Abstraction Incentive Mechanism – Methodology and Abstraction in 2018-2019

Affinity Water

June 2019

Security Notice
*This document is classified as **official sensitive** in accordance with the Security and Emergency Measures Directive as it includes specific location details of public water supply sources. This document is only to be reviewed by designated persons and must not be disclosed or published to third parties or placed on a website. A redacted version of this document is available for publication.*

Asset Strategy document control sheet

Document amendment history

Version	Status	Date	Amendment to this version
0.1	First Draft	09/04/2019	Daniel Yarker
0.2	Second draft	10/04/2019	As per IK comments
0.3	Final draft	25/04/2019	As per AP comments
1	Final	26/06/2019	Redacted for publication

Document approval

Document title				
e-Document location				
	Name	**Title**	**Signature**	**Date**
Author/originator	Dan Yarker	Senior Asset Scientist		09/04/2019
Technical Reviewer	Ilias Karapanos	Asset Specialist		10/04/2019
Approver 1 (internal use)	Affie Panayiotou	Head of Water Strategy		25/04/2019
Approver 2 (external use)	Keith Gardner	Director of Asset Strategy and innovation		30/05/2019
Legal review	Julie Smith	Head of Legal Services		24/06/2019

This page is left intentionally blank

Table of Contents

Table of Figures

Table of Tables

Executive Summary

The Abstraction Incentive Mechanism (AIM) has been proposed by Ofwat with the objective to encourage water companies to reduce the environmental impact of abstracting water at environmentally sensitive sites during low flow periods (i.e. droughts). The purpose of this document is to set out the methodology and assumptions used to calculate the AIM triggers and baseline abstraction values. Actual abstraction data from the AIM sources for the financial year 2018-19 are shown in this report, in order to track performance and validate the AIM triggers selected.

A total of 23 groundwater sources have been identified as sensitive by Affinity Water, some of which will have sustainability reductions implemented in AMP6 and AMP7. The remaining sources have an operating agreement, other licence condition or are currently under National Environment Programme investigation. The AIM taskforce guidelines as proposed by Ofwat were followed to calculate the triggers and abstraction baseline figures. The AIM triggers selected were based on the Environment Agency's Restoring Sustainable Abstraction assessments, NEP investigations or other Environmental Impact Assessment work. Where current investigations were in place, the preferred trigger points on river flows were adopted, based on Environmental Flow Indicators in consultation with the Environment Agency. In the absence of these, Q95 flows were adopted as best indication of low flow conditions for the AIM triggers. Baseline abstraction values were calculated based on the 20-year period of 1st April 1995 - 31st March 2015 as this period is considered representative enough to include a number of droughts with and without demand restrictions. Where sustainability reductions have taken place, which have not reduced the deployable output to zero Ml/d, we have kept these sources in AIM, with the new AIM baseline being defined as the new annual licensed rate. Some AIM sources are also drought permit sites and we propose that when abstracting under a drought permit, AIM should not apply for that site.

Following the Ofwat guidance, two equations were used to calculate the AIM performance and the normalised AIM performance. For the ten AIM sources at which the trigger was breached during 2018-19, the global AIM performance was -2,383.84 Ml and the normalised global AIM performance was +0.96. The negative AIM performance figure signifies an improved performance compared to historic droughts, as average abstraction was lower than the baseline at the global scale. This suggests that the company met and exceeded the AIM baseline figures for the financial year 2018-19 which is mainly linked to the lack of AIM triggers active and on-going operational outages. The high normalised AIM score is reflective of the assessment method at SLIP source. This source needs to be managed more closely during future droughts to achieve a good normalised AIM score.

Following the annual review of the AIM triggers and baseline abstractions, it appears that they are robust and representative of the catchment status. The validity of the triggers and baseline abstraction is constantly monitored and the next AIM performance review will take place in July 2019 for Q1 of 2019-20.

1 Purpose

The Abstraction Incentive Mechanism (AIM) has the objective of encouraging water companies to reduce the environmental impact of abstracting water at environmentally sensitive sites in low flow periods (i.e. droughts). The purpose of this document is to set out the methodology and assumptions used to calculate the AIM triggers and baseline abstraction values. Furthermore, actual abstraction data from the AIM sources for the financial year 2018-19 are shown in this report, in order to track performance and validate the AIM triggers selected. Affinity Water have put forward a total of 23 groundwater sources to be included in AIM, which have been deemed as potentially environmentally sensitive by previous studies. AIM has come in force in reputational form since the 1st April 2016. Seven sources have been subject to sustainability reductions since 2016, with the deployable output (DO) at three of these sites being reduced to zero Ml/d. These three sources have been omitted from the AIM assessment, in addition to the CHAL source, which has been deemed to be 'not environmentally sensitive', following discussion with the Environment Agency. This leaves a total of 19 sources that have been assessed for AIM in this report.

2 Methodology

A total of 23 sites put forward by Affinity Water have been assessed as potentially having an impact on a surface waterbody hence included in the AIM list. Seven sources have been subject to sustainability reductions as of 1 April 2018 and so the post-reduction abstraction rates are considered for this assessment period. Sustainability reductions are planned for six additional sources in AMP7. The remaining ten sources have either an operating agreement in place (i.e. augmentation scheme) or other licence condition or are currently under National Environment Programme (NEP) investigation. Some AIM sources are also drought permit sites and we propose that when abstracting under a drought permit, AIM should not apply for that site.

In order to calculate the trigger and abstraction baseline, the AIM Taskforce guidelines have been followed. Based on these, the AIM trigger is set based on a specific environmental trigger identified through the Environment Agency's (EA) Restoring Sustainable Abstraction (RSA) assessments, NEP investigations or other Environmental Impact Assessment (EIA) work. In cases where our sources are situated in catchments under previous or currently ongoing NEP investigations, we have adopted the preferred trigger points on river flows (Environmental Flow Indicators) as set out by the EA. For sites that have not been under investigation or this is currently underway with no triggers yet agreed, the Q95 flows have been adopted as the best indicator of low flow conditions below which AIM should operate. In the majority of cases, the potential impact on the surface water body is the river, so the trigger is set in the downstream gauging station that is considered to be representative of the groundwater catchment. There are exceptions to this, where a groundwater level trigger has been used instead, due to better representation of the aquifer baseline conditions or the absence of a gauging station.

The length of the record for each gauging station or groundwater level monitoring point is defined by the data availability and data quality in order to better calculate the AIM trigger. Where the Q95 or Q70 values have been used, these were adopted from the Centre of Ecology and Hydrology as published in their website[1] in July 2016.

Once the AIM triggers were identified, the baseline abstraction values were calculated based on the average abstraction during the historic period when river flows or groundwater levels were at or below the trigger. The duration of the abstraction record was chosen as the period between the 1st April 1995 and the 31st March 2015. This 20-year period was chosen as the most representative of current and future abstraction patterns, as the distribution network constantly evolves and reliance on particular sources may change accordingly. Also, if this were to extend further back, the uncertainty on data quality would increase as flow meters were not always available, with abstraction being calculated based on pump hours. Following the AIM guidance stating that "the past needs to be representative of the future", the period from 1995 – 2015 is thought to best represent the future. Furthermore, this 20-year period includes a number of low flow periods (1997, 2003, 2005, 2006 and 2012) with some of them having demand restrictions and others being unrestricted. As such, this record is considered as being long enough to incorporate different types of droughts and also smooth out abstraction values that may be very low due to site outages. In cases where outliers were found that are deemed as not representative of the future use of the sources, these were highlighted and addressed appropriately as explained in the next sections.

3 Triggers and Abstraction Baseline

Table 1 below presents the sources that were submitted to Ofwat in September 2015 for inclusion in the AIM list.

Table 1. Sources Operated Under AIM from 1 April 2016

	Source	Group	Licence Number	Avg. Ann. Licence	Max Daily Licence	2015 DO	
NEP further sites	NETH	CLAY	28/39/28/336		40.91	28.00	30.00
	BRIC	CLAY	28/39/28/336		27.28	14.00	15.00
	CHES	Individual	28/39/28/104	5.22	7.09	5.22	6.00
AMP5 sustainability operating agreements	OUGH	Individual	28/39/28/339	4.55	6.55	4.10	5.22
	SLIP	Individual	06/33/14/36	5.46	6.82	0.00	0.00
	WELL	Individual	06/33/13/10	2.27	2.27	1.15	1.15
	OFFS	Individual	06/33/13/09	1.14	1.14	0.00	0.00
	PRIM	Individual	9/40/4/497/G	3.00	4.00	3.00	3.00
	BUCM	Individual	14/033	4.00	4.00	4.00	4.00
	DENG Gravels	DENG	9/40/5/71/G	9.04	15.00	4.65	9.04
AMP6 Sustainability reduction sites	BOWB	KENS	28/39/28/130	6.82	11.37	5.82	5.82
	AMER	GREM	28/39/28/334	7	18.18	7.00	12.00
	WHIH	WHIH	29/38/03/42	22.73	30.46	15.00	28.00
	FULL	DIGS	29/38/02/46	9.09	9.09	5.60	9.09
	MARL	LITT	28/39/28/335		20.47	4.74	4.74
	PICC	LITT	28/39/28/335			15.72	15.72
	HUGH	Individual	28/39/25/47	2.28	2.27	1.60	1.75
AMP7 potential Sustainability reduction sites	DIGS	DIGS	29/38/02/46	11.37	11.37	7.88	7.88
	CHAL	GREM	28/39/28/334	4	4.55	4.00	4.50
	HOLY	STAL	28/39/28/337		9.09	8.20	9.09
	MUDL	STAL	28/39/28/337		11.37	10.03	11.37
	PERI	Individual	28/39/28/401	4.99	5	4.19	4.19
	RUNL (Chalk)	Individual	29/38/01/09	9.55	9.55	6.30	6.30

Some of these sources have individual licences whilst others are part of a group licence. The licence, DO values and potential benefit reflect the situation in September 2015 as since then, our conceptual understanding has improved and sustainability reductions have already been implemented (BOWB reduced to zero as of 1 April 2016, FULL and HUGH reduced to zero as of 1 April 2017, WHIH reduced to an annual average of 2 Ml/d as of 1 April 2017, AMER reduced to an annual average of 4 Ml/d as of 1 April 2018 and the combined annual average of MARL and PICC reduced by 6.4 Ml/d as of 1 April 2018). Hence the licence and DO values have been adjusted accordingly. Where DO has been reduced to zero Ml/d, it is proposed that AIM no longer applies to these sources as the impact of abstraction has been mitigated. Where DO has not been reduced to zero Ml/d, there remains the potential for a residual abstraction influence and so there is benefit in continuing to assess AIM against a lower AIM baseline. Therefore, FULL, HUGH and BOWB have been removed from the assessment whilst MARL, PICC, WHIH and AMER remain. CHAL source has been removed as agreed following discussion with the Environment Agency that the potential benefit from an abstraction reduction here is small.

Some of the sources assessed for AIM are located in the same catchment and have been grouped as shown in Table 4 and Table 5. The groupings have been used as the baseline was calculated based on the performance of AIM sources under historic droughts and this does not necessarily reflect the current operational regime. An example is the BRIC and NETH sources. These now both form baseload sources of the CLAY group and usually abstract at a higher rate than the AIM baseline. In the event of an operational outage at either of the sources, there is a need for the flexibility to increase abstraction at the other, to compensate the lost output. Without the grouping, we would not be able to recoup the lost volume if an outage occurred during a low flow period.

This is also important when calculating the normalised AIM score. The relative size of different abstractions means that if output from one source was increased in response to an outage at a baseload source during a low flow period, without the grouping, the normalised AIM score of the two sources would not balance and the AIM assessment would be inaccurate. Where sources are grouped, the same trigger point is used. This is downstream of both sources in the grouping, such that the benefit of their combined operation can be realised.

Based on the methodology explained in section 2, the calculated or adopted AIM triggers are presented in Table 2.

Table 2. AIM Triggers for Groundwater Sources

Source	Trigger Location	Monitoring Record	Q95 or bespoke trigger (Ml/d)	Comments
BRIC NETH	R. Colne at Berrygrove GS	April 1995 – March 2015	13.00	Bespoke trigger based on minimum flows derived from AMP5 Options Appraisal Work
WELL OUGH OFFS	R. Hiz at Hitchin GS	August 1980 – to date	0.26	Trigger based on Q95 adopted from CEH[1]
DIGS (aggregated with FULL)	R. Mimram at Panshanger GS	December 1952 – to date	18.66	Trigger based on Q95 adopted from CEH[1]
HOLY MUDL	R. Ver at Colney Street GS	April 1995 – March 2015	7.44	Trigger based on Q95 adopted from CEH[1]
MARL PICC	R. Gade at Croxley Green GS	October 1970 – to date	32.00	Trigger based on Hunton Bridge Licence condition for flows at Croxley Green
AMER	R. Misbourne at Denham Lodge GS	July 1984 – to date	5.53	Trigger based on Q95 adopted from CEH[1]
WHIH	R. Beane at Hartham Park GS	August 1979 – to date	15.47	Trigger based on Q95 adopted from CEH[1]
CHES	R. Chess at Rickmansworth GS	July 1974 – to date	15.38	Trigger based on Q95 adopted from CEH[1]
PERI RUNL Chalk	R. Lee at Luton Hoo/East Hyde GS	October 1959 – to date	7.34	Trigger based on Q70 adopted from CEH[1]
SLIP	R. Rhee at Ashwell GS	November 1965 – to date	Dependent on licensed flow condition	Trigger based on Operating Agreement for Ashwell BH Augmentation
PRIM BUCM	R. Dour at Crabble Mill GS	August 1966 – to date	18.06	Trigger based on minimum flows at Crabble Mill as per BUCM Licence condition
DENG Gravels	DENG Tubewell 19	October 2000 – March 2015	1.78mAOD	Bespoke trigger based on minimum levels for the nearby wetlands (at 1.35mAOD in TW33)

The abstraction baseline values have been calculated as the average historic abstraction, based on the period April 1995 to March 2015 when the AIM trigger would have been reached, as set out in Table 2. Where sustainability reductions have not reduced DO to zero Ml/d, the AIM baseline has been set as the post reduction annual licence limit, to discourage use of the peak licence still available under low flow conditions.

It is proposed that the AIM trigger for our SLIP source should vary, depending on flow at Ashwell gauging station on the Rhee and the abstraction rate specified in the licence. To allow for headroom, we usually abstract slightly less than we are entitled to under most of our abstraction licences. With this in mind, the AIM baseline for SLIP has been set at the 95th percentile of the licensed abstraction at the site at any time, assuming that the flow is below 2.55 Ml/d (the first step on the table) (see Table 3), so that a benefit can be claimed for any abstraction lower than usual operation during a drought.

Table 3 Moving Baseline at SLIP Source

Flow at Ashwell Gauging Station at National Grid Reference TL 267 401 in litres per second	Maximum Daily Abstraction rate in Ml/d	Proposed AIM trigger (95 % of Licensed volume)
Flows above 29.46 (2.55Ml/d)	Up to 6.82	
Between 28.95 and 29.46	5.46	5.18
Between 28.41 and 28.94	5.00	4.75
Between 27.90 and 28.40	4.55	4.32
Between 27.36 and 27.89	4.09	3.89
Between 26.83 and 27.35	3.64	3.46
Between 26.32 and 26.82	3.18	3.02
Between 25.78 and 26.31	2.73	2.59
Between 25.27 and 25.77	2.27	2.16
Between 24.74 and 25.26	1.82	1.73
Between 24.20 and 24.73	1.36	1.30
Between 23.69 and 24.19	0.91	0.86
Between 23.15 and 23.68	0.46	0.43
Less than 23.15	0.00	0.00

NETH and BRIC sources will operate under AIM at a combined daily abstraction of 37.16 Ml/d. The 5 Ml/d deficit from the current target can be met by the introduction of TOLP and/or the slight increase of EAST, which are part of the same group licence but located down catchment, so in theory are less environmentally sensitive as river flows are higher.

The Hitchin sources (WELL, OUGH and OFFS) currently have augmentation schemes in place, based on level trigger points at Charlton Mill Pond (for WELL) and Oughton Springs (for both OUGH and OFFS). It is proposed that AIM will only apply to the abstracted water for public water supply and not for augmentation, as augmentation is in place to mitigate the abstraction impacts and augmentation should reduce the frequency of the AIM trigger being breached. The EA also operates an augmentation scheme from Bath Springs borehole to the River Hiz downstream of Charlton Mill Pond and upstream of their gauging station. Despite the low augmentation volumes, if this is considered to skew the gauge readings when in operation, then a groundwater level trigger could apply based on the EA observation borehole at Lilley Bottom. The equivalent trigger for flows at Q95 (0.26 Ml/d) at Hitchin Gauging station, would be set at 92.4 mAOD based on the relationship between the groundwater level hydrograph and the river gauge as shown in Figure 1.

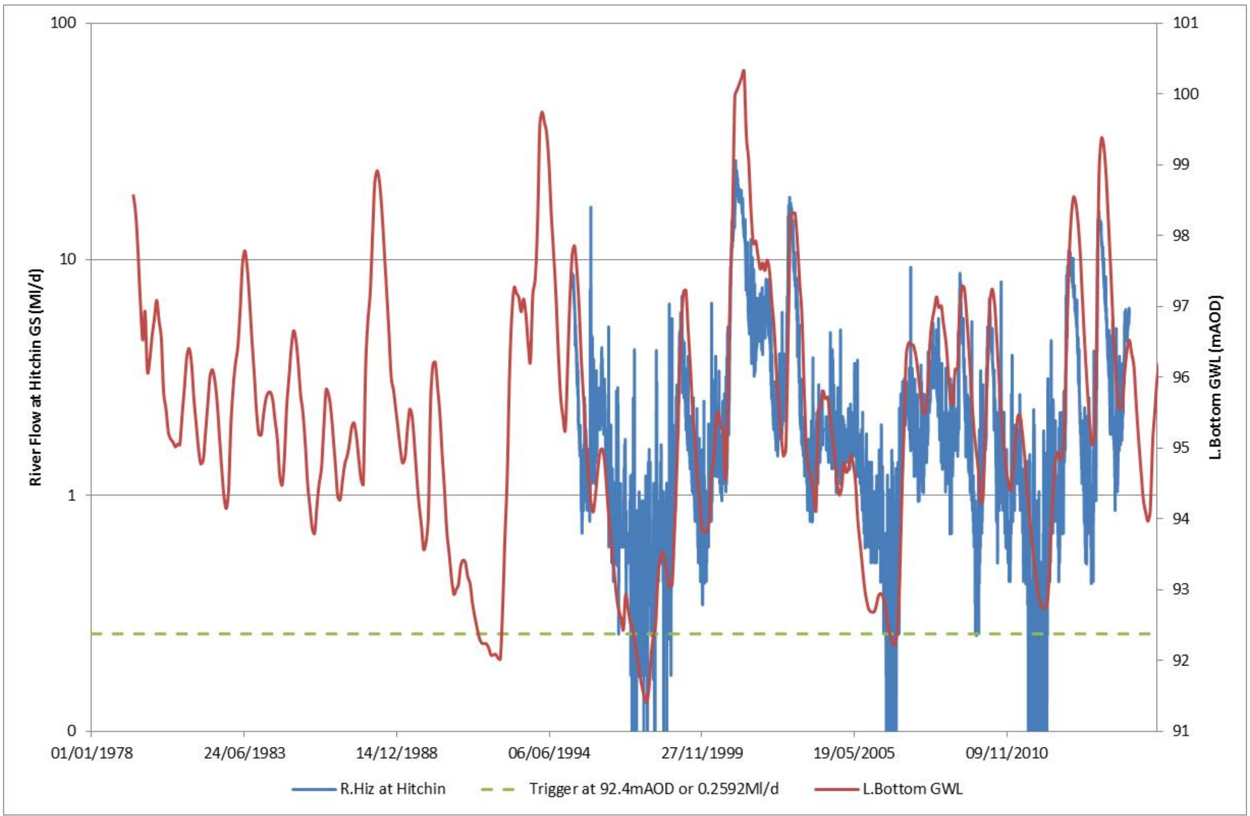

Figure 1: Relationship between River Flows at Hitchin Gauging Station and Groundwater Levels at Lilley Bottom Observation Borehole

The Mimram source (DIGS) will operate under AIM at the baseline abstraction of 7.53 Ml/d, based on the Q95 trigger flow at Panshanger Gauging Station. Since September 2017, FULL (also in the Mimram catchment) has been licensed to abstract a small volume of water (<2 Ml/d), under low groundwater conditions for flood management purposes and during such periods, the licence is aggregated with DIGS, to ensure that the 9.09 Ml/d sustainability reduction in the Mimram catchment abstraction remains. As a result, the aggregated abstraction for the two sources is reported on AIM.

The Ver sources (HOLY and MUDL) will operate under AIM at the combined output of 17.72 Ml/d. Since MUDL is considered operationally as an additional borehole for HOLY and due to their close proximity, it is proposed that the combined AIM baseline will apply instead of the individual baseline values, in order to allow operational flexibility during low flow periods. As discussed earlier, it is proposed that AIM will not apply for BOWB since the source has had its licence revoked due to sustainability reductions as of the 1 April 2016.

The Gade sources (MARL and PICC) previously operated under AIM at the combined output of 20.14 Ml/d. Following the April 2018 sustainability reduction, the new combined AIM baseline for the two sources is 14.06 Ml/d, equivalent to the combined post-reduction annual licensed rates at the two sources. As the combined daily licence at the two sources is 19.06 Ml/d, the AIM baseline will serve to discourage peak abstraction if low flows coincide with a high demand period.

Following the 2018 sustainability reduction, AMER will operate under AIM at the baseline abstraction of 4 Ml/d. This is equivalent to the post-reduction annual licensed rate. CHAL was previously included in the AIM assessment for the Misbourne catchment but has now been removed following discussions with the Environment Agency.

WHIH source is included in AIM with a baseline of 2 Ml/d. This is equal to the post-sustainability reduction annual licensed rate and similar to the Gade sources, the considerable difference between peak and average licensed conditions would serve to discourage peak use during low flow events.

CHES source will operate under AIM at the abstraction baseline of 4.08 Ml/d as calculated by the AIM methodology for flow in the Chess reaching Q95 values at the Rickmansworth gauge. It needs to be noted though that if the CHAR source is out of supply due to high nitrates, the AIM will not apply for CHES as they are both in the same catchment area. In this case, the river would theoretically benefit from CHAR being out of supply (DO of 1.78 Ml/d).

HUGH source has had a sustainability reduction implemented on the 1 April 2017 (full closure). As such, going forward, AIM will cease to apply.

The Upper Lee sources (RUNL Chalk and PERI) are being considered for sustainability reductions in AMP7. It is proposed that the combined AIM baseline of the two sources will be 9.94 Ml/d until the reductions are implemented. If the reductions are no longer required based on the monitoring results, the sources could be removed from the AIM list.

BUCM source has a licence condition that requires augmentation to the River Dour during low flow periods. However, since both this and PRIM are located in the same part of the catchment, it is proposed that when the trigger is reached at Crabble Mill gauge, that both sources will operate under AIM at the combined abstraction of 6.50 Ml/d. This was adopted based on the anticipated increased demand in this zone due to housing developments. This volume is still lower than the combined DO for the two sources by 0.5 Ml/d. It needs to be noted, that as mentioned above for sources that have river support schemes, the AIM baseline will apply to the volume of water into supply and not the augmentation volume. This will apply to BUCM only as there is no augmentation capability from PRIM.

DENG source will operate at the AIM baseline of 6 Ml/d as per the new average licence implemented on the 1 April 2015. This is a voluntary licence reduction by 3 Ml/d at average (previous licence at 9 Ml/d average), so the AIM baseline is adjusted to reflect the new operational pattern.

All triggers and AIM abstraction baseline values for the AIM sources are shown in Table 4. It should be noted that both the triggers and the baseline values are subject to consultation and may need to be reviewed following this procedure. At present, they are thought to be robust based on the current knowledge of the catchments and the historic and future use of the sources under low flow conditions. Periodic reviews of the AIM sites will take place in order to validate both the triggers and the abstraction values. The review of the AIM sites for the financial year of 2018-19 is discussed in Section 4.

Table 4. AIM Baseline Abstraction versus Triggers

Source	Catchment	Combined AIM baseline (Ml/d)	AIM baseline (Ml/d)	Average Deployable Output (Ml/d)	Operational Site Target (Ml/d)
BRIC	Colne	37.16	18.65	14.00	15.00
NETH			18.51	28.00	27.00
WELL	Hiz	0.84	0.84	1.15	1.70
OUGH		5.03	4.43	4.10	4.55
OFFS			0.60	0.00	1.00
DIGS (aggregated with FULL)	Mimram	7.53	7.53	7.88	8.00
HOLY	Ver	17.72	10.29	8.20	8.00
MUDL			7.43	10.03	10.00
MARL	Gade	14.06	8.34	8.34	8.34
PICC			5.72	5.72	5.72
AMER	Misbourne	4.00	4.00	4.00	4.00
WHIH	Beane	2.00	2.00	2.00	2.00
CHES	Chess	4.08	4.08	5.22	5.22
PERI	Upper Lee	9.94	3.36	4.19	4.50
RUNL Chalk			6.58	6.30	6.30
SLIP	Rhee	95% of licensed abstraction	95% of licensed abstraction	0.00	4.50
PRIM	Dour	6.50	2.50	3.00	2.50
BUCM			4.00	4.00	3.50
DENG Gravels	DENG	6.00	6.00	4.65	5.00

4 Abstraction in 2018-2019 versus AIM Baseline

A periodic review of the AIM triggers and baseline abstraction is undertaken on a quarterly and annual basis in order to validate the selected values. Table 5 below shows the actual abstraction figures for 2018-19 against the AIM baseline values.

Table 5. AIM baseline Abstraction versus Actual Abstraction in 2018-19

<table>
<tr><th>Source</th><th>Catchment</th><th>Combined AIM baseline (Ml/d)</th><th>AIM baseline (Ml/d)</th><th colspan="2">Actual Abstraction (2018/19) (Ml/d)</th><th>AIM Performance (Ml)</th><th>Normalised AIM Performance</th><th>Number of days flow below the trigger</th></tr>
<tr><td>BRIC</td><td rowspan="2">Colne</td><td rowspan="2">37.16</td><td>18.65</td><td>15.91</td><td rowspan="2">41.63</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td rowspan="2">0</td></tr>
<tr><td>NETH</td><td>18.51</td><td>25.72</td></tr>
<tr><td>WELL</td><td rowspan="3">Hiz</td><td>0.84</td><td>0.84</td><td colspan="2">1.41 (minus augmentation)</td><td>+43.46</td><td>+0.49</td><td rowspan="3">106</td></tr>
<tr><td>OUGH</td><td rowspan="2">5.03</td><td>4.43</td><td>0.02</td><td rowspan="2">0.86</td><td rowspan="2">-463.22</td><td rowspan="2">-0.87</td></tr>
<tr><td>OFFS</td><td>0.60</td><td>0.84</td></tr>
<tr><td>DIGS plus FULL</td><td>Mimram</td><td>7.53</td><td>7.53</td><td colspan="2">7.87</td><td>NA</td><td>NA</td><td>0</td></tr>
<tr><td>WHIH</td><td>Beane</td><td>2.00</td><td>2.00</td><td colspan="2">2</td><td>NA</td><td>NA</td><td>0</td></tr>
<tr><td>HOLY</td><td rowspan="2">Ver</td><td rowspan="2">17.72</td><td>10.29</td><td>10.42</td><td rowspan="2">17.83</td><td rowspan="2">NA</td><td rowspan="2">NA</td><td rowspan="2">0</td></tr>
<tr><td>MUDL</td><td>7.43</td><td>7.42</td></tr>
<tr><td>MARL</td><td rowspan="2">Gade</td><td rowspan="2">14.06</td><td>8.34</td><td>4.96</td><td rowspan="2">13.99</td><td rowspan="2">0</td><td rowspan="2">0</td><td rowspan="2">1</td></tr>
<tr><td>PICC</td><td>5.72</td><td>9.03</td></tr>
<tr><td>AMER</td><td>Misbourne</td><td>4.00</td><td>4.00</td><td colspan="2">3.99</td><td>NA</td><td>NA</td><td>0</td></tr>
<tr><td>CHES</td><td>Chess</td><td>4.08</td><td>4.08</td><td colspan="2">3.24</td><td>NA</td><td>NA</td><td>0</td></tr>
<tr><td>PERI</td><td rowspan="2">Upper Lee</td><td rowspan="2">9.94</td><td>3.36</td><td>3.71</td><td rowspan="2">3.88</td><td rowspan="2">-1,808.95</td><td rowspan="2">-0.61</td><td rowspan="2">299</td></tr>
<tr><td>RUNL Chalk</td><td>6.58</td><td>0.17</td></tr>
<tr><td>SLIP</td><td>Rhee</td><td>95% of licensed abstraction</td><td>95% of licensed abstraction</td><td colspan="2">4.62 (minus augmentation)</td><td>+21.36</td><td>+2.68</td><td>54</td></tr>
<tr><td>PRIM</td><td rowspan="2">Dour</td><td rowspan="2">6.50</td><td>2.50</td><td>1.47</td><td rowspan="2">3.96</td><td rowspan="2">-176.49</td><td rowspan="2">-0.73</td><td rowspan="2">37</td></tr>
<tr><td>BUCM</td><td>4.00</td><td>2.49 (minus augmentation)</td></tr>
<tr><td>DENG Gravels</td><td>DENG</td><td>6.00</td><td>6.00</td><td colspan="2">4.95</td><td>NA</td><td>NA</td><td>0</td></tr>
<tr><td colspan="4"></td><td colspan="2">TOTALS</td><td>-2,383.84</td><td>+0.96</td><td></td></tr>
</table>

Background groundwater levels have been below the long-term average (LTA) since July 2016 (Figure 2) and below the drought zone 1 curve since October 2016. Groundwater levels were in drought zone 2 from January 2017 until April 2018, when, following significant spring rainfall and snowmelt, they recovered. They peaked in June 2018, about halfway between the drought zone 1 and drought zone 2 curves, before receding, more quickly than the LTA. This caused them to cross into drought zone 2 once more in November 2018. The recovery during the recharge period of 2018-19 to date has been lacklustre and levels remain in drought zone 2. Although the summer of 2018 was characterised by hot dry weather which caused flows to rapidly decrease in gravel baseflow dominated rivers, the higher Chalk groundwater levels compared to the summer of 2017 meant that not as many AIM triggers were activated, with AIM being active in five catchments in 2018-19 compared to 12 in 2017-18.

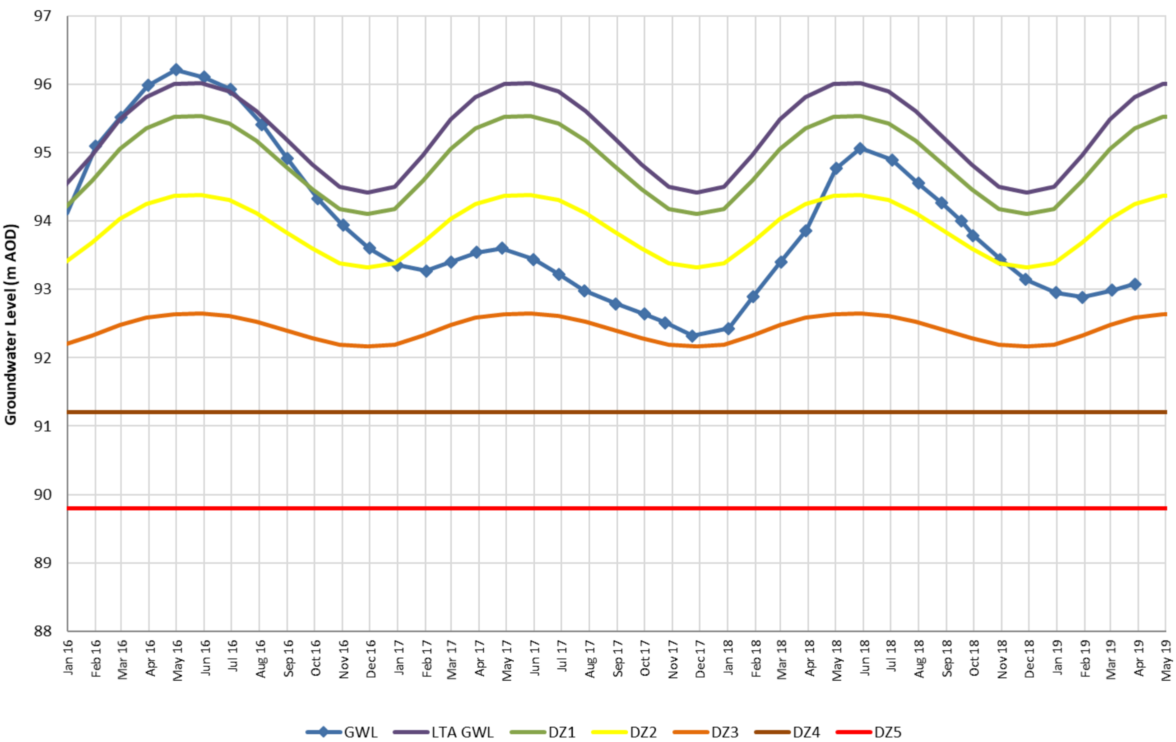

Figure 2: Background Groundwater Level Fluctuations Measured at the Environment Agency Observation Borehole at Lilley Bottom

Table 5 states the number of days in 2018-19 that each AIM trigger was active. This can be used to assess how sensitive each trigger is to drought and how spatially variable a drought is. It can be seen that the Upper Lee trigger was active for the most days during 2018-19 (299 days), followed by the Hiz (106 days) and the Rhee (54 days). Flow in the Dour was below the AIM trigger for 37 days during 2018-19, whilst flow in the Gade dipped below the trigger at Croxley Green for just one day. The length of time that the triggers were active for the Rhee and Hiz, despite flow augmentation during this time, points to potentially more severe drought conditions in the catchments of the northern flowing Chalk streams in our Central region (Rivers Cam, Hiz, Ivel, Rhee and Purwell). Flows in the Colne are artificially maintained by STW discharge and this is likely to have supported river flows during the summer, especially considering the high demand.

As specified in the AIM guidelines document from Ofwat, the AIM performance is measured based on the difference between the actual and the baseline abstraction, multiplied by the number of days when flows were at or below the trigger threshold (see equation below).

> AIM performance in Ml = (average daily abstraction during period when flows are at or below the trigger threshold - baseline average daily abstraction during period when flows are at or below the trigger threshold) * length of period when flows are at or below the trigger threshold.

In order to allow for comparison of the AIM performance between abstraction sites, either within the company or between water companies, the performance on the AIM is normalised by the baseline average daily abstraction and the length of time for which flows were at or below the trigger threshold. This is because the guidelines suggest that a performance of -1Ml is better if the AIM baseline is smaller or if the period for which flows are at or below the trigger threshold is shorter. The equation for the Normalised AIM performance is given below as proposed by Ofwat.

> Normalised AIM performance = AIM performance / (baseline average daily abstraction * length of period when river flows are at or below the trigger threshold)

As such, when applying the two equations above to measure the AIM performance and the normalised AIM performance for RUNL Chalk and PERI for 2018-19, the AIM performance is -1,808.95 Ml and the normalised performance is -0.61. The negative figure signifies an improved performance as average abstraction was lower than the baseline, over the 299 days that AIM was in effect, equating to an outperformance of 6.05 Ml/d. Both of these sources are situated in the Upper Lee catchment. The under-abstraction compared to the AIM baseline is mainly attributed to the outage at RUNL Chalk for the first half of 2018-19 due to water quality issues and the intermittent outages following the recommissioning of the site.

For the 106 days that the AIM trigger was in effect in the Hiz catchment, the AIM performance at WELL was +43.46 and the normalised AIM performance was +0.49. This signifies that after subtracting the volume of water used for augmentation, we abstracted 0.41 Ml/d more than we have done during previous droughts. The AIM performance at our OUGH and OFFS sources was -463.22 Ml and the normalised AIM performance was -0.87. This is mainly attributed to the long-running outage at OUGH due to high nitrate concentrations.

The flow in the Gade at Croxley Green was below the AIM trigger for one day during 2018-19. On this day, the average abstraction from the PICC and MARL sources was equal to the AIM baseline, and so the AIM score is zero Ml and the normalised AIM score is zero.

SLIP source is assessed based on the trigger at Ashwell gauging station on the Rhee. Flow here was below the trigger for 54 days during 2018-19. During this time, our AIM score was +21.36 Ml and our normalised AIM score was +2.68, suggesting that we abstracted on average, 0.4 Ml/d more than the rolling AIM baseline each day the trigger was in effect. The normalised AIM score is high as we are not always asked to cut back abstraction by the EA and there is a two day grace period on the SLIP licence in which to implement a reduction. As a result, there is the potential to generate a large normalised AIM score, by abstracting significantly over the AIM trigger for a short period of time, but without having been asked to cut back abstraction by the EA as per the licence condition. This happened in 2018-19 and will require better management in future years to achieve a good normalised AIM score.

The AIM trigger was active in the Dour catchment, based on the flow at Crabble Mill, for 37 days during 2018-19. The AIM performance during this period was -176.49 Ml and our normalised AIM performance was -0.73. This equates to a daily outperformance of 4.77 Ml/d compared to historic drought periods. This good performance was largely due to the decision to switch off BUCM for extended periods when the flow constraint was in effect.

No other AIM triggers were in effect during 2018-19.

In summary, for the ten AIM sources that the trigger was reached during 2018-19, the global AIM performance was -2,383.84 Ml and the global normalised AIM performance was +0.96. This suggests that the company met and exceeded the AIM performance figures for this period, with the high normalised AIM score being reflective of the assessment method at SLIP. This source needs to be managed more closely during future droughts to achieve a good normalised AIM score.

Following the quarterly and annual review of the AIM triggers and baseline abstractions, it appears that they are robust and representative of the catchment status. The validity of the triggers and baseline abstraction is constantly monitored and the next AIM performance review will take place in July 2019 for Q1 of 2019-20.

5 References

[1]: http://nrfa.ceh.ac.uk/data/search