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Abstraction Incentive Mechanism – Methodology and Assumptions

Affinity Water Report

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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. 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.

2 Methodology

A total of 23 sites put forward by Affinity Water have been assessed as having impact on a surface water body hence included in the AIM list. From these, 7 sources will suffer Sustainability Reductions in AMP6, followed by an additional 6 sources in AMP7. The remainder 10 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.

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 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 Environment Agency (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 website¹.

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 pressure on sources may fluctuate 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 that says "the past needs to be representative of the future", the period from 1995 – 2015 is thought to better 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 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

Error! Reference source not found. below presents the sources that were submitted to Ofwat in September 2015 for inclusion in the AIM list.

Table 1. Sources to be operated under AIM from 1st April 2016

	Source	Group	Licence Number	Avg. Ann. Licence	Max Daily Licence	2015 DO		AMP6 SR	AMP7 SR	Environmental Benefit
NEP further sites	NETH	LANE	28/39/28/336		40.91	28.00	30.00	No	No	Yes
	BRIC	LANE	28/39/28/336		27.28	14.00	15.00	No	No	Yes
	CHES	Individual	28/39/28/104	5.22	7.09	5.22	6.00	No	No	Yes
AMP5 sustainability operating agreements	OUGH	Individual	28/39/28/339	4.55	6.55	4.10	5.22	No	No	Yes
	SLIP	Individual	06/33/14/36	5.46	6.82	0.00	0.00	No	No	Yes
	WELL	Individual	06/33/13/10	2.27	2.27	1.15	1.15	No	No	Yes
	OFFS	Individual	06/33/13/09	1.14	1.14	0.00	0.00	No	No	Yes
	SPRI	Individual	9/40/4/497/G	3.00	4.00	3.00	3.00	No	No	Yes
	SBUC	Individual	14/033	4.00	4.00	4.00	4.00	No	No	Yes
	SDNG	SDNG	9/40/5/71/G	9.04	15.00	4.65	9.04	No	No	Yes
AMP6 Sustainability reduction sites	BOWB	KENS	28/39/28/130	6.82	11.37	5.82	5.82	Yes	N/A	Yes
	AMER	GREM	28/39/28/334	7	18.18	7.00	12.00	Yes	N/A	Yes
	WHIH	WHIH	29/38/03/42	22.73	30.46	15.00	28.00	Yes	N/A	Yes
	FULL	DIGS	29/38/02/46	9.09	9.09	5.60	9.09	Yes	N/A	Yes
	MARL	LITT	28/39/28/335		20.47	4.74	4.74	Yes	N/A	Yes
	PICC	LITT	28/39/28/335			15.72	15.72	Yes	N/A	Yes
	HUGH	Individual	28/39/25/47	2.28	2.27	1.60	1.75	Yes	N/A	Yes
AMP7 Sustainability reduction sites	DIGS	DIGS	29/38/02/46	11.37	11.37	7.88	7.88	No	Yes	Yes
	CHAL	GREM	28/39/28/334	4	4.55	4.00	4.50	No	Yes	Yes
	HOLY	STAL	28/39/28/337		9.09	8.20	9.09	No	Yes	Yes
	MUDL	STAL	28/39/28/337		11.37	10.03	11.37	No	Yes	Yes
	PERI	Individual	28/39/28/401	4.99	5	4.19	4.19	No	Yes	Yes
	RUNL	Individual	29/38/01/09	9.55	9.55	6.30	6.30	No	Yes	Yes

Some of these sources have individual Licences whilst others are part of a group Licence. The Licence and Deployable Output values reflect the situation in September 2015 as since then, Sustainability Reductions have already been implemented (BOWB reduced to zero as of 1st April 2016) hence the Licence and DO values have been adjusted accordingly. In this case, it is proposed that AIM no longer applies to these sources as the impact of abstraction has been

mitigated. In the case that Sustainability Reductions have been agreed and will be implemented in the future (either AMP6 or AMP7), it is anticipated that AIM will only apply between the 1st April 2016 and the implementation date of the Sustainability Reduction of each source. Beyond this date, AIM will cease to apply. As such, post 2024, when all agreed reductions will have been implemented (AMP6 and 7) the number of sources to be operating under AIM will reduce from 23 to 10.

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

Table 2. AIM triggers for Affinity Water Groundwater Sources

Source	Trigger Location	Monitoring Record	Q95 or bespoke trigger (MI/d)	Comments
BRIC	R. Colne at Berrygrove GS	April 1995 – March 2015	13.00	Bespoke trigger based on minimum flows derived from AMP5 Options Appraisal Work
NETH				
WELL	R. Hiz at Hitchin GS	August 1980 – to date	0.26	Trigger based on Q95 adopted from CEH ¹
OUGH				
OFFS				
DIGS	R. Mimram at Panshanger GS	December 1952 – to date	18.66	Trigger based on Q95 adopted from CEH ¹
FULL				
BOWB	R. Ver at Colney Street GS	April 1995 – March 2015	7.44	AIM not applicable due to SRs in April 2016
HOLY				Trigger based on Q95 adopted from CEH ¹
MUDL				
MARL	R. Gade at Croxley Green GS	October 1970 – to date	32.00	Trigger based on HUNT Licence for flows at Croxley Green
PICC				
AMER	R. Misbourne at Denham Lodge GS	July 1984 – to date	5.53	Trigger based on Q95 adopted from CEH ¹
CHAL				
WHIH	R. Beane at Hartham Park GS	August 1979 – to date	15.47	Trigger based on Q95 from CEH ¹
CHES	R. Chess at Rickmansworth GS	July 1974 – to date	15.38	Trigger based on Q95 adopted from CEH ¹
HUGH	HUGH Stream at High Wycombe GS	July 1997 – to date	9.68	Trigger based on Q70 adopted from CEH ¹

PERI	R. Lee at Luton Hoo/East Hyde GS	October 1959 – to date	73.44	Trigger based on Q70 adopted from CEH ¹
RUNL				
SLIP	R. Rhee at Ashwell GS	November 1965 – to date	2.55	Trigger based on Operating Agreement for Ashwell BH Augmentation
SPRI	R. Dour at Crabble Mill GS	August 1966 – to date	18.06	Trigger based on minimum flows at Crabble Mill as per SBUC Licence condition
SBUC				
SDNG	SDNG 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. The results are shown in Table 3 below and have been adopted by Affinity Water as the AIM baseline daily abstraction values.

As explained earlier, for the sites that are due for Sustainability Reductions, the AIM trigger will only apply until the Reduction has been implemented. As a result, if there is no low flow period until the Reduction is in place, the AIM will not apply.

NETH and BRIC sources will operate under AIM at a combined daily abstraction of 34.16MI/d. The 10MI/d deficit from the current target will be met by the introduction of TOLP at 8MI/d and the increase of EAST by 2MI/d. This has already been discussed with the EA for the AMP5 Options Appraisal work on the Upper Colne NEP.

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 OUGH 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. The EA also operate 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 key observation borehole at Lilley Bottom. The equivalent trigger for flows at Q95 (0.2592MI/d) at Hitchin Gauging station, would be set at 92.4mAOD based on the relationship between the groundwater level hydrograph and the river gauge as shown in Figure 1.

The Mimram sources (FULL and DIGS) will operate under AIM at the baseline abstraction of 5.34MI/d and 7.53MI/d, respectively, based on the Q95 trigger flow at Panshanger Gauging Station. It needs to be noted that we already operate FULL at the average take of 5.6MI/d as of April 2015 on a voluntary basis in order to mitigate the abstraction impacts during the period leading to formal closure of this pumping station which is due in April 2017. In the event the low flow trigger is reached at Panshanger until April 2017, then the 5.34MI/d AIM baseline will apply. After this time, the AIM will only apply to DIGS until April 2021 when its reduction will be implemented.

Table 3. AIM baseline Abstraction vs triggers

Source	Catchment	Combined AIM baseline (MI/d)	AIM baseline (MI/d)	Average Deployable Output (MI/d)	Operational Site Target (MI/d)
BRIC	Colne	34.16	18.65	14.00	15.00
NETH			18.51	28.00	27.00
WELL	Hiz	5.03	0.84	1.15	1.70
OUGH			4.43	4.10	4.55
OFFS			0.60	0.00	1.00
DIGS	Mimram	7.53	7.53	7.88	8.00
FULL			5.34	5.60	5.60
BOWB	Ver	0.00	0.00	0.00	0.00
HOLY	Ver	17.72	10.29	8.20	8.00
MUDL			7.43	10.03	10.00
MARL	Gade	20.14	4.42	4.74	4.70
PICC			15.72	15.72	15.00
AMER	Misbourne	10.38	7.51	7.00	7.00
CHAL			2.87	4.00	4.00
WHIH	Beane	19.00	19.00	15.00	15.00
CHES	Chess	4.08	4.08	5.22	5.22
HUGH	HUGH	1.46	1.46	1.60	1.80
PERI	Upper Lee	9.94	3.36	4.19	4.50
RUNL			6.58	6.30	6.30
SLIP	Rhee	3.62	3.62	0.00	4.50
SPRI	Dour	6.50	2.50	3.00	2.50
SBUC			4.00	4.00	3.50
SDNG	SDNG	6.00	6.00	4.65	5.00

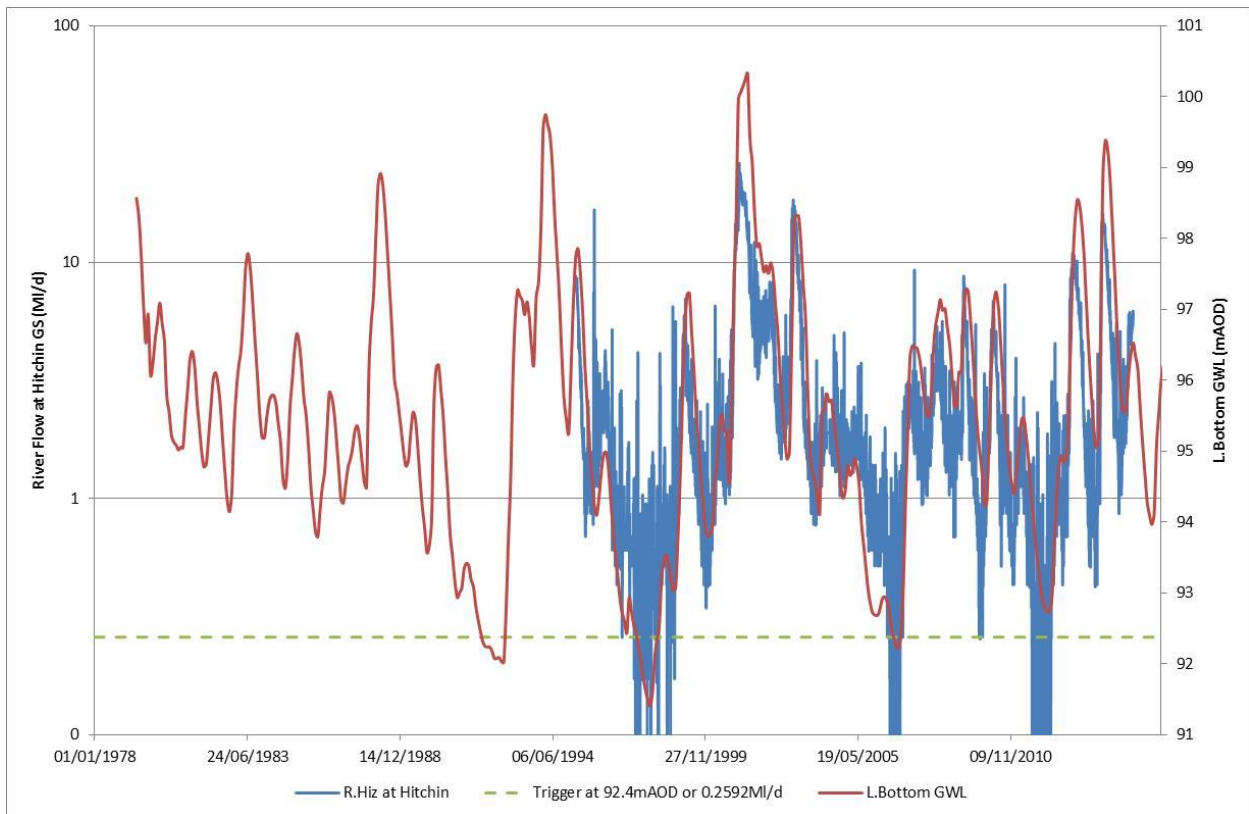


Figure 1: Relationship between River flows at Hitchin Gauging station and Groundwater Levels at Lilley Bottom Observation Borehole

The Ver sources (HOLY and MUDL) will operate under AIM at the combined output of 17.72MI/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 1st April 2016.

The Gade sources (MARL and PICC) will operate under AIM at the combined output of 20.14MI/d. It is suggested that for these two sources the combined AIM baseline is used so that there is operational flexibility between the two sources to operate at or below the 20.14MI/d aggregate volume during low flows. The two sources will have Sustainability Reductions implemented on the 1st April 2018 so the AIM will operate until this time. The baseline abstraction for MARL (4.42MI/d) was calculated by applying the AIM methodology but taking into account only abstraction values >1MI/d due to operational outages during historic low flow periods. This also discounts the very low abstraction values due to flow meter errors. Conversely, the AIM methodology suggested a higher value (17.3MI/d) for PICC, but this was capped at the drought DO of 15.72MI/d so that the aggregate volume from this and MARL is lower than the licensed volume of 20.47MI/d by 0.33MI/d.

The Misbourne sources (AMER and CHAL) will operate under AIM at the combined baseline abstraction of 10.38MI/d. Sustainability Reductions will be imposed on these sources on the 1st April 2018 for AMER and 1st April 2020 for CHAL, so the AIM will be in place until these dates.

The WHIH source in the Beane catchment will have Sustainability Reductions imposed on the 1st April 2017 but similar to FULL, its average abstraction has been reduced from 19MI/d to 15MI/d on a voluntary basis since the 1st January 2015. As such, it is proposed that the 19MI/d

AIM baseline will apply to this source as calculated based on the methodology, should there be any low flow period until the reduction is implemented.

CHES source will operate under AIM at the abstraction baseline of 4.08MI/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 1.78MI/d).

HUGH source will have Sustainability reductions imposed on the 1st April 2017 (full closure) but if a low flow period occurs as defined by the Q70 value at High Wycombe gauge, then the AIM baseline of 1.46MI/d will apply to this abstraction. As above, after the implementation of the reduction, AIM will cease to apply.

The Upper Lee sources (RUNL and PERI) will have Sustainability reductions implemented on the 1st April 2020 and 1st April 2023, respectively. It is proposed that the AIM baseline will be 9.94MI/d as the combined abstraction from the two sources until the 1st April 2020, and 3.36MI/d for PERI post April 2020 until its closure in 2023.

SLIP source has an augmentation scheme in place linked to flow in the River Rhee at Ashwell gauge. It is proposed that AIM will operate at the volume for water into supply and not the augmentation volume as explained earlier for the Hitchin sources. The AIM baseline abstraction as calculated by the methodology is 3.62MI/d.

SBUC source has a licence condition that allows augmentation to the River Dour. However, since both this and SPRI 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 6.50MI/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 0.5MI/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 SBUC only as there is no augmentation from SPRI.

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

It also needs to be noted that the triggers and the AIM abstraction 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.

References

- ¹: <http://nrfa.ceh.ac.uk/data/search>

