

Hoveton Wetlands Restoration WFD Compliance Assessment

June 2014

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An Introduction to the Water Framework Directive (WFD)

The Water Framework Directive (WFD) (2000/60/EC) is European legislation that came into effect in 2000. The aim of the legislation is to manage and protect water based on natural catchment boundaries not political boundaries. River Basin Management Plans are drawn up in each river basin district which identifies current pressures and potential solutions to ensure waterbodies are at Good Ecological Status (GES). The ecological status of a waterbody is derived from the presence of aquatic life (e.g. invertebrates and fish), physio-chemical elements (e.g. dissolved oxygen and phosphate levels) and hydromorphological elements. These elements are compared against reference conditions derived from waterbodies that have had no or little impact from humans. The waterbody can then be assigned one of five classes; High, Good, Moderate, Poor or Bad. High being no or little impact from human activity, Good, slight impact from human activity and so on. The original environmental objective of the WFD was for all waterbodies to be at GES by 2015. This deadline has been extended to 2027 with certain exemptions put in place such as deterioration due to natural causes. In 2003 the WFD became part of UK Law with a major requirement of the WFD being new activities or modifications must not lead to a deterioration of the ecological status of a waterbody, nor compromise the achievement of this good status in future.

WFD compliance assessments

The purpose of a WFD compliance assessment is to assess potential impacts of a new activity or scheme on the WFD quality elements of a waterbody. Impacts on the waterbody may cause deterioration in ecological status or lead to a failure to meet ecological objectives. If a scheme will cause deterioration of WFD status then the scheme is not WFD compliant unless a defence is made using Article 4.7, which lists as series of conditions which must be met to allow the scheme to become WFD compliant. The compliance assessment must also consider if the scheme will have any detrimental impacts on other waterbodies within the same river basin district.

Project Overview

Refer to the Natural England document ‘Hoveton Wetlands Restoration Project’ for a more detailed project overview. A summary of the planned works being assessed in this document is given below.

Hoveton Great Broad (HGB) like other broads in the area is a shallow lake created by peat excavations in medieval times. HGB is connected to the River Bure and until relatively recently the broad had good water clarity and abundant macrophyte beds. Aerial photographs from the 1940’s show extensive beds of macrophytes growing around the margins of the broad (Figure 2). Between the 1960’s and the 1980’s the water had become turbid and the majority of the submerged macrophytes were lost from the broad. This is caused by a number of reasons but primarily high phosphorus levels caused by in-lake cycling of nutrient rich sediment and over predation of zooplankton by young fish which reduces grazing pressure on phytoplankton (Moss et al., 1996). Both these conditions create phytoplankton blooms which increase turbidity and limit macrophyte growth.

This project, led by Natural England and in partnership with the Environment Agency, aims to restore the HGB and Hudsons Bay back to an ecological favorable condition. HGB and Hudsons Bay are currently assessed as being in an ‘unfavourable no change’ condition and are failing to meet GES under the WFD.

The top layer of nutrient rich sediment will be removed from the broads, the broads will be isolated from the River Bure and all fish removed. These methods have been successfully implemented on other broads with almost immediate improvements seen in water clarity and reductions in total phosphorous (Moss et al., 1996).

Silt will also be dredged from the nearby Hoveton Marshes, and this along with the sediment dredged from HGB will be used to create marginal habitat on the HGB as well as in Wroxham Broad, methods which have been successfully used on the nearby Salhouse Broad. Using the above measures it is hoped that HGB will be restored to a clear water broad with extensive macrophyte communities and greater ecological and aesthetic value.

The Assessment

Although the central aim of the project is to improve the water quality and ecological quality of the HGB waterbody and the Wroxham Broad waterbody, some WFD elements may be impacted by the works. The purpose of this document is to assess whether the planned activities will have an impact on any WFD element for the HGB and Wroxham Broad waterbodies, as well as the River Bure waterbody. Using the Environment Agency's guidance (OI 448_10) it has been identified that some WFD elements may be affected by this project.

In this section each waterbody will be introduced and each of the WFD quality elements will be discussed in relation to the planned restoration works. Each quality element will be discussed separately and any potential impacts from the different aspects of the works will be highlighted.

Key activities to be assessed:

Hoveton Great Broad (waterbody ID: GB30535977)

- Sediment removal from HGB and Hudsons Bay
- Broad isolation and fish removal
- Species-rich fen habitat creation using dredged sediment and geobags
- Silt removal from Hoveton Marshes

River Bure (waterbody ID: GB105034050930)

- Sediment removal from HGB and Hudsons Bay
- Fish introduction from the HGB

Wroxham Broad (waterbody ID: GB30535953)

- Tall-herb fen habitat creation using dredged sediment and geobags

Hoveton Great Broad (waterbody ID: GB30535977)

Table 1. Selected WFD data for Hoveton Great Broad waterbody. Quality elements are italicised, statuses are in bold and failing elements are in red and passing elements in green.

Hoveton Great Broad (waterbody ID: GB30535977)

Waterbody size:	0.37km
Typology:	High Alkalinity, Very Shallow
Hydromorphology designation:	Heavily modified
Biological Status:	Poor
<i>Macrophytes:</i>	<i>Moderate</i>
<i>Phytoplankton Blooms:</i>	<i>Poor</i>
Physio-chemical Status:	Moderate
<i>Dissolved Oxygen:</i>	<i>High</i>
<i>Total Phosphorous:</i>	<i>Moderate</i>
Specific Pollutants:	Not assessed
Morphology Status:	Good
<i>Hydrology:</i>	<i>High</i>
<i>Morphology:</i>	<i>Good</i>
Chemical Status:	Assessment not required

Hoveton Great Broad (HGB) (waterbody ID: GB30535977) consists of HGB itself as well as the smaller broad Hudson's Bay. It is connected to the River Bure (waterbody ID: GB105034050930) at various points where water exchange occurs. Water from the Hoveton Marshes also drains into this waterbody but the majority of the dykes on the marsh are silted up and the marshes themselves are scrubbing over. Sediment removal is proposed for HGB with the aim of reducing in-lake cycling of nutrients which is believed to be the main cause of total phosphorous failure. Sediment will also be removed from the dykes on Hoveton Marshes to improve ecological value and to improve access for canoes. The resulting sediment from HGB will be used to create species-rich fen with the use of geo-bags in HGB and Wroxham Broad. HGB is not classed as a Heavily Modified Waterbody (HMWB).

Macrophytes: *Current Status:* **Moderate**

Sediment removal

The removal of sediment will cause an increase in turbidity and an increase in nutrients from the suspension of organic sediment, both of which can have a negative impact on macrophytes. The impact though will only be temporary as any suspended sediment will soon settle out in the broad. Suspended nutrients will most likely flush out of the broad and/or be used up by biological activity. The sediment

removal has the potential to damage current macrophyte habitat but given that there are currently very few submerged macrophytes growing on the broad this is unlikely to have an impact on the WFD status.

Mitigation measures

- The broad will remain connected to the River Bure throughout the sediment removal works allowing for dilution and flushing of any suspended nutrients.
- The works will occur in winter when flows are higher which will increase any flushing affect. Also, biological activity is at its lowest in winter therefore any temporary impacts will be further reduced. The timing of the works will allow time for the suspended sediment to clear by spring when biological activity and in particular macrophyte growth increases.

Conclusion

The impact will be temporary and will not cause deterioration in macrophyte status. Conversely, the central aim of this project is to improve the clarity of the water in the broad which will improve conditions for macrophyte growth. The project is using proven methods to restore the broad back to an ecologically favourable condition of clear water with lush macrophyte growth. The removal of sediment will reduce phosphate levels and contribute to improving macrophyte status in the long-term. Any short-term deterioration should be viewed with this long-term gain in mind.

Species-rich fen creation

The creation of species-rich fen using the dredged sediment and geobags will occur in areas where there is currently little marginal vegetation and degrading banks (Figure 1.). Geobags will be used to re-profile the banks approximately back to an historical profile using aerial photography from the 1940's (Figure 2.) The geobags are filled with the dredged sediment and capped with fen vegetation to create a retaining wall. The void behind the wall and the existing bank is filled with sediment. Planting and natural colonisation will occur overtime to create a natural looking bank with marginal aquatic vegetation. A similar scheme in neighbouring Salhouse Broad has shown almost immediate results with macrophyte species colonising the newly created fen. The movement of sediment in and around the broad may increase turbidity and nutrient levels due to suspension of organic sediment but this impact will only be temporary.

Mitigation Measures

- The broad will remain connected to the River Bure throughout the fen creation works allowing for dilution and flushing of the suspended nutrients.
- The works will occur in winter when flows are higher which will increase any flushing affect. The timing of the works will allow time for the sediment to clear by spring when biological activity and in particular macrophyte growth increases. Also monitoring for the macrophyte element occurs in summer so the timings of the works allows for the longest period of recovery.



Figure 1. Aerial photo of HGB taken in 2013. Note turbid water and limited macrophytes. (from NE leaflet 'Hoveton Wetlands Restoration Project')



Figure 2. Aerial photo of HGB taken in 1949. Note extensive submerged macrophyte growth. (from NE leaflet 'Hoveton Wetlands Restoration Project')

Conclusion

The broad currently has a limited macrophyte community occurring in low densities therefore no deterioration in macrophyte status will occur as a result of the species-rich fen creation works. In the long term the creation of this habitat should contribute to an improvement of macrophyte status by creating greater habitat heterogeneity and improved condition for macrophytes.

Phytoplankton Blooms: *Current Status:* Poor

Sediment removal

For WFD purposes phytoplankton is monitored by measuring chlorophyll *a* and by assessing phytoplankton species composition. Phytoplankton growth shows a positive correlation with total phosphorus, although other factors such as zooplankton grazing also impact on this relationship, especially in shallow lakes (Moss et al., 1996). Higher levels of phosphorous increases the risk of phytoplankton blooms which then out-compete submerged macrophytes for sunlight (Phillips et al., 1999). The short-term increase in total phosphorous caused by suspension of the organic sediment may cause an increase in phytoplankton activity and possible blooms but the impact will be temporary as the suspended sediment will not persist.

Mitigation Measures

- The broad will remain connected to the River Bure throughout the dredging allowing for dilution and flushing of the suspended nutrients.
- The works will occur in winter when flows are higher which will increase any flushing affect. Also, biological activity is at its lowest in winter therefore any temporary impacts will be further reduced. The timing of the works will allow time for the suspended sediment to clear by spring when biological activity increases.

Conclusion

The impact of the works will be of a temporary nature and will not impact the WFD status for phytoplankton blooms. An increase in blooms may occur for a short time after the works but when the lake is monitored for WFD these impacts should no longer be apparent. Phytoplankton is monitored in the summer between July-September. In the long-term the Phytoplankton bloom status should improve as the amount of phosphate in the waterbody will be less as a result of the sediment removal. Also, as part of this project, fish will be removed from the broad and the broad isolated for up to 10 years. Removal of fish has been shown to reduce chlorophyll *a*, a proxy for phytoplankton abundance, in shallow broads (Moss et al., 1996). Fish predation of zooplankton can suppress zooplankton numbers so that they are no longer effectively grazing phytoplankton. This allows phytoplankton abundance to increase thus increasing turbidity and suppressing macrophyte growth. The removal of fish coupled with sediment removal can have an almost immediate positive impact on water clarity and macrophyte growth (Moss et al., 1996).

Dissolved Oxygen *Current Status:* High

Sediment Removal

The removal of sediment may have a short-term impact on dissolved oxygen (DO) levels. The increase in nutrients, in particular total phosphorous, caused by sediment disturbance will increase biological activity thus increasing oxygen demand. This could cause a temporary drop in DO levels but this should recover quickly as the suspended sediment and nutrients will not persist in the broad. Total phosphorous levels have been shown to drop almost immediately after sediment removal from a shallow broad (Moss et al., 1986), therefore correspondingly, no long-term decline in DO should be expected as a result of the sediment removal.

Oxygen exchange occurs between the atmosphere and water in lakes. HGB is very shallow which gives it a large surface area:volume ratio which allows for a high level of oxygen exchange between the atmosphere and the water. The sediment removal will increase the depth of the broad thus changing the surface area:volume ratio, although the increase in depth will only be 0.3m and should therefore not greatly affect DO levels. Biological activity will have a greater influence than morphology on DO levels.

Mitigation Measures

- The broad will remain connected to the River Bure throughout the dredging allowing for dilution and flushing of the suspended nutrients.
- The works will occur in winter when flows are higher which will increase any flushing affect. Also, biological activity is at its lowest in winter therefore any temporary impacts will be further reduced.

Conclusion

High status is the top status under WFD and indicates that human activity is having no or limited impact on this element. DO will only be temporarily impacted by the sediment removal and therefore there will be no deterioration in the WFD status for this element. The small change in lake depth will not impact the DO status either.

Total Phosphorous *Current Status:* Moderate

Sediment Removal

HGB is currently failing to meet good status for total phosphorus which is attributed to in lake nutrient cycling caused by the presence of nutrient rich sediment. The removal of sediment from HGB is central to this restoration project with a key aim being the reduction in total phosphorous levels from the water column. However, the restoration works themselves may cause a short-term increase in total phosphorous in the water column caused by disturbance and suspension of sediment when dredging. This impact will only be temporary and will not cause a deterioration of the WFD status.

Mitigation measures

- The broad will remain connected to the River Bure throughout the dredging allowing for dilution and flushing of any suspended nutrients.
- The works will occur in winter when flows are higher which will increase any flushing affect. Also, biological activity is at its lowest in winter therefore any temporary impacts will be further reduced.
- An Eco-bucket will be used when dredging. This reduces the risk of the re-suspension of sediment.

Conclusion

Apart from a potential short-term increase in total phosphorous the long-term impact of these works will be to reduce total phosphorous concentrations. Therefore sediment removal will not cause a deterioration of this quality element.

Hydrology *Current status:* High

No water level management works are planned for this project nor are any of the other works expected to have an indirect affect on hydrology. No abstraction of water is planned either therefore no deterioration in this element is to be expected.

Morphology *Current status:* Good

Species-rich fen creation

HGB is not classed as a Heavily Modified Waterbody and therefore has no morphological mitigation measures in place. The proposed species-rich fen creation works using geobags and dredged sediment will clearly be altering the morphology of this waterbody. However, the aim is to restore areas of marginal vegetation back to how it was in the 1940's which is considered more favourable. The broad may temporarily be in a less favourable condition morphologically soon after the geobags are put in place but these areas should be colonised rapidly by vegetation, soon giving the appearance and function of a natural margin. Similar works were performed on the neighbouring Salhouse Broad where vegetation began to colonise the newly created area almost immediately.

Conclusion

There should be no long-term deterioration of this quality element because of the species-rich fen creation works.

River Bure (waterbody ID: GB105034050930)

Table 2. Selected WFD data for the River Bure waterbody. Quality elements are italicised, statuses are in bold and failing elements are in red and passing elements in green.

River Bure (waterbody ID: GB105034050930)

Waterbody size:	54.47km
Typology:	Low, medium, calcareous
Hydromorphology designation:	Heavily modified
Biological Status:	Poor
<i>Diatoms:</i>	Moderate
<i>Macro-invertebrates</i>	Good
<i>Macrophytes</i>	Moderate
<i>Fish</i>	Poor
Physio-chemical Status:	High
<i>pH</i>	High
<i>Ammonia</i>	High
<i>Dissolved Oxygen:</i>	High
<i>Phosphate</i>	High
Morphology Status:	Moderate
<i>Hydrology:</i>	Moderate
<i>Morphology:</i>	Moderate
Chemical Status:	Good

The River Bure is a heavily modified waterbody which is navigable by boats for much of its length. Historically the Bure has suffered from poor water quality but after implementation of phosphate stripping and other measure the river is now at high status for all Phys-chem elements. The River Bure connects with HGB (waterbody ID: GB30535977) and Wroxham Broad (waterbody ID: GB30535953) at various points.

The River Bure has a number of outstanding morphological mitigation measures:

- Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution
- Bank rehabilitation / reprofiling
- Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works

- Management of the risk of fish entrainment in intakes for hydropower turbines or water resource purposes (or pumping stations) where there is downstream fish migration.
- Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone
- Operational and structural changes to locks, sluices, weirs, beach control, etc
- Appropriate channel maintenance strategies and techniques - minimise disturbance to channel bed and margins
- Appropriate channel maintenance strategies and techniques - woody debris
- Modify vessel design

Diatoms *Current Status:* Moderate

Sediment removal from Hoveton Great Broad

Diatoms are generally used in WFD to assess the impact of water quality on ecology. The diatom community of a waterbody responds in a predictable way to phosphate levels and by using the Darleq tool the level of impact is defined and a WFD classification produced. Given that the Darleq tool and hence the WFD classification respond to changes in phosphate it can be predicted that this project will have a negligible impact on this element. The only part of the project likely to impact diatoms is the sediment removal and redistribution as this may cause a short-term increase in suspended sediment and available phosphate. Also deposition of sediment can alter the diatom community to one dominated by motile taxa, this change could alter the classification. As both the HGB and Wroxham Broad connect with the River Bure it's likely that some suspended sediment and nutrients will flush into the River, but this will be small amounts that will be diluted by the flow of the River Bure and will only be temporary in nature.

Mitigation Measures

Silt curtains will be placed at points around the exit points around HGB to reduce suspended sediment flushing into the River Bure.

Conclusion

This project will cause no long-term deterioration for this element.

Macrophytes *Current Status:* Moderate

Sediment removal from Hoveton Great Broad

Long-term inputs of phosphate can impact on the macrophyte element. Any inputs of suspended nutrients and thus phosphates into the River Bure from HGB will be small and of a temporary nature, therefore no deterioration in this element is to be expected because of the dredging works.

Macroinvertebrates *Current status:* Good

Sediment removal from Hoveton Great Broad

Macroinvertebrates are good indicators of habitat quality, flow dynamics and oxygen levels, as well as being useful indicators of acute and chronic pollution incidents. Sediment is a natural part of a river but a

small input of sediment from the dredging works on HGB may cause a localised short-term impact on macroinvertebrates. Excessive sediment can alter the macroinvertebrate community as different taxa have varying tolerances to sediment. However, the inputs from these works will be negligible.

Mitigation Measures

Silt curtains will be placed at points around the exit points around HGB to reduce suspended sediment flushing into the River Bure.

Conclusion

The small, short-term and localised input of sediment from the sediment removal works will not alter the macroinvertebrate community and will therefore not have a negative impact on this element.

Fish Current status: Poor

The aim of this project is to improve the ecological value of the HGB which is connected to the River Bure and Hoveton Marshes. A healthy clear water broad with thriving macrophyte beds will be beneficial for fish which migrate between the broad, river and marshes. Aquatic macrophytes provide food for fish by encouraging macroinvertebrates as well as providing refuge from predation. Throughout the duration of this project the fish will be removed and excluded from the broad and the removed fish placed in the River Bure. This measure will improve water clarity and macrophyte growth in HGB and will not be in place indefinitely.

One of the restoration project's other aims is to improve the ecological quality of Hoveton Marshes which is connected to both the Bure and the HGB. The marshes are a network of dykes and ditches which have become silted up in recent years and are scrubbing over. The marshes were surveyed for fish in 1999 which discovered the presence of 8 species of fish. Clearly the marshes are an important habitat for fish and the restoration of this habitat as well as the improvement of HGB will ultimately have a beneficial impact on the River Bure fish.

Fish removal from Hoveton Great Broad into the River Bure

As part of the restoration project HGB will be isolated from the river and the majority of fish will be removed from the broad into the adjacent river. Only species that would be expected to occur in the Bure will be relocated into the river such as Bream and Roach. Any carp will be removed and located elsewhere.

Conclusion

None of the works will have a negative impact on this element in the River Bure. In fact the ecological improvement of HGB and Hoveton Marshes will benefit the River Bure fish population in the long-term as all of these habitats are connected.

Physio-chemical Current status: High

Dissolved Oxygen Current status: **High**

Phosphate Current status: **High**

pH *Current status:* **High**

Ammonia *Current status:* **High**

All four phys-chem elements are discussed in the same section here.

None of the works should cause any deterioration of the phys-chem elements. The small potential input of suspended nutrients as a result of the dredging works may lead to a short-term increase in phosphate levels but this will only be temporary and will not be sufficient to affect this element.

Any deterioration in ammonia and dissolved oxygen is generally linked to organic pollution. As these works are not dealing with any organic effluent or sewage treatment works these elements should not be affected by the restoration works.

The River Bure is a calcareous river and pH will not be impacted by these works.

Mitigation Measures

Silt curtains will be placed at points around the exit points around Hoveton Great Broad to reduce suspended sediment flushing into the River Bure

Conclusion

None of the physio-chemical elements will deteriorate as a result of this restoration project.

Hydrology *Current status:* Moderate

No water level management works are planned for this project nor are any of the other works expected to have an indirect affect on hydrology. No abstraction of water is planned either therefore no deterioration in this element is to be expected.

Morphology *Current status:* Moderate

Chemical *Current status:* Good

Good practice by contractors throughout the project, such as limiting any oil or petrol spills from machinery, should ensure that no deterioration in this element occurs.

Wroxham Broad (waterbody ID: GB30535953)

Table 3. Selected WFD data for the Wroxham Broad waterbody. Quality elements are italicised, statuses are in bold and failing elements are in red and passing elements in green.

Wroxham Broad (waterbody ID: GB30535953)

Waterbody size:	0.32km
Typology:	High alkalinity, very shallow
Hydromorphology designation:	Heavily modified

Biological Status: **Moderate**

<i>Diatoms:</i>	<i>Moderate</i>
<i>Chironomids</i>	<i>Moderate</i>
<i>Macrophytes</i>	<i>Moderate</i>
<i>Phytoplankton Blooms</i>	<i>Moderate</i>
<hr/>	
Physio-chemical Status:	Moderate
<i>Dissolved Oxygen:</i>	<i>High</i>
<i>Total Phosphorous</i>	<i>Moderate</i>
<i>Acid Neutralising Capacity</i>	<i>High</i>
<i>Ammonia</i>	<i>High</i>
<hr/>	
Specific pollutants:	High
<i>1-1-1-trichloroethane</i>	<i>Good</i>
<i>Copper</i>	<i>Good</i>
<i>Zinc</i>	<i>Good</i>
<i>Ammonia (Annex 8)</i>	<i>High</i>
<i>Iron</i>	<i>Good</i>
<hr/>	
Morphology Status:	Moderate
<i>Hydrology:</i>	Not assessed
<i>Morphology:</i>	<i>Moderate</i>
<hr/>	
Chemical Status:	Fail
<i>Priority hazardous substances</i>	<i>Fail</i>
<i>Tributyltin compounds</i>	<i>Fail</i>

Wroxham Broad is a navigable broad which connects with the River Bure. It is classed as a heavily modified waterbody which has suffered from bankside degradation due to a large volume of boat traffic. The only part of the restoration project which will occur in the Wroxham Broad is the creation of tall-herb fen habitat on Wroxham Island using geobags and sediment dredged from HGB. These works are actually vital for the long-term health of this waterbody. The past 50 years has seen degradation of marginal habitat and banks on the broad. If this was to continue unchecked then there is a risk of the broad's banks eroding to such an extent that it merges with the River Bure itself, thus undermining the autonomy of this waterbody. Any short-term deterioration must be viewed with this long-term outlook.

Wroxham Broad has two outstanding morphological mitigation measures:

- Bank rehabilitation
- Reprofilng and modify vessel design

Biological Current status: Moderate

Diatoms *Current status: Moderate*

Macrophytes *Current status: Moderate*

Chironomids *Current status: Moderate*

Phytoplankton blooms *Current status: Moderate*

All four biological elements are discussed in the same section here.

The tall-herb fen creation works on Wroxham Broad may cause localised turbidity through the suspension of sediment as well as an increase in total phosphorous. All the above biological elements are impacted by phosphorous and are indicators of eutrophication. The moderate status for all the biological elements suggests that Wroxham Broad is eutrophic. The tall-herb fen creation works should not negatively impact these elements. Any additions of phosphorous caused by the addition of sediment will be localised and focused on the margins of the broad.

Conclusion

There will be no deterioration in biological status for this waterbody as a result of the restoration works.

Specific pollutants *Current status: High*

The restoration works will not impact on any of these elements therefore no assessment is required.

Morphology *Current status: Moderate*

The restoration of Wroxham Island using geobags and dredged sediment from HGB will clearly impact on the morphology of the waterbody. However the scope of the works is to improve the marginal habitat and re-create a margin that is similar to one seen in the 1940's. Once the geobags have 'settled in' and have been colonised by macrophytes the margin should have a natural form and function. This part of the works actually fulfils one of the mitigation measures for this waterbody – bank rehabilitation/re-profiling. Any temporary deterioration in morphology status should be viewed with this in mind.

Conclusion

Wroxham Broad is already failing for morphology under WFD. The restoration works aim to improve this status by addressing one of the morphological mitigation measures. The restoration of marginal habitats is vital for the long-term preservation of this waterbody which has suffered from bank erosion in recent years. No deterioration of WFD status is expected.

Chemical *Current status: Fail*

This waterbody is failing for Tributyltin compounds; therefore this project will not cause a deterioration of this element as none of these compounds are being used. Good practice by contractors throughout the project, such as limiting any oil or petrol spills from machinery, should ensure that no further problems arise for this status.

Summary

The purpose of a WFD compliance assessment is to assess if a planned works or activity will have an impact on the WFD status of waterbodies directly affected by the project. In this case the actual aim of the project being assessed is to improve the ecological quality and thus WFD status of primarily the HGB waterbody, with ecological gains also planned for Hoveton Marshes and the Wroxham Broad. Despite the

predicted ecological benefits it was judged however that through the implementation of the project some WFD elements may be impacted, hence the production of this report.

This report has assessed each waterbody likely to be affected by the works by looking at elements individually in relation to each aspect of the project. Using expert judgement and evidence from previous works and research it is concluded that this project is WFD compliant and no deterioration of any status or element for any of the three waterbodies will occur. Summary tables are given below.

Table 4. Summary of the predicted WFD gains and losses for Hoveton Great Broad as a result of the planned restoration project.

Hoveton Great Broad (waterbody ID: GB30535977)	
WFD Gains	WFD losses
Improvement of macrophyte element from moderate to good	No deterioration of WFD status expected
Improvement of phytoplankton bloom element from poor to moderate	
Improvement of total phosphorous from moderate to good	

Table 5. Summary of the predicted WFD gains and losses for the River Bure as a result of the planned restoration project.

River Bure (waterbody ID: GB105034050930)	
WFD Gains	WFD losses
Possible long term improvement of fish element from poor to moderate through habitat improvement of Hoveton Marshes and HGB	No deterioration of WFD status expected

Table 6. Summary of the predicted WFD gains and losses for the Wroxham Broad as a result of the planned restoration project.

Wroxham Broad (waterbody ID: GB30535953)	
WFD Gains	WFD losses
Possible improvement of morphology status from moderate to good	No deterioration of WFD status expected
Possible improvement of macrophyte status from moderate to good	
Tall-herb fen habitat creation meets one morphological mitigation measure	

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