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# South Lincolnshire Reservoir Strategic Regional Options - Water Framework Directive

RAPID Gate 1 Submission

June 2021

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# Issue and Revision Record

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# Contents



## Tables

## Figures

# Executive summary

This report presents the results of the Water Framework Directive (WFD) assessment undertaken for the three concept design options considered for the South Lincolnshire Reservoir (SLR) Strategic Resource Option (SRO).

The WFD assesses the status of waterbodies through a two-stage assessment, an initial Level 1 basic screening and a Level 2 detailed impact screening. This report supports the Environment Assessment Report, that accompanies the Gate 1 submission report to the Regulators' Alliance for Progressing Infrastructure Development for the SLR options

In the 2019 Water Resources Management Plan (WRMP19), Anglian Water estimated an increasing deficit between water supply and demand in several Water Resource Zones over the coming decades. The development of the SLR as a strategic supply side option was identified by Anglian Water to meet the forecasted potable water demand increase and alleviate water supply shortage. The scheme was intended to increase the deployable output of the system by 150Ml/d under future climate change conditions.

During the WRMP19 process, Affinity Water and Anglian Water discussed a number of shared strategic options given the future supply deficit also identified by Affinity Water and the proximity of their areas of services. A potential transfer from Anglian Water to Affinity Water was subsequently included by both companies in their investment models as a solution directly linked to the SLR. The outputs of the initial route options appraisal, in consultation with stakeholders, Affinity Water and Anglian Water identified three exemplar sites for concept design, within the Black Sluice catchment which were selected for the Gate 1 submission.

The output of the Level 2 findings found that, subject to their progression through the approvals process, further WFD assessment would be required for all options, to improve the certainty of the levels of WFD risk outlined in the Gate 1 WFD Level 2 assessments.

# 1 Introduction

## 1.1 Overview

This document supports the Environment Assessment Report (EAR) that accompanies the Gate 1 submission to Regulators' Alliance for Progressing Infrastructure Development (RAPID) for the South Lincolnshire Reservoir (SLR) Strategic Resource Option (SRO). This report presents the findings of a Water Framework Directive (WFD) assessment applied to the SLR options.

## 1.2 SLR Options

The three options described in this report have been selected for concept design, from a larger list of potential solutions in consultation with stakeholders. Following discussion with Affinity Water and Anglian Water, three exemplar sites within the Black Sluice catchment were selected for the Gate 1 submission. These options are shown in Table 1.1. Further details on the options are set out in Chapter 2.

**Table 1.1: SLR Options**

| Option name | Description overview |
|---|---|
| Concept Design Option 1 (CDO1) | This option consists of the construction of a multi-purpose reservoir. Extraction points are assumed to be located on the River Witham and South Forty Foot Drain with transfers to the reservoir via pipeline. A third indirect intake provides for transfers from the River Trent to River Witham. |
| Concept Design Option 2 (CDO2) | This option consists of a single purpose public water supply reservoir. The transfer of water to the reservoir is achieved through diversions from the River Witham to the South Forty Foot Drain via open water transfer with flows then transferred through the South Forty Foot Drain to the reservoir. The Trent to Witham Transfer is also included within this option. |
| Concept Design Option 3 (CDO3) | This option consists of a single purpose public water supply reservoir. Extraction from the River Witham is achieved through open water transfer to the reservoir via the South Forty Foot Drain. The Trent to Witham Transfer is also included within this option. |

## 1.3 Methodology

### 1.3.1 Approach to WFD assessment for SROs

The WFD requires that all waterbodies (both surface and groundwater) achieve 'good status'. The Directive also requires that the waterbodies experience no deterioration in status. Good status is a function of good ecological status (biological, physico-chemical and hydromorphological elements and specific pollutants) and good chemical status (Priority Substances and Priority Hazardous Substances).

The All Company Working Group (ACWG) has developed a consistent framework for undertaking WFD assessments for SROs to demonstrate that options will not cause deterioration in status of any WFD waterbodies. The assessment considers mitigation that would need to be put in place to protect waterbody status. The assessment also considers WFD future objectives.

Two stages of assessment are completed under the ACWG WFD approach, an initial Level 1 basic screening and a Level 2 detailed impact screening. These are conducted/reported using a spreadsheet assessment tool which is automated and based on option information for Level 1 and expert judgment for Level 2. Further information on WFD classification and the approach

adopted can be found in *ACWG, WFD: Consistent framework for undertaking no deterioration assessments, Nov 2020*.

While SLR is a Water Resources East (WRE) scheme, the WFD assessment to support the Gate 1 submission was undertaken using the Water Resources South East (WRSE) methodology. Due to the Integrated Environmental Assessment scoping consultation only recently being completed, the WRE methodology was not ready for use in time for the preparation of this report. Furthermore, the use of the WRSE methodology is also justified on the basis that the receiving Water Resources Zone (WRZ) is within the WRSE region. It is expected the WRE methodology will be used to support the WFD work for Gate 2 submission. As the WRSE and WRE methodologies are very similar, this is not considered to be a constraint to the WFD assessment for the SLR SRO.

### 1.3.2 Level 1 – basic screening

The Level 1 WFD assessment was completed for all three SLR options. Level 1 assessment follows these steps:

- Identify affected waterbodies;
- Review SRO options;
- Identify possible impacts;
- Apply 'embedded' mitigation measures; and
- Calculate screening score (using a 6-point scale) to 'screen out' waterbodies and options with no or very minor potential impacts from further assessment.

The outcomes for the SLR options are summarised in Section 3 and Appendix A. Where waterbodies and option impacts were 'screened in', they have been taken forward to Level 2 assessment.

### 1.3.3 Level 2 – detailed impact screening

The second stage of WFD assessment has been completed for the SLR options that were screened in at Level 1, following the steps:

- Waterbody scale detailed assessment of impacts to each WFD quality element for each activity proposed as part of an SRO option;
- Assessment of data confidence level and design certainty *(note, confidence/certainty expected to be low at initial Gate 1 assessment but will increase over time);*
- Identification of further mitigation needs;
- Assessment of impacts after mitigation (scoring on a 6-point scale); and
- Identification of activities to improve certainty of assessment outcomes.

The outcomes of the Level 2 assessments are summarised in Section 4 and Appendix B.

### 1.3.4 WFD for Gate 2 and beyond

Where waterbodies and option impacts have been identified, recommendations have been made for increasing the confidence in the assessment. This is expected to be through increasing the level of detail available during later stages of option development for subsequent gateways if the relevant options are progressed. In combination assessments where different SRO option delivery is interdependent would also be required.

# 2 Scheme Description

## 2.1 Overview

As part of the Water Resource Management Plan 2019 (WRMP19), Anglian Water (AW) and Affinity Water (AFW) projected an increasing deficit between water supply and demand in several Water Resource Zones (WRZs) over the coming decades. The development of South Lincolnshire Reservoir (SLR), a winter storage reservoir in South Lincolnshire, was identified in AW WRMP19 as the preferred supply side option to meet their long-term demand for water.

A full scheme description can be found in the Gate 1 submission, the *Concept Design Report*, however a summary of the main aspects of the options is included below.

## 2.2 Option descriptions

For Gate 1, there are three options for the SLR as described in Table 2.1. Figures of the options are provided in Figure 2.1, Figure 2.2 and Figure 2.3 respectively.

**Table 2.1: SLR Gate 1 options**

| Option name | Option description |
|---|---|
| Concept Design Option 1 (CDO1) | This option consists of the construction of a multi-purpose reservoir. Extraction points are assumed to be located on the River Witham and South Forty Foot Drain with transfers to the reservoir via pipeline. A third indirect intake provides for transfers from the River Trent to River Witham and is sized to allow for the treatment and transfer of 150Ml/d Deployable Output (DO), as required by AW and AFW.<br>Benefits: Water resource (232Ml/d), flood risk mitigation in the in the lower part of the South Forty Foot Drain and Irrigation supply of 2,500Ml/year.<br>Interdependencies: Anglian Water to Affinity Water Transfer Scheme. |
| Concept Design Option 2 (CDO2) | This option consists of a single purpose public water supply reservoir. The transfer of water to the reservoir is achieved through diversions from the River Witham to the South Forty Foot Drain via open water transfer with flows then transferred through the South Forty Foot Drain to the reservoir. The Trent to Witham Transfer is also included within this option and is sized to allow for the treatment and transfer of 150Ml/d Deployable Output (DO), as required by AW and AFW.<br>Benefits: Water resource (189Ml/d), Flood risk mitigation in the South Forty Foot Drain and in the high-level carriers, particularly in Swaton and Billingborough, Increased summer flows in the South Forty Flood Drain and improved water quality in the Black Sluice catchment.<br>Interdependencies: Anglian Water to Affinity Water Transfer Scheme |
| Concept Design Option 3 (CDO3) | This option consists of a single purpose public water supply reservoir. Extraction from the River Witham is achieved through open water transfer to the reservoir via the South Forty Foot Drain. The Trent to Witham Transfer is also included within this option and is siized to allow for the treatment and transfer of 150Ml/d Deployable Output (DO), as required by AW and AFW.<br>Benefits: Water resource (189Ml/d), flood risk mitigation in the River Glen downstream of Surfleet reservoir, irrigation supply of 2,500Ml/year, increased summer flows in the South Forty Flood Drain, and improved water quality in the Black Sluice catchment.<br>Interdependencies: Anglian Water to Affinity Water Transfer Scheme |

**Figure 2.1: SLR Concept Design 1**

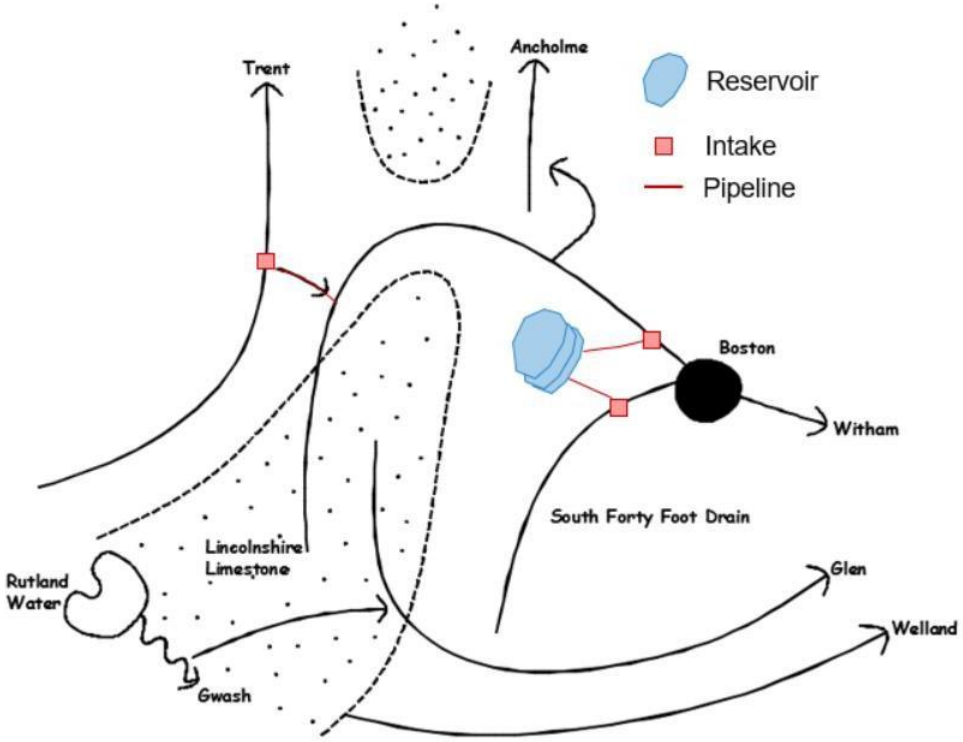



**Figure 2.2: SLR Concept Design 2**

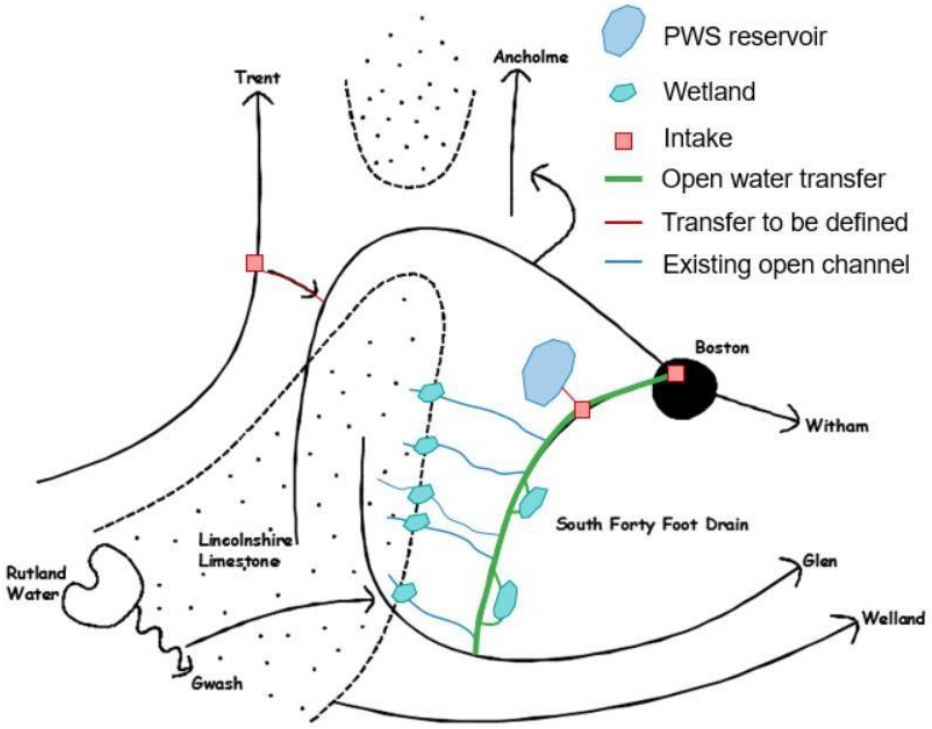
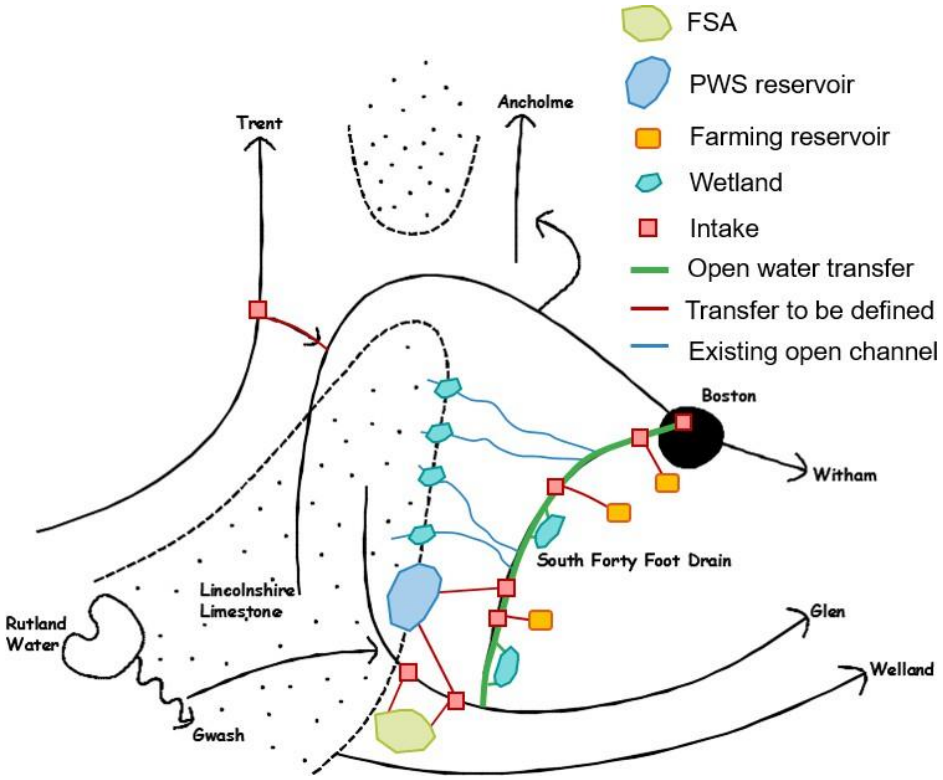


**Figure 2.3: SLR Concept Design 3**



# 3 WRSE Water Framework Directive findings (Level 1 WFD)

## 3.1 Concept Design Option 1 (CDO1)

The WRSE Stage 1 WFD assessment indicated that a Level 2 assessment would be required for the following WFD waterbodies: 'Black Sluice IDB draining to the South Forty Foot Drain' (ID: GB205030051515), 'Trent from Soar to The Beck' (ID: GB104028053110), 'Witham - conf Cringle Bk to conf Brant' (ID: GB105030056780)[1], 'Lower Witham' (ID: GB205030062426) and 'Brook Drain (including Marholm Brook)' (ID: GB105031050595).

**Table 3.1: WRSE WFD Level 1 assessment outcomes for Concept Design Option 1**

| Water resource 232Ml/d | |
|---|---|
| **WRSE Option ID** | Concept Design Option 1 (CDO1) |
| **Option Description** | Multi-purpose reservoir. Extraction points are assumed to be located on the River Witham and South Forty Foot Drain with transfers to the reservoir via pipeline. A third indirect intake provides for transfers from the River Trent to River Witham. Sized to allow for the treatment and transfer of 150Ml/d Deployable Output (DO), as required by AW and AFW.. |
| **Number of waterbodies passing WFD assessment** | 7 |
| **Waterbodies passing WFD assessment** | GB104028052632: Devon from Cotham to Trent<br>GB104028052501: Car Dyke<br>GB104028052631: Smite / Devon from Stroom Dyke to Cotham<br>GB205031050705: Vernatt's Drain<br>GB105031050600: Welland - conf Gwash to conf Greatford Cut<br>GB205031050685: Welland - conf Greatford Cut to tidal<br>GB205031050595: Maxey Cut |
| **Number of waterbodies requiring further WFD assessment** | 5 |
| **Waterbodies requiring further WFD assessment** | GB205030051515: Black Sluice IDB draining to the South Forty Foot Drain<br>GB104028053110: Trent from Soar to The Beck<br>GB105030056780: Witham - conf Cringle Bk to conf Brant<br>GB205030062426: Lower Witham<br>GB105031050595: Brook Drain (including Marholm Brook) |

## 3.2 Concept Design Option 2 (CDO2)

The WRSE Stage 1 WFD assessment indicated that a Level 2 assessment would be required for the following WFD waterbodies: 'Black Sluice IDB draining to the South Forty Foot Drain' (ID: GB205030051515), 'Trent from Soar to The Beck' (ID: GB104028053110), 'Witham - conf Cringle Bk to conf Brant' (ID: GB105030056780), 'Lower Witham' (ID: GB205030062426), 'Brook Drain (including Marholm Brook)' (ID: GB105031050595), 'South Beck' (ID: GB105030056520) and 'Swaton Drains' (ID: GB105030056515).

[1] Note, the formal WFD waterbody names include abbreviation of the words confluence (conf) and Beck (Bk). For this reason, these abbreviations have been used in this assessment.

**Table 3.2: WRSE WFD Level 1 assessment outcomes for Concept Design Option 2**

| Water resource 189Ml/d | |
|---|---|
| **WRSE Option ID** | Concept Design Option 2 (CDO2) |
| **Option Description** | Single purpose public water supply reservoir. The transfer of water to the reservoir is achieved through diversions from the River Witham to the South Forty Foot Drain via open water transfer with flows then transferred through the South Forty Foot Drain to the reservoir. The Trent to Witham Transfer is also included within this option and is sized to allow for the treatment and transfer of 150Ml/d Deployable Output (DO), as required by AW and AFW. |
| **Number of waterbodies passing WFD assessment** | 9 |
| **Waterbodies passing WFD assessment** | GB104028052632: Devon from Cotham to Trent<br>GB104028052501: Car Dyke<br>GB104028052631: Smite / Devon from Stroom Dyke to Cotham<br>GB205031050705: Vernatt's Drain<br>GB105031050600: Welland - conf Gwash to conf Greatford Cut<br>GB205031050685: Welland - conf Greatford Cut to tidal<br>GB205031050595: Maxey Cut<br>GB105030056490: Ousemere Lode<br>GB105030051555: Pointon Lode |
| **Number of waterbodies requiring further WFD assessment** | 7 |
| **Waterbodies requiring further WFD assessment** | GB205030051515: Black Sluice IDB draining to the South Forty Foot Drain<br>GB104028053110: Trent from Soar to The Beck<br>GB105030056780: Witham - conf Cringle Bk to conf Brant<br>GB205030062426: Lower Witham<br>GB105031050595: Brook Drain (including Marholm Brook)<br>GB105030056520: South Beck<br>GB105030056515: Swaton Drains |

## 3.3 Concept Design Option 3 (CDO3)

The WRSE Stage 1 WFD assessment indicated that a Level 2 assessment would be required for the following WFD waterbodies: ‘Black Sluice IDB draining to the South Forty Foot Drain’ (ID: GB205030051515), ‘Trent from Soar to The Beck’ (ID: GB104028053110), ‘Witham - conf Cringle Bk to conf Brant’ (ID: GB105030056780), ‘Lower Witham’ (ID: GB205030062426) and ‘Brook Drain (including Marholm Brook)’ (ID: GB105031050595) and Glen (ID: GB105031050720).

### Table 3.3: WRSE WFD Level 1 assessment outcomes for Concept Design Option 3

| Water resource 189Ml/d | |
|---|---|
| **WRSE Option ID** | Concept Design Option 3 (CDO3) |
| **Option Description** | Single purpose public water supply reservoir. Extraction from the River Witham is achieved through open water transfer to the reservoir via the South Forty Foot Drain. The Trent to Witham Transfer is also included within this option and Is sized to allow for the treatment and transfer of 150Ml/d Deployable Output (DO), as required by AW and AFW. |
| **Number of waterbodies passing WFD assessment** | 11 |
| **Waterbodies passing WFD assessment** | GB104028052632: Devon from Cotham to Trent<br>GB104028052501: Car Dyke<br>GB104028052631: Smite / Devon from Stroom Dyke to Cotham<br>GB205031050705: Vernatt's Drain<br>GB105031050600: Welland - conf Gwash to conf Greatford Cut<br>GB205031050685: Welland - conf Greatford Cut to tidal<br>GB205031050595: Maxey Cut<br>GB105030056520: South Beck<br>GB105030056515: Swaton Drains<br>GB105030056490: Ousemere Lode<br>GB105030051555: Pointon Lode |
| **Number of waterbodies requiring further WFD assessment** | 6 |
| **Waterbodies requiring further WFD assessment** | GB205030051515: Black Sluice IDB draining to the South Forty Foot Drain<br>GB104028053110: Trent from Soar to The Beck<br>GB105030056780: Witham - conf Cringle Bk to conf Brant<br>GB205030062426: Lower Witham<br>GB105031050595: Brook Drain (including Marholm Brook)<br>GB105031050720: Glen |

# 4 Level 2 Water Framework Directive assessments

The second stage of WFD assessment has been completed for SLR SRO options that were screened in at Level 1. Section 4.1 to Section 4.3 provide an overview of the Level 2 WFD assessments undertaken for the three Concept Design Options (outlined in Section 1). Section 4.4 provides a summary table for each option assessed.

## 4.1 Concept Design Option 1 (CDO1)

The Level 2 WFD assessment identified possible deterioration risks to fish, invertebrates, hydrological regime, dissolved oxygen and phosphate. This reflects a potential risk of reduced flow due to increased abstraction, and the additional intake structure required. It also identified potential impediments to meeting Good Ecological Status, if the hydrological regime of the waterbody was affected to the extent that Physico-chemical concentrations could increase, particularly those elements which are currently below good or if water body objectives could be compromised (by changes to the hydrological regime or due to physical modification). A summary of the Level 2 WFD assessment is included in Table 4.1 and detailed outputs are presented in Appendix B.

## 4.2 Concept Design Option 2 (CDO2)

The Level 2 WFD assessment identified possible deterioration risks to fish, invertebrates, hydrological regime, dissolved oxygen and phosphate. This reflects a potential risk of reduced flow due to increased abstraction, and the additional intake structure required. It also identified potential impediments to meeting Good Ecological Status, if the hydrological regime of the waterbody was affected to the extent that Physico-chemical concentrations could increase, particularly those elements which are currently below good or if water body objectives could be compromised (by changes to the hydrological regime or due to physical modification). A summary of the Level 2 WFD assessment is included in Table 4.2 and detailed outputs are presented in Appendix B.

## 4.3 Concept Design Option 3 (CDO3)

The Level 2 WFD assessment identified possible deterioration risks to fish, invertebrates, hydrological regime, dissolved oxygen and phosphate. This reflects a potential risk of reduced flow due to increased abstraction, and the additional intake structure required. It also identified potential impediments to meeting Good Ecological Status, if the hydrological regime of the waterbody was affected to the extent that Physico-chemical concentrations could increase, particularly those elements which are currently below good or if water body objectives could be compromised (by changes to the hydrological regime or due to physical modification). A summary of the Level 2 WFD assessment is included in Table 4.3 and detailed outputs are presented in Appendix B.

## Table 4.1: Concept Design Option 1 (CDO1) Level 2 WFD Summary

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB205030051515 | Black Sluice IDB draining to the South Forty Foot Drain | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation, particularly for the reservoir. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB104028053110 | Trent from Soar to The Beck | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Further detail on design option and confirmation of embedded mitigation | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105030056780 | Witham - conf Cringle Bk to conf Brant | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB205030062426 | Lower Witham | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105031050595 | Brook Drain (including Marholm Brook) | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

**Table 4.2: Concept Design Option 2 (CDO2) Level 2 WFD Summary**

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB205030051515 | Black Sluice IDB draining to the South Forty Foot Drain | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation, especially for the open water transfer. There is potential to incorporate ecological/hydromorphological mitigation/enhancements through creation of more 'natural' and channel cross-sectional profiles[2]. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

[2] See, for example Mayer, L., Moodie, I., Carson, C., Vines, K., Nunns, M., Hall, K., Redding, M., Sharman, P. & Bonney, S. (2017) Good Ecological Potential in Fenland Waterbodies: A Guide to Management Strategies and Mitigation Measures for achieving Good Ecological Potential in Fenland Waterbodies. Association of Drainage Authorities & Environment Agency.

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB104028053110 | Trent from Soar to The Beck | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105030056780 | Witham - conf Cringle Bk to conf Brant | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB205030062426 | Lower Witham | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105031050595 | Brook Drain (including Marholm Brook) | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105030056520 | South Beck | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation, particularly for the reservoir. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105030056515 | Swaton Drains | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation, particularly for the reservoir. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

## Table 4.3: Concept Design Option 3 (CDO3) Level 2 WFD Summary

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB205030051515 | Black Sluice IDB draining to the South Forty Foot Drain | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation, especially for the reservoir and the open water transfer. There is potential to incorporate ecological/hydromorphological mitigation/enhancements through creation of more 'natural' and channel cross-sectional profiles[2]. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB104028053110 | Trent from Soar to The Beck | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Further detail on design option and confirmation of embedded mitigation | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105030056780 | Witham - conf Cringle Bk to conf Brant | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB205030062426 | Lower Witham | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105031050595 | Brook Drain (including Marholm Brook) | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

| Waterbody ID | Waterbody Name | Confidence in WFD data | Confidence in option design | Requirements to improve confidence | Mitigation measures | Deterioration between status classes | Compromises water body objectives | Assists attainment of water body objectives | Further comments |
|---|---|---|---|---|---|---|---|---|---|
| GB105031050720 | Glen | Low | Low | Detailed review of all baseline ecological WFD data, including results of any surveys already undertaken for SLR and other prospective schemes (e.g. macrophyte and fish surveys).<br><br>Detailed hydrological assessment of the impacts of proposed abstractions and/or discharges on water quality / concentration of key physicochemical parameters.<br><br>Review of water body objectives (mitigation measures).<br><br>Further detail on design option and confirmation of embedded mitigation, particularly for the FSA. | Fish and eel screening at new intakes/pumping stations (if required).<br><br>Abstraction and discharge conditions to be set to minimise changes to hydrological regime that could cause deterioration of biological and physicochemical WFD elements. | Possible | Possible | No | Conservative assessment made based on high-level design information available. Subject to further detail on the design, the hydrological effects identified at this stage may be precautionary. |

# 5 Conclusions

## 5.1 Summary

For the SLR scheme, three Concept Design Options have been subject to a WFD assessment.

The Level 1 WFD assessment completed for Gate 1 by WRSE indicated that a number of options are anticipated to have very low risks of being non-compliant with WFD objectives, and do not require further assessment; these are listed below based on Concept Design Option.

- **Concept Design Option 1 (CD01)**
  - GB104028052632: Devon from Cotham to Trent
  - GB104028052501: Car Dyke
  - GB104028052631: Smite / Devon from Stroom Dyke to Cotham
  - GB205031050705: Vernatt's Drain
  - GB105031050600: Welland - conf Gwash to conf Greatford Cut
  - GB205031050685: Welland - conf Greatford Cut to tidal
  - GB205031050595: Maxey Cut
- **Concept Design Option 2 (CD02)**
  - GB104028052632: Devon from Cotham to Trent
  - GB104028052501: Car Dyke
  - GB104028052631: Smite / Devon from Stroom Dyke to Cotham
  - GB205031050705: Vernatt's Drain
  - GB105031050600: Welland - conf Gwash to conf Greatford Cut
  - GB205031050685: Welland - conf Greatford Cut to tidal
  - GB205031050595: Maxey Cut
  - GB105030056490: Ousemere Lode
  - GB105030051555: Pointon Lode
- **Concept Design Option 3 (CD03)**
  - GB104028052632: Devon from Cotham to Trent
  - GB104028052501: Car Dyke
  - GB104028052631: Smite / Devon from Stroom Dyke to Cotham
  - GB205031050705: Vernatt's Drain
  - GB105031050600: Welland - conf Gwash to conf Greatford Cut
  - GB205031050685: Welland - conf Greatford Cut to tidal
  - GB205031050595: Maxey Cut
  - GB105030056520: South Beck
  - GB105030056515: Swaton Drains
  - GB105030056490: Ousemere Lode
  - GB105030051555: Pointon Lode

The findings indicate that there are potentially precautionary WFD compliance risks associated primarily with the operation of new abstractions and discharges, as well as open water transfer for Concept Design Options 2 and 3. Under all three design options, potential hydrological effects could conflict with achieving WFD status objectives. This is particularly the case where

hydrology/river flow is an existing limiting factor, recorded in WFD baseline data as a 'reason for not achieving good'. The potential biological effects, particularly on fish, and physico-chemical changes (for example, reduced dilution) would require further assessment as outlined in Section 5.2.

For new or modified intakes and pumping stations, it is recognised that appropriate fish and eel screening would be required to prevent entrainment. At Gate 1, this has been considered as likely mitigation, but moderate/amber risks have been maintained until option designs and assessments are further progressed.

## 5.2 Further assessment

Subject to their progression through the approvals process, further WFD assessment would be required for the following options, to improve the certainty of the levels of WFD risk outlined in the Gate 1 WFD Level 2 assessments

- **Concept Design Option 1 (CD01)**
  - GB205030051515: Black Sluice IDB draining to the South Forty Foot Drain
  - GB104028053110: Trent from Soar to The Beck
  - GB105030056780: Witham - conf Cringle Bk to conf Brant
  - GB205030062426: Lower Witham
  - GB105031050595: Brook Drain (including Marholm Brook)
- **Concept Design Option 2 (CD02)**
  - GB205030051515: Black Sluice IDB draining to the South Forty Foot Drain
  - GB104028053110: Trent from Soar to The Beck
  - GB105030056780: Witham - conf Cringle Bk to conf Brant
  - GB205030062426: Lower Witham
  - GB105031050595: Brook Drain (including Marholm Brook)
  - GB105030056520: South Beck
  - GB105030056515: Swaton Drains
- **Concept Design Option 3 (CD03)**
  - GB205030051515: Black Sluice IDB draining to the South Forty Foot Drain
  - GB104028053110: Trent from Soar to The Beck
  - GB105030056780: Witham - conf Cringle Bk to conf Brant
  - GB205030062426: Lower Witham
  - GB105031050595: Brook Drain (including Marholm Brook)
  - GB105031050720: Glen

Areas for future focus include:

- Consultation with the Environment Agency to present and discuss key WFD risks and proposed approach to improving certainty of assessments;
- Collation and review of Heavily Modified Waterbody (HMWB) measures information from the Environment Agency for inclusion into the assessment of potential impediment to obtaining Good Ecological Potential (GEP);
- Collation and review of detailed baseline data concerning WFD biological, physicochemical and hydromorphological elements identified as being at yellow, amber, or red risk in the Level 2 assessments. This may include existing Environment Agency as well as Affinity and Anglian Water long term WFD and water quality monitoring data within the relevant

waterbodies, and targeted baseline surveys being undertaken specifically for the SRO assessments;

- Development of a conceptual model linking together how potential hydrological changes could influence water quality and the sensitivity of aquatic communities to those changes;
- Further information on the design and operation of the options;
- Under Concept Design Options 2 and 3, there is potential to incorporate ecological/hydromorphological mitigation/enhancements through creation of more 'natural' and channel cross-sectional profiles as part of the open water transfer scheme. This should be explored up to Gate 2 and beyond;
- Assessment of the combined potential WFD effects/risks of inter-reliant multiple options (where SLR is reliant on other SROs being delivered);
- Update to Level 2 WFD assessments to incorporate additional information; and
- Outlining further work or modelling required to demonstrate compliance into Gate 3.

It is noted that there may be potential changes to WFD-related legislation related to Britain's exit from the European Union (EU). The EU WFD legislation is transposed in England and Wales by *The Water Environment (WFD) (England and Wales) Regulations 2017*[3]. The Cycle 3 River Basin Management Plans (RBMPs) are also due to be published in 2021, which may bring about changes in the baseline status and objectives for waterbodies. Where necessary, changes will need to be accounted for in updates to the WFD assessments.

[3] https://www.legislation.gov.uk/uksi/2017/407/made

# A. Level 1 WFD assessment output tables

The outputs can be provided upon request.

# B. Level 2 WFD assessment output tables

The outputs can be provided upon request.

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