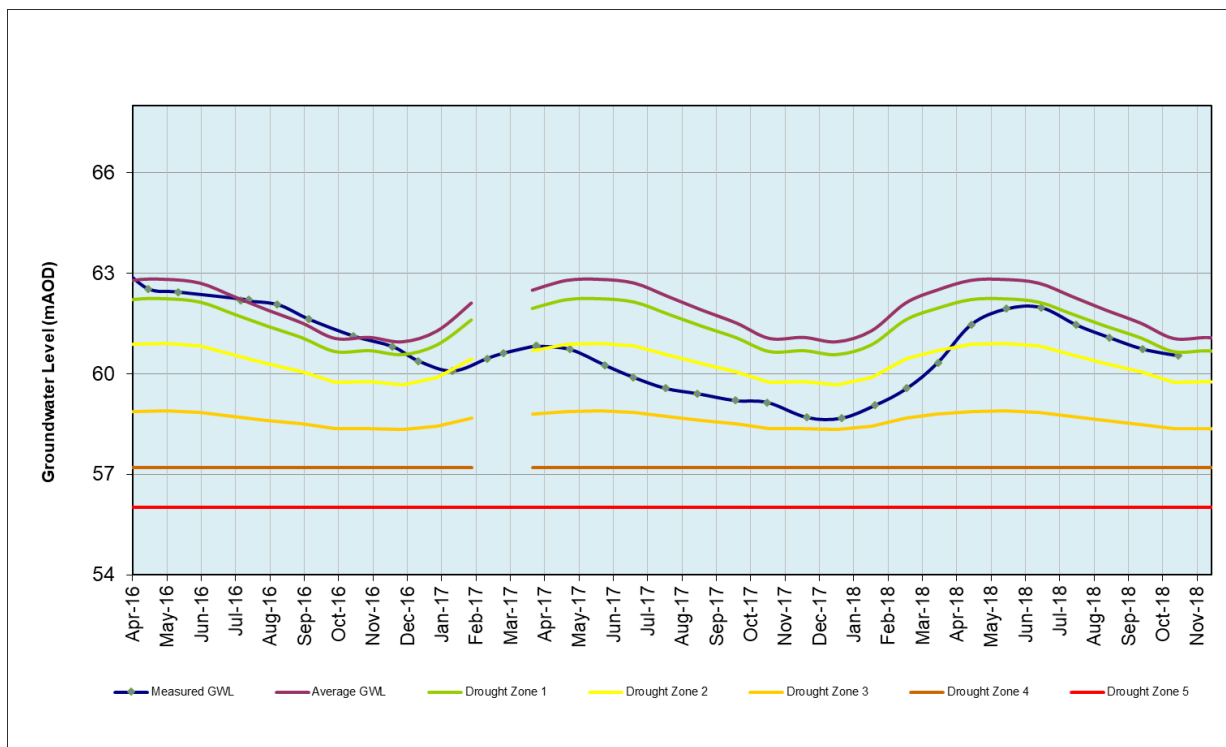


Figure A2.1: Short term control curve for Chalfont Centre

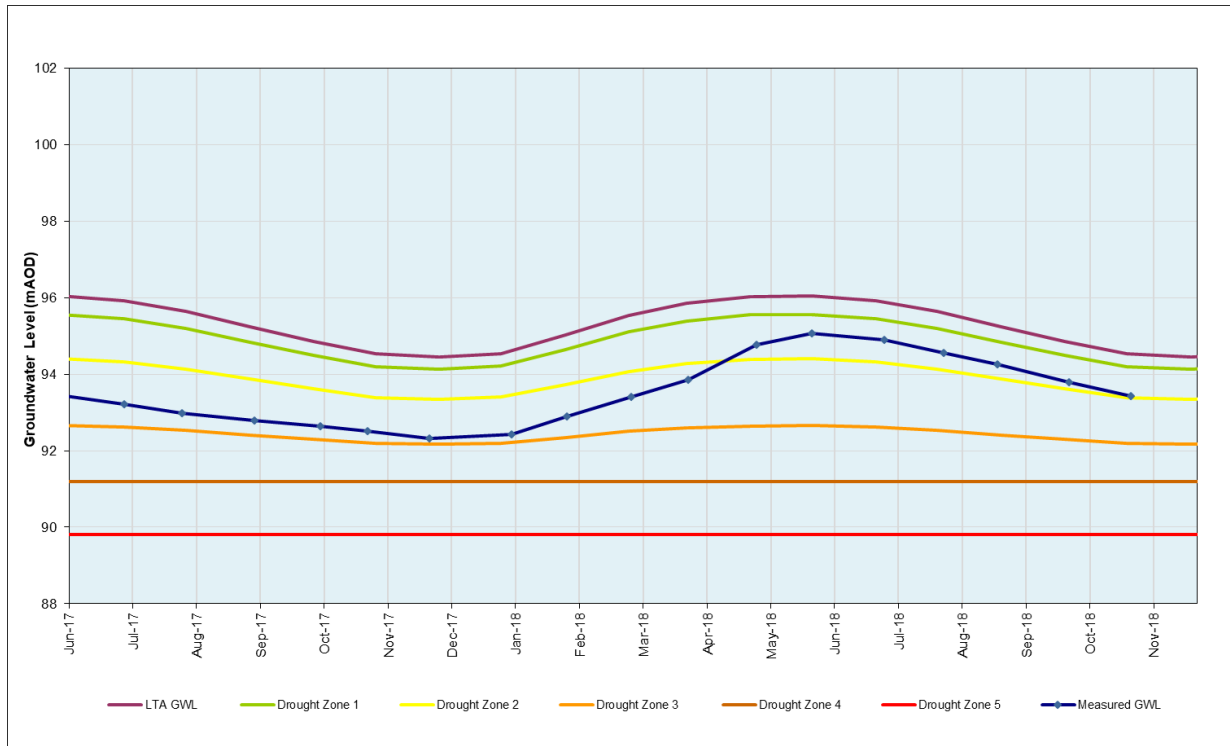


Figure A2.2: Short term control curve for Lilley Bottom

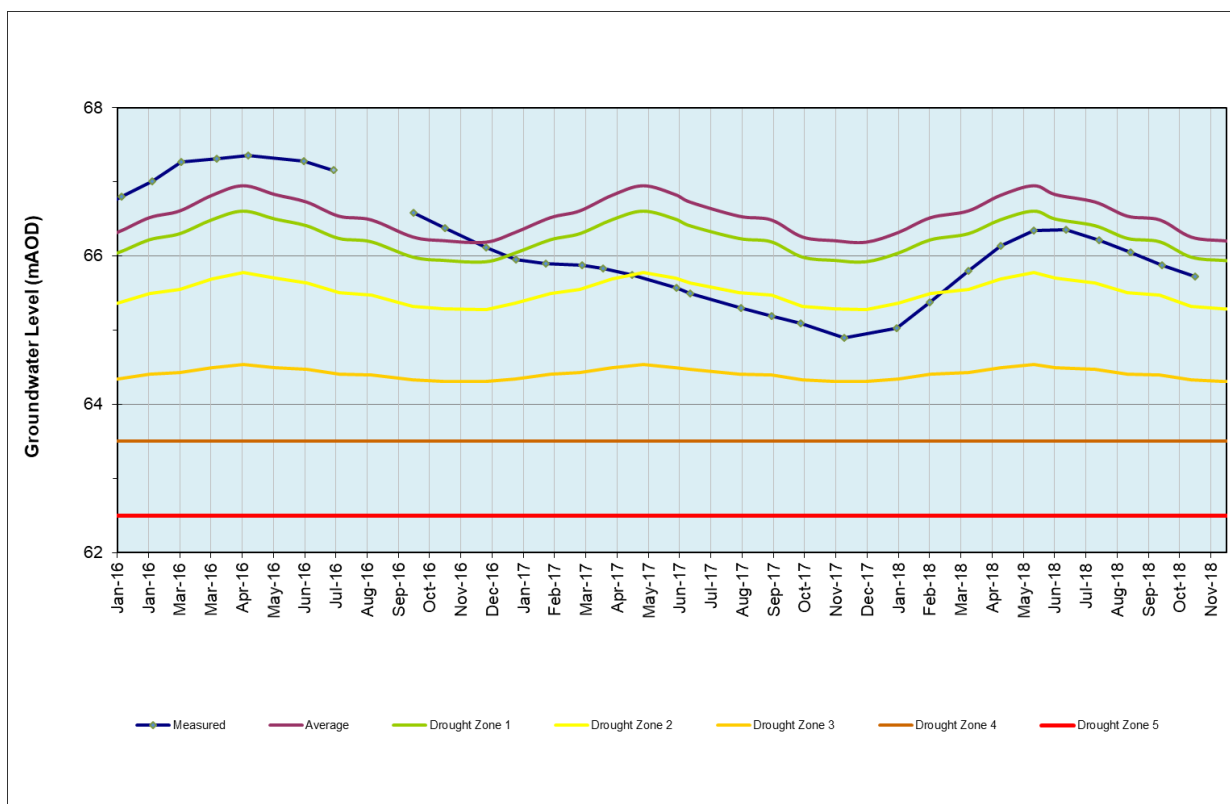


Figure A2.3: Short term control curve for Elsenham

Appendix 3 Drought Scenario Testing

A3.1 Calibration of lumped parameter groundwater level models

The following figures show the calibration for each of the lumped parameter models used in Section 4 of the DMP.

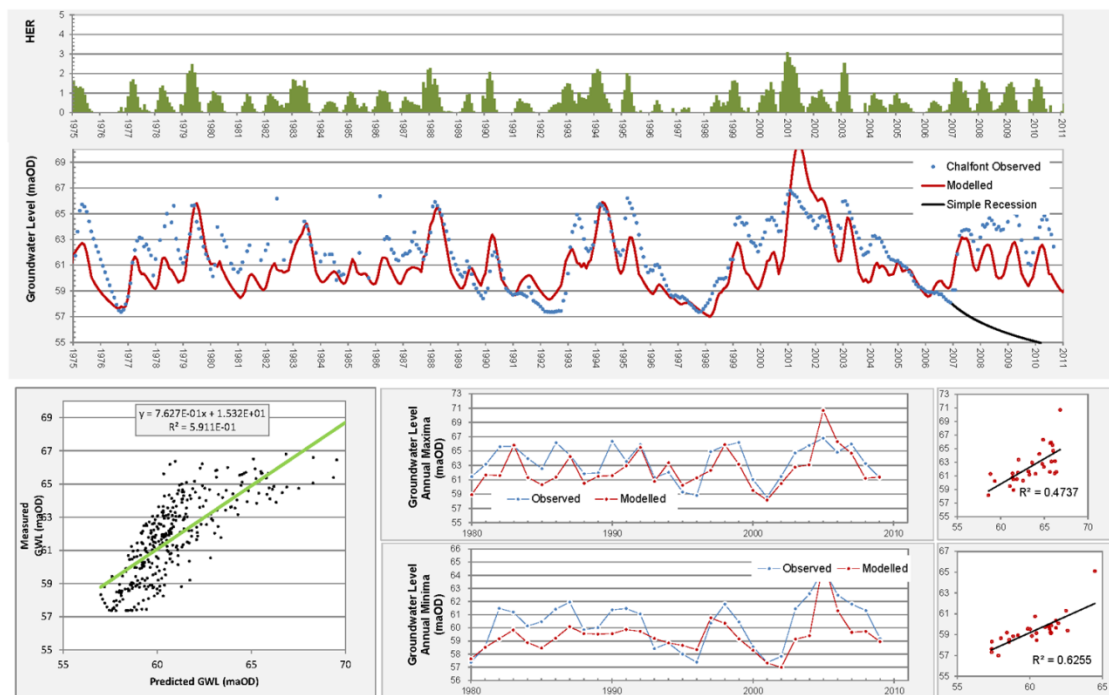


Figure A3.1: Calibration for Chalfont lumped parameter model (Water Resource Zones 1, 4 and 6)

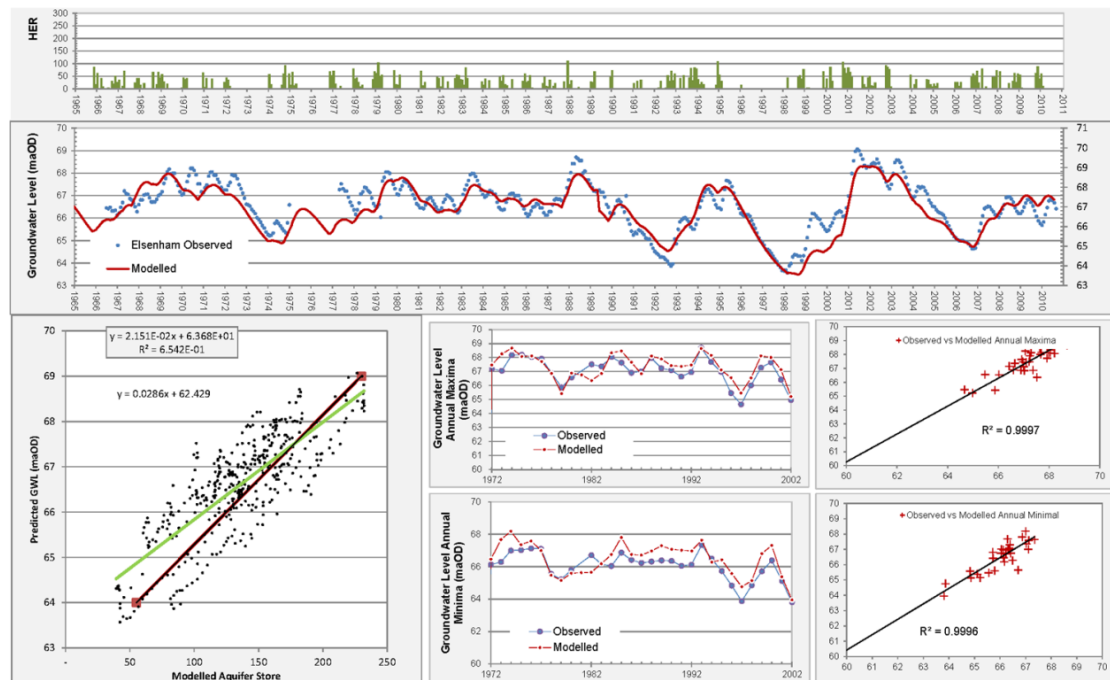


Figure A3.2: Calibration for Elsenham lumped parameter model (Water Resource Zone 5)

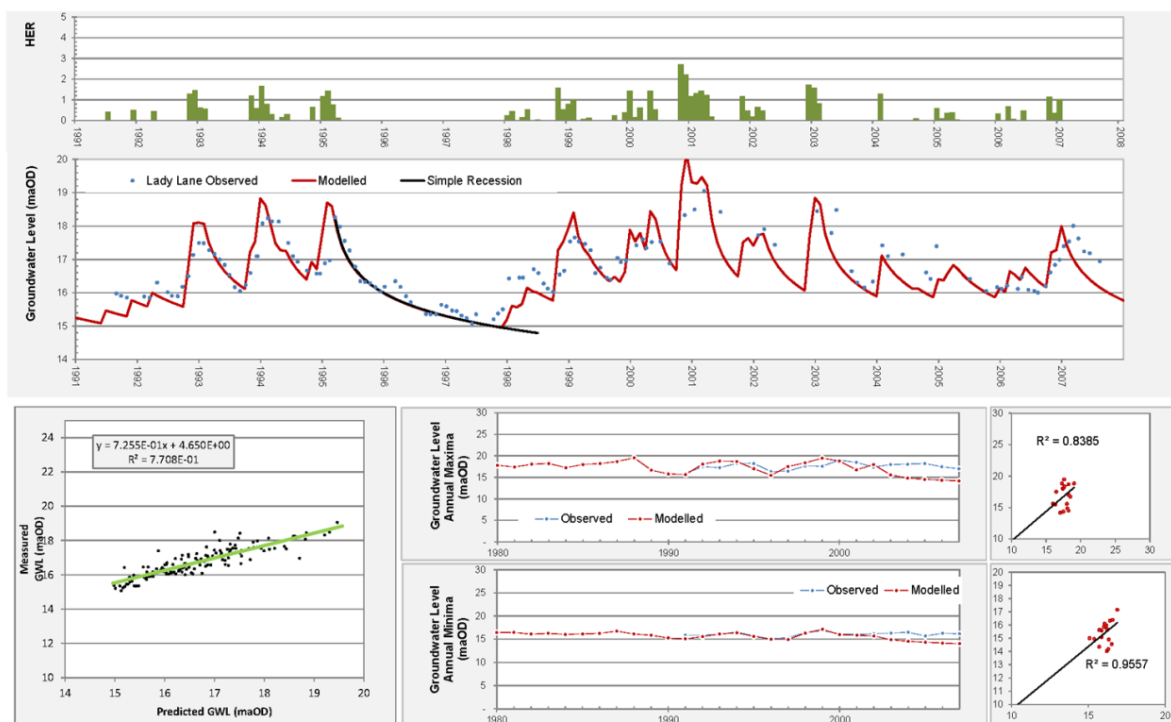


Figure A3.3: Calibration for Lady Lane lumped parameter model (Water Resource Zone 8)

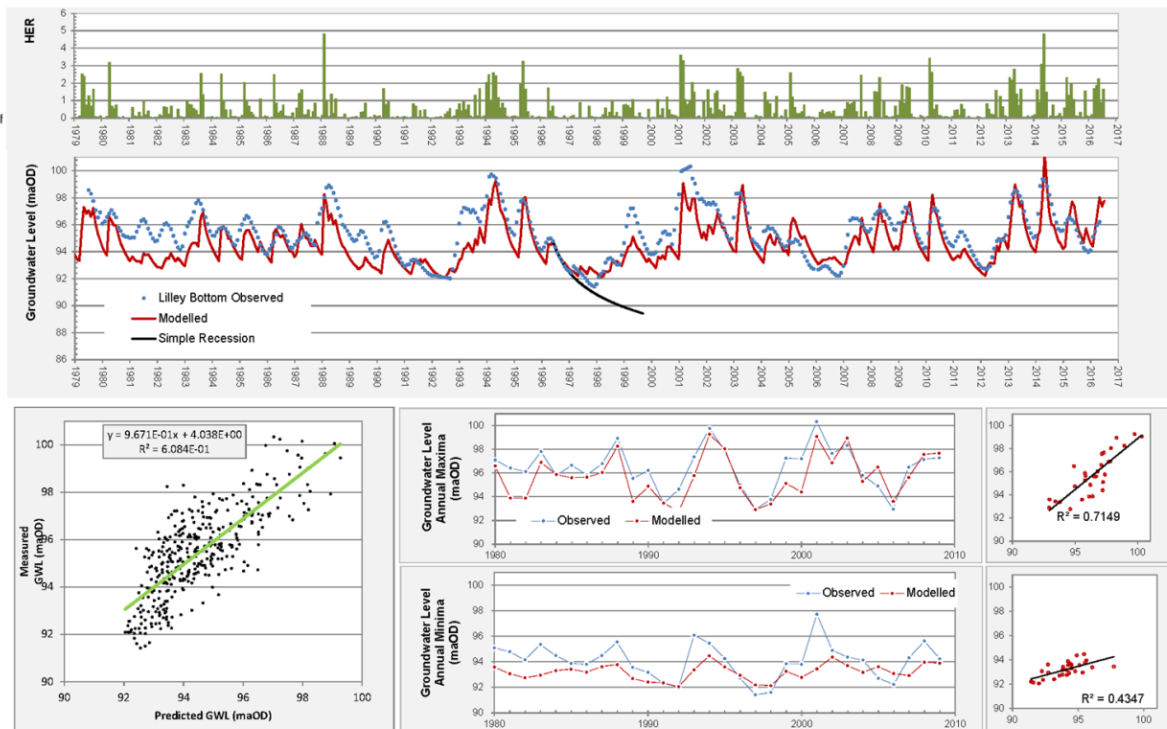


Figure A3.4: Calibration for Lilley Bottom lumped parameter model (Water Resource Zone 3)

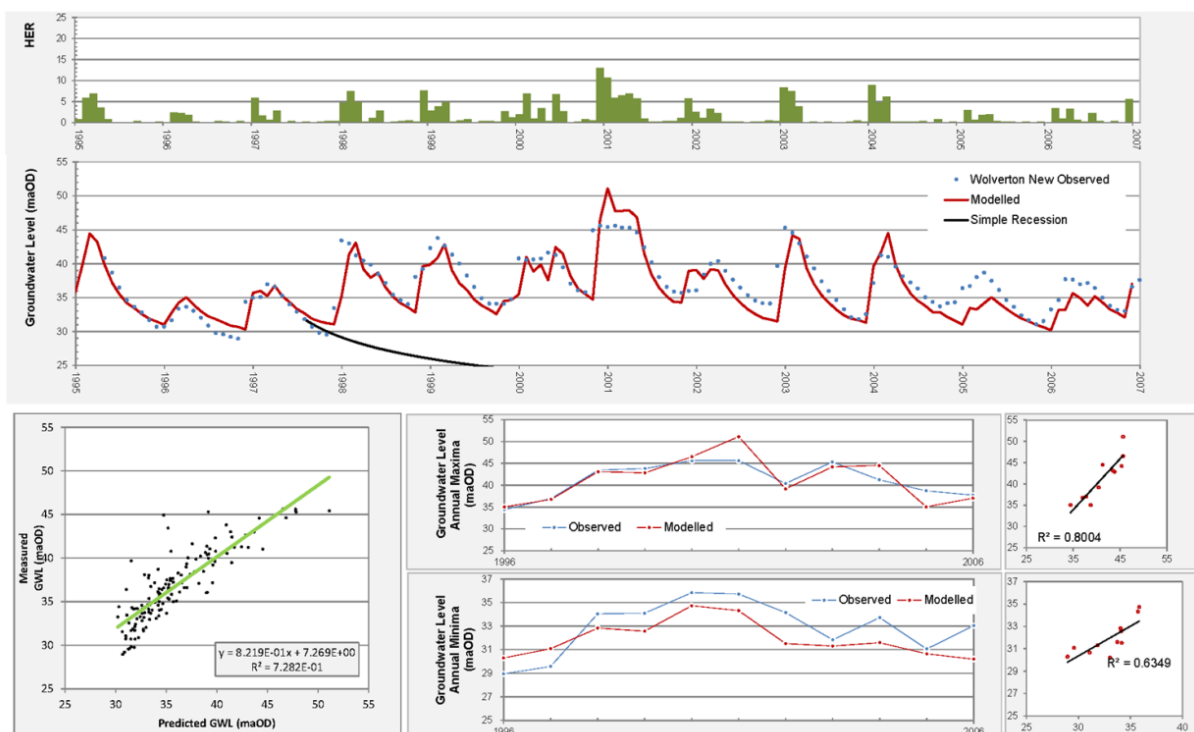


Figure A3.5: Calibration for Wolverton New lumped parameter model (Water Resource Zone 7)

A3.2 Demand profiles

The demand profiles used in the Water Resource Zone models are shown below for each region.

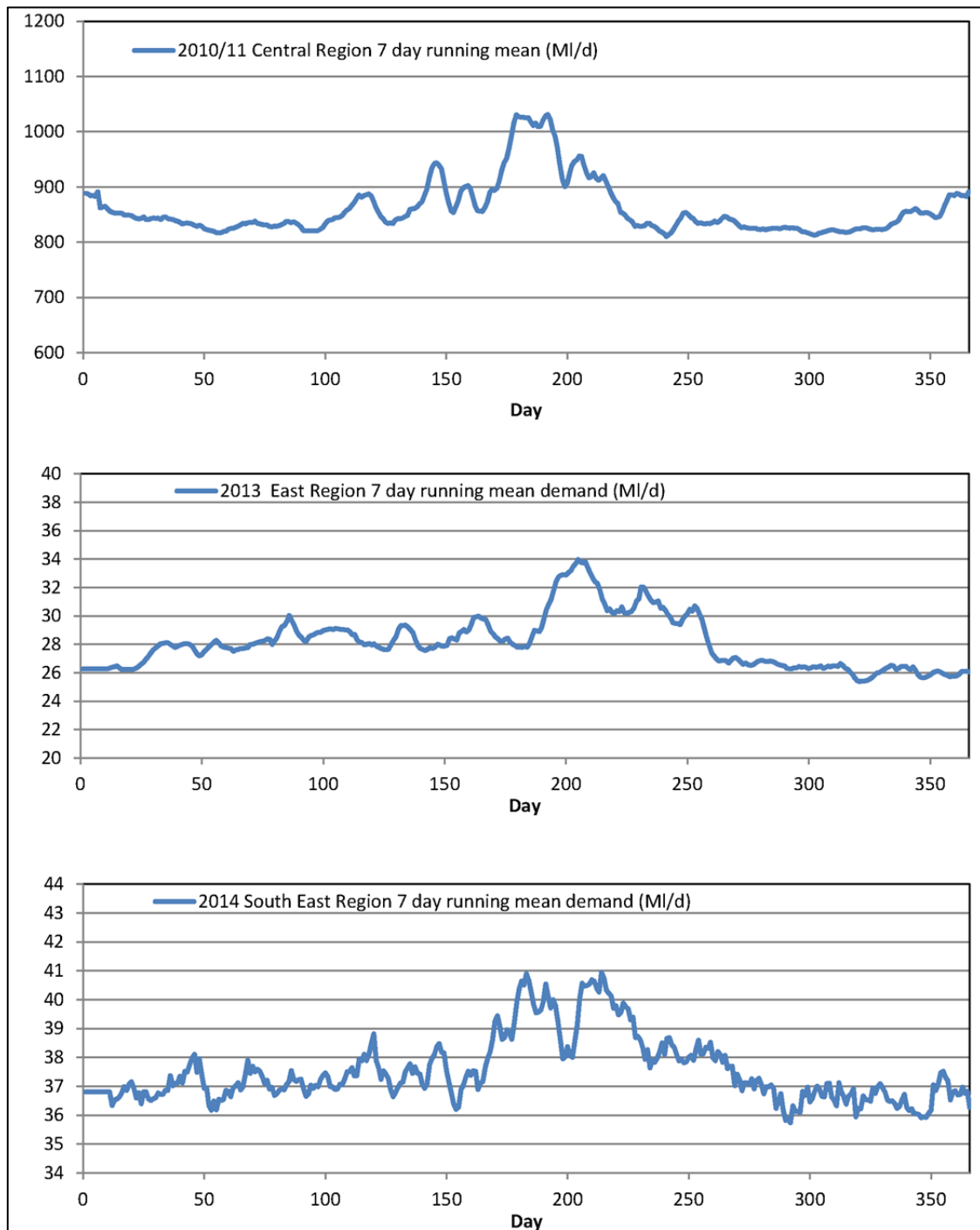
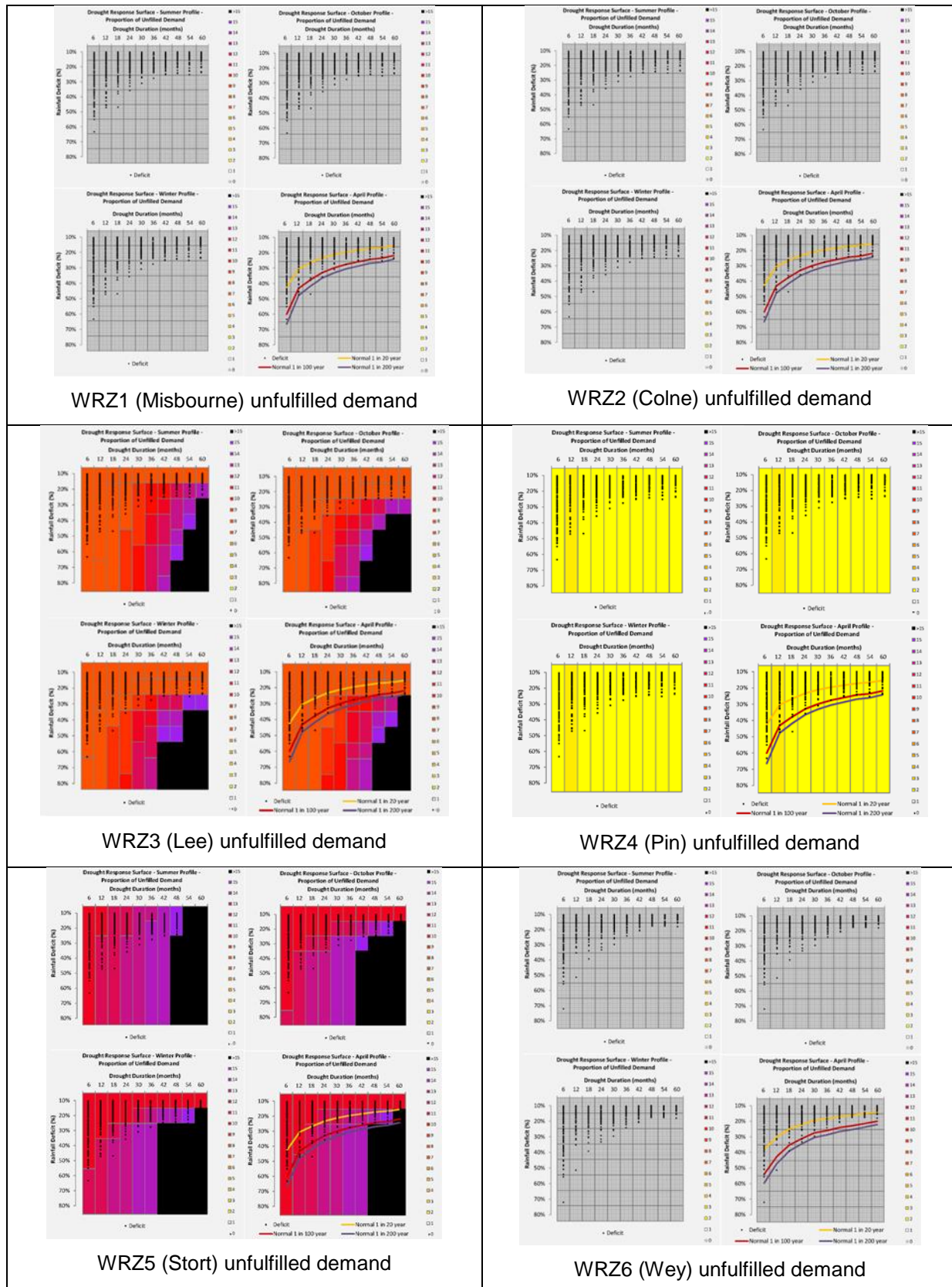


Figure A3.6: Demand profiles for each company region

A3.3 Initial Water Resource Zone model results with no transfers or drought management actions



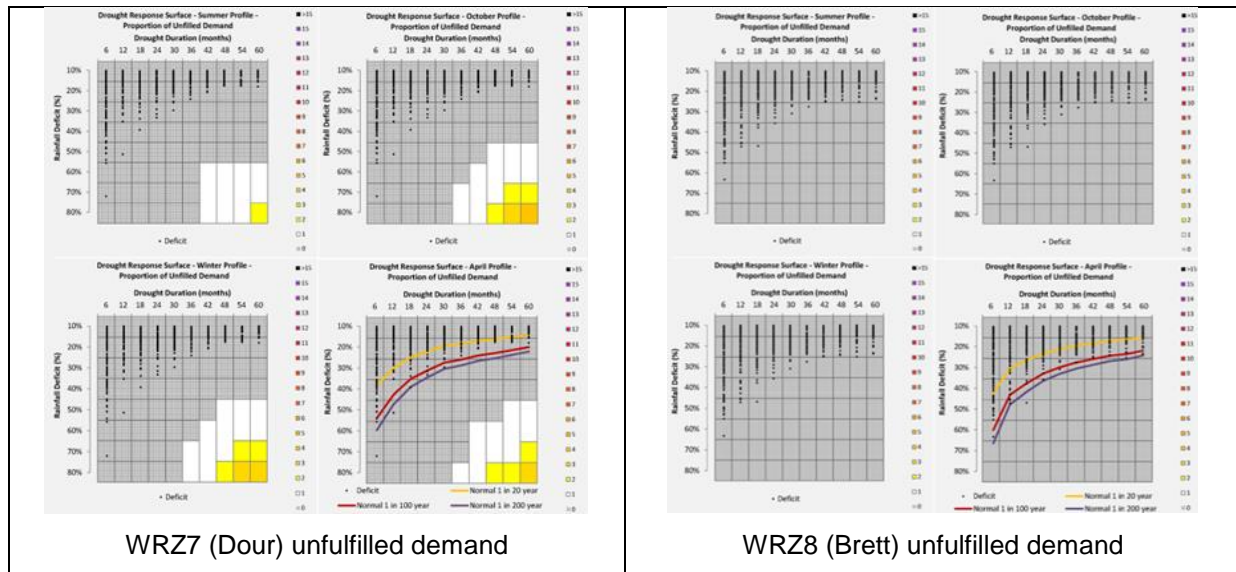
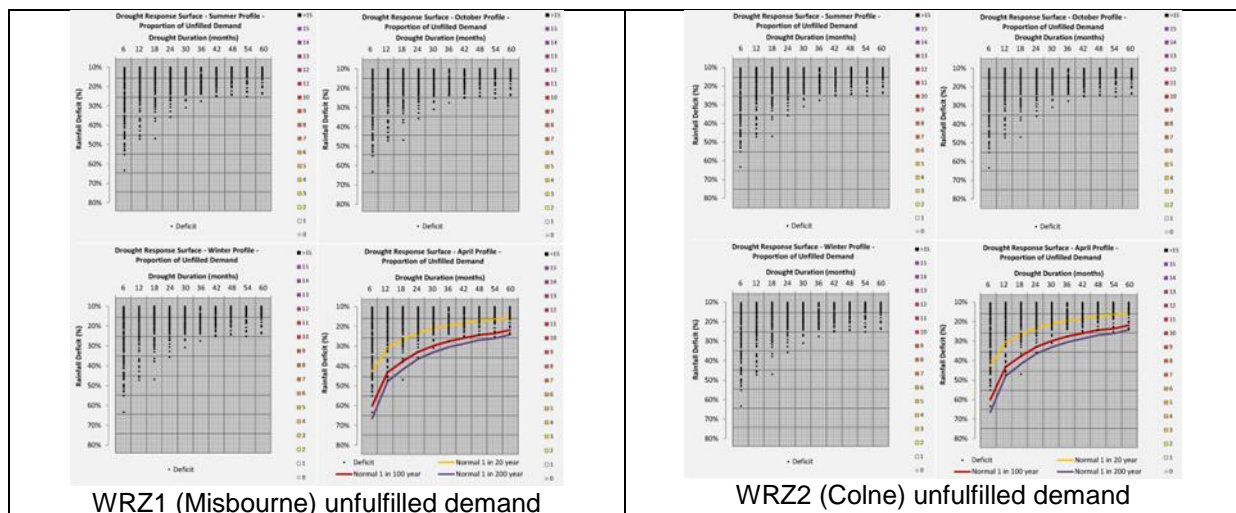


Figure A3.7: Model results with no transfers or drought management actions

A3.4 Water Resource Zone model results with transfers and without drought management actions



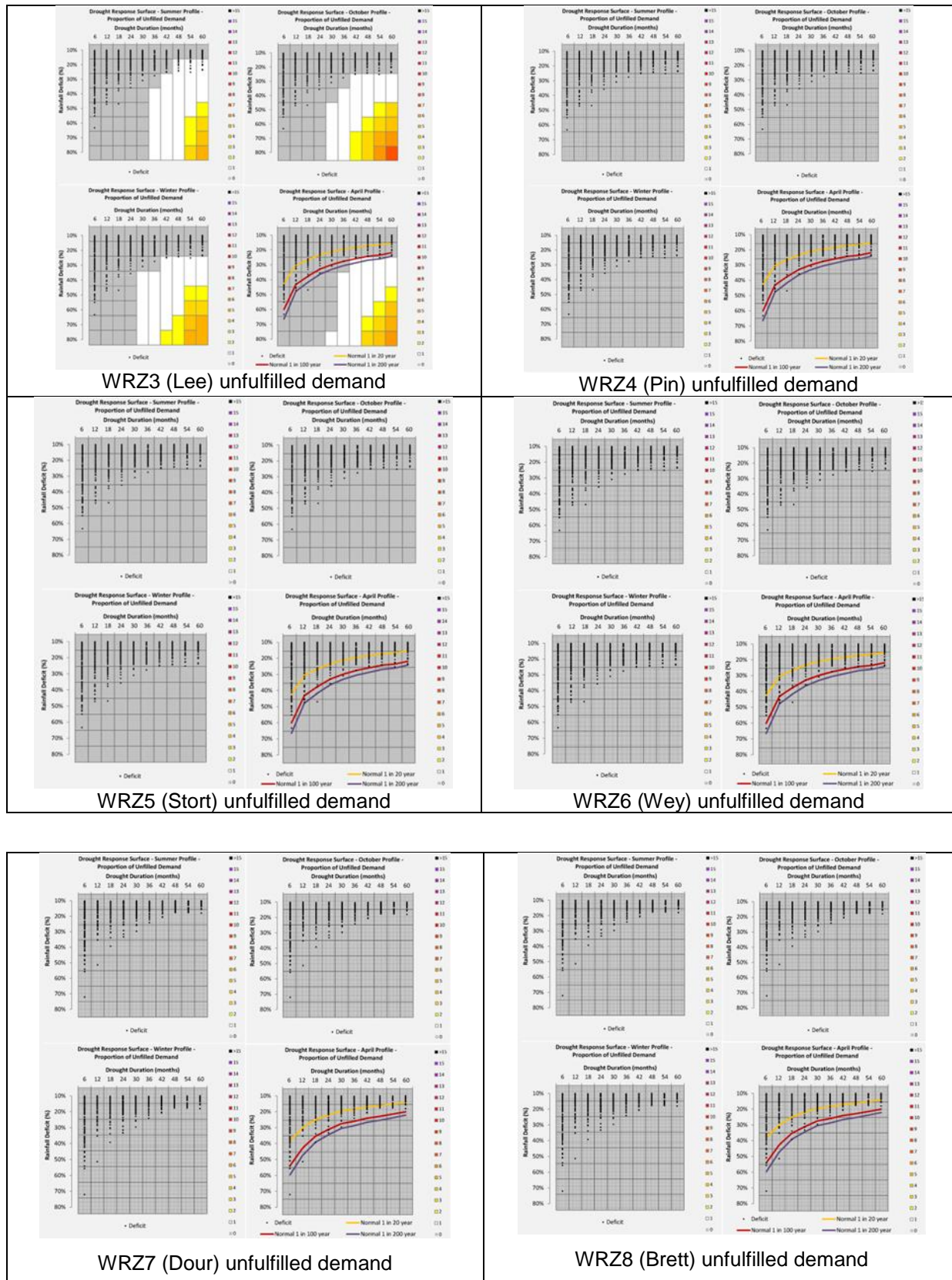
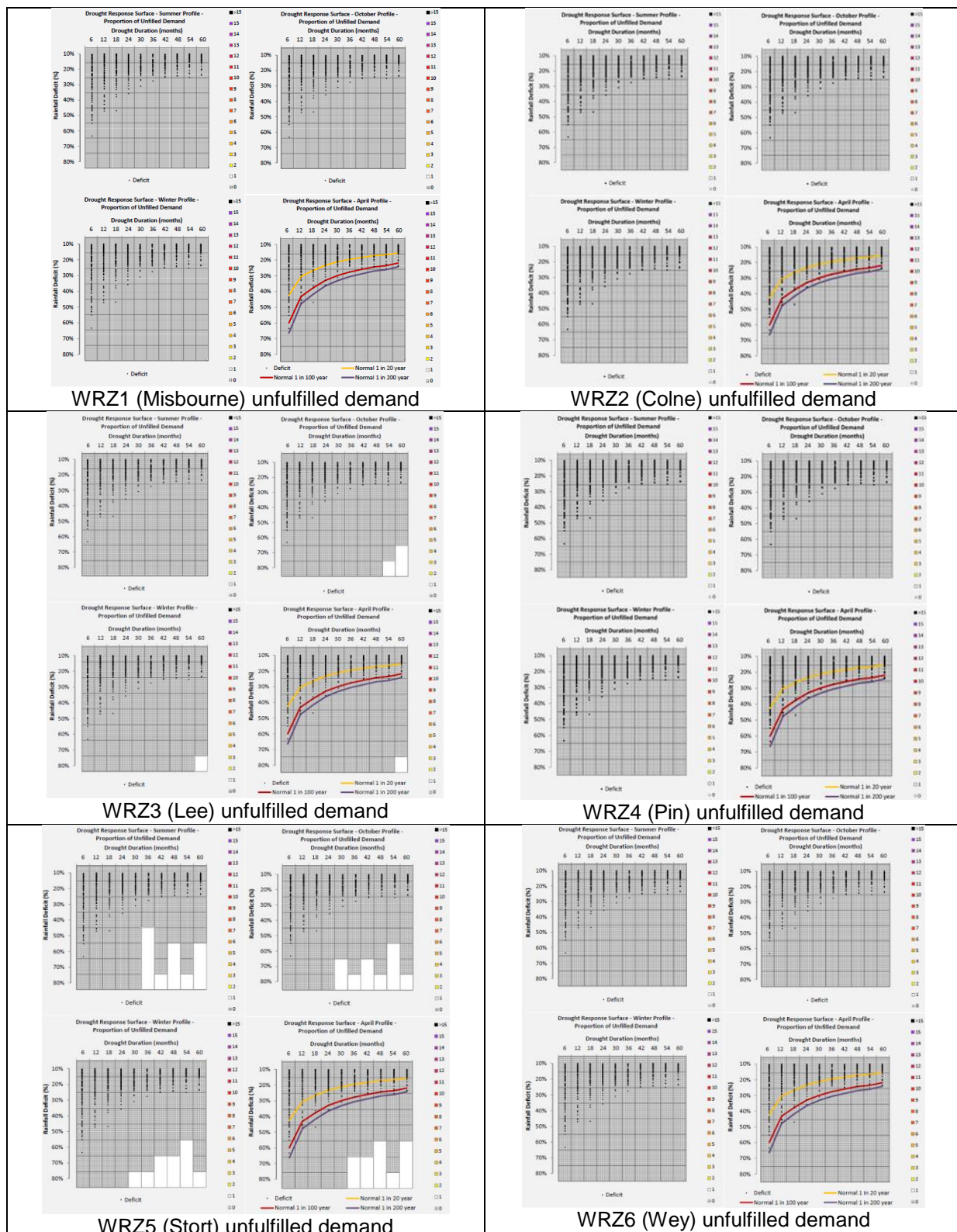


Figure A3.8: Model results with transfers and no drought management actions

A3.5 Water Resource Zone model results with transfers and drought management actions



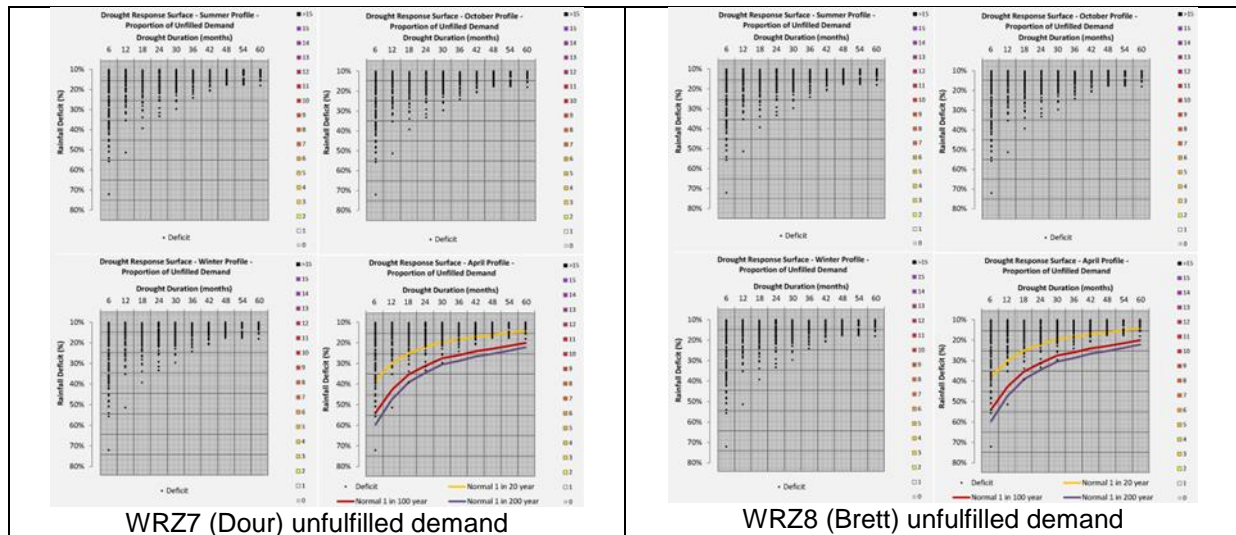


Figure A3.9: Model results with transfers and with drought management actions

A3.6 Example utilisation of resources in the worst drought scenario tested

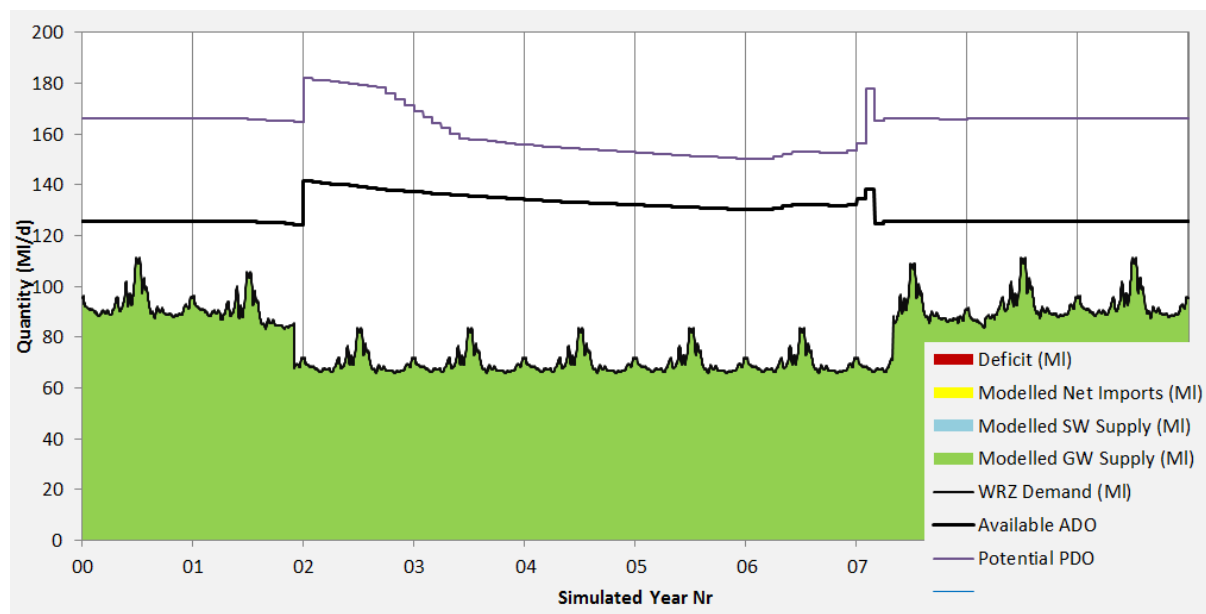


Figure A3.10: WRZ1 Example utilisation

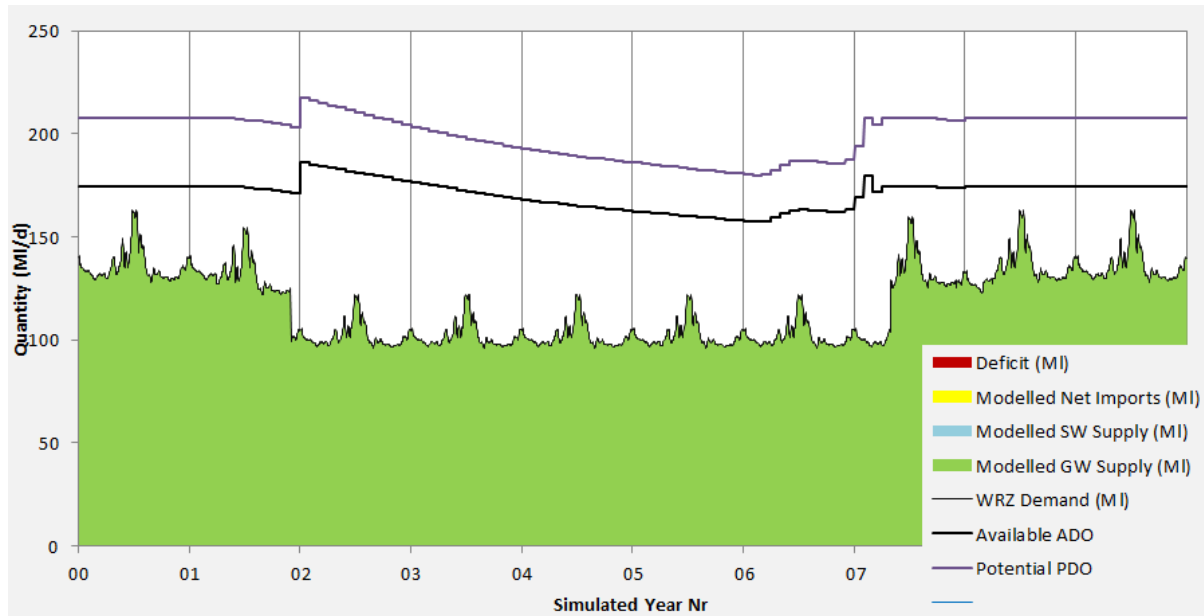


Figure A3.11: WRZ2 Example utilisation

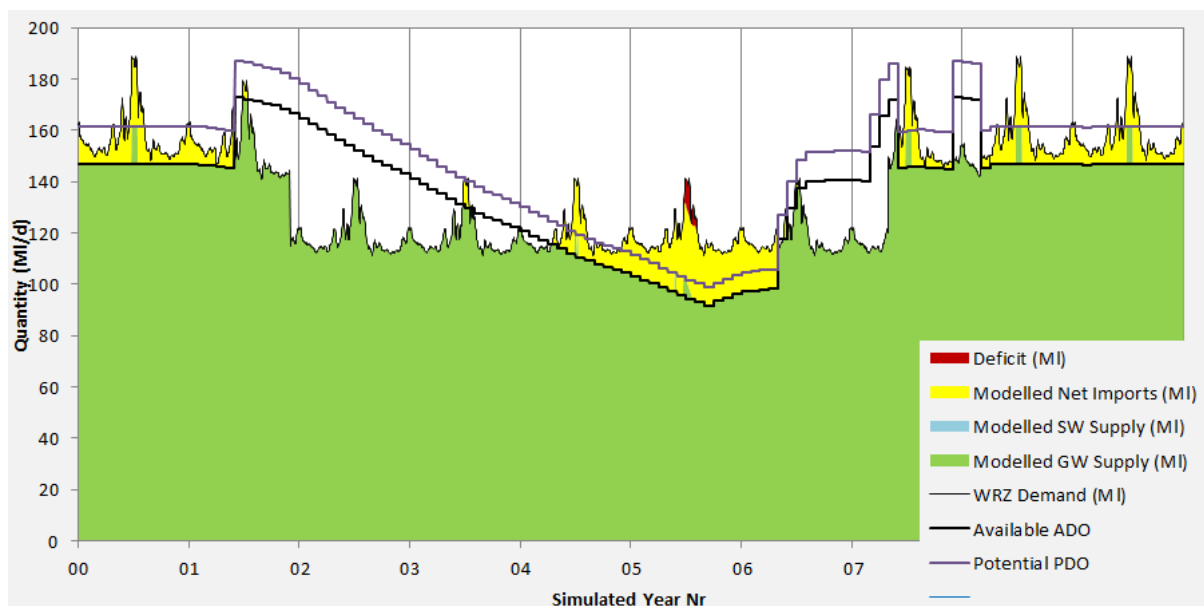


Figure A3.12: WRZ3 Example utilisation

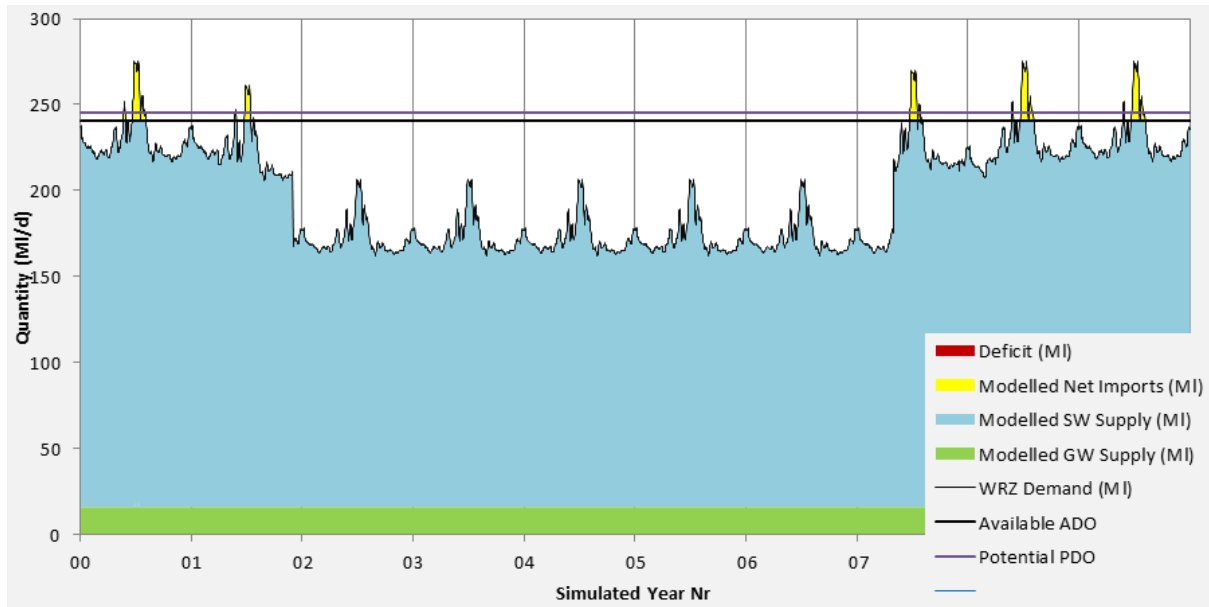


Figure A3.13: WRZ4 Example utilisation

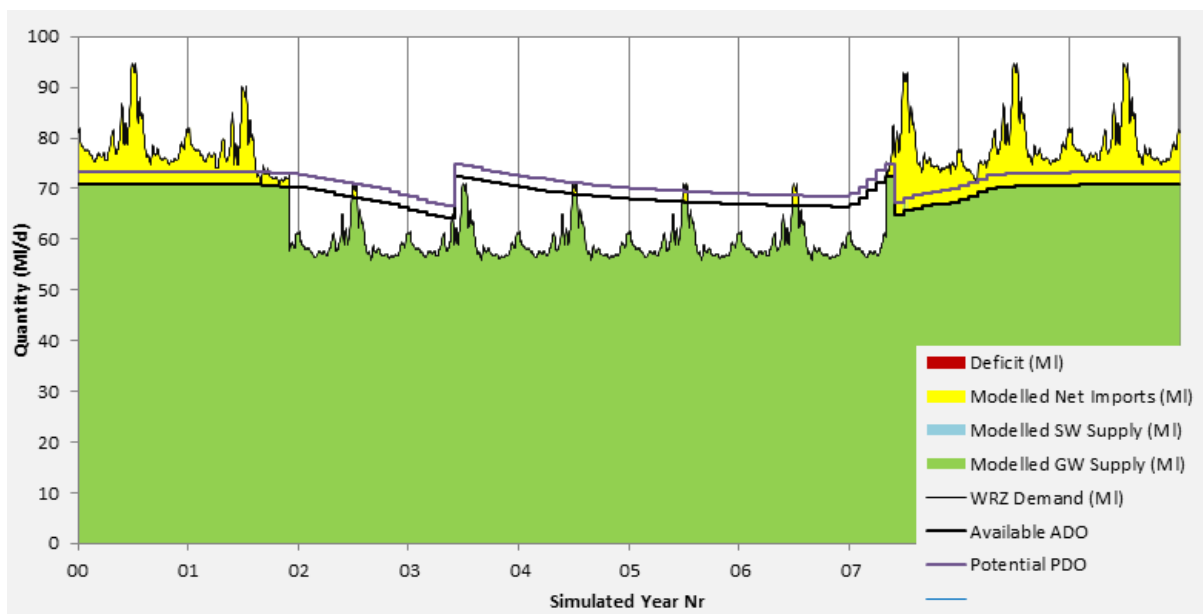


Figure A3.14: WRZ5 Example utilisation

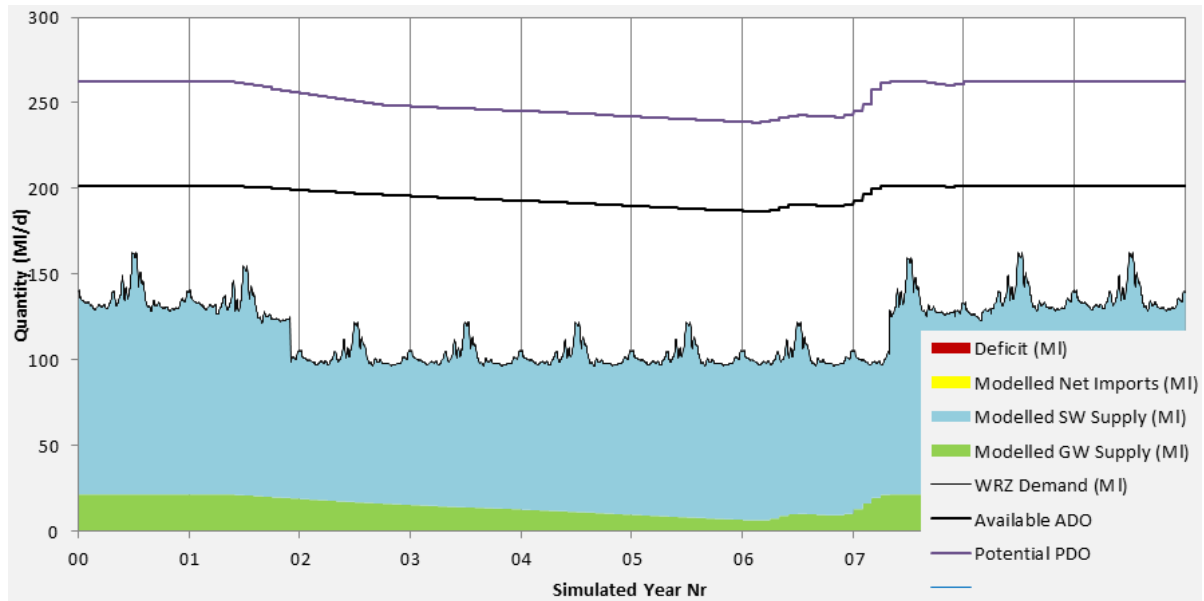


Figure A3.15: WRZ6 Example utilisation

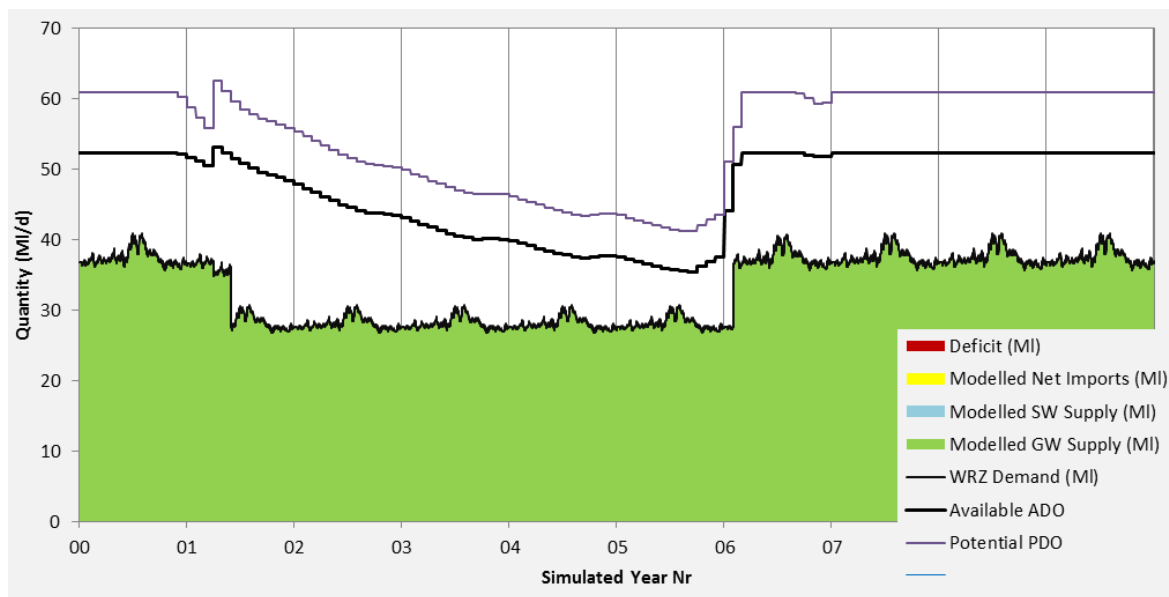


Figure A3.16: WRZ7 Example utilisation

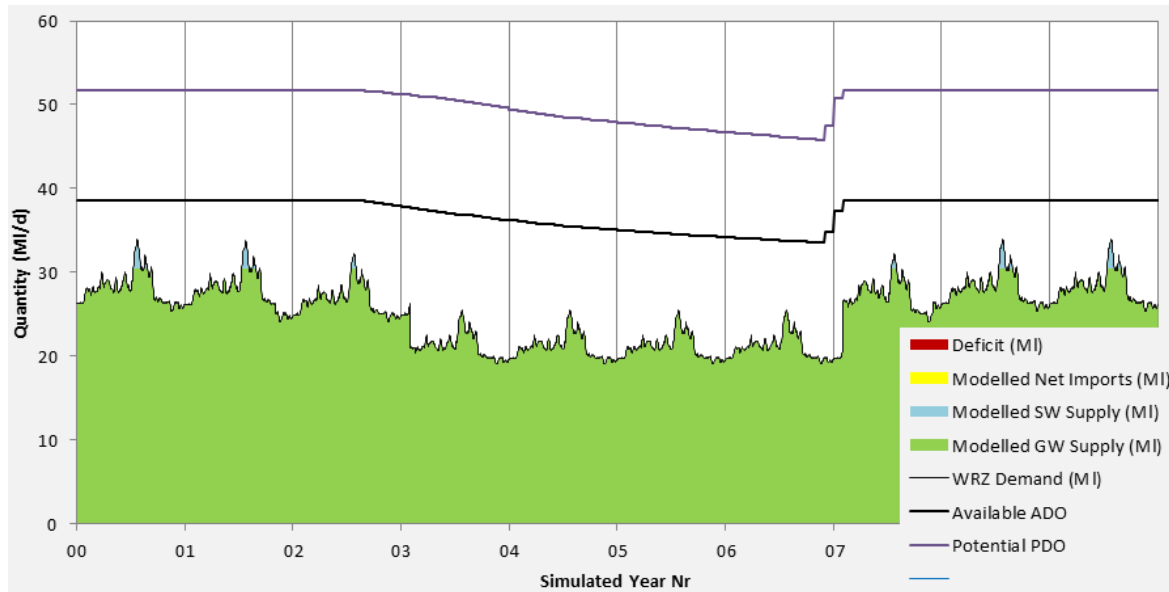


Figure A3.17: WRZ8 Example utilisation

A3.7 Examples of worked drought scenarios and associated drought management actions

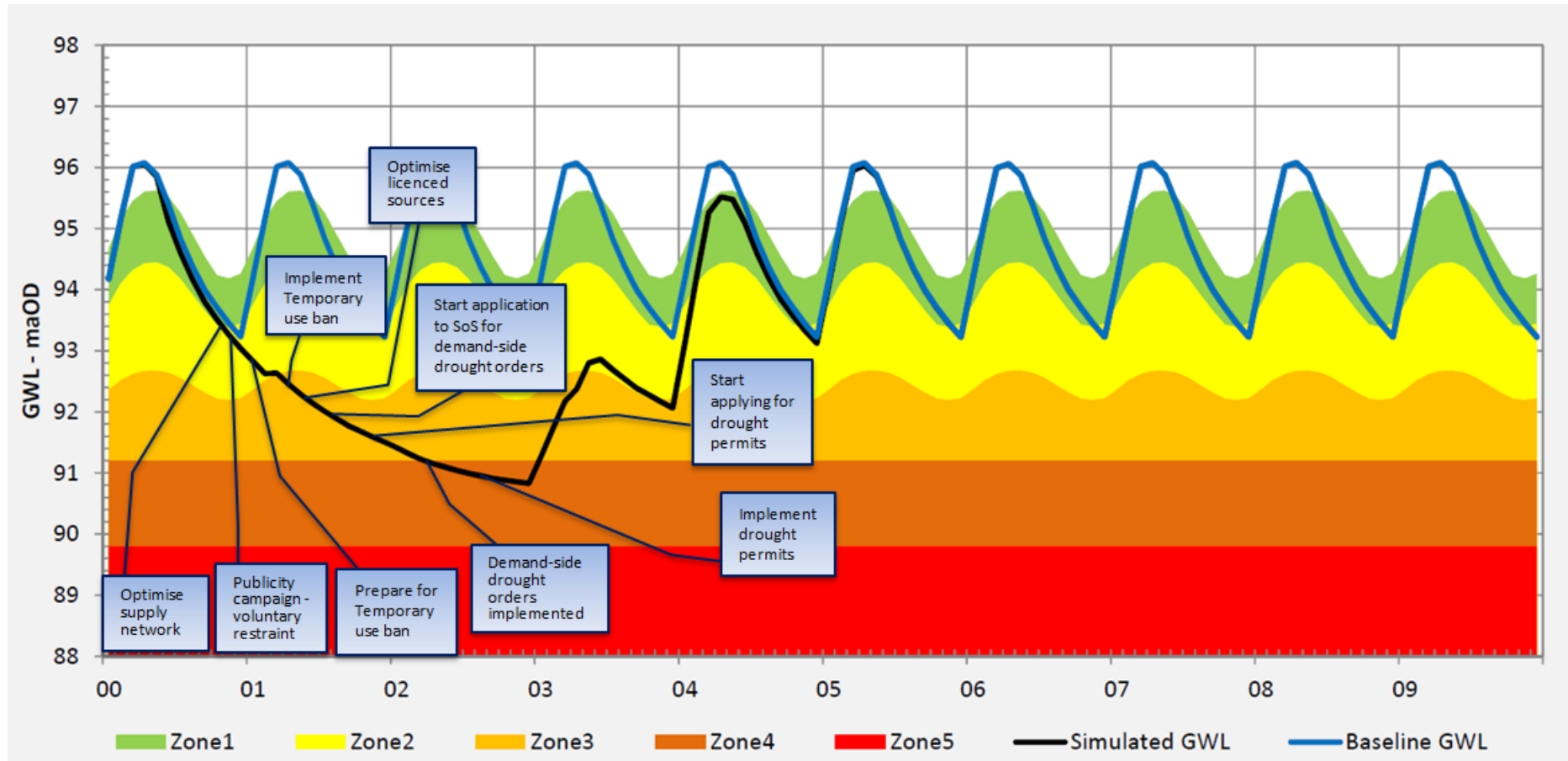


Figure A3.18 Worked scenario example showing timeline of actions associated with a developing drought. This shows an April drought start with 30% rainfall deficit, 24 month drought. This is representative of a severe historic drought (estimated approximately a 1 in 50 year event)

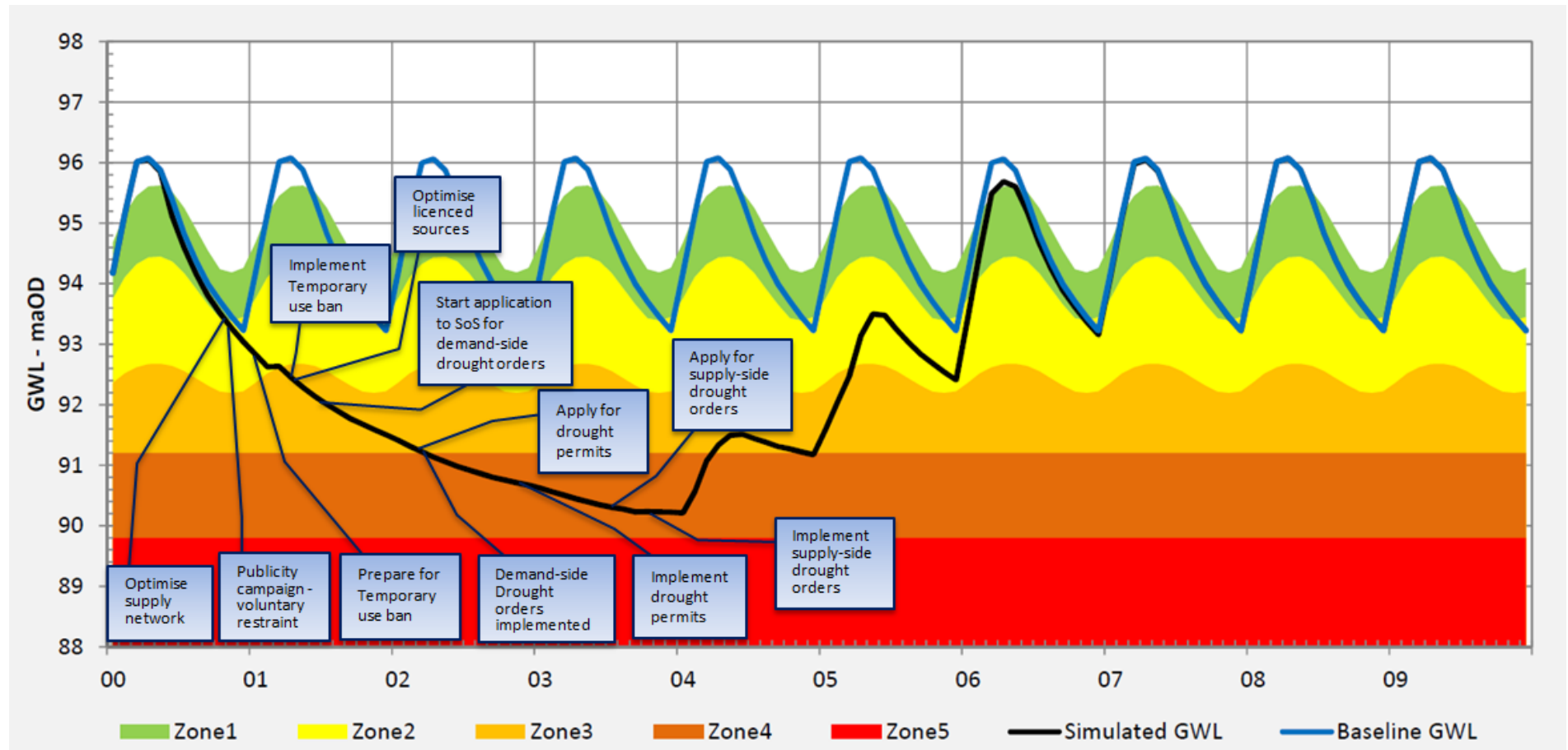


Figure A3.19 Worked scenario example showing timeline of actions associated with a developing drought. This shows an April drought start, with 30% rainfall deficit, 42 month drought. This is representative of a plausible drought more severe than in the historic record (estimated approximately 1 in 200 year event)

A3.8 Hydrograph analysis rise in groundwater levels

The two sets of data used to conduct hydrograph analysis work are:

- Rainfall return periods – obtained from the Oxford Rainfall Data set
- Actual recorded groundwater levels at Lilley Bottom Observation Borehole

The Oxford rainfall set was used as it has rainfall records from 1853. These were compared with MORECS rainfall (squares 151 and 152) and a good fit (82%) was determined for the recharge period and thus have been used to determine the return period for the recharge season in our recharge area.

The absence of long term records of operational borehole performance prevents comparison with droughts before 1976. Whilst there are long term observation borehole groundwater level sequences, it is not possible to correlate these with fluctuations in levels in operational boreholes without pumping data from historic drought events. As a result we have selected data from between 1980 and 2010 to be analysed.

For each year, the total rise in groundwater levels was recorded. A monthly breakdown of actual water levels was noted during this period of total rise and then a calculation of the rise per month was undertaken. The average rainfall return period was then plotted against the relevant year. This enabled us to plot a linear graph (Figure A3.17) demonstrating the correlation between percentage of rainfall and rise in water level. This relationship supports the methodology underpinning the hydrograph analysis that volumes of rainfall are approximately proportionate to levels of recharge, to a reasonable degree of confidence.

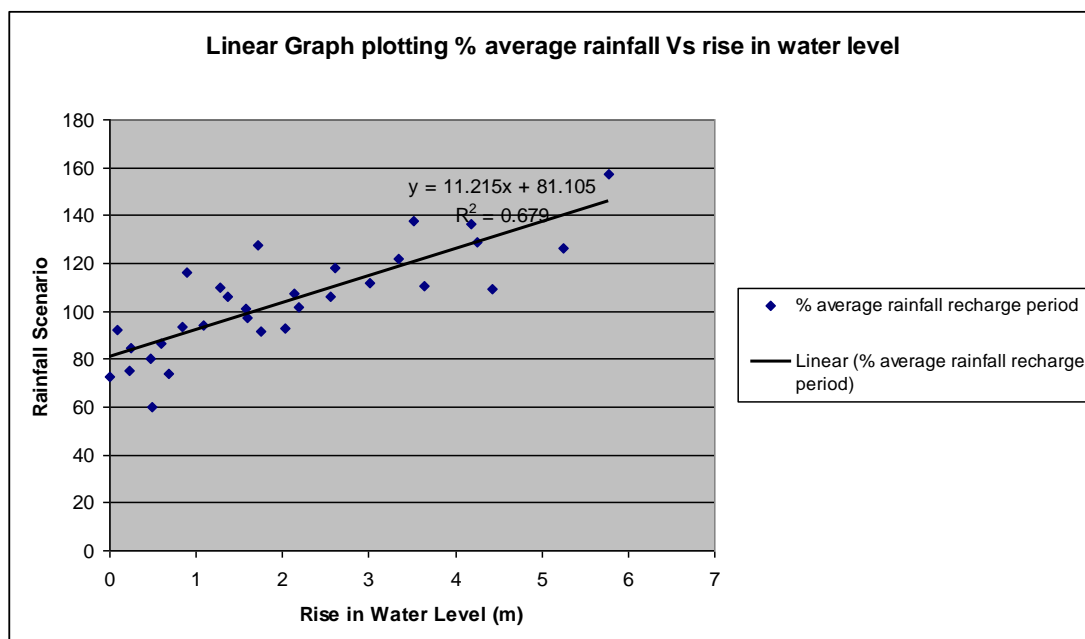


Figure A3.20 Linear graph plotting percentage average rainfall Vs rise in water level

For the available water level record, years were selected to represent the water level changes associated with the different return periods. The four rainfall scenarios that were selected for the hydrograph analysis work are outlined in table A3.1. The analysis work to generate the water level readings is outlined in Table A3.2.

Table A3.1 Four rainfall scenarios selected for analysis

Rainfall Scenario (%)	Recharge Year
130	1992/1993
120	2002/2003
80	1990/1991
60	1991/1992

Table A3.2 Analysis of rises in groundwater levels during four selected years

Rainfall Scenario		80%	60%	130%	120%
Year		1991	1992	1993	2003
RECORDED WATER LEVEL (M)					
September				92.02	
October				92.72	
November				93.75	
December				94.62	94.98
January		92.94		96.08	96.54
February	96.25	93.01	92.24	96.92	98.3
March	96.57	93.07	92.24	97.27	98.32
April	96.83	93.34			98.32
May	97.09	93.42			
June					
July					
Total rise	0.84	0.48	0	5.25	3.34
Average Month rise	0.28	0.16	0	0.875	0.835
CHANGE IN WATER LEVEL (M)					
September					
October				0.7	
November				1.03	
December				0.87	
January				1.46	1.56
February		0.07		0.84	1.76
March	0.32	0.06	0	0.35	0.02
April	0.26	0.27			0
May	0.26	0.08			
June					
July					

We have transposed the actual level of water rise per month and when the rise occurred for the 80% and 60% scenario onto a hypothetical starting water level situation to forecast two different scenarios. During the months when there is no water level rise we have assumed that groundwater levels are declining using an average monthly figure, as described in A3.8. This allowed an artificial hydrograph to be constructed to cover the different return periods. These hypothetical water sequences have been superimposed on the drought curves and indicate when and for how long we will be in any of the drought zones. The rainfall scenarios have been applied over a single, multi and long term periods.

A3.9 Hydrograph analysis fall in groundwater levels

The two sets of data used to conduct the hydrograph analysis work are:

- Rainfall return periods – obtained from the Oxford Rainfall Data set
- Actual recorded groundwater levels at Lilley Bottom Observation Borehole

The absence of long term records of operational borehole performance prevents comparison with droughts before 1976. Whilst there are long term observation borehole groundwater level sequences, it is not possible to correlate these with fluctuations in levels in operational boreholes without pumping data from historic drought events. As a result, we have selected data from between 1980 and 2010 to be analysed.

For each year, the total decline in groundwater levels was recorded. A monthly breakdown of actual water levels was noted during this period of total decline and then a calculation of the decline per month was undertaken. The average rainfall return period was then plotted against the relevant year. A linear graph was plotted, demonstrating that there is poor confidence in the correlation between percentage of rainfall and drop in water level (Figure A3.18).

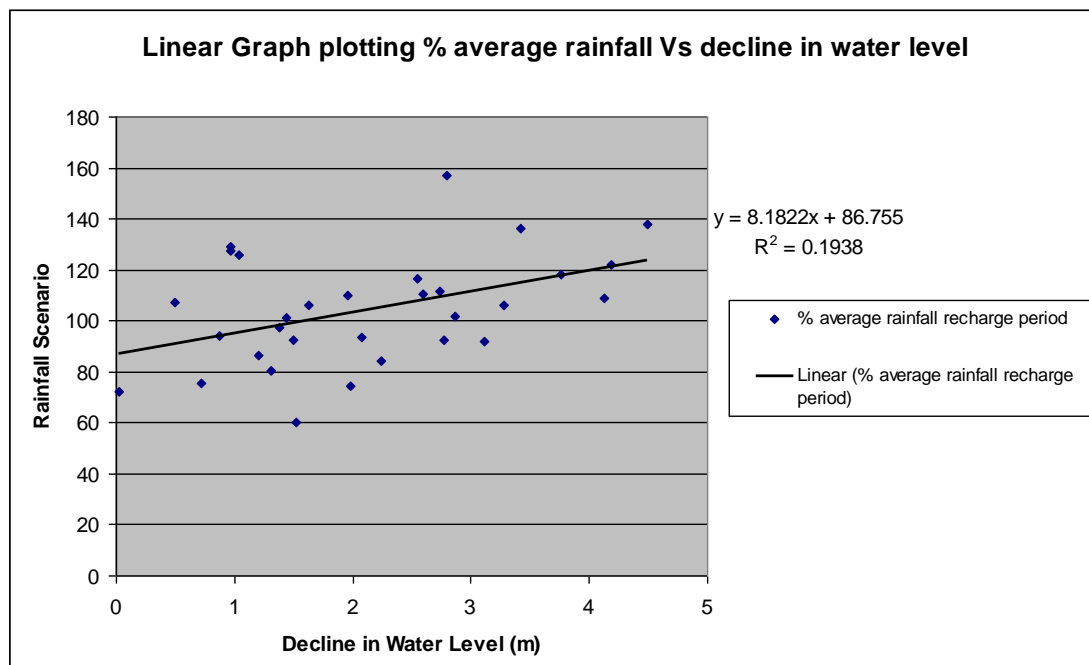


Figure A3.21 Linear Graph plotting % average rainfall vs decline in water level

A line graph was plotted comparing groundwater level declines over different years (Figure A3.3). The pattern highlights the fact that the rate of decline remains consistent regardless of summer rainfall and starting water level. Average monthly decline figures were then calculated over the last twenty years (only using the months where there has been a decline). These monthly average decline figures have then been applied to each rainfall scenario, fitting around months in which groundwater levels rise, which is related to the amount of rainfall. A more detailed breakdown of these figures is highlighted in Table A3.3.

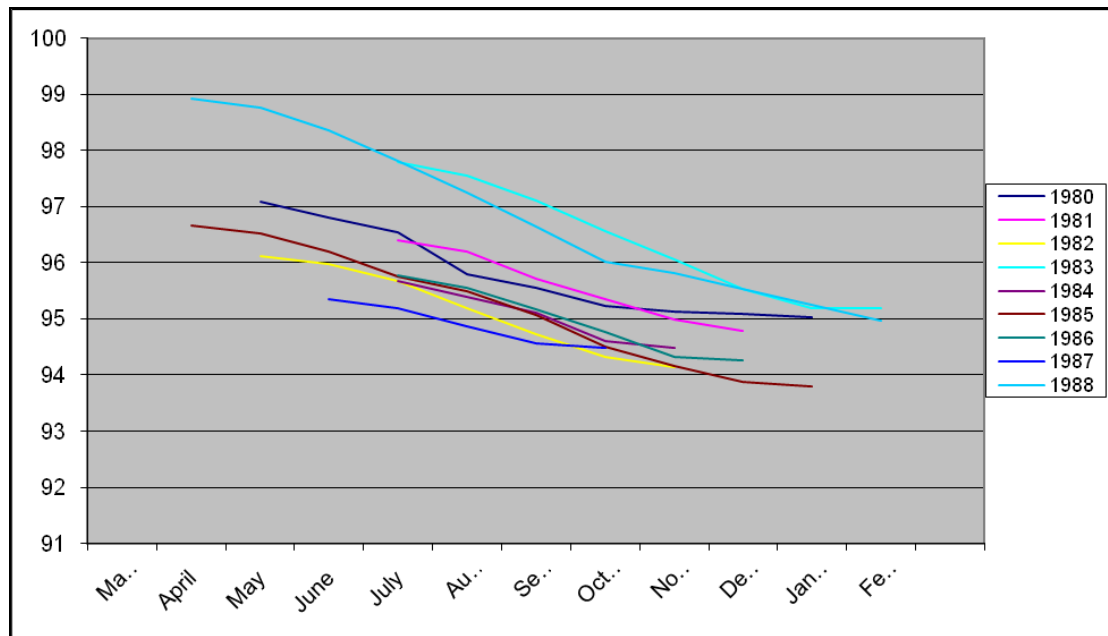


Figure A3.22: Example of similarity in rates of groundwater decline over different years

Table A3.3 Average monthly rate of groundwater decline between 1980-2011

Month	Average Decline
April	0.140
May	0.125
June	0.300
July	0.480
August	0.290
September	0.390
October	0.300
November	0.200
December	0.150
January	0.050
February	0.010
March	0.085

Appendix 4 Drought Management Actions

A4.1 Demand options during a drought

A4.2 Customer Representation Form

A4.3 Activities covered by Temporary Use Ban restrictions

A4.4 Activities covered by Drought Direction 2011 restrictions

A4.1 Demand options during drought

Table A4.1 Demand management actions during a drought

Details of action we'll take	Trigger for this action	Drought event return period (In years)	Estimated saving in demand	Location	Implementation timetable (time from trigger to implementation)	Time of Year	Duration of actions	Any permissions or constraints	Risks associated with action
Raise awareness of dry weather situation and appeal for voluntary reductions in water usage	DTZ 2	Approximately 1 in 5	Unknown	Whole supply zone	DMG will convene upon entering DTZ 2 - will be responsible for deciding time of implementation.	Usually implemented during summer months.	Likely to remain in place over summer months	DMG and Board?	Potential of not reaching all customers
Enhance leakage activity	DTZ 3	Approximately 1 in 10	Unknown	Whole supply zone	1 week preparation time	Any time of year	Duration of drought	DMG and Board	Cost implications - reducing repair times to lower leakage is complex. Also potential increased disruption to Highways and Byways.
Implement Temporary Use Ban restrictions as per the Water Industry Act 1991, Section 76, covering 11 categories of use relating to hosepipes	DTZ 3	1 in 10	3%	Whole supply zone	After entering DTZ 3, DMG will consider when to implement TUBs, depending on the time of year. 1 week preparation, 2 weeks for representations.	We are most likely to impose TUB restrictions over the summer when they will have the greatest impact on demand.	Duration of restrictions dependent on drought situation.	DMG and Board	Principally impacts on domestic customers. Possible beneficial impacts on environment due to reductions in demand.
Implement drought orders to restrict usage of water for those categories set out in Drought Direction 2011	DTZ 3/4	1 in 40	5%	Whole supply zone	Eight weeks preparation time - prior to entering DTZ 4. Application to Secretary of State to be submitted when approaching DTZ 4, 28 days for decision to be made (assuming no objections)	Any time of year	Drought orders valid for six months	Approval from DMG and Board, permission required from Secretary of State	Economic implications associated with restricted water use for some businesses.

A4.2 Temporary Use Restrictions Representation Form

Customer Representation Form

Name

Address

.....

Date

1. Is the representation on the grounds of Health and Safety? (please circle)

YES

NO

2. If not, what is the representation on the grounds of?

.....

3. Which restriction is the representation referring to?

.....

4. Please provide details on the reason for the representation

.....

.....

FOR OFFICE USE ONLY		
Representation Approved	YES	NO
Comments	
Date	
Approved by	
	

A4.3 Activities covered by temporary bans under the Flood and Water Management Act 2010

This section was updated in light of the 2011-2012 drought, following the development of the Water UK Code of Practice¹. The table below lists the restriction categories that may be used to manage a drought if temporary bans on water usage are imposed.

Figure	Activity/Title
A4.3	Watering a garden using a hosepipe
A4.4	Cleaning a private-motor-vehicle using a hosepipe
A4.5	Watering plants on domestic or other non-commercial premises using a hosepipe
A4.6	Cleaning a private leisure boat using a hosepipe
A4.7	Filling or maintaining a domestic swimming or paddling pool
A4.8	Drawing water, using a hosepipe, for domestic recreational use
A4.9	Filling or maintaining a domestic pond using a hosepipe
A4.10	Filling or maintaining an ornamental fountain
A4.11	Cleaning walls, or windows, of domestic premises using a hosepipe
A4.12	Cleaning non-domestic premises
A4.13	Cleaning paths or patios using a hosepipe

Note the following information applies to these activities:

Legislation:

All eleven activities are covered by the Water Industry Act 1991 section 76 as amended by the FWMA 2010 s36 (i.e. temporary water use bans).

Programme:

TUBs are constrained by advertising in at least two newspapers relevant to the location and our website. 2-3 weeks.

The following definitions apply to these activities:

“Using a hosepipe”

The Water Use (Temporary Bans) Order 2010 provides the definition of “using a hosepipe” in relation to the WIA 1991 as including:

- a) Drawing relevant water through a hosepipe from a container and applying it for the purpose; and
- b) Filling or partly filling a container with relevant water by means of a hosepipe and applying it for the purpose.

A reference to a hosepipe includes anything designed, adapted or used for the same purpose as a hosepipe.

“Relevant water”

Refers to mains water i.e. supplied by the water undertaker; it does not include water supplied before the water use restriction was implemented.

¹ Water UK, 2013, *Managing through Drought: Code of Practice and Guidance for Water Companies on Water use Restrictions [incorporating lessons from the 2011-12 drought]*

A4.3 – Watering a garden using a hosepipe

DEFINITIONS

The category of activity under the temporary water use ban powers is “**watering a garden using a hosepipe**”. It does **not** include using a hosepipe to water a garden for **health or safety** reasons.

Gardens

The Water Use (Temporary Bans) Order 2010 provides the definition of “a garden” as **including**:

- a) a park;
- b) gardens open to the public;
- c) a lawn;
- d) a grass verge;
- e) an area of grass used for sport or recreation;
- f) an allotment garden;
- g) any area of an allotment used for non-commercial purposes;
- h) any other green space.

“A garden” does **not include** the following:

- a) agricultural land;
- b) other land used in the course of a business for the purposes of growing, for sale or commercial use, any crops, fruit, vegetables or other plants;
- c) land used for the purposes of a National Plant Collection;
- d) a temporary garden or flower display;
- e) plants (including plant organs, seeds, crops and trees) which are in an outdoor pot or in the ground, under cover.

“**Allotment gardens**” are defined in section 22(1) of the Allotments Act 1922.

“**Agricultural land**” is as defined in section 109(1) of the Agriculture Act 1947.

“**National Plant Collection**” means a plant collection which is part of the National Council for the Conservation of Plants and Gardens’ National Plant Collection scheme.

“**Outdoor pot**” means a pot or other container that is outdoors or under cover.

“**Under cover**” means in a greenhouse or outbuilding or under a permanent canopy.

“Temporary garden or flower display” means those at a show or exhibition; and on public display for a period not exceeding 7 days.

“Grow” includes cultivate or propagate.

MESSAGES

Customers may water their gardens:

- By hand, using a bucket or watering can.
- With greywater through a hosepipe.
- Using rainwater from a water butt by hand or through a hosepipe.

The Turf Growers Association advises that established turf (>28 days old) does not require watering.

Public Sector

Under the Water Act 2003, public authorities have a water conservation duty and arguably should not wait until restrictions come into force before taking water conservation measures.

Storage tanks

Water drawn from the mains supply into tanks (other than hand held receptacles) for subsequent use for watering private gardens, lawns and landscaped areas via a hosepipe is not permitted.²

Methods for recycling water or finding water from alternative sources should be encouraged for those concerned about the financial implications of not being able to use mains water³.

Sports Pitches

Watering areas of grass used for sport or recreation using a hosepipe are covered under this activity. This includes all sports pitches or similar such as cricket and football pitches, bowling greens, horseracing tracks and golf courses. It applies to both publically and privately owned facilities; both can be large users of water but some may have private water supplies for watering sports pitches. Watering for health or safety reasons is exempt from the legislation. Sports pitches can still be watered using other sources of water and innovative recycling methods can be encouraged.

² Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

³ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

EXEMPTIONS & CONCESSIONS
<p>A statutory exemption exists in The Water Use (Temporary Bans) Order 2010 for the watering of gardens in respect of health or safety (see Section 5.7 of this report for further detail). This includes:</p> <ul style="list-style-type: none"> a) removing or minimising any risk to human or animal health or safety; and b) preventing or controlling the spread of causative agents of disease.

Figure A4.4 – Cleaning a private motor-vehicle using a hosepipe
DEFINITIONS
<p>The category of activity under the temporary water use ban powers is “cleaning a private motor-vehicle using a hosepipe”.</p> <p>The Water Use (Temporary Bans) Order 2010 defines “a private motor-vehicle” as:</p> <ul style="list-style-type: none"> a) a mechanically propelled vehicle designed, constructed or adapted for use on roads; or b) a trailer designed, constructed or adapted for attachment to a vehicle falling under (a). <p>The definition does not include:</p> <ul style="list-style-type: none"> i) a public service vehicle, as defined in section 1 of the Public Passenger Vehicles Act 1981; and ii) a goods vehicle, as defined in section 192 of the Road Traffic Act 1988. <p>Interpretation</p> <p>Taxis and minicabs are public service vehicles and so are not subject to bans⁴.</p>
MESSAGES
<p>Important positive messages:</p> <ul style="list-style-type: none"> - Customers can still wash their cars (including lights and windows) by hand using water from a bucket. - Customers can use commercial carwashes (that don’t use a hosepipe or similar apparatus), for example at garages. - Customers can wash their cars with a hosepipe connected to a rainwater or greywater source (e.g. bathwater diverted to a receptacle for subsequent use). <p>Storage tanks</p> <p>Water drawn from the mains supply into tanks (other than hand held receptacles) for subsequent use for vehicle washing via a hosepipe is not permitted⁵.</p>

⁴ Consultation on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

⁵ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

Restrictions apply to water drawn from the mains supply after the statutory notice has been given. So water drawn into a container prior to that date may be used for washing cars, regardless of whether that use involves a hosepipe⁶.

EXEMPTIONS & CONCESSIONS

None

Figure A4.5 – Watering plants on domestic or other non-commercial premises using a hosepipe

DEFINITIONS

The category of activity under the temporary water use ban powers is “**watering plants on domestic or other non-commercial premises using a hosepipe**”.

The definition applies only to the watering of plants which are in an **outdoor pot or in the ground, under cover**.

It **does not include** watering plants:

- i) grown or kept for sale or commercial use, or
- ii) that are part of a National Collection or temporary garden or flower display (see Figure A4.1 for definitions).

“**Domestic or other non-commercial premises**” means

a) any land, building or other structure used or enjoyed in connection with the use of any of the following which is used principally as a dwelling:

- i) a building or part of a building;
- ii) a caravan;
- iii) a boat; or

b) any land or premises which is not used principally for the purposes of a business.

“**Plants**” includes plant organs, seeds, crops and trees.

“**Grow**” includes cultivate or propagate.

MESSAGES

Customers may water their gardens:

- By hand, using a bucket or watering can.
- With greywater through a hosepipe.

⁶ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

- Using rainwater from a water butt by hand or through a hosepipe.

Storage tanks

Water drawn from the mains supply into tanks (other than hand held receptacles) for subsequent use for watering private gardens, lawns and landscaped areas via a hosepipe is not permitted.⁷

Methods for recycling water or finding water from alternative sources should be encourage for those concerned about the financial implications of not being able to use mains water⁸.

Public Sector

Under the Water Act 2003, public authorities have a water conservation duty and arguably should not wait until restrictions come into force before taking water conservation measures.

EXEMPTIONS & CONCESSIONS

None

Figure A4.6 – Cleaning a private leisure boat using a hosepipe

DEFINITIONS

The category of activity under the temporary water use ban powers is “**cleaning a private leisure boat using a hosepipe**”.

“**Private leisure boat**” means a vessel or other thing, other than a seaplane, which is designed, constructed or adapted to move through, in, on or over water.

The definition does **not** refer to such vessels:

- used in the course of a business; or
- made available or accessible to the public.

The definition of the activity **does not include**:

- cleaning of any area of a private leisure boat which, except for doors or windows, is enclosed by a roof and walls; and
- using a hosepipe to clean a private leisure boat for **health or safety** reasons.

Interpretation:

Boats in private ownership only are included, whether trailer launched or not⁹. The

⁷ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

⁸ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

definition extends to small watercraft such as canoes, kayaks, jet skis etc. In naval terms, a boat is small enough to be carried on another vessel (a ship). It is interpreted that ships and other large vessels such as cruise liners are normally used for commercial purposes so are not expected to come under this definition.

MESSAGES

Customers may wash such boats and vessels by hand, using a bucket.

The use of recycled water or rainwater is encouraged¹⁰.

EXEMPTIONS & CONCESSIONS

A statutory exemption exists in The Water Use (Temporary Bans) Order 2010 for the cleaning of private leisure boats in respect of **health or safety** (see Section 5.7 of this report for further detail). This includes:

- a) removing or minimising any risk to human or animal health or safety; and
- b) preventing or controlling the spread of causative agents of disease.

Biosecurity concerns associated with the reduced washing of boat hulls, such as the introduction of non-native species to the UK, are therefore covered under this exemption.

Figure A4.7 – Filling or maintaining a domestic swimming or paddling pool

DEFINITIONS

The category of activity under the temporary water use ban powers is “**filling or maintaining a domestic swimming or paddling pool**”.

The Water Use (Temporary Bans) Order 2010 defines **domestic swimming or paddling pool** as a swimming or paddling pool, other than a pool that is being used for the purposes of a business, which is:

- a) in a building or part of a building used principally as a dwelling; or
- b) on any land or in any building that is used or enjoyed in connection with (a).

The definition **excludes** filling or maintaining a pool:

- a) where necessary in the course of its construction;
- b) using a hand-held container filled with water drawn directly from a tap;
- c) that is designed, constructed or adapted for use in the course of a programme of medical treatment;

⁹ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

¹⁰ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

- d) used for the purpose of decontaminating animals from infections or disease;
- e) used in the course of a programme of veterinary treatment;
- f) in which fish or other aquatic animals are being reared or kept in captivity.

Interpretation:

No formal definition of a swimming or paddling pool is provided but the intention appears to capture all pools that have a primary use that is not personal washing. No minimum size is specified. The restriction includes permanent and temporary facilities and whole or partial filling.

MESSAGES

Customers may fill swimming and paddling pools by hand, using a bucket.

Customers may choose to use a public swimming pool as an alternative to a private pool. Public pools are not covered by this restriction.

Use of alternative water sources, including rainwater, is permitted.

Backwashing of swimming pool filters is not covered by these powers; it is the topping up of the pool to replace lost water that is covered.

EXEMPTIONS & CONCESSIONS

A number of statutory exemptions are defined for this activity (see definitions above).

Figure A4.8 – Drawing water, using a hosepipe, for domestic recreational use

DEFINITIONS

The Water Use (Temporary Bans) Order 2010 states that this activity refers to **“drawing water, using a hosepipe, to operate water slides or other recreational equipment”**.

“Domestic recreational use” means:

- a) recreational use in connection with a domestic swimming or paddling pool; or
- b) recreational use on land that is used or enjoyed in connection with a building, or part of a building, used principally as a dwelling, other than for the purposes of a business.

Interpretation:

This is interpreted to mean both slides designed to be used with water and any temporary or “ad-hoc” water slides or sprinklers. It is taken to refer to recreational use for both children and adults.

MESSAGES

Customers may use a bucket to fill similar recreational equipment, for example to enable children to play. Filling of recreational toys directly from a tap is not included.

Many Local Authorities have recreational facilities for children in particular as part of their parks.

EXEMPTIONS & CONCESSIONS

None

Figure A4.9 – Filling or maintaining a domestic pond using a hosepipe

DEFINITIONS

“Domestic ponds” are defined by the Water Use (Temporary Bans) Order 2010 as a pond, including a swimming pond, on land that is used in connection with a building, or part of a building, used principally as a dwelling; and is not being used for the purposes of a business.

The activity **does not include** filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity.

Interpretation:

The definition of both domestic and non-domestic ponds is interpreted to include both manmade and natural ponds of any size.

It is assumed that the definition of both domestic and non-domestic ponds refer to both outdoor and indoor ponds including ornamental ponds.

The activity covers both the filling and the topping up of these ponds.

MESSAGES

All ponds can be filled by the use of buckets.

The use of rainwater or other alternative (non-potable) sources is permitted.

EXEMPTIONS & CONCESSIONS

Ponds in which fish and other aquatic animals are kept are exempt from this activity (see above for definition).

Figure A4.11 – Cleaning walls, or windows, of domestic premises using a hosepipe

DEFINITIONS

The category of activity under the temporary water use ban powers is “**cleaning walls, or windows, of domestic premises using a hosepipe**”.

The Water Use (Temporary Bans) Order 2010 defines this category as applying only to the cleaning of the **external walls or windows of domestic premises**.

The definition **excludes** cleaning activities for **health or safety** reasons.

“**Domestic premises**” under this activity means:

- a) a building used principally as a dwelling or dwellings;
- b) a garage, shed, outbuilding or other building or structure used or enjoyed in connection with a building used principally as a dwelling; or
- c) a wall or other means of enclosure within the curtilage of a building used principally as a dwelling.

Interpretation:

This is interpreted to relate to all domestic building structures, whether they are permanent or temporary. Roofs are not interpreted as being covered, other than with respect to sky-light or similar windows. Domestic roofs are specifically covered under the Water Use (Temporary Bans) Order 2010 activity of ‘cleaning other artificial outdoor surfaces using a hosepipe’ (see Figure A4.13).

MESSAGES

Customers may clean building walls and windows by hand, using a bucket.¹¹

If a building can be cleaned by permanent plumbing then it is still a permitted activity.

Storage tanks

Restrictions apply to water drawn from the mains supply after the statutory notice has been given. So water drawn into a container prior to that date may be used for cleaning the exterior of buildings¹².

Greywater and rainwater may be used to clean walls or windows.

Water fed poles are frequently used by window cleaners and are considered within the definition of ‘anything designed, adapted or used to serve the same purpose as a hosepipe’. These systems use de-ionised water. Where mains water is the source used to create this de-ionised water, this activity is restricted.

EXEMPTIONS & CONCESSIONS

A statutory exemption exists in The Water Use (Temporary Bans) Order 2010 for the

¹¹ Consultation on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

¹² Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

cleaning of domestic walls or windows in respect of **health or safety** (see Section 5.7 of this report for further detail). This includes:

- a) removing or minimising any risk to human or animal health or safety; and
- b) preventing or controlling the spread of causative agents of disease.

The grounds for an exemption for these purposes are considered to be rare – perhaps linked to accidents and incidents. Washing windows at height by hand should be minimised in order to reduce the risk of falls from height (Work at Height Regulations 2005).

Figure A4.12 – Cleaning paths or patios using a hosepipe

DEFINITIONS
<p>The category of activity under the temporary water use ban powers is “cleaning paths or patios using a hosepipe”.</p> <p>The definition excludes cleaning paths or patios using a hosepipe for health or safety reasons.</p> <p>Interpretation:</p> <p>It is interpreted to include the cleaning by hosepipe of all paths or patios regardless of who is undertaking the cleaning and whether they are domestic or commercial¹³. It is interpreted that this would include paths and patios made of any material such as concrete, paving slabs, stones, permeable paving etc.</p>
MESSAGES
<p>Customers can sweep paths or patios and they may wash them by hand using a bucket.</p>
EXEMPTIONS & CONCESSIONS
<p>A statutory exemption exists in The Water Use (Temporary Bans) Order 2010 for the cleaning of paths and patios in respect of health or safety (see Section 5.7 of this report for further detail). This includes:</p> <ul style="list-style-type: none"> a) removing or minimising any risk to human or animal health or safety; and b) preventing or controlling the spread of causative agents of disease.

Figure A4.13 – Cleaning other artificial outdoor surfaces using a hosepipe

DEFINITIONS

¹³ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

The category of activity under the temporary water use ban powers is “**cleaning other artificial outdoor surfaces using a hosepipe**”.

The definition **excludes** cleaning an outdoor surface using a hosepipe for **health or safety** reasons.

“**Artificial outdoor surface**” means any of the following:

- a) any area outdoors which is paved or laid with hard or artificial material;
- b) timber decking;
- c) a quay;
- d) a trailer designed, constructed or adapted to launch boats or other vessels or craft into water, other than a private motor-vehicle (see Figure A4.4);
- e) the roof of any domestic premises.

“**Quay**” includes jetty, pontoon, wharf and slipway.

Interpretation:

It is interpreted to include the cleaning by hosepipe of all exterior surfaces, regardless of who is undertaking the cleaning and whether they are domestic or commercial¹⁴.

This includes driveways (both domestic and non-domestic); and marine infrastructure such as pontoons and slipways, whether fixed permanently in position or floating¹⁵.

MESSAGES

Customers can sweep outdoor surfaces and they may wash them by hand using a bucket.

EXEMPTIONS & CONCESSIONS

A statutory exemption exists in The Water Use (Temporary Bans) Order 2010 for the cleaning of artificial outdoor surfaces using a hosepipe in respect of **health or safety** (see Section 5.7 of this report for further detail). This includes:

- a) removing or minimising any risk to human or animal health or safety; and
- b) preventing or controlling the spread of causative agents of disease.

¹⁴ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

¹⁵ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

A4.4 Activities covered by ordinary drought orders under the Water Resources Act 1991 and defined in the Drought Direction 2011

The table below lists the restriction categories that may be used to manage a drought if drought orders **under the Water Resources Act 1991 and defined in the Drought Direction 2011** are imposed.

Figure	Activity/Title
A4.14	Watering outdoor plants on commercial premises
A4.15	Filling or maintaining a non-domestic swimming or paddling pool
A4.16	Filling or maintaining a pond
A4.17	Cleaning non-domestic premises
A4.18	Cleaning a window of a non-domestic building
A4.19	Operating a mechanical vehicle-washer
A4.20	Cleaning any vehicle, boat, aircraft or railway rolling stock
A4.21	Cleaning industrial plant
A4.22	Suppressing dust
A4.23	Operating cisterns

Note the following information applies to these activities:

Legislation:

All ten drought orders are covered under the Water Resources Act 1991, as defined in the Drought Direction 2011.

Programme:

Constrained by application to the Secretary of State and a notice period. Approx. 8-12 weeks.

The following definitions apply to these activities:

“Using a hosepipe”

The Water Use (Temporary Bans) Order 2010 provides the definition of “using a hosepipe” in relation to the WIA 1991 as including:

- a) Drawing relevant water through a hosepipe from a container and applying it for the purpose; and
- b) Filling or partly filling a container with relevant water by means of a hosepipe and applying it for the purpose.

A reference to a hosepipe includes anything designed, adapted or used for the same purpose as a hosepipe.

“Relevant water”

Refers to mains water i.e. supplied by the water undertaker; it does not include water supplied before the water use restriction was implemented.

Figure A4.14 – Watering outdoor plants on commercial premises
DEFINITIONS
<p>The activity coming under ordinary drought order powers is defined in the Drought Direction 2011 as “watering outdoor plants on commercial premises using a hosepipe” which covers the following:</p> <ul style="list-style-type: none"> i) plants which are in a pot or other container that is outdoors or under cover; ii) plants which are in the ground under cover. <p>The activity does not include watering plants that are:</p> <ul style="list-style-type: none"> i) grown or kept for sale or commercial use; or ii) part of a National Collection or temporary garden or flower display (see Figure A4.3 for definitions). <p>“Commercial premises” means any land, building, other structure or premises not being domestic or other non-commercial premises within the meaning of the temporary use ban</p> <p>“Grown” includes cultivated or propagated.</p> <p>“Plants” includes plant organs, seeds, crops and trees.</p> <p>“Under cover” means in a greenhouse or outbuilding or under permanent canopy.</p>
MESSAGES
<p>Customers may water their gardens:</p> <ul style="list-style-type: none"> - By hand, using a bucket or watering can. - With greywater through a hosepipe. - Using rainwater from a water butt by hand or through a hosepipe. <p>Storage tanks</p> <p>Water drawn from the mains supply into tanks (other than hand held receptacles) for subsequent use for watering private gardens, lawns and landscaped areas via a hosepipe is not permitted.¹⁶</p> <p>Methods for recycling water or finding water from alternative sources should be encourage for those concerned about the financial implications of not being able to use mains water¹⁷.</p>

¹⁶ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

Public Sector

Under the Water Act 2003, public authorities have a water conservation duty and arguably should not wait until restrictions come into force before taking water conservation measures. Public sector actions such as not watering plants in public places will convey a clear message to public about the need to conserve supplies¹⁸.

EXEMPTIONS & CONCESSIONS

None

Figure A4.15 – Filling or maintaining a non-domestic swimming or paddling pool

DEFINITIONS

The water use purpose coming under ordinary drought order powers is **“filling or maintaining a non-domestic swimming or paddling pool”**.

The Drought Direction 2011 defines **non-domestic swimming or paddling pool** as a swimming or paddling pool, other than a domestic swimming or paddling pool as defined and covered by the WIA section 76(2)(e) (see Figure A4.7). The intention is that domestic pools should already have been restricted under temporary water use ban powers before a company seeks a drought order.

The purpose **excludes** filling or maintaining a pool:

- a) that is open to the public;
- b) where necessary in the course of its construction;
- b) using a hand-held container which is filled with water drawn directly from a tap;
- c) that is designed, constructed or adapted for use in the course of a programme of medical treatment;
- d) that is used for the purpose of decontaminating animals from infections or disease;
- e) used in the course of a programme of veterinary treatment;
- f) in which fish or other aquatic animals are being reared or kept in captivity;
- g) that is for use by pupils of a school for school swimming lessons.

“Open to the public”

For the purposes of the exemption (a) above, a pool is **not** open to the public if it may only be used if the user is a paying member of an affiliated club or organisation; i.e. these pools are covered by this restriction.

¹⁷ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

¹⁸ Consultation on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

<p>Interpretation:</p> <p>No formal definition of a swimming or paddling pool is provided but the intention appears to capture all pools that have a primary use that is not personal washing. No minimum size is specified. The restriction includes permanent and temporary facilities and whole or partial filling.</p>
<p>MESSAGES</p>
<p>Customers may fill swimming and paddling pools by hand, using a bucket.</p> <p>Public pools are not covered by the restrictions.</p> <p>Use of alternative water sources, including rainwater, is permitted.</p> <p>Backwashing of swimming pool filters is not subject to these powers.</p>
<p>EXEMPTIONS & CONCESSIONS</p>
<p>A number of statutory exemptions are defined for this activity (see definitions above).</p>

<p>Figure A4.16 – Filling or maintaining a pond</p>
<p>DEFINITIONS</p>
<p>Definitions:</p> <p>“Domestic ponds” are defined by the Water Use (Temporary Bans) Order 2010 as a pond, including a swimming pond, on land that is used in connection with a building, or part of a building, used principally as a dwelling; and is not being used for the purposes of a business.</p> <p>The activity under both types of restriction does not include filling or maintaining a pond in which fish or other aquatic animals are being reared or kept in captivity.</p> <p>Additionally, the Drought Direction 2011 excludes filling or maintaining a pond using a hand-held container which is filled with water drawn directly from a tap.</p> <p>The Drought Direction 2011 activity of ‘filling or maintaining a pond’ excludes filling or maintaining a domestic pond using a hosepipe. The intention is that since this latter activity is already covered specifically by the temporary use ban, it should have been implemented before a drought order is sought.</p> <p>Interpretation:</p> <p>The definition of both domestic and non-domestic ponds is interpreted to include both manmade and natural ponds of any size.</p>

It is assumed that the definition of both domestic and non-domestic ponds refer to both outdoor and indoor ponds including ornamental ponds.

The activity covers both the filling and the topping up of these ponds.

MESSAGES

All ponds can be filled by the use of buckets.

The use of rainwater or other alternative (non-potable) sources is permitted.

EXEMPTIONS & CONCESSIONS

Ponds in which fish and other aquatic animals are kept are exempt from this activity (see above for definition).

Figure A4.17 – Cleaning non-domestic premises

DEFINITIONS

The water use purpose coming under ordinary drought order powers is “**cleaning non-domestic premises**”.

The Drought Direction 2011 provides the definition of this activity as the cleaning of any of the following **using a hosepipe**:

- a) any exterior part of a non-domestic building other than a window;
- b) a non-domestic wall.

It does **not** include the cleaning of any exterior part of a non-domestic building or a non-domestic wall for **health or safety** reasons.

“**Non-domestic building**” is defined in the Drought Direction 2011 as any of the following not being domestic premises:

- a) a building that is not used principally as a dwelling or dwellings;
- b) any other structure.

This definition does **not** include any domestic premises as defined and covered by the Water Use (Temporary Bans) Order 2010 (see Figure A4.11).

“**Non-domestic wall**” means a wall or any other enclosing structure or partition which:

- i) does not form part of a non-domestic building; and
- ii) is not within the curtilage of a domestic building.

Interpretation:

Interpreted to relate to both permanent and temporary buildings and structures.

Interpreted to include building roofs.

MESSAGES

Building cleaning may proceed by hand using water from a bucket.

Greywater and rainwater may be used.

Storage tanks

Restrictions apply to water drawn from the mains supply after the statutory notice has been given, so water drawn into a container prior to that date may be used for cleaning the exterior of buildings¹⁹.

EXEMPTIONS & CONCESSIONS

The Drought Direction 2011 provides a statutory exemption for **health or safety reasons** (see Section 5.7 of this report for further detail). The definition of this includes:

- a) removing or minimising any risk to human or animal health or safety; and
- b) preventing or controlling the spread of causative agents of disease.

The grounds for an exemption for these purposes are considered to be rare – perhaps linked to accidents and incidents.

Figure A4.18 – Cleaning a window of a non-domestic building

DEFINITIONS

Definitions:

The activity coming under ordinary drought order powers is defined by the Drought Direction 2011 as “**cleaning a window of a non-domestic building using a hosepipe other than for health or safety reasons**”.

“**Non-domestic building**” is defined in the Drought Direction 2011 as any of the following not being domestic premises:

- a) a building that is not used principally as a dwelling or dwellings;
- b) any other structure.

This definition does **not** include any domestic premises as defined and covered by

¹⁹ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

the Water Use (Temporary Bans) Order 2010 (see Figure A4.11).

Interpretation:

Water-fed poles are frequently used by window cleaners and it is interpreted that they are included under the definition of hosepipes. These systems use de-ionised water. Where mains water is the source used to create this de-ionised water, this activity is restricted. The Inspector at the Mid Kent Water and Southern Water (Eastern area) ordinary drought order Hearings in 2006 indicated that window cleaners could argue that they are using water in a process (de-ionising) and so not covered by this restriction²⁰. This has not been tested.

MESSAGES

Customers may clean windows by hand, using a bucket.²¹

The use of rainwater is permitted.

EXEMPTIONS & CONCESSIONS

The Drought Direction 2011 provides a statutory exemption for **health or safety reasons** (see Section 5.7 of this report for further detail). The definition of this includes:

- a) removing or minimising any risk to human or animal health or safety; and
- b) preventing or controlling the spread of causative agents of disease.

The grounds for an exemption for these purposes are considered to be rare – perhaps linked to accidents and incidents. Washing windows at height by hand should be minimised in order to reduce the risk of falls from height (Work at Height Regulations 2005).

Figure A4.19 – Operating a mechanical vehicle-washer

DEFINITIONS

The activity falls under ordinary drought order powers and is defined by the Drought Direction 2011 as “**operating a mechanical vehicle-washer, whether automatic or not**”.

Interpretation:

Both Sutton and East Surrey Water and Thames Water appeared to consider that this restriction relates to mechanical car washers.

²⁰ Report to the Secretary of State for Environment, Food and Rural Affairs, Applications by Mid Kent Water Limited and Southern Water Services Limited for ordinary drought orders restrictions on the non-essential use of water

²¹ Consultation on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

At the 2006 Hearing for the drought order applications for Mid Kent Water and Southern Water, Esso submitted an objection on the grounds that reducing margins on fuel sales meant that the contribution of car washers to profitability was important to the continuing viability of these businesses. The Inspector did not find that this argument was convincing²².

MESSAGES

Cars and other vehicles can still be washed using buckets or using other sources of water.

EXEMPTIONS & CONCESSIONS

Exemptions on bio security grounds may be warranted.

Figure A4.20 – Cleaning any vehicle, boat, aircraft or railway rolling stock

DEFINITIONS

The activity falls under ordinary drought order powers and is defined by the Drought Direction 2011 as **“cleaning any vehicle, boat, aircraft or railway rolling stock using a hosepipe”**.

It does **not** include such cleaning for **health or safety reasons**.

“Boat” is defined by The Drought Direction 2011 as meaning a vessel or other thing which:

- a) is designed, constructed or adapted to move through, in, on or over water; and
- b) is not a private leisure boat within the meaning applied under the Temporary Use Ban.

“Vehicle” is defined as any of the following which is not a private motor-vehicle within the meaning applied under the Temporary Use Ban:

- a) a vehicle designed, constructed or adapted for use on roads; or
- b) a trailer or other thing designed, constructed or adapted for attachment to a vehicle falling within (a) above.

Interpretation:

The restriction is not specifically limited to the cleaning of external surfaces so would include the use of a hosepipe to wash down an interior area.

²² Report to the Secretary of State for Environment, Food and Rural Affairs, Applications by Mid Kent Water Limited and Southern Water Services Limited for ordinary drought orders restrictions on the non-essential use of water

Interpreted to include all road **vehicles** including taxis and private hire vehicles, commercially owned trucks and utilities and public transport vehicles²³.

It is assumed that **'boats'** includes small watercraft such as canoes, kayaks, jet skis etc. In naval terms, a boat is small enough to be carried on another vessel (a ship). It is interpreted that ships and other large vessels such as frigates and cruise liners would also be included in the ban.

Railway rolling stock is interpreted to include passenger train cars, freight train cars, locomotives and tube trains.

Aircraft are interpreted to include privately and commercially owned airplanes, helicopters, gliders and hot air balloons.

MESSAGES

Methods for recycling water or finding water from alternative sources should be used for those concerned about the financial implications of not being able to use mains water²⁴.

Greywater and rainwater may be used.

Storage tanks

Restrictions apply to water drawn from the mains supply after the statutory notice has been given, so water drawn into a container prior to that date may be used for cleaning²⁵.

EXEMPTIONS & CONCESSIONS

The Drought Direction 2011 provides a statutory exemption for **health or safety reasons**. The definition of this includes:

- a) removing or minimising any risk to human or animal health or safety; and
- b) preventing or controlling the spread of causative agents of disease.

Biosecurity concerns associated with the reduced washing of boat hulls, such as the introduction of non-native species to the UK, are therefore covered under this exemption.

²³ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

²⁴ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

²⁵ Summary of responses to the consultation, between 23 March and 15 June 2007, on proposed changes to powers to restrict non-essential uses of water, Defra, 2007

Figure A4.5.8 – Cleaning industrial plant

DEFINITION
<p>The activity coming under ordinary drought order powers is defined by the Drought Direction 2011 as “cleaning industrial plant using a hosepipe other than for health or safety reasons”.</p> <p>Interpretation:</p> <p>Companies may identify industrial customers separately to other commercial customers. Local planning designations may also identify industrial locations.</p> <p>Plant is interpreted to mean:</p> <p><i>“The equipment, including machinery, tools, instruments and fixtures necessary for an industrial operation²⁶”.</i></p> <p>This restriction is not interpreted to apply to normal industrial and manufacturing processes and necessary housekeeping, as the impacts of such a wide definition would be significant. Water companies may wish to seek guidance from a legal advisor to clarify this interpretation.</p>
MESSAGES
<p>Customers may clean such industrial plant by hand using a bucket.</p> <p>The use of greywater and rainwater is permitted.</p> <p>The use of water drawn into containers prior to the commencement of the restriction is allowed.</p>
EXEMPTIONS & CONCESSIONS
<p>The Drought Direction 2011 provides a statutory exemption for health or safety reasons (see Section 5.7 of this report for further detail). The definition of this includes:</p> <ul style="list-style-type: none"> a) removing or minimising any risk to human or animal health or safety; and b) preventing or controlling the spread of causative agents of disease.

²⁶ Adapted from <http://www.thefreedictionary.com/Plant>

Figure A4.5.9 – Suppressing dust

DEFINITIONS
<p>The activity coming under ordinary drought order powers is defined by the Drought Direction 2011 as “suppressing dust using a hosepipe other than for health or safety reasons”.</p> <p>Interpretation:</p> <p>This covers both domestic and non-domestic areas and all surfaces.</p>
MESSAGES
<p>Customers should use alternative, non-potable sources of water for dust suppression, such as recycled, greywater or rainwater. This is particularly the case where dust suppression is a necessary part of a business process.</p> <p>Customers may use a bucket for the purposes of dust suppression, although it should be noted that the practicality of this may be limited to small scale operations.</p>
EXEMPTIONS & CONCESSIONS
<p>The Drought Direction 2011 provides a statutory exemption for health or safety reasons (see Section 5.7 of this report for further detail). The definition of this includes:</p> <ul style="list-style-type: none"> a) removing or minimising any risk to human or animal health or safety; and b) preventing or controlling the spread of causative agents of disease.

Figure A4.4.20 – Operating cisterns

DEFINITIONS
<p>Definition:</p> <p>The activity coming under ordinary drought order powers is defined by the Drought Direction 2011 as “operating a cistern in any building that is unoccupied and closed”.</p> <p>“Cistern” is defined as meaning an automatically-operated flushing cistern which services a water closet pan or urinal.</p> <p>Interpretation:</p> <p>Occupation by security staff is interpreted to comprise a building that is “unoccupied”.</p>
MESSAGES
<p>There are existing water efficient devices that customers can install to comply with this restriction, for example by installing controls to only flush after use or at certain times of day.</p>

Waterless urinals, greywater or rainwater systems can also be fitted.

Customers will benefit from cost savings in the short and long term due to reduced water consumption.

EXEMPTIONS & CONCESSIONS

None

Appendix 5 Environmental Assessment Statements

List of Tables:

- A5.1 Summary of Environmental Assessment of Drought Permit on River Rib**
- A5.2 Summary of Environmental Assessment of Drought Permits on River Cam**
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- A5.11 Summary of Environmental Assessment of Drought Permits on River Dour**

This Appendix provides summaries of environmental assessment reports (EARs) for sources that may be subject to a drought permit or drought order application in the event of a serious drought. These EARs will remain provisional and will be updated on an annual basis to reflect new data collected. The reports have been prepared in close consultation with the Environment Agency, and are intended to fulfil the requirement that we are as close to 'application ready' as possible, in accordance with the EA Drought Plan Guideline Extra Information (November 2016). The full reports are available to view upon request at our offices.

Table A5.1: Summary of environmental assessment of drought permit on River Rib

	Option Name	THUN Drought Permit
Option Implementation Assessment	Action to increase water supply	Relaxation of low flow constraint.
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented.
	Additional Deployable Output of action	Additional 2.73MI/d
	Location	River Rib (THUN)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts.
	Permissions required and constraints	Agreement of the Environment Agency is required. Relevant discussions will be held with the Environment Agency. Discussions will also be held with the local interest groups.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low
	Summary of likely environmental impacts	Minimal impacts from increased abstraction.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos. Previous AMP 4 and AMP 5 studies. Water quality sampling and groundwater level monitoring.
		Environment Agency: Standard Environment Agency Biosys data, 1 River gauging station flow and water level data, EA monthly groundwater level monitoring, Water Framework Directive (WFD) classification data, macroinvertebrate surveys 3 three times per year and fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging to commence monthly

	Option Name	THUN Drought Permit
		in DTZ 3, fortnightly in DTZ 4, increasing to weekly whilst drought permit is in operation.
	Mitigation measures	Fish rescues by the EA where necessary.
	Impact on other activities	No other activities are expected to be impacted on. The impacts on other permitted rights of abstraction are likely to be negligible.

Table A5.2: Summary of environmental assessment of drought permit on River Cam

Option Implementation Assessment	Option Name	UTTL Drought Permit
	Action to increase water supply	Reduction in augmentation from UTTL.
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented.
	Deployable Output of action	Additional 6Ml/d
	Location	River Cam (UTTL)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts. A public hearing might be required, should objections be received.
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency. Discussions will also be held with Local and Parish Councils, the Audley End Estate and other local interest groups. A public hearing might be required, should objections be received.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low-Medium
	Summary of likely environmental impacts	Cessation in augmentation will likely result in more persistent dry conditions within a localised area.
	Is option likely to have a significant effect on any European designated	No

Option Name		UTTL Drought Permit
	site(s) or any SSSIs?	
	Baseline information used	Affinity Water: Quarterly river photos at 7 locations. 20 hourly groundwater level loggers, 3 surface water loggers.. Bi-annual macroinvertebrate monitoring at 7 locations, and macrophyte monitoring at 1 site. Monthly spot gauging.
		Environment Agency: Standard Environment Agency Biosys data, 1 River gauging station flow and water level data, 3 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, bi-annual macroinvertebrate surveys on a 3 year rolling programme at 7 locations.
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging to commence monthly in DTZ 3, fortnightly in DTZ 4, increasing to weekly whilst drought permit is in operation.
	Mitigation measures	Fish rescues by the EA where required.
	Impact on other activities	Poor water quality at Audley End landscaped water features, protected rights on private abstractions.

Table A5.3: Summary of environmental assessment of drought permit on River Gade

Option Name		HUNT and PICC Drought Permits
Option Implementation Assessment	Action to increase water supply	Increase PICC abstraction to pre-SR volumes. Relaxation of the low flow constraint at HUNT.
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented and drought permits with lower environmental impact have been utilised.
	Deployable Output of action	PICC – Additional 5 MI/d HUNT – Additional 2.91MI/d
	Location	River Gade (HUNT and PICC)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental

	Option Name	HUNT and PICC Drought Permits
		impacts.
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency. Discussions will also be held with Local and Parish Councils and other local interest groups. A public hearing might be required, should objections be received.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low-Medium
	Summary of likely environmental impacts	Reduction of river flows, potential for fish entrapment behind weirs/barriers and increased sediment deposition. Possible deterioration of macroinvertebrates status. Potential extension of the dried out reaches downstream and delay in the recovery of the dried out reaches post-drought.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos at 5 locations and 8 groundwater level monitoring locations. 8 monthly spot gauging locations. 3 surface water level loggers. 8 bi-annual macroinvertebrate monitoring locations, and 4 bi-annual macrophyte monitoring points. 1 water quality sample point. Previous AMP studies.
		Environment Agency: Standard Environment Agency Biosys data, 2 River gauging station flow, 7 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, bi-annual macroinvertebrate surveys at 10 locations and tri-annual at 2 locations and fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging to be carried out monthly in DTZ 2 and DTZ 3, increasing to fortnightly in DTZ 4 and/or whilst drought permit is in operation.

	Option Name	HUNT and PICC Drought Permits
	Mitigation measures	Fish rescues by the EA where necessary. Numerous projects to be carried out by AW to improve drought resilience of river, including artificial narrowing of the channel, removal of weirs.
	Impact on other activities	No other activities are expected to be impacted on.

Table A5.4: Summary of environmental assessment of drought permit on River Ver

	Option Name	BOWB Drought Permit
Option Implementation Assessment	Action to increase water supply	BOWB – Recommission source and abstract pre-SR volumes.
	Trigger	DTZ 3 or 4 Drought Trigger and after all available supply side options and drought permits with lower environmental impacts have been implemented.
	Deployable Output of action	BOWB – Additional 5.82 Ml/d
	Location	River Ver (BOWB)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts. A public hearing might be required, should objections be received. BOWB would require a minimum lead time of 6 months to account for recommissioning of source.
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency. Discussions will also be held with Local and Parish Councils and other local interest groups. A public hearing might be required, should objections be received.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Medium
	Summary of likely environmental impacts	Delay of recovery of the dried out reaches after the drought by 1-2 months, potential extension of the dried out reaches, reduced flow velocity at low flow reaches, deterioration of macroinvertebrates status.

Option Name		BOWB Drought Permit
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos at 9 locations. Monthly spot gauging at 23 sites, hourly monitoring of groundwater levels at 12 sites, 9 river level loggers, 1 water quality sampling point. Previous AMP studies.
		Environment Agency: Standard Environment Agency Biosys data, 3 River gauging stations flow and 5 water level logger data, 6 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, macroinvertebrate surveys Bi-annual at 10 points and tri-annual at 2 points, fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	Walk-over survey to identify affected locations (EA and AW), spot gauging monthly at 10 locations during Drought Zone 3 and fortnightly during DTZ4 and/or drought provision duration.
	Mitigation measures	Fish rescues by EA where necessary. Numerous projects to be carried out by AW to improve drought resilience of river, including artificial narrowing of the channel, removal of weirs.
	Impact on other activities	No other activities are expected to be impacted on. The impacts on other permitted rights of abstraction are likely to be negligible.

Table A5.5: Summary of environmental assessment of drought permit on Hughenden Stream

Option Name		HUGH Drought Permit
Option Implementation Assessment	Action to increase water supply	Recommissioning of source following SR.
	Trigger	DTZ 3 or 4 Drought Trigger and after all available supply side options and drought permits with lower environmental impacts have been implemented.
	Deployable Output of action	Additional 1.75 MI/d
	Location	Hughenden Stream

	Option Name	HUGH Drought Permit
	Implementation timetable	<p>Drought monitoring is to start when DTZ 3 is breached. Discussion for lifting provisions will commence when in or approaching DTZ 4 and the application for the permits higher on the list have been submitted.</p> <p>Lead time of at least 6 months will be required to bring source back into production.</p>
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low
	Summary of likely environmental impacts	Possible delay in recovery of flows following a drought.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Monthly spot gauging and river photos at 6 locations. 1 surface water level logger. 3 groundwater level monitoring locations. 2 bi-annual macroinvertebrate and 1 macrophyte monitoring point.
		Environment Agency: 7 groundwater monitoring locations. 1 macroinvertebrate monitoring point. 2 gauged river flow points.
	Summary of additional baseline monitoring requirements	Walk-over survey to identify affected locations (EA and AW). Spot gauging monthly at 4 locations during Drought Zone 3 and fortnightly during DTZ4 and/or drought provision duration
	Mitigation measures	Fish rescues by the EA if required.
	Impact on other activities	No other activities are expected to be impacted on. The impacts on other permitted rights of abstraction are likely to be negligible

Table A5.6: Summary of environmental assessment of drought permit on River Hiz

	Option Name	WELL Drought Permit
Option Implementation Assessment	Action to increase water supply	Cessation in augmentation.
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented and drought permits with lower environmental impact have been utilised.
	Deployable Output of action	Additional 0.3 MI/d
	Location	River Hiz (WELL)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts. A public hearing might be required, should objections be received
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency. Discussions will also be held with the local interest groups, tenants of Charlton Mill Pond and local parish councils. A public hearing might be required, should objections be received.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low
	Summary of likely environmental impacts	Drying out of reach which would normally supported by the augmentation.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	<p>Affinity Water: 1 hourly surface level logger.</p> <p>Environment Agency: Standard Environment Agency Biosys data, 2 River gauging station flow, 4 EA monthly groundwater level monitoring locations, 2 surface water level sites, Water Framework Directive (WFD) classification data.</p>

	Option Name	WELL Drought Permit
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging to commence monthly at 3 locations in DTZ 3, increasing to fortnightly in DTZ 4 and/or whilst drought permit is in operation. Bi-annual macroinvertebrate monitoring to be carried out.
	Mitigation measures	Fish rescues by EA where required.
	Impact on other activities	No other activities are expected to be impacted on

Table A5.7: Summary of environmental assessment of drought permit on River Oughton

	Option Name	OUGH/OFFS Drought Permit
Option Implementation Assessment	Action to increase water supply	Cessation of augmentation
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented and drought permits with lower environmental impact have been utilised.
	Deployable Output of action	Additional 1 MI/d
	Location	River Oughton (WELL, OUGH/OFFL)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts. A public hearing might be required, should objections be received
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency. Discussions will also be held with the local interest groups, tenants of Charlton Mill Pond and local parish councils. A public hearing might be required, should objections be received.
	Risks associated with option	The associated risks are environmental and detailed below.

Environmental Assessment	Option Name	OUGH/OFFS Drought Permit
	Risk to the environment	Low
	Summary of likely environmental impacts	Reduction of flow immediately downstream of Oughton Head – where augmentation would be supplying the bulk of the flow during a drought.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos, 1 hourly surface level logger. Previous AMP studies.
		Environment Agency: Standard Environment Agency Biosys data, 2 River gauging station flow, 4 EA monthly groundwater level monitoring locations, 2 surface water level sites, Water Framework Directive (WFD) classification data.
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging to commence fortnightly in DTZ 3, increasing to weekly in DTZ 4 and/or whilst drought permit is in operation.
	Mitigation measures	Fish rescues by the EA where necessary.
	Impact on other activities	No other activities are expected to be impacted on

Table A5.8: Summary of environmental assessment of drought permit on River Beane

Option Implementation Assessment	Option Name	WHIH Drought Permit
	Action to increase water supply	Abstract pre-SR peak DO at WHIH
	Trigger	DTZ 3 or 4 Drought Trigger and after all available supply side options and drought permits with lower environmental impacts have been implemented.
	Deployable Output of action	Additional 26 Ml/d
	Location	River Beane

	Option Name	WHIH Drought Permit
	Implementation timetable	Drought monitoring is to start when DTZ 3 is breached. Discussion for lifting provisions will commence when in or approaching DTZ 4 and the application for the permits higher on the list have been submitted.
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be held with the Environment Agency.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Medium
	Summary of likely environmental impacts	Potential reduction of river flows, particularly downstream of Watton-at-Stone. An extension of the period of dry river bed. This may in turn cause delays in recoveries of macroinvertebrate macrophyte and fish communities.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos at 17 locations. Groundwater level monitoring at 6 locations. Bi-annual macroinvertebrate monitoring at 8 locations, and macrophyte monitoring at 9 locations. Monthly spot gauging at 13 locations. Weekly water quality sampling at 4 locations. Previous AMP studies.
		Environment Agency: Standard Environment Agency Biosys data, 2 River gauging stations flow, 15 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, macroinvertebrate surveys Bi-annual at 10 points and tri-annual at 2 points, fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	Walk-over surveys to identify affected locations (EA and AW), spot gauging fortnightly at 4 locations during Drought Zone 4 and during drought provision duration.
	Mitigation measures	Fish rescues by EA where required. Numerous projects to be carried out by AW to improve drought resilience of river, including artificial narrowing of the channel and removal of weirs.
	Impact on other activities	No other activities are expected to be impacted on. The impacts on other permitted rights of abstraction are likely to be negligible

Table A5.9: Summary of environmental assessment of drought permit on River Misbourne

	Option Name	AMER Drought Permit
Option Implementation Assessment	Action to increase water supply	Abstract pre-SR peak DO at AMER
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented and drought permits with lower environmental impact have been utilised.
	Deployable Output of action	Additional 8Ml/d
	Location	River Misbourne (AMER)
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts. A public hearing might be required, should objections be received.
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be frequently held with the Environment Agency. Discussions will also be held with Chilterns Chalk Streams Project, Chilterns Society, Misbourne River Action and Local and Parish Councils.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low
	Summary of likely environmental impacts	Potential minor reduction in flows, and possible delay in recovery of flows after the drought.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	<p>Affinity Water: Quarterly river photos at 8 locations and 12 monthly groundwater level monitoring locations. Monthly spot gauging at 16 locations. 1 water quality sample point. Bi-annual macroinvertebrate monitoring at 15 locations. Previous AMP studies.</p> <p>Environment Agency: Standard Environment Agency Biosys data, 2 River gauging station flow and 1 water level logger, 18 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, 4 bi-annual macroinvertebrate surveys and 1 tri-annual</p>

Option Name		AMER Drought Permit
		survey at 4 locations, macrophyte surveys at 16 locations, fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging at 6 locations to commence fortnightly in DTZ 4, increasing to weekly whilst drought permit is in operation.
	Mitigation measures	Fish rescues by EA where required. Numerous projects to be carried out by AW to improve drought resilience of river, including artificial narrowing of the channel and removal of weirs.
	Impact on other activities	No other activities are expected to be impacted on

Table A5.10: Summary of environmental assessment of drought permit on River Mimram

Option Name		FULL Drought Permit
Option Implementation Assessment	Action to increase water supply	Recommission FULL and abstract up to pre-SR peak DO
	Trigger	DTZ 3 or 4 and after all available supply side options have been implemented and drought permits with lower environmental impact have been utilised.
	Deployable Output of action	Additional 9.09 Ml/d
	Location	River Mimram and FULL
	Implementation timetable	Additional drought monitoring to commence when DTZ 3 is breached. Discussion for lifting provisions to commence when in or approaching DTZ 4 and all other supply options have been implemented other than drought orders and permits with higher environmental impacts. A public hearing might be required, should objections be received. In addition FULL would require a minimum lead time of 6 months to account for recommissioning of source
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be frequently held with the Environment Agency. Discussions will also be held with Friends of the Mimram and local Parish Councils. A public hearing might be required, should objections be received.
	Risks associated with option	The associated risks are environmental and detailed below.

Environmental Assessment	Option Name	FULL Drought Permit
	Risk to the environment	Low
	Summary of likely environmental impacts	Potential delay in recovery of flows post drought.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos at 10 locations, 13 hourly groundwater level monitoring locations, monthly spot gauging at 13 locations. Bi-annual macroinvertebrate surveys at 17 locations, annual macrophyte surveys at 8 locations. Previous AMP studies.
		Environment Agency: Standard Environment Agency Biosys data, 3 River gauging station flow, 19 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, 5 bi-annual macroinvertebrate surveys and 2 tri-annual survey at 7 locations, fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	The following monitoring activities will be implemented in the lead up to and during the drought permit period. Monthly walk-over surveys to commence in DTZ 2, the frequency of the surveys will increase as DTZ 3 and 4 are breached. Spot gauging to commence monthly in DTZ 2, fortnightly in DTZ 3, increasing to weekly in DTZ 4 and/or whilst drought permit is in operation.
	Mitigation measures	Fish rescues by the EA if required. Numerous projects to be carried out by AW to improve drought resilience of river, including artificial narrowing of the channel and removal of weirs.
	Impact on other activities	No other activities are expected to be impacted on

Table A5.11: Summary of environmental assessment of drought permit on River Dour

	Option Name	SDRE, SHOL, SLYE, SBUC Drought Permits
Option Implementation Assessment	Action to increase water supply	Release of low flow constraints on licences
	Trigger	DTZ 3 or 4 Drought Trigger and after all available supply side options and drought permits with lower environmental impacts have been implemented.
	Deployable Output of action	Additional 8.27 MI/d
	Location	River Dour (SDRE, SHOL, SLYE, SBUC)
	Implementation timetable	Drought monitoring is to start when DTZ 3 is breached. Discussion for lifting provisions will commence when in or approaching DTZ 4.
	Permissions required and constraints	Permission from the Environment Agency is required. Pre-application discussions will be frequently held with the Environment Agency. Discussions will also be held with the Dour Steering Group.
	Risks associated with option	The associated risks are environmental and detailed below.
Environmental Assessment	Risk to the environment	Low
	Summary of potential environmental impacts	Delay to rewetting of the river at the end of a drought.
	Is option likely to have a significant effect on any European designated site(s) or any SSSIs?	No
	Baseline information used	Affinity Water: Quarterly river photos at 6 locations. Spring and autumn macroinvertebrate and macrophyte monitoring. Previous AMP studies.
		Environment Agency: Standard Environment Agency Biosys data, Hydroecological Validation (HEV) analysis, 2 River gauging stations flow , 27 EA monthly groundwater level monitoring locations, Water Framework Directive (WFD) classification data, fisheries surveys at 3 locations.
	Summary of additional baseline monitoring requirements	Walk-over survey to identify affected locations (EA and AW), spot gauging fortnightly at 3 locations during Drought Zone 3 and weekly during drought provision duration.

	Option Name	SDRE, SHOL, SLYE, SBUC Drought Permits
	Mitigation measures	Mitigation will occur initially through compliance with low flow licence conditions.
	Impact on other activities	No other activities are expected to be impacted on. The impacts on other permitted rights of abstraction are likely to be negligible.

Appendix 6 Environmental Monitoring Plan

This Appendix contains information relating to Section 7, Environmental Monitoring, business-as-usual monitoring and potential enhanced drought monitoring programme and mitigation. The sections within this Appendix are listed below:

A6.1 Location River Monitoring Photographs

Table A6.1 Locations of environmental monitoring photographs

A6.2 External Monthly Hydrological Data

Table A6.2 External data sets received and analysed for the Affinity Water Monthly Water Situation Report

A6.3 Potential Enhanced Drought Monitoring Schedules

Table A6.3 Summary of Enhanced Drought Monitoring for River Rib

Table A6.4 Summary of Enhanced Drought Monitoring for River Cam

Table A6.5 Summary of Enhanced Drought Monitoring for River Gade

Table A6.6 Summary of Enhanced Drought Monitoring for River Ver

Table A6.7 Summary of Enhanced Drought Monitoring for Hughenden Stream

Table A6.8 Summary of Enhanced Drought Monitoring for River Hiz

Table A6.9 Summary of Enhanced Drought Monitoring for River Oughton

Table A6.10 Summary of Enhanced Drought Monitoring for River Beane

Table A6.11 Summary of Enhanced Drought Monitoring for River Misbourne

Table A6.12 Summary of Enhanced Drought Monitoring for River Mimram

Table A6.13 Summary of Enhanced Drought Monitoring for River Dour

The proposed drought monitoring plans are incorporated into the relevant Environmental Assessment Reports (EARs), which are in draft stage – these will remain as drafts until such time as they are needed for drought permit applications. These plans will be updated following further consultation and engagement with the EA. It is therefore possible that the proposed monitoring plans will change, and the below sections will be updated accordingly.

A6.1 Locations of River Monitoring Photographs

Environmental impact monitoring photographs have been taken consistently at a number of key locations, in the key catchments in our area, since 1998. These photographs are taken quarterly, to cover each of the seasons. The River Dour photograph monitoring sequence commenced in March 2015.

Table A6.1: Locations of Environmental Impact Monitoring Photographs

River	Photo No	Description
Ash	Ash01	Upstream, near the source of the B1038 road bridge Brent
Ash	Ash02	Downstream, Next to sewage works, Furneux Pelham
Ash	Ash03	Downstream, From Parsonage Lane Bridge, Albury
Ash	Ash04	Downstream, Hadham Ford, Little Hadham
Ash	Ash05	Downstream, From Winding Hill Bridge, Much Hadham
Ash	Ash06	Downstream, From the End of Pegs Lane Widford
Ash	Ash07	Downstream, From B1004 road bridge, Near Wareside
Ash	Ash08	Downstream, From Hollycross Road Bridge, Near Ware
Ashwell Springs	Ashwell01	Down steps at Ashwell Springs SSSI
Beane	Beane01	Upstream from footbridge over river next to the road, near Roe Green
Beane	Beane02	Downstream from road bridge over river
Beane	Beane03	Downstream from road looking under road bridge, Cromer
Beane	Beane04	Downstream from road bridge, next to Walkern Mill
Beane	Beane05	Downstream from Road, Aston
Beane	Beane06	Downstream from ford next to WHIH 1
Beane	Beane07	Downstream from road bridge looking towards Watton-at-Stone
Beane	Beane08	Downstream from Church Lane bridge, Stapleton
Beane	Beane09	Downstream from Vicarage Road Bridge, Waterford
Beane	Beane10	Upstream from bridge over river to car Park, Hartham (Hertford)
Bulbourne	Bulbourne01	Upstream from Boswick Lane bridge, Dudswell
Bulbourne	Bulbourne02	Upstream from New Road (B4506) Bridge, Berkhamsted
Bulbourne	Bulbourne03	Downstream from Bank Mill Lane, Berkhamsted
Bulbourne	Bulbourne04	Downstream from Little Heath Lane, near Bourne End

River	Photo No	Description
Bulbourne	Bulbourne05	Downstream from Two Waters Road, Hemel Hempstead (near confluence with Gade)
Cam	Cam01	Upstream, from North Hall Road Bridge, near Henham
Cam	Cam02	Downstream, from Crabtree Hill Bridge, near Widdington
Cam	Cam03	Downstream, from road bridge to Widdington
Cam	Cam04	Upstream, from Sparrowsend Hill bridge, Wendens Ambos
Cam	Cam05	Downstream, From Walden Road bridge, Wendens Ambos
Cam	Cam06	Downstream, from Walden Road Bridge, Littlebury
Cam	Cam07	Downstream, from road bridge (off the B1383) in Little Chesterford
Chess	Chess01	The source, river runs along Missenden Road and disappears by a house outside Chesham
Chess	Chess02	Bury Pond, This also feeds the upper reaches of The Chess
Chess	Chess03	Waterside, From a Bridge which crosses the river by a weir
Chess	Chess04	Latimer Road and Stoney Lane cross roads, bridge where the river joins the lake in Latimer Park.
Chess	Chess05	River from public footpath which both run next to CHOR
Chess	Chess06	Rickmansworth, off A 412 Next to playing field by bridge where Chess Flows under A412
Colne	Colne01	Mimmshall Brook, North Mymms Park
Colne	Colne02	Upstream from B556 Courses Road bridge Colney Heath
Colne	Colne03	Upstream Watery Lane Bridge Broad Colney
Colne	Colne04	Upstream Near Drop Lane Bricket Wood confluence with Ver
Colne	Colne05	Downstream from Bushey Mill Lane bridge Watford
Gade	Gade01	Upstream from road bridge at Hudnall Corner
Gade	Gade02	Downstream from road bridge, Great Gaddesdon
Gade	Gade03	Upstream from bridge near Red Lion pub, Water End
Gade	Gade04	Downstream from A4147 bridge, Hemel Hempstead
Gade	Gade05	Downstream from road bridge, confluence with Grand Union Canal
Hiz	Hiz01	Ash Brook from Arch Road, Little Wymondley, Looking downstream

River	Photo No	Description
Hiz	Hiz02	Ippollitts Brook from Waterdell Lane, St. Ippollitts, Looking downstream
Hiz	Hiz03	River Hiz from Charlton Road with junction of Maydencroft Lane, Charlton, Looking downstream
Hiz	Hiz04	River Purwell from Chaucer Way bridge (off Purwell Lane), Hitchin, Looking downstream
Hiz	Hiz05	River Hiz from Cadwell Lane, downstream, next to sewage works
Hiz	Hiz06	River Oughton (Oughton Head) from Oughtonhead Lane (Footpath) off Hitchin Road. Looking downstream.
Hiz	Hiz07	River Hiz from Arlesey Road bridge, Cadwell. Looking downstream
Hiz	Hiz08	River Hiz from Mill Lane, Arlesey. Looking downstream
Hiz	Hiz09	River Hiz from the A6001 Langford. Looking downstream
Ivel	Ivel01	River Ivel Navigation, Near Clifton, up & downstream
Ivel	Ivel02	River Ivel, from B658 road bridge south of Biggleswade
Lee	Lee01	The source from Sundon Park Road Luton
Lee	Lee02	Downstream from Kingsdown Avenue bridge Luton
Lee	Lee03	Downstream from Osbourne Road bridge Luton
Lee	Lee04	Downstream from Cooters End Lane East Hyde
Lee	Lee05	Downstream from B652 Station Road Batford
Lee	Lee06	Downstream from B651 Station Road bridge Wheathampstead
Mimram	Mimram01	The source, through hedge from Lilley Bottom Road, Near Whitwell
Mimram	Mimram02	Downstream from road next to Nine Wells Watercress Farm, Whitwell
Mimram	Mimram03	Downstream from The Valley bridge, Whitwell
Mimram	Mimram04	Upstream looking into the garden of Rose Cottage, Whitwell
Mimram	Mimram05	Upstream from road, view of old mill pond, Hoo Farm
Mimram	Mimram06	Downstream from road at Kimpton Mill
Mimram	Mimram07	Downstream, view across St. Albans Road Ford (Pulmer Water)
Mimram	Mimram08	Upstream from High Street bridge, Welwyn
Mimram	Mimram09	Upstream from A1000 road bridge, near Digswell
Mimram	Mimram10	Downstream from Digswell Park Road bridge, near

River	Photo No	Description
		Digswell
Misbourne	Misbourne01	Upstream near the source from Link Road bridge, Great Missenden
Misbourne	Misbourne02	Upstream & Downstream from Deep Mill Lane bridge, off A413
Misbourne	Misbourne03	Downstream from road bridge in Little Missenden
Misbourne	Misbourne04	Downstream from Mill Lane bridge, Amersham Old Town
Misbourne	Misbourne05	Downstream from Bottom House Farm Lane, Off A413
Misbourne	Misbourne06	Upstream from Pheasant Hill bridge next to The Pheasant Inn, Chalfont St. Giles
Misbourne	Misbourne07	Upstream from 'Over the Misbourne' off A413, Gerrards Cross
Misbourne	Misbourne08	Downstream from Old Mill Road bridge, Denham (near confluence with the Colne)
Quin	Quin01	Upstream from Bull Lane, Buckland
Quin	Quin02	Upstream from Bull Lane, Buckland (different to No 1)
Quin	Quin03	Upstream near Howlet's Farm, Barkway
Quin	Quin04	Upstream at Cross road to west of Nuthampstead
Quin	Quin05	Downstream from road off Briggin Hill near Anstey
Quin	Quin06	Downstream from Worsted Lane, Hare Street
Quin	Quin07	Downstream from Station road, Braughing
Rib	Rib01	Upstream from road in reed end, near source
Rib	Rib02	Downstream from bridge over river to entrance to Hodenhoe Manor
Rib	Rib03	Upstream from Vicarage Road bridge, Buntingford
Rib	Rib04	Downstream, road bridge near Westmill Bury, Westmill
Rib	Rib05	Upstream from A120 road bridge, Standon
Rib	Rib06	Downstream, Barwick Ford
Rib	Rib07	Upstream from A10 footbridge over river, Wadesmill
Rib	Rib08	Downstream from access road bridge to Paynes Hall, (off A602) Westmill.
Rib	Rib09	Downstream from Ware Park Road bridge, Bengoe, near confluence with River Lea.
Stort	Stort01	The source, Duddenhoe Grange, Langley
Stort	Stort02	Downstream from road bridge at Stickling Green
Stort	Stort03	Downstream from Poor Bridge, south of Clavering
Stort	Stort04	Downstream from The Street bridge, Manuden

River	Photo No	Description
Stort	Stort05	Downstream from road bridge next to Bentfield Mill House near Stansted Mountfitchet
Stort	Stort06	Downstream from Rye Street car park bridge, Bishop's Stortford
Stort	Stort07	Downstream from Pig Lane road bridge, south Bishop's Stortford
Stort	Stort09a	River Stort, Downstream from Burntmill Lane, Harlow
Stort	Stort09b	Stort Navigation, downstream from Burntmill Lane, Harlow
Stort	Stort10	Downstream from High Street bridge, Roydon
Ver	Ver01	The source, Kensworth Lynch
Ver	Ver02	Upstream, from Church End bridge, Markyate
Ver	Ver02a	Downstream from London Road Markyate
Ver	Ver03	Downstream, from River Hill bridge, Flamstead
Ver	Ver03a	Upstream from Watling Street Flamstead
Ver	Ver04a	Downstream from Luton Lane Harpendenbury
Ver	Ver04	Downstream, from bridge at Redbournbury
Ver	Ver05	Downstream, from St. Michael's Street bridge
Ver	Ver06	Weir in Westminster Lodge Park
Ver	Ver07	Downstream, Burydell Lane, Park Street
Ver	Ver08	Upstream, confluence with Colne, near Drop Lane
Dour	Dour01	Bushy Ruff
Dour	Dour02	Russell Gardens
Dour	Dour03	Temple Ewell
Dour	Dour04	Kearnsey
Dour	Dour05	Crabble Mill
Dour	Dour06	A2 Buckland Paper Mill
Dour	Dour07	Pencester Gardens

A6.2 External data sets used for monthly hydrological monitoring report

Table A6.2: External data sets received and analysed for the Affinity Water Monthly Hydrological Report

Data	Description	Frequency	Data Source
Rainfall Effective Precipitation Soil Moisture Deficit	MORECS Data for Squares: 151, 152, 153, 161, 174 and 175	Weekly	Met Office
River Flows	River Red at Redbourn River Mimram at Fulling Mill River Ver at Redbourn River Gade at Croxley Green River Beane at Hartham River Rib at Wadesmill River Rhee at Ashwell River Cam at Great Chesterford River Stort at Roydon River Misbourne at Little Missenden River Mimram at Panshanger River Thames Kingston River Dour at Crabble Mill	Daily	Environment Agency
Groundwater Levels	Elsenham Nursery Lilley Bottom Therfield Rectory Chalfont Centre Wolverton New OBH Denge 33 Lady Lane	Monthly	Environment Agency

A6.3 Notes and key to enhanced environmental drought monitoring

Hydrometric monitoring:

- Spot flow gauging
- Drawings of recorded cross-sections
- Calculation of flow through each spot-gauged cross-section
- Comparison of depths and velocities under different flow conditions

Macroinvertebrate monitoring:

- Kick-sampling with variations as appropriate to sample the range of habitats at sites identified by the Environment Agency
- Preparation of data tables for macroinvertebrates, arranged by site and by date
- Counts of taxa per sample
- LIFE scores for taxa, where available (Extance *et al*, 1999)
- Analysis of samples for trends
- Assessment of sensitivity of macroinvertebrates to flow

Fisheries monitoring:

Baseline walk-over surveys will be discussed with the Environment Agency and conducted by both ourselves and the Environment Agency on the Rib, Cam, Gade, Ver, Hiz, Oughton, Misbourne, Mimram and Dour in Drought Zone 2/3, in order to identify reaches that are under stress. Stretches of the river will be assessed for the potential to become isolated should the drought situation deteriorate and flagged. The reaches of the river where rescued fish could be relocated are also identified.

During the spot gauging visits and the river photo rounds any changes in the situation of the river will be reported and discussed with the Environment Agency Fisheries experts. If an action for fish rescuing is identified, we will liaise with the Environment Agency for a consensus on actions.

A6.3.1 River Rib monitoring

Table A6.3: Summary of Enhanced Drought Monitoring for River Rib

River Rib	Description	Grid Reference	Reason	Drought Zone 3 Frequency		Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Levels	TL 31/13 Moles Farm - logger to be installed by AW		Proximity to THUN	Hourly (AW)	Hourly (AW)	Hourly (AW)	
	TL 31/05 Marshalls Farm - to be installed by AW	TL3611018660	Proximity to THUN				
	Standon Lordship - logger to be installed by AW	TL3920021400	Proximity to THUN				
Gauged River Flows	Rib at Wadesmill	TL536000217400		Daily (EA)	Daily (EA)	Daily (EA)	
Spot Gauging including Physical Chemical Parameters & Photos	Latchford	TL539400220510	Proximity to THUN	Monthly (AW)	Fortnightly to weekly (AW)	Weekly, reducing to fortnightly, reducing to monthly (AW)	
	Barwick Ford	TL538750234750	Proximity to THUN				
	Fabdens		Proximity to THUN				
	Wadesmill	TL536000217400	Proximity to THUN				
	Paynes Hall	TL533800216400	Proximity to THUN				
Macro-invertebrates	Location u/s THUN			Spring Summer and Autumn (EA)			
	Barwick Hall	TL538750234750		Spring and Autumn (EA) NB additional monitoring by AW subject to agreement			
	Wadesmill	TL536000217400					
	Above Chapmore End STW	TL-33800-16350					
	Bengeo Hall	TL533100213450					
Fisheries	Barwick Ford	TL538750234750		Walk-over Surveys (EA & AW)	Walk-over Surveys (EA & AW)	Walk-over Surveys (EA & AW)	
	8 Acre Plantation						
	Bengeo Hall	TL533100213450					
Fixed point Photograph	9 locations			During Walkover (EA & AW)			

A6.3.2 River Cam monitoring

Table A6.4: Summary of Enhanced Drought Monitoring for River Cam

River Cam	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Level	TL53/021 Oaks Plantation	TL551984238616		Monthly (EA)	Monthly (EA)	Monthly (EA)
	TL54/018 Bordeaux Farm	TL 51132 41854				
	TL53/002 Crossways	TL551792235967				
	Audley End Verge	TL 51984 38616	DS of Augmentation	AW	AW	AW
	TL53/004 Holmwood	TL 51678 34742	Proximity to sources	Hourly (AW)	Hourly (AW)	Hourly (AW)
	Springwell Farm (private well)	TL 52032 41042	Proximity to sources (DS of UTTL)			
	St Joshua's Bridge (Gravel)	TL52166 36740	Proximity to Cam, DS of UTTL - US influence of augmentation			
	St Joshua's Bridge (Chalk)	TL 52172 36729	Proximity to Cam, DS of UTTL - US influence of augmentation			
Gauged River Flows	Cam at Great Chesterford	TL 51885 36177		Daily (EA)	Daily (EA)	Daily (EA)
Spot Gauging (Including Physical Chemical Parameters)	St Joshua's Bridge	TL 52123 36814	DS of Augmentation	Monthly (AW)	Fortnightly to Weekly (AW)	Monthly (AW)
	Littlebury	TL 51861 39725	DS of Augmentation			

River Cam	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
and Site Photos)	Little Chesterford	TL 51444 41946	DS of Augmentation			
Fisheries		NA		Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
Macro-invertebrates	Wendon Brook, Uttlesford	TL5195136168		Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	Wendon's Ambo	TL5220036800				
	Littlebury	TL5188439638				
	Great Chesterford	TL5038742705				
Historic Fixed Point Photograph	7 locations	TL 53373 29186 TL 52363 31157 TL 52382 32456 TL 52052 35898 TL 52124 36749 TL 51889 39636 TL 51428 41922		Quarterly (AW)		

A6.3.3 River Gade monitoring

Table A6.5: Summary of Enhanced Drought Monitoring for River Gade

River Gade	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Level	Dagnall OBH	SP9960015540		Monthly (EA)	Monthly (EA)	Monthly (EA)
	Coldharbour Farm	SP9875011230				
	Gade 2	TL 03067 11296				
	Hollybush Farm	TL0142009970				
	Gade 3	TL 04386 09784				
	Gade 4	TL 05074 08716				
	Gade 5	TL 05307				

River Gade	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
		07732				
	Bovingdon Green	TL0119102827				
	Woodhurst	TL0470002820				
	Gade 6	TL 05440 06312				
	Stevens Nurseries	TQ0670898436				
Gauged River Flows	Bury Mill GS	TL 05315 07665	Proximity to PCCC	Daily (EA)	Daily (EA)	Daily (EA)
	Croxley Green GS	TL 824395241	Proximity to HUNT			
Spot Gauging including Physical Chemical Parameters & Photos	Behind Red Lion Pub	TL 04033 10147	Proximity to PCCC	Monthly (AW)	Monthly to fortnightly (AW)	Fortnightly, reducing to monthly (AW)
	Noake Mill Lane	TL 04350 09724	Proximity to PCCC			
	Picotts End PS	TL 04873 09204	Proximity to PCCC			
	US Gadebridge Park	TL 05099 08440	Proximity to PCCC			
	Bury Mill GS	TL 05315 07665	Proximity to PCCC			
Fisheries		NA		Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
Macro-invertebrates	Great Gaddesdon	TL 03056 11264		Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	Gade Water Nurseries	TL 04067 10108				
	Gade Bridge Lane	TL 05154 08231				
Fixed point Photographs	Up to 5 locations	TL 0144013363 TL 0305111305 TL0396710326 TL0511708533 TL0547405990		As agreed following walkover surveys of river		

A.6.3.4 River Ver drought monitoring

Table A6.6: Summary of Enhanced Drought Monitoring for River Ver

River Ver	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Level and River Level	TL01/176 River Hill	TL0798015060		Monthly (EA)	Monthly (EA) NB additional monitoring by AW subject to agreement	Monthly (EA)
	TL11/161 Luton Lane	TL1067714038				
	TL11/35 Bridge Nurseries	TL04943 18242				
	TL11/162 Chequer Lane	TL10919 11740				
	TL10/113 Bow Bridge	TL 12501 08971				
	TL10/50 Express Dairy					
	Turn Pike Farm	TL0418619704		Monthly (AW)	Monthly (AW)	Monthly (AW)
	Kensworth Nurseries	TL0494318242				
	Brick Kiln Farm	TL 0359717397				
	Red Cow Farm	TL0523017559				
	Markyate	TL0600816834				
	River Hill RRL	TL 08010 15093				
	Luton Lane	TL1067714038				
	Waterend Lane	TL1109912399				
	Chequer Lane	TL 10919 11740				
	Redbournbury Mill OBH	TL1190210720				
	Redbournbury Mill RRL	TL1190210720				
	Irish Weir RRL	TL 12162 10361				
	Shafford Mill RRL	TL 12546 09363				
	Bow Bridge RRL	TL 12501 08971				

River Ver	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
	Childwickbury (Dip Only)	TL1409110744				
	Batchwood	TL1380408835				
	Abbey Mill	TL 14205 06874				
	Sopwell RRL	TL 15520 05463				
	Sopwell Meadows RRL	TL 15421 05102				
	Burydel Lane RRL	TL 14789 04207				
	Drop Lane RRL	TL 14257 01275				
Gauged River Flows	River Ver at Redbourn	TL1108913208		Daily (EA)	Daily (EA)	Daily (EA)
	River Red at Redbourn	TL10066611717				
	River Ver at Colney Street	TL1823003690				
Spot Gauging Including Physical Chemical Parameters and Site Photos	Friars Wash	TL0866714999	Close proximity to FRIA	Monthly (AW)	Fortnightly (AW)	Fortnightly, reducing to monthly (AW)
	Redbourn Golf Course	TL1081213922	Close proximity to FRIA			
	u/s Redbourn	TL1108913208	Close proximity to FRIA			
	Redbournbury	TL1194010749	Close proximity to BOWB			
	Shafford Farm	TL1255809242	Close proximity to BOWB			
	Pre Mill House	TL1276608528	Close proximity to BOWB			
Macro-invertebrates	River Hill, Flamstead	TL508000215100		Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	Luton Lane, Redbourn	TL510737213996				
	Chequers Lane	TL510900211700				
	Below	TL511950210700				

River Ver	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
	Redbournbury Farm Ford					
	Above Pre Mill House	TL512750208580				
	Below Redbourne Road	TL1132311248				
	Below Kingsbury Mill	TL1383007452				
	Cottonmill Lane	TL1499106554				
	Sopwell	TL1553705438				
	Burydell Lane, Park Street	TL1491204011				
	Above Colne	TL1422201418				
	At Redbourn	TL1120012800				
Fisheries	Upper Ver		Close proximity to FRIA and BOWB	Regular walk-over Surveys (EA & AW)		
	Shafford Mill					
	Verulam Golf Club					
Fixed point Photographs	9 locations	TL 04926 17934 TL 05961 16827 TL 06777 15905 TL 08000 15098 TL 08597 14966 TL 10728 14036 TL 11868 10748 TL 13835 07461 TL 14207 06862		Quarterly (AW)		

A6.3.5 Hughenden Stream drought monitoring

Table A6.7: Summary of Enhanced Drought Monitoring for Hughenden Stream

Hughenden Stream	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4 Drought Permit Frequency	Post Drought Frequency
Groundwater Level	Church Farm	SU86539588	Continuous (AW)	Continuous (AW)	Continuous (AW)
	Bowling Green	SU86429496			
	Church House	SU8647095510			

	SU89_98-Hughenden Valley	SU86489627	Continuous (EA)	Continuous (EA)	Continuous (EA)
	SU89_27-North Dean House	SU85549815			
	SU89_64-Park Farm	SU83879427			
Gauged River Flows	2569-HIGH WYCOMBE	SU86359371	Continuous (EA)	Continuous (EA)	Continuous (EA)
	2550-Wye at Wycombe	SU853936			
Spot Gauging including Physical Chemical Parameters and Photos	HUGH02-Church Farm	SU86589585	Monthly (AW)	Fortnightly to Weekly (AW)	Weekly, reducing to fortnightly, reducing to monthly (AW)
	HUGH03-Hughenden Manor	SU8661595505			
	HUGH04-Hughenden Park	SU8644794472			
	HUGH05-High Wycombe Gauging Station	SU8637593714			
Fisheries	Hughenden Stream		Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
Macro-invertebrates	Hughenden Manor	SU86619550	Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	35529_Hughenden Park Car Park, High Wycombe	SU8642494520			
Fixed point Photographs	Taken at Spot Gauging sites		Monthly (AW)	Fortnightly to Weekly (AW)	Weekly, reducing to fortnightly, reducing to monthly (AW)

A6.3.6 River Hiz drought monitoring

Table A6.8 Summary of Enhanced Drought Monitoring for River Hiz

River Hiz	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Level	TL12/128A BGS CH1 Well Head	TI517699227698		Monthly (EA)	Monthly (EA)	Monthly (EA)
	TL12/133 Bath Springs New	TL517938228078				
	TL12/135 Bath Springs New	TL517902228095				
	TL12/089 Bath Springs New	TL517942228090				
Gauged River Flows	Hiz at Hitchin	TL518534229020		Daily (EA)	Daily (EA)	Daily (EA)
	Hiz at Arlesey					

River Hiz	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Surface Water Level	Charlton Mill Pond	TL1781127952		Monthly (EA), 2 hourly (AW)	Monthly (EA), 2 hourly (AW)	Monthly (EA), 2 hourly (AW)
	Windmill Pub Pond Charlton			Monthly (EA)	Monthly (EA)	Monthly (EA)
	Oughton Head					
Spot Gauging (Including Physical Chemical Parameters and Site Photos)	Hiz at WELL		Proximity to WELL	Monthly (AW)	Fortnightly to Weekly (AW)	Monthly (AW)
	Hiz at Charlton		DS of Charlton Mill			
	Hiz at Priory Park					
Fisheries				Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
Macro-invertebrates				Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
Historic Fixed Point Photography	9 Locations			Quarterly (AW)		

A6.3.7 River Oughton drought monitoring

Table A6.9: Summary of Enhanced Drought Monitoring for River Oughton

River Oughton	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Surface Water Level	Oughton Head		Monitoring of water levels in the spring	EA	EA	EA
	Westmill	TL1720130802	Monitoring of water levels in the Oughton			
Surface Water Level	Level Logger at Oughton Head Spring		Continuous monitoring of water levels in the spring	Continuous (AW)	Continuous (AW)	Continuous (AW)

Spot Gauging (including chemical analysis parameters and photo points)	US of Confluence - location TBC		To monitor flows downstream of OFFS/OUGH	Fortnightly	Fortnightly increasing to weekly	Weekly decreasing to fortnightly
Fisheries	River Oughton		To identify areas of stress	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
Macro-invertebrates	Flour Mill Grounds			EA Monitoring Point		
Fixed point Photographs	1 Location	TL 16109 29886		Photographs to be taken during walkovers and when spot gauging		

A6.3.8 River Beane drought monitoring

Table A6.10: Summary of Enhanced Drought Monitoring for River Beane

River Beane	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Levels	Beane 6	TL2801523354		Monthly (AW)	Monthly (AW)	Every 90 days (AW)
	Beane 5	TL2810024001				
	Beane 3	TL2922126287				
	Beane 7	TL2800022621	Proximity to WHIH			
	Beane 9	TL2900719998	Proximity to WHIH			
	Well House Bramfield	TL3018014960				
	Woodhall Park Home Farm	TL3146618273				
Gauged River Flows	Bragbury Park	TL2748821164		Daily (EA)	Daily (EA)	Daily (EA)
	Hartham Park	TL3247313102				
Spot Gauging including Physical Chemical Parameters & Photos	AST1	TL2808823404	Proximity to WHIH	Monthly (AW)	Fortnightly	Fortnightly reducing to monthly (AW)
	WHIH	TL2842022033	Proximity to WHIH			
	Frogmore Hall	TL2894020853	Proximity to WHIH			

River Beane	Description	Grid Reference	Reason	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
	Frogmore	TL2895220517	Proximity to WHIH			
Fisheries	Church Lane, Stapleford	TL3133617339		Walk-over Surveys (AW, EA) Additional monitoring subject to agreement	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
	Mill Lane, Watton-at-Stone	TL2999619522				
	Hartham Common					
Macro-invertebrates	At Frogmore Hall	TL2893220842		Spring and Autumn (EA)		
	AST1	TL2804523354				
	Below Church End Ford, Walkern	TL2924726498				
	Upstream Stevenage Brook	TL2892620516				
	At Hartham Common	TL-32700-13300				
	Watton-at-Stone	TL2977119790				
Fixed point Photographs	10 locations	TL3098233199 TL3084429857 TL2955028098 TL2855825394 TL2801322637 TL2876121478 TL2971719763 TL3102116917 TL3114515027 TL3238412987		Quarterly (AW)		

A6.3.9 River Misbourne drought monitoring

Table A6.11: Summary of Enhanced Drought Monitoring for River Misbourne

River Misbourne	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Level	SP80/62 Black Horse	SP8906402048	Monthly (EA)	Monthly (EA)	Monthly (EA)
	SP80/63 Missenden Abbey	SP8981900922			
	SU99/59 London Road	SU9048799850			
	SU99/60 Mill House	SU9278198866			
	SU99/61 Old Road	SU9470397922			
	SU99/71 Amersham Church	SU 96629 96964			
	SU99/62 Amersham Bypass	SU9662996964			
	SU99/63 Bottom House Farm	SU 9830095340			
	SU99/64 Chalfont St Giles	SU 9913093640			
	SU99/65 Cherry Acre	SU 9978092620			
	TQ09/128 Chalfont St Peter	SU 9913093640			
	London Road	SU9050099820	Hourly (AW)	Hourly (AW)	Hourly (AW)
	Missenden Abbey	SP8980000920			
Gauged River Flows	River Misbourne at Little Missenden	SU9202999112	Daily (EA)	Daily (EA)	Daily (EA)
	River Misbourne at Denham Lodge	SU9467798649			
Spot Gauging including	Deepmill Lane	SU9088899403			
	Little Missenden	SU9344698442			

River Misbourne	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Physical Chemical Parameters & Photos	Shardeloes Lake (Old Rd)	SU9466997909			
	Amersham Mill	SU9537597519			
	Amersham Bypass	SU9663796923			
	Quarrendon Mill	SU9761096271			
	London Rd Depot	SU9794395876			
	Misbourne Farm	SU9867794628			
	Chalfont St Giles	SU9880094088	Monthly (AW)	Fortnightly (AW)	Weekly, reducing to fortnightly, reducing to monthly (AW)
	Waterhall	SU9985391981			
	Chalfont St Peter	SU9999691148			
	Gerrards Cross Golf Course	TQ0053989861			
	Isle of Wight Farm Left	TQ0127088399			
	Isle of Wight Farm Right	TQ0129788326			
Macro-invertebrates	Little Missenden	SU9344698442	Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	Above Old Amersham	SU9473097920			
	Bottom House Farm Lane	SU9831195366			
	Community Centre, Chalfont St Peter	TQ0001491119			
	Above Gerrards Cross STW	TQ0130088350	Spring Summer and Autumn (EA)		
	Below Gerrards Cross STW	TQ0290687629	Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	Denham Country Park	TQ0484886359	Spring Summer and Autumn (EA)		
Fisheries	DS Shardeloes Lake		Walk-over Surveys (EA & AW)	Walk-over Surveys (EA & AW)	Walk-over Surveys (EA & AW)
	Isle of Wight Farm				

River Misbourne	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
	Denham Country Club	TQ0471186419			
Fixed point Photographs	8 Locations	SP 89549 01491 SU 90849 99454 SU 92788 98885 SU 95333 97530 SU 98319 95346 SU 99159 93690 TQ 01308 88388 TQ 04427 86272			

A6.3.10 River Mimram drought monitoring

Table A6.12: Summary of Enhanced Drought Monitoring for River Mimram

River Mimram	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/ Drought Permit Frequency	Post Drought Frequency
Groundwater Level	TL21/105 Mimram 9 (Digswell Park)*	TL2399415383	Monthly (EA)	Monthly (EA)	Monthly (EA)
	TL21/106 Mimram 8 (Hertford Rd)*	TL531800212300			
	TL21/108 Mimram 7 (Wellington PH)	TL2301316210			
	TL21/109 Mimram 6 (Fulling Mill La)	TL2257317011			
	TL21/110 Mimram 5 (Kimpton Rd)	TL2154516664			
	TL 21/107 Mimram 4 (Codicote PS)	TL2106717522			
	TL21/108 Mimram 7 (Wellington PH)	TL23013 16210	Hourly (AW)	Hourly (AW)	Hourly (AW)
	TL21/110 Mimram 5 (Kimpton Rd)	TL21545 16664			
	TL 21/107 Mimram 4 (Codicote PS)	TL21031 17535			
	Welwyn Viaduct	TL24595 15015			
	Franks Field	TL24175 15074			
	Digswell PS	TL23 15			
Gauged River Flows	Mimram at Whitwell	TL518400221200	Daily (EA)	Daily (EA)	Daily (EA)
	Mimram at Fulling Mill	TL522500216900			
	Mimram at Panshanger	TL528200213300			
Spot Gauging including Physical	D/S Kimpton Mill	TL1980718479	Monthly (AW)		
	U/S Codicote Mill	TL20337 18221			

River Mimram	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/ Drought Permit Frequency	Post Drought Frequency
Chemical Parameters & Photos	D/S Codicote Mill	TL20766 17981			
	Pulmer Water	TL21238 16726			
	D/S Pulmer Water	TL22185 16822			
	D/S Fulling Mill GS	TL 23009 16443			
	Singlers Marsh back channel	TL22918 16492			
	U/S Singlers Bridge	TL23009 16443			
	Welwyn High Street	TL23055 16115			
	U/S Sherrardswood School	TL23628 15981			
	U/S Bessemer Road	TL24084 15349			
	Digswell Park Road	TL24242 15034			
	West Lodge	TL24765 14976			
Fisheries	Tewin Flyfishers		Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
	Panshanger Quarry				
	Codicote				
	Duck Trap Wood				
	Fulling Mill Lane	TL2267016930			
Macro-invertebrates	Whitwell	TL1839021220	Spring and Autumn (EA)		
	Below Whitwell, Hoo End	TL1936020150			
	Codicote Bottom	TL20758 18005			
	Below Codicote Bottom	TL21202 16744			
	Rye End Farm	TL1965019000			
	Above Welwyn Town	TL2267016930	Spring and Autumn (AW)		
	Tewin Water School, Digswell	TL25310 14630			
	Sherradswood School	TL2363215966			

River Mimram	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/ Drought Permit Frequency	Post Drought Frequency
	Panshanger	TL2790013400	Spring and Autumn (EA)		
Fixed point Photographs	Taken at Spot Gauging sites & 10 Fixed Historic Locations		Quarterly (AW)		

* AW also holds some hourly logger data for these boreholes

A6.3.11 River Dour drought monitoring

Table A6.13: Summary of Enhanced Drought Monitoring for River Dour

River Dour	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
Groundwater Level	Chilton Farm	TR27714315	Monthly (EA)	Monthly (EA)	Monthly (EA)
	Abbey Road				
	Russell Gardens				
	Minnis Lake Chalk	TR2909043540			
	Kearnsey Manor Chalk	TR2880444041			
	Bushy Ruff	TR278 435			
	Woverton New	TR26534273			
	Watersend	TR 2751 4496			
	Buckland Hospital				
	Pencester Gardens				
	Pencester Garden Shallow OBH				
	Cow Lane	TR 3040 4115			
	Manor Road	TR3012040520			
	Lydden No1				
	Lye Oak	TR2458744044			
	Elms Vale 1				
Gauged River Flows	Crabble Mill GS	TR2986943051	Daily (EA)	Daily (EA)	Daily (EA)
	Pencester GS	TR3195541695			
	Watersend Mill, Temple Ewell				
Spot Gauging	Crabble Mill	TR 29869 43051	Monthly (AW)	Fortnightly to Weekly (AW)	Weekly, reducing to fortnightly,
	Buckland Bridge	TR 30640 42720			

River Dour	Description	Grid Reference	Drought Zone 3 Frequency	Drought Zone 4/Drought Permit Frequency	Post Drought Frequency
	Pencester Gardens	TR 31955 41695			reducing to monthly (AW)
	Lower Road	TR 28753 44264			
	Russell Gardens	TR 28610 43770			
Fisheries	Length of River Dour		Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)	Walk-over Surveys (AW, EA)
Macro-invertebrates	Temple Ewell		Spring and Autumn (EA) NB additional monitoring by AW subject to agreement		
	Russell Gardens	TR 28629 43770			
	Buckland Bridge	TR3064042720			
	Crabble Mill	TR2986943051			
	Pencester Gardens	TR3195541695	Spring Summer and Autumn (EA)		
Fixed point Photographs	6 locations	TR 28305 43682 TR 28629 43770 TR 28592 44308 TR 2986943051 TR 3064042720 TR 3195541695			

