Appendix to Hoveton Project: Creating a sustainable future for the Bure system. Consultation comments on Hoveton Documentation

Environment Agency feedback is listed first followed by Natural England feedback

Environment Agency

[redacted]: no feedback received
[redacted] Thank you for inviting me to comment on the "Hoveton Project; creating a sustainable future" and associated literature. I would like to comment first on the time frame for this feedback and the challenge it presents. Despite participating and presenting imperial data at project meetings I was not aware of this documents existence until receipt of your email 25th Nov. 2019. The documents cover a plethora of subjects, methods, legislation and principles which would require much longer time frames than proposed to take account of the required reading to inform and formulate a comprehensive balanced response. That said, I would like the opportunity to use my technical expertise to feedback some of my thoughts and points of view on the documents provided. I support the objective of the project to establish a stable, balanced clear water floral and faunal community within Hoveton Broad, to that aim I, along with others attending a number of meetings to discuss the proposed project and its implementation. Concerns were raised at many levels and at a number of the meetings regarding possible impacts arising from the project and whether those concerns were valid. The overall impression at the meetings implied that the project would go ahead regardless of concerns raised even when the concerns of adverse impacts were backed up with sound scientific evidence. Mitigation was discussed and forwarded by our Defra partners, but on many occasions was found wanting. I was not aware of this documents existence until receipt of your email 25th Nov. 2019 The documents cite assorted scientific literature that support and enforce previously used methods to achieve stable clear water conditions in enclosed lakes and thus provide the required conditions for diverse, sustainable macrophyte communities to thrive. Each paragraph ends with the point that bio-manipulation (fish removal) is imperative to create suitable conditions for the required plant community to exist. As a relatively new method, literature indicates varying degrees of success using bio manipulation to achieve stable macrophyte dominated clear water states. Literature also highlights the need for low nutrient inputs and presence as a prerequisite to clear water. The document highlights the Environment Agencys' role as the competent and regulatory body for WFD, and explains that the overall water body status for HGB is classified as "poor". While this is true, the individual elements, used to ascertain overall status may not be poor. The status comes about from the "one out, all out" rule whereby a water body status is classified by the lowest classification of biological elements (fish, invertebrates or macrophyte) (P10, fig 5). Each element has an independent classification as defined by the approved models used for classification. The restoration document cites a lake model used for WFD classification in the Netherlands to indicate that the fish community and abundance in HGB would be classified as poor. The use of the Dutch classification tool for this water body is erroneous. The tool does not take account of the fish community, geographic aspects or hydraulic regime currently applicable to HGB. The sought diverse fish assemblage referred to in the document and tool are already present in HGB (and the connected Broads system).

In addition growth rates as provided by scale analysis of the Broadland fish stock show growth rates comparable to national standards. By proxy this means that the current stock levels of fish are not exceeding food supply. By default, based on the growth rates, the current fish population structures are also within bounds of the system to support. This is supported within the document by the acknowledged decline in both bream and roach populations and recruitment referred to (P29, section 4.2).

The document implies that no suitable WFD fish classification tool is applicable or in use for HGB or the Broads and therefore that the overall poor status applies to all elements. This is not the case. Fisheries technical specialists judge the fish element of both HGB and the connected Broads system to fall between good and high. This is backed up by classifications derived from the FCS2 fish classification tool approved for use by all European members of WFD of nearby similar water bodies.

If the fish element is the reason for the poor status of the water body, removal and subsequent exclusion of fish from HGB would likely cause a deterioration in class (poor to bad) as determined using the FCS2 model. This being the case the removal of fish from a water body would cause immediate deterioration in the fish element. The document details how this is not permissible and what action should be taken to prevent such an occurrence (P 29, section 4.3). A higher initial fish classification would make a deterioration more noticeable and likely.

As a fish specialist this email has so far concentrated on the immediate effects fish removal is likely to have on both HGB and the connected system from a legal perspective. A much wider risk is posed to the fish population within the Broads should HGB be closed off from the system.

The innovative intense monitoring of the fish population in HGB and connected system have highlighted the unique and vital importance of HGB and Hudsons bay to the Broadland system. The 2019 spawning surveys show that Bream spawned on 3 separate occasions in Hudson Bay.
Only one other limited spawning event was observed throughout the system during the monitoring 2019 time frame.
Based on expert judgement it is likely that a small congregation of juvenile bream spawned in the Ant system.
Compared to the 3 events that took place in Hudson Bay the Ant spawning event would not provide the required recruitment necessary to maintain the bream population in the wider system.

Much has been made of the fecund nature of bream and the premise that they will spawn anywhere suitable. Again the spawning surveys of 2019, anecdotal evidence and literature do not support this view.

I note a colleague has highlighted the lack of attention to the eel regulations when considering placing the barriers across HGB entrances. Regulations regarding eel protecting are by necessity stringent and strict, not only covering adult escapement but also juvenile access and recruitment. Whichever classification tool is used, eel would be an expected species and classification could suffer from their absence or lack of population growth.

Although mentioned in the main document little attention has been given to the protected species present on the Broad. Otter (Lutra lutra) inhabit HGB and the connected system. The pertinent regulations and their application to protect these mammals has been omitted from the document. The Otter regulations insist that changes to habitat and food sources must not impact otter existence or create conditions likely to influence location choice. It is commonly known that otter prefer prey food in the 100 to 180 mm range in abundant supply, Both roach and bream of this size are abundant in HGB, their removal is likely to influence foraging ability and therefore recruitment of otters not only in HGB but in the wider system too.

Further protected species that utilise HGB for food are cormorant and the much rarer fish dependant predator; Osprey. Again little regard is given to these species despite their importance at the site and in the wider catchment.

Although mentioned many times in the document a glaring omission from the document is the method to be used to carry out biomanipulation. It is likely that electric fishing will be chosen, indeed tenders have been invited for the proposed bio manipulation using this method (Hindes,Pers conv).

Removal of such high number of juvenile and adult fish in a short period of time will incur significant mortalities within the stock
It is liklkey that 10's of thousands of fish will be injured or die during the manipulation process.
Such a high number of fish deaths would be classed as a category 1 incident, as defined in the EA incident response manual and would elicit a suitable response. Further, were such a high number of fish deaths be a consequence of an individual or companys actions, retribution would be sought and restocking take place.

There are many more aspects of this project that give reason for concern, far too many to be covered in such a short time frame allowed for the response to this Magnus opus document.

I would however like to re-iterate that as the Environment Agency we should make decisions based on analysis of scientific evidence. It is a mantra and one we adhere to so that decisions and legal challenges can be robustly defended now and in the future.

Analysis of the imperial scientific evidence relating to this project shows that HGB is vital for the future of The Broads fishery (a fishery that supports a multimillion pound recreational tourist industry) its flora and fauna. Changing it to achieve an objective in isolation from its holistic role could result in significant reputational damage to those who seek and agree to its isolation.

[redacted] No feedback received.

[redacted] :

I fully support the findings and thoughts of all individuals from the fisheries Technical Group, which have been highlighted during discussions and meetings, and also sent as comments based on the reported submitted by NE on 25th November 2019.

Significant points of Question / dispute, or significant omission of fact.

- HGB is referred to as a lake in terms of classification and restoration. HGB is a broad interconnected with the river. HGB is there for more like a large bay attached to a river system, not a lake. Therefore lake restoration techniques are very unlikely to work on a broad as it is part of a river.

- Positive that NE have recognised that impact on the fish is unknown, but no suitable habitat mitigation is in place? How can you measure mitigation if the impact is unknown? Why would you want to degrade any animal population without implementing a sound mitigation plan first? Just the initial process of removing the fish from the broads will kill thousands of individuals, especially venerable 0+ fish using the broad as a nursery.

- The fish community has not changed in line with increased eutrophication over the last 50 years. Historical data clearly represents this.

- The report states that 'the scale and extent of the impact cannot be predicted – it is possible the fish may fail to spawn, or they may move elsewhere in the system with unknown impact on spawning success'. This is far too subjective with no evidence to suggest that the fish population will not be effected. All life stages need to be considered, not just spawning success. 10 years of unsuccessful spawning and recruitment will render the fish population at serious risk of decline.

- The restored broad will apparently result in a greater angling experience. What evidence is there to support this? Angling on the broads is thriving at present, so our anglers do not want a different angling experience in the future.

- The eutrophic state of the broad seems to be blamed on the fish population. This is factually incorrect as greater factors like the number of roosting seagulls on the broad, surrounding land use, and development are more likely to be the cause of nutrient enrichment. Factors that are not going to be addressed by bio-manipulating the broad.

- Sedimentation and turbid conditions are mentioned as a direct result of fish biomass. This is not the case as clearly water fetch, boat traffic on the river, and grazing water fowl are going to have a much greater impact on this then the presence of fish. Clearly represented by fig 1, showing clearest conditions during the winter and spring when fish biomass is at its highest, and very turbid conditions during late summer when biomass is at its lowest.

- One of the notified features of HGB is the population of Otters. If you take out the roach and bream, the Otter population will not be sustainable on HGB. Plus the presence of other fish eating animals like Bitten, Ospreys etc.

- The lack of macrophyte communities within HGB have been blamed on pollution and siltation. Two factors that the fish have very little influence on. Likely to be caused by greater external factors. Removing the fish will not change this.

- I understand the importance of restoring habitats to encourage designated species listed within the document, but this should not achieved to the detriment of other species of animals.

- The report states that the fish biomass must be maintain or where necessary restored to a total projected estimate of less than 200kg/ha. The broad rarely sustains fish biomass greater than 200kg/ha, other than during spawning season, or winter aggregations. In which case the biomass should be considered total biomass for the river system, not just the surface area of the broad, due to the connective nature of the ecosystem.

- The habitat on HGB is currently the best you will find on the northern broads system. Encouraging the characteristic zonation of vegetation is wishful thinking due to other pressures on the (wider) environment like boat traffic, and surrounding land use, which are not going to be addressed by the restoration. Removing the fish will not achieve this on HGB.

- NE are suggesting that fish cannot be present within a weedy environment. This is factually incorrect as many fisheries in the UK that are weedy also contain huge biomasses of fish. The external factors from the wider northern broad's environment are the cause of lack weed growth, not the presence of fish.

- Bream are a native, integral species of the broads that have been abundant for over a century, not a non-native damaging species that they are portrayed to be in the report. Historic evidence shows HGB

abundant with weed during times when huge numbers of bream would have naturally been utilising the habitat.

- Figure 2 is misleading as it suggests the broad is being destroyed by the fish. Strange that Wroxham, Barton, Decoy, and HGB scored low. Does that mean the bream are destroying all these broads in the same way? Surely this demonstrates that greater wider environmental problems are causing this decline in habitat?

- Section 2. Why choose Hoveton Great Broad? NE try and justify choosing HGB. Firstly NE would not have considered HGB if you work had been completed to investigated and identified how important the habitat was to the fish community. Essential work that should have been carried out at the very start of this process. The fact the HGB is the only broad not subject to saline conditions is exactly why it is so critically important for the whole broad's fish community. Shocking to think the fish are going to be forced to live out life stage in totally unsuitable areas of the broads putting them hugely at risk. NE also state that 'all of the sites with a high probability of success have already had restoration management and indeed some recovery. Some recovery does not sound very promising, or statistically strong. Is it really worth putting thriving fish community at risk in the hope that the broad may benefit from some recovery?

- NE also state in section 2 that all other broads that may have been selected for the bio-manipulation have already been bio-manipulated, or restored. The broads NE are referring to have shown little recovery due to the work completed. Some of which (Cookshoot broad) are still disconnected from the wider system, and therefore no access to fish, 20 years later. Even though the bio-manipulation was only planned to be for a 10 year period. Our concern is that if the bio-manipulation of HGB lasts for 10 years the impact will be significant, but if NE then decide to extend it to 20 years due to the lack of desirable results, the magnitude of impact will be even greater.

- Completing the bio-manipulation of HGB will but 100,000's of fish at risk. The stress of attempting to migrate to the closed off habitat will be devastating alone. However the physical removal of fish after the barriers are in place will potential cause very high mortality of fish, especially juveniles, leading to a cat 1 incident where 10,000's of fish will be at risk. The processed involved in removing such a huge biomass of fish, due to the scale, will potentially cause great environmental harm, and damage angling on the broad's beyond repair.

- In section 3.3; principles of bio manipulations, NE refer to the food chain being disrupted by the roach and bream populations as the young fish feed on zooplankton. This is misleading due to the fact that greater external factors are causing the unnaturally intense algae blooms i.e. nutrient load from surrounding land use. How do NE know that the broad will support large enough numbers of zooplankton to reduce the algae blooms? With or without the fish.

- NE have a misconception that the broads only supports healthy populations of bream and roach. This is incorrect as the broads in fact contain large number of pike, rudd and perch etc. If the bream and roach are removed then the pike will likely starve, after which the rudd and perch will dominate the broad. NE are not completing the bio-manipulation to improve the fish assemblage within the broads.

- Figure 15 is misleading. Fig 1 within the report clear shows that turbidity is at its lowest when bream are in the highest numbers, and vice versa. Increased nutrient load and boat traffic is having a greater impact on this. The bream certainly do not have the greatest impact on sediment suspension on the broad.

- The report states that the broad has been dredged successfully making the water body deeper. This is factually incorrect. We have seen maps showing no change in depth.

- NE have approached this project with very little consideration to the fish community on the broads. Essentially NE are proposing to install barriers, which will definitely prevent migratory fish from entering a key spawning, and fry rearing habitat. All work to investigate the impacts on fish has been completed by EA, with all findings disregarded by NE no matter how significant. The installation of the barriers is completely unacceptable and should not be permitted by the EA. The decision made will set a precedent for the future.

[redacted] :

Just a few general comments on the proposed project for Biomanipulating HGB and Hudsons Bay.

I'm concerned that insufficient consideration has been given to the effect on the population of Bream in the Bure, Ant and Thurne System.

The work of the local Fisheries Team and Expert Contractors has clearly demonstrated the seasonal importance of the HGB in the spawning and subsequent recruitment of Bream to the Broads population.

Philopatry (Site Fidelity).

It has been communicated by others ([redacted] and [redacted]) that Bream (Abramis brama (L.)) show marked fidelity to discrete areas of rivers and still waters for a number of reasons including reproduction, feeding and refuge. This sophisticated behaviour has only recently been identified in Bream although it has previously been studied in a wide range of species from various freshwater and marine habitats. These include 3-spined Stickleback Gasterosteus aculateus (Ward et al 2013), Pacific Halibut (Nielsen and Seitz 2017) Atlantic Cod Gadus morhua (Skaeraasen et al 2011) Dace Leuciscus leuciscus (Clough and Ladle 2005) and Barbel Barbus barbus (Baras 1994; Baras et al 1996). Each of these studies demonstrated a high degree of philopatry during spawning season. This needs to be taken into account before a decision is made regarding future work on HGB. Denying the adult bream access to their preferred spawning area comes with a high risk of significant negative effects on recruitment and health of the Bream stocks in the Bure, Ant and Thurne system.

This is a key issue as there's no evidence that the adults will simply select another area if they're unable to make their historic migration into and out of HGB. The available evidence indicates the opposite as no significant spawning was observed or detected in other (apparently) suitable habitats nearby.

Without any evidence to the contrary or a meaningful attempt at mitigation (requiring installation/construction and monitoring prior to isolation of HGB) the precautionary principle must apply. The Agency risks serious reputational issues with our stakeholders if we take any other approach.

Denial of Access.

The proposal to deny the Bream access to the historic spawning areas on HGB appears to have been taken with little or no consideration of the effect on the natural cycle. This is disappointing considering the importance of the species to the Fishery interests on the broads.

Reproduction in the majority of Cyprinids, is primarily driven and triggered by temperature followed to a lesser extent by photoperiod. In Europe, adults are "locked into" this annual cycle with little temporal annual variation. Interruption of this natural reproductive cycle will cause significant stress to the pre-spawning adults as they seek to complete their normal spawning migration.

The effects of stress on oocyte development, yolk deposition and egg viability in Cyprinids has been described in detail by Horvath (1985 and 1986) and Bienarz et al (1976). Both authors discuss and describe the ability of Cyprinids (members of the Common Carp Family) to resorb eggs when subjected to stressors or interruptions in their natural spawning cycle. This process (Gonadal regression or Atresia) has few physiological penalties to the adult female in the short-term (the yolk is re-cycled and incorporated into the next batch of eggs) but there are population-scale medium to long-term penalties due to the lack of recruitment. Gonadal regression has also been described for a number of species including North Atlantic Cod Gadus morhua (Rideout, Burton and Rose 2005), Walleye Pollack Gadus chalcogramma (Privalikhin et

al 2015), Herring Clupea harengus (Ojaveer et al 2015 and Kurita et al 2005) and Tilapia Orechromis mossambicus (Chabi and Ganesh 2012)
Optimum Recruitment Potential.
At Calverton, we've been developing new techniques in Aquaculture for more than 35 years. This includes approximately 30 years experience in the production of Bream. The crucial stages for the successful production of larvae and fry are incubation of the eggs and first-feeding of the resulting larvae.
Experience has shown that incubation of the eggs at a stable warm temperature 16oC+ provides optimum conditions for successful hatching, yolk sac absorption, swim bladder inflation and subsequent exogenous feeding. Temperature stability is a key factor.
It has been identified using temperature data that the conditions that occur in HGB are perfect for the development and hatching of Bream eggs.
The shallow and sheltered nature of HGB, presence of suitable spawning substrate and the stable temperature conditions are all conducive to successful recruitment.
Unusually, Bream larvae are the only species produced at Calverton that require "green water" as a first feed. Experience has shown that starting the larvae on a soup of Unicellular Algae, motile protozoans and small (<100 micron) rotifera gives them the best chance of growth and survival. These conditions are found (in abundance) on HGB at the time of egg hatching and "first-feeding".

[redacted]:
Please find below 2 comments.

Comment 1
- section 3.2 (p.15), paragraph 2 which is on the subject of Diffuse Water Pollution plans.

In consultation with an area colleague who works on the Diffuse Water Pollution plans with Natural England they have commented that the plans are not at a stage to say exactly what is needed yet, there are still queries and a draft version of option appraisals is currently with the national Natural England team to discuss options around this.

In light of this they have suggested the following edits (in red) to the Diffuse water pollution plans paragraph:

The Diffuse Water Pollution Plan review (DWPP – still in draft and unpublished) is modelling P in the broads and in the river. The current sources of P in the river Bure are shown in figure 10.

This shows that the major contributors are Sewage Treatment Works (STWs), agriculture, and urban run-off. In order to achieve the target of 0.03mg/l in the Bure the DWPP has modelled that 12 STWs will need further P stripping up to the technical achievable limit, and 100% uptake of P reduction methods across agriculture, in addition to diffuse pollution reductions from urban areas.

Anglian Water have investigations in 2020-2021 to identify the best ways of meeting their fair share reduction, with the aim of having schemes for improvement in AMP8 (2025-2030). The Catchment Sensitive Farming review 2006 -2018 shows that since 2006 34% of the farmed area in England is managed by CSF engaged farmers with an uptake of 59.6% uptake of advised measures. This has seen a modelled decrease of 2.4% for total P in rivers from farm sources within target areas up to January 2018 (EA 2019). It is evident from this data that a 100% of uptake for all agriculture methods on all agricultural land within the Bure catchment is not going to be achieved within the short to medium term. Therefore, to meet ~~the statutory timeframes for achieving GES~~ (there aren't statutory timeframes for the DWPP work) ~~and~~ favourable conditions measures including additional farm and urban diffuse pollution advisors,

encouraging farmer cluster groups, use of wetlands or other land use changes, and biomanipulation are all being considered and assessed.

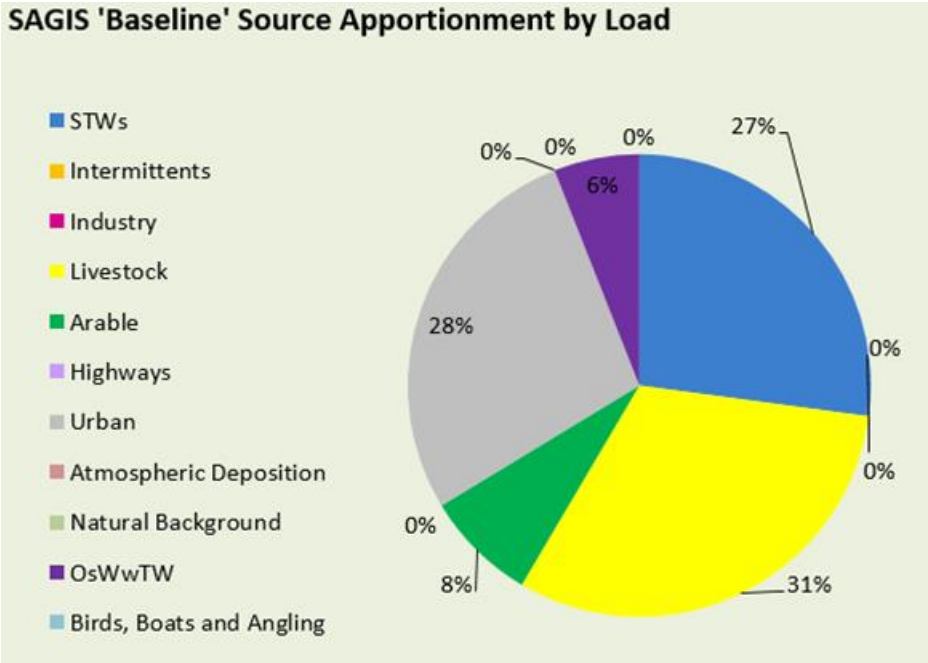

Figure 10. Source appointment of phosphorus within the river Bure catchment.

Comment 2

-section 3.6 (p.22) paragraph 2. The total phosphorus concentration quoted in this sentence has been mistyped (highlighted in yellow):

The annual average total phosphorus in the River Bure at Wroxham is 0.60 ug/l.

The total phosphorus concentration should either be quoted as 60ug/l or 0.06 mg/l

[redacted] : (see separate email attached for full comments)

A(n almost) perfectly timed reminder why putting in barriers to fish migration in Hoveton Great Broad would be pushing against the tide of international river management practice to open up access for fish to their spawning grounds.

From: "[redacted]>

Date: 4 December 2019 at 08:21:30 GMT

To: [redacted]

Subject: FW: First Fish Migration Award for WFMD2020

Hi all,

A long-time away but it will soon be on us – World Fish Migration Day is 16th May and it would be great if we could do something to mark the occasion - perhaps an outreach event or a fish-focused outcome day.

Cheers,

[redacted]

[redacted]:

DRAFT as at 14:23 3 December 2019

Hoveton Project: creating a sustainable solution for the Bure system
3 December 2019
These comments relate to the above document as forwarded via email on 25 November 2019 at 12:39. In principle I also support the submitted comments of my fisheries colleagues on the HGB Technical Group.

Whilst the opportunity for reviewing this document is welcomed, the timescale available is not sufficient to properly scrutinise the information provided. Given the importance of the potential risks and impacts we have previously highlighted throughout the life of the project and our regulatory role as competent authority for fisheries and WFD this is a significant concern. Moreover, it must be noted that despite raising significant concerns, particularly over the last 12 months1 2 3, the project has not presented any further information (including most of the contents of the above report), amended proposals or offered significant engagement with EA Fisheries specialists in the HGB Technical Group that would have enabled us to review our position.

1 HGB Fish barriers permitting meeting notes Nov 2018 - SL Objections Dec 2018 to AW
2 HGB fish barriers permitting meeting notes Nov 2018 - JL&GP objections to AW Dec 2018
3 Hoveton Great Broad Restoration final Fisheries position June 2019

Despite the limited time available to review the document, it is clear that there remain a number of significant gaps in the evidence used to support the proposed biomanipulation methodology, whereas we have strong evidence to support taking a precautionary approach in light of fisheries concerns. Assumptions, selective use of material and significant omissions within the document are also noted. It is also challenging to disaggregate content written for and behalf of the project from information put forward by the EA and fisheries in particular. The points below are intended to highlight some key risks/issues moving forward and is not intended as an exhaustive review given the limited time available.

Summary of some key issues with the document and risks:
A) WFD No Deterioration Risk and Hydromorphological harm – Our assessment of the evidence base has highlighted that the Project presents a risk of WFD No Deterioration within HGB and other connected WFD waterbodies. We cannot undertake or authorise any activity that may cause a deterioration of the status of a waterbody.
B) Uncertainty of biomanipulation success – There are arguably no biomanipulation projects in the Broads that have demonstrably delivered sustainable ecological improvement (i.e. without further interventions or with restored connectivity) and there appear to be significant uncertainties with the chances of success in the case of HGB
C) Conflicts with our Fisheries duties – The evidence base confers significant challenges to our duties to maintain, improve and develop fisheries under e.g. SAFFA 1975, Environment Act 1995 and government guidance with respect to socio-economic growth
D) Challenges to our reputation – The Environment Agency makes sound, evidence based decisions to protect and improve the environment. There is considerable potential for challenges associated with HGB and significant risks that some potential outcomes conflict with established Agency positions e.g. WFD and Hydropower permits, Close Season Review (2019)
DRAFT as at 14:23 3 December 2019

E) Conflict with established practice to for removal of weirs and barriers to fish migration – The installation of barriers to fish migration and preventing fish passage to primary spawning and recruitment habitat conflicts with established International practice. The Environment Agency and partners are spending millions of pounds to remove barriers and open up spawning sites. E.g. EA Powick Sluice, R. Trent, Nottingham (£5 million EA fish passage project); Unlocking the Severn Project

A) WFD No Deterioration Risk and Hydromorpholigical harm

1. In considering WFD I refer to EA Position 1340_16 "Supporting implementation of river basin management plans, EA WFD and hydropower guidance and previous correspondence with National Fisheries colleagues on this matter as it pertains to assessing the impacts of the HGB project on fish, WFD compliance and Agency policy and process in respect of permits and authorisations4.

4 e.g. Hoveton Great Broad – WFD no deterioration legal questions. Robertson, R. EA National Fisheries Services

5 References available from Lane, S. Environment Agency on request

2. Environment Agency (1340_16) states: "The Environment Agency must not undertake or authorise (that is, issue a permit or licence for) any activity that: -

a. may cause a deterioration of the status of a waterbody or

b. will jeopardise the attainment of good status unless the Article 4.7 defence applies"

3. In light of the available evidence it remains our technical judgement that the proposed biomanipulation of Hoveton Great Broad and Hudsons Bay (herein after referred to as HGB) carries significant risks of WFD Fish Deterioration within the HGB waterbody and multiple other WFD waterbodies (both lake and river) within the Bure WFD Operational catchment.

4. HGB is an inter-connected (i.e. in respect of the unhindered free movement and migration of aquatic organisms including fish between HGB and other habitats with the Northern Broads system) part of an open lowland tidal river system, not a closed, isolated lake habitat. The assessment of fish populations and potential impacts from biomanipulation on them must therefore be on the basis of the fish assemblage found within the open system, reflecting established principles and guidance e.g. by WFD UKTAG (Dec 2013). The current fish assemblage of the Broads is reflected in EA/NRA fish monitoring data and the historic literature and compares with similar data from other lowland river systems e.g. the fens. Baseline for WFD is assessed on the current fish assemblage, not historic or aspirational targets and advice from National Fisheries colleagues confirms our primary evidence base is significant.

5. There is significant evidence in the historic literature5 that the Broads supported abundant populations of roach, bream and other fish species including pike, perch, tench, rudd and eel. Bream are also noted in the rivers and Broads by Browne (1658). Bream and roach were extensively netted, even during spawning time in the C19th, with fish sold on for food, manure and unwanted fish were simply left to rot on the banks e.g. Everitt (1902). The established angling custom and practice of the time was to remove all fish caught, leading to the establishment of the Norfolk and Suffolk Broads Act in 1877 in an effort to protect fish stocks and fisheries from exploitation.

6. Primary baseline and comparative survey evidence gathered by the project indicates that HGB is the dominant Broad for fish within the Bure Broads group and shows significant diel and seasonal migrations of fish between HGB and the wider system for feeding and breeding (e.g. the 'fish motorway', ARIS multibeam fixed station monitoring, HGB, November 2014) 6. This confirms our position that HGB must be assessed as a key part of the open system (Bure catchment), rather than a fully enclosed lake. In this respect we must also consider the possible impacts of the project on other WFD waterbodies within the Northern Broads catchment area.

6 e.g. Investigating the fish stocks of Hoveton Great Broad A multimethod approach to a complex system, Presentation to IFM Conference, Lane and Hindes, 2016
7 e.g. Year 1 Annual Report for PhD Steering Group Nov 2018. Winter, E. Bournemouth University
8 Bream Spawning Habitat Assessment v1.3. 2018. Fishtrack Ltd for Natural England
9 Baseline fish surveys and comparative fish survey reports for Natural England. Fishtrack Ltd.
10 Interim summary of findings from bream spawning assessment, Northern Broads system – Rivers Bure , Ant and Thurne and associated Broads April/May 2019
11 Observations, video and ARIS multibeam PAS sampling of a major bream spawning event on HGB. Lane, S. May 2015
12 Northern Broads Fish tracking Project/PhD fish tracking data 2017-2019. Environment Agency, Bournemouth University, Fishtrack Ltd, Natural England

7. Page 9 – The stated aims for biomass of total fish production within HGB appear to be generic and based on a closed system, where a high fish biomass is assumed to be bad for the purposes of lake restoration. This is not deliverable in an open system, where fish freely move between habitats, especially given established patterns of diel, seasonal and spawning migrations of fish between HGB and the wider system within the primary evidence. Further, such a crude approach (assuming presence infers impact) does not account for fish behaviour whilst present in HGB (for example, multibeam ARIS sonar transects show bream are typically loafing ('asleep') in HGB during the day in the autumn, before moving out into the wider system to feed at night. Whilst densities in HGB are high during the day, these data suggest that high densities of bream cannot be assumed to have an impact on the Broad. Likewise, repeated surveys during darkness just hours later demonstrate that there were few bream present in the Broad (Lane, S. & Reeds, J. Pers Obs, in prep).

8. Further, our primary evidence, including recent data from fish tracking studies7, strongly shows HGB is the principle broad for fish within the Bure Broads group and is potentially uniquely important habitat for spawning and recruitment for bream within the catchment 8 9 10 11 12. The evidence that bream form large spawning aggregations and spawn in specific, extremely localised habitats in the Broads ties in to evidence on other cyprinid species cited in the recent Environment Aency Close Season review13 14 15. The importance of HGB as a key habitat for spawning and recruitment is also backed up by observations within the literature16 17.

13 Close_season_rationale, Environment Agency 2015
14 Coarse_fishing_close_season_outcome_briefing, Environment Agency 2019
15 Response to HGB Document. Alan Henshaw EA National Fisheries 2 December 2019
16 'On the other hand, large numbers of [bream and roach] regularly congregate in off river sites such as Hoveton Great Broad at spawning time, and such waters probably form an important breeding refuge for these, and perhaps other species'. George, M. 1992. The land use, ecology and conservation of Broadland
17 'Hoveton Great Broad – In one of the backwaters off this Broad I saw the biggest shoal of bream of my life. It was at spawning time and the fish had congregated in a small area. The fish, up to 4lb, were so numerous that they appeared to be jammed solidly together and created the impression that it might have been possible to walk to the shore across their backs'. Colliins, P. 1967. Fishing the Norfolk Broads
18 Interim summary of findings from bream spawning assessment, Northern Broads system – Rivers Bure , Ant and Thurne and associated Broads April/May 2019
19 Response to HGB Document. Alan Henshaw EA National Fisheries 2 December 2019

9. The primary evidence shows that bream spawn preferentially in HGB, despite there being apparently suitable physical habitats elsewhere in the system e.g. as assessed during the April/May 2019 bream spawning survey. No significant aggregations of adult bream were observed outside of HGB, despite side-imaging sonar and mobile acoustic tracking coverage of multiple Broads on the same day during the survey period. The tracking evidence confirms multiple spawning migrations from the furthest extent of the

catchment e.g. away from the Upper Thurne, which comprises open, extensive macrophyte-dominated habitats – (e.g. Page 7: Broads Authority macrophyte monitoring data show some of the highest plant species richness and abundance scores from open Broads that have not been biomanipulated e.g. Martham North and South Broads, Heigham Sounds and Hickling Broad).

10. Our tracking evidence shows that some fish have undertaken this same migration multiple times in the same month and in successive years.

11. The document infers that bream will spawn elsewhere when barriers to fish migration are installed in HGB, yet provides no primary evidence to support this. The use of nets to provide spawning substrate within Ormesby (an artificially closed lake) cited on page 27 in this respect is erroneous – these nets were deliberately placed along the phragmites edge where bream were known to spawn and it is my understanding were no controls in random locations elsewhere in the lake. Despite our advice and guidance to the project to develop, trial and gather supporting evidence for the provision of mitigation elsewhere in the system, no significant or viable proposals have been provided to date to offset the loss of HGB.

12. Page 27 – The document suggests the presence of tagged fish in Broads other than HGB during the spawning season could indicate that they spawn elsewhere. This cannot be inferred in the absence of any confirmed evidence spawning actually took place at a specific location. Primary evidence18 within the Northern Broads catchment shows no significant spawning took place in 2019 on similar physical habitats to those found within HGB (e.g. willow roots, sedge roots, lilly fronds). This infers that other factors are critical in determining spawning and recruitment site selection by fish (e.g. thermal advantages) that are poorly understood. Whilst there are few studies on bream, other fish species are known to show spawning site fidelity, as described in the response to this document by Alan Henshaw (2 December 201919). DRAFT as at 14:23 3 December 2019

For example, work by the Environment Agency (Reeds, J. and Gardner, C) in lowland rivers of Lincolnshire shows clear evidence of spawning site fidelity in bream, even where apparently more suitable habitats are available elsewhere with the catchment and the primary site habitat quality is thought to be deteriorating20. Thus the provision of additional physical spawning habitat elsewhere in the system is unlikely to provide adequate mitigation for the loss of HGB. In any case mitigation measures cannot be considered adequate if their efficacy has yet to be demonstrated and they are proposed to be delivered at an indeterminate time, extent and quality after barriers to fish migration have been installed in HGB. It must also be noted that monitoring in and of itself does not constitute mitigation.

20 Lincolnshire bream study, Reeds, J. Environment Agency A&R Fisheries Technical Specialist Pers. comm 2019
21 Response to HGB Document_Alan Henshaw EA National Fisheries 2 December 2019
22 Close_season_rationale, Environment Agency
23 Coarse_fishing_close_season_outcome_briefing
24 e.g. FIP 2017_18 Broads Fish Migration V5 Project Description FINAL AREA SUBMISSION
25 EA/NRA records of saline incursion incidents, inc. evidence of fish kills in Horning on the River Bure, February 1993, South Walsham Broad etc.
26 Correspondence between A.J. Rudd (Sec.) and E. J. Trafford. Jan 1910. Yare and Bure Preservation Society. Norfolk County Archive
27 'Sufficient to say it fulfils an important function while remaining closed [to the public], for it is sanctuary where fish can live and breed. While areas like this remain in Broadland the fish stocks of the whole area are secure. The huge shoals of bream as well as tench, perch and roach, can filter out into the Bure via a number of dykes'. Collins, P. (1967) Fishing the Norfolk Broads
28 e.g. FIP 2017_18 Broads Fish Migration V5 Project Description FINAL AREA SUBMISSION

13. Further, disturbance of spawning fish is known to carry significant risks (e.g. stress, reabsorption of eggs and failure of spawning and recruitment)21. Such factors form an important component of the Environment Agency's recent decision (2019) to retain the coarse fish close season22 23. Displacing fish from known spawning sites at a waterbody scale therefore carries significant risk to spawning and recruitment, which the project appears to be unable to quantify or mitigate.

14. We can also evidence that HGB is likely to be important for resilience of fish populations at a catchment scale, given the established existing environmental factors on fisheries e.g. variable spawning success. Environmental incidents caused by existing environmental threats and pressures in the Broads are already known to cause significant fish kills e.g. saline incursions and prymnesium that already impact a large part of the catchment at multiple waterbody scale (Lane, S. pers. obs. 1992-2019)24 25. These existing and sometimes unknown risks are acknowledged by the document (e.g. page 29; page 31) and the importance of HGB in respect of resilience for fish populations is also cited within historic record26 27. However the document does not acknowledge the potential in-combination impact of these existing environmental risks to fish and the medium-long term loss of HGB as the primary fish habitat within the northern broads catchment28

15. Where a WFD Fish Deterioration Risk is identified, we require a technical solution to alleviate that risk. For fish migration concerns, for example in the case of hydropower applications, usually this means installing fish pass, if there is enough space and flow to do so. If not, then we would reject the application because the risk could not be mitigated. In the case of habitat losses, the requirement for mitigation to offset WFD Deterioration Risk is well established. In the case of hydropower applications, habitat loss can occur through e.g. depleted reach impacts or scouring of weir pools that may destroy unique gravel spawning beds. Identified impacts must be at the waterbody level and not at a local impact level.

16. Where a plan or project is likely to lead to environmental impacts, it is standard practice to ensure that adequate evidence-based mitigation is in place prior to works taking place, in this case the installation of barriers to fish passage between HGB and the wider Northern Broads catchment. Despite our advice and guidance throughout the life of the project (and contrary to the assertion on page 33 of the document that NE and EA have agreed a fishery improvement programme), no viable mitigation proposals have been presented by the project to date. Our position was made clear in December 2018 and again in June 2019 when the HGB Fisheries technical group met to review all the evidence following our completion of the agreed Spring Bream spawning survey.

17. In light of this evidence base we consider the risk of WFD Fish Deterioration affects both HGB as a WFD waterbody and multiple other WFD waterbodies within the Bure WFD Operational catchment.

18. I am seeking further clarification from colleagues in respect of the WFD Hydromorphological Quality, as the primary evidence base also suggests a case to infer the potential for hydromorph harm at a waterbody level should barriers to fish migration be installed in HGB (e.g. preventing the migration of aquatic organisms between laterally connected habitats for feeding and breeding).

19. It is noted by National Fisheries colleagues that the available evidence for the HGB project is far more information than is usually available to make decisions, e.g. in the case of permitting hydropower applications (Robertson, R. National Fisheries, EA 2019).

20. All WFD lakes and approximately half of all River WFD water bodies do not have any WFD fish monitoring and thus no formal set Fish Objectives in the River Basin Management Plan (RBMP). However, this does not make such sites exempt from WFD Fish No Deterioration or Set Fish Objectives risk assessments prior to us making permitting decisions.

21. In such scenarios, e.g. for hydropower applications, the Agency relies on expert judgement from Area Fisheries specialists and any other available monitoring information to inform our decision making. We rely on the expert judgement of local area fisheries officers to determine if there is 1) a Fish Status No Deterioration risk or 2) any risks to achieving set WFDS objectives for Fish Status e.g. good status by 2027.

22. It is not uncommon in other parts of the business e.g. Water Quality or Water Resources to refuse permit applications on the grounds of a WFD elemental deterioration risk, if WFD exemption clauses (Article 4.6 or 4.7) are not applicable and where a technical solution to mitigate the risk of WFD elemental deterioration is not feasible. In such cases it is standard practice to refuse the application.

23. It is my understanding that EA lawyers have confirmed the following in principle:

'It is standard practice for the Environment Agency to refuse any EA authorisation or permit application, if we have identified a WFD No Deterioration elemental risk and where a technical solution cannot be found to mitigate that risk and where the WFD No Deterioration exemption rules (Article 4.6 or 4.7) are not applicable'.

24. It is my understanding that WFD objectives are timebound (2015, 2027), whereas Habitats Directive objectives, such as restoring the site to Favourable Condition, are not. It is noted that water quality and rooted macrophytes have generally improved in the tidal Bure system over the last two decades – (Peirson, G. pers. comm.; Lane, S. pers. obs). Not undertaking the proposed biomanipulation methodology will not cause the HGB to deteriorate and will not prevent the consideration, or development, of alternative methodologies for aiding restoration now or in the future. The delivery of HD objectives is therefore not constrained in this instance as inferred in the document.

B) Uncertainty of biomanipulation success

25. There are arguably no biomanipulation projects in the Broads that have demonstrably delivered sustainable ecological improvement (i.e. without further interventions or following restored connectivity following isolation) and there remain uncertainties with the chances of success in the case of HGB.

26. Page 8 – Reasons for Not Achieving Good Status (RNAG) for most Broads waterbodies are driven by P failures, not fish, confirming the underlying reason why these Broads have poor water clarity and hence poor macrophyte assemblages is cultural eutrophication caused by excessive nutrient loads29. No consideration appears to be given to the nutrient impact of the significant gull roost on HGB, or the potential via wildfowl, particularly given that it was highlighted by anglers during the original consultation process and observed by fisheries staff undertaking baseline fish surveys.

29 Reasons for Not Achieving Good Status (RNAG) in the waterbodies that are likely to be impacted by the Hoveton Great Broad biomanipulation (fish removal) project. Robertson, R. EA National fisheries Services

27. Page 11 – The document infers that 'all the sites with a high probability of success have already had restoration management and indeed some recovery'. However, the connectivity of sites such as Ormesby and Cockshoot has not yet been restored and in many cases ongoing management interventions are still required. There does not appear to be an example of a successful, sustainable biomanipulation project within the Broads area.

28. Page 17 – Natural England are 'hopeful' that 10 years 'should' provide sufficient time for the clear water and plant dominated state to be recreated. The document notes that it has taken 15-20 years in the 'successful' biomanipulated Cockshoot and Ormesby Broads, inferring a sustainable, stable clear water

state has been delivered. However, neither of these Broads can yet be considered successful – Cockshoot is still isolated from the wider Bure system, as is Ormesby from the wider Trinity Broads group and fish interventions are still being undertaken on Ormesby some 20+ years later. Clear water and macrophytes have not been sustained on other biomanipulated Broads following the removal of barriers e.g. Pound End.

29. It is surprising that the Project now proposes to extend the lifespan of the barriers for an additional 10 years, which confirms significant uncertainty around the chances of sustainable restoration success. This is akin to a permanent isolation of a key part of an open system and confirms that there is significant uncertainty about the chances of success of the proposed biomanipulation methodology within the previously stated 10 year period, which given the potential risks and impacts on fish is unacceptable. The Project has not consulted key stakeholders such as the angling community on this basis30.

30 5_HGBRP BASG ESG meeting outcomes. Fishtrack Ltd, for Natural England
30. Given the stated importance of propagule availability within the seed bank for the re-establishment of macrophytes (refer also to page 16), there does not appear to be any evidence of monitoring results during and after the extensive dredging operations on HGB that shows that the seedbank still remains in situ.

31. It is worth noting that the risk of increasing saline incursion (e.g. over the proposed 10 - 20 year life of HGB isolation) also poses a major threat to the resilience of Broads fish populations, particularly when they are displaced from key habitat within the system and are already at risk from catatastrophic and chronic impacts elsewhere in the system.

32. No mention of impacts of dredging in reducing P, or other possible methods to reduce P input from the wider Bure catchment. There is no discussion of other potential ways to reduce nutrient release/cycling in the Broad, for example reducing sediment disturbance caused by wind fetch.

33. Page 16 – The assertion that bream foraging behaviour is significantly detrimental to macrophyte growth does not appear to be supported by the evidence, either the historic record relating to the observed Broads fish community pre-eutrphication 50-100 years ago, or e.g. baseline ARIS multibeam sonar transect evidence showing extremely delicate, precise benthic feeding action of bream foraging in the open water of HGB at night. Other causes of sediment disturbance, nutrient release (e.g. wind fetch, grazing waterfowl), nutrient input (significant gull roost; waterfowl) are not discussed.

34. Page 19 – The inference that bream and roach are not compatible with complex, macrophyte-dominated broads is not supported by the evidence (e.g. historic literature examples citing abundant bream and roach populations C19th through C20th c.f. aerial photo confirmation that HGB was in Phase 2 clear water & plants condition in 1949 e.g. George (1992) – available from Lane, S. Fisheries TS, Environment Agency). Significant declines in the eel population have been noted internationally and cannot be attributed directly to shifts in the fish population due to eutrophication effects. Sampling method efficacy (e.g. electric fishing is poor at catching large mobile fish such as bream in open water – ARIS assessment of PASE, Lane, Hindes and Reeds, in prep.), water clarity, timing (significant differences observed during the day c.f. sampling at night in open water), season and isolation of Broads can all affect the observed fish assemblage (for example bream cannot recolonize isolated, formerly connected Broads in the event of a fish kill e.g. Alderfen (Peirson, pers. comm.).

c) Conflicts with our Fisheries duties
35. The document cites a perceived conflict between the achievement of the Conservation and WFD Objectives for HGB and the interests of the wider Broadland fishery for angling, suggesting that fish are a secondary consideration. However, fish are a key part of the ecology of aquatic habitats and are, as a

consequence, one of the constituent biological elements for which risks, impacts and mitigation measures must be considered within WFD (dealt with above).

36. In addition, fish provide one of Broadland's most significant and obvious ecosystem services through angling31, for which abundant, healthy and resilient fish stocks and the environment that supports them are essential.

31 The value of angling in ENS. Lane, S. Environment Agency 2015.
37. It follows that in addition to WFD and Habs Regs, the potential impacts and risks of the proposed biomanipulation methodology on fish must also be considered by the competent authority in accordance with the Agency's statutory duties under e.g. SAFFA 1975, the Environment Act 1995 and Statutory guidance e.g. to increase the socio-economic benefit of fisheries in rural areas and areas with low income etc

38. Potential impacts to fish have already been discussed as part of my comments on WFD above.

D) Challenges to our reputation (e.g. hydrowpower, Statutory Close Season)
39. Further risks for the fisheries function have previously been highlighted e.g. from perceived setting of precedents in respect of fisheries permitting decisions e.g. HGB vs. EA permitting guidance, policies and process and application to permitting decisions resulting in refusal e.g. hydropower.

40. Risks of disturbance to spawning fish were evaluated as part of the recent Environment Agency consultation and review into the Close Season on English rivers32 33. The legal basis for the statutory close seasons is to protect fisheries from the impacts of angling during the breeding season. Coarse fish close seasons byelaws prohibit angling on rivers and the Broads bwetween 15 March to 15 June, with the aim of protecting spawning fish. Most river fisheries are in multiple ownership, with fish free to move between stretches owned by different people. Fisheries management actions taken by one owner will have an impact on the neighbouring waters; this is of particular importance with regard to spawning sites on rivers, which are often very localised. The risks to fish highlighted by the HGB project tie in with these principles.

32 Close_season_rationale, Environment Agency 2015
33 Coarse_fishing_close_season_outcome_briefing. Environment Agency 2019
34 Response to HGB Document. Alan Henshaw EA National Fisheries 2 December 2019

41. In response to the 2000 Salmon & Freshwater Fisheries review, Government supported our view that any changes to the statutory Close Season should be based on sound science. The Agency's position was that in the absence of scientific evidence, we must take a precautionary approach towards rivers, retaining the current close season.

42. In August 2019, the Environment Agency concluded a consultation and review into the close season on rivers and the Broads. The review concluded that the close season should be retained on English rivers and the Broads.

43. Experience from The Environment Agency's own coarse fish broodstock collection and coarse fish rearing over 20 years supports the experience of others that some species, notably chub and barbel, form large spawning aggregations and that these can be very sensitive to disturbance while spawning. Where disturbed, spawning females may reabsorb their eggs and defer spawning to the following season rather than spawning elsewhere or later34. Access to suitable spawning habitats is limited in many of our morphologically altered rivers.

44. The evidence base from our monitoring and tracking in the Broads demonstrates that bream also form large spawning aggregations and migrate
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to specific habitats for spawning and recruitment (principally HGB). This ties directly in to the evidence cited by the business to retain the close season.

45. A decision to continue with the proposed biomanipulation would directly contradict the decision taken in respect of the Close Season, opening up potential significant reputational challenges for the business and our legal position e.g. we would continue to prosecute anglers for disturbing fish in the close season on the rivers and Broads, but we would concurrently and knowingly be causing significant disturbance to spawning fish and preventing fish spawning by preventing them reaching their spawning grounds.

[redacted] :
Below is my response to this document submitted by Natural England to the Environment Agency.

Firstly, I wish to express my disappointment and frustration for the very limited response time offered. All involved in progressing both the project and our understanding of the wider aquatic system covered by the project have tried to work in an open and collaborative manner. This report has obviously been in production for a significant time and at no stage was this raise with any of the discussion platforms previously consulted.

My overall impression of the document is the selective, at times biased, approach when presenting supporting information for the project. At times, an oversimplification of complex ecological processes is a concern.

In the time available to me, the following points raise some of the issues that arise from the report:

1. HGB is part of a wider open aquatic system. It should not be considered in isolation and therefore applying biomanipulation methods most suited for closed lake systems is an oversimplification. Indeed, the reports leans towards the possibility of failure by indicating that the closure period may need to be extended beyond the planned ten years. In my view twenty years is unacceptable and would represent a permanent closure.
2. The fish population is not a HGB fish population. It has been demonstrated with the recent tracking research, for example, that fish populations are dynamic in their movements across the whole Bure and Northern Broads system. The use of biomass figures for bream in the report should not be applied to HGB alone but across the whole system.
3. Biomanipulation risks a deterioration in WFD status for fish in both HGB and other linked WFD waterbodies. Under the current WFD approach of ‘one out, all out’ this may result in a widespread WFD deterioration caused by the licencing of an activity to which we had knowledge of the potential consequences.
4. The EA has a general policy of barrier removal or mitigation to assist fish to complete all stages of their life cycle. The erection of a barrier in this project contravenes this general approach.
5. The report shows that under current land use and water treatment conditions the wider catchment phosphate levels will remain higher than the manipulated HGB. A catchment wide approach should aim to focus attention on the cause and not the symptoms of the perceived decline in trophic status.
6. Increasingly, our understanding of cyprinid reproduction is more complicated and selective than the report indicates. Simply moving to sub-optimal or ‘other’ habitat does not fully address the

requirements for both reproduction, and crucially, survival. The latter has been largely overlooked and is equally important in considering recruitment. Indeed, the report states that if bream are unable to find suitable alternative spawning habitat away from HGB this will impact the wider Broads fishery.

7. The Dutch classification system cited fails to mention the caveats for UK waters as described by G. Peirson.
8. The report states that "biomanipulation will virtually assure clear water conditions". This cannot be substantiated, indeed there is a likely risk that this will not be achieved within the scope of the project.

In conclusion, significant issues remain unanswered within both the report and the wider project. The absence of crucial scientific-based evidence to support proposed risk mitigation measures remain absent.

There is a strong likelihood that a decision to proceed will face legal challenge. Furthermore, there is a clear reputational risk for the EA. The latter will result in additional challenges for the organisation in delivering sustainable fisheries management, in particular at a local level.

Finally, any decision will need to address a question that goes to the heart of the issue. With the information available and balancing the risks/benefits, would we (EA) licence this project from another 3rd party? In my view the answer is clearly, no.

[redacted]

These comments relate specifically to the PDF document entitled as above, which I understand has been compiled solely by Natural England.

I have made a large number of comments on the text of the document using "stickies". The observations made are repeated in many of these comments but I felt that it was necessary to re-iterate these as they are relevant in different ways to many of the points made by the authors of that document.

However there are some fundamental issues that emerge from the document which I believe are the root of some of the conflicts of interest that we have in the planning and execution of the HGB restoration project.

1. **Hoveton Great Broad is part of an much wider interconnected system and should be managed as such**
   Current legislation (WFD and HD) sees the Hoveton Great Broad complex as one waterbody with specific ecological targets. In reality it is an important part of a much wider ecosystem namely the Bure and Northern Broads complex which may have differing ecological targets from HGB in isolation. Hence activities on HGB have the potential to have impacts, both positive and negative, far beyond the water body itself. This is the <u>key issue</u> underlying most of the differences of opinion between ourselves and Natural England.

2. **What are appropriate and achievable ecological targets for HGB and the Bure system as a whole?** We have limited data and information on current and historical fish abundance and community structure in this wider Broads system, especially in recent times. Likewise we have no appropriate fish ecological status assessment tool for this system – it isn't a typical European lowland river system nor is it a lake.
   The Bure/Northern Broads system does have many of the characteristics of a more natural lowland river system with significant areas of connected wetland and the broads themselves and connecting dykes which are akin to floodplain lakes and side-channels, conversely the lower reaches are heavily modified with embanked, re-sectioned, in some cases straightened, channels,

no lateral connectivity, and limited marginal or instream habitat diversity. Levels of nutrients, especially phosphate, are elevated, and the lower reaches are affected by saline incursion and by suspended sediment that is transported inland by rising tides. Hence it is very difficult to ascertain and agree what would be reference condition or high ecological status or high ecological potential for the system, and further to that, what is an appropriate or achievable target condition for the Bure Northern Broads system as a whole, given the constraints imposed by a growing human population, navigation, land drainage for agriculture and flood risk management in the face of rising sea levels due to climate change.

3. **Good ecological status in the Bure and its associated broads is not incompatible with abundant stocks of fish including roach and bream.**
   A combination of clear water conditions, abundant macrophytes and abundant stocks of roach and bream are recorded as evident during various periods in recent history. Contrary to expectations, recent improvements in water chemistry and water/ environmental quality in the broads system appear to have resulted in an increase in fish abundance and of bream in particular.

4. **Is biomanipulation a sustainable activity?**
   When biomanipulation was first publicised as a lake management technique, it was "sold" as a one-off operation that, if carried out thoroughly and under the right nutrient conditions, enable the "reverse switch" to clearwater conditions, providing re-colonisation by fish prior to restablishment of macrophytes was not permitted. However recent experience is suggesting that in order to maintain clearwater conditions, biomanipulation might have to be a regular activity. This brings into question its sustainability and could be viewed as striving to maintain an artificial lake ecosystem that isn't commensurate with the natural underlying conditions. This is of particular concern since NE have raised the possibility that they may propose isolating HGB from the main river even beyond the original ten years.

5. **Hoveton Great Broad and Hudson's bay are almost unique and of prime importance for fish recruitment in the Bure system.** Natural England maintain the stance that even if HGB is isolated from the main river for a number of years, there is adequate alternative habitat in the Bure / Northern Broads system to fulfil the needs of all life-stages of bream and other species and so the threat to the fishery is minimal. This ignores the growing body of evidence that points not only to its importance for spawning bream but to the unique combination of characteristics including its location (with respect to threats from prymnesium and from increasingly frequent saline intrusion), quality of habitat for spawning, a significantly different thermal environment from other similar habitats, and lack of disturbance from navigation. There is also evidence that fish including bream exhibit spawning site fidelity and homing behaviour meaning that it could take many years for the bream to find and utilise new spawning grounds.

6. **Isolation of Hoveton Great Broad and Hudson's Bay from the Bure system for a number of years could result in a deterioration Ecological Status in the Bure system.** In contrast, Natural England have suggested that a decline in bream and roach stocks in the Bure system would be good because it would indicate that the system was moving towards Good Ecological Status. However this is over-simplistic and was based on using some lake fish classification tools which have limited applicability to a lowland river system in the UK. A crash in stocks of roach and bream in the Bure

system would unlikely to be matched by an increase in stocks of other species in the system as a whole because the environment isn't suitable and is unlikely to ever be because of the constraints mentioned in 2. Rudd, tench perch and pike may well do better in the upper parts of the Bure system and associated broads but we could well be left with a void in the lower reaches, i.e. the ecosystem as a whole could be considered to be in an even worse state than at present.

7. **Inadequate mitigation for impacts on the wider Bure system caused during the restoration works.** The project plan includes some elements that offer potential benefits to the Bure/Northern Broads fishery including the opening up of some of the marsh dykes and creation of new potential spawning habitat in Decoy Broad. Whilst these have been "branded" as fishery mitigation activities they were an essential part of the project in any case and were not originally included for fishery mitigation. They may well offer some benefits but cannot be realistically expected to mitigate for the loss of HGB from the system, any such mitigation works would have to be properly designed and demonstrated as being effective prior to the isolation of HGB from the Bure system.

8. **Continuing a policy of disconnecting broads from the main rivers systems will compromise the long-term resilience of the Broads system as a whole.** There is a history of disconnecting broads from the main river system in order to preserve or restore the ecological conditions therein. In the early years of broads restoration this was appropriate, however now that huge improvements in water quality in the system as a whole have been achieved, a strategy of continuing to isolate lateral water bodies from the main river appears inward-looking, provides very localised benefits and could leave the system as whole less resilient and in a worse ecological condition than would otherwise be the case. Restoration of Hoveton Great Broad, if successful should pave the way towards reconnecting many of the isolated high quality broads with the rivers now that water quality is improving. For this reason I remain supportive of the project as a whole but would ask that we reconsider the approach especially with regard to effective mitigation of the temporary impacts of isolation of HGB, a far more ambitious scheme for mitigation is required.

[redacted]

Thank you for including me in the circulation list for these documents – I'm just confirming that I've nothing to add in terms of factual comment.

[redacted]

In my opinion the Hoveton report is a detailed and accurate representation of the situation and risks. I do believe Hoveton is the correct site for such a biomanipulation project and although there is likely to be some impact to the roach and bream populations, and thus potentially the angling economy, I believe any impacts will be relatively short-term and outweighed by the necessity to restore clear-water communities both from a WFD requirement but also to ensure the diversity of habitats throughout Broadland from a wider UK conservation perspective. We need to identify effective methods to tackle eutrophication and biomanipulation has been proven, both in the Norfolk Broads and abroad, to be an effective mechanism to achieve this. My main concern is that without additional interventions to reduce the nutrient input the clear-water community may not persist for many years and the Broad will return to its current eutrophic state within a relatively short period of the fish populations returning. This is an unknown but without undertaking such trials we will be unable to further our understanding of how to effectively restore such ecosystems.
I am very happy to discuss further if you would like.

[redacted]

[redacted]

[redacted]

Thank you for the opportunity to provide further comments on the recently circulated report. You have already received an e-mail from [redacted] setting out his thoughts. Below are a number of bullets capturing my main concerns from the perspective of fish populations and fisheries and the legislation associated with these. I know that you'll receive more detail supporting these concerns from the local team and national colleagues from the research side of our business.

- The most significant concern relates to the reference condition for HGB and HB. I have been able to find references to the fish community in this system dating back to the 19th century which show that fish communities were dominated by a number of species including bream and roach. There is other evidence confirming this view that the local team will provide in their response. I'm surprised that the report shared with us failed to review all of the available evidence and so failed to provide a balanced view of the relevant information. Alongside this, the report failed to highlight the limitations and caveats associated with the Dutch WFD classification method, provided by [redacted] which has been to suggest that roach and bream are not indicative of un-impacted fish communities at this location. The significance of this is that we cannot discount that removing bream and roach for HGB and HB would not cause a deterioration under the WFD. Knowingly causing a deterioration to achieve Favourable Conservation status is questionable and open to legal challenge.

- Alongside this are the wider impacts to the fish populations of the Bure system. If bream selectively spawn in HGB and are unable or unwilling to spawn elsewhere then deteriorations could occur in linked water bodies with the same risks identified above.

- If it is concluded that there is no risk of deterioration under the WFD, then there are potential risks around our duty to maintain, improve and develop fisheries (Env. Act). This balance would likely fall in favour of the HD if it delivered a fish population/fishery that was typical of this system before the impacts of eutrophication. However, the scale of the impacts on the wider Bure system would be relevant in this case.

- In section 6 the final paragraph suggests that opening the barriers would constitute 'a release into the site of any wild, feral or domestic animal, plant or seed' which NE would only consent if the operation did not impact on the SSSI. First, I would question the legal interpretation of a 'release' in this context and second would highlight that while nutrient levels remain elevated this could see the barriers in place for an indeterminate period.

- Questions remain around the effectiveness of Biomanipulation in open systems, particularly where background nutrient pressures remain elevated.

[redacted]

Thanks for the copy of this draft report. Here are the comments from national AFNE Biodiversity as requested:

- The sites referred to are part of an internationally and nationally important conservation site (reflected in the SAC, SPA, NNR, SSSI and Ramsar status), which are in unfavourable condition. Natural England,

working with partners including the EA, has a statutory obligation to restore the sites to favourable conservation status.

• An agreed programme of actions to restore these Natura 2000 sites have been established for many years, including under the Habitats Directive Review of Consents programme for which the EA was a competent authority with the goal of restoring sites to favourable/ favourable recovering conservation status. The EA has worked with a range of consent and permit holders to continually reduce levels of pollution entering into these sites and their catchments, in accordance with their duties under both the Habitats and the Water Framework Directives.

• Eutrophication is a major issue within the Bure and wider Broadland catchment. Although we would expect most lowland river and lake systems to be naturally eutrophic, the high levels of eutrophication at these protected sites are damaging to the ecosystem and the designated features. This is reflected in the current ecological status of the waterbodies under Water Framework Directive (WFD) and the unfavourable no change status of the protected sites referred to in this report. Maintaining the status quo (i.e. unfavourable status and poor ecological status) of the sites, therefore, is not an option, under both the Habitats and the Water Framework Directives.

• To reach favourable condition/favourable -recovering and good ecological status (GES) this hyper-eutrophication does need to be addressed. It is a key cause of the site's failure to meet favourable condition and GES. The site needs to meet both of these objectives regardless of past conditions and how long they have persisted. Large populations of Bream and Roach have been show in the scientific literature (referenced in the report) to be positively correlated with increases in nutrient levels and decreases in numbers of macrophytes and both of these trends underpin the failure of the site to meet its requirements under the two directives.

• Biomanipulation has been shown to be an effective intervention for lake restoration within the Broads already (as referenced in S3.4 of the report). A trial of biomanipulation at this site (Figure 17 in the report) demonstrates its potential for likely success.

• One area however where the final report could perhaps provide more clarity is why it was not considered possible to create refuge areas for fish or deliver biomanipulation in a staged or zoned manner over a more extended period of time.

[redacted]

This morning is the first chance I have had to read the documents. Comments from myself are below.

- Timescale for response to the documents, are these forming part of the official consenting process?. How old is the project? Five or six years old now, how long did that 48 page PDF take to write, probably several months? Why is there such as short deadline for comments on the proposals from the wider fish community. Is this driven by ourselves or Natural England? No organisation provides a week to provide technical comments and assessments for a project on this scale, the indication that this gives out is that the impact on the fish population of the Broads is a secondary concern to the project and hasn't been properly planned or mitigated and there is a rush to get consent. That impact could be one of the most substantial seen on a freshwater fish population in our lifetimes, there is very little work on mitigation suggested in the document, it seems to work on the assumption that fish can go simply elsewhere. Does that precedent and timeline apply to hydropower schemes and spawning salmonids? This project and the outcome of it will be under intense scrutiny from groups like the AT and BASG, the first thing that will stand out if anybody were to scrutinise the process will be the application procedure is that the EA fisheries community has formally commented

on the proposals within a week. Is that standard practice, will we be consenting all applications within a week from now on?

- Eel regs, I have searched through the PDF document and the word “eel” appears four times. Not one of these times does it relate to the consideration or implementation of the eel regs. Apologies if I have missed any correspondence or documents relating to this but if there is separate document/process for the eel regs and this project then can I have access to it? Is there a plan for silver eels migrating off Hoveton Broad in regard to the barriers going in place, assessment, research and mitigation of? We are asking FCRM, IDB’s and water companies to invest in significant infrastructure changes to provide safe passage for migrating eels, we would need a firm idea of how consenting these barriers to go in would fall into line with this. An indication that they are eels, and will find a way out of Hoveton no matter what doesn’t really provide us with a very stable ground when attempting to work with partners and stakeholders to implement the eel regs. Eels encountering a barrier in the form of a pump station screen will often travel a long way back upstream and avoid migration, have similar studies been carried out on the planned fish barriers? The PDF is written by an Environment Agency employee, a project outline supporting an action by another government body that directly affects large numbers of eels and there is no mention of the eel regs? Is that PDF legally disclosable in a FOI request? If it is and the project were approved then it would be of significant benefit to anybody looking to negate the eel regs during an enforcement situation. In LNA we have hydropower applications, hundreds of pump stations and dozens of assets where we wouldn’t accept a project outline that doesn’t mention the eel regs. To not include any mention of this is unacceptable in a document proposal created by the EA, detrimental to ourselves and possibly undermines a lot of work that has been carried out by our staff. It highlights a lack of understanding of the regulations involved with fish populations, a poorly researched and evidenced project outline and a lack of thought around the impact the project would have on the wider ecology of the Broads. The eel is an endangered species, where is the consideration of that in this project? In a similar vein there is very little to no scientific detail or basis about how other fish communities would change with the loss of connectivity to Hoveton Broad and the wider food chain for otters and bitterns etc.

- Bream are not goldfish, they do not forget where they are every six seconds. The work carried out on Hoveton has already highlighted how complex their migrations are and how specific their habitat preferences/migratory paths are. Hoveton Broad and its connection to the Broads is probably the most important site in terms of furthering our knowledge of coarse fish populations and their movements in the UK. The work we have done on the Fens using tags and new sonar technology is starting to indicate that adult bream shoals are very likely to pass down generational knowledge to younger fish that then follow the same routines. Denying access to the Broad is likely to have a massively detrimental impact to the fish population, research, understanding and especially the mitigation of this should form the largest section of any project like this. In this one it forms the smallest, the documents simply states how bream create muddy water time and time again. That is well known and well documented.

- There is no mention in the documents on the impact of how a changing climate would affect the type of waterbody they are trying to create in relation to invasive macrophyte/algal growth. Hoveton Broad is always going to be eutrophic and shallow, the dredging work will not significantly increase water depths throughout the Broad. For the past two summers we have had temperatures of 38 degrees and suffered dozens on fish kills in LNA. The waterbodies most are risk in hot weather from algal blooms are clear water, eutrophic stillwaters. Photo attached below, this is Thrapston Lake in the Nene Valley, it is eutrophic. The conditions in Thrapston are similar to the ones NE are looking to create in Hoveton. It is 140 acres, has limited to no connectivity to the River Nene which runs next door, has clear water, and a relatively low fish biomass. It does not possess a diverse macrophyte community, it was classed as poor for macrophytes for WFD in 2016 and is dominated by an invasive, Canadian Pondweed followed closely by filamentous algae. In 2018 it was completely covered in blue green algae, DO levels of 4% with a loss of an estimated 100,00 fish. The assumption that bream are downgrading Hoveton comes with a warning, the conditions for providing diverse macrophyte growth have changed with the climate. Give an invasive macrophyte a chance in Hoveton with its vast supply of sediment and nutrients and it will outcompete everything.

Same goes for algal growth, clear water, nutrients and record breaking temperatures = blue green algae. I would argue that the reason there has never been a single algal related fish kill on the Broad is due to the presence of the fish population. Bream are significant zoological agents of sediment generation and mobilisation, that is well documented. The assumption that water quality will improve with their removal is by no means a given, there is no mention of the management or response that would be undertaken for invasive plant species or algal blooms in the documents.

- Reputational risk for ourselves. In no other industry would this project be approved in its current state. The evidence points conclusively to the importance of Hoveton in the Broads system for fish. If fish can “go elsewhere” why aren’t they now? Why are they swimming past other Broads and visiting Hoveton, why are they using energy budgets to migrate to Hoveton when they can go somewhere closer, its learned behaviour, those migrations to spawning grounds are built in. Any organisation tasked with maintaining, improving and developing a species with the evidence we have would not consent this. The cost of the project not being consented for NE pales into insignificance for the longer term fish population of the Broads.

Best regards,

[redacted]

NATURAL ENGLAND

<u>Comments on 'Hoveton Project: creating a sustainable future for the Bure system'</u>
Submitted by
[redacted]

We are collectively submitting a response to the EA Fisheries contribution to the discussion from our position as Natural England Specialists and Project staff.

We would like it noted that the list of contributors as cited in paragraph one needs further clarity. There is a difference between providing factual evidence and expressing an opinion that the project should not go ahead. Some individuals on the list may be evidence led but remain neutral on opinion. For clarity it should be highlighted who is giving opinion and what that opinion actually is.

1. A total of 24 documents have been referenced by the EA fisheries team. We were not initially given access to these so are unable to fully understand their relevance to the argument presented. The case submitted in section 7 does not include any interpretation of the evidence, nor any explanation of findings or conclusions made. As a result it is very hard to make comment on their position. We did get a zip file of some documents on 29th November and we present our views on these below.

2. In general terms the 24 references are largely internal documents expressing opinions. We feel that there is lack of clear scientific evidence of the case presented. The document 'Coarse fishing close season on English Rivers, August 2019 by [redacted] is cited but without specific page references. Is there a specific section of this document that is being used for evidence or the entire document? Additionally, [redacted] has written numerous other documents relevant to this topic. Was there a reason this one was used, ignoring others?

3. Direct reference is made to the WFD but this doesn't say anything about fish classifications so this is seemingly trying to add weight to an argument without the corroborating evidence.

4. '*..high risk that the isolation of HGB and HB will have a significant detrimental impact*….' we believe that section 4 of our report clearly evidences that the system has the potential to be highly adaptable. Only the bream that do not find other locations to spawn within the broads system will be impacted by the isolation of HGB and HB. Section 4 provides evidence that bream are a highly adaptable species with high fecundity, and that during the spawning season a large proportion of the population visit other sites in addition to HGB and HB. It would also be useful to have their definition of 'detrimental' and what their baseline/reference points are.

5. '… significant additional risks that are not yet fully understood…' The high biomass of bream and roach within HGB and HB is a sign of the poor condition of the broads. There is a greater risk of failing statutory duties if nothing is done. We have always clearly said that there is the potential of an impact on the current fish communities, and therefore a short term impact on a section of the current fishery. However, this will lead to an improved diverse and stable wider fishery for the future as described in section 4. The biomass of bream is currently dominating the system and this is a key factor in its degraded state. Bream are a vital part of a balanced fishery in this area but would not dominate it in a more naturally functioning system.

6. There is a reference to 'pike Spawning' but we are unsure what significance this has to the debate. It has been shown that pike have no preference for Hoveton over other areas in broadland and equally conditions on HGB for pike will greatly improve following restoration. Indeed, the restoration of piscivore numbers within the fish assemblage is a specific aim of the project as it is intimately linked to the restoration of the broad as a whole.

Specific comments on references supplied on 29th November

References were supplied in a zip folder and numbered. However, these did not correlate to the numbering in the submitted response so it is very hard to understand how these references can support the debate presented. In our comments here we will refer to the numbering in the zip folder.

References 3 & 4:

The e mail exchanges suggest that we do not know enough about bream and how they use the system to judge the impact of the project and appropriately mitigate. We believe that on the contrary the project has allowed us to massively improve the understanding of bream (and pike) in the Broads fishery, so we have already made a significant contribution to future fishery management. Under Freshwater Fisheries Act we are not required to take a precautionary approach to works which these e mails imply. Finally, and more importantly, there is absolutely no consideration of the health of the current fishery, it starts from the position that the current fishery must be maintained. We feel we have adequately evidenced why this cannot be the case.

References 5, 6, & 17

These references highlight the lack of knowledge, at the time of writing, on the coarse fish within the Broads and are justifications for more EA spending on monitoring the broadland coarse fish. These references also mention how the project will help fill significant gaps in fishery knowledge and help future fisheries management. Ref 17 specifically talks about developing WFD classification for healthy fish populations. Again, the evidence supplied in our documentation clearly demonstrates that the current population found during monitoring is not healthy or functioning naturally. It is unclear how these references which highlight evidence gaps in the EA's knowledge of this fishery have led to the conclusions that this project represent too high a risk.

Reference 31:

As mentioned in the report this economic assessment is not robust - therefore whilst we don't dispute angling contributes to the local economy we need a robust economic assessment carried out. This has been, for this reason, added to our 'Fisheries Improvement Programme' as attached to original set of documents. It must also be borne in mind that the project is only likely to have an impact on bream and roach numbers in the wider system and it is debateable how big this impact will be. This document acknowledges the economic importance of other elements of the fishery particularly pike which are likely to benefit from this project. Consequently the impact of this project should not be assessed against the economic value of fishing in the entirety of the

broads, but the impact the project may have which will be a much smaller proportion of the figures presented.
References 9,
This presentation highlights the high use of Hoveton Great Broad by bream and roach, this is not contested by the project and is why numbers need to be reduced to allow restoration to occur. This presentation also supports the statement above with respect to pike spawning. Again it is difficult to see how this leads to the conclusion that the project is too high a risk.
Reference 12
This presentation states that
"it is not considered that the effects upon roach and bream in the wider system will be significant.

We are planning to look at these concerns."

It also concludes that HGB does not support significant Pike spawning, but it does support high numbers of bream and that roach dominate by number (not biomass). Again it is difficult to see how this presentation supports the conclusion that the barrier represent too high a risk.

Reference 23 & 34
These are summary documents about the close season, reference 23 is about the decision to maintain the close season in rivers. It is difficult to see the relevance of the EA deciding on the close season in rivers, to the decision that the project is too high a risk. If these are relevant it needs to be explained.

Reference 24
This South East Rivers Trust website describes the degradation of river habitat by impoundments and weirs. It specifically describes how upstream of such structures the river becomes 'lake like' and that natural processes such as sediment transport can no longer occur and that the river loses its dynamic processes and prevents movement of species and substances along the river. The project would not dispute this, but these are the impacts of putting barriers across rivers. HGB is already 'lake like' and the installation of the barrier will not prevent movement along the River Bure or impact on the dynamic processes of the river.

This general international acknowledgment that barriers across rivers are bad for rivers and fish cannot be extrapolated to this proposal, which does not propose a barrier across the Bure, but proposes a temporary barrier that will prevent access to an adjacent lake that was created by peat cutting. Therefore it is difficult to see how this reference is relevant or supports the conclusions made.

Reference 25
This is the website for the Unlocking the River Severn project illustrating the importance of river connectivity for salmon, shad and eels. Again the Hoveton project is not creating barriers across the river and out of the fish mentioned only eel are found in the Bure. Eel have been found in greater number in the Broadland lakes with fewer bream and roach. Therefore it is difficult to see how this reference is relevant or supports the conclusions made.
Reference 27
This guidance clearly states
"Important! This document sets out the legal requirements under the Water Framework Directive (WFD) to protect and improve the water environment in relation to physical works in rivers. WFD also applies to lakes, estuaries and coastal waters but these are not covered in this document. "

When considering what types of physical works need to be assessed it is clear that these are "All physical works that alter the physical form of or flow within the river need to be considered."

As previously stated as this barrier does not go across the river it will not impact the river in this way. Consequently it is difficult to see the relevance of this document to the project proposed.

Reference 29
This refers to the implementation of river basin management plans. It provides a high level position and overview of requirements. It is difficult to see how this supports the conclusions made. The majority of the broads including HGB are not meeting their WFD objectives and this project would help it to do so. As we have commented, we believe that failure to biomanipulate HGB & HB would mean we are failing on WFD objectives, particularly those of WFD protected areas.
In conclusion no evidence has yet been supplied that justifies the conclusions made. However, there is evidence from the bream tracking study that there is a significant risk of change (rather than detrimental impact) in the current fishery, but this change is accepted as it is not an impact but a restructuring, leading to a better (more balanced, sustainable, resilient etc) fishery overall. However, the scale, range and timing of this change is more difficult to determine. Taken a step further, as the wider fishery is effectively adapting to the changed habitat, the angling opportunity then adapts to the changed fishery (methods, gear, target species, expectations).

Hoveton Project: creating a sustainable future for the Bure system

Annex Statement to the main paper with the aim of providing clarity to the key messages for the decision meeting on 6th December.

- The primary regulatory driver is the Habitat Regulations (Favourable Condition) with a WFD Protected Area objective of achieving the higher bar set by the Habitat Regulations.

- It should be noted that compliance with the Habitat Regulations, and by association the WFD, is a statutory obligation of both competent authorities. If we are to comply with our statutory responsibilities then there is no option or decision to be made here: the restoration project must continue.

- 'The EA is an associate beneficiary of the project, which is being led by NE' – to be clear, the EA is a fully signed up project partner. There are reputational risks here to two DEFRA organisations, that should be working in unison, being seen to be in disagreement with each other.

- The dominance of bream (and roach) in the fish population is a symptom of eutrophication, a natural fish assemblage in the broads would be more diverse with fewer bream and roach. Such an unimpacted fish assemblage is reflected in the WFD definition of good ecological status and the conservation objectives –Currently the fish assemblage is degraded and fails its statutory objectives.

- 'There has also been a question raised over whether a project that is designed to create WFD and HD improvements should continue if there is a chance of causing deterioration in the fish element of the broad and the wider connected water bodies' –The current fish assemblage is indicative of a degraded habitat and currently a barrier to the restoration of high quality habitat and a fish community representative of such. A change to the current fish population does not necessarily (and is unlikely to) represent a deterioration when assessed against reference conditions and a naturally functioning ecological system (the true test of WFD and Habs Regs).

- The project is in year five of six. Most of the work to date has involved sediment removal and physical habitat restoration.

- 'The key question to be answered is whether the installation of the fish barriers as proposed by the project can go ahead' – and if it does not due to the EA not signing off on the key component of the project, the barrier installation, how does the EA wish to justify non-compliance with Habs Regs and lack of progress towards WFD objectives?

- 'Both NE and EA have a statutory duty to restore the sites to Favourable Condition, but the EA also have a duty to maintain, improve and develop fisheries' – this does not include maintaining and developing fisheries which are incompatible with their surrounding reference freshwater habitat. Taken a step further 'Every public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity' , NERC Act 2006.

- 'Exclusion of the fish from these broads is intended as a temporary measure to kick-start an improvement in other biological elements such as macrophytes and phytoplankton and a restored fish assemblage. While this could have a short-medium term (c. 10 years) impact on the fish population, the scale and extent of the impact cannot be predicted – it is possible the bream may fail to spawn, or they may move elsewhere in the system with unknown impact on bream spawning success'. But fewer bream in the wider system has the potential to help move the the wider broads system towards its WFD and Habs directive objectives.

- 'It is expected that a restored Broads ecosystem would support a more natural, more diverse, more stable and more resilient fish population in future, leading to a different angling experience'.