Appendix 1

Baseline data of risk of deterioration to water bodies from water abstraction

Contents

1.0 Executive Summary

1.0.1 A number of water bodies, including chalk streams, are impacted by the abstraction of groundwater which is essential to supply existing homes, business, and agriculture and growth in Greater Cambridge.

1.0.2 The Water Framework Directive (WFD) legislative process has produced an investigations programme which has confirmed failures in the Hydrological regime supporting element. This supporting element assesses the ability for flow to support ecology.

1.0.3 Both of the underlying chalk groundwater bodies from which CWC abstract water, currently have a WFD status of Poor. This indicates that the groundwater is not providing enough water to the surface water bodies and features that depend on them for baseflow at historical levels of abstraction.

1.0.4 There are 27 surface waterbodies identified as being affected by CWC abstraction. The hydrological regime in 12 of these water bodies does not support good ecological status. An additional 9 waterbodies failed in a previous cycle of the WFD.

1.0.5 For a further 14 waterbodies, the hydrological regime element would fail at full licensed levels of abstraction representing a risk of deterioration.

1.0.6 There are waterbodies where abstraction (including from CWC) is currently a contributing factor to ecological pressure. These are:

- GB105033037810 Granta.
- GB105033037590 River Cam (Audley End to Stapleford).
- GB105033037600 Cam (Stapleford to Hauxton Junction).

1.0.7 There are waterbodies where increased abstraction (at fully licensed scenario) is predicted to cause ecological impact and risk of deterioration under WFD. These are:

- GB105033037810 Granta.
- GB105033037590 River Cam (Audley End to Stapleford).
- GB105033037600 Cam (Stapleford to Hauxton Junction).
- GB105033037610 Rhee (downstream of Wendy).
- GB105033043070 Sapiston River.
- GB105033043090 Little Ouse (Hopton Common to Sapiston Confluence).
- GB105033043100 Little Ouse (Sapiston confluence to Nun's bridge).

1.0.8 HEV analysis has identified a further two waterbodies in which flow pressure is currently contributing to ecological impairment. These are:

- GB105033037560 Wendon Brook.
- GB105033038120 Hoffer Brook.

1.0.9 Some water bodies require artificial support from groundwater in order to support the ecology. Abstraction (including from CWC) is currently mitigated by these schemes. Increased use of existing support schemes is now not considered to be a sustainable long term solution for further mitigation of increased levels of abstraction.

1.0.10 WFD Investigations have established a link between hydrological failure (flow deficit) and ecological impairment which include abstraction pressure. Measures have been established to address both the deficits in flows and the risk of deterioration through the Water Industry National Environment Programme (WINEP) and through the process of abstraction licence renewal.

1.0.11 Increased levels of abstraction have the potential to:

- Cause deterioration in the formal WFD element classifications.
- Cause impairment to ecology in surface water bodies.
- Cause deterioration to SSSIs.
- Reduce the diversity of habitats and species characteristic of chalk rivers, including nationally rare taxa.
- Compound naturally ephemeral waterbodies and weaken the ability of headwaters and springs to provide reliable flows during dry weather which sustain ecology.
- Compromise measures currently being implemented to return flows to supporting good ecological status in water bodies (e.g. Granta, Hobsons Brook).
- Reduce the resilience of rivers and wetlands to climate change, including temperature related impacts.

2.0 Assessments of waterbodies impacted by Cambridge Water Company abstraction licences

2.1 The Water Framework Directive (WFD) and the River Basin Management Plan (RBMP)

2.1.1 The Water Framework Directive (2000/60/EC) requires EU Member States to achieve good status in all bodies of surface water and groundwater. This was transposed into UK legislation as the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (WFD Regulations). Good status is comprised of four assessments: ecological and chemical status of surface waters, and chemical and quantitative status of groundwater. River basin management plans (RBMPs) set the legally binding locally specific environmental objectives that underpin water regulation (such as permitting) and planning activities.

2.2 Surface water – WFD Hydrological regime assessment

2.2.1 Having the right flow in our water bodies is essential to supporting a healthy ecology. The UK Technical Advisory Group (UKTAG) is responsible for developing environmental standards and conditions for achieving WFD requirements for rivers and lakes. The standards vary by river type and flow, with stricter standards at lower flows and for water body types considered more sensitive to abstraction. These standards identify allowable percentage change from natural flow for differing river 'types' and at different flows.

2.2.2 We translate the UKTAG river flow standards into the Environmental Flow Indicators (EFI) for use in England. The EFI is set at a level believed to support Good Ecological Status (GES) under the WFD. The EFI allows for regulatory environmental flow targets to be set for rivers anywhere in England. EFIs are flow thresholds that are set with reference to natural flow conditions and aim to ensure that water resources activities do not cause or contribute to the failure of WFD objectives.

2.2.3 Under the Water Framework directive, the assessment of flows in rivers, the hydrological regime assessment, is a supporting element for Good Ecological Status and a defining element for High Ecological Status. This means that it must not be a factor in the failure of the biology to achieve good ecological status or for the water body to achieve good ecological potential if it is heavily modified. This also means that a failure of the hydrological regime does not automatically constitute a failure of Good Ecological Status under the WFD. However, a failure or worsening of an existing failure of the hydrological regime is treated as an indicator of potential for deterioration when considering abstraction increases and resultant lowering of flows.

2.2.4 To undertake this assessment, we have used the CAMS version of the RAM (Resource Assessment and Management) Framework[1]. This approach has been used to assess water resources at a catchment scale since 2001. The assessment is based on a comparison of scenario flows (flows which represent full licensed and recent actual levels of abstraction) against Ecological flow indicators (EFI), the flows required to sustain healthy ecology at low flows (Q952).

[1] **More information about CAMS and RAM4 can be found here*

[2] The Q95 flow is the flow that is exceeded 95% of the time for a given period of record (in this case 1990 To 2012). This flow is an industry standard for expressing low river flows. It is also the flow percentile at which the WFD hydrology regime compliance assessments are made.

2.2.5 The recent actual scenario models the effects on flows from the average annual level of actual abstraction that has been taken historically, currently 2010-15. Where the recent actual flow scenario is below the EFI, the status for the Hydrological regime is “Does not support good”. The extent of the deficit in flows is categorised by bands 1, 2 and 3 where band 3 is the largest flow deficit.

2.2.6 The recent actual level of abstraction is a lower level of abstraction than if all licences took their full licensed quantity. The full licensed scenario therefore represents the risk of deterioration from increased levels of abstraction and by extension, presents a risk of ecological deterioration if it results in new flow failures against the EFI or a worsening of an existing failure.

2.2.7 For 12 of the waterbodies affected by CWC (Cambridge Water Company) groundwater abstraction (listed below in **Table 1**), the 2019 assessment shows that low flows ($Q95_2$) are not deemed to be sufficient to support the ecology based on current levels of abstraction and full licensed quantities of abstraction would deteriorate low flows (Q95) even further below those needed to support the ecology.

Table 1 - Table showing the classification years where hydrological regime did not support good ecological status or potential in waterbodies impacted upon by CWC abstraction licences and the extent of flow deficit rated from Band 1 to Band 3.

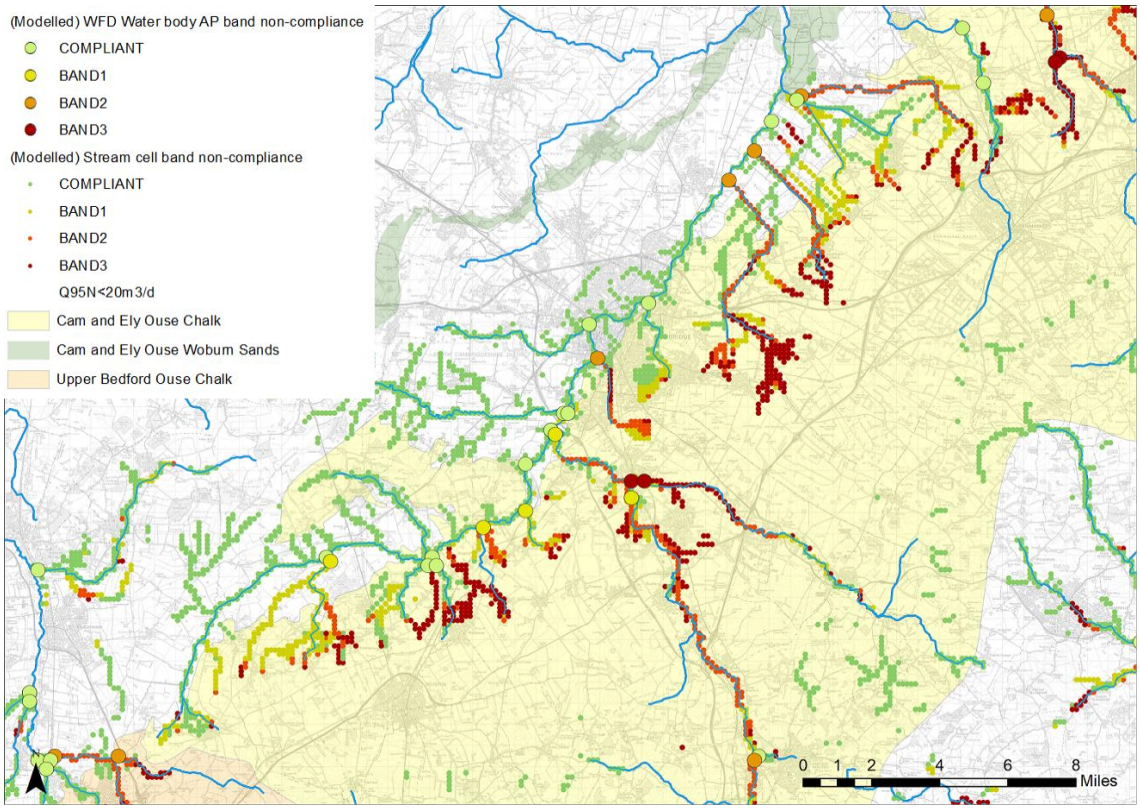
		Years in which Hydrological regime did not support good ecological status or potential		2019 Hydrological regime Compliance bands	
WFD Water body ID	Water body name	Cycle 1 (2009-2014)	Cycle 2 (2015-2019)	Levels of recent actual abstraction (based on 2010-2015)	Levels of abstraction based on full licence quantities
GB105033042730	West Brook		Supports Good	COMPLIANT	COMPLIANT
GB105033047921	Ouse (Roxton to Earith)		Supports Good	COMPLIANT	COMPLIANT
GB105033037600	Cam (Stapleford to Hauxton)	2009-2014	2015; 2016; 2019	BAND1	BAND2
GB105033037810	Granta	2009-2014	2015; 2016; 2019	BAND1	BAND3
GB105033037590	Cam (Audley End to Stapleford)	2010-2014	2015; 2016; 2019	BAND1	BAND2
GB105033037620	Hobson's Brook	2009-2014	2015; 2019	BAND3	COMPLIANT
GB105033042700	Bottisham Lode - Quy Water	2011; 2012; 2014	Not assessed	Not Assessed	Not Assessed
GB105033037610	Rhee (DS Wendy)	2011	Supports Good	COMPLIANT	COMPLIANT
GB105033038080	Shep	2011-2014	Supports Good	COMPLIANT	BAND1
GB105033038120	Hoffer Brook	2011; 2012; 2014	Not assessed*	Not Assessed	Not Assessed
GB105033037820	Millbridge and Potton Brooks	2009-2013	Supports Good	COMPLIANT	BAND1
GB105033038060	Mel		Not assessed	Not Assessed	Not Assessed
GB105033037570	Tributary of Cam	2012-2014	2015; 2016; 2019	BAND3	BAND3
GB105033037740	Cat Ditch	2009-2013	2015; 2016; 2019	BAND3	BAND2
GB105033038030	Mill River	2014	Supports Good	COMPLIANT	COMPLIANT
GB105033038100	Rhee (US Wendy)	2011; 2012	Not assessed	Not Assessed	Not Assessed
GB105033037560	Wendon Brook	2009-2014	2015; 2016; 2019	BAND1	BAND2
GB105033042690	Bourn Brook		Supports Good	COMPLIANT	BAND1
GB105033042670	Cherry Hinton Brook	2012; 2013; 2014	2015; 2019	BAND1	COMPLIANT
GB105033042710	Swaffham - Bulbeck Lode	2011; 2012; 2014	Not assessed	Not Assessed	Not Assessed
GB105033042780	New River	2009-2014	2015; 2016; 2019	BAND3	BAND3
GB105036040980	Stour (u/s Wixoe)	2009; 2010; 2011	Not assessed	Not Assessed	Not Assessed

GB105033042860	Soham Lode		Supports Good	COMPLIANT	BAND2
GB105033043070	Sapiston River	2009-2014	2015; 2016; 2019	BAND1	BAND3
GB105033043090	Little Ouse (DS Sapiston Confl)	2011-2014	2015; 2016; 2019	BAND1	BAND3
GB105033043100	Little Ouse (DS Hopton Com.)	2011-2014	2015; 2016; 2019	BAND2	BAND3
GB105033043190	Thet (DS Swangey Fen)		Supports Good	COMPLIANT	BAND1

2.2.8 Some waterbodies are 'Not Assessed' as they have a water resources reason for being 'Heavily modified' or 'Artificial', this is because they are supported by groundwater augmentation. These support schemes utilise groundwater to support river flows once a pre-determined trigger level is met. Whilst there is no hydrological regime assessment, there is a reliance on these schemes to maintain the ecological communities in these watercourses.

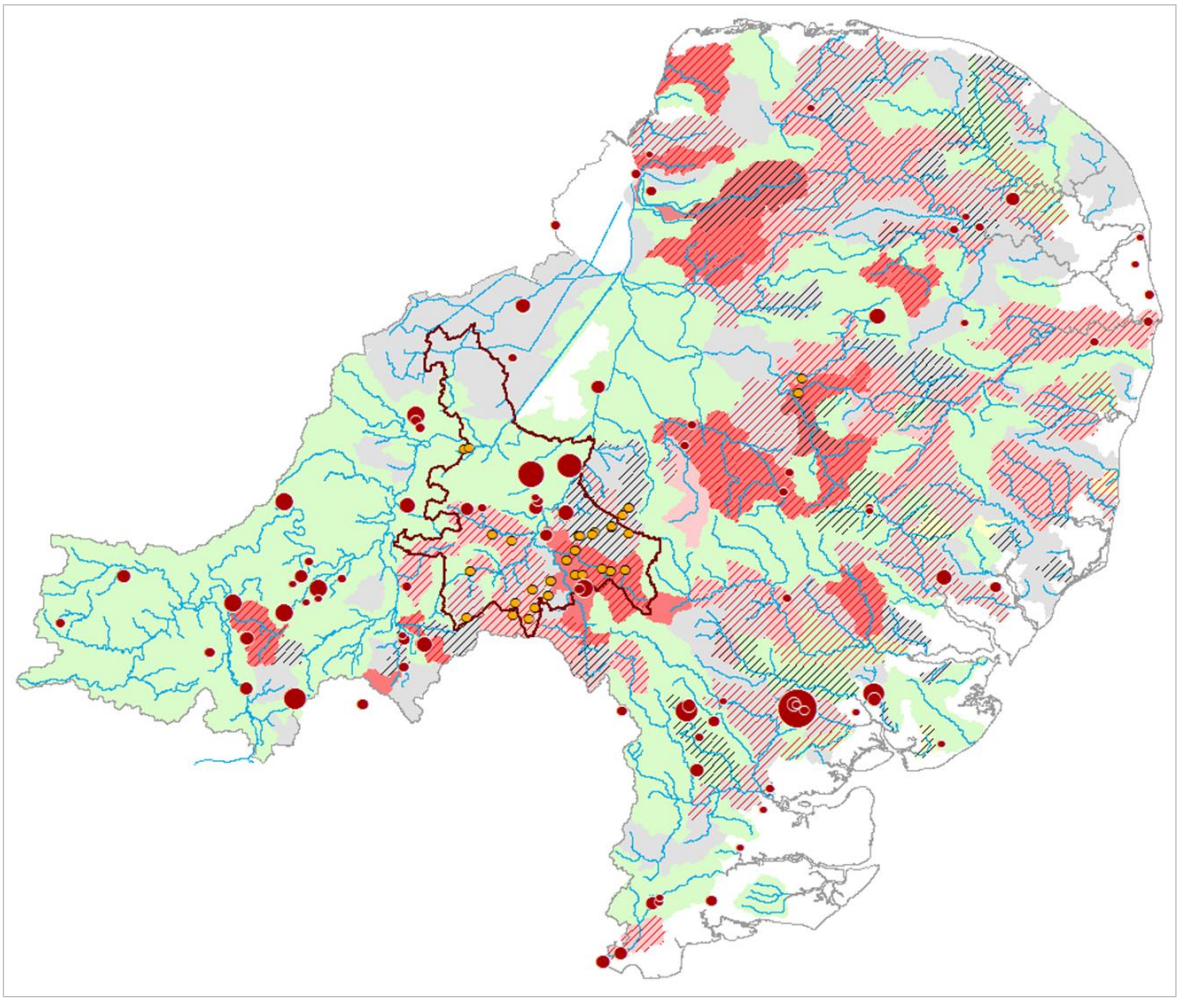
2.2.9 When we investigate a Hydrological regime (supporting) element failure, we look to consolidate our understanding of the relationship between low flows and what the ecology needs. If there is a flow deficit, we look at which abstractions are potentially causing that deficit to occur. To progress the investigation further, we look for additional evidence that there is an impact or, there is potential for impact to the ecology.

2.2.10 The formal WFD classification represents an assessment of the flow compliance at a point which represents the individual water body. This assessment point (AP) is at the bottom of the water body where flow scenarios can include all artificial influences (abstraction and discharges) upstream. This means that in some water bodies, there are flow pressures which can occur in headwaters or upstream of significant inputs (tributaries or artificial discharges) which do not appear to fail under WFD and only become apparent if further investigation is undertaken. This explains why there are investigations and outcomes in water bodies which do not appear to fail under the WFD at face value.



Map 1 – Modelled assessment point (AP) and upstream cell band compliances

2.3 Summary of Hydrological regime investigations outcomes



Map 2 – investigation outcomes, CWC abstraction and potential housing growth in East Anglia

2.3.1 The map above shows the outcomes of the investigations we have undertaken in East Anglia area. The **Green** waterbody catchments indicate that the Hydrological regime 'Supports Good' and we have not had a reason to undertake any further hydrology investigation. The **Grey** waterbody catchments indicate that the Hydrological regime 'Does not support Good' but a hydrology investigation has deemed that there is no impact on ecology or that there are natural conditions such as ephemerality that prevent improvement. The waterbodies have therefore been screened out from further investigation. The **Pink** waterbody catchments indicate that the Hydrological regime 'Does not Support Good' and further investigation has established that ecology is sensitive to abstraction.

2.3.2 In addition, the darker **Red** waterbody catchments also show where the investigation process has identified measures that are required to achieve Good ecological status or potential. These have progressed to the Water Industry National Environment Programme (WINEP)[3] in Asset Management Plan[4] (AMP) 6 or 7 for implementation by 2025.

[3] The WINEP is the formal route by which environmental obligations are identified and delivered by the water industry. The WINEP informs the water company water resources management plans and business plans which are updated on a 5 yearly cycle.

[4] AMP periods refer to the 5 yearly investment time steps linked to water company business plans.

2.3.3 The additional **Red** hatching shows where we require further measures or investigation through the WINEP process for the prevention of deterioration. The additional **Black** hatching shows where the Anglian groundwater model[5] also demonstrates a risk of (1-2 bands) deterioration at full licence levels of abstraction.

2.3.4 Finally, the **Red** boundary shows the Supply zone for Cambridge water and the **Orange** dots are Cambridge Water's abstraction boreholes. The **Red** circles are housing allocations >1000 homes from the local development plan(s) and are proportional in size to the size of development (no. of houses). What this demonstrates is that although much of the development in CWC's supply area may be proposed in a water body which is not under pressure from abstraction. The water which will supply the new homes will come from boreholes in water bodies where we have established that abstraction is unsustainable.

2.4 Groundwater – WFD Quantitative assessment

2.4.1 The EA assesses the impact of abstraction on WFD groundwater bodies, as well as their dependent surface water features, through four quantitative test elements. It is important to consider that Good groundwater quantitative status is achieved by ensuring that the available groundwater resource is not deteriorated by the long-term annual average rate of abstraction. Accordingly, the level of groundwater should not lead to any reduction in the ecological status of connected surface waters or in groundwater-dependent terrestrial ecosystems. The table below shows quantitative element statuses in classification years for the groundwater bodies which represent the primary aquifers impacted by CWC.

Table 2 - Table showing the classification years where the Groundwater quantitative element statuses were at 'Poor'

		Years in which Quantitative elements were at Poor status			
Waterbody Id	Waterbody Name	Quantitative Dependent Surface Water Body Status	Quantitative GWDTEs test	Quantitative Saline Intrusion	Quantitative Water Balance
GB40501G400500	Cam and Ely Ouse Chalk	2009-2019	2009-2016		2009-2016
GB40501G445700	Cam and Ely Ouse Woburn Sands				
GB40601G603000	Upper Bedford Ouse Chalk	2009-2019			2009-2016

2.4.2 The water balance test compares levels of abstraction with the aquifer's ability to recharge. The 2019 status is Good. The groundwater Balance test was previously poor in the 2016 classification and is now deemed to be at Good status, however, there remains a risk of deterioration to Poor, at full licensed quantities of abstraction.

2.4.3 This status change needs to be treated with caution due to a change in methodology. Up to 2016, the test compared cumulative groundwater abstraction impacts on low river flows (average Q70-Q95), across rivers draining the groundwater body. The basis of this test is that there is a

[5] The Anglian groundwater model is a tool that has been developed to model the interaction of surface water and groundwater under the influence of abstraction and discharges. The tool is a more sophisticated tool than the CAMS/RAM ledger based approach used for this work, but was not able to be utlised within the time and resource constraints the EA faced.

naturally available low flow resource. If abstraction impacts exceed this naturally available low flow resource, then the water body was deemed to be in deficit and to be failing.

2.4.4 Since 2019, the test methodology has been revised and assesses if groundwater abstraction impacts exceed an environmental flow allocation assessed at average flow conditions (Q50), which is less precautionary than the initial test due to comparing groundwater abstraction impact on flows at average conditions not low summer flow conditions.

2.4.5 The dependent surface water body status fails in both chalk groundwater water bodies. Most of the surface water bodies listed in **Table 1** are sourced from chalk groundwater and springs at the headwaters, hence why this groundwater quantitative element fails.

2.5 Hydrological regime – Ecological assessment

2.5.1 The aim of the ecological assessment is to understand whether the ecological community is being impaired by flow pressure as a result of abstraction. Flow reductions can have a direct impact on the community as some species have requirements for specific flow velocities or habitats that are lost as flows recede. Reduced flows can also result in fine sediment accumulation which can reduce habitat availability for certain ecological groups, due to smothering of coarser substrates. It is also possible that, when a waterbody is subject to water quality pressures, lower flows can concentrate the impacts of such pressures.

2.5.2 Macroinvertebrates are commonly used as bio-indicators of flow pressure, due to a good understanding of the ecological requirements of different families / species and available metrics that summarise the sensitivity of taxa to such impacts. Here we have undertaken two types of analysis, hydroecological validation and hydroecological modelling, as described below.

Hydroecological validation

2.5.3 Hydroecological validation (HEV) plots were produced, using available long-term datasets for the relevant waterbodies. The datasets come from sites that are assessed for different work programmes, not just for WFD assessment. The plots display the following macroinvertebrate community metrics (as an observed:expected (O/E) ratio[6]) plotted with river flow data:

- Lotic Invertebrate Flow Evaluation (LIFE)[7] – to assess pressure related to flow velocity change.
- Average Score Per Taxon (WHPT-ASPT)[8] – to assess pressures linked to overall ecological health.
- Number of Taxa (WHPT-NTAXA)[8] – to assess pressures linked to overall ecological health.

[6] Expected scores were derived using the River Invertebrate Classification Tool (RICT). O/E ratios present a measure of how close the observed macroinvertebrate community corresponds to unimpacted reference conditions / community at a site.

[7] Extence, C.A., Balbi, D.M. and Chadd, R.P., 1999. River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives. Regulated Rivers: Research & Management: An International Journal Devoted to River Research and Management, 15(6), pp. 545-574.

[8] Refer to: Invertebrates (General Degradation)- Whalley, Hawkes,Paisley & Trigg (WHPT) metric Method Statement (wfduk.org)

- Proportion of Sediment-sensitive Invertebrates (PSI)[9] – to assess pressure related to fine sediment accumulation.

2.5.4 By assessing these metrics together, it is possible to identify sites in which the invertebrate community is influenced by flow pressure. As flow velocity declines, taxa which prefer higher velocities become unable to persist, reducing in abundance and sometimes being lost from the watercourse, resulting in a decline in the LIFE score. As the flow pressure becomes greater, the effects may be seen in the other metrics, as loss of taxa can have a negative effect on the WHPT-ASPT and WHPT-NTAXA.

2.5.5 As mentioned above, reduced flow velocities can lead to accumulation of fine sediment on the riverbed, reducing the overall habitat complexity. This can impair the macroinvertebrate community and is evidenced through a decline in the PSI metric. In addition, reduced flow can have an impact on water quality through reduced velocity and dilution of physico-chemical elements, which can further impair the WHPT-ASPT and WHPT-NTAXA metrics.

2.5.6 It is important to recognise that most macroinvertebrate sampling sites which have been assessed were not implemented specifically to determine flow pressures. Under WFD sites were selected based on their position within a waterbody, where they could pick up multiple pressures affecting the ecological community within that waterbody. This means that often the sites are not situated in the upper reaches of waterbodies, where flow pressures can be the greatest. It also means that the sites can be subject to multiple, confounding pressures, making the assessment of a specific pressure more difficult to ascertain. It is also important to understand that the WFD macroinvertebrate classification system uses only the WHPT-ASPT and WHPT-NTAXA metrics to generate the classification. This can result in face value classifications which do not represent the full range of pressures affecting the macroinvertebrate community. However, as described above, as flow pressure exerts an influence on the macroinvertebrate community, the impacts will ultimately be felt across all metrics and therefore sites subject to flow pressure are deemed to be at risk of deterioration under WFD.

Hydroecology modelling

2.5.7 Hydroecological models were developed and used to predict existing and future ecological impacts from abstraction on waterbodies impacted by CWC abstraction licences. The models used macroinvertebrate data from 37 sites across 25 waterbodies in the Greater Cambridge and wider East Anglia area. Groundwater modelled flow time series were derived for Naturalised, Historical and Fully Licensed scenarios and used to quantify abstraction pressure at each macroinvertebrate site. The models were applied to scenario analysis to predict and evidence ecological impact (as per changes to LIFE O/E and WHPT-ASPT O/E scores) between scenarios. It is important to note that abstraction pressure was based on Q75 statistics, which was a result of using modelled monthly flow data as it provides a more reliable estimate than Q95. Q75 represents moderate to low flow conditions, and the results may present more conservative

[9] C.A. Extence, R.P. Chadd, J. England, M.J. Dunbar, P.J. Wood, E.D. Taylor (2011).
The assessment of fine sediment accumulation in rivers using macro-invertebrate community response
River Res. Appl., 29 (1) (2011), pp. 17-55

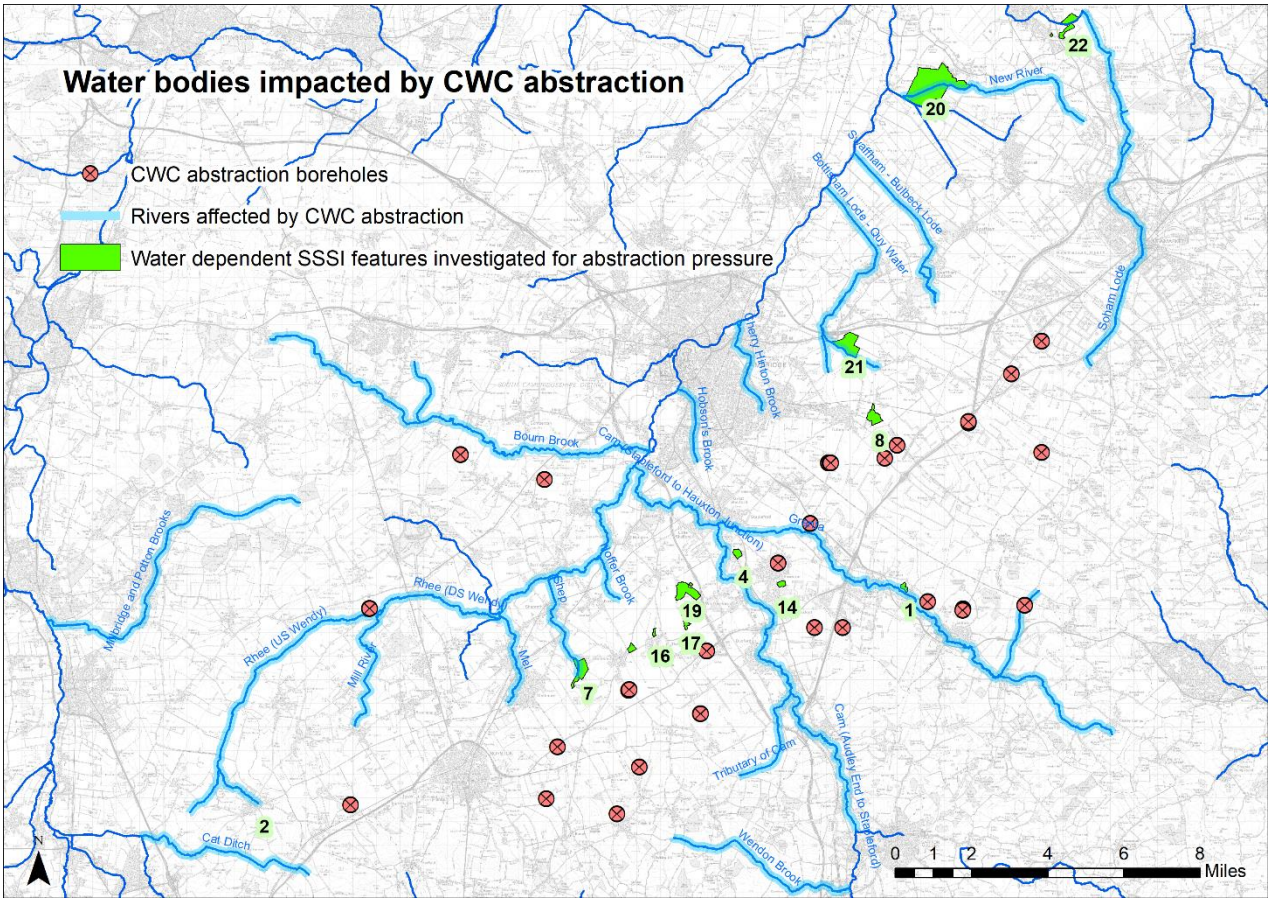
assessments of ecological impact than Q95 (low flows), particularly at sites that are prone to drying during drought.

2.5.8 Ten waterbodies impacted by CWC abstraction licences were assessed, whose results are outlined in the relevant waterbody sections below. For reference, the LIFE (F) figures have predicted O/E scores plotted against a red dashed threshold boundary of 1.0, with scores <1.0 indicating a progressively greater degree of flow pressure. For WHPT-ASPT figures, predicted O/E scores are presented against a background of horizontal colour bands that depict indicative macroinvertebrate WFD classes: High (blue), Good (green), Moderate (yellow), Poor (orange) and Bad (red). For full details of the modelling please refer to the technical report (see **Appendix A**).

2.6 Groundwater-dependent terrestrial ecosystems (GWTEs)

2.6.1 Good quantitative groundwater status requires that the level of groundwater should not lead to any reduction in the ecological status of connected surface waters or in groundwater-dependent terrestrial ecosystems. Below are details of SSSIs investigated under the Restoring Sustainable Abstraction (RSA)[10] programme which make up the GWTE assessment of the WFD GW quantitative status.

2.6.2 Both Chalk groundwater bodies are at Good status for this element as the RSA programme of work has been completed. There are details below which describe the outcomes of this work and the conditions required to maintain this status which relate to Cambridge Water abstraction.



Map 3 - Water dependent SSSIs affected by GW abstraction from the Chalk

Table 3 – Map key to SSSIs

Map No.	Site Name
1	Alder Carr
2	Ashwell Springs
4	Dernford Fen
7	Fowlmere Watercress Beds
8	Fulbourn Fen
14	Sawston Hall Meadows

16	Thriplow Meadows
17	Thriplow Peat Holes
19	Whittlesford-Thriplow Hummocky Fields
20	Wicken Fen
21	Wilbraham Fens
22	Soham Wet horse Fen

[10] RSA TBC by Jen

Sites where there is a risk of deterioration if abstraction increases:

Alder Carr SSSI

2.6.3 Alder Carr has been investigated under the RSA programme, but it is thought that the solutions have not been successful. Analysis of water level monitoring on site shows groundwater levels are being suppressed below the surface, thought to be due to abstraction from the nearby Cambridge Water abstraction. Cambridge Water has applied for funding to re-investigate impact to this SSSI in AMP8 (2025-2030). Any increase to historic abstraction has the potential to worsen impact at this site.

Dernford Fen and Sawston Hall Meadows SSSIs

2.6.4 These SSSIs were investigated in both the RSA programme and by Cambridge Water in AMP4 (2005-2010). To conclude the investigation, Cambridge Water provided reassurances in its draft drought plan 2017 that it did not plan to increase abstraction from the licences near the SSSI above the historical quantities and would use other licences preferentially during periods of drought. There is a risk to the SSSI should this no longer be followed, and abstraction increased to fully licensed rates.

Thriplow Peat Holes; Thriplow Meadows; Ashwell Springs; Fowlmere Watercress Beds; and Fulbourn Fen SSSIs

2.6.5 These sites have been subject to previous investigations through either the RSA programme or by Cambridge Water under the AMP process. The sites all depend on augmentation from Agency run groundwater support schemes to mitigate against the impact that Cambridge Water's abstractions have on the groundwater levels and corresponding spring flows that feed the SSSIs. The investigations were concluded on the basis that this augmentation would continue to protect the site habitats in times of dry weather.

2.6.6 Increases in abstraction will mean that the support schemes will need to run for longer to ensure water levels are maintained. Support schemes are known to become less efficient as groundwater levels recede and more water is lost back to ground. Therefore, there is a deterioration risk that increasing licensed abstraction rates will reduce the capacity of our groundwater schemes to provide adequate mitigation to the SSSIs, also considering the possible impacts of climate change.

Wilbraham Fen SSSI

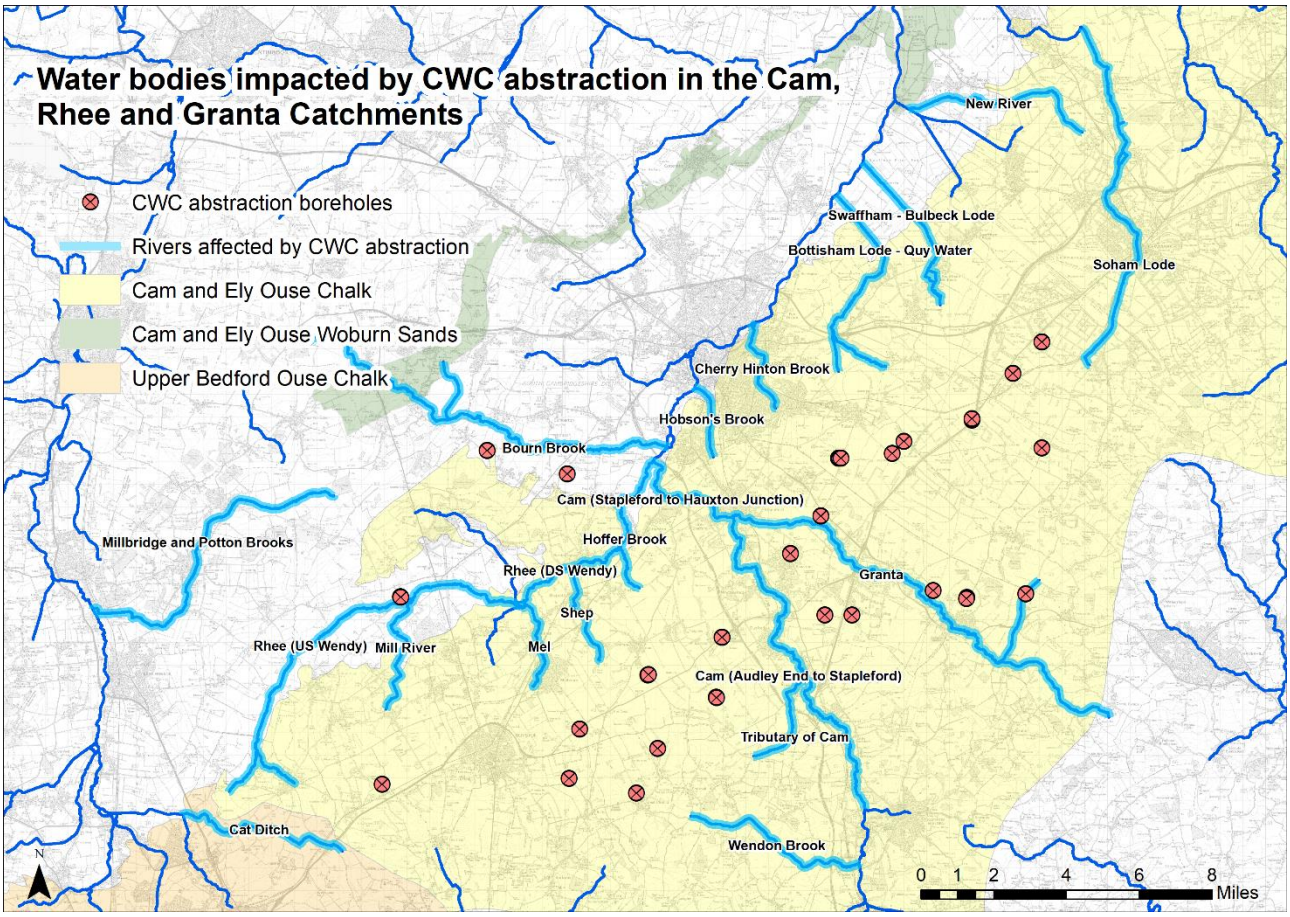
2.6.7 This site was subject to previous investigation under the RSA programme where it was shown that it relied on inputs from the Little Wilbraham River and the Agency's groundwater support scheme. The site also benefits from some chalk input but to a lesser extent. Flows of the Little Wilbraham River and the chalk groundwater were deemed impacted by abstraction. Mitigation measures have been identified to better retain water on site but have to date not been implemented. There is a risk of deterioration to the water levels on site should abstraction levels increase above historic rates, especially considering mitigation measures are yet to be implemented.

Summary of Outcomes from WFD Hydrological Regime Investigations and Supporting Ecological Evidence for Water Bodies impacted by CWC abstraction

The information below summarises the conclusions from investigations carried out under the WFD and other historical programmes of work as well as ecological evidence of impacts, or the potential for impact from flows affected by abstraction. This work has been undertaken across multiple cycles of the WFD. Current classification information is from 2019 data.

3.0 Cam, Rhee and Granta catchment

3.0.1 The Cam, Rhee and Granta catchment covers the region south of Cambridge. It comprises the upper reaches of the river Cam, flowing north from Saffron Waldon, and its major tributaries the river Rhee, which rises at Ashwell springs in Hertfordshire, and the River Granta between Saffron Waldon and Haverhill. Rivers are characterised by their base flow from the underlying chalk geology. The catchment is predominantly rural with an agricultural land use. The rivers and tributaries are important for priority biodiversity species including white-clawed crayfish, otter, water vole and brown trout, and the catchment has important wetland Sites of Special Scientific Interest.



Map 4 – Water bodies impacted by CWC abstraction in the Cam, Rhee and Granta and in the Lower Cam catchments

3.1 Water body ID: GB105033037810 Granta

Catchment data explorer

Table 4 – WFD Element classifications for WB ID GB105033037810

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	High	Good	Good	Good
Invertebrates	Good	Good	Good	High	High
Macrophytes and Phytobenthos Combined	Not assessed	Moderate	Moderate	Moderate	Moderate
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	High	High	High	Good	Good
Phosphate	Not assessed	Not assessed	Poor	Poor	Poor
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

3.1.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 1 failure to Band 3 failure*.

3.1.2 There have been concerns about the flow in the river Granta since the early 1990s when there was a drought period (1989 to 1992) and the river dried up.

3.1.3 Between 2000 to 2005 (Asset Management Planning Period 3), water companies investigated their impact of abstraction on rivers and wetlands. An investigation funded by Cambridge Water indicated that the company's abstractions impact on the river Granta, particularly close to Linton. Between 2005 to 2010 (Asset Management Planning Period 4) Government did not allow funding for river projects because the money was needed for Habitat Directive Wetland sites.

3.1.4 Following this desk study and Investigations in AMP3, it was determined that abstractions from Cambridge Water's groundwater sources were closely linked to low flows in the river Granta. The impacts of nearby PWS abstractions were evaluated and a bespoke flow target derived that would support the requirements of the river ecology. The flow target for ecology was supported by further work undertaken by the Environment Agency during 2012-14.

3.1.5 As a result, flow thresholds at the Babraham gauging station on the Granta, linked to hands off flow licence conditions at Cambridge Water's Linton, Rivey Hill and Horseheath licences were implemented to mitigate the impact of abstraction on flows in the Granta. The reductions on

licences comprise a total supply loss of 3.128Ml/d at annual average, and of 4.48Ml/d at daily licence volumes. Conditions ensure that as flow drops, there is a corresponding decrease in daily abstraction from the licences that impact the flow. It assumes the Agency's existing groundwater support scheme remains in place to augment flows and does not preclude that some stretches of the river may still dry up in drought conditions.

3.1.7 These conditions were effective from 2020, with a further condition on the Horseheath licence effective from 2025 along with a reduction in overall licence aggregate to prevent abstraction increasing above the historic maximum rate. However, increases in other background licences could compromise the ability of these measures to improve the waterbody to good status. Ongoing monitoring of the ecology will be crucial to assessing the success of the scheme and whether further mitigation measures are required in the future.

Ecological evidence

3.1.8 The hydroecological model outputs did not indicate an abstraction pressure impact at Q75 on the macroinvertebrate community at the two most upstream sites, A604 Linton Bypass (56031) and Hildersham Ford (56037), with historical and naturalised scores for both O/E metrics displaying similar values. In contrast, an increasing abstraction impact is observed moving downstream to sites Bourn Bridge (56054) and Stapleford Road Bridge (56083) (see Figures 1 and 2).

3.1.9 Bourn Bridge (56054) shows an impact of abstraction pressure in the most recent years (2015-2020) with historical LIFE (F) O/E scores being lower than naturalised; this is mirrored in WHPT-ASPT O/E scores where abstraction pressure is predicted to lower the indicative WFD class from High to Good on occasions.

3.1.10 Stapleford Road Bridge (56083) shows a significant adverse impact of abstraction pressure on the macroinvertebrate community with a large deviation in both biotic scores between historic and naturalised scenarios. Predicted historical LIFE (F) O/E scores in recent years (2015-2020) are up to 12% lower than naturalised scores with historical scores falling below a LIFE (F) O/E threshold score of 1.0. Historical WHPT-ASPT O/E scores in recent years (2015-2020) also show the same scale of deviation with predicted scores being up to 15% lower than predicted naturalised scores; this indicates that abstraction pressure has impacted macroinvertebrate communities and lowered the indicative macroinvertebrate WFD class status from High to Good status.

3.1.11 All four sites show some adverse impact of abstraction under the Fully Licensed scenario; however, three of the sites show notable impacts – Hildersham Ford (56037), Bourn Bridge (56054) and Stapleford Road Bridge (56083). Recent (2015-2020) predicted fully licensed LIFE (F) O/E scores across these three sites are typically 9-12% lower than historical scores, and at Stapleford Road Bridge (56083) scores are up to 20% lower compared to the naturalised scores. Recent (2015-2020) fully licensed WHPT-ASPT O/E scores also show significant decreases relative to historical predictions, resulting in deteriorations in indicative macroinvertebrate WFD class statuses under the fully licensed scenario. For example, Hildersham Ford (56037) shows instances of a decline in macroinvertebrate WFD class from Good to Moderate, Bourn Bridge (56054) also shows a deterioration from Good to Moderate status, and Stapleford Road Bridge (56083) shows instances of a two-class deterioration from High to Moderate and single class deteriorations of High to Good and Good to Moderate status.

3.1.12 Predictions for A604 Linton Bypass (56031) indicate a less severe impact of abstraction on the macroinvertebrate community. Despite this reduced impact compared to the three downstream

sites, WHPT-ASPT O/E scores do show instances of indicative macroinvertebrate WFD class deterioration from High-Good status.

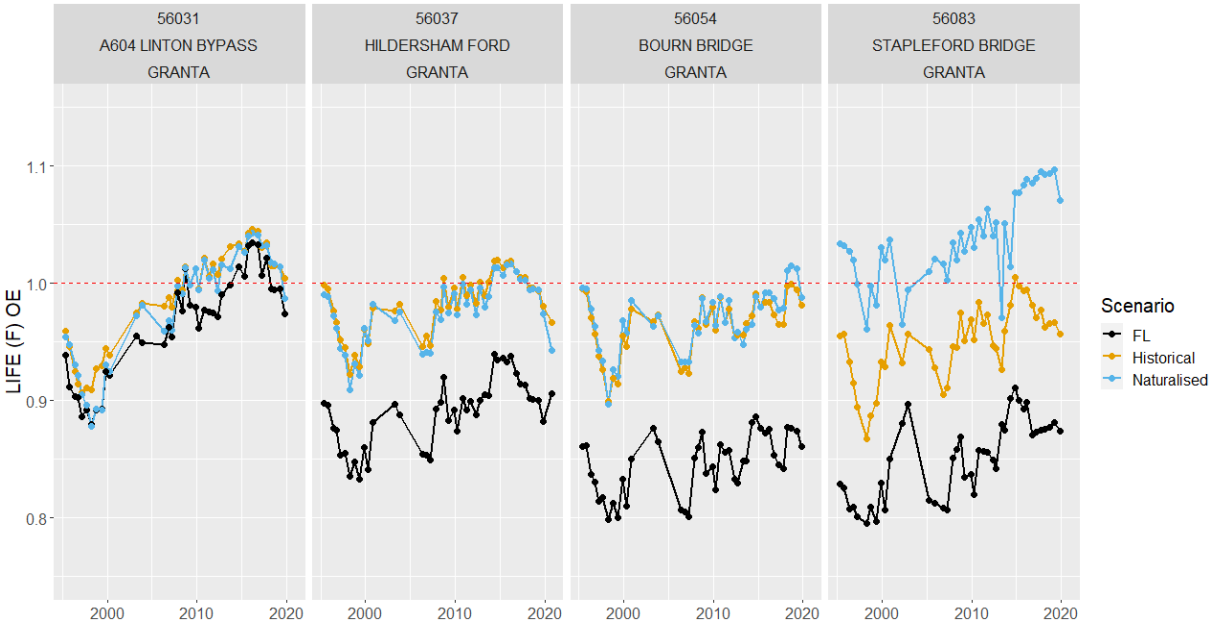


Figure 1 - Predicted LIFE (F) O/E scores for historical, naturalised, and fully licensed scenarios for four sites in GB105033037810 Granta

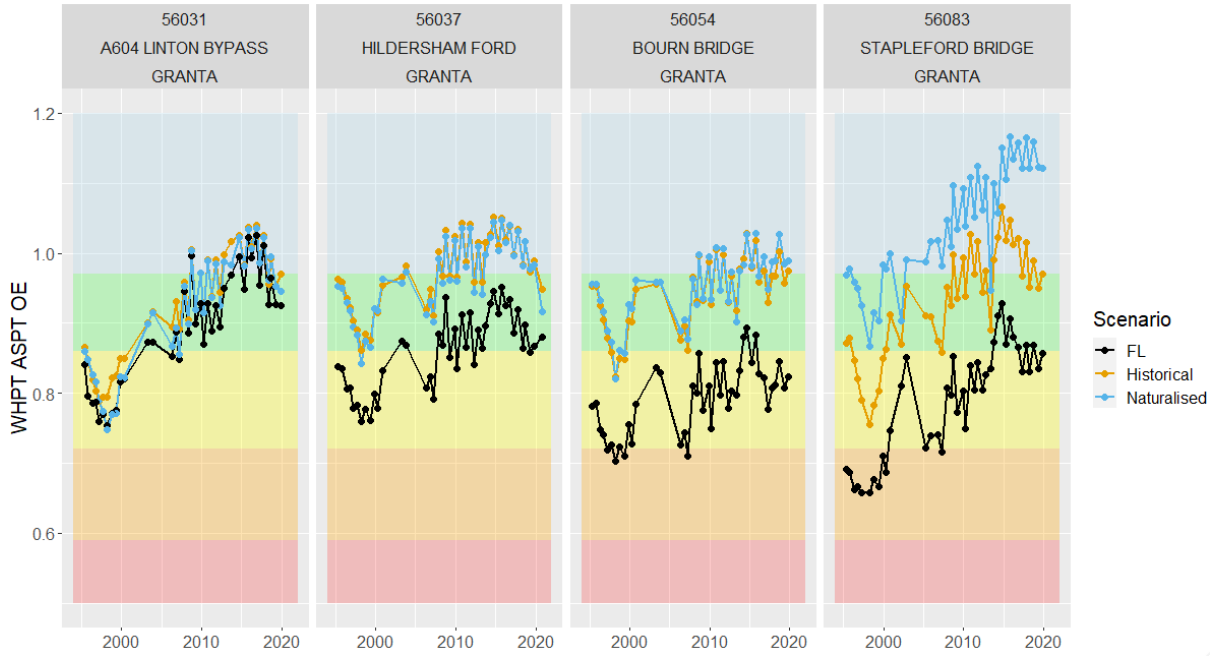


Figure 2 - Predicted WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for four sites in GB105033037810 Granta

3.1.13 The sample sites at A604 Linton Bypass (56031) and Stapleford Road Bridge (56083) have both been found to support a Nationally Scarce beetle *Hydraena rufipes,* which is of conservation importance. This species is assigned to flow group II in the LIFE index, indicating a species which shows a preference for moderate to fast flow velocities.

Drought impacts

Figure 3 - Images showing dry riverbed at Stapleford gauging weir on the river Granta during prolonged dry weather in 2019

3.2 Water body ID: GB105033037590 River Cam (Audley End to Stapleford)

Catchment data explorer

Table 5 – WFD element classifications for WB ID GB105033037590

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Moderate	Good	Good	Good	Good
Invertebrates	High	High	High	High	High
Macrophytes and Phytobenthos Combined			Poor	Poor	Poor
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	High	High	High	Good	Good
Phosphate		Poor	Poor	Poor	Poor
pH	High	High	High	High	High
Temperature	High	High	High	High	Good
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

3.2.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 1 failure to Band 2 failure.

3.2.2 Abstraction for public water supply represents 56 % of the total licensed abstraction in the upper Cam area. There are 8 sewage treatment works which return water to the Cam catchment and tributaries upstream of Great Chesterford but there is a net loss from the catchment in the region of 17Ml/d. The hydrology investigation concluded that hydrological impacts linked to abstraction licences are a reason for failure of a biology element for the waterbody at sample sites above Great Chesterford.

3.2.3 Affinity Water hold several licences in the Upper Cam catchments that have been shown to impact flows in this waterbody. One of the abstraction licences held by Affinity Water contains a cessation clause whereby if the flow at the Agency's Great Chesterford gauging station on the River Cam falls below 2,800,000 gallons per day (12.72 Ml/d) then the water company should either suspend abstraction, discharge sufficient water to restore flows to the target or pump into the river the equivalent quantity they abstract. This condition has been on the licence since its issue in the 1960s.

3.2.4 Work commissioned by the Environment Agency in 2014 indicated that the flow trigger and subsequent augmentation was not sufficient to ensure adequate protection to the ecological communities from abstraction impact. Subsequently, Affinity Water were funded to carry out an options appraisal investigation in the AMP6 period (2015 to 2020).

3.2.5 The results of this showed that abstractions by Affinity Water do impact of flows of the Cam and that the minimum flow needed by the ecology (EFIQ95) is higher than that set when the augmentation was first licensed in the 1960s (15.64Ml/day). The options for this waterbody taken forward by Affinity Water to be delivered in AMP7 by April 2025 are; a reduction in Affinity's licensed abstraction in the Upper Cam area by 32%, habitat restoration, and increasing the existing river support scheme to protect a higher minimum residual flow.

3.2.6 Whilst other licence holders are primarily responsible for the abstraction influence on this waterbody, CWC's abstractions do contribute to the cumulative effect of abstraction on the groundwater body in the Cam catchment areas. Increases of abstraction have the potential to reduce the water available for the natural spring flow and in addition compromise the improvement scheme being implemented by Affinity Water.

Ecological evidence

3.2.7 The model outputs indicated an abstraction pressure impact on the macroinvertebrate community within the waterbody. The comparison of LIFE (F) and WHPT-ASPT O/E scores predicted under the naturalised and historical scenarios indicates that the macroinvertebrate community has been subject to impact from abstraction pressure, with the most notable impacts being observed at Littlebury (56056) and Great Chesterford Road Bridge (56065); see Figure 4 and Figure 5.

3.2.8 Figure 4 shows that predicted historical LIFE (F) O/E scores are consistently and markedly lower than the naturalised scenario throughout the entire timeseries at the two sites. The impact of abstraction is indicated further with recent (2015-2020) predicted historical LIFE O/E scores falling below the threshold of 1.0, in contrast to the predicted naturalised scenario, which shows scores above 1.0.

3.2.9 Similar results were observed for WHPT-ASPT (Figure 5). The naturalised scenarios for Littlebury (56056) and Great Chesterford (56065) show predicted O/E scores to be consistently higher in the absence of abstraction over the entire length of the timeseries. There are periods when abstraction pressure is predicted to lower the indicative WFD class (based on WHPT-ASPT O/E) either from High to Good or from Good to Moderate status; recent (2015-2020) WHPT-ASPT O/E predictions for Littlebury (56056) demonstrate a decrease in indicative macroinvertebrate WFD class from High to Good status. A similar impact is also indicated for Great Chesterford Road Bridge (56065); however, predictions made under the Historical scenario are close to the High-Good boundary.

3.2.10 Dernford Lock Gauging Station (56087) further downstream shows less impact from abstraction pressure on the macroinvertebrate community with historical predicted LIFE (F) O/E and WHPT-ASPT O/E scores showing a smaller deviation from the naturalised scenario.

3.2.11 The model output for the Fully Licensed (FL) scenario showed a significant adverse impact from increased abstraction pressure across all sites. Predictions for recent years (2015-2020) show a decrease in LIFE (F) O/E scores to values between 0.87-0.9 indicating a significant negative impact on the macroinvertebrate community, with predicted scores falling by up to 16%. A similar adverse impact is also indicated by WHPT-ASPT O/E scores where the indicative WFD classification status for each site is predicted to deteriorate against the historical scenario. For example, Littlebury (56056) shows a deterioration from Good to Moderate status, Great

Chesterford Road Bridge (56065) shows instances of a two-class deterioration from High to Moderate, and of a one class deterioration from either Good to Moderate or High to Good status. Similarly, Dernford Lock Gauging Station (56087) shows instances of deterioration from High to Good status.

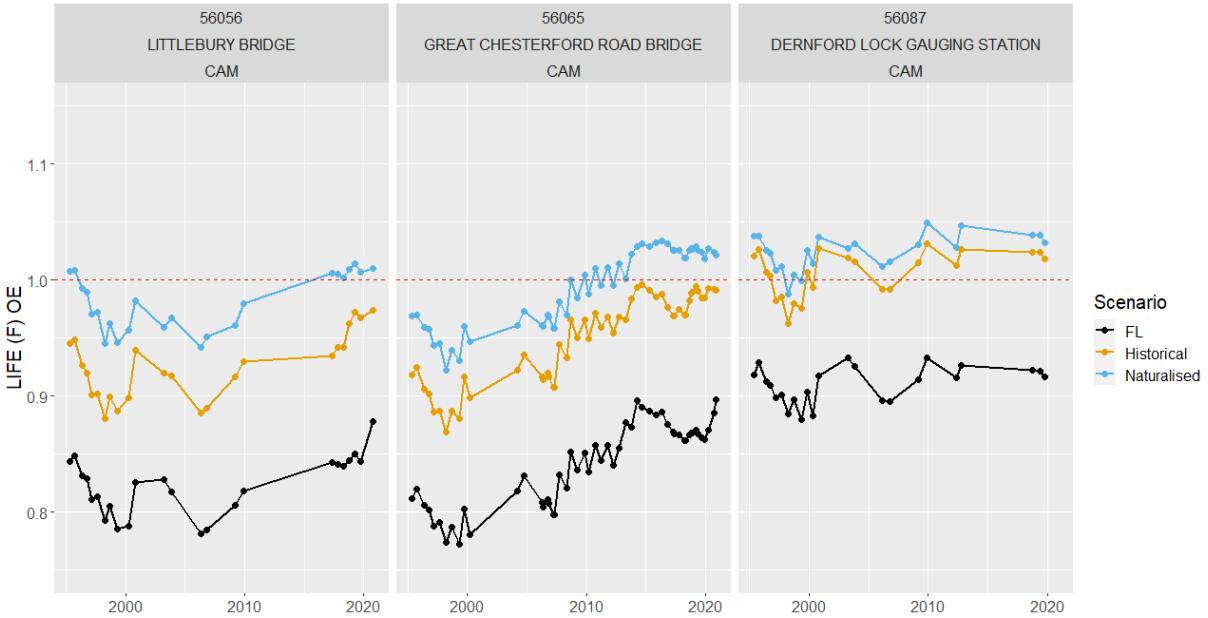


Figure 4 - Predicted LIFE (F) O/E scores for historical, naturalised, and fully licensed scenarios for sites in GB105033037590 Cam (Audley End to Stapleford)

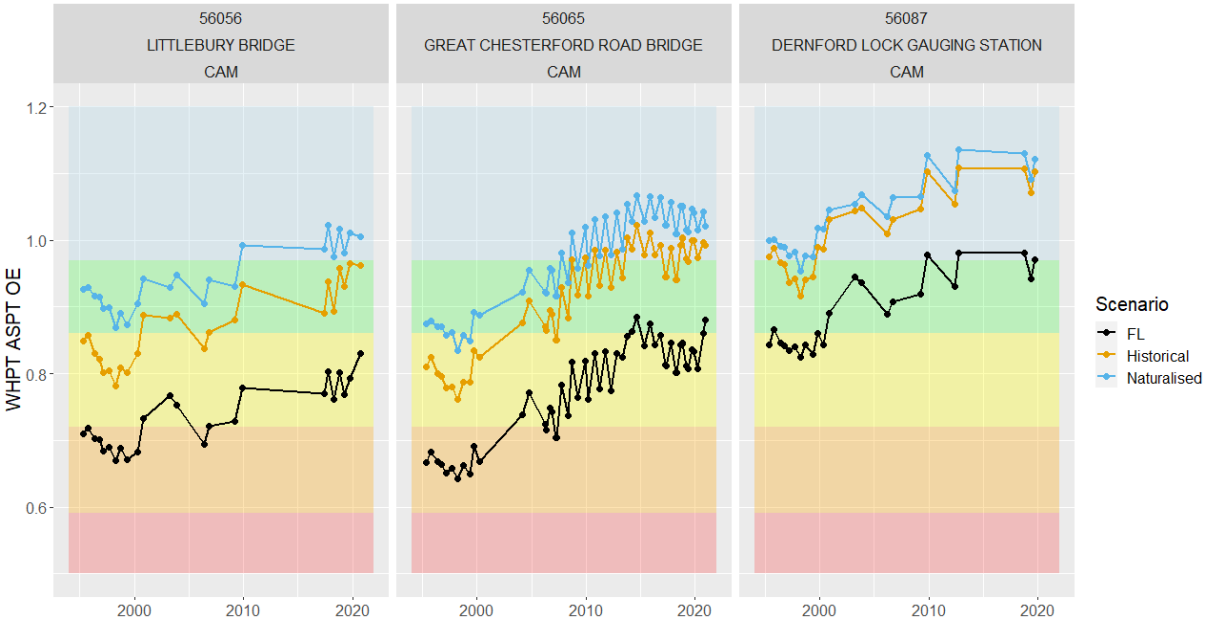


Figure 5 - Predicted WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for three sites in GB105033037590 Cam (Audley End to Stapleford)

3.3 Waterbody ID: GB105033037600 Cam (Stapleford to Hauxton Junction)

Catchment data explorer

Table 6 – WFD element classifications for WB ID GB105033037600

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Poor	Good	Good	Good	Good
Invertebrates	High	High	High	High	High
Macrophytes and Phytobenthos Combined			Good	Good	Good
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	High	High	High	High	High
Phosphate	Poor	Poor	Poor	Poor	Poor
pH	High	High	High	High	High
Temperature	High	High	Good	Good	Moderate
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

3.3.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 1 failure to Band 2 failure.

3.3.2 It has been shown that there are significant relationships between flows at Dernford gauging station and ecology indicators however the flow target at Dernford is 21.5 Ml/d and this target is being met. There was no evidence at the time of the WFD investigation in 2012 that flow was a limiting factor for fish or invertebrates and hydrological impacts linked to abstraction licences were not a reason for failure of a biology element.

Ecological evidence

3.3.3 The model output indicated an abstraction pressure impact on the macroinvertebrate community within the waterbody. Predicted historical LIFE (F) and WHPT-ASPT O/E scores are lower than predicted naturalised scores, indicating an impact of abstraction pressure on the macroinvertebrate community throughout the timeseries, which continues into recent years (2015-2020) (see Figure 6).

3.3.4 The model output for the Fully Licensed (FL) scenario indicated a significant adverse impact to macroinvertebrate communities due to increased abstraction pressure. Recent (2015-2020) LIFE (F) O/E scores are predicted to significantly decline and fall below the threshold of 1.0 and the indicative macroinvertebrate WFD class status is predicted to decline from High to Good status.

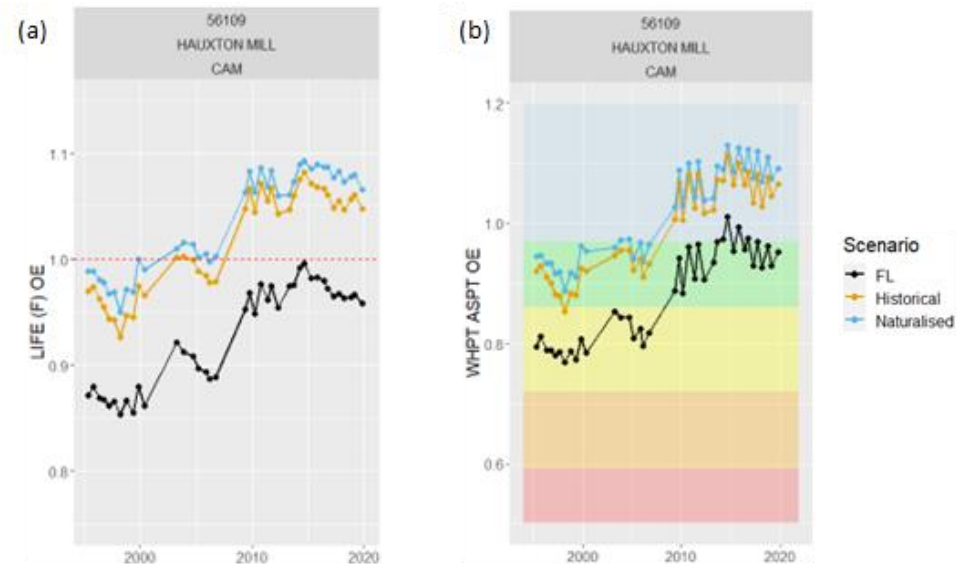


Figure 6 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Hauxton Mill, River Cam in GB105033037600 Cam (Stapleford to Hauxton Jct.)

3.4 Waterbody ID: GB105033037560 Wendon brook

Catchment data explorer

Table 7 – WFD element classifications for WB ID GB105033037560

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates	Good	High	High	High	High
Macrophytes and Phytobenthos Combined		High	High	High	High
Physico-chemical quality elements					
Ammonia (Phys-Chem)			High	High	High
Dissolved oxygen			Good	High	High
Phosphate			High	High	Good
pH			High	High	High
Temperature			High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

3.4.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 1 failure to Band 2 failure.

3.4.2 On the balance of evidence, non-CWC water company abstractions intercept flows that would otherwise arise in the lower part of Wendon Brook. There is some evidence of flow stress for the ecology, but only in periods of dry weather. Measures have been established through the WINEP to cap (non-CWC) licences to prevent deterioration from increased abstraction from said sources. There are currently no actions to improve flows due to the watercourse being isolated from the chalk aquifer along most of its length and ephemeral in nature.

3.4.3 Whilst other licence holders are primarily responsible for the abstraction influence on this waterbody, CWC's abstractions do contribute to the cumulative effect of abstraction on the groundwater body in the Cam catchment areas. Increases of abstraction have the potential to reduce the water available for the spring flow of chalk fed rivers and the water environment.

Ecological evidence

3.4.4 The macroinvertebrate community at the Wendon Brook site does respond to prevailing flow conditions when assessed via HEV plot, showing declines during periods of low flow but recovers well during higher flows. There is a clear deterioration in the LIFE O/E ratio during prolonged dry weather periods where flow sensitive taxa such as the freshwater shrimp *Gammarus pulex and* the mayfly *Baetis rhodani* decrease in abundance and others such as the caddisfly *Agapetus*

fuscipes are lost from the site. This provides evidence of acute flow sensitivity on this waterbody and suggests an increase in abstraction pressure would have a negative impact at this site. Furthermore, the loss of taxa from the site would result in a decline in WHPT-NTAXA which could cause a risk of deterioration under WFD classification.

Figure 7 - Macroinvertebrate sample site on Wendon Brook (56055)

3.5 Waterbody ID: GB105033037570 Tributary of Cam

Catchment data explorer

Table 8 – WFD element classifications for WB ID GB105033037570

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates				Moderate	
Macrophytes and Phytobenthos Combined				Good	Good
Physico-chemical quality elements					
Ammonia (Phys-Chem)		High	High	High	High
Dissolved oxygen		Bad	Bad	Poor	Poor
Phosphate		Moderate	Moderate	Moderate	Moderate
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

3.5.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. The assessment already shows a Band 3 failure*, full licensed quantities of abstraction would deteriorate low flows (Q95) even further.

3.5.2 The waterbody was investigated by the Agency (2013 & 2019) to determine whether impacts of abstraction were causing the DNSG status and ecological failure. The groundwater model calculates a natural Q95 flow for the waterbody of zero meaning although there is evidence of a flow deficit in the lower reaches, much of the waterbody is naturally ephemeral.

Ecological evidence

3.5.3 Monitoring on this watercourse was established in 2013 as part of the WFD programme. The site was visited Spring and Autumn in 2013 and was found to be dry in October. It was monitored again in 2015 when a classification status of Moderate was assigned and investigated. The investigation identified the hydrological regime as a considerable influence on the ecological community as the site was prone to drying. Periods of low flow were also deemed to be affecting the dissolved oxygen levels, which in turn acted to restrict the macroinvertebrate community which was able to colonise during the wet phases.

Figure 8 - Macroinvertebrate sample site on Ickleton Brook (161079)

3.6 Water body ID: GB105033038100 Rhee (upstream of Wendy)

Catchment data explorer

Table 9 – WFD Element classifications for WB ID GB105033038100

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Moderate	Good	High	High	Poor
Invertebrates		High	High	High	Good
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)		High	High	High	High
Dissolved oxygen		High	High	Good	High
Phosphate		Poor	Poor	Poor	Poor
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime		Supports Good			

Hydrology investigation outcomes

3.6.1 The cycle 1 classification in 2011 showed that at recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This was not the case in 2014 however, when the hydrological regime status was 'Supports Good'. This water body was designated as heavily modified in cycle 2 for reasons which include water resources and is no longer assessed. This is because the river is supported by groundwater abstraction designed to support low flows.

Ecological evidence

3.6.2 Hydroecological model outputs show similar predicted scores between historical and naturalised LIFE (F) O/E and WHPT-ASPT O/E scenarios indicating no discernible abstraction impact on the macroinvertebrate community at Tadlow Bridge Farm (56171) (see Figure 9).

3.6.3 The fully licensed (FL) scenario also predicts marginal / negligible differences from historical and naturalised LIFE (F) O/E and WHPT-ASPT O/E scores indicating a negligible to no discernible impact of increased abstraction pressure on the macroinvertebrate community at the site.

Figure 9 Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Tadlow Bridge Farm, River Rhee GB105033038100 Rhee (US Wendy)

3.7 Waterbody ID: GB105033038030 Mill River

Catchment data explorer

Table 10 WFD element classifications for WB ID GB105033038030

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates		High	High	High	High
Macrophytes and Phytobenthos Combined		Poor	Poor	Poor	Poor
Physico-chemical quality elements					
Ammonia (Phys-Chem)		High	High	High	High
Dissolved oxygen		High	High	High	High
Phosphate		Poor	Poor	Poor	Poor
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Supports Good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

3.7.1 The cycle 1 classification in 2014 showed that at recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This has not been the case in subsequent years however, when the hydrological regime status has been 'Supports Good'. Most recent assessments show full licensed quantities of abstraction would not deteriorate the hydrological regime status from 'Compliant'.

Ecological evidence

3.7.2 HEV plot analysis has shown that the macroinvertebrate community does respond to flow pressure at the sample site however, this has not caused significant deviation to the LIFE O/E ratios or the overall ecological health WHPT-ASPT O/E and WHPT-NTAXA O/E since 2000. The watercourse in the location of the sampling site has undergone significant marginal bank and in-channel enhancement in recent years, including features which have resulted in channel narrowing resulting in improved flow velocities. These enhancements will be influencing the macroinvertebrate community able to colonise the site.

Figure 10 - Macroinvertebrate sample site on Mill River (56160)

3.8 Water body ID: GB105033037610 Rhee (downstream of Wendy)

Catchment data explorer

Table 11 – WFD Element classifications for WB ID GB105033037610

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	Moderate	Moderate	Good	Poor
Invertebrates	Good	Good	High	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	Good	Good	Good	Good	Good
Phosphate	Poor	Poor	Poor	Poor	Poor
pH	High	High	High	High	High
Temperature	High	High	High	High	Good
Hydromorphological Supporting Elements					
Hydrological Regime	Supports Good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

3.8.1 The cycle 1 classification in 2011 showed that at recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This has not been the case in subsequent years however, when the hydrological regime status has been 'Supports Good'. Most recent assessments show full licensed quantities of abstraction would not deteriorate the hydrological regime status from 'Compliant'.

Ecological evidence

3.8.2 Hydroecological model outputs indicate a very slight /negligible impact of historical abstraction pressure on the macroinvertebrate community at Haslingfield Road Bridge (56119) for both LIFE (F) O/E and WHPT-ASPT O/E scores across the timeseries. This is depicted by only a slight difference in predicted metric scores between historical and naturalised scenarios (see Figure 11).

3.8.3 An adverse impact of abstraction pressure on the macroinvertebrate community is predicted if abstraction were to increase to Fully Licensed (FL). For recent years (2015-2020) LIFE (F) O/E scores are predicted to decline relative to historical and naturalised scenarios, falling below the threshold of 1.0, and the indicative macroinvertebrate WFD status suggests a risk of deterioration from High to Good status.

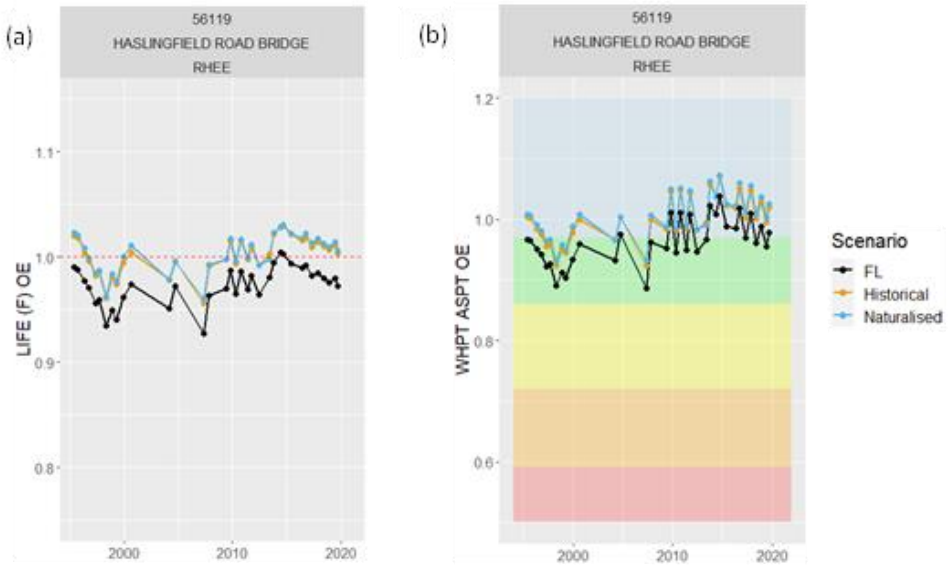


Figure 11 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Haslingfield Road Bridge, River Rhee in GB105033037610 Rhee (DS Wendy)

3.9 Water body ID: GB105033038060 Mel

Catchment data explorer

Table 12 – WFD Element classifications for WB ID GB105033038060

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Moderate	Moderate	Moderate	Moderate	High
Invertebrates		High	High	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)			High	High	High
Dissolved oxygen			High	High	High
Phosphate			High	High	High
pH			High	High	High
Temperature			High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime		Supports Good			

Hydrology investigation outcomes

3.9.1 This water body has been designated as heavily modified for reasons which include water resources and is no longer assessed. This is because the river is supported by groundwater abstraction designed to support low flows. As such, there have been no hydrology assessments in any years which have shown non-compliance.

3.9.2 There have been concerns from a local interest group about the flows in the headwaters of the Rivel Mel in times of dry weather. Although the stretch can be supported by the Agency's Rhee groundwater support scheme, the effectiveness of this is known to decline as groundwater levels recede. To address the concerns of the local group, the Agency has commissioned a study to investigate the efficiency of the scheme and to monitor flows in the headwaters. An initial report has been completed with further work expected this summer.

Ecological evidence

3.9.3 The macroinvertebrate community at the sample site on the river Mel has routinely been reported at High status under WFD and has therefore not been reviewed in that context.

Figure 12 - Macroinvertebrate sample site on River Mel (56139)

3.10 Waterbody ID: GB105033038080 Shep

Catchment data explorer

Table 13 – WFD element classifications for WB ID GB105033038080

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	Good	Good	Good	Good
Invertebrates	High		High	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)			High	High	High
Dissolved oxygen			High	Good	High
Phosphate			Good	Good	Moderate
pH			High	High	High
Temperature			High	High	Good
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

3.10.1 The cycle 1 classification in 2011 and 2013 showed that at recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This was not the case in subsequent years, when the hydrological regime status was 'Supports Good'. Based on 2019 classification, full licenced levels of abstraction would deteriorate the water body to a Band 1 failure.

Ecological evidence

3.10.2 The HEV analysis shows that the macroinvertebrate community does respond to flow pressure at the sample site, with long-term data trends indicating impacts during low flow periods. However, a recent impact from signal crayfish activity has been detected which has caused a decline in the WHPT-NTAXA O/E and increases in LIFE O/E and WHPT-ASPT O/E, making it difficult to interpret the recent data.

Figure 13 - Macroinvertebrate sample site on River Shep (56128)

3.11 Waterbody ID: GB105033038120 Hoffer brook

Catchment data explorer

Table 14 – WFD element classifications for WB ID GB105033038120

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates		Good	Good	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)		High	High	High	High
Dissolved oxygen		Good	High	Good	Moderate
Phosphate		High	High	High	High
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime		Does not support good			

Hydrology investigation outcomes

3.11.1 The cycle 1 classification in 2011 showed that at recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This was not the case in 2014 however, when the hydrological regime status was 'Supports Good'. This water body was designated as heavily modified in cycle 2 for reasons which include water resources and is no longer assessed. This is because the river is supported by groundwater abstraction designed to support low flows.

Ecological evidence

3.11.2 This waterbody had a historical macroinvertebrate site, which was reinstated in 2012 as part of the WFD programme. The HEV analysis indicates that the macroinvertebrate community does respond to flow pressure at the sample site, particularly around low flow periods, based on a limited number of sampling events. Abundances of the freshwater shrimp *Gammarus pulex* and flow sensitive mayfly and caddisfly species (such as *Hydropsyche* sp. and *Sericostoma personatum*) were all lowest in the immediate aftermath of dry weather events. This indicates that the macroinvertebrate community at the site is susceptible to flow pressures. The river support scheme is therefore critical to maintaining the macroinvertebrate community in this waterbody.

Figure 14 - Macroinvertebrate sample site on Hoffer Brook (56121)

4.0 Lower Cam catchment

4.0.1 The river Cam flows through the city of Cambridge, popular for punting, canoeing and rowing, to its confluence with the Ely Ouse within the South Level. Tributaries include the Bourn, Bin, Hobsons and Cherry Hinton Brooks and the water level managed New River and the Burwell, Soham, Bottisham and Swaffham Bulbeck Lodes. The catchment is important for wetland species and habitats. Although some water courses are embanked, there are excellent examples of important fenland habitat, notably Wicken Fen and Chippenham Fen.

4.1 Water body ID: GB105033042690 Bourn Brook

Catchment data explorer

Table 15 – WFD Element classifications for WB ID GB105033042690

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Moderate	Moderate	Moderate	Moderate	Moderate
Invertebrates		Good	Good	Good	Good
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	Moderate	Good	Good	Good	High
Phosphate	Not assessed	Poor	Poor	Poor	Poor
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Supports Good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

4.1.1 At recent actual levels of abstraction, low (Q95) flows are deemed to be sufficient to support the ecology. Full licensed quantities of abstraction however, would deteriorate low flows (Q95) from Compliant to a Band 1 failure status.

Ecological evidence

4.1.2 The macroinvertebrate communities at the sample sites on the Bourn Brook have routinely been reported at Good status under WFD and have therefore not been reviewed in that context.

Figure 15 - Macroinvertebrate sample sites on Bourn Brook (56154 and 161112)

4.2 Waterbody ID: GB105033037620 Hobson's brook

Catchment data explorer

Table 16 – WFD element classifications for WB ID GB105033037620

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates		Good	Good	Good	Good
Macrophytes and Phytobenthos Combined		Good	Good	Good	Good
Physico-chemical quality elements					
Ammonia (Phys-Chem)		Good	High	High	High
Dissolved oxygen		Good	Good	Good	Good
Phosphate		High	High	High	High
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Supports Good	Does not support good

Hydrology investigation outcomes

4.2.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction show improvement in low flows (Q95) from a Band 3 failure to Compliant status* which is linked to the input of water from the new support scheme as detailed below.

4.2.2 Nine Wells Local Nature Reserve is situated within this waterbody and is an important area for public recreation consisting of wooded wetland habitat fed by Chalk springs. This spring flow continues downstream to Hobson's Brook which flows towards Cambridge. In the 17th Century, an artificial water course called Hobson's Conduit was constructed to divert some of the water from Hobson's Brook for the benefit of people in Cambridge. The Hobson's Conduit is now a Scheduled Ancient Monument.

4.2.3 There have been concerns about Nine Wells spring site since 1976 when it is thought the drought caused the disappearance of the rare glacial flatworm *Crenobia alpina as* there was insufficient spring flow to maintain the constant flow and cool temperature of water required by the species.

4.2.4 CWC funded an investigation to assess the impact of their borehole abstraction on the spring flows of Nine Wells. The results indicated that their abstractions do have an impact at Nine Wells by abstracting water that would otherwise emerge at the site as spring flow.

4.2.5 To mitigate against the impact of their abstraction, CWC had a condition applied to their Babraham abstraction licence to augment the springs through recharge boreholes at Nine Wells if the flow reduces below a trigger level. This condition came into force in 2020 and since then augmentation has been needed every year to support flows. Monitoring of the ecology and flow

is required to measure the effectiveness of this scheme and further measures or adjustments to the support scheme may be necessary.

Ecological evidence

4.2.6 In accordance with WFD rules, a monitoring point was established in the lower reaches of the waterbody, but this did not account for the complexities of the watercourse route through Cambridge. As such, a site in the upper reaches of the waterbody was established specifically to monitor the hydrological pressures acting on the macroinvertebrate community, particularly considering the Nine Wells support scheme implemented in mid-2020.

4.2.7 Further data will be required to understand the effectiveness of the river support scheme, but initial data indicates that the additional water in the Brook has given rise to increased abundances of some flow-sensitive taxa including the caddisfly *Agapetus fuscipes,* blackfly larvae *Simulium* sp. and the freshwater limpet *Ancylus fluviatilis*. The river support scheme is likely to be critical to the macroinvertebrate community in this waterbody.

Figure 16 - Macroinvertebrate sample site on Hobson's Brook (186045)

4.3 Water body ID: GB105033042670 Cherry Hinton Brook

Catchment data explorer

Table 17 – WFD Element classifications for WB ID GB105033042670

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates		Moderate	Moderate	Moderate	Moderate
Macrophytes and Phytobenthos Combined		Good	Good	Good	Good
Physico-chemical quality elements					
Ammonia (Phys-Chem)		Moderate	Poor	Poor	Moderate
Dissolved oxygen		Poor	Poor	Poor	Poor
Phosphate		Good	Good	Good	Moderate
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Supports Good	Does not support good

Hydrology investigation outcomes

4.3.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction show improvement in low flows (Q95) from a Band 1 failure to Compliant status* due to the input of mains water leakage into the catchment.

4.3.2 Cambridge Water was funded to carry out an investigation during AMP6 (2015 to 2020) to examine the impact of abstraction on the flows of the Cherry Hinton Brook. Flow rates were deemed compliant at the waterbody outflow but there were concerns over impacts to the headwaters should abstraction by Cambridge Water at their Fleam Dyke source increase to fully licensed rates. Monitoring was established in 2019 in the headwaters of the waterbody to investigate the relationship between flow and ecology. More data will be required before any conclusions of ecological impact can be made for this site.

4.3.3 There remains a risk of fully licensed abstraction to deteriorate flows and the ecology at the headwaters. Cambridge Water has agreed to reduce their Fleam Dyke source by 2025 to the extent of the impact, but more restrictive caps may be required depending on the results of the ongoing monitoring.

Ecological evidence

4.3.4 In accordance with WFD rules, a monitoring point was established in the lower reaches of the waterbody, but this did not account for the complexities of the interaction with another watercourse, the East Main Drain, through Cambridge. A site in the upper reaches of the waterbody was established specifically to monitor the hydrological pressures acting on the

macroinvertebrate community. The new site was established in 2019 and as such, there is currently insufficient data for analysis to be undertaken to understand potential impacts on the macroinvertebrate community.

Figure 17 - Macroinvertebrate sample site on Cherry Hinton Brook (196711)

4.4 Water body ID: GB105033042700 Bottisham Lode – Quy Water

Catchment data explorer

Table 18 – WFD Element classifications for WB ID GB105033042700

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates		Good	Good	Good	Good
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)		High	High	High	High
Dissolved oxygen		High	High	High	High
Phosphate		Poor	Poor	Poor	Poor
pH		High	High	High	High
Temperature		High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime		Does not support good			

Hydrology investigation outcomes

4.4.1 The cycle 1 classification in 2011, 2012 and 2014 showed that at recent actual levels of abstraction, low (Q95) flows were not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This water body was designated as heavily modified in cycle 2 for reasons which include water resources and is no longer assessed. This is because the river is supported by groundwater abstraction designed to support low flows.

4.4.2 Bottisham Lode is an embanked man-made channel which is largely level based at the outflow, it is however sourced by chalk inputs in the headwaters, most notably the Little Wilbraham River system and Fulbourn Fen SSSI.

4.4.3 There are known effects on the groundwater table from public water supply abstractions in the catchment. The Environment Agency has provided river support using the Lodes Granta groundwater support scheme since 1991. There is some uncertainty however, as to the effectiveness of this support where water can be lost again to ground in downstream reaches in periods of dry weather.

4.4.4 There is a history of concern from local stakeholders, who formed Wilbraham River Preservation Society (WRPS) about low flows and drying of the river, particularly upstream of Hawk Mill. A practical river diversion solution was completed as part of the RSA programme in 2012 which was thought to have benefit for the ecology and allow more water from the support scheme to flow downstream. However, there is still significant concern about lack of river flows and impact of abstraction in the headwaters of this catchment.

Ecological evidence

4.4.5 The macroinvertebrate community at the sample sites on the Bottisham Lode-Quy Water waterbody have routinely been reported at Good status under WFD. The data were reviewed via HEV analysis in WFD cycle 1 to investigate the hydrology failure and the outcome of that investigation was that there was insufficient evidence to demonstrate a link between flow pressure and ecological impairment. The site on Quy Water (56061) is subject to very low flows during dry weather periods and was recorded dry at the Autumn 2011 sampling event. The river support scheme is therefore critical to maintaining the macroinvertebrate community in this waterbody.

Figure 18 - Macroinvertebrate sample sites on Bottisham Lode-Quy Water (56061 (left) & 56046 (right))

Drought impacts

4.4.6 The pictures below demonstrate the effect of the artificial groundwater augmentation at a location downstream. At this location, the support can be the difference between isolated pools or a completely dry bed which, ecologically can be crucial.

Figure 20 - Comparison of downstream section of the river with (left), and without (right) GW support during prolonged dry weather in 2019

4.5 Water body ID: GB105033042710 Swaffham – Bulbeck Lode

Catchment data explorer

Table 19 – WFD Element classifications for WB ID GB105033042710

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates		High	High	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)			High	High	High
Dissolved oxygen			High	High	High
Phosphate			Poor	Poor	Poor
pH			High	High	High
Temperature			High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime		Does not support good			

Hydrology investigation outcomes

4.5.1 The cycle 1 classification in 2011, 2012 and 2014 showed that at recent actual levels of abstraction, low (Q95) flows were not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This water body was designated as heavily modified in cycle 2 for reasons which include water resources and is no longer assessed. This is because the river is supported by groundwater abstraction designed to support low flows.

4.5.2 The Swaffham Bulbeck lode is an embanked man-made channel which is largely level based with little flow lower down. It is however sourced by chalk inputs in the headwaters. It is augmented by GW pumped to support low flows and ecology. There is some uncertainty however, as to the effectiveness of this support where water can be lost again to ground in downstream reaches.

Ecological evidence

4.5.3 In accordance with WFD rules, a monitoring point was established in the lower reaches of the waterbody, at a location deemed to be representative of the waterbody as a whole. An investigation was undertaken in 2017 to determine whether there was an alternative location which could be assessed specifically for hydrological pressure. Due to the steep nature of the banks and the presence of a gauging station, an alternative site which represented the upper reaches, that are subject to more varied flow patterns, could not be established.

Figure 21 - Macroinvertebrate sample site on Swaffham-Bulbeck Lode (56044)

4.6 Water body ID: GB105033042860 Soham Lode

Catchment data explorer

Table 20 – WFD Element classifications for WB ID GB105033042860

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	Good	High	Good	Good
Invertebrates	Good	Good	Good	Good	Good
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	High	High	High	Good	High
Phosphate	High	High	Moderate	Poor	Moderate
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Supports Good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

4.6.1 At recent actual levels of abstraction, low (Q95) flows are deemed to be sufficient to support the ecology. Full licensed quantities of abstraction however, would deteriorate low flows (Q95) from Compliant to a Band 2 failure status.

4.6.2 The waterbody is augmented by groundwater which is pumped to support low flows and ecology at the headwaters in Snailwell. There is some uncertainty however, as to the effectiveness of this support where water can be lost again to ground in downstream reaches in drought conditions.

Ecological evidence

4.6.3 Hydroecological model outputs indicate that historically there has been no discernible impact from abstraction pressure at River Lane Fordham (56004). Modelled flows at the site indicate the watercourse is discharge-rich and although historical LIFE (F) O/E and WHPT-ASPT O/E scores are lower than naturalised, this is not indicative of an abstraction pressure in this instance (see details in Appendix A; Section 3.3.6.1).

4.6.4 The model output indicates a negligible / no discernible abstraction impact at the site, if abstraction were to increase to Fully Licensed (FL), with similar predicted O/E metric scores displayed between the fully licensed and naturalised scenarios in recent years (2015-2020) (see Figure 22).

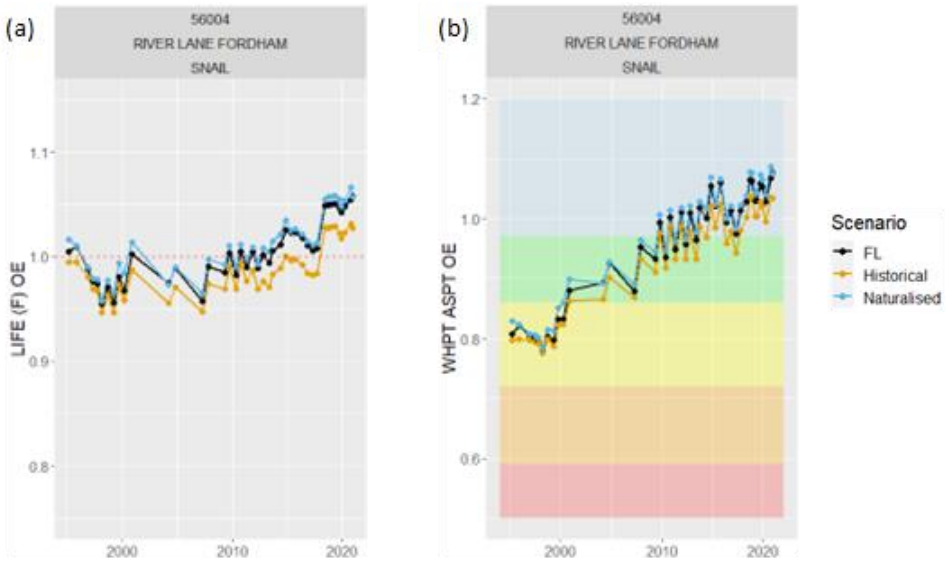


Figure 22 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for River Lane Fordham, River Snail GB105033042860 Soham Lode

4.7 Water body ID: GB105033042780 New River

Catchment data explorer

Table 21 – WFD Element classifications for WB ID GB105033042780

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates	**High**	**High**		**High**	**High**
Macrophytes and Phytobenthos Combined			**High**	**Good**	**Good**
Physico-chemical quality elements					
Ammonia (Phys-Chem)	**High**	**High**	**High**	**High**	**High**
Dissolved oxygen	**High**	**High**	**High**	**High**	**High**
Phosphate	**High**	**High**	**High**	**High**	**High**
pH	**High**	**High**	**High**	**High**	**High**
Temperature	**High**	**High**	**High**	**High**	**High**
Hydromorphological Supporting Elements					
Hydrological Regime	**Does not support good**	**Does not support good**	**Does not support good**	**Does not support good**	**Does not support good**

Hydrology investigation outcomes

4.7.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Whilst the water body is already a Band 3 failure*, full licensed quantities of abstraction would deteriorate low flows (Q95) even further.

4.7.2 The impact of abstraction was reviewed under the Habitats Directive for Wicken Fen SSSI part of Fenland SAC. Despite the face value WFD assessment, there is a lack of evidence on the relationship between biology and flow, and hydrological impacts are not deemed to be a reason for failure of a biology element.

4.7.3 The waterbody contains part of the Lodes system of drains and river which discharge into the river Cam. The New River runs adjacent to Wicken Fen, where it is referred to as Wicken Lode. The river flows rely on rainfall and baseflow from the Chalk aquifer. In particular, the upper reaches derive flow from the Lower Chalk aquifer. In the lower reaches the river runs over Gault Clay and becomes level dependent. The river can be augmented in the upper reaches from the Agency's Lodes Granta groundwater support scheme in times of low flows.

Ecological evidence

4.7.4 In accordance with WFD rules, a monitoring point was established in the lower reaches of the waterbody, at a location deemed to be representative of the waterbody as a whole. The watercourse is modified and during the Summer has a high percentage cover of aquatic plants which could create channel narrowing which in turn may improve the flow velocity. The data

were reviewed in WFD cycle 1 to investigate the hydrology failure and that investigation found insufficient evidence to demonstrate a link between flow pressure and ecological impairment.

4.7.5 The sample site has been found to support a regionally notable beetle *Hydraena nigrita,* which is of conservation importance. This species is assigned to flow group II in the LIFE index, indicating a species which shows a preference for moderate to fast flow velocities.

Figure 23 - Macroinvertebrate sample site on New River (56021)

5.0 Ivel catchment

The river Ivel catchment is bounded by the Chiltern Hills to the south and Greensand Ridge to the North. The River Ivel and River Flit, and some tributaries, rise from springs in the Chiltern chalk. Several smaller watercourses (Running Waters, Chicksands Brook and Millbridge-Common Brooks) rise from the Woburn Sands aquifer. The river Ivel headwaters are dominated by the North Hertfordshire towns of Hitchin, Letchworth and Baldock. Other towns are Ampthill, Biggleswade and Sandy. Elsewhere the catchment is rural with agriculture and horticulture. The catchment is noted for its angling interest, water vole and otter populations and important wetland habitats.

5.1 Water body ID: GB105033037820 Millbridge and Potton brooks

Catchment data explorer

Table 22 – WFD Element classifications for WB ID GB105033037820

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	High	High	High	High	High
Invertebrates	Moderate	Moderate	Moderate	Moderate	Poor
Macrophytes and Phytobenthos Combined	Moderate	Moderate	Moderate	Good	Good
Physico-chemical quality elements					
Ammonia (Phys-Chem)	Good	Good	Good	Good	Good
Dissolved oxygen	Good	Moderate	Good	Good	Moderate
Phosphate	Moderate	Moderate	Moderate	Good	Moderate
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

5.1.1 The cycle 1 classification between 2009 and 2013 showed that at recent actual levels of abstraction, low (Q95) flows were not deemed to be sufficient to support the ecology and full licensed quantities of abstraction would deteriorate low flows (Q95) even further. This was not the case in 2014 however, when the hydrological regime status was 'Supports Good'.

5.1.2 The investigation undertaken between 2010 and 2016 concluded that abstraction was a reason for failure and measures were implemented to revoke licences and to apply hands off flow restrictions to some (non-water company) surface water abstraction licences upon their renewal in 2016. Since the implementation of these conditions, the waterbody has continued to support good ecological status.

5.1.3 There remains a risk of deterioration in this waterbody at full licensed levels of abstraction however which would move the hydrological regime status from Compliant to a Band 1 failure.

Ecological evidence

5.1.4 The macroinvertebrate community has been assessed via HEV analysis at two sample sites in this waterbody (56191 and 56196), where water quality pressures were shown to be exerting an impact on the macroinvertebrate community. There was evidence that channel modification and flow pressures could also be impacting the macroinvertebrate community, but these impacts were partially masked by the water quality influence. Whilst the water quality has started to show signs of improvement in recent years, it is still the primary influence on the macroinvertebrate community. It is worthy of note that during periods of low flow, the water quality impacts on the macroinvertebrate community are exacerbated.

Figure 24 - Macroinvertebrate sample sites on Millbridge and Potton Brook (56191 (left) & 56196 (right))

5.2 Water body ID: GB105033037740 Cat ditch

Catchment data explorer

Table 23 – WFD Element classifications for WB ID GB105033037740

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish					
Invertebrates			**Bad**	**Bad**	
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)					
Dissolved oxygen					
Phosphate					
pH					
Temperature					
Hydromorphological Supporting Elements					
Hydrological Regime	**Does not support good**	**Does not support good**	**Does not support good**	**Does not support good**	**Does not support good**

Hydrology investigation outcomes

5.2.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction also show that the waterbody would be non-compliant.

5.2.2 This water body was screened out from further investigation in 2016 because hydrological impacts are not a reason for failure of a biology element, and it is recognised that Cat Ditch is ephemeral even under naturalised conditions. The impact of abstraction does not significantly change this.

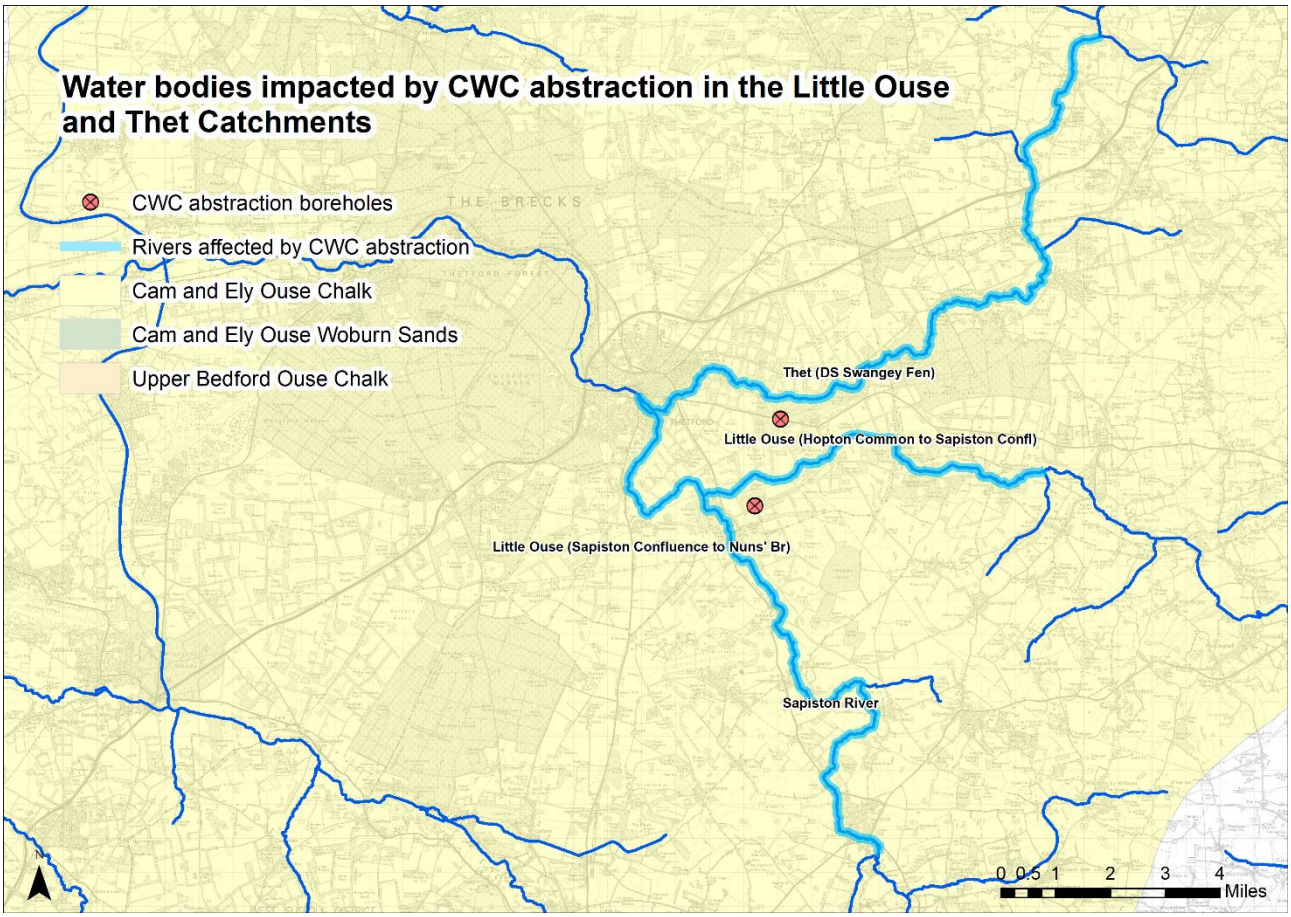
Ecological evidence

5.2.3 This waterbody had a historical macroinvertebrate site, which was reinstated in 2013 as part of the WFD programme. The site was visited 13 times between 2013-2019 and was recorded as dry on four occasions. Due to the frequent drying of the site, there was insufficient ecological evidence to determine whether flow pressure caused by abstraction was affecting the macroinvertebrate community.

Figure 25 - Macroinvertebrate sample site on Cat Ditch (56192)

6.0 Little Ouse and Thet catchment

6.0.1 The upper reaches and tributaries of the River Thet and the River Sapiston extend as far as Attleborough and Elmswell before their confluences with the Little Ouse at Thetford and Euston. The Little Ouse flows on to the South Level just north of Lakenheath. This catchment is characterised by Breckland and woodlands with varied land use including forestry and agriculture. The catchment is important for local, national and internationally protected species and habitats including Eel, Otter and Water vole as well as one of the few remaining populations of the native white-clawed crayfish within the river Thet.



Map 5 – Water bodies impacted by CWC abstraction in the Little Ouse, Sapiston and Thet Catchments

6.1 Water body ID: GB105033043070 Sapiston River

Catchment data explorer

Table 24 – WFD Element classifications for WB ID GB105033043070

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	Good	Good	Good	High
Invertebrates	Moderate	Moderate	High	High	High
Macrophytes and Phytobenthos Combined			Moderate	Moderate	Moderate
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	Moderate	Poor	Good	Good	High
Phosphate		Poor	Poor	Poor	Poor
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

6.1.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 1 failure to Band 3 failure*.

6.1.2 The river flow of the Sapiston River depends on rainfall and baseflow from the Chalk. There have been concerns about low flows in the Sapiston River in the drought years. The major abstraction influence on flow is the public water abstraction at Ixworth held by Anglian Water, although the proximity of CWC's abstraction at Euston will also impact flows in this waterbody but to a lesser extent (predicted to be 20% of impact).

6.1.3 This waterbody was investigated by Anglian Water during the AMP6 period (2015-2020) where impacts on flow from abstraction were confirmed. To mitigate against these impacts Anglian Water are obligated to undertake habitat restoration, reduce their abstraction to historic rates and provide river augmentation to protect a residual flow. These measures are planned to be implemented by 2025.

6.1.4 Increases in abstraction by CWC have the potential to impact on the flows of the Sapiston River and to reduce the effectiveness of the mitigation measures stated above by Anglian Water.

Ecological evidence

6.1.5 Hydroecological model outputs indicate a very slight / negligible impact of historical abstraction pressure on the macroinvertebrate community at Bardwell Bridge (55931) for both LIFE (F) O/E

and WHPT-ASPT O/E scores across the timeseries (see Figure 26). This is depicted by only a slight difference in predicted metric scores between historical and naturalised scenarios.

6.1.6 An adverse impact of abstraction pressure on the macroinvertebrate community is predicted if abstraction were to increase to Fully Licensed (FL). For recent years (2015-2020) LIFE (F) O/E scores are predicted to decline relative to historical and naturalised scenarios, and the indicative macroinvertebrate WFD status suggests a risk of deterioration from High to Good status.

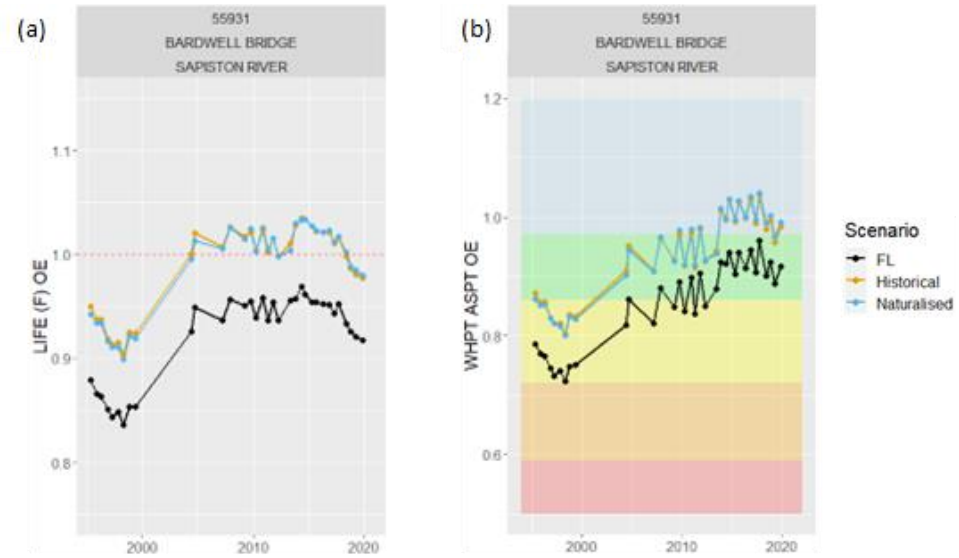


Figure 26 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Bardwell Bridge, Sapiston River GB105033043070 Sapiston River

6.2 Water body ID: GB105033043190 Thet (downstream of Swangey fen)

Catchment data explorer

Table 25 – WFD Element classifications for WB ID GB105033043190

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	Good	Good	Good	Moderate
Invertebrates	Good	High	High	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	Good	Good	High	Good	Good
Phosphate	Moderate	Moderate	Moderate	Moderate	Moderate
pH			High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Supports Good	Supports Good	Supports Good	Supports Good	Supports Good

Hydrology investigation outcomes

6.2.1 At recent actual levels of abstraction, low (Q95) flows are deemed to be sufficient to support the ecology. However, full licensed quantities of abstraction would deteriorate low flows (Q95) and move the status from 'Compliant' to a Band 1 failure.

6.2.2 The Thet receives water discharged as part of the Great Ouse groundwater scheme (GOGs) for which the Agency holds an abstraction licence from the Chalk aquifer. This scheme is used to support the Ely Ouse to Essex transfer. Although the primary purpose of the GOGs is for water transfer to Essex, there is the secondary benefit of mitigating against any losses of flow caused by abstraction in drought periods. This river support is crucial in maintaining the flows and ecology at good status.

Ecological evidence

6.2.3 Hydroecological model outputs show negligible differences between historical and naturalised LIFE (F) O/E and WHPT-ASPT O/E predicted scores indicating no discernible abstraction impact on the macroinvertebrate community at Bridgham Track Bridge (55897) (see Figure 27).

6.2.4 The fully licensed (FL) scenario also predicts marginal / negligible differences from historical and naturalised LIFE (F) O/E and WHPT-ASPT O/E scores indicating a negligible to no discernible impact of increased abstraction pressure on the macroinvertebrate community at the site.

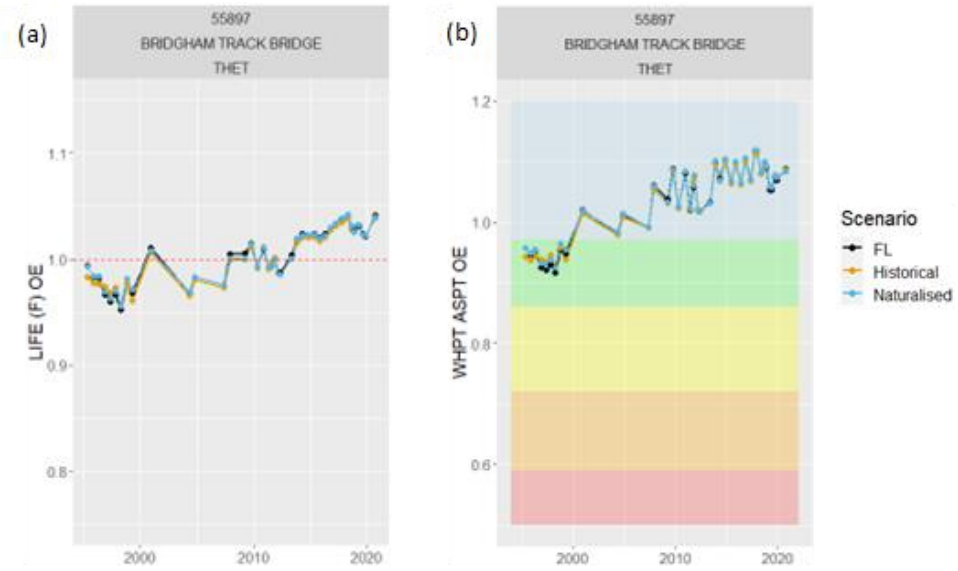


Figure 27 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Bridgham Track Bridge, River Thet GB105033043190 Thet (DS Swangey Fen)

6.3 Water body ID: GB105033043090 Little Ouse (Hopton Common to Sapiston Confluence)

Catchment data explorer

Table 26 - WFD Element classifications for WB ID GB105033043090

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Good	Good	Good	Good	High
Invertebrates	Good	Good	Good	Good	High
Macrophytes and Phytobenthos Combined			Good	Good	Good
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	Poor	Poor	Poor	Moderate	Good
Phosphate	Good	Good	Moderate	Moderate	Good
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

6.3.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 1 failure to Band 3 failure*.

6.3.2 The Little Ouse receives water discharged as part of the Great Ouse groundwater scheme (GOGs) for which the Agency holds an abstraction licence from the Chalk aquifer. This scheme is used to support the Ely Ouse to Essex transfer. Although the primary purpose of the GOGs is for water transfer to Essex, there is the secondary benefit of mitigating against any losses of flow caused by abstraction in drought periods. This scheme is used when an export of water is needed to meet demands in Essex. In general, the scheme is used in drought periods and hence whilst this scheme is in use, the current reduction of flow is replaced by this discharge of water. An existing agreement with surface water abstractors from the River Little Ouse, who pay supported rates, means that the Agency supports the river with groundwater when flow reaches 94 l/s (8.12 Ml/d) at Euston County Bridge to avoid restrictions with cessations conditions. This flow was calculated as sufficient to protect the ecology from the impacts of low flow.

6.3.3 The amount water available to discharge as part of the GOGs scheme has been reduced to protect the impact of this abstraction from groundwater on nearby water dependent designated sites. Recent years have shown the support is now not always able to maintain the residual flow of 94 l/s. Increasing abstraction above historic rates may further reduce the capability of the scheme to protect against low flows, risking impacts on the ecology.

Ecological evidence

6.3.4 Hydroecological model outputs show a negligible to no discernible abstraction impact on the macroinvertebrate community at Nun's Bridge Thetford (55943), with historical LIFE (F) O/E and WHPT-ASPT O/E scores either being similar or slightly higher than naturalised scores throughout the time series (see Figure 28).

6.3.5 The model output for the fully licensed scenario shows both LIFE (F) O/E and WHPT-ASPT O/E scores to be significantly lower than historical and naturalised scenarios, indicating a significant adverse impact of increased abstraction pressure on the macroinvertebrate community. The WHPT-ASPT O/E fully licensed (FL) scores show several instances of a decline in indicative macroinvertebrate WFD class from High to Good status. Although no recent (2015-2020) data was available for model calibration when making subsequent predictions, the expectation is that relative differences in O/E scores between the fully licensed and the historical and naturalised scenarios would continue. Hence an abstraction impact on the macroinvertebrate community is expected to persist.

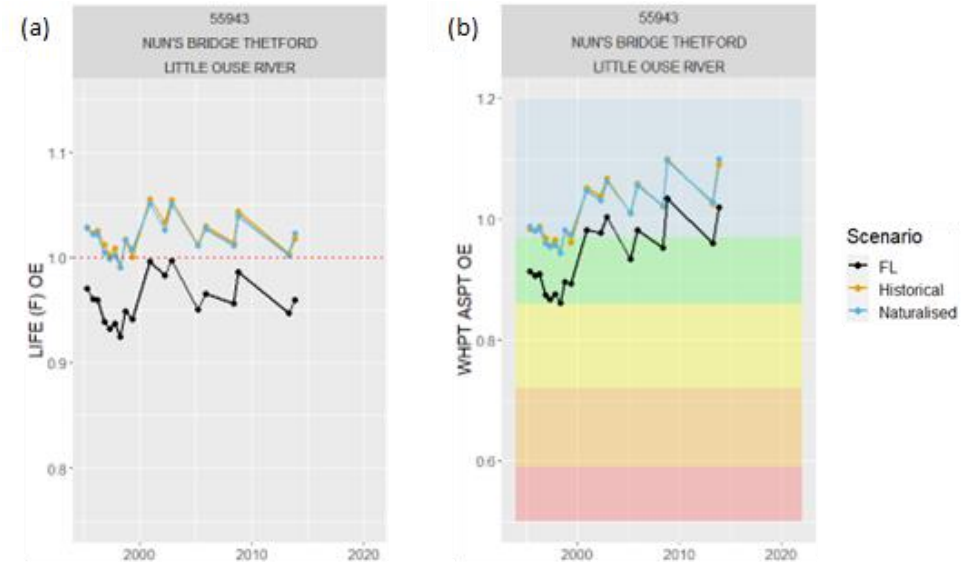


Figure 28 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Nun's Bridge Thetford, Little Ouse River GB105033043090 Little Ouse (DS Sapiston Confl)

Drought impacts

Figure 29 - Images showing dry riverbed in the month of September at Euston gauging station on the Little Ouse upstream of the Sapiston confluence during the 2022/23 drought

6.4 Water body ID: GB105033043100 Little Ouse (Sapiston confluence to Nun's bridge)

Catchment data explorer

Table 27 – WFD Element classifications for WB ID GB105033043100

Classification Item	2013	2014	2015	2016	2019
Biological quality elements					
Fish	Bad	Bad	Bad	Moderate	Moderate
Invertebrates		High	High	High	High
Macrophytes and Phytobenthos Combined					
Physico-chemical quality elements					
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	High	High	Good	Good	High
Phosphate			Moderate	Moderate	Moderate
pH	High	High	High	High	High
Temperature	High	High	High	High	High
Hydromorphological Supporting Elements					
Hydrological Regime	Does not support good	Does not support good	Does not support good	Does not support good	Does not support good

Hydrology investigation outcomes

6.4.1 At recent actual levels of abstraction, low (Q95) flows are not deemed to be sufficient to support the ecology. Full licensed quantities of abstraction would deteriorate low flows (Q95) even further and move the status from a Band 2 failure to Band 3 failure*.

6.4.2 The Little Ouse receives water discharged as part of the Great Ouse groundwater scheme (GOGs) for which the Agency holds an abstraction licence from the Chalk aquifer. This scheme is used to support the Ely Ouse to Essex transfer. Although the primary purpose of the GOGs is for water transfer to Essex, there is the secondary benefit of mitigating against any losses of flow caused by abstraction in drought periods. This scheme is used when an export of water is needed to meet demands in Essex. In general, the scheme is used in drought periods and hence whilst this scheme is in use, the current reduction of flow is replaced by this discharge of water. An existing agreement with surface water abstractors from the River Little Ouse, who pay supported rates, means that the Agency supports the river with groundwater when flow reaches 94 l/s (8.12 Ml/d) at Euston County Bridge to avoid restrictions with cessations conditions. This flow was calculated as sufficient to protect the ecology from the impacts of low flow.

6.4.3 The amount water available to discharge as part of the GOGs scheme has been reduced to protect the impact of this abstraction from groundwater on nearby water dependent designated sites. Recent years have shown the support is now not always able to maintain the residual flow of 94 l/s. Increasing abstraction above historic rates may further reduce the capability of the scheme to protect against low flows, risking impacts on the ecology.

Ecological evidence

6.4.4 Hydroecological model outputs show negligible differences between historical and naturalised LIFE (F) O/E and WHPT-ASPT O/E predicted scores indicating no discernible abstraction impact on the macroinvertebrate community at Road Bridge Knettishall (55932) (see Figure 30).

6.4.5 An adverse impact of abstraction pressure on the macroinvertebrate community is predicted if abstraction were to increase to Fully Licensed (FL). For recent years (2015-2020) LIFE (F) O/E scores are predicted to decline relative to historical and naturalised scenarios, and the indicative macroinvertebrate WFD status suggests a risk of deterioration from High to Good status.

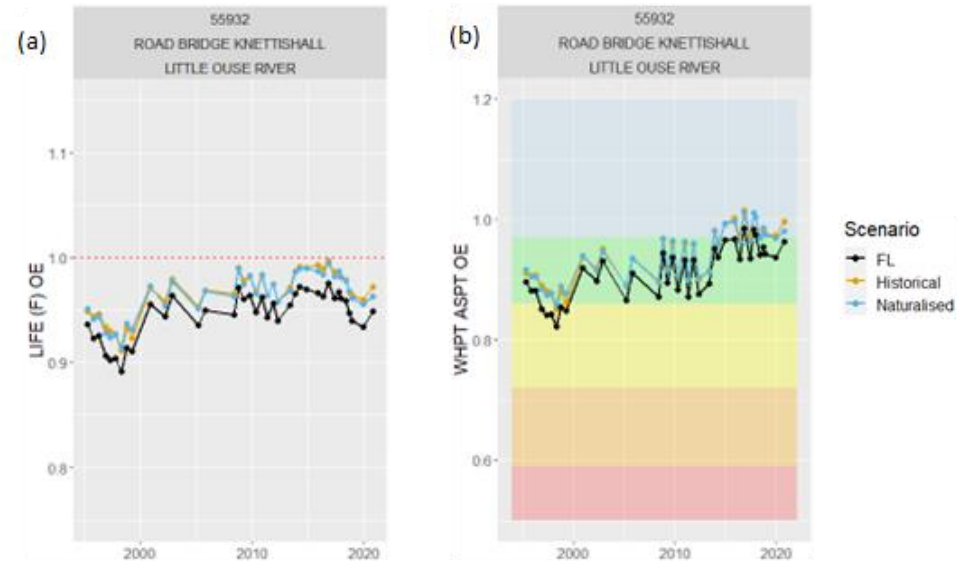


Figure 30 - Predicted LIFE (F) O/E and WHPT-ASPT O/E scores for historical, naturalised, and fully licensed scenarios for Road Bridge Knettishall, Little Ouse River GB105033043100 Little Ouse (DS Hopton Common)