



DROUGHT PLAN: ENVIRONMENTAL ASSESSMENT REPORT

South West Area: Upper Calder Area Reservoirs

Report for: Yorkshire Water Services Ltd

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YW Drought Plan 2026 Environmental Support

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Glossary

Abstraction Licence

The authorisation granted by the Environment Agency (England) or Natural Resources Wales (for sites in Wales) to allow the removal of water from a source.

Biochemical Oxygen Demand (referred to as BOD)

The amount of oxygen that would be consumed if all the organic material in one litre of water were oxidised by bacteria and protozoa.

Compensation Releases

Water company licences that authorise abstractions from a reservoir may have conditions imposed, whereby specified amount of water has to be released into the watercourse, downstream of the reservoir in order to compensate the river for the abstraction.

Discharge Consent

A written consent issued by the Environment Agency permitting the discharge of specific pollutants into the aquatic environment. Discharge consents have conditions attached to them that limit the amount and concentration that can be discharged to ensure that there is no threat to the environment.

Drought Order

An authorisation granted by the Secretary of State (England) or Welsh Ministers (Wales) under drought conditions which imposes restrictions upon the use of water and/or allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.

Drought Permit

An authorisation granted by the Environment Agency (England) or Natural Resources Wales (for sites in Wales) under drought conditions which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.

Environmental Drought

Environmental droughts arise from reduced water flows in rivers and streams. In the summer raised temperatures may further exacerbate drought conditions. Such conditions cause physiological stress to living organisms, the degree of stress increasing with drought severity and time.

Environmental Quality Ratio (EQR)

EQRs express the current condition of a biological quality element such as macroinvertebrates or fish. This is achieved by comparing the observed value of the appropriate metric (for example WHPTASPT) calculated from samples with the value of the same metric expected at WFD reference state.

Local Wildlife Sites (LWS)

Local Wildlife Sites are non-statutory designations. They are areas which are locally important for the conservation of wildlife. They are identified and selected for the significant habitats and species that they contain.

Lotic-Invertebrate Index Flow Evaluation (referred to as LIFE)

Is a method that allows the aquatic invertebrate community recorded at a site to be scored according to its dependence on current velocity. The LIFE value obtained can be compared to that predicted for the site under normal flow conditions and may show if the invertebrate community is experiencing flow related stress. Comparing observed and predicted scores for each gives an Environmental Quality Index (EQI) that is used as a measure of stress experienced at a site from low flow. A value of 1.0 indicates that the invertebrate community has the flow sensitivity predicted for the site. A value of less than 0.975 indicates the possibility of significant stress due to low flow.

Macroinvertebrate

Macroinvertebrates are small, but visible with the naked eye, animals without backbones (insects, worms, larvae etc.). Waterbodies have communities of aquatic macroinvertebrates. The species composition, species diversity and abundance in a given waterbody can provide valuable information on the relative health and water quality of a waterway.

Natural Environment and Rural Communities (NERC) Act Section 41

The Natural Environment and Rural Communities (NERC) Act came into force on 1 October 2006. Section 41 of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The NERC Act Section 41 list contains many of England's rarest and most threatened species. The lists are known as the Section 41 habitats of principal importance (also known as 'priority habitats') and the Section 41 species of principal importance (also known as 'priority species').

pH

A measure of the acidity or alkalinity of a liquid based on a logarithmic scale of concentration of hydrogen ions. < 7 is acidic, > 7 is alkaline.

Ramsar site

Internationally important wetland site.

Special Area of Conservation (SAC)

Special Area of Conservation – Designated under the European Habitats Directive (1991)

Special Protection Area (SPA)

Special Protection Area – Classified under the European Birds Directive (1979)

Site of Special Scientific Interest (SSSI)

A site given a statutory designation by Natural England or Natural Resources Wales because it is particularly important, on account of its nature conservation value.

Supply Drought

A supply drought occurs when water sources are at low levels due to a lack of rainfall. Water companies manage resources to ensure public supplies do not run out.

Walley Hawkes Paisley Trigg (referred to as WHPT)

Is a method that allows the aquatic invertebrate communities recorded at a site to be scored according to their tolerance to environmental pressures such as organic pollution. WHPT can be expressed as a score (the sum of values for each taxon in a sample), as an average score per taxon (ASPT) and as the number of scoring taxa (N-taxa). WFD status is based on ASPT and N-taxa. WHPT was introduced as the basis for the UK's river invertebrate status classification under the Water Framework Directive in the second River Basin Management Plans, published in 2015.

Abbreviations

AOD	–	Above Ordnance Datum
BOD	–	Biochemical Oxygen Demand
CIEEM	–	Chartered Institute of Ecology and Environmental Management
CSO		Combined Sewer Overflow
DPG	–	Environment Agency (2025) Drought Plan Guideline
EAR		Environmental Assessment Report
EcIA	–	Ecological Impact Assessment
EMP	–	Environmental Monitoring Plan
EQR	–	Ecological Quality Ratio
HoF		Hands off Flow
JNCC	–	Joint Nature Conservation Committee
LIFE	–	Lotic-invertebrate Index for Flow Evaluation
LNR	–	Local Nature Reserve
LWS		Local Wildlife Site
MCZ		Marine Conservation Zone
MI	–	Megalitres (1MI is equivalent to 1000 cubic metres or 1,000,000 litres)
NERC	–	Natural Environment and Rural Communities (refers to Section 41 of the Act)
NNR	–	National Nature Reserve
PSI		Proportion of Sediment-sensitive Invertebrates
PyWR		Python Water Resources: an open-source water resources simulation model
RBMP		River Basin Management Plan
RHS	–	River Habitat Survey
RICT		River Invertebrate Classification Tool
SAC	–	Special Area of Conservation
SPA	–	Special Protection Area
SRP		Soluble Reactive Phosphorous
SSSI	–	Site of Special Scientific Interest
TUB		Temporary Use Ban
WFD		Water Framework Directive: Council of the European Communities 2000 Directive 2000/60/EC (OJ No L 327 22.12.2000) (establishing a framework for Community action in the field of water policy). As transposed into UK law by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Statutory Instrument 2003 No. 3242
WHPT	–	Walley Hawkes Paisley Trigg (see Glossary)
WwTW	–	Wastewater Treatment Works

Executive summary

This Environmental Assessment Report (EAR) provides an independent and robust assessment of the potential environmental effects of the implementation of Yorkshire Water Services Ltd's (YWSL) South West Area Reservoirs: Middle Calder Area reservoir drought options. The report has been prepared in support of YWSL's Drought Plan 2027.

The environmental assessment has been conducted in accordance with Government regulations and using the Environment Agency's 2025 Drought Plan Guideline (DPG)¹ and the Environment Agency's 'Environmental Assessment for Water Company Drought Plans' supplementary guidance.

In accordance with the DPG, the environmental assessment comprises the following components:

- an assessment of the likely changes in hydrology (flow/level regime) due to implementing the proposed drought options;
- identification of the key environmental receptors that are sensitive to these changes and an assessment of the likely impacts on these receptors;
- identification of mitigation that may be required to prevent or reduce impacts on sensitive receptors; and
- recommendations for baseline, in-drought and post-drought order monitoring requirements.

The environmental assessment focuses on the potential changes to water availability (levels and flows) and any consequent implications for geomorphology, water quality, ecology and other relevant environmental receptors, for example, landscape, navigation, recreation and heritage.

This EAR considers the impacts of the South West Area - Upper Calder area reservoir drought options in Appendix A and Appendix B, with a summary presented in **Sections 5** and **6**. Cumulative impacts with other drought options listed in YWSL's Drought Plan are considered. The assessments undertaken confirm the receptors requiring consideration of monitoring and mitigation; which are summarised in **Section 6** and provided in full in the Draft Drought Plan 2027 Environmental Monitoring Plan (EMP).

Throughout the environmental assessment process, YWSL have proactively engaged key stakeholders, including the Environment Agency and Natural England.

Key stakeholders will be further consulted throughout the drought permit/order application process.

¹ Environment Agency (2025) Water Company Drought Plan Guideline, March 2025.

CONTENTS

1. INTRODUCTION	1
1.1 PURPOSE OF DOCUMENT	1
1.2 BACKGROUND TO STUDY	1
1.3 CONSULTATION	2
1.4 CONTENT OF REPORT	2
2. DROUGHT MANAGEMENT PROPOSALS	4
3. APPROACH TO ENVIRONMENTAL ASSESSMENT	5
3.1 OVERVIEW	5
3.2 LIMITATIONS OF ASSESSMENT	5
4. DROUGHT OPTIONS OVERVIEW	7
4.1 DROUGHT PERMIT/ORDER DESCRIPTIONS	7
4.2 POTENTIALLY IMPACTED REACHES	10
4.3 WFD WATERBODIES IN STUDY AREA	13
5. PHYSICAL ENVIRONMENT EFFECTS	14
6. RECEPTORS ASSESSMENT, MONITORING AND MITIGATION	15
6.1 SUMMARY OF IMPACTS	15
6.2 MONITORING AND MITIGATION	17

Appendices

APPENDIX A PHYSICAL ENVIRONMENT
APPENDIX B ENVIRONMENTAL RECEPTORS
APPENDIX C MONITORING AND ECOLOGICAL MITIGATION MEASURES

1. INTRODUCTION

1.1 PURPOSE OF DOCUMENT

Yorkshire Water Services Ltd (YWSL) is updating its Statutory Drought Plan, last published in April 2022 (the 'Drought Plan 2022'). The Draft 2027 Drought Plan will reflect the guidance provided in the Environment Agency's Drought Plan Guideline (DPG). The Environment Agency shared an updated draft DPG with water companies in July 2024 along with an updated draft of the supplementary guidance on the environmental assessment for water company drought planning. The guidance was subsequently consulted on and a final version, DPG2025², was provided in March 2025. The DPG requires that water companies must demonstrate in their drought plan that they have met their responsibility to monitor, assess and where possible mitigate for the environmental impact of all their supply side drought options, including drought permits and drought orders. Drought permits/orders are management actions that, if granted, can allow more flexibility to manage water resources and the effects of drought on public water supply and the environment. Ultimately, the environmental assessments should inform choices on when and how to use the different supply side drought options considered in a drought plan.

The objective of this Environmental Assessment Report (EAR) is to provide an independent and robust assessment of the potential environmental effects of the implementation of the South West Area Reservoirs: Upper Calder Area drought permits. This EAR has been prepared in support of a drought permit application in Summer 2025 to the Environment Agency, in accordance with the Water Resources Act 1991, as amended by the Environment Act 1995, the Water Act 2003 and subsequently the Water Act 2014.

The environmental assessment has been conducted in accordance with Government regulations and using the Environment Agency's DPG2025 and the 'Environmental Assessment for Water Company Drought Plans - supplementary guidance'.

In accordance with the DPG, the environmental assessment comprises the following components:

- an assessment of the likely changes in hydrology (flow/level regime) due to implementing the proposed drought options.
- identification of the key environmental receptors that are sensitive to these changes and an assessment of the likely impacts on these receptors.
- identification of mitigation that may be required to prevent or reduce impacts on sensitive receptors.
- recommendations for baseline, in-drought and post-drought order monitoring requirements.

The methodology for this environmental assessment has been developed in consultation with the Environment Agency and is documented separately in 'YWSL's Drought Plan 2027 Environmental Assessment Methodology'³. A summary of the assessment approach is provided in **Section 3**.

The assessments undertaken in this EAR confirm the receptors that require consideration of mitigation and the appropriate monitoring triggering mitigation. Appropriate mitigation actions identified are both available and practicable and reflect previous agreement with the Environment Agency (see **Section 1.3**). The methodologies and details for monitoring and mitigation requirements are documented in the standalone document 'YWSL's Draft Drought Plan Environmental Monitoring Plan (EMP)'. A summary of the monitoring and mitigation requirements are included in **Section 6** of this EAR.

This EAR should be read alongside the Methodology and EMP documents.

1.2 BACKGROUND TO STUDY

Water companies in England and Wales are required to prepare and maintain Statutory Drought Plans under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003 (and subsequently the Water Act 2014), which set out the short operational steps a company will take before, during and after a drought. The Water Industry Act 1991 defines a Drought Plan as 'a plan for how the water undertaker will

² Environment Agency (2025) Water company drought plan guideline. March 2025.

³ Ricardo (2025). Yorkshire Water Drought Plan 2027 Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to drought orders or drought permits’.

Yorkshire Water Services Limited (YWSL) published their current statutory Drought Plan in April 2022 (the ‘DP 2022’) which encompasses the period 2022-2027. Drought Plans are updated every five years to remain relevant and align with updated guidance. As a result, YWSL are now in the process of revising their statutory Drought Plan for the period 2027-2032. The Drought Plan (England) Directions set out the timescales for publication of the Drought Plans. The updated directions for Draft Drought Plan 2027 are yet to be published but it is anticipated that water companies will submit these to the Secretary of State in October 2025.

The Drought Plan provides a comprehensive statement of the actions YWSL will consider implementing during drought conditions to safeguard essential water supplies to customers and minimise environmental impact. Drought Plans encompass a number of drought options that will only be implemented if and when required. Each drought is different in terms of its severity, season, location and duration and each combination of these factors may require a bespoke reaction in terms of measures. In the context of drought planning, individual drought options are taken to constitute alternatives.

1.3 CONSULTATION

The purpose of these studies, as well as informing any future assessment process and providing a generic template, is to allow a more considered consultation process and to encompass consultees’ concerns in a timely manner, avoiding the time constraints necessary for an actual drought permit/order application.

Throughout the preparation and submission of the Final Drought Plan 2022, YWSL proactively engaged with key stakeholders and regulators regarding the scope and outcomes of the environmental assessment, including with the Environment Agency and Natural England. Discussions were also held between YWSL and the Environment Agency on the scope of monitoring/mitigation in Autumn 2018 following a period of prolonged dry weather. These discussions identified certain issues around the appropriateness and practicality of YWSL’s monitoring-led mitigation plan as set out in its Draft Drought Plan 2019 EMP. The outcome of these discussions and resulting agreements informed the basis of the approach for the update of the environmental assessments and EMP for the Drought Plan 2022.

Throughout 2024 and to date, YWSL have held a number of meetings with the Environment Agency during the early stages of the preparation of the Draft Drought Plan 2027, including several meetings focused on the proposed approach to the environmental assessments which are documented in the Drought Plan 2027 Environmental Assessment Methodology⁴. Proactive consultation will continue to be conducted for the Draft Drought Plan 2027 submission.

Further consultation with key stakeholders will be undertaken throughout the drought permit application process.

1.4 CONTENT OF REPORT

This EAR reflects the environmental assessment reporting components described in the DPG as being required to ensure the Upper Calder Area reservoir drought permit/orders are ‘application ready’. The structure of this EAR is provided below with reference to other relevant documents.

Section 1: Introduction

Section 2: Drought management proposals - including an overview of YWSL’s water supply system, drought planning, the need for the applications, alternative options and proposed drought permit/order details (to be completed at the time of a drought permit application)

Section 3: Approach to environmental assessment - description of the approach to assessing environmental impacts and identification of mitigation and monitoring requirements, with reference to the details which are provided in YWSL’s Drought Plan 2027 Environmental Assessment Methodology⁵.

⁴ Ricardo (2025). Yorkshire Water Drought Plan 2027 Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

⁵ Ricardo (2025). Yorkshire Water Drought Plan 2027 Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

- Section 4:** **Drought options overview: Upper Calder Area reservoirs** - overview of drought permit conditions.
- Section 5:** **Physical environment effects: Upper Calder Area reservoirs** - baseline assessment of physical environment and assessment of potential changes in the physical environment as a result of the drought options, and from cumulative operation with options described in other EARs. Detailed information is provided in **Appendix A** and summarised in **Section 5**.
- Section 6:** **Receptors assessment, monitoring and mitigation: Upper Calder Area reservoirs** - impact assessment on environmental receptors, identification of mitigation and monitoring requirements, including cumulative reaches. Detailed information is provided in **Appendix B** and in YWSL's Draft Drought Plan EMP and summarised in **Section 6**. **Appendix C** summarises the full suite of monitoring and mitigation measures as detailed in the EMP.

Appendices

- Appendix A** Physical Environment
- Appendix B** Environmental Receptors
- Appendix C** Environmental Monitoring and Mitigation Measures

2. DROUGHT MANAGEMENT PROPOSALS

See Appendix A which provides details of the drought management proposals.

3. APPROACH TO ENVIRONMENTAL ASSESSMENT

3.1 OVERVIEW

The environmental assessment of the drought options in this report has been prepared in accordance with Environment Agency's 2025 DPG; specifically, the Environment Agency's 'Environmental Assessment for Water Company Drought Plans - supplementary guidance'. The approach to environmental assessment and the bespoke assessment methodologies used have been developed in consultation with the Environment Agency and are documented separately in YWSL's Drought Plan 2027 Environmental Assessment Methodology⁶ ('the Methodology').

Depending on the particular ongoing water resources drought, different management options may be available and the full range of drought permit/orders may not be used by YWSL at the same time. This EAR considers the impacts of implementation of all nine of the Upper Calder Area reservoir drought permit/orders.

The Environment Agency's 2025 DPG requires the completion of environmental assessment and production of an environmental monitoring plan for each of the supply side actions included in a drought plan. The environmental assessments should also include any mitigation measures that could be implemented. The Methodology provides detailed approaches to the specific requirements of the DPG which are:

- Setting out the Zone of Influence (ZOI) and timing of the drought options (see **Section 3.4** of the Methodology) and the likely changes to the hydrology (or hydrogeology) due to a proposed action (**Section 3.5** of the Methodology).
- Identifying the key receptors of the environment which are likely to be affected by these changes and assess their sensitivity (see **Section 3.6** of the Methodology).
- Assess the likely impact on these receptors, allocate a level of confidence in your assessment and set out the actions you will take to reduce uncertainty (see **Section 3.7** of the Methodology).
- Mitigating against the potential impacts and where datasets are considered insufficient to undertake an environmental assessment, it is the responsibility of the water company to implement environmental monitoring to generate the information required (see **Section 3.8** of the Methodology).

The overall approach taken in completing the environmental assessment to demonstrate an understanding of the impact on the environment of implementing the proposed drought options is illustrated in **Figure 3-1**.

Results of the assessment have also informed the Habitats Regulations Assessment (HRA) and Strategic Environmental Assessment (SEA) which support YWSL's Draft Drought Plan 2027 and are documented separately. Outcomes of any subsequent assessment, i.e. as documented in this report, will be continually reviewed in terms of implications for SEA and HRA.

The Environment Agency's 2025 DPG also requires water companies to 'consider the combined environmental effects of your supply side drought options, and where relevant, the combination effects of your actions with those of neighbouring water companies and other abstractors'. The SEA and HRA for a drought plan as a whole should inform these combined assessments.

3.2 LIMITATIONS OF ASSESSMENT

Details on the quality of the data collected and used in the assessment, limitations and any assumptions made, are included in the relevant technical appendices (**Appendix A** and **B**).

For receptors where the assessment remains uncertain because of data limitation, the requirement for additional targeted monitoring has been considered and is documented in YWSL's Drought Plan EMP..

⁶ Ricardo (2025). Yorkshire Water Drought Plan 2027 Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

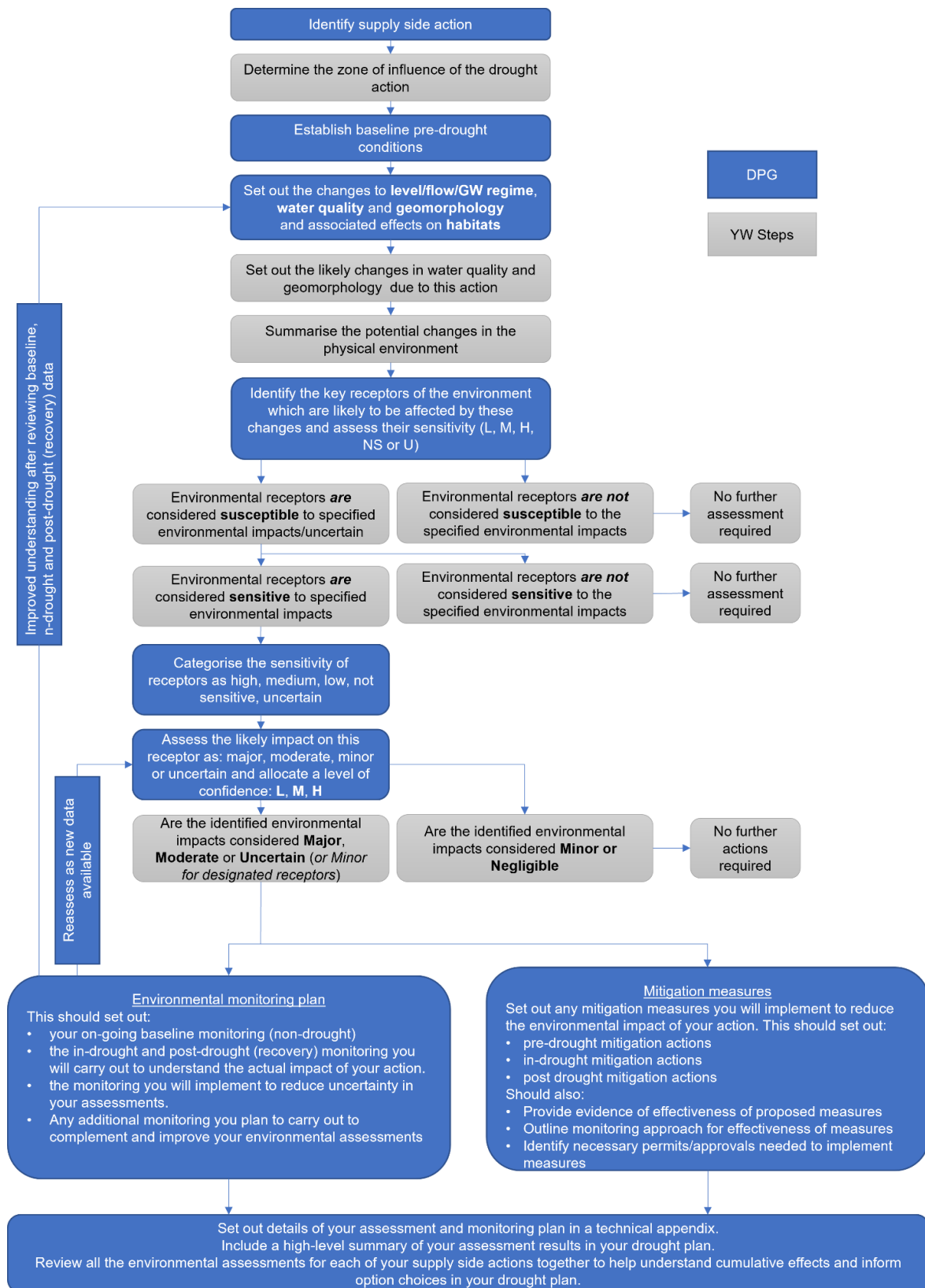


Figure 3-1 Approach to undertaking environmental assessments as identified in the 2025 DPG. Steps in blue are 2025 DPG tasks. Tasks indicated in grey are YWSL tasks

4. DROUGHT OPTIONS OVERVIEW

4.1 DROUGHT PERMIT/ORDER DESCRIPTIONS

This EAR assesses the potential impacts on the environmental receptors of the South West Area during the period of implementation of associated drought options, specifically the Upper Calder Area. This EAR should be read in conjunction with the Middle Calder EAR. Two EARs have been produced to aid clarity due to the large number of reservoirs in the South West, however the study area should be considered as continuous.

The Upper Calder Area reservoirs comprise ten drought options as summarised in **Table 4-1**:

1. Gorple Lower Reservoir drought permit;
2. Widdop Reservoir drought permit;
3. Walshaw Dean Lower Reservoir drought permit;
4. Warley Moor Reservoir drought permit;
5. Ogden Reservoir drought permit;
6. Withens Clough Reservoir drought permit;
7. Turvin Clough Prescribed Flow drought permit;
8. Ryburn Reservoir drought permit;
9. Booth Wood Reservoir drought permit;
10. Slitheroe Bridge Maintained Flow drought permit;

Further details on the existing arrangements at each site and the proposed drought options are found in **Appendix A**, Section A2. The study area is illustrated in **Figure 4-1**.

Table 4-1 South West Area - Upper Calder reservoirs drought permit descriptions

Compensation Water Source	Receiving Watercourse	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Gorple Lower Reservoir drought permit						
Gorple Lower Reservoir	Graining Water	2.70	1.35	1.35	0.89	1.81
Widdop Reservoir drought permit						
Widdop	Graining Water	3.24 (Jan- Sept) 12.96 (Oct- Dec) above normal control line 6.5 (Oct- Dec) below normal control line	1.62 (Jan – Sept) 3.24 (Oct - Dec)	1.62 (Jan- Sept) 3.25 (Oct- Dec) below normal control line	1.07 (Jan – Sept) 2.15 (Oct – Dec)	2.17 (Jan- Sept) 4.35 (Oct- Dec) below normal control line
Walshaw Dean Lower Reservoir drought permit						
Walshaw Dean Lower	Alcomden Water	3.78 (Jan- Sept) 15.12 (Oct- Dec) above normal control line 7.56 (Oct- Dec) below normal control line	1.89 (Jan - Sept) 3.78 (Oct - Dec)	1.89 (Jan- Sept) 3.78 (Oct - Dec)	1.25 (Jan - Sept) 2.49 (Oct - Dec)	2.52 (Jan- Sept) 5.07 (Oct- Dec)
Warley Moor Reservoir drought permit						

Compensation Water Source	Receiving Watercourse	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Warley Moor	Luddenden Brook	3.02	1.51	1.51	1.00	2.02
Ogden Reservoir drought permit						
Ogden	Hebble Brook	3.42	1.71	1.71	1.13	2.29
Withens Clough Reservoir drought permit						
Withens Clough	Withens Clough	2.64	1.32	1.32	0.87	1.77
Turvin Clough Prescribed Flow drought permit						
Turvin Clough Prescribed Flow	Turvin Clough	6.82	3.41	3.41	2.25	4.57
Ryburn Reservoir drought permit						
Ryburn Reservoir	River Ryburn	5.90	2.95	2.95	1.95	3.95
Booth Wood Reservoir drought permit						
Booth Wood Reservoir	Booth Dean Clough	3.41	1.71	1.71	1.13	2.28
Slitheroe Bridge Maintained Flow						
Slitheroe Bridge Maintained Flow ⁷	River Ryburn	18.00	9.00	9.00	6.00	12.00

⁷ It should be noted that the Slitheroe Bridge maintained flow drought option could not be applied unless the upstream Booth Wood and Ryburn drought options were applied also. The scheme is not licensed and in practice is not independent of the Booth Wood and Ryburn drought options.

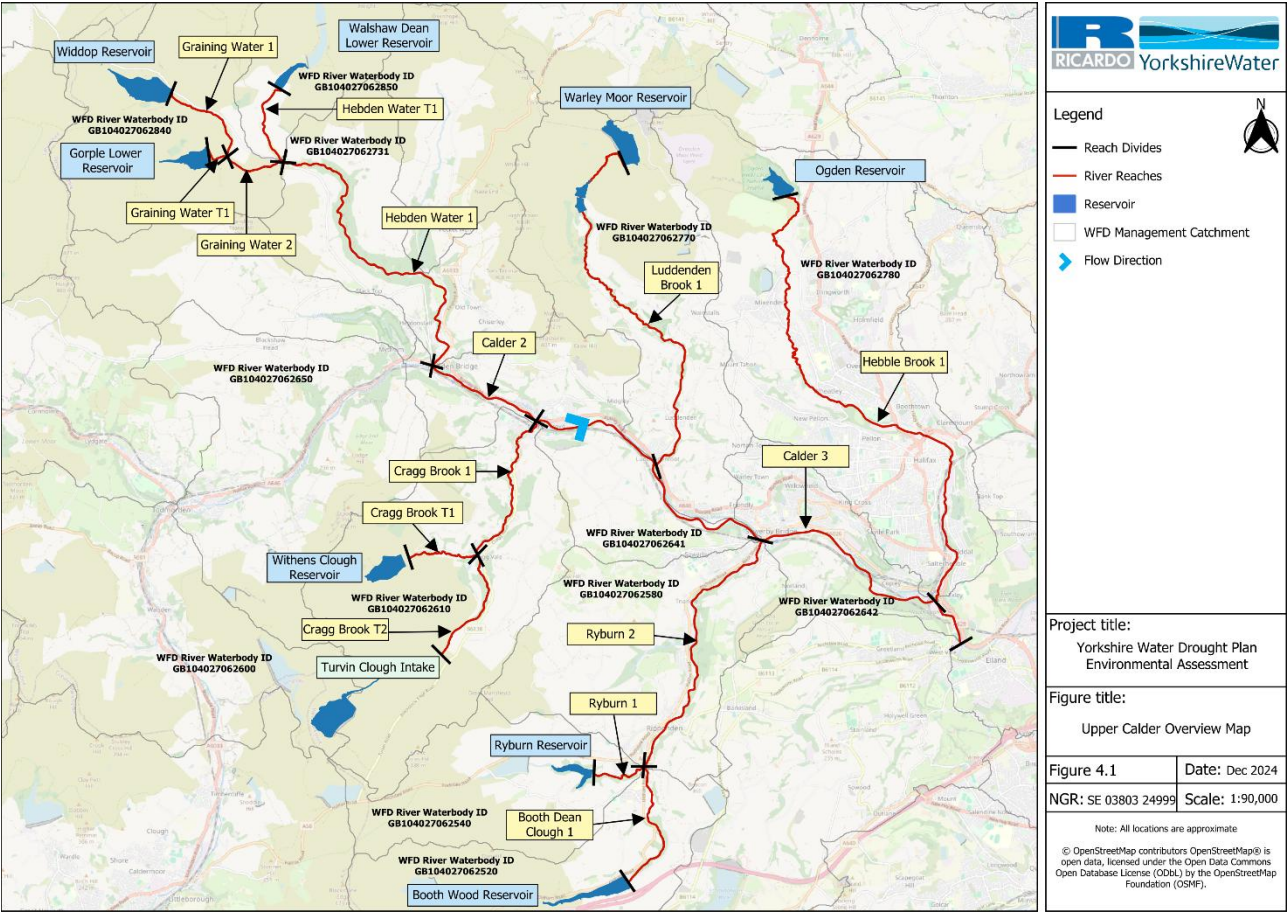
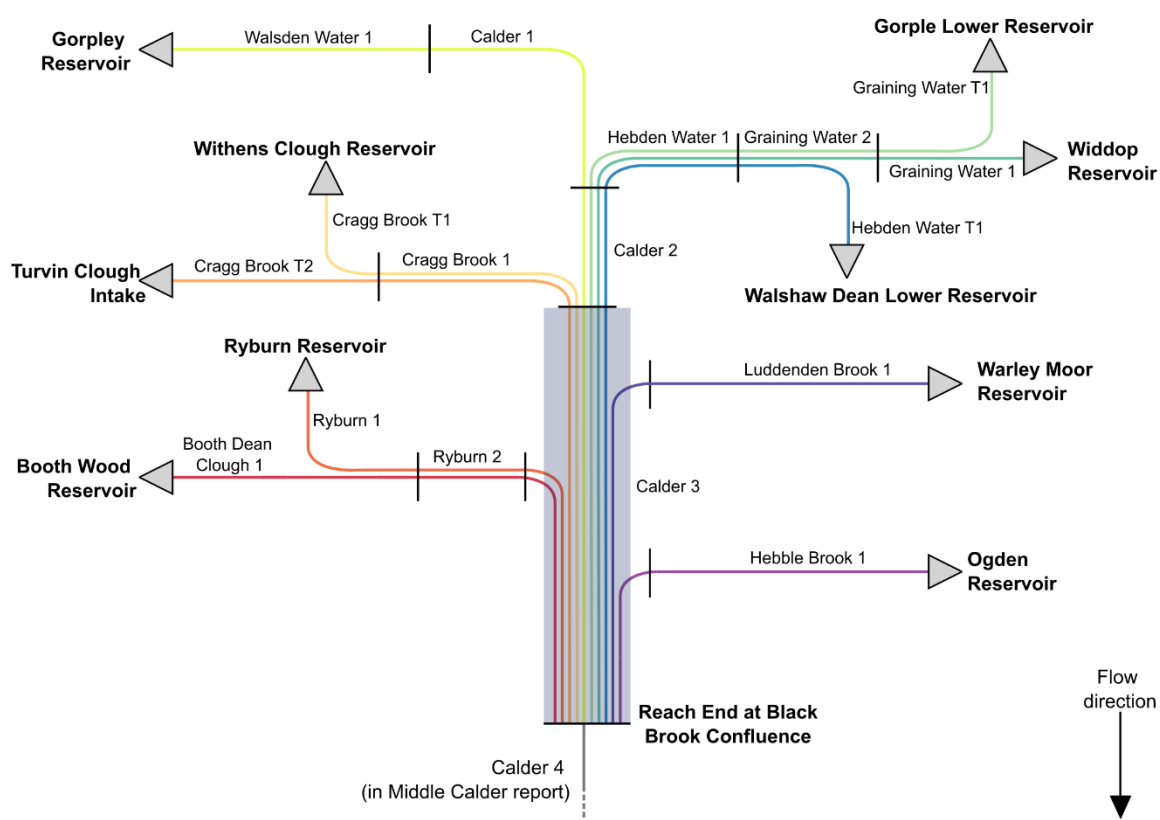


Figure 4-1 Overview of drought permits

4.2 POTENTIALLY IMPACTED REACHES

The zone of influence associated with each drought option is defined through hydrological effects. Within the overall zone of influence, reaches are then defined on a hydrological basis. Section 3.4 of YWSL's Drought Plan 2027 Environmental Assessment Methodology⁸ sets out this approach in detail. The reaches for the Upper Calder Area reservoir drought permits/orders have been defined previously during the environmental assessment of YWSL past drought plans. **Table 4-2** provides details of these reaches, which are illustrated in **Figure 4-1**, and in a schematic below in **Figure 4-2**.

Figure 4-2 South West Area: Upper Calder reservoirs drought permit/orders reach schematic⁹



⁸ Ricardo (2025). Yorkshire Water Drought Plan 2027. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

⁹ Note – Gorpley Reservoir is an EA drought order option and the assessment for this and the associated reaches is documented in a separate stand-alone Environmental Assessment Report.

Table 4-2 South West Area: Upper Calder Reservoirs reach details

Reach name	Watercourse name	Reach start	Reach end	Downstream reach	Drought measure									
					Gorple Lower Reservoir	Widdop Reservoir	Walshaw Dean Lower Reservoir	Warley Moor Reservoir	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Ryburn Reservoir	Booth Wood Reservoir	Slitheroe Bridge Maintained Flow	Ogden Reservoir
Graining Water T1	Gorple Lower Brook	Gorple Lower Reservoir	Graining Water	Graining Water 2	✓									
Graining Water 1	Graining Water	Widdop Reservoir	Confluence between Gaining Water and Gorple Lower Brook	Graining Water 2		✓								
Graining Water 2	Graining Water	Confluence between Gaining Water and Gorple Lower Brook	Confluence Between Graining Water and Alcomden Water	Hebden Water 1	✓	✓								
Hebden Water T1	Alcomden Water	Walshaw Dean Lower Reservoir	Confluence Between Graining Water and Alcomden Water	Hebden Water 1			✓							
Hebden Water 1	Hebden Water	Confluence between Graining Water and Alcomden Water	River Calder	Calder 2	✓	✓	✓							
Calder 2	River Calder	Confluence between Hebden Water and the River Calder	Confluence between Cragg Brook and the River Calder	Calder 3	✓	✓	✓							
Cragg Brook T1	Withens Clough	Withens Clough Reservoir	Confluence between Withens Clough and Turvin Clough	Cragg Brook 1					✓					
Cragg Brook T2	Turvin Clough	White Holme Reservoir	Confluence between Withens Clough and Turvin Clough	Cragg Brook 1						✓				
Cragg Brook 1	Cragg Brook	Confluence between Withens Clough and Turvin Clough	River Calder	Calder 3					✓	✓				
Calder 3	River Calder	Confluence between Cragg Brook and the River Calder	Confluence between Black Brook and the River Calder	Calder 4 (Middle Calder EAR)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Luddenden Brook 1	Luddenden Brook	Warley Moor Reservoir	Confluence between Luddenden Brook and the River Calder	Calder 2				✓						
Booth Dean Clough 1	Booth Dean Clough	Booth Wood Reservoir	Confluence between Booth Dean Clough and the River Ryburn	Ryburn 2								✓		
Ryburn 1	River Ryburn	Ryburn Reservoir	Confluence between Booth Dean Clough and the River Ryburn	Ryburn 2							✓			
Ryburn 2	River Ryburn	Confluence between Booth Dean Clough and the River Ryburn	River Calder	Calder 3							✓	✓	✓	

Reach name	Watercourse name	Reach start	Reach end	Downstream reach	Drought measure									
					Gorple Lower Reservoir	Widdop Reservoir	Walshaw Dean Lower Reservoir	Warley Moor Reservoir	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Ryburn Reservoir	Booth Wood Reservoir	Slitheroe Bridge Maintained Flow	Ogden Reservoir
Hebble Brook 1	Hebble Brook	Ogden Reservoir	Confluence between Hebble Brook and the River Calder	Calder 3					✓					

Footnote: those drought measures which are located upstream of the River Calder mainstem reaches Calder 2 and Calder 3, but that do not significantly influence flow in those reaches are shaded grey. A bespoke assessment for any future drought permit/order application for these drought options only would not incorporate these reaches. Similarly the monitoring and mitigation specification would not reference these reaches

4.3 WFD WATERBODIES IN STUDY AREA

The study area and focus of the environmental assessment covers the WFD waterbodies listed in **Table 4-3**. The WFD waterbodies are also illustrated on **Figure 4-1**.

Table 4-3 WFD waterbodies considered in the assessment

Drought Option	Reach	WFD Waterbody
Gorple Lower Reservoir	Graining Water T1	GB104027062840 Graining Water from Widdop Reservoir to Hebden Water
Widdop Reservoir	Graining Water 1	GB104027062840 Graining Water from Widdop Reservoir to Hebden Water
Gorple Lower Reservoir; Widdop Reservoir	Graining Water 2	GB104027062840 Graining Water from Widdop Reservoir to Hebden Water
Walshaw Dean Lower Reservoir	Hebden Water T1	GB104027062850 Alcomden Water from Walshaw Dean Reservoir to Widdop
Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir	Hebden Water 1	GB104027062731 Hebden Water from Widdop Beck to River Calder
Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Withens Clough Reservoir; Turvin Clough Prescribed Flow	Calder 2	GB104027062641 Calder from Colden Water to Ryburn Confluence
Withens Clough Reservoir	Cragg Brook T1	GB104027062610 Cragg Brook from Source to River Calder
Turvin Clough Prescribed Flow	Cragg Brook T2	GB104027062610 Cragg Brook from Source to River Calder
Withens Clough Reservoir; Turvin Clough Prescribed Flow	Cragg Brook 1	GB104027062610 Cragg Brook from Source to River Calder
Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Ogden Reservoir; Turvin Clough Prescribed Flow; Ryburn Reservoir; Booth Wood Reservoir; Slitheroe Bridge Maintained Flow	Calder 3	Calder from Colden Water to Ryburn Confluence (GB104027062641) Calder from Ryburn Confluence to River Colne (GB104027062642)
Warley Moor Reservoir	Luddenden Brook 1	GB10402706770 Luddenden Brook from source to River Calder
Booth Wood Reservoir	Booth Dean Clough 1	GB104027062520 Booth Dean Clough from Source to River Ryburn
Ryburn Reservoir	Ryburn Reach 1	GB104027062540 Ryburn from Source to Booth Dean Clough
Ryburn Reservoir; Booth Wood Reservoir; Slitheroe Bridge Maintained Flow	Ryburn Reach 2	GB104027062580 Ryburn from Booth Dean Clough to River Calder
Ogden Reservoir	Hebble Brook 1	GB104027062780 Hebble Brook from source to River Calder

5. PHYSICAL ENVIRONMENT EFFECTS

Potential impacts on the physical environment due to the Upper Calder Area reservoir drought permit/orders are summarised below in **Table 5-1**. Full details are provided in **Appendix A**.

Table 5-1 Summary of potential changes in the physical environment as a result of the South West Area: Upper Calder reservoirs drought options

Reach	River flow impact	Flow depleted reaches and risks*	Risk to river habitats	Risk to water quality
Graining Water T1	Major	None	Moderate	Minor
Graining Water 1	Major	None	Moderate	Minor
Graining Water 2	Major	None	Moderate	Minor
Hebden Water T1	Major	None	Moderate	Minor
Hebden Water 1	Major	Major	Major	Moderate
Calder 2	Moderate (summer/autumn) Minor (winter)	None	Minor	Moderate
Cragg Brook T1	Major	None	Moderate	Minor
Cragg Brook T2	Major	None	Major	Minor
Cragg Brook 1	Major	None	Moderate	Minor
Calder 3	Moderate (summer/autumn) Minor (winter)	Minor	Minor	Moderate
Luddenden Brook 1	Major	None	Major	Minor
Booth Dean Clough 1	Major	None	Moderate	Minor
Ryburn 1	Major	Major	Major	Moderate
Ryburn 2	Major	Minor	Major	Moderate
Hebble Brook 1	Major	None	Moderate	Moderate

* the length of flow depleted reach is indicated where appropriate. 'Flow depleted reach' refers to the length between the abstraction and discharge point of non-consumptive licences (e.g. aquaculture, hydro-power).

6. RECEPTORS ASSESSMENT, MONITORING AND MITIGATION

6.1 SUMMARY OF IMPACTS

Potentially sensitive receptors (environmental receptors) have been identified within each impacted reach considering the level of impact on the physical environment identified in **Section 5** and **Appendix A**. This sensitivity assessment has been used to identify receptors which have been considered for detailed assessment. Both these stages are documented in full in **Appendix B**.

Potential impacts on environmental receptors due to the Upper Calder Area reservoir drought permit/orders are summarised below in **Table 6-1**.

Table 6-1 Summary of potential impacts to environmental receptors as a result of the Upper Calder Area reservoirs drought options

River Reach	Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Associated Drought Options	Gorple Lower Reservoir	Widdop Reservoir	Gorple Lower Reservoir; Widdop Reservoir	Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Withens Clough Reservoir; Turvin Clough Prescribed Flow	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Withens Clough Reservoir; Turvin Clough Prescribed Flow	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Ogden Reservoir; Turvin Clough Prescribed Flow; Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Warley Moor Reservoir	Booth Wood Reservoir	Ryburn Reservoir	Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Ogden Reservoir
WFD Waterbody	GB104027062840 Graining Water from Widdop Resr to Hebden Water			GB104027062850 Alcomden Water - Walshaw Dean Resrs to Widdop	GB104027062731 Hebden Water from Widdop Beck to R Calder	GB104027062641 Calder from Colden Water to Ryburn Confluence	GB104027062610 Cragg Brook from Source to River Calder			GB104027062641 Calder from Colden Water to Ryburn Confluence GB104027062642 Calder from Ryburn Confluence to River Colne	GB104027062770 Luddenden Brook from source to River Calder	GB104027062520 Booth Dean Clough from Source to River Ryburn	GB104027062540 Ryburn from Source to Booth Dean Clough	GB104027062580 River Ryburn from Booth Dean Clough to River Calder	GB104027062780 Hebble Brook from Source to River Calder
Statutory Designated Sites/Local Wildlife Sites															
N/A															
NERC and Notable Species Receptors															
White-clawed crayfish <i>Austropotamobius pallipe</i>	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	N/A
Otter <i>Lutra lutra</i>	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	N/A	Negligible	Negligible	Negligible
Water vole <i>Arvicola amphibious</i>	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	N/A	Moderate	Moderate	Moderate
<i>Ameletus inopinatus</i>	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Atherix ibis</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A
<i>Oulimnius troglodytes</i>	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Paraleptophlebia cincta</i>	N/A	N/A	N/A	N/A	N/A	N/A	Minor	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Potamophylax rotundipennis</i>	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor
<i>Rhyacophila septentrionis</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A
<i>Sialis nigripes</i>	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A
<i>Stictonectes lepidus</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A
<i>Tinodes unicolor</i>	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout <i>Salmo trutta</i>	Moderate	Moderate	Moderate	Moderate	Major	Moderate	Moderate	Major	Moderate	Moderate	Major	Moderate	Major	Major	Moderate
Bullhead <i>Cottus gobio</i>	N/A	N/A	N/A	N/A	Moderate	Minor	N/A	Moderate	Minor	Minor	N/A	N/A	N/A	Moderate	Minor
Grayling <i>Thymallus thymallus</i>	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A
WFD Waterbody WFD Status Receptors															
Fish	Minor	Moderate	Moderate	Moderate	Major	Minor	Moderate	Major	Moderate	Minor	Major	Moderate	Major	Major	Moderate
Invertebrates	Minor	Moderate	Moderate	Moderate	Moderate	Minor	Moderate	Moderate	Moderate	Minor	Moderate	Moderate	Major	Major	Major

6.2 MONITORING AND MITIGATION

The Environment Agency's 2025 DPG requires YWSL to set out a monitoring plan following assessment of the sensitivity and impacts associated with drought options, as indicated in **Figure 3-1**. In particular the DPG indicates that any drought plan should be accompanied by an EMP that sets out:

- on-going baseline monitoring to inform sensitivity and impact assessments.
- the monitoring that will be implemented to reduce uncertainty identified in the assessment of either the sensitivity of the environment or impacts on receptors considered in the detailed assessment.
- the in-drought and post-drought (recovery) monitoring that will be carried out to understand the actual impact of drought options.

As indicated in Figure 3-1; the DPG also requires YWSL to set out a mitigation plan following the assessments of potential impacts associated with each drought management action. In particular the DPG indicates that any drought plan should be accompanied by an EMP that sets out:

- measures to avoid, reduce or mitigate adverse impacts on the environment of supply side drought options; and
- compensation measures for adverse effects that remain after mitigation measures have been applied.

The DPG requires that this information is set out as a separate document alongside, and linked to, each environmental assessment.

The assessments undertaken in this EAR confirm the receptors requiring consideration of mitigation and appropriate monitoring triggering mitigation. YWSL's Drought Plan EMP provides a comprehensive description of the schedule of monitoring and trigger-based mitigation agreed as relevant and practicable based on the nature and timing of permit implementation. The mitigation and monitoring proposals will act as a safeguard that responds and is responsive to both predicted and unpredicted drought impacts.

The monitoring and mitigation recommendations have been developed through agreement with the Environment Agency, in particular during 2018, 2020 and 2022 (see **Section 1.3**). Consultation between YWSL and the Environment Agency is ongoing, and the EMP will be updated as required to reflect future agreements.

The EMP also documents the baseline monitoring recommendations which have been identified as required following the completion of the environmental assessment. Baseline monitoring will ensure that sufficient baseline data is available to inform the sensitivity and impact assessment and to reduce any uncertainty in the assessment.

A summary of the monitoring and mitigations recommendations for the South West Area – Upper Calder reservoir drought permits are provided in **Table 6-2** and **Table 6-3**. **Appendix C** provides a description of each monitoring and mitigation measure with reference to the codes used in **Table 6-2** and **Table 6-3**.

Table 6-2 Summary of recommended monitoring for the South West Area: Upper Calder reservoirs drought options

Reach		Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Hydrological Impact		Major	Major	Major	Major	Major	Moderate (summer/ autumn) Minor (winter)	Major	Major	Major	Moderate (summer/ autumn) Minor (winter)	Major	Major	Major	Major	Major
Associated Drought Options		Gorple Lower Reservoir	Widdop Reservoir	Gorple Lower Reservoir; Widdop Reservoir	Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Withens Clough Reservoir; Turvin Clough Prescribed Flow	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Withens Clough Reservoir; Turvin Clough Prescribed Flow	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Ogden Reservoir; Turvin Clough Prescribed Flow; Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Warley Moor Reservoir	Booth Wood Reservoir	Ryburn Reservoir	Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Ogden Reservoir
WFD Waterbody		GB10402706 2840	GB10402706 2840	GB10402706 2840	GB10402706 2850	GB10402706 2731	GB10402706 2641	GB10402706 2610	GB10402706 2610	GB10402706 2610	GB10402706 2641 GB10402706 2642	GB10402706 2770	GB10402706 2520	GB10402706 2540	GB10402706 2580	GB10402706 2780
Code	Description	Graining Water from Widdop Resr to Hebden Water	Graining Water from Widdop Resr to Hebden Water	Graining Water from Widdop Resr to Hebden Water	Alcomden Water - Walshaw Dean Resrs to Widdop	Hebden Water from Widdop Beck to R Calder	Calder from Colden Water to Ryburn Confluence	Cragg Brook from Source to River Calder	Cragg Brook from Source to River Calder	Cragg Brook from Source to River Calder	Calder from Colden Water to Ryburn Confluence. Calder from Ryburn Confluence to River Colne	Luddenden Brook from source to River Calder	Booth Dean Clough from Source to River Ryburn	Ryburn from Source to Booth Dean Clough	River Ryburn from Booth Dean Clough to River Calder	Hebble Brook from Source to River Calder
Baseline Monitoring																
BMON_H	Routine flow/levels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BMON_WQ	Routine WQ	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BMON_E1	Macroinvertebrate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BMON_E2	Fisheries (including Lamprey)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BMON_E3	Habitat Walkover mapping	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
On-set of Environmental drought																
ODMON_WS	River condition walkover survey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
In-Drought (during drought option implementation)																
IDMON_WSE	Surveillance walkover (habitat quality and ecological stress)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDMON_WS WQ1	Surveillance walkover (water quality and ecological stress)	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	x
IDMON_WS WQ2	CSO Monitoring	x	x	x	x	✓	✓	x	x	x	✓	x	x	x	✓	✓
Post-Drought (Drought Options Removed)																
PDMON_E1	Macroinvertebrate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PDMON_E2	Fisheries	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 6-3 Summary of recommended mitigation measures for the South West Area: Upper Calder reservoirs drought options

Reach		Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Hydrological Impact		Major	Major	Major	Major	Major	Moderate (summer/autumn) Minor (winter)	Major	Major	Major	Moderate (summer/autumn) Minor (winter)	Major	Major	Major	Major	Major
Associated Drought Options		Gorple Lower Reservoir	Widdop Reservoir	Gorple Lower Reservoir; Widdop Reservoir	Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Withens Clough Reservoir; Turvin Clough Prescribed Flow	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Withens Clough Reservoir; Turvin Clough Prescribed Flow	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Ogden Reservoir; Turvin Clough Prescribed Flow; Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge	Warley Moor Reservoir	Booth Wood Reservoir	Ryburn Reservoir	Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Ogden Reservoir
WFD Waterbody		GB10402706 2840	GB10402706 2840	GB10402706 2840	GB10402706 2850	GB10402706 2731	GB10402706 2641	GB10402706 2610	GB10402706 2610	GB10402706 2610	GB10402706 2641 GB10402706 2642	GB10402706 2770	GB10402706 2520	GB10402706 2540	GB10402706 2580	GB1040270 62780
Code	Description	Graining Water from Widdop Resr to Hebden Water	Graining Water from Widdop Resr to Hebden Water	Graining Water from Widdop Resr to Hebden Water	Alcomden Water - Walshaw Dean Resrs to Widdop	Hebden Water from Widdop Beck to R Calder	Calder from Colden Water to Ryburn Confluence	Cragg Brook from Source to River Calder	Cragg Brook from Source to River Calder	Cragg Brook from Source to River Calder	Calder from Colden Water to Ryburn Confluence, Calder from Ryburn Confluence to River Colne	Luddenden Brook from source to River Calder	Booth Dean Clough from Source to River Ryburn	Ryburn from Source to Booth Dean Clough	River Ryburn from Booth Dean Clough to River Calder	Hebble Brook from Source to River Calder
In-Drought (During Drought Option Implementation)																
IDMIT_H1	Third party abstraction	x	x	x	x	✓	x	x	x	x	x	x	x	✓	x	✓
IDMIT_H2	Temporary cessation for SSSI's	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
IDMIT_WQ1	Improving the effluent quality	x	x	x	x	x	x	x	x	x	x	x	x	x	✓	x
IDMIT_WQ2	Short-term relaxation of drought permit flow reduction	x	x	x	x	✓	✓	x	x	x	✓	x	x	x	✓	✓
IDMIT_E1	Gradual or temporary adjustments to abstraction or compensation flows	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDMIT_E2	Aeration of watercourse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDMIT_E3	Refuges	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDMIT_E4	In-stream structures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IDMIT_E5	Inspection and clearing of screens	x	x	x	x	✓	✓	x	x	x	✓	x	x	x	✓	✓
IDMIT_E6	Fish/crayfish rescue and relocate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Post-Drought (Drought Options Removed)																
PDMIT_E1	Habitat enhancement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PDMIT_E2	Freshets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PDMIT_E3	Barrier modification	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PDMIT_E4	Coarse fish restocking	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

APPENDICES

- Appendix A** Physical Environment
- Appendix B** Environmental Receptors
- Appendix C** Environmental Monitoring and Mitigation Measures

APPENDIX A PHYSICAL ENVIRONMENT

Insert Appendix A – Physical Environment

APPENDIX B ENVIRONMENTAL RECEPTORS

Insert Appendix B – Environmental Receptors

APPENDIX C MONITORING AND ECOLOGICAL MITIGATION MEASURES

Table C1-1 Monitoring and mitigation measures included in the YWSL Draft Drought Plan EMP

Baseline Monitoring - to ensure an adequate baseline dataset exists to describe non-drought conditions for those receptors likely to be impacted by drought permit implementation and to fill any data gaps and reduce uncertainty identified during the environmental assessment	
BMON_H	EA/YWSL to continue monitor river flows and levels/reservoir levels and spill at key monitoring sites
BMON_WQ	EA to continue routine water quality monitoring at existing network of sites on current monthly programme, which includes those on un-impacted reaches suitable as control sites.
BMON_E1	Macroinvertebrate monitoring at a number of locations, including rivers potentially affected by drought measures; to continue in low flow/drought years pending agreement with the EA regarding aquatic species welfare.
BMON_E2	Fish (including Lamprey) monitoring at a number of locations, including rivers potentially affected by drought measures; to continue in low flow/drought years pending agreement with the EA regarding aquatic species welfare.
BMON_E3	Walkover surveys of to map habitat distribution and quality, identifying drought sensitive habitats such as areas of riffle, pools and artificial features as well as features relevant to key ecological receptors like lamprey and salmonids. Results to be captured by annotated walkover maps.
On-set of Environmental drought – monitoring leading to selection and implementation of appropriate mitigation measures	
ODMON_WS	Walkover surveys of habitat quality and identification of drought sensitive habitats such as areas of riffle, pools and artificial features such as weirs and sluices that may be isolated or impassable during low flows. Results to be captured by annotated walkover maps, photography and completion of a 'River Conditions Observation Form - Low Flows' form.
In-Drought (during drought option implementation) – monitoring leading to selection and implementation of appropriate mitigation measures	
IDMON_WSE	Surveillance walkover surveys of habitat quality and ecological stress, recording signs of environmental problems (reaches to match those in ODMON_WS)
IDMON_WSWQ1	Targeted surveillance walkover surveys of water quality and ecological stress local to 'significant' water quality pressures', to include water quality spot sampling in priority areas such as pools and weirs where aquatic species may become isolated during low flows.
IDMON_WSWQ2	Discharge validation at key outfalls and downstream, where triggered by review of monitoring data. On site walkover will validate whether key CSOs are spilling, or have been recently, observe for signs of fish stress and take spot water quality sampling at additional locations including at locations of potential fish stress.
In-Drought (During Drought Option Implementation) – Mitigation	
IDMIT_H1	Negotiation with the licence holder of a temporary reduction of third party abstractions presenting 'significant' impacts to sensitive features, including financial compensation by Yorkshire Water.
IDMIT_H2	At identified SSSIs, mitigation would comprise the temporary cessation of impacting drought options by Yorkshire Water.
IDMIT_WQ1	Improving the effluent quality from Yorkshire Water WwTWs presenting 'significant' impacts to sensitive features, thereby reducing the water quality pressure (ammonia and oxygen balance) on the impacted features.
IDMIT_WQ2	Short-term relaxation of drought permit flow reduction to dilute/disperse a build up of water quality pressures identified during walkover surveys IDMON_WSWQ1.

IDMIT_E1	Gradual or temporary adjustments to abstraction or compensation flows to prevent stranding, displacement, or stress in sensitive aquatic species (e.g. fish, macroinvertebrates, white-clawed crayfish).
IDMIT_E2	Aeration of watercourse where significant mortality or change in species abundances are likely to be attributed to water quality deterioration.
IDMIT_E3	Creation of alternative refuges in deeper water where walkover surveys identify the loss of important deep water habitat or high densities of fauna in refuges (fish, white-clawed crayfish, water vole)
IDMIT_E4	Provision of in-stream structures and flow baffles to create functional refuges to support flow sensitive species where walkover surveys identify a projected loss of habitat inundation (macroinvertebrates, fish, white-clawed crayfish, water vole, otter)
IDMIT_E5	Regular inspection and clearing of screens to ensure they retain their correct working function (fish, white-clawed crayfish)
IDMIT_E6	Rescue of individuals or groups, in consultation with the EA or NE as appropriate, and relocation to suitable habitat where they are seen to be in distress or where artificially high densities are likely to result in significant impacts (fish, white-clawed crayfish). Measures will be taken to ensure biosecurity at all times. It should be noted that movement of crayfish requires licensing which can take up to 8 weeks. Movement of crayfish would only take place after consultation agreeing that this was the best course of action.
Post-Drought (Drought Options Removed) – Monitoring	
PDMON_E1	Macroinvertebrate monitoring at a number of locations, including rivers following implementation of drought measures; pending agreement with the EA regarding aquatic species welfare.
PDMON_E2	Fish monitoring at a number of locations, including rivers following implementation of drought measures; pending agreement with the EA regarding aquatic species welfare.
Post-Drought (Drought Options Removed) – Mitigation	
PDMIT_E1	Enhancement of habitat beyond the impacted reach (macroinvertebrates, fish, fine-lined pea mussel, white-clawed crayfish, water vole)
PDMIT_E2	Provision of artificial freshets to ensure fish are capable of migrating where survey identifies insufficient water depth or volume across structures to facilitate migration (fish)
PDMIT_E3	Modification to barriers and/or flows to improve passage where walkover survey identifies insufficient water depth or volume at obstacles (fish)
PDMIT_E4	Restocking of coarse fish from the catchment where monitoring indicates loss of fish abundance or recruitment (fish)



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APPENDIX A – PHYSICAL ENVIRONMENT

A1 INTRODUCTION

This appendix assesses the potential impacts on the physical environment of the South West Area during the period of implementation of associated drought options, specifically the Upper Calder Area. This appendix should be read in conjunction with the Middle Calder EAR. Two EARs have been produced to aid clarity due to the large number of reservoirs in the South West, however the study area should be considered as continuous.

The Upper Calder Area reservoirs comprise ten drought options as reported in this appendix:

1. Gorple Lower Reservoir
2. Widdop Reservoir
3. Walshaw Dean Lower Reservoir
4. Withens Clough Reservoir
5. Turvin Clough Prescribed Flow
6. Warley Moor Reservoir
7. Booth Wood Reservoir
8. Ryburn Reservoir
9. Slitheroe Bridge Maintained Flow.
10. Ogden Reservoir

Details regarding the approaches/methodologies used for assessing susceptibility and sensitivity to drought options and the assessment of the impacts associated with drought options are presented in YWSL's Drought Plan 2027 Environmental Assessment Methodology¹.

This appendix is set out in the following sections:

Section A.2 Drought options

Section A.3 Study area

Section A.4 Physical environment effects – this includes for each reach:

1. Reach introduction
2. Reach setting
3. River flow regime
4. River habitats
5. River water quality
6. Summary of potential changes in the physical environment as a result of the drought options.

Annex 1 provides a list of all regulated abstractions in each reach.

Annex 2 provides a list of all wastewater treatment works (WwTW) and combined sewer overflows (CSOs) considered in the assessment.

Annex 3 maps the intermittent water quality pressures associated with the Calder 3 reach

Annex 4 documents the flow transposition in the absence of measured data (for illustrative time series) approach for those reaches where flow transposition has been utilised.

¹ Ricardo (2025). Yorkshire Water Drought Plan 2027. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

A2 DROUGHT OPTIONS

The Upper Calder Area comprise ten drought options at compensation flow reservoirs as reported in this appendix:

- Gorple Lower Reservoir
- Widdop Reservoir
- Walshaw Dean Lower Reservoir
- Withens Clough Reservoir
- Turvin Clough Prescribed Flow
- Warley Moor Reservoir
- Booth Wood Reservoir
- Ryburn Reservoir
- Slitheroe Bridge Maintained Flow
- Ogden Reservoir.

The licence conditions and drought permit conditions of each are introduced below.

A2.1 GORPLE LOWER RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to impound water in Gorple Lower Reservoir for supply to customers. Under the Impoundment Licence NE/027/0012/033, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourse, Graining Water (Hebden Water). Under the terms of the licence 2.70 MI/d should be released. The drought permit application for Gorple Lower Reservoir is to reduce the compensation releases by 50% to 1.35 MI/d from the date the permit is granted and to reduce further to 0.89 MI/d if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.1**.

Table A2.1 Gorple Lower Reservoir licence data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Gorple Lower Reservoir	Graining Water	SD 945314	2.70	1.35	1.35	0.89	1.81

A2.2 WIDDOP RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to impound water in Widdop Reservoir for supply to customers. Under the Impoundment Licence NE/027/0012/032, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourse, Graining Water (Hebden Water). Under the terms of the licence 3.24 MI/d should be released between January and September, and 12.96 MI/d should be released between October and December unless the volume of water in Widdop Reservoir is equal to or less than 1,385.36MI/d then 6.50 MI/d should be released.

The drought permit application for Widdop Reservoir is to reduce the compensation releases by 50% to 1.62 MI/d between January and September, or to 3.24 MI/d between October and December, from the date the permit is granted and to reduce further to 1.07 MI/d between January and September, or to 2.15 MI/d between October and December, if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.2**.

Table A2.2 Widdop Reservoir licence data

Compensation Water Sources	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Widdop	Graining Water	SD 937327	3.24 (Jan-Sept) 12.96 (Oct-Dec) above NCL 6.50 (Oct- Dec) below NCL	1.62 (Jan – Sept) 3.25 (Oct - Dec)	1.62 (Jan-Sept) 3.25 (Oct- Dec) below NCL	1.07 (Jan – Sept) 2.15 (Oct – Dec)	2.17 (Jan-Sept) 4.35 (Oct- Dec) below NCL

A2.3 WALSHAW DEAN LOWER RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to impound water in Walshaw Dean Lower Reservoir for supply to customers. Under the Impoundment Licence NE/027/0012/031, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourse, Alcomden Water (Hebden Water). Under the terms of the licence 3.78 MI/d should be released between January and September, and 15.12 MI/d should be released between October to December unless the total volume of water in Walshaw Dean Upper Reservoir, Walshaw Dean Middle Reservoir and Walshaw Dean Lower Reservoir is equal to or less than 1,291.41 MI then 7.56 MI/d should be released.

The drought permit application for Walshaw Dean Lower Reservoir is to reduce the compensation releases by 50% to 1.89 MI/d between January and September or to 3.78 MI/d between October and December when the combined volume in the Walshaw Dean reservoirs is equal to or below 1,291.41 MI/d, and to reduce further to 1.26 MI/d between January and September or to 2.52 MI/d between October and December, if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.3**.

Table A2.3 Walshaw Dean Lower Reservoir licence data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Walshaw Dean Lower	Alcomden Water	SD 958329	3.78 (Jan- Sept) 15.12 (Oct-Dec) above NCL 7.56 (Oct- Dec) below NCL	1.89 (Jan - Sept) 3.78 (Oct - Dec)	1.89 (Jan- Sept) 3.78 (Oct- Dec)	1.25 (Jan - Sept) 2.49 (Oct - Dec)	2.52 (Jan- Sept) 5.07 (Oct- Dec)

A2.4 WITHENS CLOUGH RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to abstract water from Withens Clough Reservoir for supply to customers under the 1890 Morley Corporation Water Act. Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourses, the Withens Clough and Cragg Brook. Under the terms of the Act, 2.64 MI/d should be released (defined in the Act as 580,000 gallons per day).

The drought permit application for Withens Clough is to reduce the compensation release by 50% to 1.32 MI/d from the date the permit is granted and reduce further to 0.87 MI/d if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.4**.

Table A2.4 Withens Clough Reservoir Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Withens Clough	Withens Clough	SD 986232	2.64	1.32	1.32	0.87	1.77

A2.5 TURVIN CLOUGH PRESCRIBED FLOW DROUGHT PERMIT

Under the 1960 Wakefield Water Order Yorkshire Water is required to ensure a flow of 6.82 MI/d is left in the Cragg Brook at the Turvin Clough intake, defined in the Act as 1,500,000 gallons per day if abstracting water. The drought permit application for Turvin Clough is to reduce the prescribed flow left in the stream by 50% to 3.41 MI/d from the date the permit is granted and reduce further to 2.25 MI/d if regional stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.5**.

Table A2.5 Turvin Clough Prescribed Flow Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Prescribed Flow MI/d	Proposed Drought Option Prescribed Flow MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Prescribed Flow MI/d (Trigger 2)	Benefit MI/d
Turvin Clough Prescribed Flow	Turvin Clough	SD 992211	6.82	3.41	3.41	2.25	4.57

A2.6 WARLEY MOOR RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to abstract water from Warley Moor Reservoir for supply to customers. Under the 1961 Calderdale Water Board Order, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourse, the Luddenden Dean Beck. Under the terms of the Order 3.02 MI/d should be released.

The drought permit application for Warley Moor Reservoir is to reduce the compensation release by 50% to 1.51 MI/d from the date the permit is granted and the reduce further to 1.00 MI/d if regional stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. The compliance point for this Warley Moor release is actually downstream of Castle Carr reservoir (the bottom reservoir of the chain), so the release is in fact made from Castle Carr reservoir. These conditions are set out in **Table A2.6**.

Table A2.6 Warley Moor Reservoir Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Warley Moor	Luddenden Brook	SE 023300	3.02	1.51	1.51	1.00	2.02

A2.7 BOOTH WOOD RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to abstract water from Booth Wood Reservoir for supply to customers. Under the 1966 Wakefield and District Water Order, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourses, Booth Dean Clough and the River Ryburn.

Under the terms of the order, 18.005 Ml/d (165,028 gallons) should be released between 06:00 and 18:00 on Monday to Saturday and 3.410 Ml/d (31,250 gallons) all other hours. Since the 1980s Yorkshire Water has been operating under the terms of a flow trial agreement with the Environment Agency, releasing 3.41 Ml/d.

The drought permit application for Booth Wood Reservoir is to reduce the compensation release by 50% to 1.71 Ml/d from the date the permit is granted and to reduce further to 1.13 Ml/d if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.7**.

Table A2.7 Booth Wood Reservoir Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release Ml/d	Proposed Drought Option Compensation Release Ml/d (Trigger 1)	Benefit Ml/d	Proposed Drought Option Compensation Release Ml/d (Trigger 2)	Benefit Ml/d
Booth Wood Reservoir	Booth Dean Clough	SE 033166	3.41	1.71	1.70	1.13	2.28

A2.8 RYBURN RESERVOIR DROUGHT PERMIT

Yorkshire Water is required to release water from Ryburn Reservoir to the watercourses downstream. Under the 1924 Wakefield Corporation Act, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourse, the River Ryburn. Under the terms of the Act 5.90 Ml (898,000 gallons per day to stream and 400,000 gallons per day to mill continuous) should be released daily. In agreement with the Environment Agency, a release of a total of 5.90 Ml/d is released to the Mill Pond and Stream.

The drought permit application for Ryburn Reservoir is to reduce the compensation releases by 50% to 2.95 Ml/d from the date the permit is granted and to reduce further to 1.95 Ml/d if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.8**.

Table A2.8 Ryburn Reservoir Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release Ml/d	Proposed Drought Option Compensation Release Ml/d (Trigger 1)	Benefit Ml/d	Proposed Drought Option Compensation Release Ml/d (Trigger 2)	Benefit Ml/d
Ryburn Reservoir	River Ryburn	SE 035189	5.90	2.95	2.95	1.95	3.95

A2.9 SLITHEROE BRIDGE MAINTAINED FLOW DROUGHT PERMIT

Yorkshire Water has a flow trial agreement with the Environment Agency to support a maintained flow of 18 Ml/d at Slitheroe Bridge on the River Ryburn. Under the terms of the agreement the Environment Agency will notify Yorkshire Water of the daily flow at Slitheroe Bridge and if it falls below 18 Ml, Yorkshire Water will release additional flow as necessary from Booth Wood and Ryburn Reservoirs. As stated in the agreement changes to these releases will be made on working days.

The drought action for Slitheroe Bridge Maintained Flow is to half the maintained flow to 9 Ml/d and to reduce further to 6 Ml/d if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.9**.

Table A2.9 Slitheroe Bridge Maintained Flow Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Slitheroe Bridge Maintained Flow ²	River Ryburn	SE 034189	18.00	9.00	9.00	6.00	12.00

A2.10 OGDEN RESERVOIR DROUGHT PERMIT

Yorkshire Water is licensed to abstract water from Ogden Reservoir for supply to customers under the 1961 Calderdale Water Board Order, Yorkshire Water has a legal obligation to release flow from the reservoir to compensate the downstream receiving watercourse, the Hebble Brook. The statutory requirement under the order is to release 82,500 gallons/hour between the hour of 6:00–17:45 Monday to Friday and 6:00-11:00 on Saturday. The current compensation release is 3.42 MI/d under an ‘enforcement position’ agreed with the Environment Agency. The drought permit application for Ogden is to reduce the compensation release by 50% to 1.71 MI/d from the date the permit is granted and reduce further to 1.13 MI/d if regional reservoir stocks are below the Drought Control Line for four consecutive weeks or more, as defined in the Yorkshire Water Drought Plan. These conditions are set out in **Table A2.10**.

Table A2.10 Ogden Reservoir Licence Data

Compensation Water Source	Receiving Watercourse	NGR	Normal Compensation Release MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 1)	Benefit MI/d	Proposed Drought Option Compensation Release MI/d (Trigger 2)	Benefit MI/d
Ogden	Hebble Brook	SE 066306	3.42	1.71	1.71	1.13	2.29

² It should be noted that the Slitheroe Bridge maintained flow drought option could not be applied unless the upstream Booth Wood and Ryburn drought options were applied also. The scheme is not licensed and in practice is not independent of the Booth Wood and Ryburn drought options.

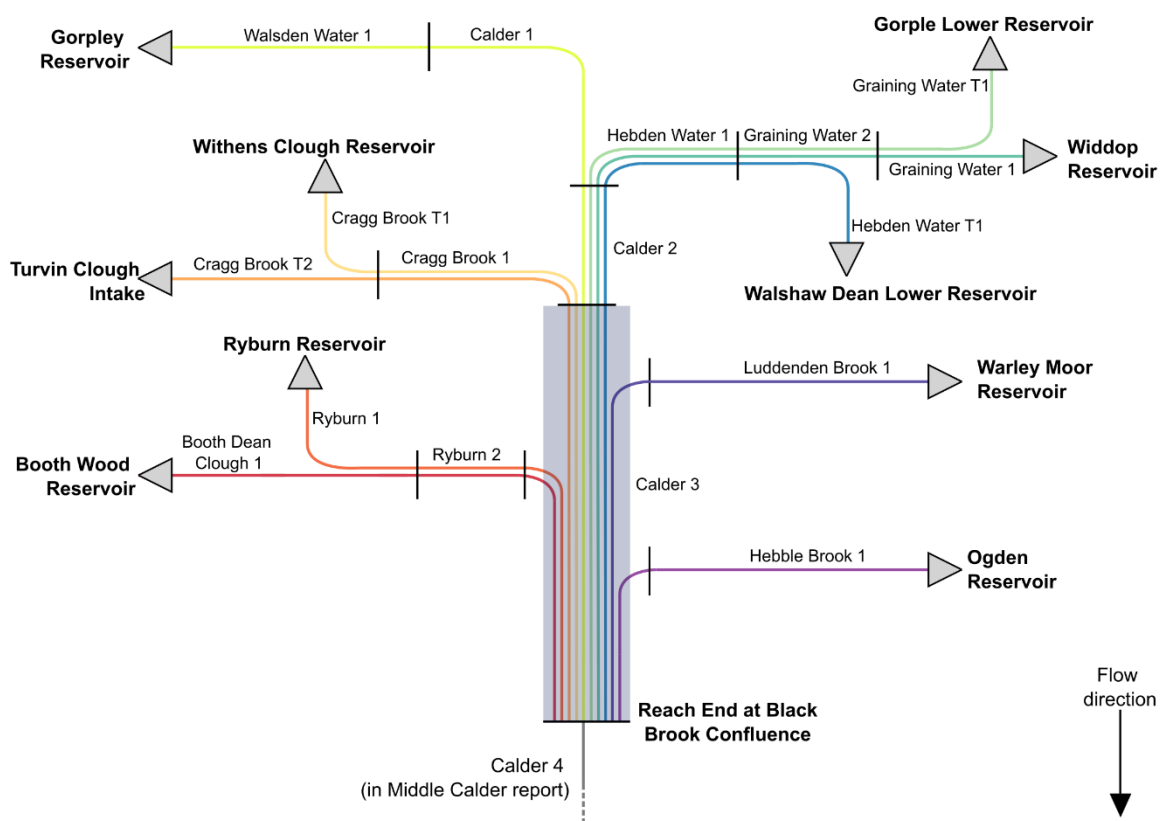
A3 STUDY AREA

The zone of influence associated with each drought option is defined through hydrological effects. Within the overall zone of influence, reaches are then defined on a hydrological basis. YWSL's Drought Plan 2027 Environmental Assessment Methodology³ sets out this approach in detail in **Section 3.4**. The zone of influence and individual reaches for assessment of impacts are set out in **Section A3.1** below. Information on the likely timings of drought options are set out in **Section A3.2** below.

A3.1 ZONE OF INFLUENCE OF THE DROUGHT OPTIONS

The reaches for the Upper Calder area reservoir drought options have been defined previously during the environmental assessment of YWSL past drought plans. **Table A3.1** provides details of these reaches, and the reaches are illustrated in main EAR **Figure 4.1** and in a schematic below in **Figure A3.1**. Though no longer part of the YWSL drought plan, Gorpley Reservoir is represented on **Figure A3.1** for consistency with the stand-alone EAR for the Gorpley Reservoir Drought Order and to assist with cumulative assessment. No Upper Calder Area drought permit would impact the Walsden Water 1 or Calder 1 reaches, as such, no assessment of impacts on this reach is provided in this report.

Figure A3.1 Upper Calder Area reach schematic



3 Ricardo (2025). Yorkshire Water Drought Plan 2027. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. February 2025.

Table A3.1 Upper Calder Area reach details

Reach name	Watercourse name	Reach start	Reach end	Downstream reach	Drought measure									
					Gorple Lower Reservoir	Widdop Reservoir	Walshaw Dean Lower Reservoir	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Warley Moor Reservoir	Booth Wood Reservoir	Ryburn Reservoir	Slitheroe Bridge Maintained Flow	Ogden Reservoir
Graining Water T1	Gorple Lower Brook	Gorple Lower Reservoir	Graining Water	Graining Water 2	✓									
Graining Water 1	Graining Water	Widdop Reservoir	Confluence between Graining Water and Gorple Lower Brook	Graining Water 2		✓								
Graining Water 2	Graining Water	Confluence between Graining Water and Gorple Lower Brook	Confluence Between Graining Water and Alcomden Water	Hebden Water 1	✓	✓								
Hebden Water T1	Alcomden Water	Walshaw Dean Lower Reservoir	Confluence Between Graining Water and Alcomden Water	Hebden Water 1			✓							
Hebden Water 1	Hebden Water	Confluence between Graining Water and Alcomden Water	River Calder	Calder 2	✓	✓	✓							
Calder 2	River Calder	Confluence between Hebden Water and the River Calder	Confluence between Cragg Brook and the River Calder	Calder 3	✓	✓	✓							
Cragg Brook T1	Withens Clough	Withens Clough Reservoir	Confluence between Withens Clough and Turvin Clough	Cragg Brook 1				✓						
Cragg Brook T2	Turvin Clough	White Holme Reservoir	Confluence between Withens Clough and Turvin Clough	Cragg Brook 1					✓					
Cragg Brook 1	Cragg Brook	Confluence between Withens Clough and Turvin Clough	River Calder	Calder 3				✓	✓					
Calder 3	River Calder	Confluence between Cragg Brook and the River Calder	Confluence between Black Brook and the River Calder	Calder 4 (Middle Calder EAR)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Luddenden Brook 1	Luddenden Brook	Warley Moor Reservoir	Confluence between Luddenden Brook and the River Calder	Calder 2						✓				
Booth Dean Clough 1	Booth Dean Clough	Booth Wood Reservoir	Confluence between Booth Dean Clough and the River Ryburn	Ryburn 2							✓			
Ryburn 1	River Ryburn	Ryburn Reservoir	Confluence between Booth Dean Clough and the River Ryburn	Ryburn 2								✓		
Ryburn 2	River Ryburn	Confluence between Booth Dean Clough and the River Ryburn	River Calder	Calder 3							✓	✓	✓	
Hebble Brook 1	Hebble Brook	Ogden Reservoir	Confluence between Hebble Brook and the River Calder	Calder 3										✓

The end of each study area has been defined previously from review of hydrological information – either flow gauge data that corroborates that drought option hydrological impacts have reduced to negligible, or by simple review of contributing catchment area where there is an order of magnitude step change in this from confluence with a significantly larger river or joining tributary. No significant impacts related to the drought options occur below these points. The end of the study area, the confluence of ‘Calder 4’ and the River Aire, is described in the Middle Calder EAR, please see Section A3.1 in that report.

A3.2 TIMING OF DROUGHT MEASURE EFFECTS

The assessment presented in this appendix is in support of a drought permit application for a drought permit to be implemented in summer 2025. In line with the YWSL’s Drought Plan 2027 Environmental Assessment Methodology⁴, the assessment here is appropriate for the assessment of hydrological impacts on low flow regimes in watercourses during the spring, summer and autumn. The assessment is also appropriate to determine the impacts of drought options on watercourses during the winter, when watercourses have relatively lower sensitivity to changes in low flow, and moderate sensitivity to changes in moderate flow. This covers the range of potential impacts associated with a six month drought permit

⁴ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

A4 PHYSICAL ENVIRONMENT EFFECTS

A4.1 INTRODUCTION

This section provides a characterisation of the physical environment within the zone of influence (as defined above in **Section A3**) and includes the following information for each reach:

1. Reach setting
2. River flow regime (reference conditions and sensitivity)
3. River habitats (reference conditions and likely sensitivity)
4. River water quality, including water quality pressure (reference conditions and sensitivity).

An assessment of likely changes from drought option implementation for each reach within the zone of influence is then provided.

YWSL's Drought Plan 2027 Environmental Assessment Methodology⁵ provides details of the approach in Section 3.5. The approach has been developed to ensure compliance with the Environment Agency's March 2025 (DPG2024)⁶ This also includes an updated draft of the supplementary guidance on the environmental assessment for water company drought planning.

A4.2 GRAINING WATER T1

A4.2.1 Reach introduction

Graining Water T1 is potentially impacted by a Gorple Lower Reservoir drought permit. A summary of physical environment information for this reach is provided in **Figure A4.1**. The reach includes part of the following river waterbody:

- Graining Water from Widdop Reservoir to Hebden Water (GB104027062840).

A4.2.2 Reach setting

Graining Water T1, located on main EAR **Figure 4.1**, comprises a 0.6 km stretch of Gorple Lower Brook from the outflow of Gorple Lower Reservoir to the confluence of Gorple Lower Brook and Graining Water. The reach is dominated by reservoir outflows with an additional catchment area of 0.14km² along the length of the reach. Graining Water 2 (see **Section A4.4** below) is downstream.

A4.2.3 River flow regime

During the implementation of South West Area drought options, storage in Gorple Lower Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. A reduction of up to 1.81Ml/d in the statutory compensation release rate of 2.70Ml/d represents a 67% reduction in the flow at the upstream end of the reach, regardless of the time of year. During a winter refill period when catchment flows are generally increasing, there may be some limited flow accretion along the reach so that the percentage flow reduction is less at the lower end of the reach. However, the flow reduction at the top of the reach will remain at 67% until the reservoir reaches top water level and begins to spill again.

The hydrological impact of drought options on Graining Water T1 is therefore assessed as **major** for both a summer/autumn period and any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Graining Water T1. There are no flow depleted reaches within Graining Water T1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

⁵ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

⁶ Environment Agency (2025) Water company drought plan guideline. Final, March 2025.

A4.2.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 31 October 2018 at a reservoir outflow of 3.33Ml/d.

Graining Water T1 is straight reach situated in a deep vee-shaped valley which falls ~46m over 0.6km, a slope of 4.4°. The channel is essentially free of riparian tree cover with only four individual trees noted along its length, all on the left bank. The channel is between 1.8 – 2.8m wide, although one small section was measured at 4m wide. At the YWSL baseline monitoring site (Site 13521), the width of the channel is 3.52m. The channel is a typical upland step-pool sequence with large boulders throughout the channel; this is confirmed by the YWSL baseline monitoring site where 60% of the substrate was of boulder grade. Substrate variation was observed, and cobbles (30%) and pebbles/gravels (10%) were also recorded. Smooth flow was observed between the boulders, however flow variation was also observed near the boulders where flow was broken. The observation from aerial imagery is also confirmed by the YWSL baseline monitoring, where smooth flow dominated (60%), however areas of riffle (10%), pools (20%) and backwater (10%) were also observed. From the vegetation observed, channel banks are assumed to be composed of earth and boulders. Surrounding land-use is upland heath and moorland vegetation.

Graining Water T1 (Gorple Lower Brook) contains high energy environments, as indicated by the step-pool sequence typical of upland watercourses and the absence of depositional features typical of low energy environments. The large substrate identified as present provides significant refuge habitat for fish species. The sparse cover of trees in the riparian habitat means that there is a low input of allochthonous energy, however the peat bank substrate will compensate this to some degree, and macroinvertebrate species composition will reflect this. There are no barriers to migration/movement of fish and sediment present in Graining Water T1.

The drought options reduction in flow could lead to several potential impacts within Graining Water T1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of drought option.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) due to channel shape in deep V-shaped valley.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of drought option, with retention of dominant habitat types.
- Moderate risk to longitudinal connectivity due to steep nature of channel.
- Minor risk of changes in sediment dynamics for duration of drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Graining Water T1 from drought option is therefore assessed as **moderate**.

A4.2.5 River water quality

There are no water quality monitoring sites in Graining Water T1. As such, for this assessment, the furthest upstream sample site in the downstream reach (Graining Water 2), Graining Water at Blake Dean has been used to characterise the water quality in this reach. There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Graining Water T1 as a result of the drought option is presented in **Table A4.1**.

Table A4.1 Potential risks to water quality in Graining Water T1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. No seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with High (0.013 mg/l) and Good (0.028 mg/l) WFD status throughout the

	Total ammonia	Oxygen	Phosphate
			monitoring period with three samples achieving Poor status. No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.2.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Graining Water T1 as a result of the drought option is presented in **Table A4.2**.

Table A4.2 Summary of potential changes in the physical environment of Graining Water T1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Graining Water T1.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potential change the energy of the system. This has the potential for moderate risk of changes in available habitat for different species requirements and moderate risk to longitudinal connectivity. There is also a minor risk of reduction in total wetted aquatic habitat in the reach and minor risk of change in sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.1

A4.3 GRAINING WATER 1

A4.3.1 Reach introduction

Graining Water 1 is potentially impacted by a Widdop Reservoir drought permit. A summary of physical environment information for this reach is provided in **Figure A4.2**. The reach includes part of the following river waterbody:

- Graining Water from Widdop Reservoir to Hebden Water (GB104027062840).

A4.3.2 Reach setting

Graining Water 1, located on main EAR **Figure 4.1**, comprises a 2.2 km stretch of Graining Water from the outflow of Widdop Reservoir to the confluence of Gorple Lower Brook and Graining Water. The reach is dominated by reservoir outflows with an additional catchment area of 7.5km² along the length of the reach. Graining Water 2 (see **Section A4.4** below) is downstream.

A4.3.3 River flow regime

During the implementation of South West Area drought options, storage in Widdop Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. During the spring/summer period of 1 April to 30 September the statutory compensation release rate is 3.24MI/d; a reduction of 2.17 MI/d therefore represents a reduction of up to 67% in the flow at the top of this reach, and this is assessed as a major hydrological impact. During the autumn/winter period of 1 October to 31 March the statutory compensation release rate, when reservoir level is below the Normal Control Line, is 6.5MI/d; a reduction of 4.33 MI/d therefore represents a reduction of up to 67% in the flow at the top of this reach, and this is assessed as a major hydrological impact.

The hydrological impact of drought options on Graining Water 1 is therefore assessed as **major** for both a summer/autumn period and any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Graining Water 1. There are no flow depleted reaches within Graining Water 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.3.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 31 October 2018 at a reservoir outflow of 8.10MI/d.

Graining Water 1 is fairly straight reach, located in a deep vee-shaped valley, which falls ~46m over 2.2km, a slope of 1.2°. Riparian vegetation is limited with only two trees located on the left bank towards the end of the channel. The channel is between 1.3 – 2.6m wide. Channel width increases to 3.3 – 3.9m after the inflow from Greave Clough (~0.9km downstream). The channel is a typical upland step-pool sequence with large boulders throughout the channel, particularly in the mid and lower sections of Graining Water 1. There is one RHS site on the reach (site ID 273), one pool and no riffles were observed as well as one vegetated point bar. The survey did not observe any impoundment of the channel. At the YWSL baseline monitoring site (survey 13523), boulders dominated (60%), however cobble (25%), pebble/gravel (10%) and sand (5%) were also observed. Due to the nature of the channel morphology, flow was broken over steps and smooth in pools, rippled flow was dominant at the YWSL baseline monitoring site. Banks are extensively vertical/undercut or steep (>45°) and eroding banks were observed at the site. Reinforced banks are also noted to be present at this site. Surrounding land-use is moorland heath.

Graining Water 1 contains high energy environments, as indicated by the step-pool sequence typical of upland watercourses and the absence of depositional features typical of low energy environments. The large substrate identified as present provides significant refuge habitat for fish species. The sparse cover of trees in the riparian habitat means that there is a low input of allochthonous energy, however peat bank substrate will compensate this to some degree, and macroinvertebrate species composition will reflect this. Migration/movement of fish and sediment are not impacted by the presence of anthropogenic structures as there are no weirs or culverts in Graining Water 1.

The drought options reduction in flow could lead to several potential impacts within Graining Water 1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of drought options.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) due to channel shape in deep V-shaped valley.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of drought option, with retention of dominant habitat types.
- Moderate risk to longitudinal connectivity due to steep nature of channel.
- Minor risk of changes in sediment dynamics for duration of the drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Graining Water 1 from the drought option is therefore assessed as **moderate**.

A4.3.5 River water quality

There are no water quality monitoring sites in Graining Water 1. As such, for this assessment the first sample site in the downstream reach (Graining Water 2), Graining Water at Blake Dean has been used to characterise the water quality in this reach. There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Graining Water 1 as a result of the drought option is presented in **Table A4.3**.

Table A4.3 Potential risks to water quality in Graining Water 1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. No seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with Good (0.028 mg/l) and High (0.013 mg/l) WFD status throughout the monitoring period with three samples achieving Poor status. No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.3.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Graining Water 1 as a result of the drought option is presented in **Table A4.4**.

Table A4.4 Summary of potential changes in the physical environment of Graining Water 1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that the drought option is implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Graining Water 1.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potential change the energy of the system. This has the potential for moderate risk of changes in available habitat for different species requirements and moderate risk to longitudinal connectivity. There is also a minor risk of reduction in total wetted aquatic habitat in the reach and minor risk of change in sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.2

A4.4 GRAINING WATER 2

A4.4.1 Reach introduction

Graining Water 2 is potentially impacted by both the Gorple Lower Reservoir and Widdop Reservoir drought permits. A summary of physical environment information for this reach is provided in **Figure A4.3**. The reach includes part of the following river waterbody:

- Graining Water from Widdop Reservoir to Hebden Water (GB104027062840).

A4.4.2 Reach setting

Graining Water 2, located on main EAR **Figure 4.1**, comprises a 1.4 km stretch of Graining Water from the confluence with Gorple Lower Brook to the confluence with Alcomden Water (downstream of this confluence the watercourse is known as Hebden Water). Hebden Water 1 (see **Section A4.6** below) is downstream.

A4.4.3 River flow regime

River flow in Graining Water 2 is influenced by the Gorple Lower Reservoir influenced flows of Graining Water T1 and Widdop Reservoir influenced flows of Graining Water 1. As such limited flow variability would be apparent during the implementation of South West Area drought options part-reflecting local hydrological response to rainfall conditions during the ongoing environmental drought.

Daily mean flows at the upstream end of this reach, immediately downstream of the Graining Water T1 and Graining Water 1 confluence have been estimated using the Gustard flow transposition method. There is no gauged flow data available for Graining Water, so flows at the upstream end of this reach have been estimated using the Gustard flow transposition method, based on catchment parameter ratios and gauged flow data from an available downstream gauge at Mytholmroyd on the River Calder (see **Annex 4** for further details). As for the Walsden Water flow transposition, the Mytholmroyd record was first adjusted to allow for the Eastwood and Redacre WwTWs effluent discharges and the effects of the reservoirs in the upper catchment. Measured outflows from Gorple Lower and Widdop Reservoirs were then added back on to the estimated (transposed) data series, to provide an estimated flow record for Graining Water downstream of the Gorple Lower Brook confluence with medium confidence.

Graining Water 2 is affected by the combined flow reduction resulting from the Gorple Lower Reservoir drought option (1.81 Ml/d) and the variable flow reduction resulting from the Widdop Reservoir drought option as outlined above for Graining Water 1. The maximum flow reduction during the period from April to September is therefore 3.98 Ml/d (2.17 Ml/d + 1.81 Ml/d), representing reductions of 55% and 61% in the summer Q_{95} and Q_{99} flow statistics respectively. During the period from October to March, the combined flow reduction would be 6.16 Ml/d (when reservoir storage is below the control line), however the residual flow would not be less than the combined minimum compensation flows from Gorple Lower and Widdop Reservoirs (0.89 Ml/d + 2.15 Ml/d) so in practice the combined flow reduction would not reduce the flow statistics to below 3.04 Ml/d. Based on reducing the flows no lower than 3.04 Ml/d, the reductions in the year round Q_{95} and Q_{50} flow statistics would be 60% and 29% respectively.

The hydrological impact of drought options on Graining Water 2 is therefore assessed as **major** for both a summer/autumn period and any winter refill period while drought options remain in place. Due to data limitations in the Mytholmroyd flow gauge record, 1/4/2010-31/3/2011 has been used to illustrate a recent environmental drought scenario in **Figure A4.3**, rather than 1/4/2018-31/3/2019 as specified in the YWSL's Drought Plan 2027 Environmental Assessment Methodology⁷.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Graining Water 2. There are no flow depleted reaches within Graining Water 2. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

⁷ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

A4.4.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 31 October 2018 at an estimated river flow at the flow assessment point for the reach of 15Ml/d.

Graining Water 2 is a fairly straight reach located in a deep vee-shaped valley. Graining Water 2 falls ~29m over 1.4km, a slope of 1.2°. Riparian vegetation is limited with isolated to scattered trees on the left bank, mostly at the very end of Graining Water 2. The channel is between 4.6 – 7.6m wide, at the YWSL baseline monitoring site (survey 13536) the river is 7.60m wide. The channel is a typical upland step-pool sequence with large boulders throughout the channel, particularly in the mid sections of Graining Water 2. One island is visible ~0.4km downstream from the start of Graining Water 2. At the RHS site (site ID 6420), no pools, five riffles and no point bars were observed. The survey did not note any impoundment of the reach. Substrate variation was observed at the YWSL baseline monitoring site, where bedrock (10%), boulders (30%), cobble (35%), pebble/gravel (20%) and sand (5%) were observed. Due to the nature of the channel morphology, flow was broken over steps and smooth in pools. Flow types noted at the RHS sites were predominantly rippled, however several other flow types were noted, mainly chute flow, chaotic flow, unbroken and broken standing waves and free fall flow. The YWSL baseline monitoring site showed similar flow variation, smooth flow dominated (45%), however areas of riffle (35%), backwater (15%) and pools (5%) were also observed. Due to the vegetation present on aerial imagery it is assumed that banks are predominantly composed of earth and boulders. Surrounding land use is predominantly rough pasture with some broadleaf woodland and moorland heath.

Graining Water 2 contains both high and low energy environments as indicated by the step-pool sequence typical of upland watercourses. The flow structure indicates a wide variety of flow types and substrate is dominated by boulder with cobble also present. The large substrate type present provides significant refuge habitat for fish species, and spawning habitat may be present in limited extent with pebble present in discrete patches. The sparse cover of trees in the riparian habitat means that there is a low input of allochthonous energy, however peat bank substrate will compensate this to some degree, and macroinvertebrate species composition will reflect this. Migration/movement of fish and sediment are not impacted by the presence of anthropogenic structures as there are no weirs or culverts in Graining Water 2.

The drought options reduction in flow could lead to several potential impacts within Graining Water 2:

- Major risk of changes in the energy of the system associated with around 50-60% reduction in flow for the duration of drought options.
- Potentially moderate risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars and islands) and protrusion of bedrock outcrops and bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought options.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of drought option, with few changes to the range and abundance of flow types.
- Minor risk to longitudinal connectivity noting the absence of weirs in the reach.
- Minor risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Graining Water 2 from drought options is therefore assessed as **moderate**.

A4.4.5 River water quality

One water monitoring location is present in the reach, Graining Water at Blake Dean (NE-49505155). There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Graining Water 2 as a result of drought options is presented in **Table A4.5**.

Table A4.5 Potential risks to water quality in Graining Water 2 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. No seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with Good (0.028 mg/l) and High (0.013 mg/l) WFD status throughout the monitoring period with three samples achieving Poor status. No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.4.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Graining Water 2 as a result of drought options is presented in **Table A4.6**.

Table A4.6 Summary of potential changes in the physical environment of Graining Water 2 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Major impacts</i>	Reductions of 29% to 61% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Graining Water 2.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for moderate risks to total wetted aquatic habitat and available habitat for different species. There is also a minor risk to longitudinal connectivity and sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.3

A4.5 HEBDEN WATER T1

A4.5.1 Reach introduction

Hebden Water T1 is potentially impacted by a Walshaw Dean Lower Reservoir drought permit. A summary of physical environment information for this reach is provided in **Figure A4.4**. The reach includes part of the following river waterbodies:

- Alcomden Water - Walshaw Dean Reservoir to Widdop (GB104027062850).

A4.5.2 Reach setting

Hebden Water T1, located on main EAR **Figure 4.1**, comprises a 2.0 km stretch of Alcomden Water from the outflow of Walshaw Dean Lower Reservoir to the confluence of Alcomden Water and Graining Water. The reach is dominated by reservoir outflows with an additional catchment area of 1.9km² along the length of the reach. Hebden Water 1 (see **Section A4.6** below) is downstream.

A4.5.3 River flow regime

During the implementation of South West Area drought options, storage in Walshaw Dean Lower Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. During the spring/summer period of 1 April to 30 September the statutory compensation release rate is 3.78Ml/d; a reduction of 2.52Ml/d therefore represents a reduction of up to 67% in the flow at the top of this reach, and this is assessed as a major hydrological impact. During the autumn/winter period of 1 October to 31 March the statutory compensation release rate, when the reservoir level is below the Normal Control Line, is 7.56Ml/d; a reduction of 5.07Ml/d therefore represents a reduction of up to 67% in the flow at the top of this reach, and this is assessed as a major hydrological impact.

The hydrological impact of drought options on Hebden Water T1 is therefore assessed as **major** for a summer/autumn period and for any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Hebden Water T1. There are no flow depleted reaches within Hebden Water T1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.5.4 River habitats

River habitats have been characterised at a whole reach scale. No additional information for a representative 500m reach has been surveyed. A requirement for a walkover of this reach is stipulated in the EMP.

Hebden Water T1 is fairly straight reach in a shallow vee-shaped valley which falls ~78m over 2.0 km, a slope of 2.2°. Tree cover is isolated to scattered along Hebden Water T1 but increases to continuous at the end of the reach. The channel is between 2.9 – 7.38m wide. The channel is a typical upland step-pool sequence with large boulders throughout the channel. At RHS site (site ID 11310), no pool, three riffles and no point bars were observed. The survey did not note any impoundment of the reach. At the YWSL baseline monitoring site (survey 13522), boulders (40%) and cobbles (40%) dominated, however areas of pebble/gravel (15%) and sand (5%) were also observed. There is smooth flow between the boulders within the pools, and broken flow over the boulders (steps). The YWSL baseline monitoring site also noted riffle flow dominated (45%). From the vegetation observed, channel banks are assumed to be composed of earth and boulders. The surrounding land-use is rough pasture with some broadleaf woodland at the end of Hebden Water T1.

Hebden Water T1 is likely to be dominated by high energy environments, as indicated by the slope, step-pool sequence and flow structure identified, with low energy environmental isolated at best, with no depositional features identified. The large substrate identified will provide significant refuge habitat for fish species along with the vertical and steep bank profiles. The scattered cover of trees means that there is a low input of allochthonous energy. Migration/movement of fish and sediment is unlikely to be impacted by anthropogenic features in Hebden Water T1, noting the presence of one weir identified on the reach.

The drought options reduction in flow could lead to several potential impacts within Hebden Water T1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of the drought option.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) due to channel shape in shallow V-shaped valley.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of drought option, with retention of dominant habitat types.
- Moderate risk to longitudinal connectivity due to steep nature of channel.
- Minor risk of changes in sediment dynamics for duration of the drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Hebden Water T1 from the drought option is therefore assessed as **moderate**.

A4.5.5 River water quality

One water monitoring location is present in the reach, Alcomden Water at Footbridge (NE-49505156). There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Hebden Water T1 as a result of the drought option is presented in **Table A4.7**.

Table A4.7 Potential risks to water quality in Hebden Water T1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. Some seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Seasonality was apparent with saturation rising in late winter/spring and falling in late summer/autumn	Orthophosphate concentrations were predominantly consistent with Good (0.028 mg/l) and High (0.013 mg/l) WFD status throughout the monitoring period.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.5.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Hebden Water T1 as a result of the drought option is presented in **Table A4.8**.

Table A4.8 Summary of potential changes in the physical environment of Hebden Water T1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that the drought option is implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Hebden Water T1.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potential change the energy of the system. This has the potential for moderate risk of changes in available habitat for different species requirements and moderate risk to longitudinal connectivity. There is also a minor risk of reduction in total wetted aquatic habitat in the reach and minor risk of change in sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.4

A4.6 HEBDEN WATER 1

A4.6.1 Reach introduction

Hebden Water 1 is potentially impacted by the Gorple Lower Reservoir, Walshaw Dean Lower Reservoir and Widdop Reservoir drought permits. A summary of physical environment information for this reach is provided in **Figure A4.5**. The reach includes all of the main channel of the following river waterbodies:

- Hebden Water from Widdop Beck to R Calder (GB104027062731).

A4.6.2 Reach setting

Hebden Water 1, located on main EAR **Figure 4.1**, comprises a 7.5km stretch of Hebden Water from the confluence with Graining Water and Alcomden Water down to the confluence with the River Calder. Calder 2 (see **Section A4.7** below) is downstream.

A4.6.3 River flow regime

River flow in Hebden Water 1 is influenced by Gorple Lower Reservoir, Widdop Reservoir and Walshaw Dean Reservoir outflows. As such limited flow variability outside of would be apparent during the implementation of South West Area drought options part-reflecting local hydrological response to rainfall conditions during the ongoing environmental drought.

Daily mean flows at the upstream end of this reach, immediately downstream of the Graining Water 2 and Hebden Water T1 confluence have been estimated using the Gustard flow transposition method. There is no gauged flow data available for Hebden Water, so flows at the upstream end of this reach have been estimated using the Gustard flow transposition method, based on catchment parameter ratios and gauged flow data from an available downstream gauge at Mytholmroyd on the River Calder (see **Annex 4** for further details). As for the Walsden Water and Graining Water flow transpositions, the Mytholmroyd record was first adjusted to allow for the Eastwood and Redacre WWTWs effluent discharges and the effects of the reservoirs in the upper catchment. Measured outflows from Gorple Lower, Widdop and Walshaw Dean Lower reservoirs were then added back on to the estimated (transposed) data series, to provide an estimated flow record for Hebden Water downstream of the Graining Water/Alcomden Water confluence with medium confidence.

Hebden Water 1 is affected by the combined flow reduction resulting from the Gorple Lower Reservoir drought option (1.81 Ml/d) and the variable flow reductions resulting from both the Widdop Reservoir and Walshaw Dean Lower Reservoir drought options as outlined previously. The maximum flow reduction during the period from April to September is therefore 6.50 Ml/d (2.52 Ml/d + 2.17 Ml/d + 1.81 Ml/d), which represents reductions of 56% and 61% in the summer Q_{95} and Q_{99} flow statistics respectively. This would be assessed as a major hydrological impact during the summer months. During the period from October to March, the combined flow reduction would be 11.23 Ml/d (when reservoir storage is below the control line), however the residual flow would not be less than the combined minimum compensation flows from Gorple Lower Widdop and Walshaw Dean Lower reservoirs (0.89 Ml/d + 2.15 Ml/d + 2.49 Ml/d) so in practice the combined flow reduction would not reduce the year round flow statistics values to below 5.53 Ml/d. The reductions in the year round Q_{95} and Q_{50} flow statistics would be 58% and 36% respectively, and this would therefore be assessed as a major hydrological impact during the winter months also.

The hydrological impact of drought options on Hebden Water 1 is therefore assessed as **major** for a summer/autumn period and for any winter refill period while drought options remain in place. Due to data limitations in the Mytholmroyd flow gauge record, 1/4/2010-31/3/2011 has been used to illustrate a recent environmental drought scenario in **Figure A4.5**, rather than 1/4/2018-31/3/2019 as specified in the YWSL's Drought Plan 2027 Environmental Assessment Methodology⁸.

There are two significant flow pressures influencing flow in Hebden Water 1, both are non-consumptive abstraction licences leading to a flow depleted reach as described in **Section A4.6.3.1**. There are no significant discharges within Hebden Water 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

⁸ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

A4.6.3.1 Flow depleted reaches/significant water quality pressures

There are two separate licensed abstractions depleting flow in Hebden Water 1 for hydroelectric power generation.

The first abstraction is a large volume hydropower abstraction with a peak abstraction rate of 35.43 Ml/d, without a hands-off-flow condition, ('Hebden Water – Hardcastle Crag – Hebden Bridge') with potential flow impacts leading to a depleted reach for ~150m. An abstraction at that rate could reduce flows in the depleted reach, during environmental drought, without or in combination with drought options, to zero.

Further downstream on Hebden Water 1 is a second large volume hydropower abstraction with a peak daily licensed abstraction rate of 69.98Ml/d, without a hands-off flow condition, ('Bridge Mill Goyt – Bridge Mill') with potential flow impacts leading to a depleted reach for ~25m. An abstraction at that rate could reduce flows in the depleted reach, during environmental drought, without or in combination with drought options, to zero.

A walkover reach covering these sections of the river has been included in the schedule of monitoring for Hebden Water 1 (see main EAR Section 6). YWSL will liaise with the abstractors in advance of permit implementation to determine appropriate mitigation measures.

A4.6.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 31 October 2018 at an estimated river flow at the flow assessment point for the reach of 26 Ml/d.

Hebden Water 1 is a fairly sinuous reach which flows through a vee-shaped valley. Hebden Water 1 falls ~126m over 7.5km, a slope of 1.0°. The channel is heavily shaded for most of its length flowing through Hebden Dale and flows through Hebden Bridge at the end of the reach. Where the channel is visible through tree cover the channel is between ~6-21m wide. In the upper sections of Hebden Water 1, where visible, there are numerous step-pool sequences with abundant boulders in the channel. There are four RHS sites within this reach, ~4km downstream the reach is RHS site ID 26454, ~3.2km downstream is RHS site ID 21119, ~4.7km downstream the reach is RHS site ID 11311 and ~6.8km downstream is RHS site ID 18618. At the furthest upstream RHS site 26454, 11 pools, four riffles and no point bars were observed. The survey also noted that <33% of the channel was ponded by artificial channel impoundment, but there was no record of channel realignment or over deepening. This RHS site (26454) also recorded a range of flow types, although rippled flow dominated, occasional broken waves and chute flow with frequent smooth flow also noted. At the RHS site 21119, two pools, no riffles and no point bars were observed. The survey also noted no observed channel realignment, over deepening or impoundment. At this RHS site 21119, gravel/pebble dominated, and cobble was frequent. Flow types are predominantly rippled and broken and unbroken standing waves, although smooth flow is noted at the mid and lower sites. At the RHS site 11311, 16 pools and five riffles were observed as well as one unvegetated point bar. The survey also noted that <33% of the channel was ponded by artificial channel impoundment, with no observed channel realignment or over deepening. At the lower site 11311, boulders dominated, however occasional cobbles were also observed. Unbroken standing waves dominated at RHS Site 11311. At the furthest downstream RHS site, 18618, one pool, three riffles, and no point bars were observed. The survey also noted that there >33% of the channel had been realigned and over-deepened, with no observed water impoundment.

The presence of exposed bedrock and exposed boulders have been noted by all RHS sites in Hebden Water 1. Data for the RHS sites identify that both the left and right banks are predominantly composed of earth at the upper site, with brick or laid stone increasing at the mid site and up to 60% at the lower site. Bank face vegetation at the upper site is dominantly uniform and simple, transforming to simple and complex at the mid site and bare to simple at the lower site. Bank top vegetation is characterised by complex vegetation altering to a mix of uniform to simple vegetation downstream. A range of bank types were noted throughout Hebden Water 1, with vertical and steep (>45°) recorded at the upper site, however shallower sections were noted on the left banks, vertical with toe and reinforced at the mid site and reinforced and gentle at the lower site. Surrounding land use is predominantly deciduous woodland, rough pasture in the very upper Hebden Water 1 and suburban/urban development in the lower Hebden Water 1.

Hebden Water 1 is likely to be dominated by high energy environments, as indicated by the slope, step-pool sequence and flow structure identified, with some low energy environments present, indicated by the low presence of depositional features. The predominant substrate composition is suitable for spawning habitat for fish and considered likely to be extensively present. The presence of larger substrate types and vertical/undercut or steep bank profiles will provide some refuge potential for juvenile and adult fish. The extensive cover of trees in the riparian habitat will provide significant amounts of allochthonous energy to Hebden Water 1, provide additional refuge potential for fish and resting opportunities for otter. The extensive presence of riparian land-use in the surrounding land also has the potential to support breeding otter. Migration/movement of fish and sediment in Hebden Water 1 may be impacted by the presence of 12 weirs in Hebden Water 1. The habitat of the watercourse is unlikely to provide any important habitat opportunity for great crested newt (GCN) as they typically inhabit ponds and ditches with little or no flow.

The drought options reduction in flow could lead to several potential impacts within Hebden Water 1:

- Major risk of changes in the energy of the system associated with around 50-60% reduction in flow for the duration of drought options.
- Potentially moderate risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars and islands) and protrusion of bedrock outcrops and bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought options.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of drought options, with few changes to the range and abundance of flow types.
- Major risk to longitudinal connectivity noting the presence of 12 weirs in the reach and the two flow depleted reaches.
- Minor risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Hebden Water 1 from drought options is therefore assessed as **major**.

A4.6.5 River water quality

The most upstream of two water quality monitoring sites present in this reach, Hebden Water at Hebden Bridge (NE-49500377) has been used for this assessment due to its superior data quality. There is one frequently spilling CSO potentially presenting an environmental risk in the reach and no significant continuous water quality pressures. A summary description of the potential risks to water quality in Hebden Water 1 as a result of drought options is presented in **Table A4.9**.

Table A4.9 Potential risks to water quality in Hebden Water 1 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Slight seasonality was apparent with saturation rising in late winter/spring and falling in late summer/autumn.	Orthophosphate concentrations were predominantly consistent with High WFD status (0.013 mg/l) throughout the monitoring period. With one instance of Poor status (0.747 mg/l) on 10.2.2014.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent

	Total ammonia	Oxygen	Phosphate
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	Risk of short term acute, infrequent, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) locally downstream of one listed CSO during rainfall events.		None
Other point source pressures presenting risk	None	None	None
Summary	Moderate risk from drought options associated with CSO discharge	Moderate risk from drought options associated with CSO discharge	Minor risk from drought options

A4.6.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Hebden Water 1 as a result of drought options is presented in **Table A4.10**.

Table A4.10 Summary of potential changes in the physical environment of Hebden Water 1 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Major impacts</i>	Reductions of 61% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>Major</i>	Two flow depleted reaches (~150m and ~25m) with potential for periods of time with zero flow without mitigation.
River habitats <i>Major risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risk to longitudinal connectivity. There is also potential moderate risk of reduction in total wetted aquatic habitat in the reach, and moderate risk of changes in available habitat for different species requirements. There is a minor risk of change in sediment dynamics
Water quality <i>Moderate risk</i>	- Moderate risk from short term acute, infrequent, temporary water quality pressures locally downstream of one listed CSO during rainfall events. - Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous water quality pressures in this reach.

Insert Figure A4.5

A4.7 CALDER 2

A4.7.1 Reach introduction

Calder 2 is potentially impacted by the Gorple Lower Reservoir, Widdop Reservoir and Walshaw Dean Lower Reservoir drought permits. A summary of physical environment information for this reach is provided in **Figure A4.6**. The reach includes part of the following river waterbody:

- Calder from Colden Water to Ryburn Confluence (GB104027062641).

A4.7.2 Reach setting

Calder 2, located on main EAR **Figure 4.1**, comprises a 2.5 km stretch of the River Calder from its confluence with Hebden Water down to its confluence with Cragg Brook. Calder 3 (see **Section A4.11** below) is downstream.

A4.7.3 River flow regime

River flow in Calder 2 is influenced by the upstream River Calder and the Gorple Lower Reservoir, Widdop Reservoir and Walshaw Dean Reservoir influenced flows of Hebden Water 1. As some flow variability would be apparent during the implementation of South West Area drought options part-reflecting local hydrological response to rainfall conditions during the ongoing environmental drought.

The combined flow reduction from the Gorple Lower Reservoir, Widdop Reservoir and Walshaw Dean Reservoir drought permit varies according to the time of year and, for Widdop and Walshaw Dean Lower reservoirs during October to December, depends on whether storage is above or below the control line. The maximum combined flow reductions assume that storage in both Widdop and Walshaw Dean Lower Reservoirs is below the control line in the baseline drought conditions.

Flows in Calder 2 are measured at the Mytholmroyd gauging station. With no flow transposition required, there is high confidence in the hydrological assessment. During the period from April to September, the maximum combined flow reduction at Mytholmroyd is 6.50 Ml/d and this represents a reduction of 12% and 16% in the summer Q_{95} and Q_{99} flow statistics respectively. This would therefore be assessed as a moderate hydrological impact during the summer months.

During the period from October to March, the combined flow reduction would be 11.23 Ml/d (when reservoir storage is below the control line). The reductions in the year round Q_{95} and Q_{50} flow statistics would be 19% and 6% respectively, and this would therefore be assessed as a minor hydrological impact during the winter months.

The hydrological impact of drought options on Calder 2 is therefore assessed as **moderate** for a summer/autumn period and **minor** for any winter refill period while drought options remain in place.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Calder 2. There are no flow depleted reaches within Calder 2. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.7.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 19 September 2018 at an estimated river flow at the flow assessment point for the reach of ~118Ml/d.

Calder 2 is a relatively straight reach with some sinuous sections. The reach falls ~5m over 2.5 km, a slope of 0.1°. The channel is shaded along much of its length with scattered to semi-continuous riparian tree cover. Where the channel is visible through tree cover it measures between ~18-24m wide, however at 1.8km downstream from the start of Calder 2 the channel narrows significantly to between 6-8m wide. This is apparently due to anthropogenic modification of the channel. In the few visible sections of the reach only a single side bar is visible at the start of Calder 2 with some scattered boulders protruding through the flow. Where visible on aerial imagery, the channel surface indicates that smooth flow predominates with some small areas of broken flow in the middle of the reach. At the YWSL baseline monitoring site (survey 13537), it was recorded that run (50%) dominated the flow type, with riffle (30%), backwater (10%) and glide (5%) present.

Where banks are vegetated it is assumed that they are composed of earth. In the upper reaches reinforcement of banks is frequent, with re-sectioning of banks present from 1.8km downstream from the start of the reach. At the YWSL baseline monitoring site 13537, the dominant substrate was cobbles (40%), with boulders (30%), pebbles/gravel (25%) and sand (5%) also present. Surrounding land-use is predominantly suburban/urban development, with some rough pasture and parkland and gardens, particularly in the middle of the reach. There are three RHS sites within this reach, ~560m downstream in the reach, site ID 25726, ~840m downstream is site ID 18607 and ~970m downstream is site ID 27699. At the furthest upstream RHS site, 25726, two riffles were observed as well as <33% of the channel realigned and impounded, with no observed over deepening. At the RHS site 18607, there were no pools, riffles or point bars observed. The survey noted >33% of the channel had been realigned and over deepened, with no impoundment of the channel. At the furthest downstream RHS site, 27699, four pools and three riffles were observed as well as one unvegetated point bar. The survey also noted that >33% of the channel had been realigned and over deepened, with no impoundment of the channel.

Calder 2 is likely to contain both high and low energy environments, as indicated by the shallow slope of the watercourse, presence of depositional features and likely flow structure. The habitat present could support spawning habitat in isolated patches and is likely to support features suitable for providing refuge to adults and juveniles. The presence of trees in the riparian corridor is relatively scattered, providing some allochthonous energy input into the reach, additional cover for fish and some resting opportunities for otter. Migration/movement of fish and sediment in Calder 2 may be impacted by the one weir present.

The drought options reduction in flow could lead to several potential impacts within Calder 2:

- Up to moderate risk of changes in the energy of the system associated with up to 19% reduction in flow for periods of time during summer/autumn and winter refill drought options
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars and islands) and protrusion of bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought options noting the retention of an overall variable flow pattern.
- Potentially minor risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of drought options, with few changes to the range and abundance of flow types.
- Minor risk to longitudinal connectivity from one in-channel structure for periods of time during the duration of drought options.
- Minor risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Calder 2 from drought options is therefore assessed as **minor**.

A4.7.5 River water quality

Two water monitoring sites are present in the reach. The most upstream monitoring site, River Calder At Hebden Bridge (NE-49500612), has been used due to superior data quality (noting no paired flow data is available from 2018 onwards due to there being no gauged flow data at the Mytholmroyd flow gauge after this period). There are two frequently spilling CSO potential presenting an environmental risk in the reach and no significant continuous water quality pressures. See Annex 2 for a full list of discharges considered in the assessment. A summary description of the potential risks to water quality in Calder 2 as a result of drought options is presented in **Table A4.11**.

Table A4.11 Potential risks to water quality in Calder 2 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were primarily consistent with High WFD status (0.2 mg/l) throughout the monitoring period with two instances of Good status (0.3 mg/l). Some seasonality was apparent with concentration rising in late winter/ early spring and declining late spring early summer.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Some Seasonality was apparent with saturation rising in late winter/spring and falling in late summer/autumn. Saturation repeatedly peaks in April and May.	Orthophosphate concentrations were predominantly consistent with Moderate status (0.095 mg/l) or lower.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	Strong
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	Risk of short term acute, infrequent, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) locally downstream of two listed CSO during rainfall events.		None
Other point source pressures presenting risk	None	None	None
Summary	Moderate risk from drought options associated with CSO discharge	Moderate risk from drought options associated with CSO discharge	Moderate risk from drought options associated with change in dilution of diffuse pollution pressures.

A4.7.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Calder 2 as a result of drought options is presented in **Table A4.12**.

Table A4.12 Summary of potential changes in the physical environment of Calder 2 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Moderate impacts (summer/autumn)</i> <i>Minor impacts (winter)</i>	Reductions of 19% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Calder 2.
River habitats <i>Minor impacts</i>	The up to moderate reduction in flow will lead to a potentially minor change in the energy of the system. This has the potential for minor risks to total wetted aquatic habitat, available habitat for different species, longitudinal connectivity and sediment dynamics.
Water quality <i>Moderate impacts</i>	- Moderate risk from short term acute, infrequent, temporary water quality pressures locally downstream of two listed CSOs during rainfall events. - Phosphate quality is variable with strong flow sensitivity, therefore a moderate risk to water quality has been assessed associated with change in dilution of diffuse pollution pressures to phosphate.

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
	- Reported ammonia and dissolved oxygen water quality is predominantly consistent with High status with no apparent flow sensitivity for dissolved oxygen and ammonia. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia and dissolved oxygen has been assessed. - No identified risk associated with continuous discharges.

Insert Figure A4.6

A4.8 CRAGG BROOK T1

A4.8.1 Reach introduction

Cragg Brook T1 is potentially impacted by a Withens Clough Reservoir drought permit. A summary of physical environment information for this reach is provided in **Figure A4.7**. The reach includes part of the following river waterbody:

- Cragg Brook from Source to River Calder (GB104027062610).

A4.8.2 Reach setting

Cragg Brook T1, located on main EAR **Figure 4.1**, comprises a 1.6 km stretch of Withens Clough from the outflow of Withens Clough Reservoir to the confluence of Withens Clough and Turvin Clough. The reach is dominated by reservoir outflows with an additional catchment area of 1.6km² along the length of the reach. Cragg Brook 1 (see **Section A4.10** below) is downstream.

A4.8.3 River flow regime

During the implementation of South West Area drought options, storage in Withens Clough Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. A reduction of up to 1.77Ml/d in the statutory compensation release rate of 2.64Ml/d represents a 67% reduction in the flow at the upstream end of the reach, regardless of the time of year. During a winter refill period when catchment flows are generally increasing, there may be some limited flow accretion along the reach so that the percentage flow reduction is less at the lower end of the reach. However, the flow reduction at the top of the reach will remain at 67% until the reservoir reaches top water level and begins to spill again.

The hydrological impact of drought options on Cragg Brook T1 is therefore assessed as **major** for a summer/autumn period and for any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Cragg Brook T1. There are no flow depleted reaches within Cragg Brook T1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.8.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 03 October 2018 at a reservoir outflow of 2.87Ml/d.

Cragg Brook T1 is very sinuous reach which flows through a deep vee-shaped valley and falls ~99m over 1.6km, a slope of 3.5°. The channel is shaded with deciduous riparian tree cover along much of the lower sections of Cragg Brook T1. Where visible, channel width is between 2-3m. There are two RHS surveys undertaken at RHS site ID 26414, the first survey (survey ID 39629) conducted, was dated for 2014 and the later survey (survey ID 41182) was dated for 2023. The first survey at RHS site 26414 (survey 39629), recorded bankfull width as 3.7m. The channel is a step-pool sequence with extensive boulders visible in the channel. The RHS survey (39629) recorded several side bars within the channel and the presence of exposed boulders. No other in-channel depositional features were visible within the rest of Cragg Brook T1. Flow at the RHS site was dominated by rippled flow, however occasional chute flow and frequent unbroken standing waves was also recorded. Elsewhere in the Cragg Brook T1, the flow was smooth, as recorded by extant aerial imagery with areas of broken flow over the bedrock steps. Bed substrate at the RHS site was dominated by boulders, however frequent areas of cobble and occasional gravel/pebble was also recorded. At the RHS site, the left bank was comprised of bricks, and the right bank comprised of earth and boulders and possibly peat given the nature of the soils along the rest of Cragg Brook T1. In the initial 0.6km of Cragg Brook T1 surrounding land use is predominately moorland heath with broadleaf woodland in the remaining section. Suburban/urban land use increases at the end of the reach as Cragg Brook T1 passes through Cragg Vale. The second RHS survey (survey 41182), 23 pools, 2 riffles and no point bars were observed. The survey also noted that <33% of the channel had been realigned but there was no observed over deepening or impoundment of the channel.

Cragg Brook T1 is likely to be dominated by high energy environments, as identified by the valley slope and shape and the step-pool sequence typical of watercourses of this type. The extensive coverage of trees in the riparian habitat will ensure a high input of allochthonous energy into the watercourse, which will be reflected in the macroinvertebrate composition, and provide cover to fish, along with the large substrate types present. The movement/migration of fish and sediments through the catchment is likely to be influenced by the presence of a couple of weirs.

The drought options reduction in flow could lead to several potential impacts within Cragg Brook T1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of the drought option.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) due to channel shape in deep V-shaped valley.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of the drought option, with retention of dominant habitat types.
- Moderate risk to longitudinal connectivity due to steep nature of channel in the reach.
- Minor risk of changes in sediment dynamics for duration of the drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Cragg Brook T1 from the drought option is therefore assessed as **moderate**.

A4.8.5 River water quality

One water monitoring location is present in this reach: Withens Clough at Bod Bridge (NE-49505157). There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Cragg Brook T1 as a result of the drought option is presented in **Table A4.13**.

Table A4.13 Potential risks to water quality in Cragg Brook T1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were primarily consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Some seasonality is apparent	Orthophosphate concentrations were predominantly consistent with Good (0.028 mg/l) and High (0.013 mg/l) WFD status throughout the monitoring period, with one instance of Poor status on 28.03.2014.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.8.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Cragg Brook T1 as a result of the drought option is presented in **Table A4.14**.

Table A4.14 Summary of potential changes in the physical environment of Cragg Brook T1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that the drought option implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Cragg Brook T1.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potential change in the energy of the system. This has the potential for moderate risk of changes in available habitat for different species requirements and a moderate risk to longitudinal connectivity. There is also potential minor risk of reduction in total wetted aquatic habitat in the reach and a minor risk of change in sediment dynamics
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.7

A4.9 CRAGG BROOK T2

A4.9.1 Reach introduction

Cragg Brook T2 is potentially impacted by a Turvin Clough Prescribed Flow drought permit. A summary of physical environment information for this reach is provided in **Figure A4.8**. The reach includes part of the following river waterbodies:

- Cragg Brook from Source to River Calder (GB104027062610).

A4.9.2 Reach setting

Cragg Brook T2, located on main EAR **Figure 4.1**, comprises a 2.6 km stretch of Withens Clough from the outflow of Turvin Clough intake to the confluence of Withens Clough and Turvin Clough. The reach is dominated by the Turvin Clough prescribed flow with an additional catchment area of 8.9km² along the length of the reach. Cragg Brook 1 (see **Section A4.10** below) is downstream.

A4.9.3 River flow regime

The normal minimum prescribed flow downstream of the Turvin Clough intake is 6.82 MI/d, and YWSL must ensure that this flow is maintained downstream of their abstraction at all times when abstraction is taking place. Under this drought permit the prescribed flow below the intake is reduced from 6.82 MI/d to 2.25MI/d. The maximum flow reduction is therefore 4.57MI/d in this reach, a reduction of up 67% noting that the lowest natural flows are protected by the prescribed flow condition.

The hydrological assessment methodology set out in the YWSL's Drought Plan 2027 Environmental Assessment Methodology⁹ is not suitable for this reach due to the nature of the prescribed flow condition meaning that there would be no impact on natural low flows. The 67% difference between the baseline and drought option scenario flows has been used to derive the magnitude of hydrological impact. The hydrological impact of the drought option on Cragg Brook T2 is therefore assessed as **major** for a summer/autumn period when abstraction is occurring while the drought option remains in place. This reach is immediately downstream of the Turvin Clough intake so confidence in the hydrological assessment is high. Due to data limitations in the river flow record for Turvin Clough, 1/4/2024-31/3/2025 has been used for illustrative purposes in **Figure A4.3**, rather than 1/4/1996-31/3/1997 and 1/4/2018-31/3/2019 as specified in the YWSL's Drought Plan 2027 Environmental Assessment Methodology¹⁰.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Cragg Brook T2. There are no flow depleted reaches within Cragg Brook T2. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.9.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 03 October 2018 at a river flow of 5.58MI/d.

Cragg Brook T2 is fairly straight reach which flows through a deep vee-shaped valley and falls ~145m over 2.6 km, a slope of 3.2°. The channel is heavily shaded with extensive deciduous riparian tree cover along much of its length. The channel is visible in the upper sections of Cragg Brook T2 (for ~1km downstream) and the channel width is between 2.0-2.6m, increasing to 6-7m in width ~0.93km downstream. At the YWSL baseline monitoring site (site 13528), the channel width is 1.78m. The channel appears to be a step-pool sequence with extensive boulders visible in the channel. No other features were visible. The flow is smooth with areas of broken flow over bedrock steps. At the YWSL baseline site, rippled flow dominated. Channel bed substrate at the YWSL baseline monitoring site, cobbles dominated (40%), however boulders (35%), pebbles/gravel (23%) and sand (2%) were also observed. It is likely that channel banks are composed of earth and boulders and possibly peat given the nature of the soils. In the upper 1km of Cragg Brook T2 surrounding

⁹ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

¹⁰ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

land use is generally moorland heath and rough pasture becoming broadleaf woodland thereafter with some suburban/urban land use on the left bank at the confluence with Withens Clough.

Cragg Brook T2 is likely to be dominated by high energy environments, as indicated by the relatively straight planform, with the watercourse following the step-pool sequence typical in rivers of this type. The large substrate types present will provide some refuge potential for fish species, however the presence of suitable spawning habitat is unknown. The extensive coverage of trees in the riparian habitat will ensure a high input of allochthonous energy into the watercourse, which will be reflected in the macroinvertebrate composition, and provide additional cover to fish. The movement/migration of fish and sediments through Cragg Brook T2 may be influenced by the presence of three weirs.

The drought options reduction in flow could lead to several potential impacts within Cragg Brook T2:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of the drought option.
- Potentially major risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars) and protrusion of bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought option, noting the retention of an overall variable flow pattern.
- Potentially major risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of the drought option, with changes to the range and abundance of flow types.
- Major risk to longitudinal connectivity from three noted weirs for periods of time during the duration of the drought option, noting the retention of an overall variable flow pattern.
- Moderate risk of changes in sediment dynamics for duration of drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Cragg Brook T2 from the drought option is therefore assessed as **major**.

A4.9.5 River water quality

There are no water quality monitoring sites in Cragg Brook T2. As such, for this assessment, the most upstream sample site in the downstream reach (Cragg Brook 1), Cragg Brook at Mytholmroyd has been used to characterise the water quality in this reach. There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Cragg Brook T2 as a result of drought options is presented in **Table A4.15**.

Table A4.15 Potential risks to water quality in Cragg Brook T2 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent concerning concentrations at this site.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Seasonality was apparent concerning saturation at this site, with saturation rising in late winter/spring and falling in late summer/autumn. Saturation repeatedly peaks in April and May.	Orthophosphate concentrations were predominantly consistent with Good (0.028 mg/l) and High (0.013) WFD status throughout the monitoring period, with two instances of results achieving Poor (0.752 mg/l) status.

	Total ammonia	Oxygen	Phosphate
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.9.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Cragg Brook T2 as a result of the drought option is presented in **Table A4.16**.

Table A4.16 Summary of potential changes in the physical environment of Cragg Brook T2 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that the drought option is implemented - noting that the lowest natural flows are protected by the prescribed flow condition.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Cragg Brook T2.
River habitats <i>Major risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risks to total wetted aquatic habitat, available habitat for different species and longitudinal connectivity. There is also a moderate risk to sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.8

A4.10 CRAGG BROOK 1

A4.10.1 Reach introduction

Cragg Brook 1 is potentially impacted by both the Withens Clough Reservoir and Turvin Clough Prescribed Flow drought permits. A summary of physical environment information for this reach is provided in **Figure A4.9**. The reach includes part of the following river waterbody:

- Cragg Brook from Source to River Calder (GB104027062610).

A4.10.2 Reach setting

Cragg Brook 1, located on main EAR **Figure 4.1**, comprises a 3.6 km stretch of Cragg Brook from the confluence of Withens Clough and Turvin Clough down to the confluence with the River Calder at Mytholmroyd. Calder 3 (see **Section A4.11** below) is downstream.

A4.10.3 River flow regime

River flow in Cragg Brook 1 is influenced by the Withens Clough Reservoir influenced flows of Cragg Brook T1 and Turvin Clough Prescribed Flow influenced flows of Cragg Brook T2. As such limited flow variability would be apparent during the implementation of South West Area drought options part-reflecting local hydrological response to rainfall conditions during the ongoing environmental drought.

Daily mean flows at the upstream end of this reach, immediately downstream of the Cragg Brook T1 and Cragg Brook T2 confluence have been estimated using the Gustard flow transposition method. There is no gauged flow data available for Cragg Brook, so flows at the upstream end of this reach have been estimated using the Gustard flow transposition method, based on catchment parameter ratios and gauged flow data from an available downstream gauge at Mytholmroyd on the River Calder (just upstream of the confluence with the Cragg Brook) (see **Annex 4** for further details). As for the Walsden Water, Graining Water and Hebden Water flow transpositions, the Mytholmroyd record was first adjusted to allow for the Eastwood and Redacre WwTWs effluent discharges and the effects of the reservoirs in the upper catchment. Adjustments were made to catchment parameters for the Cragg Brook assessment point, to allow for the catchments upstream of the Withens Clough Reservoir impoundment and the Turvin Clough intake prescribed flow location. Measured outflows from Withens Clough Reservoir and measured daily flows downstream of the Turvin Clough intake were then added back on to the estimated (transposed) data series, to provide an estimated flow record for Cragg Brook 1 with moderate confidence.

The equivalent method was also used to estimate a flow data series for the Cragg Brook immediately upstream of its confluence with the River Calder at Mytholmroyd. This was then summed with the Mytholmroyd gauged record to create an estimated daily flow series for the River Calder downstream of the Cragg Brook tributary (this is required for the assessment of the next reach downstream, Calder 3).

This reach is affected by the combined flow reduction resulting from the Withens Clough Reservoir drought option (maximum reduction of 1.77 Ml/d) and the Turvin Clough prescribed flow drought option (maximum reduction of 4.57 Ml/d). The maximum combined flow reduction is therefore 6.34 Ml/d. However, the residual flow in the Cragg Brook would not be lower than the sum of the minimum compensation from Withens Clough Reservoir and the prescribed flow downstream of the Turvin Clough intake, when abstraction is taking place ($0.87 \text{ Ml/d} + 2.25 \text{ Ml/d} = 3.12 \text{ Ml/d}$). The prescribed flow reductions do not cause the flows to go below the minimum compensation flows. This represents reductions of 58% and 62% in the summer Q_{95} and Q_{99} flow statistics respectively. The flow reduction represents a reduction of 56% and 34% in the year round Q_{95} and Q_{50} flow statistics respectively.

The hydrological impact of drought options on Cragg Brook 1 is therefore assessed as **major** for a summer period and for any winter refill period while drought options remain in place. Due to data limitations in the Mytholmroyd flow gauge record, 1/4/2010-31/3/2011 has been used to illustrate a recent environmental drought scenario in **Figure A4.9**, rather than 1/4/2018-31/3/2019 as specified in the YWSL's Drought Plan 2027 Environmental Assessment Methodology¹¹.

¹¹ Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Cragg Brook 1. There are no flow depleted reaches within Cragg Brook 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.10.4 River habitats

River habitats have been characterised at a whole reach scale. No additional information for a representative 500m reach has been surveyed. A requirement for a walkover of this reach is stipulated in the EMP.

Cragg Brook 1 is a fairly sinuous reach which flows through a deep vee-shaped valley and falls ~78m over 3.6km, a slope of 1.2°. The channel is heavily shaded with extensive deciduous riparian tree cover along much of its length. The channel is only visible at the confluence with the River Calder, where it is around 6m in width, at the RHS site (site ID 18555), river bankfull width was recorded as 8.5m. However, this is unlikely to be fully representative of channel width due to the confined nature of the channel as it flows through the urban area of Mytholmroyd. As the river channel cannot be seen on aerial imagery (with the exception of a small section adjacent to the confluence with the River Calder) no geomorphological features or flow types could be discerned for most of Cragg Brook 1. At the YWSL baseline monitoring site (13540), it was recorded that run (75%) dominated, as well as evidence of riffle (20%), and backwater (5%) flow types. At the RHS site, no in-channel depositional features were observed. Flow was dominated by unbroken standing waves; however, frequent broken standing waves were also recorded. Bed substrate was dominated by cobbles. Due to the nature of the vegetation, it is predicted that banks are composed of earth or peat, becoming reinforced towards the end of Cragg Brook 1. At the RHS site, the left bank was comprised of dominantly bricks and occasional earth, and the right bank was comprised of dominantly earth, abundant brick and occasional concrete. Both banks had been reinforced and re-sectioned. The channel was 100% re-sectioned. Land use on both banks is predominantly rough pasture and broadleaf woodland with some improved grassland at 2.1km downstream. Urbanisation is variable along Cragg Brook 1 becoming dominant as the channel flows through Mytholmroyd ~2.5km downstream.

Cragg Brook 1 (Cragg Brook from Confluence with Withens Clough to Confluence with River Calder) is relatively similar to Cragg Brook T2 (Section A4.11), however the sinuous planform of the watercourse would suggest a greater proportion of low energy flows were present, although high energy flows are still likely to dominate as shown by the RHS data. The extensive coverage of trees in the riparian habitat will ensure a high input of allochthonous energy into the watercourse, which will be reflected in the macroinvertebrate composition, and provide cover to fish. The movement/migration of fish and sediments through Cragg Brook 1 may be influenced by the presence of five weirs.

The drought options reduction in flow could lead to several potential impacts within Cragg Brook 1:

- Major risk of changes in the energy of the system associated with up to 62% reduction in flow for the duration of drought options.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) due to channel shape in deep V-shaped valley.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of drought options, with retention of dominant habitat types.
- Moderate risk to longitudinal connectivity due to steep nature of channel in the reach.
- Minor risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Cragg Brook 1 from drought options is therefore assessed as **moderate**.

A4.10.5 River water quality

One water monitoring location is present in this reach: Cragg Brook at Mytholmroyd (NE-49500145). There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Cragg Brook 1 as a result of drought options is presented in **Table A4.17**.

Table A4.17 Potential risks to water quality in Cragg Brook 1 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent concerning concentrations at this site.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Seasonality was apparent concerning saturation at this site, with saturation rising in late winter/spring and falling in late summer/autumn. Saturation repeatedly peaks in April and May.	Orthophosphate concentrations were predominantly consistent with Good (0.028 mg/l) and High (0.013) WFD status throughout the monitoring period, with two instances of results achieving Poor (0.752 mg/l) status.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.10.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Cragg Brook 1 as a result of drought options is presented in **Table A4.18**.

Table A4.18 Summary of potential changes in the physical environment of Cragg Brook 1 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Major impacts</i>	Reductions of up to 62% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Cragg Brook 1.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risks to total wetted aquatic habitat. There is also a moderate risk to available habitat for different species and longitudinal connectivity. There is a minor risk to sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.9

A4.11 CALDER 3

A4.11.1 Reach introduction

Calder 3 is potentially impacted by the combined impacts of the Gorple Lower Reservoir, Widdop Reservoir, Walshaw Dean Lower Reservoir, Withens Clough Reservoir and Turvin Clough Prescribed Flow drought options. Further downstream the reach is potentially influenced by the combined impacts of the Slitheroe Bridge (including Ryburn and Booth Wood Reservoir options), Ogden Reservoir and Scammonden Reservoir drought options. A summary of physical environment information for this reach is provided in **Figure A4.10**. The reach includes part of the following river waterbodies:

- Calder from Colden Water to Ryburn Confluence (GB104027062641).
- Calder from Ryburn Confluence to River Colne (GB104027062642).

A4.11.2 Reach setting

Calder 3, located on main EAR **Figure 4.1**, comprises a 11.8km stretch of the River Calder from the confluence with the Cragg Brook down to the confluence with the Black Brook. The downstream reach, Calder 4, is assessed in the Middle Calder EAR.

A4.11.3 River flow regime

The upstream end of this reach is affected by the Gorple Lower Reservoir, Widdop Reservoir and Walshaw Dean Lower Reservoir influenced flows of Calder 2 and the Withens Clough Reservoir and Turvin Clough Prescribed Flow influenced flows of Cragg Brook 1. There are continued impacts along the reach from the Slitheroe Bridge Maintained Flow influenced Ryburn 2 and the Ogden Reservoir influenced Hebble Brook 1.

The combined flow reduction from all the above varies according to the time of year and, for Widdop and Walshaw Dean Lower Reservoirs during October to December, depends on whether storage is above or below the control line. The maximum combined flow reductions assume that storage in both Widdop and Walshaw Dean Lower Reservoirs are below the control line in the baseline drought conditions.

Flows in the Calder 3 reach are estimated downstream of the Cragg Brook confluence. The Cragg Brook flow record (see **Section 4.10.3**) has been summed with the gauged record at Mytholmroyd in order to determine estimated flow statistics for the River Calder at Mytholmroyd downstream of the Cragg Brook confluence with moderate confidence.

The overall flow reduction of 12.84 Ml/d downstream of the River Calder and Cragg Brook confluence represents reductions of 19% and 25% in the summer Q_{95} and Q_{99} flow values respectively, and would therefore be assessed as a major hydrological impact during the summer months.

During the period from October to March, the combined flow reduction of up to 17.57 Ml/d below the Cragg Brook confluence would equate to reductions of up to around 24% and 8% in the year round Q_{95} and Q_{50} flow values respectively, and this would therefore be assessed as a moderate hydrological impact during the winter months.

The hydrological impact of drought options on Calder 3 is therefore assessed as **moderate** for a summer/autumn period and **minor** for any winter refill period while drought options remain in place. Due to data limitations in the Mytholmroyd flow gauge record, 1/4/2010-31/3/2011 has been used to illustrate a recent environmental drought scenario in **Figure A4.10**, rather than 1/4/2018-31/3/2019 as specified in the YWSL's Drought Plan 2027 Environmental Assessment Methodology¹²

An additional assessment point was reviewed downstream of the River Ryburn confluence which included a flow reduction of 12Ml/d from the Slitheroe Bridge Maintained Flow. The overall flow

¹² Ricardo (2025). YWSL Drought Plan 2027. Environmental Assessment Methodology. Report for YWSL Services Ltd. February 2025.

reduction of 26.86ML/d downstream of the River Calder and River Ryburn confluence represents reductions of 18% and 19% in the summer Q_{95} and Q_{99} flow values respectively, and would therefore be assessed as a moderate hydrological impact during the summer months.

During the period from October to March, the combined flow reduction of up to 31.59 ML/d below the River Ryburn confluence would equate to reductions of up to around 17% and 8% in the year round Q_{95} and Q_{50} flow values respectively, and this would therefore be assessed as a minor hydrological impact during the winter months.

Therefore, the hydrological impact of drought options on River Calder downstream of the River Ryburn confluence is assessed as **moderate** for a summer/autumn period and **minor** for any winter refill period while drought options remain in place.

There is one significant flow pressure influencing flow in Calder 3, a discharge permit leading to a significant flow addition from Halifax WwTW, with a dry weather flow of 57.70 ML/d. There are no significant abstractions within Calder 3. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.11.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 14 September 2018 at an estimated river flow at the flow assessment point for the reach of ~150ML/d.

Calder 3 is a fairly sinuous reach with relatively straight sections throughout the reach. The reach falls ~23m over 11.8km, a slope of 0.1°. Riparian tree cover ranges between scattered to continuous on both banks along the reach. The channel is visible on aerial imagery for most of its length. Channel width has been measured as between ~7-24m in the upstream of the reach increasing to ~10-33m in the downstream reaches. Extant aerial imagery shows a wide array of in-channel features with 12 mid channel bars (8 of which are vegetated) and 24 side bars (7 of which are vegetated). In the upstream reaches an extensive section (~0.5km long) of bank erosion is noted at a distance of 1km downstream. Localised bank erosion has also been noted in the mid-section of the channel. The sediment bar features suggest particle sizes around of pebble and cobble. Some boulders have been noted protruding through the flow surface. At the further upstream YWSL baseline monitoring site (survey 13538), it was recorded that the dominant substrate was boulders (40%) and cobbles (30%), with pebbles/gravel (15%) and sand (15%) also present. At the furthest downstream YWSL baseline monitoring site (13539), pebbles/gravel (40%) and cobbles (30%) dominated the substrate, with boulders (15%) and sand (15%) also present. Where visible on aerial imagery, the channel surface indicates that smooth flow predominates, however multiple areas of broken flow have been identified, and these are taken to be related to riffles. At the further upstream YWSL baseline monitoring site (survey 13538) it was recorded that the predominant flow was cascade (55%), with riffle (15%), run (15%), pool (10%) and backwater (5%) also present. At the furthest downstream YWSL baseline monitoring site (13539), run (80%) was dominant, with riffle (10%) and backwater (10%) also present. Where banks are vegetated it is assumed that they are composed of earth. Bank reinforcement is common in the mid sections of the reach around Sowerby Bridge and resectioning is present in the upper and mid sections of the reach. Surrounding land use is predominantly improved grassland, parkland and gardens and broadleaf woodland. Suburban/urban development is predominant in parts of the reach, as the river flows alongside Halifax.

Calder 3 is likely to be dominated by low energy environments, with the shallow slope gradient indicating that they are lowland watercourses. The significant presence of depositional features and dominant flow type identified confirms this, however the presence of some erosional features also suggests high energy environments are likely to be present. The likely presence of riffles suggests the potential for spawning habitat to be present, with significant cover likely to be provided in the channel. Calder 3 is also likely to support features suitable for providing cover/refuge for juvenile and adult fish. The regular presence of trees in the riparian corridor will provide allochthonous energy into the system, which will be reflected in the macroinvertebrate species composition, provide some cover to juvenile and adult fish and some resting opportunities to otter. The woodland is potentially subject to increased

disturbance by the surrounding urban and suburban land uses, however the extensive woodland present in the surrounding land use of Calder 3 also provides potential for breeding habitat for otter to be present. The presence of suitable marginal vegetation to support water vole is unknown, and so suitable habitat is considered likely to be present on a precautionary basis. The movement/migration of fish and sediment in Calder 3 will be influenced by the presence of eight weirs in the reach.

The drought options reduction in flow could lead to several potential impacts within Calder 3:

- Up to moderate risk of changes in the energy of the system associated with up to 25% reduction in flow for periods of time during summer/autumn and winter refill drought options
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars and islands) and protrusion of bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought options, noting the retention of an overall variable flow pattern.
- Potentially minor risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of drought options, with few changes to the range and abundance of flow types.
- Minor risk to longitudinal connectivity from eight in-channel structures for periods of time during the duration of drought options, noting the retention of an overall variable flow pattern.
- Minor risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Calder 3 from drought options is therefore assessed as **minor**.

A4.11.5 River water quality

The furthest upstream of three water quality monitoring points on this reach, River Calder at Sowerby Bridge (NE-49500625), was used for this assessment (noting no paired flow data is available from 2018 onwards due to there being no gauged flow data at the Mytholmroyd flow gauge after this period). There are six frequently spilling CSOs potentially presenting an environmental risk in the reach. Though Halifax WwTW presents a flow pressure in this reach, SIMCAT modelling has not flagged WwTW as a significant continuous water quality pressure as a result of the YWSL drought permits impacting this reach.. See Annex 2 for a full list of discharges considered in the assessment.

A summary description of the potential risks to water quality in Calder 3 as a result of drought options is presented in **Table A4.19**

Table A4.19 Potential risks to water quality in Calder 3 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were mostly consistent with High WFD status (0.2 mg/l) with three instances of results achieving Good status (0.3 mg/l). No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. Some seasonality was apparent.	Orthophosphate concentrations were predominately consistent with Moderate (0.102 mg/l) and Poor (0.804 mg/l) status. Strong seasonality is apparent.

	Total ammonia	Oxygen	Phosphate
Flow sensitivity (diffuse pollution)	None apparent	None apparent	Strong
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	Risk of short term acute, infrequent, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) locally downstream of six listed CSOs during rainfall events.		None
Other point source pressures presenting risk	None	None	None
Summary	Moderate risk from drought options associated with CSO discharge	Moderate risk from drought options associated with CSO discharge	Moderate risk from drought options associated with change in dilution of diffuse pollution pressures.

A4.11.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Calder 3 as a result of drought options is presented in **Table A4.20**.

Table A4.20 Summary of potential changes in the physical environment of Calder 3 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Moderate impacts (summer/autumn)</i> <i>Minor impacts (winter)</i>	Reductions of up to 25% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>Minor</i>	- There are no flow depleted reaches or significant abstractions within Calder 3. - There is one significant flow addition in the reach associated with a water company discharge.
River habitats <i>Minor impacts</i>	The up to moderate reduction in flow will lead to a potentially minor change in the energy of the system noting the retention of an overall variable flow pattern. This has the potential for minor risks to total wetted aquatic habitat, available habitat for different species, longitudinal connectivity and sediment dynamics.
Water quality <i>Moderate impacts</i>	- Moderate risk from short term acute, infrequent, temporary water quality pressures locally downstream of six listed CSOs during rainfall events. - Phosphate quality is variable with strong flow sensitivity, therefore a moderate risk to water quality has been assessed associated with change in dilution of diffuse pollution pressures to phosphate. - Reported ammonia and dissolved oxygen water quality is predominantly consistent with High status with no apparent flow sensitivity for dissolved oxygen and ammonia. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia and dissolved oxygen has been assessed. - No identified risk associated with continuous discharges.

Insert Figure A4.10

A4.12 LUDDENDEN BROOK 1

A4.12.1 Reach introduction

Luddenden Brook 1 is potentially impacted by a Warley Moor Reservoir drought permit. A summary of physical environment information for this reach is provided in **Figure A4.11**. The reach includes all of the main channel of the following river waterbodies:

- Luddenden Brook from source to River Calder (GB104027062770).

A4.12.2 Reach setting

Luddenden Brook 1, located on main EAR **Figure 4.1**, comprises a 9.1 km stretch of Luddenden Brook from the outflow of Warley Moor Reservoir to the confluence with the River Calder. The reach is dominated by reservoir outflows with an additional catchment area of 19.3km² along the length of the reach. Calder 3 (see **Section A4.11** above) is downstream.

A4.12.3 River flow regime

During the implementation of Upper Calder Area drought options, storage in Warley Moor Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. A reduction of up to 2.02Ml/d in the statutory compensation release rate of 3.02Ml/d represents a 67% reduction in the flow at the upstream end of the reach, regardless of the time of year. During a winter refill period when catchment flows are generally increasing, there may be some limited flow accretion along the reach so that the percentage flow reduction is less at the lower end of the reach. The compliance point for the Warley Moor Reservoir release is actually downstream of Castle Carr Reservoir (the bottom reservoir of the chain). The flow reduction at the top of the reach will remain at 67% until the reservoir reaches top water level and begins to spill again.

The hydrological impact of drought options on Luddenden Brook 1 is therefore assessed as **major** for a summer period and for any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Luddenden Brook 1. There are no flow depleted reaches in Luddenden Brook 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.12.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 27 September 2018 at a reservoir outflow of 5.14Ml/d.

Luddenden Brook 1 is fairly sinuous reach which falls ~318m over 9.1km, a slope of 2.0°. From aerial imagery, on the sections of the river not heavily shaded the estimated average width is 4.3m. The top of the reach between Warley Moor Reservoir and Upper Dean Head Reservoir is sparse in riparian tree cover. The reach then extends through Upper Dean Head Reservoir, Lower Dean Head Reservoir, Castle Carr Reservoir and Castle Carr Fountain. Throughout this upper section of the reach there is little urbanisation and significant channel modification. Past Castle Carr Fountain, the channel is heavily shaded with extensive deciduous riparian tree cover along most of its length. There is little to no urbanisation in this middle section of the reach, there are some small settlements and farms. At the lower end of the reach the river flows through Luddenden, where there is urbanisation in the village alongside the reach. There are 17 weirs throughout the reach as well as one dam in the middle section of the reach. There are five road bridges that cross the river in this reach, it is not possible to use aerial imagery to determine the number of foot bridges in the reach due to the extensive riparian tree cover. The land use for the upper section of the reach around the reservoirs is mostly moors and heathland, with a small amount of peat bogs. The land use for the middle and downstream sections of this reach are predominantly pastures and discontinuous urban fabric towards the end of the reach.

Luddenden Brook 1 is likely to be dominated by high energy environments, as indicated by the slope of the watercourse and step-pool sequence of the reach, however low energy environments are also present with depositional features identified in Luddenden Brook 1 and the flow structure indicates they may be present.

The presence of riffles in the watercourse indicate spawning habitat may be present, although this will be in discrete patches as cobble is the dominant substrate type. Significant cover for adult and juvenile fish is provided in the channel by the presence of boulders and extensive undercut/vertical banks. The extensive cover of trees in the riparian habitat will also provide cover to fish as well as significantly contribute allochthonous energy into the watercourse, which will be reflected in the macroinvertebrate species composition. The presence of trees in the riparian habitat may also provide resting habitat opportunities for otter, and the presence of extensive areas of woodland in the upper reaches could provide suitable opportunities for breeding. The migration/movement of fish and sediment in Luddenden Brook 1 may be influenced by the presence of 17 weirs, noting 10 downstream of the lowest dam.

The drought options reduction in flow could lead to several potential impacts within Luddenden Brook 1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of the drought option.
- Potentially major risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars) and protrusion of bed elements (such as larger particles) through the flow surface for periods of time during the duration of the drought option, noting the retention of an overall variable flow pattern.
- Potentially major risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of the drought option, with changes to the range and abundance of flow types.
- Major risk to longitudinal connectivity from 10 noted weirs downstream of the lowest dam, for periods of time during the duration of the drought option, noting the retention of an overall variable flow pattern.
- Moderate risk of changes in sediment dynamics for duration of the drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Luddenden Brook 1 from the drought option is therefore assessed as **major**.

A4.12.5 River water quality

There is one water monitoring location present in Luddenden Brook Reach 1, Luddenden Brook at Luddenden Foot (NE-49500499). There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Luddenden Brook 1 as a result of drought options is presented in **Table A4.21**.

Table A4.21 Potential risks to water quality in Luddenden Brook 1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were predominately consistent with 'High WFD status (0.2 mg/l) throughout the monitoring period. There was 1 instance of Moderate (0.75 mg/l) status on 08/09/2014. No seasonality was apparent.	Dissolved oxygen saturation (%) was consistent with 'High WFD status (80%) throughout the monitoring period. No seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with Good (0.031mg/l) and High (0.015mg/l) WFD status throughout the monitoring period, with two occurrences of concentrations achieving 'Poor' status (0.783 mg/l). No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent

	Total ammonia	Oxygen	Phosphate
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.12.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Luddenden Brook 1 as a result of the drought option is presented in **Table A4.22**.

Table A4.22 Summary of potential changes in the physical environment of Luddenden Brook 1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Luddenden Brook 1.
River habitats <i>Major risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risks to total wetted aquatic habitat, available habitat for different species and longitudinal connectivity. There is also a moderate risk to sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.11

A4.13 BOOTH DEAN CLOUGH 1

A4.13.1 Reach introduction

Booth Dean Clough 1 is potentially impacted by both the Booth Wood Reservoir and Slitheroe Bridge Maintained Flow drought permits. A summary of physical environment information for this reach is provided in **Figure A4.12**. The reach includes part of the following river waterbodies:

- Booth Dean Clough from Source to River Ryburn (GB104027062520).

A4.13.2 Reach setting

Booth Dean Clough 1, located on main EAR **Figure 4.1**, comprises a 3.0 km stretch of Booth Dean Clough from the outflow of Booth Wood Reservoir to the confluence with the River Ryburn. The reach is impacted by the Booth Wood Reservoir and Slitheroe Bridge Maintained Flow drought permits. Ryburn 2 (see **Section A4.14** below) is downstream.

A4.13.3 River flow regime

During the implementation of Upper Calder Area drought options, storage in Booth Wood Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. A reduction of up to 2.28 Ml/d in the statutory compensation release rate of 3.41 Ml/d represents a 67% reduction in the flow at the upstream end of the reach, regardless of the time of year. Compensation flows are also part of the Slitheroe Bridge maintained flow. Combined releases from Ryburn, Booth Wood reservoirs are made to ensure a maintained flow of normally no less than 18.00 Ml/d downstream at Slitheroe Bridge on the River Ryburn (as measured at the Ripponden gauge), and under this drought permit the maintained flow is reduced by up to 12.00 Ml/d, to a flow of 6.00 Ml/d. During environmental drought conditions there is likely to be limited flow accretion along the reaches downstream of the reservoirs to the location of the maintained flow, therefore the majority of the maintained flow requirement will have to be made up from the combined releases from the two reservoirs. Therefore, under this drought permit, the maximum reduction in the combined release from the two reservoirs will be 12.00 Ml/d, a reduction of 67%. The outflow from each individual reservoir in the group may vary but on average will be reduced by up to 67%.

The hydrological impact of drought options on Booth Dean Clough 1 is therefore assessed as **major** for a summer/autumn period and for any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There are no significant flow pressures, either abstractions or discharges, influencing flow in Booth Dean Clough 1. There are no flow depleted reaches within Booth Dean Clough 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.13.4 River habitats

River habitats have been characterised at a whole reach scale. No additional information for a representative 500m reach has been surveyed.

Booth Dean Clough 1 is a fairly sinuous reach, flowing through a deep vee-shaped valley, which falls ~82m over 3km, a slope of 1.6°. The channel is heavily shaded with extensive deciduous riparian tree cover along most of its length. As the river channel cannot be seen on aerial imagery no geomorphological features or flow types could be discerned. There are two RHS site (site ID 26379 and site ID 26494). At the most upstream site (site ID 26379) in the reach, six pools, two riffles and no point bars were observed. The survey did not observe any channel modification, including channel realignment, over deepening of the channel or impoundment. At the downstream RHS site (site ID 26494) flow was dominated by rippled flow, however frequent smooth flow and occasional unbroken standing waves was also recorded. At the site several side bars, mid-channel bars and natural berms were recorded. Banks were comprised of dominant amounts of brick and frequent amounts of earth on the left bank and dominant amounts of earth, abundant amounts of brick and occasional amounts of bedrock on the right bank. Both banks had been reinforced and were steep (>45°), the right bank had been undercut. Due to the nature of the vegetation along the reach it is predicted that banks are predominately composed of earth. Land-use in the upper 2.5km of the reach on both banks is

predominantly mixed woodland with some rough pasture and improved grassland. In the last 0.5km Land-use on both banks is predominantly improved grassland with broadleaf woodland. Urbanisation increases towards the end of Booth Dean Clough 1.

Booth Dean Clough 1 is likely to comprise high and low energy environments, as indicated by the sinuous nature of the watercourse and slope of the valley. The extensive coverage of trees in the riparian habitat will ensure a high input of allochthonous energy into the watercourse, which will be reflected in the macroinvertebrate composition, and provide some cover to fish. The movement/migration of fish and sediments in Booth Dean Clough 1 is likely to be influenced by the presence of five weirs.

The drought options reduction in flow could lead to several potential impacts within Booth Dean Clough 1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of the drought option.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) due to channel shape in deep V-shaped valley.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of the drought option, with retention of dominant habitat types.
- Moderate risk to longitudinal connectivity due to steep nature of channel in the reach.
- Minor risk of changes in sediment dynamics for duration of the drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Booth Dean Clough 1 from the drought option is therefore assessed as **moderate**.

A4.13.5 River water quality

One water monitoring location is present in Booth Dean Clough 1, Booth Dean Clough Above Ryburn Conf (NE-49505154), which was used for this assessment. There are no intermittent or continuous pressures in this reach. A summary description of the potential risks to water quality in Booth Dean Clough 1 as a result of the drought option is presented in **Table A4.23**.

Table A4.23 Potential risks to water quality in Booth Dean Clough 1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were primarily consistent with High WFD status (0.2 mg/l) with one result achieving Good status (0.3mg/l). No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. No seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with Good (0.03 mg/l) and High (0.014mg/l) WFD status throughout the monitoring period, with two instances of concentrations achieving Moderate or lower status. No seasonality was apparent.
Flow sensitivity (diffuse pollution)	Weak	Weak	Weak
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	None	None	None

	Total ammonia	Oxygen	Phosphate
Summary	Minor risk from drought options	Minor risk from drought options	Minor risk from drought options

A4.13.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Booth Dean Clough 1 as a result of the drought option is presented in **Table A4.24**.

Table A4.24 Summary of potential changes in the physical environment of Booth Dean Clough 1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that the drought option is implemented.
Flow depleted reaches/significant flow pressures <i>None</i>	There are no flow depleted reaches or significant flow pressures within Booth Dean Clough 1.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for moderate risks to available habitat for different species and longitudinal connectivity. There is also a minor risk to total wetted aquatic habitat and to sediment dynamics.
Water quality <i>Minor risk</i>	- Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with only weak flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous or intermittent water quality pressures in this reach.

Insert Figure A4.12

A4.14 RYBURN 1

A4.14.1 Reach introduction

Ryburn 1 is potentially impacted by both the Ryburn Reservoir and Slitheroe Bridge Maintained Flow drought permits. A summary of physical environment information for this reach is provided in **Figure A4.13**. The reach includes part of the following river waterbodies:

- River Ryburn from Source to Booth Dean Clough (GB104027062540).

A4.14.2 Reach setting

Ryburn 1, located on main EAR **Figure 4.1**, comprises a 1.4 km stretch of the River Ryburn from the outflow of Ryburn Reservoir to the confluence with Booth Dean Clough. Ryburn 2 (see **Section A4.15** below) is downstream.

A4.14.3 River flow regime

During the implementation of Upper Calder Area drought options, storage in Ryburn Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. A reduction of up to 3.95MI/d in the statutory compensation release rate of 5.90MI/d represents a 67% reduction in the flow at the upstream end of the reach, regardless of the time of year. Compensation flows are contribute to the flow requirement of the Slitheroe Bridge maintained flow. Combined releases from Ryburn and Booth Wood reservoirs are made to ensure a maintained flow of normally no less than 18.00 MI/d downstream at Slitheroe Bridge on the River Ryburn (as measured at the Ripponden gauge), and under this drought permit the maintained flow is reduced by up to 12.00 MI/d, to a flow of 6.00 MI/d. During environmental drought conditions there is likely to be limited flow accretion along the reaches downstream of the reservoirs to the location of the maintained flow, therefore the majority of the maintained flow requirement will have to be made up from the combined releases from the three reservoirs. Therefore, under this drought permit, the maximum reduction in the combined release from the two reservoirs will be 12.00 MI/d, a reduction of 67%. The outflow from each individual reservoir in the group may vary but on average will be reduced by up to 67%.

The hydrological impact of drought options on Ryburn 1 is therefore assessed as **major** for both a summer period and any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There is one significant flow pressure influencing flow in Ryburn 1, a non-consumptive abstraction licence leading to a flow depleted reach as described in **Section A4.14.3.1**. There are no significant discharges within Ryburn 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.14.3.1 Flow depleted reaches/significant flow pressures

There is one separate licensed non-consumptive abstraction depleting flow in Ryburn 1 for fish farm through-flow¹³.

The abstraction is for ~450m of Ryburn 1 between the offtake and outfall, with a peak daily licensed abstraction rate of 1.36MI/d. This abstraction is a non-consumptive fish farm abstraction ('River Ryburn') without a hands-off-flow condition with potential flow impacts. An abstraction at that rate could reduce flows in the depleted reach, during environmental drought to ~4.5MI/d without the drought options. With the drought option this would reduce to ~0.61MI/d, an 87% reduction.

A walkover reach covering the section of the river has been included in the schedule of monitoring for Ryburn 1 (see main EAR Section 6). YWSL will liaise with the abstractors in advance of permit implementation to determine appropriate mitigation measures.

¹³ YWSL are investigating the status of this fish farm which may no longer be operational. The assessment will be updated when further information is available. In the interim monitoring and mitigation remains specified for this pressure (see also Section A4.18.5).

A4.14.4 River habitats

River habitats have been characterised at a whole reach scale. No additional information for a representative 500m reach has been surveyed during the onset of drought. A requirement for a walkover of this reach is stipulated in the EMP. Despite this, **Figure A4.13** uses images of this reach taken as part of the Ryburn/Booth Wood Reservoir flow testing undertaken as part of the YWSL Reservoirs Environmental Strategy project on 16th May 2024 with a reservoir outflow of 10.5 Ml/d.

Ryburn 1 is a fairly sinuous reach, flowing through a shallow vee-shaped valley, which falls ~28m over 1.4km, a slope of 1.1°. The channel is heavily shaded with extensive deciduous riparian tree cover along most of its length. It is not possible to calculate channel widths in Ryburn 1 due to the visibility of the channel. At the RHS site (site ID 26485), the channel bankfull width was recorded as 12m wide. As the river channel cannot be seen on aerial imagery no geomorphological features or flow types could be discerned for much of the reach. At the RHS site, two unvegetated side bars were recorded. Flow at the RHS site was dominantly rippled, however frequent areas of unbroken standing waves were also observed. At the survey site four pools and three riffles were recorded. Bed substrate at the RHS site was dominated by boulders, however frequent areas of cobble and occasional bedrock were also observed. The RHS survey noted exposed boulders dominated and occasional exposed bedrock at the survey site. At the RHS site, banks were dominated by earth, however areas of bedrock, brick and boulders were also observed. Elsewhere along Ryburn 1, due to the nature of the vegetation it is predicted that the channel banks are composed of earth, however there is likely to be concrete, brick or stone reinforcement on the left bank due to the presence of housing along the reach. Banks were dominantly steep at the RHS site, and the right bank was recorded as undercut. Frequent stable cliffs were also recorded on the right bank. Both the right and left bank had been reinforced. Land use on the left bank is predominantly suburban/urban with some improved grassland. On the right bank land use is predominantly broadleaf woodland with improved grassland and tilled land beyond the woodland.

Ryburn 1 is likely to comprise high and low energy environments, as indicated by the sinuous nature of the watercourse and slope of the valley. The extensive coverage of trees in the riparian habitat will ensure a high input of allochthonous energy into the watercourse, which will be reflected in the macroinvertebrate composition, and provide some cover to fish. The movement/migration of fish and sediments in Ryburn 1 is likely to be influenced by the presence of 10 weirs.

The drought options reduction in flow could lead to several potential impacts within Ryburn 1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for periods of time during the duration of drought options.
- Potentially major risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars) and protrusion of bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought options, noting the retention of an overall variable flow pattern.
- Potentially major risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of drought options, with changes to the range and abundance of flow types.
- Major risk to longitudinal connectivity from 10 noted weirs downstream of the lowest dam, for periods of time during the duration of drought option, noting the retention of an overall variable flow pattern.
- Moderate risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Ryburn 1 from drought options is therefore assessed as **major**.

A4.14.5 River water quality

For this assessment the one water monitoring location present in Ryburn Reach 1, Ryburn At A672 Slitheroe Bridge (NE-49500672). There is one significant continuous discharge into Ryburn 1, the flow return from Ryburn Trout farm. A summary description of the potential risks to water quality in Ryburn 1 as a result of drought options is presented in **Table A4.25**.

Table A4.25 Potential risks to water quality in Ryburn 1 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were primarily consistent with High WFD status (0.2 mg/l) throughout the monitoring period. No seasonality was apparent concerning concentrations at this site.	Dissolved oxygen saturation (%) values were consistent with WFD status (80%) throughout the monitoring period. No seasonality was apparent concerning saturation at this site.	Orthophosphate concentrations were predominantly consistent with Good (0.028mg/l) and High (0.013mg/l) WFD status throughout the monitoring period. No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	None	None	None
Other point source pressures presenting risk	Ryburn Trout Farm would discharge flow into low river flow. Discharge without permit conditions. Monitoring site downstream indicates few risks.	Ryburn Trout Farm would discharge flow into low river flow. Discharge without permit conditions. Monitoring site downstream indicates few risks.	Ryburn Trout Farm would discharge flow into low river flow. Discharge without permit conditions. Monitoring site downstream indicates few risks.
Summary	Moderate risk from drought options in combination with fish farm discharge.	Moderate risk from drought options in combination with fish farm discharge.	Moderate risk from drought options in combination with fish farm discharge.

A4.14.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Ryburn 1 as a result of drought options is presented in **Table A4.26**.

Table A4.26 Summary of potential changes in the physical environment of Ryburn 1 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>Major impacts</i>	~450m flow depleted reach with potential for periods of time with flow reduced by 87% without mitigation.
River habitats <i>Major risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risks to longitudinal connectivity. There is also moderate risk to available habitat for different species and minor risks to total wetted aquatic habitat and to sediment dynamics.
Water quality <i>Moderate risk</i>	- The fish farm is without permit conditions and would be discharged flow at the ratio of 2:1 river flow to effluent. Moderate risk has been assumed. - Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
	only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. • No risk associated with any intermittent water quality pressures in this reach.

Insert Figure A4.13

A4.15 RYBURN 2

A4.15.1 Reach introduction

Ryburn 2 is potentially impacted by the Ryburn Reservoir, Booth Wood Reservoir and Slitheroe Bridge Maintained Flow drought permits. A summary of physical environment information for this reach is provided in **Figure A4.14**. The reach includes part of the following river waterbodies:

- River Ryburn from Booth Dean Clough to River Calder (GB104027062580).

A4.15.2 Reach setting

Ryburn 2, located on main EAR **Figure 4.1**, comprises a 6.2 km stretch of the River Ryburn from the confluence with Booth Dean Clough down to the confluence with the River Calder. Calder 3 (see **Section A4.11** above) is downstream.

A4.15.3 River flow regime

Flows at the top end of this reach are measured at the Ripponden gauging station just downstream of the River Ryburn/Booth Dean Clough confluence. This is also the gauge used to monitor compliance with the Slitheroe Bridge maintained flow condition. The flow reduction is therefore assessed against the normal maintained flow value of 18.00 Ml/d, as this is the baseline flow that would have to be maintained throughout drought conditions unless a drought permit was in place. Under this drought permit the maintained flow at Slitheroe Bridge would be reduced by up to 12.00 Ml/d (from 18.00 Ml/d to 6.00 Ml/d) as outlined previously. This equates to a 67% flow reduction.

The hydrological impact of drought options on Ryburn 2 is therefore assessed as **major** for both a summer period and any winter refill period while drought options remain in place.

There is one significant flow pressure influencing flow in Ryburn 2, a discharge licence leading to a significant flow addition from Ripponden Wood WwTW, with a dry weather flow of 1.64 Ml/d and a maximum daily flow of 2.78Ml/d. There are no significant abstractions within Ryburn 2. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.15.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 19 September 2018 at an estimated river flow at the flow assessment point for the reach of 19.35Ml/d.

Ryburn 2 is a fairly sinuous reach with several straight sections, which flows through a deep vee-shaped valley. The reach falls ~63m over 6.2km, a slope of 0.6°. The channel is heavily shaded with extensive deciduous riparian tree cover along much of its length, although shading decreases as the reach flows towards Sowerby Bridge. At the RHS site, (site ID 26378), no pools, three riffles and no point bars were observed. The survey also did not observe any channel realignment, over deepening or artificial ponding. The bankfull width at this site was recorded as 9m. Exposed boulders were extensive at the RHS site, and exposed bedrock was present. Broken standing waves were also noted, with unbroken standing waves, smooth and chute flow was recorded at the RHS site, however rippled flow dominated. Surrounding land-use is generally broadleaf woodland and suburban/urban land use, particularly as the channel passes through Sowerby Bridge.

Ryburn 2 is likely to support both high and low energy environments, as indicated by the range of flow types present and the presence of depositional features. Although typical spawning habitats for most species (unconsolidated gravels) is not extensively present, it is likely to be present in discrete patches and the high number of riffles likely to be present, as indicated in the RHS data, indicates the potential to support spawning. The large substrate types identified as present in the substrate composition will provide cover and refuge for juvenile and adult fish. The regular tree cover in the riparian corridor will provide allochthonous energy into the system, which will be reflected in the macroinvertebrate species composition, provide additional cover to fish and potential resting opportunities for otter. The extensive woodland present in the surrounding land use also provides potential for breeding habitat for otter to be present. The movement/migration of fish and sediments in Ryburn 2 is likely to be influenced by the presence of eleven weirs.

The drought options reduction in flow could lead to several potential impacts within Ryburn 2:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for periods of time during the duration of drought options.
- Potentially moderate risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins, the margins of within-channel features (such as channel bars and islands) and protrusion of bed elements (such as larger particles) through the flow surface for periods of time during the duration of drought options.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for periods of time during the duration of drought options, with changes to the range and abundance of flow types.
- Major risk to longitudinal connectivity from 11 weirs for periods of time during the duration of drought options.
- Moderate risk of changes in sediment dynamics for duration of drought options. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Ryburn 2 from drought options is therefore assessed as **major**.

A4.15.5 River water quality

For this assessment the most upstream of the three water monitoring points in the reach, River Ryburn Above Ripponden Wood Wpc Wk (NE-49500668), was used. There are seven frequently spilling CSO potentially presenting an environmental risk in the reach. Water quality modelling identifies one continuous discharge, YWSL Ripponden Wood WwTW, presenting a significant risk to both dissolved oxygen and total ammonia in Ryburn 2. A summary description of the potential risks to water quality in Ryburn 2 as a result of drought options is presented in **Table A4.26**.

Table A4.26 Potential risks to water quality in Ryburn 1 as a result of drought options

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were primarily consistent with High WFD status (0.2 mg/l) throughout the monitoring period With one instance of Good status. No seasonality was apparent.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. No seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with Good (0.031mg/l) and High (0.014mg/l) WFD status throughout the monitoring period with some results achieving Moderate WFD status or lower. No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	Risk of medium-term chronic, regular, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) downstream of Ripponden Wood WwTW.		None
Intermittent pressures presenting risk	Risk of short term acute, infrequent, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) locally downstream of seven listed CSO during rainfall events.		None
Other point source pressures presenting risk	None	None	None

	Total ammonia	Oxygen	Phosphate
Summary	Moderate risk from drought options associated with reduction in dilution of WwTW and CSO discharge	Moderate risk from drought options associated with reduction in dilution of WwTW and CSO discharge	Minor risk from drought options

A4.15.6 Summary of potential changes in the physical environment as a result of drought options

An overall summary of potential changes in the physical environment of Ryburn 2 as a result of drought options is presented in **Table A4.27**.

Table A4.27 Summary of potential changes in the physical environment of Ryburn 2 as a result of drought options

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that drought options implemented.
Flow depleted reaches/significant flow pressures <i>Minor</i>	- There are no flow depleted reaches or significant abstraction pressures within Ryburn 2. - There is one significant flow addition in this reach associated with a water company wastewater discharge.
River habitats <i>Major risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risks to longitudinal connectivity. There is also moderate risk to available habitat for different species, to total wetted aquatic habitat and to sediment dynamics.
Water quality <i>Moderate risk</i>	- Moderate risk from medium-term chronic, regular, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) downstream of Ripponden Wood WwTW. - Moderate risk from short term acute, infrequent, temporary water quality pressures locally downstream of seven listed CSO during rainfall events. - Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed.

Insert Figure A4.14

A4.16 HEBBLE BROOK 1

A4.16.1 Reach introduction

Hebble Brook 1 is potentially impacted by an Ogden Reservoir drought permit. A summary of physical environment information for this reach is provided in **Figure A4.15**. The reach includes part of the following river waterbodies:

- Hebble Brook from source to River Calder (GB104027062780).

A4.16.2 Reach setting

Hebble Brook 1, located on main EAR **Figure 4.1**, comprises a 12.4 km stretch of Hebble Brook from the outflow of Ogden Reservoir to the confluence with the River Calder. The reach is dominated by reservoir outflows with an additional catchment area of 30.9km² along the length of the reach. Calder 3 (see **Section A4.11** above) is downstream.

A4.16.3 River flow regime

During the implementation of South West Area drought options, storage in Ogden Reservoir is likely to be below top water level and therefore the reservoir compensation flow represents a high proportion of the flow in this reach. A reduction of up to 2.29Ml/d in the statutory compensation release rate of 3.42Ml/d represents a 67% reduction in the flow at the upstream end of the reach, regardless of the time of year. During a winter refill period when catchment flows are generally increasing, there may be some limited flow accretion along the reach so that the percentage flow reduction is less at the lower end of the reach. However, the flow reduction at the top of the reach will remain at 67% until the reservoir reaches top water level and begins to spill again.

The hydrological impact of drought options on Hebble Brook 1 is therefore assessed as **major** for a summer period and for any winter refill period while drought options remain in place. With this reach being immediately downstream of the reservoir, the confidence in the assessment of the hydrological impact is high.

There is one significant flow pressure influencing flow in Hebble Brook 1 as described in **Section A4.16.3.1**. There are no flow depleted reaches within Hebble Brook 1. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.16.3.1 Flow depleted reaches/significant flow pressures

Though no licensed daily quantities are available, the Environment Agency have advised that the Canal and Rivers Trust abstraction (NE/027/0012/048) should be considered as significant flow pressure in this reach. YWSL will liaise with the abstractors in advance of permit implementation to determine appropriate mitigation measures. A walkover has been included downstream of this abstraction in the schedule of monitoring for Hebble Brook 1 (see main EAR Section 6).

A4.16.4 River habitats

River habitats have been characterised at a whole reach scale and with additional information for a representative 500m reach from survey information on 19 September 2018 at a reservoir outflow of 3.76Ml/d.

Hebble Brook 1 is moderately sinuous reach which falls ~240m over 12.4 km, a slope of 1.1°. Riparian vegetation ranges between isolated to semi-continuous in the upper 7km of the reach with few trees in the lower reaches (due to extensive urbanisation). In the upper 7km where the channel is visible, channel width varies between 2.9-3.4m. In the upper 7km section, where the channel is visible only one island is visible. Within the first 3km of the reach there are two RHS sites (site ID 26488 and 22218), throughout these surveys a total of one pool, 13 riffles and no point bars were observed. There were no observations from these surveys of channel modification, including over deepening, realignment or impoundment. Variation in flow was observed at the upper site (22218) and frequent broken standing waves, occasional chaotic flow and unbroken standing waves was observed, although rippled flow still dominated. There is another RHS survey (site ID 21114) further down the reach, 4.7km from the start. There were no pools, four riffles and no point bars observed, as well as no observed channel modification, including over deepening, realignment or impoundment. Channel bed substrate at the upper RHS site (22218) was dominated by cobbles and recorded

frequent boulders. Surrounding land-use is generally rough pasture and broadleaf woodland in the upper and mid sections. Urbanisation increases from the mid to lower Hebble Brook 1 as the reach passes through Halifax.

Hebble Brook 1 contains both high and low energy environments, as indicated by the presence of both depositional and erosional features, however the flow structure identifies that high energy environments are likely to be more extensive. Although suitable substrate for spawning is not identified as dominant, it is likely to occur in discrete patches in the reach. The large substrate types will provide refuge opportunities for juvenile and adult fish, however the gentle bank profiles will restrict the cover provided by the marginal habitat. The scattered nature of trees in the riparian corridor will provide some allochthonous energy to the watercourse, provide limited additional cover for fish and some potential resting opportunities for otter. Due to an absence of extensive woodland with thick understorey, breeding habitat for otter is not considered likely to be present. The earth banks provide suitable burrowing opportunities for otter and water vole, with the bank reinforcement potentially providing additional habitat opportunity for otter. The gentle sloping banks with simple vegetation is likely to support water vole, however the bare banks in the middle of the site and uniform vegetation throughout is unlikely to provide sufficient cover for the species. Migration/movement of fish and sediment are likely to be influenced by the presence of 15 weirs in Hebble Brook 1 and six culverts, with the longest potentially forming a significant barrier isolating upstream and downstream habitats.

The drought options reduction in flow could lead to several potential impacts within Hebble Brook 1:

- Major risk of changes in the energy of the system associated with up to 67% reduction in flow for the duration of the drought option.
- Potentially minor risk of reduction in wetted aquatic habitat (wetted width reduction) with increasing exposure of channel margins noting the extent of channel modifications for duration of the drought option.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) noting the extent of channel modifications for duration of the drought option.
- Major risk to longitudinal connectivity noting the presence of both weirs and culverts in the reach.
- Minor risk of changes in sediment dynamics for duration of the drought option. Reductions in discharge will lead to reductions in velocity and could lead to increased potential for the deposition of any fine sediment in transport noting that sources will be largely dormant during environmental drought. During winter refill periods, overland flow processes that add fine sediment to the channel during rainfall events will increase in-channel flows and increase velocities. Coarse sediment dynamics are unlikely to be affected.

The overall risk to river habitats on Hebble Brook 1 from the drought option is therefore assessed as **moderate**.

A4.16.5 River water quality

For this assessment the second water monitoring point of three in the Hebble Brook Reach 1, Hebble Brook At Myrtle Cottage (NE-49500374) was used due to its superior data quality. There are three frequently spilling CSO potentially presenting an environmental risk in the reach and no significant continuous water quality pressures. A summary description of the potential risks to water quality in Hebble Brook 1 as a result of drought options is presented in **Table A4.28**.

Table A4.28 Potential risks to water quality in Hebble Brook 1 as a result of the drought option

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were primarily consistent with High WFD status (0.2 mg/l) throughout the monitoring period with some instance of Good status (0.3mg/l). Slight seasonality was apparent at this site.	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period. No seasonality was apparent. Slight seasonality was apparent.	Orthophosphate concentrations were predominantly consistent with Good (0.043mg/l) and High (0.021mg/l) WFD status throughout the monitoring period with two results below this standard.

	Total ammonia	Oxygen	Phosphate
			No seasonality was apparent.
Flow sensitivity (diffuse pollution)	None apparent	None apparent	None apparent
WwTW presenting increased risk	None	None	None
Intermittent pressures presenting risk	Risk of short term acute, infrequent, temporary water quality pressures (acute toxicity of ammonia, suffocation from oxygen sags) locally downstream of three listed CSOs during rainfall events.		None
Other point source pressures presenting risk	None	None	None
Summary	Moderate risk from drought options associated with CSO discharge	Moderate risk from drought options associated with CSO discharge	Minor risk from drought options

A4.16.6 Summary of potential changes in the physical environment as a result of the drought option

An overall summary of potential changes in the physical environment of Hebble Brook 1 as a result of the drought option is presented in **Table A4.29**.

Table A4.29 Summary of potential changes in the physical environment of Hebble Brook 1 as a result of the drought option

Physical environment aspect reviewed	Assessment of risk from implementation of the drought option
River flows <i>Major impacts</i>	Reductions of up to 67% in river flows throughout the reach at any time of year that the drought option is implemented.
Flow depleted reaches/significant flow pressures <i>Moderate</i>	One significant flow pressure reducing flow in this reach as advised by the Environment Agency.
River habitats <i>Moderate risk</i>	The major reduction in flow will lead to a potentially major change in the energy of the system. This has the potential for major risks to longitudinal connectivity. There is also moderate risk to available habitat for different species and minor risks to total wetted aquatic habitat and to sediment dynamics.
Water quality <i>Moderate risk</i>	- Moderate risk from short term acute, infrequent, temporary water quality pressures locally downstream of three listed CSOs during rainfall events. - Reported ammonia, phosphate and dissolved oxygen water quality is predominantly consistent with High or Good status and with no apparent flow sensitivity. As such only a minor risk associated with change in dilution of diffuse pollution pressures to ammonia, dissolved oxygen and phosphate has been assessed. - No risk associated with any continuous water quality pressures in this reach.

Insert Figure A4.15

ANNEX 1 – REGULATED ABSTRACTIONS IN UPPER CALDER AREA REACHES

DP reach	Licence No.	Use Description	NGR 1	Max Annual Quantity m ³	Max Daily Quantity	Significance
Hebden Water 1	2/27/12/33 3/R01	Hydroelectric Power Generation	SD 97268 29941	3400676	35430	Yes
Hebden Water 1	NE/027/00 12/006	Hydroelectric Power Generation	SD 99293 27357	14845904	69984	Yes
Hebden Water 1	NE/027/00 12/008	Transfer Between Sources (Post Water Act 2003)	SD 99298 27358	-	-	No
Hebden Water 1	NE/027/00 12/008	Hydroelectric Power Generation	SD 99298 27358	-	-	No
Calder 3	NE/027/00 12/041	Supply To A Canal For Throughflow	SE0366624978	-	-	No
Calder 3	NE/027/00 12/037	Supply To A Canal For Throughflow	SE0735823590	-	-	No
Ryburn 1	2/27/12/29 5	Fish Farm/Cress Pond Throughflow	SE 0260 1865	500000	1360	Yes
Ryburn 2	2/27/12/02 8	Fish Farm/Cress Pond Throughflow	SE045216	1500	23	No
Hebble Brook 1	NE/027/00 12/048	Supply To A Canal For Throughflow	SE0987122984	-	-	Yes

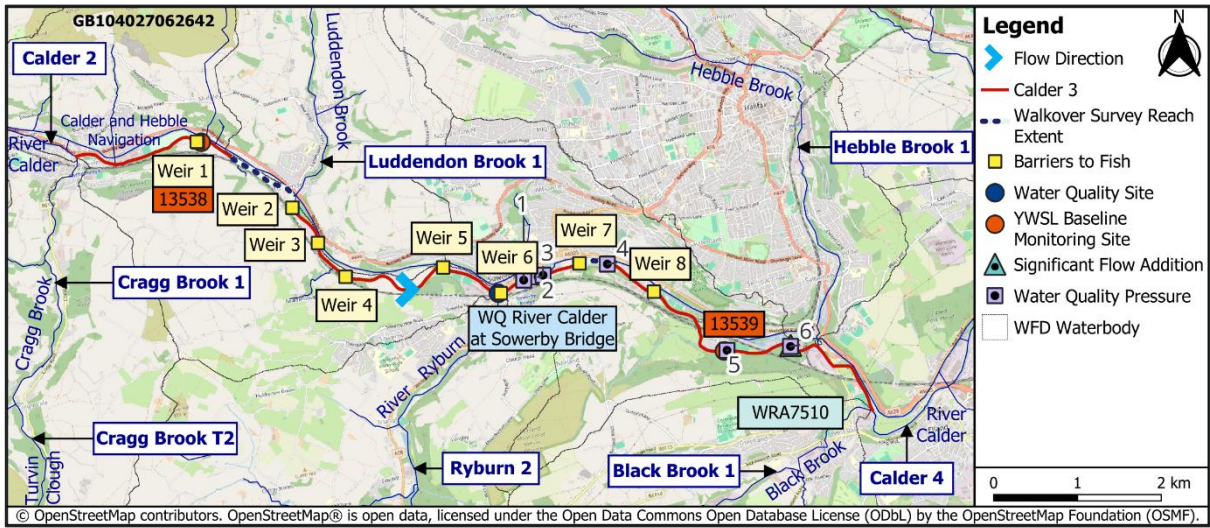
ANNEX 2 – REGULATED DISCHARGES IN UPPER CALDER AREA REACHES

Name	Permit Reference	Outfall NGR	Significant Water Quality Pressure	Intermittent/Continuous
Back Wharf Street/CSO	WRA9230	SE 06225 23620	Yes	Intermittent
Birchcliffe Road/No 2 CSO	WRA8418	SD 99342 27319	No	Intermittent
Carver Clough/No 2 CSO	2853	SE 03445 18360	No	Intermittent
Copley Village/No 2 SPS	YWS00089	SE08466 555676	Yes	Intermittent
Crow Nest Bridge/CSO	WADC864	SD 99587 26845	Yes	Intermittent
Halifax Copley/STW	YWS01420	SE 09220 22290	Yes	Intermittent
Heptonstall Road/CSO	WRA8417	SD 99149 27765	No	Intermittent
Ibbotroyd/CSO	WADC1040	SD 99978 27919	No	Intermittent
Jumples/CSO	WRA8135	SE 06453 27890	Yes	Intermittent
Lower Mill/CSO	1587	SD 99240 28786	No	Intermittent
Lumb Clough/CSO	WRA9316	SE 04450 21285	Yes	Intermittent
Mount Pellon/CSO	WRA8083	SE 07948 26134	Yes	Intermittent
New Inn West Street/CSO	WRA8446	SE 05892 23460	Yes	Intermittent
New Road/CSO	WADC1161	SE 04156 25805	No	Intermittent
Old Bridge Inn/CSO	WADC1284	SE 04068199791	Yes	Intermittent
Old Gate/CSO	WADC1201	SD 99204 27292	No	Intermittent
Princess Bridge/No 2 CSO	WRA8487	SD 99470 26932	Yes	Intermittent
Raglan Street/CSO	2989	SE 08420 25814	Yes	Intermittent
Ripponden/STW/3XDWF Overflow	YWS00923	SE 04520 20540	Yes	Intermittent
Rochdale Canal/CSO	WRA7128	SE 06405 23627	Yes	Intermittent
Salem Cricket Ground/CSO	WRA8419	SD 99204 28057	Yes	Intermittent
Sowerby Bridge/CSO	WRA7389	SE 07240 23635	Yes	Intermittent
Sowerby Croft Lane/2 CSO	WRA8414	SE 05779 22925	Yes	Intermittent
The Drive/CSO	YWUCD2/71	SE 01125 26086	No	Intermittent
Watson Mill Lane/CSO	WRA8413	SE 05584 22995	Yes	Intermittent
West Street/CSO	WRA9233	SE 05828 23292	Yes	Intermittent
Wharfe House/CSO	WRA8420	SE 06463 23638	Yes	Intermittent
Airedale STW	WRA6658	SE4692827020	No	Continuous
Barr Lane STW	E682(SS)	SE2531614571	No	Continuous
Barsey Green STW	1433	SE0672020002	No	Continuous
Caldervale (Wakefield) STW	C4106	SE3506420411	No	Continuous
Claphouse Fold STW	3808	SE2937312256	No	Continuous
Coxley Lane STW	E734(SS)	SE2777217206	No	Continuous
Crofton STW	2207	SE3618118482	No	Continuous
Denholme (Doe Park) WwTW	2251	SE0763534257	No	Continuous
Halifax STW	WRA7510	SE0925022390	No	Continuous

Name	Permit Reference	Outfall NGR	Significant Water Quality Pressure	Intermittent/Continuous
High Royd STW	967	SE0457823968	No	Continuous
Hollingwell Hill STW	E718(SS)	SE1067131257	No	Continuous
New Bridge Hall and Midgehole	3534	SD9890029000	No	Continuous
Private (Secondary treated sewage effluent)	EPRCB3495EH	SD9995723216	No	Continuous
Redacre STW	E740(SS)	SE0081026410	No	Continuous
Ripponden Wood STW	E741(SS)	SE0453020610	Yes	Continuous
Stoney Springs Mill	NPSWQD000756	SE0285625970	No	Continuous
The Pack Horse. Widdop	C5089	SD9480031500	No	Continuous

ANNEX 3 – CALDER 3 SIGNIFICANT INTERMITTENT WATER QUALITY PRESSURES

Map and table of the significant intermittent water quality pressures on the Calder 3 reach.



Map Number	CSO Name
1	Back Wharf Street CSO
2	Rochdale Canal CSO
3	Wharfe House CSO
4	Sowerby Bridge CSO
5	Copley Village/No 2SPS
6	Halifax Copley STW

ANNEX 4 – FLOW TRANSPOSITION IN THE ABSENCE OF MEASURED DATA (FOR ILLUSTRATIVE TIME SERIES)

The Gustard¹⁴ method for flow transposition has been used to scale flows from a suitable donor gauge to an ungauged assessment point. This is applied across the flow duration curve as follows:

- 1) For low flows (Q95 and lower flows):

$$\text{AP flow} = \frac{\text{Donor flow} \times \text{AP area} \times \text{AP BFI-HOST}}{\text{Donor area} \times \text{Donor BFI-HOST}}$$

- 2) For mean flows and higher:

$$\text{AP flow} = \frac{\text{Donor flow} \times \text{AP area} \times \text{AP SAAR} \times \text{AP SPR-HOST}}{\text{Donor area} \times \text{Donor SAAR} \times \text{Donor SPR-HOST}}$$

For this assessment this equation has been applied to flows of Q50 and higher, accepting that Q50 is not mean flow.

- 3) For intermediate flows between Q95 and Q50 a proportion of each of equation (1) and (2) has been used, based on Q statistic.

Scaling factors have been applied to the daily flow series of the donor catchment using the on-the-day Q statistic. Data covers the period from 1990-2024, unless otherwise stated.

As agreed with the Environment Agency, all abstractions and discharges of >5% of the summer Q95 of the donor gauge have been naturalised. Where those abstractions or discharges are YWSL then daily data have been used in the naturalisation. For all other identified abstractions or discharges the permitted value has been used in the naturalisation. Flow modifications in the catchment of the Assessment Point (AP) are treated similarly. This then provides the following equation:

- 4) Daily flow at AP = scaled Naturalised donor gauge flow + flow modifications in recipient catchment

The flow transposition approach has been utilised for APs in three reaches of the Upper Calder Area EAR:

- Graining Water 2
- Hebden Water 1
- Cragg Brook 1

The section below identifies the specific datasets and values used in the derivation of the illustrative flow series at the AP in those reaches with appropriate measured data.

¹⁴Gustard, A., Bullock, A. and Dixon, J. M. (1992). Low flow estimation in the United Kingdom. Institute of Hydrology Report No. 108, Centre for Ecology and Hydrology, Wallingford.

Graining Water 2

Aspect	Point	Data source
Donor gauge	River Calder at Mytholmroyd	EA daily mean flow
Summer Q95 at donor gauge for identifying abstractions/ discharges for naturalisation	53.5Ml/d	Derived from EA dataset for the 1990-2018 period
Naturalisation of donor gauge	• Eastwood WwTW discharge removed from flow series • Redacre WwTW discharge removed from flow series • Reservoir outflows upstream of the Mytholmroyd flow gauge (Gorpley, Gorple Lower, Widdop, Walshaw Dean) removed from flow series • Reservoired catchments upstream of the Mytholmroyd flow gauge (Gorpley, Gorple Lower, Widdop, Walshaw Dean Lower) removed from flow scaling	• YWSL daily mean discharges or dry weather flows when not available • YWSL daily flow and level data • FEH
Naturalisation of recipient AP scaling	• Reservoired catchments upstream of the AP (Gorple Lower, Widdop) removed from flow scaling	• FEH
Post processing of recipient AP (flow)	• Gorple Lower Reservoir outflow added to flow series • Widdop Reservoir outflow added to flow series	• YWSL daily flow and level data

Catchment descriptors were collected, for each relevant site, from the FEH Webservice¹⁵ as listed below:

	Area km ²	SAAR mm	SPR-HOST	BFI-HOST
Donor gauge	146.8	1360	46.770	0.4
Naturalised donor gauge	124.1	1353	45.052	0.4
Recipient AP (raw)	18.4	1393	57.030	0.3
Naturalised recipient AP	7.7	1381	58.189	0.2

Scaling factors applied to the naturalised donor gauge daily flow series in deriving the naturalised daily flow series at the recipient AP are listed below:

Q95 and lower flow scaling factor	Q50 and higher flow scaling factor
0.040	0.082

¹⁵ <https://fehweb.ceh.ac.uk/GB/map>

Hebden Water 1

Aspect	Point	Data source
Donor gauge	River Calder at Mytholmroyd	EA daily mean flow
Summer Q95 at donor gauge for identifying abstractions/ discharges for naturalisation	53.5Ml/d	Derived from EA dataset for the 1990-2018 period
Naturalisation of donor gauge	• Eastwood WwTW discharge removed from flow series • Redacre WwTW discharge removed from flow series • Reservoir outflows upstream of the Mytholmroyd flow gauge (Gorpley, Gorple Lower, Widdop, Walshaw Dean) removed from flow series • Reservoir catchments upstream of the Mytholmroyd flow gauge (Gorpley, Gorple Lower, Widdop, Walshaw Dean Lower) removed from flow scaling	• YWSL daily mean discharges or dry weather flows when not available • YWSL daily flow and level data • FEH
Naturalisation of recipient AP scaling	• Reservoir catchments upstream of the AP (Gorple Lower, Widdop, Walshaw Dean Lower) removed from flow scaling	• FEH
Post processing of recipient AP (flow)	• Gorple Lower Reservoir outflow added to flow series • Widdop Reservoir outflow added to flow series • Walshaw Dean Lower Reservoir outflow added to flow series	• YWSL daily flow and level data

Catchment descriptors were collected, for each relevant site, from the FEH Webservice¹⁶ as listed below:

	Area km ²	SAAR mm	SPR-HOST	BFI-HOST
Donor gauge	146.8	1360	46.770	0.4
Naturalised donor gauge	124.1	1353	45.052	0.4
Recipient AP (raw)	31.1	1385	56.930	0.3
Naturalised recipient AP	10.7	1376	57.141	0.3

Scaling factors applied to the Naturalised donor gauge daily flow series in deriving the Naturalised daily flow series at the recipient AP are listed below:

Q95 and lower flow scaling factor	Q50 and higher flow scaling factor
0.059	0.111

¹⁶ <https://fehweb.ceh.ac.uk/GB/map>

Cragg Brook 1

Aspect	Point	Data source
Donor gauge	River Calder at Mytholmroyd	EA daily mean flow
Summer Q95 at donor gauge for identifying abstractions/ discharges for naturalisation	53.5Ml/d	Derived from EA dataset for the 1990-2018 period
Naturalisation of donor gauge	• Eastwood WwTW discharge removed from flow series • Redacre WwTW discharge removed from flow series • Reservoir outflows upstream of the Mytholmroyd flow gauge (Gorpley, Gorple Lower, Widdop, Walshaw Dean Lower) removed from flow series • Reservoired catchments upstream of the Mytholmroyd flow gauge (Gorpley, Gorple Lower, Widdop, Walshaw Dean Lower) removed from flow scaling	• YWSL daily mean discharges or dry weather flows when not available • YWSL daily flow and level data • FEH
Naturalisation of recipient AP scaling	• Reservoired/prescribed flow catchments upstream of the AP (Withens Clough Reservoir impoundment, Turvin Clough prescribed flow) removed from flow scaling	• FEH
Post processing of recipient AP (flow)	• Withens Clough Reservoir outflow added to flow series • Turvin Clough prescribed flow added to flow series	• YWSL daily flow and level data • YWSL daily abstraction data

Catchment descriptors were collected, for each relevant site, from the FEH Webservice¹⁷ as listed below:

	Area km ²	SAAR mm	SPR-HOST	BFI-HOST
Donor gauge	146.8	1360	46.770	0.4
Naturalised donor gauge	124.1	1353	45.052	0.4
Recipient AP (raw)	19.4	1375	54.100	0.29
Naturalised recipient AP	7.1	1322	48.171	0.36

Scaling factors applied to the naturalised donor gauge daily flow series in deriving the naturalised daily flow series at the recipient AP are listed below:

Q95 and lower flow scaling factor	Q50 and higher flow scaling factor
0.054	0.060

¹⁷ <https://fehweb.ceh.ac.uk/GB/map>



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APPENDIX B – ENVIRONMENTAL RECEPTORS

B1 INTRODUCTION

This **Appendix** Assesses the potential impacts on the environmental receptors of the Southwest Area during the period of implementation of associated drought options, specifically the Upper Calder Area. This appendix should be read in conjunction with the Middle Calder EAR. Two EARs have been produced to aid clarity due to the large number of reservoirs in the Southwest, however the study area should be considered as continuous.

The Upper Calder Area Reservoirs comprise ten drought options as reported in this appendix:

1. Gorple Lower Reservoir
2. Widdop Reservoir
3. Walshaw Dean Lower Reservoir
4. Warley Moor Reservoir
5. Ogden Reservoir
6. Withens Clough Reservoir
7. Turvin Clough Prescribed Flow
8. Ryburn Reservoir
9. Booth Wood Reservoir
10. Siltheroe Bridge Maintained Flow.

Details regarding the approaches/methodologies used for assessing susceptibility and sensitivity to drought management actions and the assessment of the impacts associated with drought management actions are presented in Sections 3.6 and 3.7 of YWSL's Drought Plan 2022 Environmental Assessment Methodology¹.

The environmental preferences within which a species can successfully exist and the relationship between populations in stressed river conditions remains subject to debate. The prediction of impacts of hydrological and water quality changes on aquatic ecology remains subject to significant uncertainty and this may be exacerbated where data are limited. This assessment has, therefore, adopted a precautionary approach, with potential impacts highlighted where doubt exists.

The assessment of environmental receptors is informed by the assessment of the physical environment (which includes hydrology and hydrodynamics; geomorphology; and water quality), this is summarised in Section 5 presented in full in **Appendix A**.

Points of interest referred to throughout the text are indicated in **Figure B1.1**. Note that the only local wildlife sites mapped on the figure are those which were agreed with the Environment Agency in 2019 as having water dependent receptors.

This appendix is set out in the following sections:

Section B.2 Baseline and sensitivity– this includes for each reach:

1. Statutory designated sites
2. NERC and local wildlife sites (LWS)
3. NERC and other protected species
4. WFD receptors
5. Invasive non-native species (INNS)
6. Landscape, navigation, recreation and heritage.

Section B.3 Environmental receptors screening.

Section B.4 Receptors assessment, monitoring and mitigation – this includes for each reach:

1. Receptors assessment

¹ Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

2. Summary of impacts.

Section B.5 Cumulative impacts receptors assessment.

Section B.6 Monitoring and mitigation

[Insert Figure B1.1]

B2 BASELINE & SENSITIVITY

Details regarding the approaches/methodologies used for assessing susceptibility and sensitivity to drought option implementation are presented in Section 3.6 YWSL's Drought Plan 2022 Environmental Assessment Methodology².

B2.13 GRAINING WATER T1

B2.13.1 Statutory designated sites

Table B2.1 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.1**).

Table B2.1 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 SPA	Major		Not sensitive	No
South Pennine Moors SSSI	Major		Not sensitive	No

B2.13.2 NERC and local wildlife sites

Table B2.2 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.2**).

Table B2.2 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats – Blanket Bog -9697	Major	The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Low	No

² Ricardo (2025). Yorkshire Water Drought Plan 2027. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. March 2025.

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats - Grass moorland -376445 -376558 - 376436 -376437 -376557 -376715 -376630 -376716 -376627 -376626 -376714 -376717 -376629 -376628	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland Heath -506478 -506477 -506480	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.13.3 NERC and other protected species

Table B2.3 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although suitable habitat may be present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. Suitable habitat is present in the adjacent reaches and data records have identified otters in 2022 within 500m of the impacted reach. Distribution of information and survey data for the species was considered to be limited, but otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have

been recorded in the impacted, although data does identify that suitable habitat is present in the adjacent reaches. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an uncertain sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.3 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially to use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	medium	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially to use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundo rustica</i>)	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
		- Little Ringed Plover Bird (<i>Charadrius dutius</i>) - Redshank (<i>Tringa tetanus</i>)		

B2.13.4 WFD receptors

The sensitivity analysis has considered the relationship between macroinvertebrate and/or fish communities and the supporting environmental variables over the baseline period. **Table B2.9** below summarises of the RBMP Cycle 3 Status/ Potential of the WFD waterbody, including WFD receptors for fish and macroinvertebrates. The purpose of the analysis is to establish whether biological metrics/indices respond inter-annually to changes in flow and associated environmental variables including habitat quality and availability.

B2.13.4.1 Macroinvertebrates

The WFD waterbody GB104027062840 Graining Water from Widdop Resr to Hebden Water is classified as high for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, Graining Water (ID 1151) (classified as 'high', last classified 2019).

Baseline macroinvertebrate data is provided by one YWSL monitoring sites, U/S Graining Water (ID 23). U/S Graining Water had baseline survey data for two seasonal samples for 2018, 2021, 2022 and 2023.

The WFD status of the macroinvertebrate community in Graining Water T1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Graining Water T1 is highly sensitive to reduced flows (**Figure B2.1**). See **Table B2.4** for guidance in interpreting raw LIFE scores.

Table B2.4 LIFE score sensitivities

LIFE score	Invertebrate community flow sensitivity
7.26 and above	High sensitivity to reduced flows
6.51 – 7.25	Medium sensitivity to reduced flows
6.5 and below	Low sensitivity to reduce flows

WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by Ricardo survey data for the site U/S Graining Water, environmental parameters were unavailable in the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Table B2.5**.

Table B2.5 Macroinvertebrate EQR classification boundaries

WHPT Classification	WHPT _{ASPT} EQR	WHPT _{NTAXA} EQR	LIFE EQR (Non-WFD)	PSI EQR (Non-WFD)
High	>0.97	>0.8	0.94	0.7
Good	0.86 - 0.97	0.68 - 0.8		
Moderate	0.72 - 0.86	0.56 - 0.68		
Poor	0.59 - 0.72	0.47 - 0.56		
Bad	<0.59	<0.47		

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period WHPT_{ASPT} scores ranged between 6.25 and 7.74, averaging 6.9, with the lowest WHPT_{ASPT} score of 6.25 at Site 23 in Autumn 2021, and the highest score of 7.74 at Site 23 in Spring 2023. The WHPT_{ASPT} expected score for this site is 6.76, with all samples above the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.9 and 1.14, averaging 1.01, with the lowest WHPT_{ASPT} EQR of 0.9 at Site 23 in Autumn 2021, and the highest EQR of 1.14 at Site 23 in Spring 2023.

In Graining Water T1 data from the site identifies macroinvertebrate communities which varies in terms of diversity. WHPT_{NTAXA} scores varied considerably during the monitoring period, ranging between 10 and 20, averaging 15.13 with the lowest WHPT_{NTAXA} score of 10 at Site 23 in Spring 2021, and the highest score of 20 at Site 23 in Autumn 2023. The WHPT_{NTAXA} expected score for this site is 16.3, with 2 of the 8 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.61 and 1.14, averaging 0.89, with the lowest WHPT_{NTAXA} EQR of 0.61 at Site 23 in Spring 2021, and the highest EQR of 1.14 at Site 23 in Autumn 2023.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.06 and 7.77, averaging 7.51 with the lowest LIFE_{FAMILY} score of 7.06 at Site 23 in Autumn 2023, and the highest score of 7.77 at Site 23 in Spring 2022. The LIFE_{FAMILY} expected score for this site is 7.59, with 1 of the 8 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.93 and 1.02, averaging 0.99, with the lowest LIFE_{FAMILY} EQR of 0.93 at Site 23 in Autumn 2023, and the highest EQR of 1.02 at Site 23 in Spring 2022.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 69 and 87.5, averaging 78.91, with the lowest PSI_{FAMILY} score of 69 at Site 23 in Autumn 2023, and the highest score of 87.5 at Site 23 in Spring 2021. The PSI_{FAMILY} expected score for this site is 72.22, with 1 of the 8 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.95 and 1.21, averaging 1.09, with the lowest PSI_{FAMILY} EQR of 0.95 at Site 23 in Autumn 2023, and the highest EQR of 1.21 at Site 23 in Spring 2021.

No INNS species were recorded during the monitoring period.

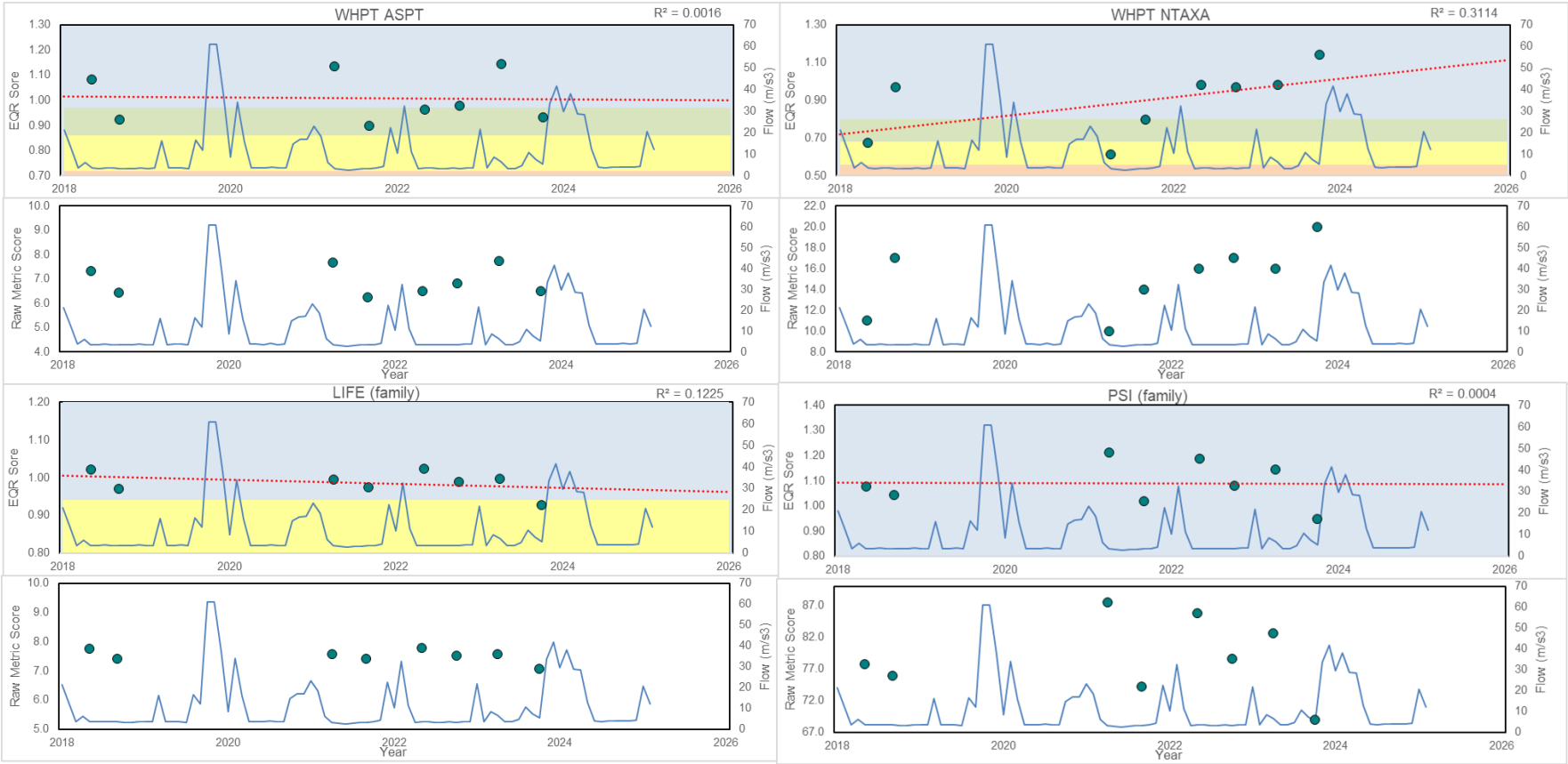
No designated species were recorded during the monitoring period.

Table B2.6 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE Family EQR Score	LIFE Family Score	PSI Family EQR Score	PSI Family Score	WHPT ASPT EQR Score	WHPT ASPT EQR Class	WHPT ASPT Score	WHPT NTAXA EQR Score	WHPT NTAXA EQR Class	WHPT NTAXA Score
23	SD9477931543	8	2021 to 2018	0.93 - 1.02 (0.99)	7.06 - 7.77 (7.51)	0.95 - 1.21 (1.09)	69 - 87.5 (78.91)	0.9 - 1.14 (1.01)	G - H (H)	6.25 - 7.74 (6.9)	0.61 - 1.14 (0.89)	M - H (H)	10 - 20 (15)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.1 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key
23

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.13.4.2 Fish

Waterbody GB104027062840 Graining Water from Widdop Resr to Hebden Water is classified under Cycle 3 (2022) as 'poor'. The classification is informed by three sites, D/S Greave Clough (ID 28948) classified as 'moderate', Bridge D/S Reservoir (ID 11939) classified as 'moderate' and U/S Greave Clough (ID 28950) classified as 'poor'.

Baseline fisheries data is provided by two YWSL monitoring sites, Gorple Cottages (ID YW10020) and Gorple Lower Reservoir Outfall (ID YW10021). Both sites were surveyed in 2015 through to 2018 and in 2021, with Gorple Cottages receiving an additional survey in 2024.

Table B2.7 details survey sites within the Graining Water T1 reach.

Brown trout were the only species counted, with a highest count of 33 during a single-catch sample at Gorple cottages in 2018, and lowest of 1 in 2021 at the same site. Numbers were relatively consistent, with Gorple Cottages typically counting more than Gorple Lower Reservoir Outfall, although both sites showed low abundance.

Table B2.8 details species presence by year across all sites within the Graining Water T1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.7 Graining Water T1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
YW10020	Gorple Cottages	SD946314	Electric Fishing (AC, PDC and DC)	6	2015	2024
YW10021	Gorple Lower Reservoir outfall	SD945314	Electric Fishing (AC, PDC and DC)	5	2015	2021

Table B2.8 Graining Water T1 Fish Survey Results

Tolerance Category ³	Species Name	2015	2016	2017	2018	2021	2024
Low tolerance	Brown trout	X	X	X	X	X	X

B2.13.4.3 WFD waterbody status

Table B2.9 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.9** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.9 WFD classifications

Waterbody ID & Name	GB104027062840 Graining Water*	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)	Major	
Overall	Moderate	

³ UKTAG Rivers Assessment Methods: Fish Fauna (Fisheries Classification Scheme 2 – FCS2) By WFD-UKTAG, December 2008.

Waterbody ID & Name		GB104027062840 Graining Water*	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
RBMP Cycle 3 Status/ Potential	Fish	Poor	Medium
	Macroinvertebrates	High	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Moderate	
	Fish	Moderate	
	Macroinvertebrates	Good	
Waterbody Measures		None	

*Gorple Lower Brook is not specifically classified. Details identified relate to the receiving watercourse of the Gorple Lower Brook (i.e. Graining Water 2).

B2.13.5 Invasive non-native species (INNS)

Table B2.10 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.10**).

Table B2.10 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Montbretia (<i>Crocsmia pottsii x aurea</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.13.6 Landscape, navigation, recreation and heritage

Table B2.11 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.11**)

Table B2.11 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Pennine Bridleway – National Trail	Major	The route of the trail runs alongside Widdop Beck and Hebden Water. The river forms part the landscape setting of the trail.	Not sensitive	No

B2.14 GRAINING WATER 1

B2.14.1 Statutory designated sites

Table B2.12 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.12**).

Table B2.12 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 SPA	Major		Not sensitive	No
South Pennine Moors SSSI	Major		Not sensitive	No

B2.14.2 NERC and local wildlife sites

Table B2.13 summarises the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.13**).

Table B2.13 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats – Blanket Bog	Major	The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Low	No

Site/Receptor and designation		Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
-9660 -9662 -9664 -9666 -9668 -9691 -4383 -4389 -4426 -9641 -12299 -12302 -12322	-12370 -12381 -9669 -9670 -9677 -9681 -9697 -3576 -3577 -3581 -526304 -3556 -5142 -543				
NERC Priority Habitats - Grass moorland -376459 -376461 -376462 -376565 -376566 -376627 -376628 -376629 -376631 -376632 -376716 -376717		Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland Heath -506477 -506480		Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.14.3 NERC and other protected species

Table B2.14 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although suitable habitat may be present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought

permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otter are considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.14 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially to use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Medium	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially to use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may	Uncertain	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
		reduce habitat availability and alter the species food supply.		
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundo rustica</i>) - Little Ringed Plover Bird (<i>Charadrius dutius</i>) - Redshank (<i>Tringa tetanus</i>)	Not sensitive	No

B2.14.4 WFD receptors

B2.14.4.1 Macroinvertebrates

The WFD waterbody GB104027062840 Graining Water from Widdop Resr to Hebden Water is Water is classified as high for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, Graining Water (ID 1151) (classified as 'high', last classified 2019).

Baseline macroinvertebrate data is provided by two Environment Agency monitoring sites, D/S Grieve Clough (ID 145540) and U/S Grieve Clough (ID 145539). Environmental parameters used to calculate EQR scores were not available for the two sites mentioned above, but environmental parameters from Ricardo survey data was available for Site 145539, which was used to calculate EQR scores for the impacted reach. D/S Grieve Clough had baseline survey data for two seasonal samples for 2010, whereas U/S Grieve Clough had baseline survey data for 14 seasonal samples from 2010 to 2023, including four seasonal sampled taken in 2010, two in 2020 and 2023, and three taken in 2021 and 2022.

The WFD status of the macroinvertebrate community in Graining Water 1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Graining Water 1 is highly sensitive to reduced flows (Figure B2.2 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores). See **Table B2.4** for guidance in interpreting raw LIFE scores.

WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by Ricardo survey data for the site U/S Grieve Clough, environmental parameters were unavailable in the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see Figure B2.2 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores. See **Table B2.5** guidance in interpreting EQR scores for WHPT WFD classification.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 5.51 and 7.53, with an average of 6.95 with the lowest WHPT_{ASPT} score of 5.51 at Site 145539 in Autumn 2020, and the highest score of 7.53 at Site 145540 in Spring 2010. The WHPT_{ASPT} expected scores for ranged between 5.9 to 6.87 across the sites, with 1 of the 16 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.8 and 1.23, averaging 1.07, with the lowest WHPT_{ASPT} EQR of 0.8 at Site 145539 in Autumn 2020, and the highest EQR of 1.23 at Site 145539 in Summer 2020.

In Graining Water 1, WHPT_{NTAXA} scores varied significantly, giving scores between 10 and 32, averaging 16, with the lowest WHPT_{NTAXA} score of 10 at Site 145539 in Spring 2023, and the highest score of 32 at Site 145539 in Autumn 2020. The WHPT_{NTAXA} expected scores ranged between 15.05 and 19.39 across the sites, with 1 of the 16 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.54 and 1.65, averaging 0.89, with the lowest WHPT_{NTAXA} EQR of 0.54 at Site 145539 in Spring 2023, and the highest EQR of 1.65 at Site 145539 in Autumn 2020. WHPT_{NTAXA} EQR scores showed variance between seasonal surveys, ranging between 0.54 and 1.65, indicative of Poor to High ecological status.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 6.96 and 8.4, averaging 7.78, with the lowest LIFE_{FAMILY} score of 6.96 at Site 145539 in Autumn 2020, and the highest score of 8.4 at Site 145540 in Spring 2010. The LIFE_{FAMILY} expected scores ranged between 7.33 and 7.52 across the sites, with 1 of the 16 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.94 and 1.13, averaging 1.05, with the lowest LIFE_{FAMILY} EQR of 0.94 at Site 145539 in Autumn 2020, and the highest EQR of 1.13 at Site 145540 in Spring 2010.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 43.9 and 92.3, averaging 78.53, with the lowest PSI_{FAMILY} score of 43.9 at Site 145539 in Autumn 2020, and the highest score of 92.3 at Site 145539 in Autumn 2021. The PSI_{FAMILY} expected scores ranged between 67.46 to 69.61 across the sites, with 1 of the 16 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.63 and 1.33, averaging 1.14, with the lowest PSI_{FAMILY} EQR of 0.63 at Site 145539 in Autumn 2020, and the highest EQR of 1.33 at Site 145539 in Autumn 2021.

A total of two INNS species, including *Potamopyrgus antipodarum* and *Crangonyx pseudogracilis* were recorded as present at Site 145539 in 2020.

No designated species were recorded during the monitoring period.

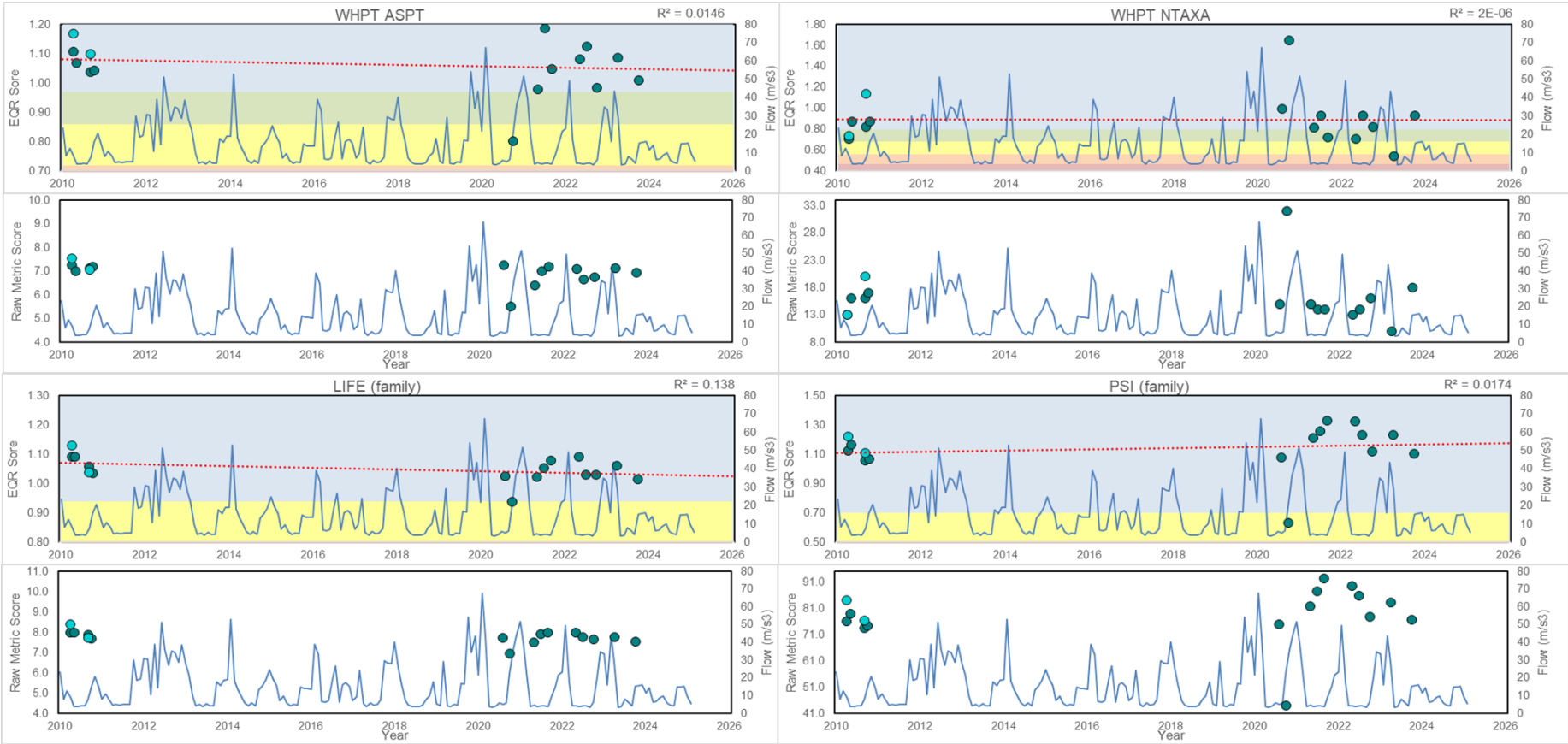
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.15 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	L LIFE Family EQR Score	LIFE Family Score	PSI Family EQR Score	PSI Family Score	WHPT ASPT EQR Score	WHPT ASPT EQR Class	WHPT ASPT Score	WHPT NTAXA EQR Score	WHPT NTAXA EQR Class	WHPT NTAXA Score
145539	SD9435132434	14	2010 to 2023	0.94 - 1.09 (1.04)	6.96 - 8 (7.74)	0.63 - 1.33 (1.14)	43.9 - 92.3 (78.29)	0.8 - 1.23 (1.06)	M - H (H)	5.51 - 7.26 (6.89)	0.54 - 1.65 (0.88)	P - H (H)	10 - 32 (16)
145540	SD9475032129	2	2010	1.04 - 1.13 (1.09)	7.71 - 8.4 (8.06)	1.11 - 1.22 (1.16)	76.32 - 84 (80.16)	1.1 - 1.17 (1.13)	H - H (H)	7.08 - 7.53 (7.31)	0.74 - 1.14 (0.94)	G - H (H)	13 - 20 (17)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.2 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key	
145539	145540

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.14.4.2 Fish

Waterbody GB104027062840 Graining Water from Widdop Resr to Hebden Water is classified under Cycle 3 (2022) as 'poor'. The classification is informed by three sites, D/S Greave Clough (ID 28948) classified as 'moderate', Bridge D/S Reservoir (ID 11939) classified as 'moderate' and U/S Greave Clough (ID 28950) classified as 'poor'.

Baseline fisheries data is available for two site, D/S Greave Clough and U/S Greave Clough. D/S Greave clough and U/S Greave Clough were surveyed in 2010, 2018 and 2021, with U/S Greave Clough receiving an additional survey in 2015.

YSWL commissioned additional surveys at three sites, D/S Greave Clough, U/S Greave Clough and U/S Graining Water. U/S Graining water was surveyed in 2015 through to 2018 and in 2021. US/ Grave Clough was surveyed in 2020 through to 2022.

Table B2.16 details survey sites within the Graining Water 1 reach.

The WFD status of the fish community in Graining Water 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site U/S Greave Clough is individually classified as 'poor' with a site EQR of 0.088 based on FCS2 EQR scores from the 2024, a further decrease of the already 'poor' score based on an EQR of 0.1662 based on 2018 survey data. Of an expected two species, only one was observed. The EQR score for brown trout is 0.138, with observed density significantly lower than expected density. Bullhead were expected to be present, but none were counted. The low EQR score for brown trout and absence of bullhead had a significant impact on the site EQR value.

The site D/S Greave Clough is individually classified as 'poor' with a site EQR of 0.0888 based on the FCS2 EQR scores from the 2024 survey. The site has relatively low diversity with only one species observed from an expected two. The EQR score for brown trout is 0.145 with density significantly lower than expected. Bullhead were expected to be observed at the site but were not. The low EQR score for brown trout and absence of bullhead had a significant impact on the site EQR value.

Brown trout were the only species counted within the reach, with all three sites and years displaying similar abundances. The highest count of 38 was at D/S Greave Clough in 2021, with the lowest count of 14 at U/S Graining Water in 2015.

Table B2.17 details species presence by year across all sites within the Graining Water 1 reach.

All fish counts are available in **Annex 1** to this appendix. Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.16 Graining Water 1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
28948	d/s Greave Clough	SD9456032351	Electric Fishing (AC, PDC and DC)	4	2010	2024
28950	u/s Greave Clough	SD9447232402	Electric Fishing (AC, PDC and DC)	7	2010	2024
YW10019	U/S Graining Water	SD9477931543	Electric Fishing (AC, PDC and DC)	5	2015	2021

Table B2.17 Graining Water 1 Fish Survey Results

Tolerance Category ³	Species Name	2010	2015	2016	2017	2018	2020	2021	2022	2024
Low tolerance	Brown trout	X	X	X	X	X	X	X	X	X

B2.14.4.3WFD waterbody status

Table B2.18 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.18** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.18 WFD classifications

Waterbody ID & Name		GB104027062840 Graining Water	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	Poor	Medium
	Macroinvertebrates	High	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Moderate	
	Fish	Moderate	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.14.5 Invasive non-native species (INNS)

Table B2.19 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.19**).

Table B2.19 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) -New Zealand mud snail <i>Potamopyrgus antipodarum</i>	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.14.6 Landscape, navigation, recreation and heritage

Table B2.20 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.20**).

Table B2.20 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Calder/Aire Link – National Trail	Major	The route of the trail runs alongside Widdop Beck and Hebden Water. The river forms part the landscape setting of the trail.	Not sensitive	No
National Trails	Major	The route of many trails run alongside Hebden Water and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Camp/Caravan Site at High Greenwood	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Old Church of St Thomas Becket, 210m Northeast of Daisy Field Farm	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Wayside Cross also known as Tinker Cross – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling – Graining Water	Major	Casual angling only	Not sensitive	No
Other watersports – canoeing on Graining Water	Major	Prevailing drought conditions would not have been conducive to canoeing. Therefore, impacts of drought option implementation would be minimal.	Not sensitive	No

B2.15 GRAINING WATER 2

B2.15.1 Statutory designated sites

Table B2.21 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.21**).

Table B2.21 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No

B2.15.2 NERC and local wildlife sites

Table B2.22 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.22**).

Table B2.22 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Hardcastle Craggs LWS	Major	The site hosts neutral and acid grassland, ancient woodland and species rich neutral, acid and wet woodland. Graining Water 2 runs through the site for a short stretch at the end of the reach (~150m). These receptors are considered to have low sensitivity to drought permit implementation over and above the impacts of the baseline environmental drought and given the limited	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
		interaction is not considered sensitive to changes in this reach.		
NERC Priority Habitats - Grass moorland -376433 -376556 -376628 -376627 -37662 -76716 -376717 -378886 -378890 -378891 -378892 -404132 -404140	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland Heath -503972 -503973 -503976 -503977 -506477 -506480 -503980	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Deciduous woodland -326142 -326143 -326144	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland flushes, fens and swamps -478093 -478094 -478097 -478098	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.15.3 NERC and other protected species

Table B2.23 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

The nationally scarce mayfly *Ameletus inopinatus* was recorded at site 1151 in 2015. Based on the available information these receptors are considered to be susceptible to drought option impacts and has a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although suitable habitat may be present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otter are considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.23 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrate Upland mayfly - <i>Ameletus inopinatus</i>	Major	Typically found in fast-flowing, well-oxygenated upland streams. This species is highly sensitive to intermittent changes in flow velocity and oxygen limitation in reduced flows.	Moderate	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially to use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Medium	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially to use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundo rustica</i>) - Little Ringed Plover Bird (<i>Charadrius dutius</i>) - Redshank (<i>Tringa tetanus</i>)	Not sensitive	No

B2.15.4WFD receptors

B2.15.4.1Macroinvertebrates

The WFD waterbody GB104027062840 Graining Water from Widdop Resr to Hebden Water is classified as high for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, Graining Water (ID 1151) (classified as 'high', last classified 2019).

Baseline macroinvertebrate data is provided by one Environment Agency monitoring site, Graining Water (ID 1151), which had baseline survey data for a single seasonal sample in 2015; two seasonal samples for 2010, 2018, 2020 and 2023; and three seasonal samples in 2021 and 2022.

The WFD status of the macroinvertebrate community in Graining Water 2 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Graining Water 2 is highly sensitive to reduced flows (**Figure B2.3**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.3**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 6.49 and 7.68, averaging 7.13, with the lowest WHPT_{ASPT} score of 6.49 at Site 1151 in Autumn 2023, and the highest score of 7.68 at Site 1151 in Spring 2010. The WHPT_{ASPT} expected score for this site is 7.44, with all samples above the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.9 and 1.05, averaging 0.98, with the lowest WHPT_{ASPT} EQR of 0.9 at Site 1151 in Autumn 2023, and the highest EQR of 1.05 at Site 1151 in Summer 2022.

In Graining Water 2 data, WHPT_{NTAXA} scores varied significantly between 13 and 27, averaging 19, with the lowest WHPT_{NTAXA} score of 13 at Site 1151 in Summer 2020, and the highest score of 27 at Site 1151 in Autumn 2010. The WHPT_{NTAXA} expected score for this site is 22.05, with 2 of the 15 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.62 and 1.27, indicative of Moderate to High ecological status and averaging 0.88, with the lowest WHPT_{NTAXA} EQR of 0.62 at Site 1151 in Summer 2020, and the highest EQR of 1.27 at Site 1151 in Autumn 2010.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.05 and 8.33, averaging 7.72, with the lowest LIFE_{FAMILY} score of 7.05 at Site 1151 in Autumn 2023, and the highest score of 8.33 at Site 1151 in Summer 2022. The LIFE_{FAMILY} expected score for this site is 7.86, with 2 of the 15 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.9 and 1.07, averaging 0.98, with the lowest LIFE_{FAMILY} EQR of 0.9 at Site 1151 in Autumn 2023, and the highest EQR of 1.07 at Site 1151 in Summer 2022.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 61.8 and 95, averaging 79.06, with the lowest PSI_{FAMILY} score of 61.8 at Site 1151 in Autumn 2023, and the highest score of 95 at Site 1151 in Autumn 2021. The PSI_{FAMILY} expected score for this site is 76.32, with 5 of the 15 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.82 and 1.26, averaging 1.05, with the lowest PSI_{FAMILY} EQR of 0.82 at Site 1151 in Autumn 2023, and the highest EQR of 1.26 at Site 1151 in Autumn 2021.

A single INNS species, *Crangonyx pseudogracilis*, was recorded at Site 1151 between 2022 to 2023.

A single designated species, *Ameletus inopinatus*, was recorded at Site 1151 in 2015.

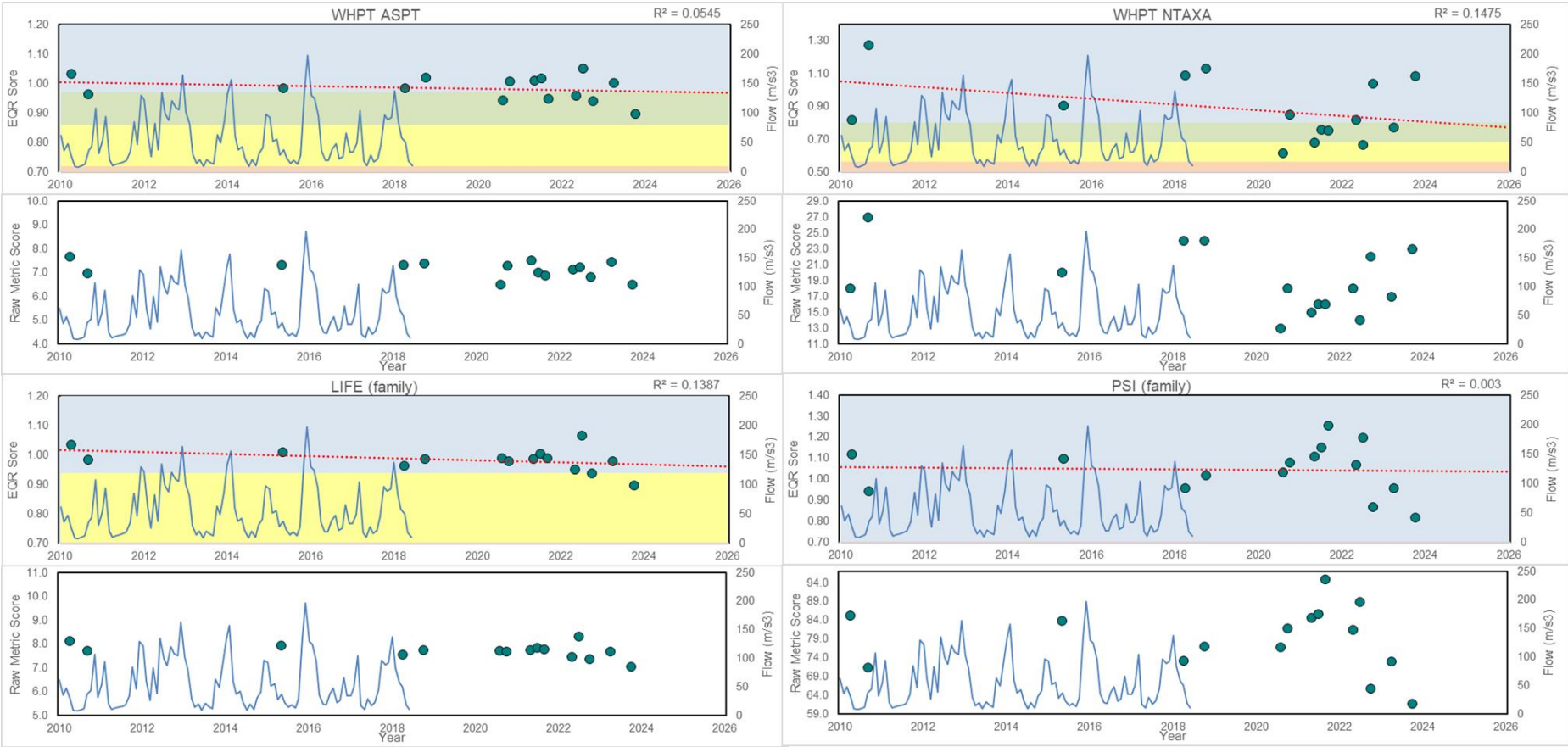
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.24 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
1151	SD9584031350	15	2010 to 2023	0.9 - 1.07 (0.98)	7.05 - 8.33 (7.72)	0.82 - 1.26 (1.05)	61.8 - 95 (79.06)	0.9 - 1.05 (0.98)	G - H (H)	6.49 - 7.68 (7.13)	0.62 - 1.27 (0.88)	M - H (H)	13 - 27 (19)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.3 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key
1151

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

*Flow data not available for post 2018 due to gauging station (27088 - Calder at Mytholmroyd) closure for Flood Alleviation Scheme works

B2.15.4.2Fish

Waterbody GB104027062840 Graining Water from Widdop Resr to Hebden Water is classified under Cycle 3 (2022) as ‘poor’. The classification is informed by three sites, D/S Greave Clough (ID 28948) classified as ‘moderate’, Bridge D/S Reservoir (ID 11939) classified as ‘moderate and U/S Greave Clough (ID 28950) classified as ‘poor’.

Baseline fisheries data is available for one site, Bridge D/S Reservoir, surveyed in 2010, 2015 and 2018 and 2021. YWSL commissioned additional surveys at Bridge D/S Reservoir in 2022 through to 2024. **Table B2.25** details survey sites within the Graining Water 1 reach.

The WFD status of the fish community in Graining Water 2 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Bridge D/S Reservoir is individually classified as ‘poor’ with a site EQR of 0.15 based on 2024 survey results, a drastic decrease from the ‘moderate’ EQR of 0.3736 in the 2018 survey. The site has relatively low diversity, with only one species counted from an expected two. The EQR score for brown trout was 0.247, with density significantly lower than expected. Bullhead were expected to be present but none were counted. The absence of bullhead and low density of trout contributed to the ‘poor’ site classification.

Brown trout were the only species counted and in low to moderate abundance. The highest count of 104 was in 2024, with the lowest of 40 in 2015, however the survey methodology was single catch in 2015. Counts vary significantly between years, with a second lowest count of 41 in 2023, compared to the highest of 104 in 2024.

Table B2.26 details species presence by year across all sites within the Graining Water 2 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.25 Graining Water 2 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
11939	Bridge d/s Reservoir	SD9579331320	Electric Fishing (AC, PDC and DC)	8	2010	2024

Table B2.26 Graining Water 2 Fish Survey Results

Tolerance Category ³	Species Name	2010	2015	2018	2021	2022	2023	2024
Low tolerance	Brown trout	X	X	X	X	X	X	X

B2.15.4.3WFD waterbody status

Table B2.27 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.27** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 20 statuses, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.27 WFD classifications

Waterbody ID & Name		GB104027062840 Graining Water	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	Poor	Medium
	Macroinvertebrates	High	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Moderate	
	Fish	Moderate	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.15.5 Invasive non-native species (INNS)

Table B2.28 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.28**).

Table B2.28 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam <i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.15.6 Landscape, navigation, recreation and heritage

Table B2.29 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.29**).

Table B2.29 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calder/Aire Link – National Trail	Major	The route of the trail runs alongside Widdop Beck and Hebden Water. The river forms part the landscape setting of the trail.	Not sensitive	No
National Trails	Major	The route of many trails run alongside Hebden Water and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Camp/Caravan Site at High Greenwood	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Old Church of St Thomas Becket, 210m Northeast of Daisy Field Farm	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Wayside Cross also known as Tinker Cross – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling – Graining Water	Major	Casual angling only	Not sensitive	No
Other watersports – canoeing on Graining Water	Major	Prevailing drought conditions would not have been conducive to canoeing. Therefore, impacts of drought option implementation would be minimal.	Not sensitive	No

B2.16 HEBDEN WATER T1

B2.16.1 Statutory designated sites

Table B2.30 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.30**).

Table B2.30 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No

B2.16.2 NERC and local wildlife sites

Table B2.31 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.31**).

Table B2.31 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Hardcastle Craggs LWS	Major	The site hosts neutral and acid grassland, ancient woodland and species rich neutral, acid and wet woodland. Hebden Water T1 runs through the site for a short stretch at the end of the reach (~100m). These receptors are considered to have low sensitivity to drought permit implementation over and above the impacts of the baseline environmental drought and given the limited interaction is not considered sensitive to changes in this reach.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats - Grass moorland -376597 -374900 -374887 -374899 -374888 -374898 -374890 -374889 -376627 -378886 -378890 -378892 -378891	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland Heath -503972 -503973 -503976 -503977 -506477 -506480 -503980	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Lowland dry acid grassland -404140 -404132	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – No main habitat but additional habitats present (Blanket and valley bog, European dry heaths) -462603 -462602 -462573 -462575 -462568 -462580	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
-462577				
NERC Priority Habitats – Upland flushes, fens and swamps -478097 -478098 -478093 -478094	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland heathland -503977 -503980	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.16.3 NERC and other protected species

Table B2.32 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

White-clawed crayfish are a NERC Act Section 41 species and are sensitive to habitat modification from the management of waterbodies. Data obtained from the Environment Agency and YWSL, as well as a review of available data from NBN gateway was used inform the assessment of the receptor in the impacted reach. However, no information from survey findings was available for white-clawed crayfish, therefore it was not possible to conclusively rule out their presence. Based on the available information this receptor is considered to be susceptible to drought option impacts and has an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. Suitable habitat and records of otter presence have been identified adjacent to the impacted reach. Distribution of information and survey data for the species was considered to be limited, but otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.32 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundo rustica</i>) - Little Ringed Plover Bird (<i>Charadrius dubius</i>) - Redshank (<i>Tringa tetanus</i>) - Eurasian Curlew (<i>Numenius arquata</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>)	Not sensitive	No

B2.16.4 WFD receptors

B2.16.4.1 Macroinvertebrates

The WFD waterbody GB104027062850 Alcomden Water - Walshaw Dean Resrs to Widdop is classified as high for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, U/S Graining Water (ID 1152), classified as 'high', last classified 2019.

Baseline macroinvertebrate data is provided by one Environment Agency monitoring site, U/S Graining Water (ID 1152). U/S Graining Water had baseline survey data for two seasonal samples for 2010, 2018, 2021, 2022 and 2023 with only a single seasonal sample for 2015.

The WFD status of the macroinvertebrate community in Hebden Water T1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Hebden Water T1 is highly sensitive to reduced flows (**Figure B2.4**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.4**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 6.64 and 7.56, averaging 7.11, with the lowest WHPT_{ASPT} score of 6.64 at Site 1152 in Autumn 2021, and the highest score of 7.56 at Site 1152 in Spring 2018. The WHPT_{ASPT} expected score for this site is 7.47, with all samples above the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.91 and 1.01, averaging 0.96, with the lowest WHPT_{ASPT} EQR of 0.91 at Site 1152 in Autumn 2021, and the highest EQR of 1.01 at Site 1152 in Spring 2018.

In Hebden Water T1 data from the site identifies macroinvertebrate communities with high diversity. WHPT_{NTAXA} scores ranged between 18 and 29, averaging 22.45, with the lowest WHPT_{NTAXA} score of 18 at Site 1152 in Autumn 2021, and the highest score of 29 at Site 1152 in Spring 2015. The WHPT_{NTAXA} expected score for this site is 21.50, with all samples above the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.86 and 1.35, averaging 1.06, with the lowest WHPT_{NTAXA} EQR of 0.86 at Site 1152 in Autumn 2021, and the highest EQR of 1.35 at Site 1152 in Spring 2015.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.57 and 7.95, averaging 7.79, with the lowest LIFE_{FAMILY} score of 7.57 at Site 1152 in Autumn 2018, and the highest score of 7.95 at Site 1152 in Spring 2018. The LIFE_{FAMILY} expected score for this site is 7.89, with all samples above the 'Good/Moderate boundary'. LIFE_{FAMILY} EQR scores ranged between 0.96 and 1.01, averaging 0.99, with the lowest LIFE_{FAMILY} EQR of 0.96 at Site 1152 in Autumn 2018, and the highest EQR of 1.01 at Site 1152 in Spring 2018.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 74.47 and 89.7, averaging 80.54, with the lowest PSI_{FAMILY} score of 74.47 at Site 1152 in Autumn 2018, and the highest score of 89.7 at Site 1152 in Spring 2022. The PSI_{FAMILY} expected score for this site is 77.11, with four of the eleven above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.97 and 1.16, averaging 1.05, with the lowest PSI_{FAMILY} EQR of 0.97 at Site 1152 in Autumn 2018, and the highest EQR of 1.16 at Site 1152 in Spring 2022.

No INNS species were found during within the baseline monitoring dataset, however two species were recorded through the NBN dataset, with these being *Crangonyx pseudogracilis* and *Potamopyrgus antipodarum*.

No designated species were recorded during the monitoring period.

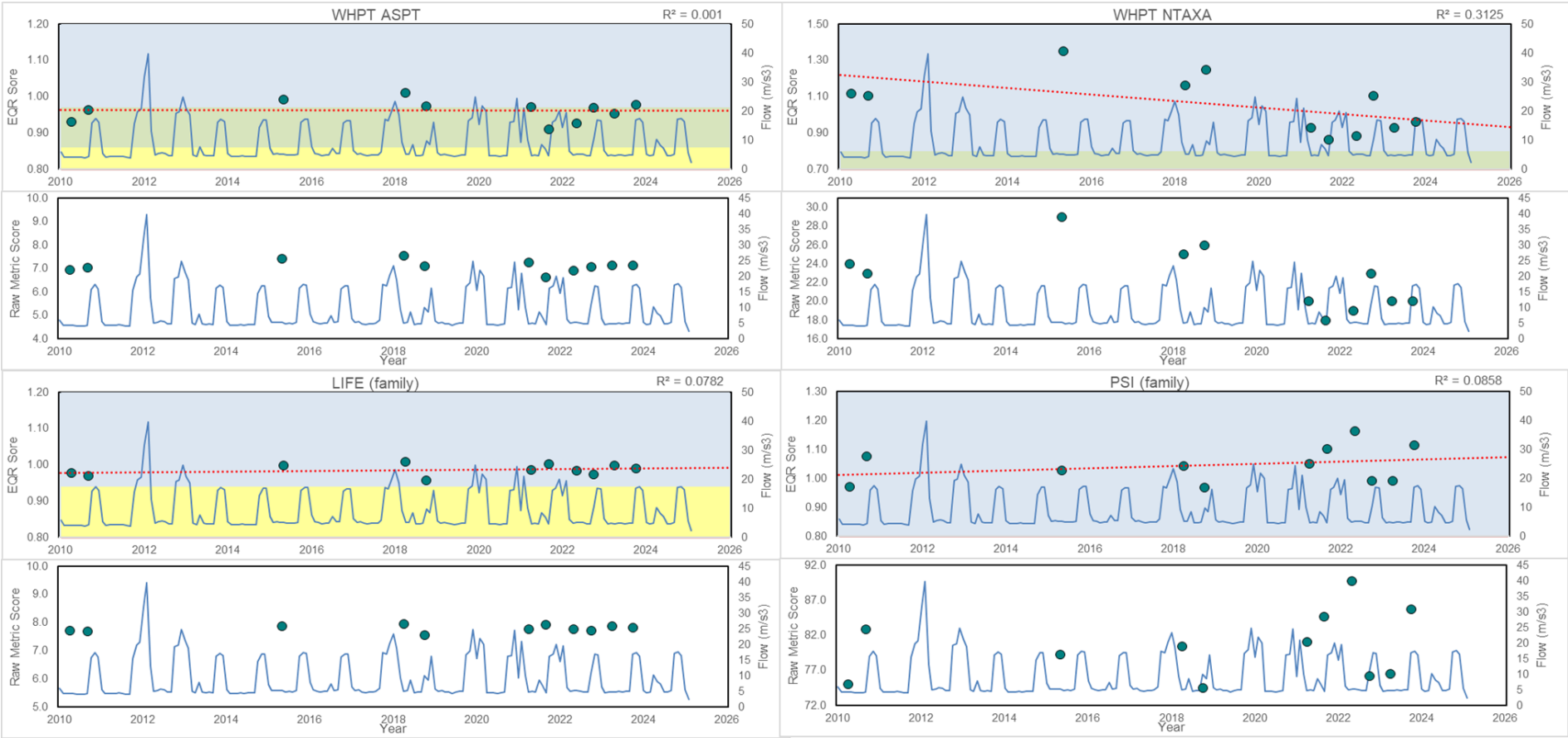
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.33 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
1152	SD9589931437	11	2010 to 2023	0.96 - 1.01 (0.99)	7.57 - 7.95 (7.79)	0.97 - 1.16 (1.05)	74.47 - 89.7 (80.54)	0.91 - 1.01 (0.96)	G - H (G)	6.64 - 7.56 (7.11)	0.86 - 1.35 (1.06)	H - H (H)	18 - 29 (22)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.4 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key
1152

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.16.4.2 Fish

Waterbody GB104027062850 Alcomden Water - Walshaw Dean Resrs to Widdop is classified under Cycle 3 (2022) as 'moderate', a deterioration from 'good' in 2019. The classification is informed by one site, Alcomden Water (Drought Site 2) (ID 11954) classed as 'moderate', a deterioration from 'good' in 2019.

Baseline fisheries data is available for one site, Alcomden Water (Drought Site 2) (ID 11954) surveyed in 2010, 2015 and 2018.

YWSL commissioned additional surveys at Alcomden Water (Drought Site 2) in 2022 and 2023.

Table B2.34 details survey sites within the Hebden Water T1 reach.

The WFD status of the fish community in Hebden Water T1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Alcomden Water (drought Site 2) is individually classified as good with a site EQR of 0.4216, based on the FCS2 EQR scores from the 2018 survey. The site has a relatively low diversity, with only one species present from an expected two species. The EQR score for trout is 0.695, the observed densities were higher than expected at this site. Although Bullhead are expected to be present at a low prevalence of 0.49, no individuals were observed.

Brown trout were the only species counted at Alcomden Water (Drought Site 2) in moderate numbers. The highest count of 76 was in 2018 whilst the lowest count of 36 was in 2015, however, this one survey was the only which utilised a single-catch sample methodology which would result in a lower count than a catch-depletion survey.

Table B2.35 details species presence by year across all sites within the Hebden Water T1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.34 Hebden Water T1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
11954	Alcomden Water (Drought Site 2)	SD9558532250	Electric Fishing (AC, PDC and DC)	5	2010	2023

Table B2.35 Hebden Water T1 Fish Survey Results

Tolerance Category ³	Species Name	2010	2015	2018	2022	2023
Low tolerance	Brown trout	X	X	X	X	X

B2.16.4.3 WFD waterbody status

Table B2.36 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.36** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.36 WFD classifications

Waterbody ID & Name		GB104027062850 Alcomden Water - Walshaw Dean Resrs to Widdop	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Good	
	Fish	Moderate	Medium
	Macroinvertebrates	High	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Good	
	Fish	Good	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.16.5 Invasive non-native species (INNS)

Table B2.37 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.37**).

Table B2.37 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
Invasive non-native species – mammals American mink (<i>Neovision vision</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Rhododendron (<i>Rhododendron</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
<i>ponticum</i>)				

B2.16.6 Landscape, navigation, recreation and heritage

Table B2.38 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.38**).

Table B2.38 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Calder/Aire Link – National Trail	Major	The route of the trail runs alongside Hebden Water. The river forms part the landscape setting of the trail.	Not sensitive	No
National Trails	Major	The route of many trails run alongside Hebden Water and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Camp/Caravan site at High Greenwood	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Old Church of St Thomas Becket, 210m Northeast of Daisy Field Farm	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Wayside Cross also known as Tinker Cross – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
The old bridge over Hebden Water at Hebden Bridge – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling – Alcomden Water	Major	Casual angling only	Not sensitive	No

B2.17 HEBDEN WATER 1

B2.17.1 Statutory designated sites

Table B2.39 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.39**).

Table B2.39 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No

B2.17.2 NERC and local wildlife sites

Table B2.40 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.40**).

Table B2.40 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Hardcastle Craggs LWS	Major	Likely to be in connectivity with impacted reach and support aquatic receptors. The site hosts neutral and acid grassland, ancient woodland and species rich neutral, acid and wet woodland. Hebden 1 runs through the centre of the site. These receptors are considered to have low sensitivity to drought permit implementation over and above the impacts of the baseline environmental drought.	Medium	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
		Mill ponds are present within the site including Gibson Mill, which is associated with a significant non-consumptive abstraction (see Appendix A Section 4.8.3.1). The sensitivity to drought permit implementation over and above the impacts of the baseline drought is considered low, as the National Trust operation of the site has contingency for low flows and the abstraction licence has no hands off flow condition associated with it, hence the abstraction could reduce flows to zero prior to the implementation of a drought permit; no impacts on the pond over and above the natural drought are anticipated.		
Rochdale Canal - LWS	Major	Site is runs near the confluence of Hebden Water and the River Calder; unlikely to be in connectivity with the impacted reach.	Not sensitive	No
New High Laithe Farm LWS	Major	Biological Heritage Site (BHS) under environmental stewardship for hedgerow restoration, land management, and pond creation with clough woodland corridors and associated species-rich grassland. Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
High Hirst Meadows LWS	Major	Managed native woodland with flower-rich hay meadow habitats located Southeast of the impacted reach. Unlikely be in connectivity with the impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Deciduous woodland -194800, 196953, 195895, 196643, 196734, 196926, 196779, 197045, 196607, 196824, 196991, 196802, 196862, 196585, 197329, 197194, 196934, 197543, 197731, 198115, 198069, 196940	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors. Species include English oak (<i>Quercus robur</i>), ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), hazel (<i>Corylus avellana</i>), hawthorn (<i>Crataegus monogyna</i>), holly (<i>Ilex aquifolium</i>), soft rush (<i>Juncus effusus</i>), common reedmace (<i>Typha latifolia</i>), and reed sweet grass (<i>Glyceria maxima</i>)	Not sensitive	No
NERC Priority Habitats – Lowland dry acid grassland -512978, 512980, 512973, 512968, 512941	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Lowland meadows	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
-567154, 567084				
NERC Priority Habitats – Good quality semi-improved grassland -474673, 474679, 474660	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.17.3 NERC and other protected species

summarises the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

One nationally scarce macroinvertebrate species (*Oulimnius troglodytes*) was observed in 1576 between 2015 to 2016. Based on the available information this receptor is considered to be susceptible to drought option impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

White-clawed crayfish are a NERC Act Section 41 species and are sensitive to habitat modification from the management of waterbodies. Data obtained from the Environment Agency and YWSL, as well as a review of available data from NBN gateway was used inform the assessment of the receptor in the impacted reach. However, no information from survey findings was available for white-clawed crayfish, therefore it was not possible to conclusively rule out their presence. Based on the available information this receptor is considered to be susceptible to drought option impacts and has an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. YWSL data showed one historic record of otter presence in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Based on the limited available information otter are considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Several NERC Act Section 41 and notable fish species have been identified as present in the impacted reach, including one NERC Act Section 41 fish species (brown trout) and one notable fish species (bullhead).

Table B2.41 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrates Riffle beetle <i>Oulimnius troglodytes</i>	Major	<i>O. troglodytes</i> is highly sensitive to flow and water level changes, favouring fast-flowing, well-oxygenated streams with stable substrates. It relies on constant high flow for its predatory larvae, making it vulnerable to drought and flow reductions.	Moderate	Yes
Notable Species – Invertebrates Large cinnamon sedge <i>Potamophylax rotundipennis</i>	Major	<i>P. rotundipennis</i> is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. There will be no likely impacts on the species as a result of water quality pressures.	Low	Yes
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially to use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	High	Yes
Notable Species – Fish - Bullhead (<i>Cottus gobio</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundo rustica</i>) - Little Ringed Plover Bird (<i>Charadrius dutius</i>) - Redshank (<i>Tringa tetanus</i>) - Eurasian Curlew (<i>Numenius arquata</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>)	Not sensitive	No

B2.17.4WFD receptors

B2.17.4.1Macroinvertebrates

The WFD waterbody GB104027062731 Hebden Water from Widdop Beck to R Calder is classified as good for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, Hebden Bridge (ID 439), classified as 'good', last classified in 2019 (**Table B2.42**).

Baseline macroinvertebrate data is provided by three Environment Agency monitoring sites, Hebden Stream Gauge (ID 1576), U/S Crimsworth Dean Beck (ID 1154) and Hebden Bridge (ID 439). Hebden Stream Gauge had baseline survey data for two seasonal samples for 2010, and 2012 to 2024, excluding 2020 and 2023 where only one seasonal sample was taken. U/S Crimsworth Dean Beck had baseline survey data for two seasonal samples for 2012 to 2023. Hebden Bridge had baseline survey data for two seasonal samples for 2010, and 2018, and only a single seasonal sample for 2015 and 2020.

The WFD status of the macroinvertebrate community in Hebden Water 1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Hebden Water 1 is highly sensitive to reduced flows (**Figure B2.5**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.5**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 6.36 and 8.3, averaging 7.43, with the lowest WHPT_{ASPT} score of 6.36 at Site 439 in Autumn 2010, and the highest score of 8.3 at Site 1154 in Spring 2017. The WHPT_{ASPT} expected scores for ranged between 6.93 and 7.43 across the sites, with all samples above the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.91 and 1.13, averaging 1.02 with the lowest WHPT_{ASPT} EQR of 0.91 at Site 1154 in Spring 2024, and the highest EQR of 1.13 at Site 1154 in Spring 2017.

In Hebden Water 1 data from the site identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 14 and 31, averaging 23.13 with the lowest WHPT_{NTAXA} score of 14 at Site 439 in Autumn 2010, and the highest score of 31 at Site 439 in Spring 2015. The WHPT_{NTAXA}

expected scores ranged between 22.12 and 25.63 across the sites, with 4 of the 52 samples below the 'Good/Moderate boundary'. $WHPT_{NTAXA}$ EQR scores ranged between 0.57 and 1.36, averaging 0.99, with the lowest $WHPT_{NTAXA}$ EQR of 0.57 at Site 439 in Autumn 2010, and the highest EQR of 1.36 at Site 1576 in Autumn 2017.

$LIFE_{FAMILY}$ EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. $LIFE_{FAMILY}$ scores ranged between 7.25 and 8.47, averaging 7.99, with the lowest $LIFE_{FAMILY}$ score of 7.25 at Site 439 in Autumn 2018, and the highest score of 8.47 at Site 1154 in Spring 2018. The $LIFE_{FAMILY}$ expected scores ranged between 7.71 and 7.87 across the sites, with 1 of the 52 samples below the 'Good/Moderate' boundary. $LIFE_{FAMILY}$ EQR scores ranged between 0.93 and 1.08, averaging 1.02, with the lowest $LIFE_{FAMILY}$ EQR of 0.93 at Site 1576 in Autumn 2021, and the highest EQR of 1.08 at Site 439 in Autumn 2010.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 65.52 and 95.24, averaging 84.24, with the lowest PSI_{FAMILY} score of 65.52 at Site 439 in Autumn 2018, and the highest score of 95.24 at Site 1154 in Spring 2017. The PSI_{FAMILY} expected scores ranged between 69.44 and 75.99 across the sites, with 3 of the 52 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.94 and 1.28, averaging 1.14, with the lowest PSI_{FAMILY} EQR of 0.94 at Site 439 in Autumn 2018, and the highest EQR of 1.28 at Site 1154 in Autumn 2012.

A total of three INNS species, including *Potamopyrgus antipodarum*, *Crangonyx pseudogracilis/floridanus* and *Pacifastacus leniusculus* were recorded as present at three sites between 2010 to 2020.

A total of two designated species, including *Oulimnius troglodytes* and *Potamophylax rotundipennis* were recorded as present at Site 1576 between 2015 to 2016.

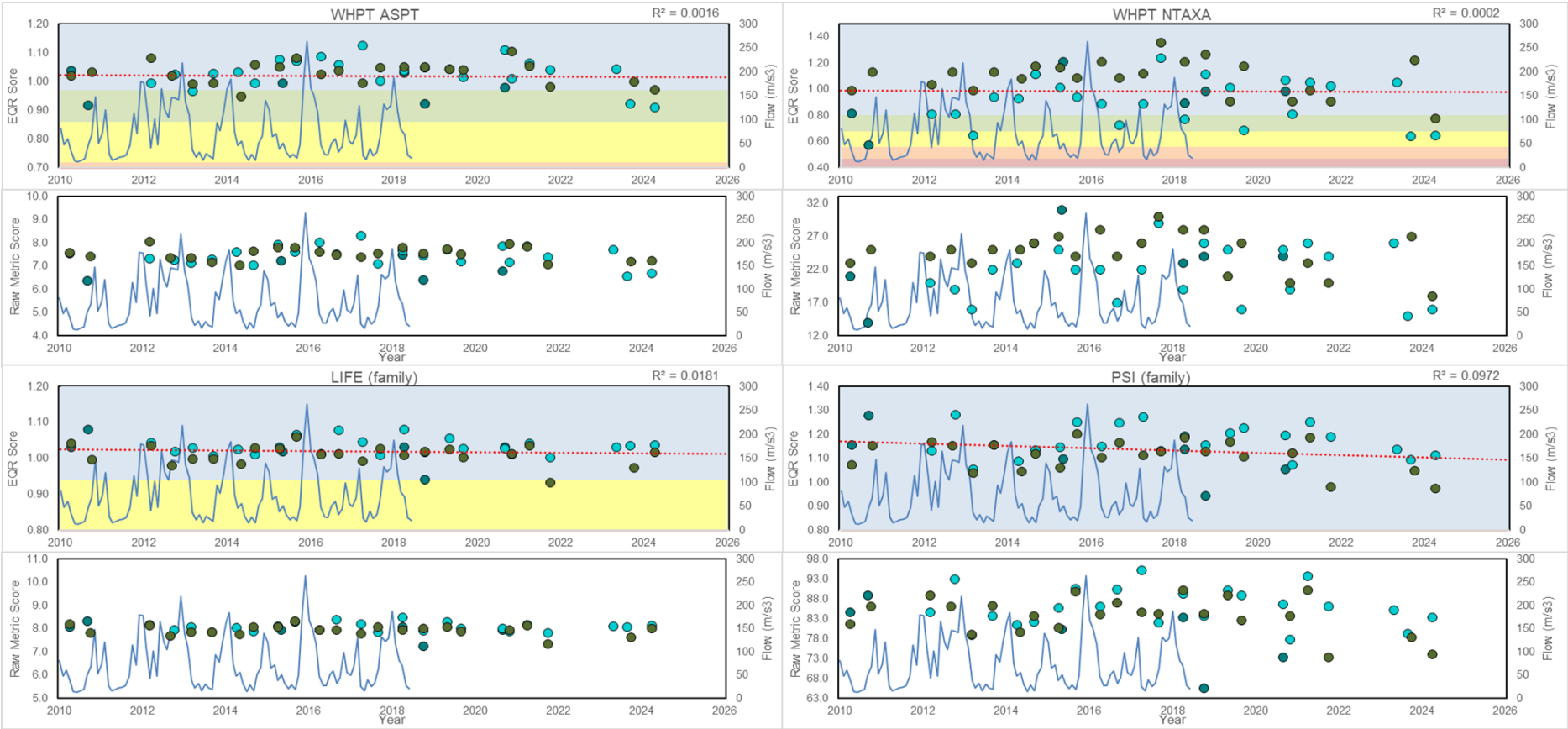
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.42 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
439	SD9921727283	6	2010 to 2020	0.94 - 1.08 (1.02)	7.25 - 8.33 (7.94)	0.94 - 1.28 (1.11)	65.52 - 88.89 (79.34)	0.92 - 1.04 (0.98)	G - H (H)	6.36 - 7.54 (6.96)	0.57 - 1.21 (0.91)	M - H (H)	14 - 31 (23)
1154	SD9882629070	23	2012 to 2024	1 - 1.08 (1.03)	7.81 - 8.47 (8.07)	1.05 - 1.28 (1.17)	77.78 - 95.24 (85.97)	0.91 - 1.13 (1.03)	G - H (H)	6.55 - 8.3 (7.45)	0.64 - 1.24 (0.91)	M - H (H)	15 - 29 (22)
1576	SD9730130659	23	2010 to 2024	0.93 - 1.06 (1.01)	7.33 - 8.32 (7.93)	0.97 - 1.2 (1.11)	73.33 - 90.24 (83.79)	0.95 - 1.11 (1.03)	G - H (H)	7.05 - 8.04 (7.53)	0.78 - 1.36 (1.09)	G - H (H)	18 - 30 (25)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.5 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key		
439	1154	1576

*Flow data not available for post 2018 due to gauging station (27088 - Calder at Mytholmroyd) closure for Flood Alleviation Scheme works

B2.17.4.2 Fish

Waterbody GB104027062731 Hebden Water from Widdop Beck to R Calder is classified under Cycle 3 (2022) as 'moderate'. The classification is informed by three sites, Hebden Bridge (ID 28947) classified as 'good', an increase from 'moderate' in 2019, Gibsons Mill (ID 8297) classified as 'moderate' and Foster Mill Bridge (ID 76444) classified as 'poor'.

Baseline data is available for three sites, Foster Mill Bridge, Gibsons Mill and Hebden Bridge. Foster Mill Bridge was surveyed in 2021. Hebden Bridge was surveyed in 2010, 2015, 2018 and 2021. Gibsons Mill was surveyed in 2010, 2011, 2012, 2015, 2017, 2018, 2019 and 2021. YWSL commissioned additional surveys at Hebden Bridge in 2022 through to 2024. **Table B2.43** details survey sites within the Hebden Water 1 reach.

The WFD status of the fish community in Hebden Water 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Gibsons Mill is individually classified as 'moderate' with a site EQR of 0.3056 based on FCS2 scores from the 2024 survey. The site had relatively low diversity with one species observed from an expected three species. The EQR score for trout is 'good' at 0.772 with observed density slightly below expected density. Bullhead and stone loach were expected to be present at the site, but no individuals were observed. Despite the absence of bullhead and stone loach, the slightly lower density of brown trout contributed to a 'moderate' overall site classification.

The site Hebden Bridge is individually classified as 'good' with a site EQR of 0.4064 based on FCS2 scores from the 2024 survey, improving from the 'moderate' FCS2 EQR score of 0.2068 in 2018. The site has moderate diversity with three species observed from an expected five. The EQR score for brown trout is moderate with observed density noticeably lower than expected density. Bullhead and stone loach are present at rates higher than expected, with a high EQR score of 1. Minnow and grayling are expected to be present at the site, but none were observed. The high EQR score for bullhead and stone loach along with the moderate score for brown trout contributed to the 'good' overall site classification, despite the absence of minnow and grayling.

The site Foster Mill Bridge is individually classified as 'moderate' with a site EQR of 0.312 based on FCS2 scores from the 2024 survey. The site has relatively poor diversity, with two species observed from an expected five. Brown trout have a high individual EQR score of 0.8163 with observed density higher than expected density. Bullhead have a high EQR of 1 with an observed density significantly higher than expected density. Stone loach, minnow and grayling were expected to be present but were not observed. The high EQRs for brown trout and bullhead contribute to the 'moderate overall site classification, but lower observed diversity than expected limit the score.

Brown trout were the only species counted at all sites during every survey year, abundance varied from low to high, with a maximum count of 222 in 2010 at Gibsons Mill and lowest count of 12 at Hebden Bridge, although this survey utilised a single-catch sample methodology. Bullhead and stone loach have both been counted at Hebden Bridge, with bullhead also counted at Foster Mill Bridge. No bullhead or stone loach were counted at Gibsons Mill. Bullhead were present in moderate to high abundance, with a highest count of 227 in 2021 at Foster Mill Bridge and lowest count of 52 in 2023, however, this was utilising a catch-per-unit-effort methodology compared to a catch depletion methodology. Stone loach were captured sporadically in low numbers.

Table B2.44 details species presence by year across all sites within the Hebden Water reach. All fish counts are available in Annex 1 to this appendix.

The site within the impacted reach (Hebden Water 1) shows a moderate to high abundance of trout at Gibsons Mill, with moderate to high abundance of trout and bullhead at Hebden Bridge. Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **high** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.43 Hebden Water 1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
8297	Gibsons Mill	SD9733729781	Electric Fishing (AC, PDC and DC)	10	2010	2024
28947	Hebden Bridge	SD9917927259	Electric Fishing (AC, PDC and DC)	8	2010	2024
76444	Foster Mill Bridge	SD9917727832	Electric Fishing (AC, PDC and DC)	2	2021	2024

Table B2.44 Hebden Water 1 Fish Survey Results

Tolerance Category ³	Species Name	2010	2011	2012	2015	2017	2018	2019	2021	2022	2023	2024
Medium tolerance	Stone loach				X				X	X		X
Low tolerance	Bullhead				X		X		X	X	X	X
Low tolerance	Brown trout	X	X	X	X	X	X	X	X		X	X

B2.17.4.3WFD waterbody status

Table B2.45 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.45** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.45 WFD classifications

Waterbody ID & Name				GB104027062731 Hebden Water from Widdop Beck to R Calder	Sensitivity <i>(Uncertain, High, Medium, Low, Not Sensitive)</i>
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)				Major	
RBMP Cycle 3 Status/ Potential		Overall		Moderate	
		Fish		Moderate	High
		Macroinvertebrates		Good	Medium
Hydro-morph designation				Heavily modified	
RBMP3 Waterbody Objective		Overall		Good	
		Fish		Moderate	
		Macroinvertebrates		Good	
Waterbody Measures				None	

B2.17.5 Invasive non-native species (INNS)

Table B2.46 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.46**).

Table B2.46 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Signal Crayfish (<i>Pacifastacus leniusculus</i>) -Freshwater shrimp (<i>Crangonyx pseudogracilis/floridanus</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
Invasive non-native species – mammals American mink (<i>Neovision vision</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Pink purslane (<i>Claytonia sibirica</i>) -Rhododendron (<i>Rhododendron ponticum</i>) -Yellow archangel (<i>Lamiasstrum galeobdolon subsp. Argentatum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.17.6 Landscape, navigation, recreation and heritage

Table B2.47 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.47**).

Table B2.47 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calder/Aire Link – National Trail	Major	The route of the trail runs alongside Hebden Water. The river forms part the landscape setting of the trail.	Not sensitive	No
National Trails	Major	The route of many trails run alongside Hebden Water and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Camp/Caravan site at High Greenwood	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Old Church of St Thomas Becket, 210m Northeast of Daisy Field Farm	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Wayside Cross also known as Tinker Cross – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
The old bridge over Hebden Water at Hebden Bridge – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling – Hebden Water	Major	Casual angling only	Not sensitive	No

B2.18 CALDER 2

B2.18.1 Statutory designated sites

Table B2.48 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.48**).

Table B2.48 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Milner Royd – Local Nature Reserve	Major	No water dependent receptors.	Not sensitive	No
Scarr and Long Woods – Local Nature Reserve	Major	No water dependent receptors.	Not sensitive	No

B2.18.2 NERC and local wildlife sites

Table B2.49 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.49**).

Table B2.49 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Rochdale Canal LWS	Major	Unlikely to be in connectivity with impacted reach	Not sensitive	No
NERC Priority Habitats – Ancient Woodland -Red Acre Woods	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Lowland dry acid grassland -512985	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitat – Deciduous woodland	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors. Species include English oak (<i>Quercus robur</i>), ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), hazel (<i>Corylus avellana</i>), hawthorn	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
-197788, 197965, 198022, 197778, 197055, 198278, 198128, 198305, 198554, 198756, 198849, 199002, 198939, 198740, 200092, 199889, 199743, 200245, 200279, 197931, 196991, 197057		(<i>Crataegus monogyna</i>), holly (<i>Ilex aquifolium</i>), soft rush (<i>Juncus effusus</i>), common reedmace (<i>Typha latifolia</i>), and reed sweet grass (<i>Glyceria maxima</i>)		

B2.18.3 NERC and other protected species

Table B2.50 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although suitable habitat may be present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. Suitable habitat is present in the adjacent reaches and 2019 data records have identified otter presence within 500m of the impacted reach. Distribution of information and survey data for the species was considered to be limited, but otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Several NERC Act Section 41 and notable fish species have been identified as present in the impacted reach, including one NERC Act Section 41 fish species (brown trout) and two notable fish species (bullhead and grayling).

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.50 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrates - <i>Tinodes unicolor</i>	Moderate	<i>Tinodes unicolor</i> are moderately sensitive to changes in flow and water levels, typically inhabiting well-oxygenated streams but capable of tolerating some reduction in flow. Its burrowing behaviour and generalist feeding habits allow it to persist during periods of moderate hydrological stress.	Low	Yes
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Moderate	Limited data is available for the impacted reach. White-clawed crayfish could potentially use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Low	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Moderate	Limited data is available for the impacted reach. Otters use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Moderate	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Moderate	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
Notable Species – Fish - Bullhead (<i>Cottus gobio</i>) - Grayling (<i>Thymallus thymallus</i>)	Moderate	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Moderate	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Curlew (<i>Numenius arquata</i>)	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
		- Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundoo rustica</i>) - Little Ringed Plover Bird (<i>Charadrius dutius</i>) - Redshank (<i>Tringa tetanus</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Snipe		

B2.18.4WFD receptors

B2.18.4.1 Macroinvertebrates

The WFD waterbody GB104027062641 Calder from Colden Water to Ryburn Confluence is classified as 'good' for macroinvertebrates in 2022, Cycle 3. The classification is informed by three sites, D/S Hebden Bridge (ID 57) (classified as 'good', last classified 2016), D/S Brearley Weir (ID 1406) (classified as 'good', last classified 2015), Site 1150 (classified as 'good', last classified in 2016).

Baseline macroinvertebrate data is provided by two Environment Agency monitoring sites, D/S Hebden Bridge (ID 57) and Site ID 213635. Environmental parameters used to calculate EQR scores were not available for Site 213635, therefore no site specific EQR value could be calculated in RICT3 (Ricardo survey data also unavailable). D/S Hebden Bridge has baseline survey data two seasonal samples for 2010, 2013, 2014, 2020, 2022 and 2023, while only one seasonal sample was taken in 2024. Site 213635 has baseline survey data for one seasonal samples for 2023.

The WFD status of the macroinvertebrate community in Calder 2 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Calder 2 is highly sensitive to reduced flows (**Figure B2.6**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer for D/S Hebden Bridge. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.6**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 5.49 and 6.99, averaging 6.28, with the lowest WHPT_{ASPT} score of 5.49 at Site 57 in Spring 2023, and the highest score of 6.99 at Site 57 in Spring 2013. The WHPT_{ASPT} expected scores for ranged between 6.81 and 7.14 across the sites, with 2 of the 14 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.77 and 0.98, averaging 0.9, with the lowest WHPT_{ASPT} EQR of 0.77 at Site 57 in Spring 2023, and the highest EQR of 0.98 at Site 57 in Autumn 2020.

In Calder 2 data from the sites identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores varied between 14 and 30, averaging 21.43, with the lowest WHPT_{NTAXA} score of 14 at Site 57 in Spring 2022, and the highest score of 30 at Site 57 in Autumn 2014. The WHPT_{NTAXA} expected scores ranged between 22.48 and 22.67 across the sites, with 3 of the 14 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.62 and 1.32, averaging 0.95, with the lowest WHPT_{NTAXA} EQR of 0.62 at Site 57 in Spring 2022, and the highest EQR of 1.32 at Site 57 in Autumn 2014.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 6.64 and 8.55, averaging 7.59, with the lowest LIFE_{FAMILY} score of 6.64 at Site 57 in Spring 2023, and the highest score of 8.55 at Site 57 in Spring 2013. The LIFE_{FAMILY} expected scores ranged between 7.63 and 7.8 across the sites, with 1 of the 14 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.85 and 1.1, averaging 0.98, with the lowest LIFE_{FAMILY} EQR of 0.85 at Site 57 in Spring 2023, and the highest EQR of 1.1 at Site 57 in Spring 2013.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 46.2 and 85.19, averaging 68.57, with the lowest PSI_{FAMILY} score of 46.2 at Site 57 in Spring 2023, and the highest score of 85.19 at Site 57 in Spring 2013. The PSI_{FAMILY} expected scores ranged between 68.12 and 72.15 across the sites, with 7 of the 14 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.64 and 1.18, averaging 0.98 with the lowest PSI_{FAMILY} EQR of 0.64 at Site 57 in Spring 2023, and the highest EQR of 1.18 at Site 57 in Spring 2013.

A total of two INNS species, including *Crangonyx pseudogracilis/floridanus* and *Potamopyrgus antipodarum* were recorded as present at two sites between 2010 to 2024.

A single designated species, *Tinodes unicolor*, was recorded at Site 57 in 2013.

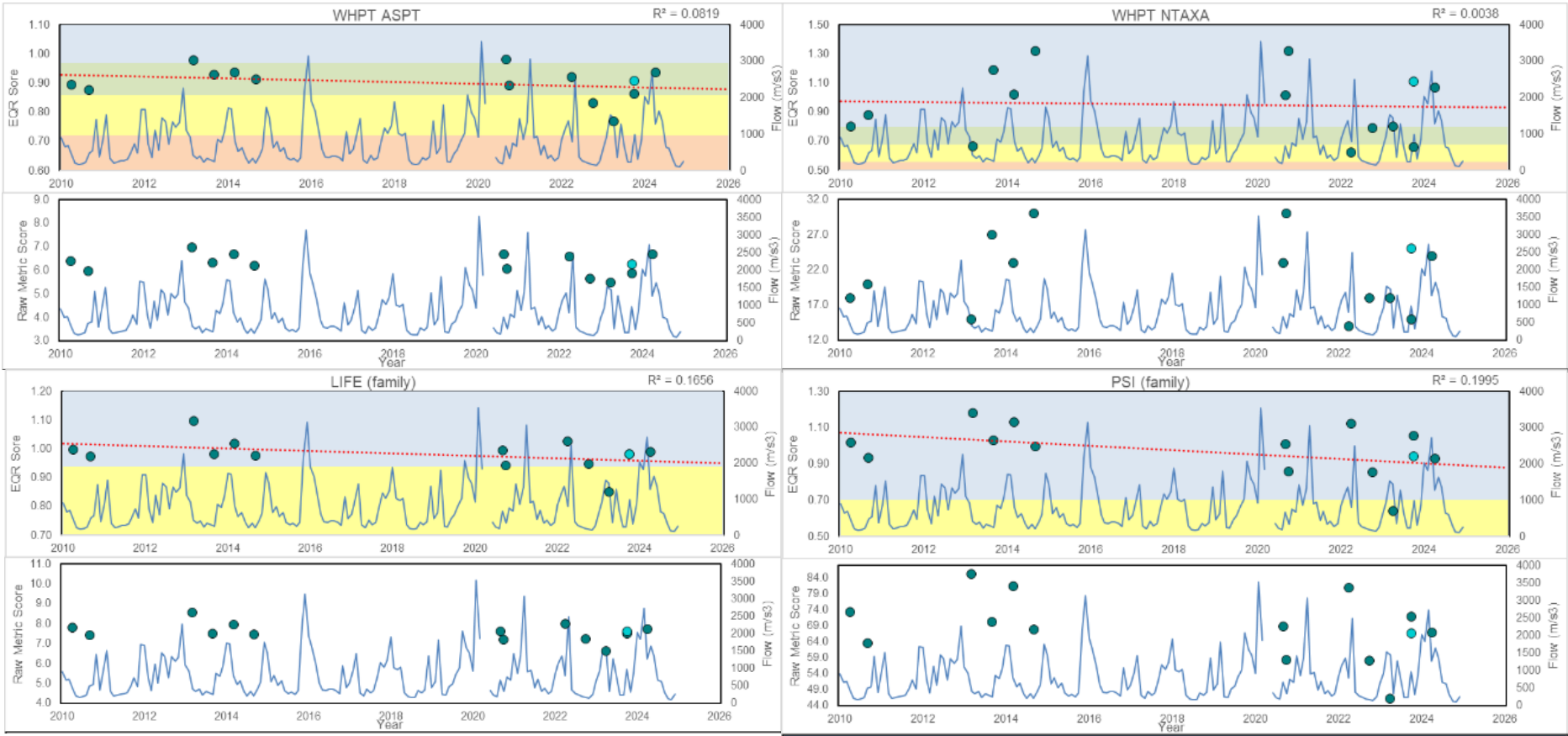
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and has a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.51 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
57	SD9955326857	13	2010 to 2024	0.85 - 1.1 (0.98)	6.64 - 8.55 (7.58)	0.64 - 1.18 (0.98)	46.2 - 85.19 (68.72)	0.77 - 0.98 (0.9)	M - H (G)	5.49 - 6.99 (6.28)	0.62 - 1.32 (0.94)	M - H (H)	14 - 30 (21)
213635	SE0002126594	1	2023	0.98	7.62	0.94	66.67	0.91	G	6.25	1.11	H	25

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.6 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key	
57	213635

B2.18.4.2Fish

The WFD waterbody GB104027062641 (Calder from Colden Water to Ryburn Confluence) is classified under cycle 3 (2022) as ‘good’ for fish, an improvement from ‘moderate’ in 2019. The classification is informed by two sites, Hebble End (Co-op Car Park) (ID 34544) classified as ‘good’ and Hebden Bridge Train Station classified as ‘good’ in 2022, improving from ‘moderate’ in 2019.

Baseline data is available for one site, Hebden Bridge Train Station, surveyed in 2021.

YWSL commissioned additional surveys at three sites, Hebden Bridge Train Station, Hawks Clough (ID YW10048) and Caldene Avenue (ID YW10049). All three sites were surveyed in 2015, 2016, 2017 and 2018. Hawks Clough received additional surveys in 2021 and 2024.

Table B2.52 details survey sites within the Calder 2 reach.

The WFD status of the fish community in Calder 2 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Hebble End (Co-op Car Park) is individually classified as good with a site EQR of 0.521, based on the FCS2 EQR scores from the 2017 survey. The site has a moderate diversity, with only three species present from an expected five species. The EQR score for trout is 0.604, trout had a similar (though slight lower) observed density compared to the expected density. Bullhead and stone loach are observed at increased numbers, with EQR scores of 1.

The site Hebden Bridge Train Station is individually classified as ‘moderate’ with an EQR of 0.3098 based on the FCS2 EQR scores from the 2024 survey. The site has moderate diversity, with three species present from an expected five species. The EQR score for brown trout is moderate with density noticeably lower than expected. Bullhead and stone loach had a high EQR score of 1 with both observed densities significantly higher than the expected density. Minnow and grayling were expected to be present but were not counted. The low than expected density of brown trout and absence of minnow and grayling contributed to the ‘moderate’ overall site classification, despite the higher than expected density of bullhead and stone loach.

Bullhead were the only species counted at every site during every survey year. Brown trout were counted every year but were not counted at Caldene Avenue in 2016 and 2017. Bullhead were counted in low to high abundance, with a lowest count of 4 at Hawks Clough and Hebden Bridge Train station in 2017, and highest count of 258 at Hawks Clough in 2024. The lowest count utilised a single-catch methodology whereas the highest count employed a catch-depletion methodology. Brown trout were counted in low numbers typically, but with one moderate count in 2024 at Hawks Clough with 72 individuals counted. The lowest count of 1 was in 2016 at Hawks Clough. Grayling were counted sporadically in low numbers, with a highest count of 5 in 2017 at Hawks Clough. Stone loach were counted at most sites in low numbers, whilst stickleback were only counted at Hebden Bridge Train Station in 2021 with nine individuals.

Table B2.53 details species presence by year across all sites within the Calder 2 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.52 Calder 2 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
51863	Hebden Bridge Train Station	SD9952926875	Electric Fishing (AC, PDC and DC)	6	2015	2024
YW10048	Hawks Clough	SE002264	Electric Fishing (AC, PDC and DC)	6	2015	2024
YW10049	Caldene Avenue	SE007263	Electric Fishing (AC, PDC and DC)	4	2015	2018

Table B2.53 Calder 2 Fish Survey Results

Tolerance Category ³	Species Name	2015	2016	2017	2018	2021	2024
High tolerance	3-spined stickleback					X	
Medium tolerance	Stone loach	X	X	X	X	X	X
Low tolerance	Bullhead	X	X	X	X	X	X
Low tolerance	Brown trout	X	X	X	X	X	X
Low tolerance	Grayling	X	X	X	X		X

B2.18.4.3WFD waterbody status

Table B2.54 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.54** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.54 WFD classifications

Waterbody ID & Name		GB104027062641 Calder from Colden Water to Ryburn Confluence	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	Good	Medium
	Macroinvertebrates	Good	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Good	
	Fish	Moderate	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.18.5 Invasive non-native species (INNS)

Table B2.55 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.55**).

Table B2.55 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Signal Crayfish (<i>Pacifastacus leniusculus</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
-Freshwater shrimp (<i>Crangonyx pseudogracilis/floridanus</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)				
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Japanese Rose (<i>Rosa rugosa</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.18.6 Landscape, navigation, recreation and heritage

Table B2.56 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.56**).

Table B2.56 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Calder/Aire Link – National Trail	Major	The route of the trail runs alongside Hebden Water. The river forms part of the landscape setting of the trail.	Not sensitive	No
National Trails	Major	The route of many trails run alongside Hebden Water and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Camp/Caravan site at High Greenwood	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Old Church of St Thomas Becket, 210m Northeast of Daisy Field Farm	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Wayside Cross also known as Tinker Cross – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
The old bridge over Hebden Water at Hebden Bridge – Scheduled Ancient Monument	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling – River Calder	Major	Casual angling only	Not sensitive	No

B2.19 CRAGG BROOK T1

B2.19.1 Statutory designated sites

Table B2.57 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.57**).

Table B2.57 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Parrock Clough - LWS	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 - SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
Withens Clough SSSI	Major	The SSSI citation is focused on the springs and lines of drainages arising within the field. The site has notable flora species including <i>Spahgnum</i> mosses, <i>Juncus</i> spp, purple moor grass, <i>Potamogeton polygonifolius</i> and <i>Menyanthes trifoliata</i> . However, as the mire is soligenous, it receives water from rain and slope runoff, therefore no adverse impacts are expected from implementing the drought order. Further, the gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No

B2.19.2 NERC and local wildlife sites

Table B2.58 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.58**).

Table B2.58 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats - Grass moorland -36593 -369445 -369435 -370367 -370226 -371798 -373799 -371789 -371788	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Blanket bog -11535 -11596	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitat – Deciduous woodland -198551, 198471, 198340, 198075, 197972, 197844, 197427, 197050,	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors. Species include English oak (<i>Quercus robur</i>), ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), hazel (<i>Corylus avellana</i>), hawthorn (<i>Crataegus monogyna</i>), holly (<i>Ilex aquifolium</i>), soft rush (<i>Juncus effusus</i>), common reedmace (<i>Typha latifolia</i>), and reed sweet grass (<i>Glyceria maxima</i>)	Not sensitive	No

B2.19.3 NERC and other protected species

Table B2.59 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

White-clawed crayfish are a NERC Act Section 41 species and are sensitive to habitat modification from the management of waterbodies. Data obtained from the Environment Agency and YWSL, as well as a review of available data from NBN gateway was used inform the assessment of the receptor in the impacted reach. However, no information from survey findings was available for white-clawed crayfish, therefore it was not possible to conclusively rule out their presence. Based on the available information this receptor is considered to be susceptible to drought option impacts and has an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otter are considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used to inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.59 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrate Purple Dun - <i>Paraleptophlebia cincta</i> Black-legged Alderfly - <i>Sialis nigripes</i>	Major	The species are associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. There will be no likely impacts on the species as a result of water quality pressures.	Low	Yes
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact	Medium	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
- Brown trout (<i>Salmo trutta</i>)		spawning, migration, provision of cover, predation, inter and intra-species competition etc.		
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Swallow (<i>Hirundo rustica</i>)	Not sensitive	No

B2.19.4 WFD receptors

B2.19.4.1 Macroinvertebrates

The WFD waterbody GB104027062610 Cragg Brook from Source to River Calder classified as 'good' for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, U/S Railway bridge (ID 1303), which is located downstream of the impacted reach (Cragg Brook 1), classified as 'good', last classified in 2016.

Baseline macroinvertebrate data is provided by one Environment Agency monitoring site in the impacted reach, U/S Footbridge (ID 1169). U/S Footbridge had baseline survey data for two seasonal samples for 2010, 2012 to 2019, 2021, and 2022, while only one seasonal sample was taken in 2020 and 2023.

The WFD status of the macroinvertebrate community in Cragg Brook T1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Cragg Brook T1 is highly sensitive to reduced flows (**Figure B2.7**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, **Figure B2.7**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 6.26 and 7.84, averaging 7.13, with the lowest WHPT_{ASPT} score of 6.26 at Site 1169 in Autumn 2013, and the highest score of 7.84 at Site 1169 in Spring 2019. The WHPT ASPT expected score for this site is 7.45, with all samples above the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.86 and 1.05, averaging 0.97, with the lowest WHPT_{ASPT} EQR of 0.86 at Site 1169 in Autumn 2013, and the highest EQR of 1.05 at Site 1169 in Spring 2019.

In Cragg Brook T1 data from the sites identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 15 and 30, averaging 23.46, with the lowest WHPT_{NTAXA} score of 15 at Site 1169 in Spring 2022, and the highest score of 30 at Site 1169 in Spring 2014. The WHPT_{NTAXA} expected score for this site is 21.36, with all samples above the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.7 and 1.4, averaging 1.12, with the lowest WHPT_{NTAXA} EQR of 0.7 at Site 1169 in Spring 2022, and the highest EQR of 1.4 at Site 1169 in Spring 2014.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.29 and 8.11, averaging 7.71, with the lowest LIFE_{FAMILY} score of 7.29 at Site 1169 in Autumn 2012, and the highest score of 8.11 at Site 1169 in Spring 2021. The LIFE_{FAMILY} expected score for this site is 7.86, with 2 of the 24 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.92 and 1.03, averaging 0.98, with the lowest LIFE_{FAMILY} EQR of 0.92 at Site 1169 in Autumn 2012, and the highest EQR of 1.03 at Site 1169 in Spring 2021.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 69.23 and 90, averaging 80.45, with the lowest PSI_{FAMILY} score of 69.23 at Site 1169 in Autumn 2015, and the highest score of 90 at Site 1169 in Spring 2022. The PSI_{FAMILY} expected score for this site is 76.72, with 6 of the 24 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.9 and 1.17, averaging 1.05, with the lowest PSI_{FAMILY} EQR of 0.9 at Site 1169 in Autumn 2015, and the highest EQR of 1.17 at Site 1169 in Spring 2022.

One INNS species, *Potamopyrgus antipodarum* was recorded as present at Site 1169 between 2014 to 2023, and *Crangonyx pseudogracilis* was recorded during the NBN data search.

A total of two designated species, including *Paraleptophlebia cincta* and *Sialis nigripes* were recorded as present at site 1169 in 2013.

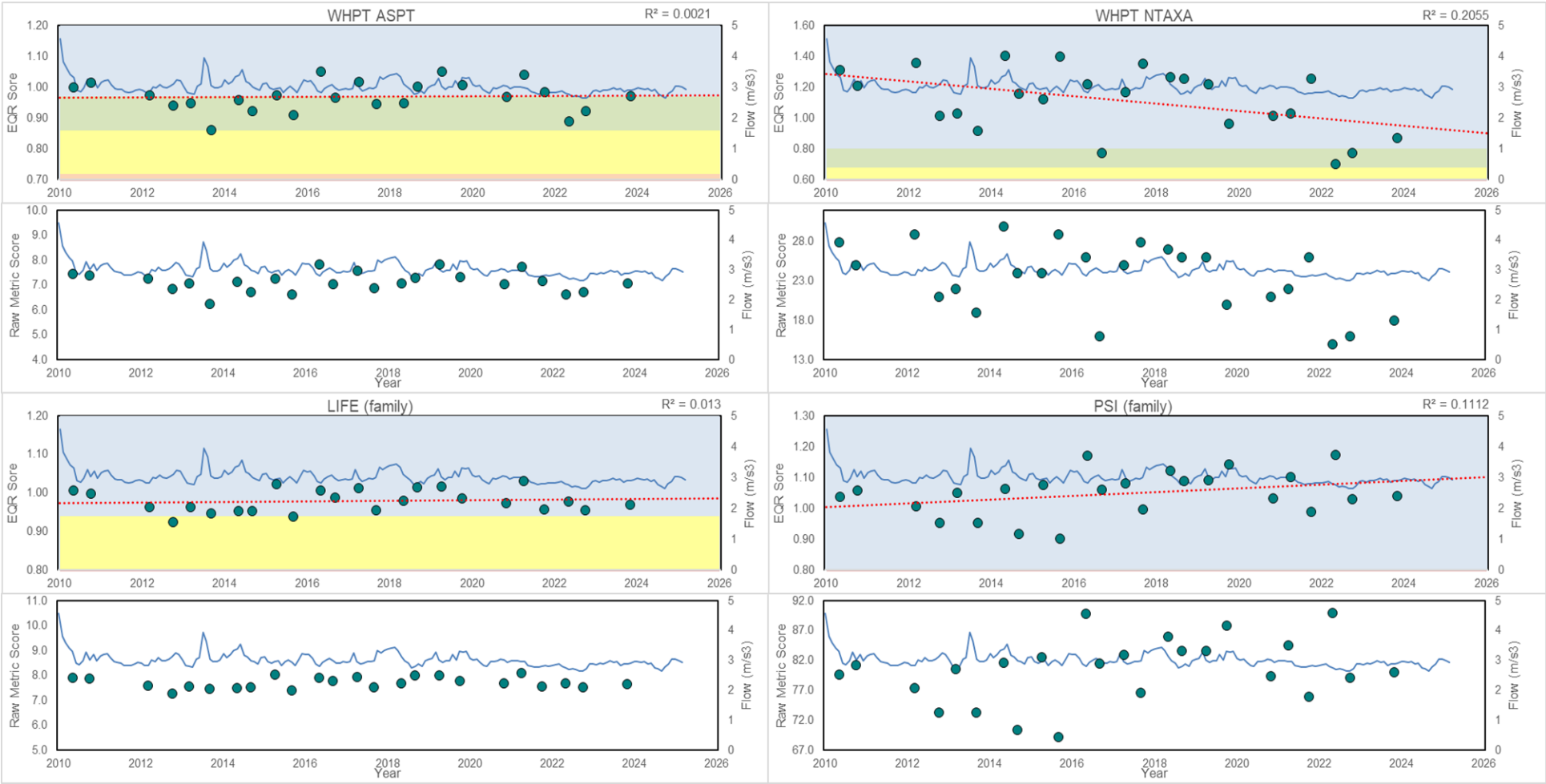
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.60 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
1169	SD9987023174	24	2010 to 2023	0.92 - 1.03 (0.98)	7.29 - 8.11 (7.71)	0.9 - 1.17 (1.05)	69.23 - 90 (80.45)	0.86 - 1.05 (0.97)	G - H (G)	6.26 - 7.84 (7.13)	0.7 - 1.4 (1.12)	G - H (H)	15 - 30 (23)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.7 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key
1169

B2.19.4.2 Fish

Waterbody GB104027062610 Cragg Brook from Source to River Calder is classified under Cycle 3(2022) as 'high', improving from 'moderate' in 2019. The classification is informed by one site, Mytholmroyd (ID 11867), classified as 'high', improving from 'moderate' in 2019.

Baseline data is available for one site, Withens Clough (ID 36582), surveyed in 2010.

YWSL commissioned additional baseline surveys at two sites, Withens Clough and Housing Estate of Rudd Lane (ID YW10034). Both sites were surveyed in 2015 through to 2018, with Housing Estate off Rudd Lane receiving further surveys in 2021 and 2024.

Table B2.61 details survey sites within the Cragg Brook T1 reach.

The WFD status of the fish community in Cragg Brook T1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Mytholmroyd is individually classified as 'good' with an EQR value of 0.5522 based on the FCS2 EQR scores from the 2024 survey, improving from 'moderate' in 2015 with an EQR score of 0.3488. The site has relatively good diversity, with three species from an expected four observed. The EQR score for brown trout is moderate with an EQR score of 0.4353, with the observed density lower than the expected density. Bullhead and stone loach were counted in numbers that significantly exceeded their expected densities with an EQR score of 1. Minnow were expected to be present but none were counted. The higher-than-expected density of bullhead and stone loach and presence of brown trout contributed to the 'good' overall classification.

Mytholmroyd had a site classification of moderate, with an EQR value of 0.3488, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively low diversity, with only two species present from an expected four species. Trout had a high EQR score of 0.7377, the observed density of trout were above those expected at the site. Bullhead are observed at increased numbers, with a EQR score of 1. Stone loach were not observed at the site, although they are expected to be present in the reach.

The site Withens Clough is individually classified as poor with a site EQR of 0.0596, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively low diversity, with only one species present from an expected three species. The EQR score for trout is low, at 0.1503, the observed densities are significantly lower than expected at the site. which has an overall effect on the site's EQR value. This difference in classification between the sites can be attributed to low EQR score of trout, although species richness, which was poorer at this site, is a contributing factor to the classification.

Brown trout were the only species counted at all sites and in low abundances. The highest count of 22 was in 2024 at the site Housing Estate off Rudd Lane, with the lowest count of 1 in 2018 at both Withens Clough and Housing Estate off Rudd Lane. No fish were captured during the survey at Housing Estate off Rudd Lane in 2016.

With Mytholmroyd being located downstream of the impacted reach in Cragg Brook 1, the site recorded an increased number of trout when compared to upstream. The fish community at Mytholmroyd is significantly different to that of the sites surveyed in the impacted reach, and therefore not representative of sensitivity of the fish community in the impacted reach.

Table B2.62 details species presence by year across all sites within the Cragg Brook T1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information within Cragg Brook T1 the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.61 Cragg Brook T1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
36582	Withens Clough	SD9989623175	Electric Fishing (AC, PDC and DC)	5	2010	2018
YW10034	Housing estate off Rudd Lane	SD997231	Electric Fishing (AC, PDC and DC)	6	2015	2024

Table B2.62 Cragg Brook T1 Fish Survey Results

Tolerance Category ³	Species Name	2010	2015	2016	2017	2018	2021	2024
Low tolerance	Brown trout	X	X	X	X	X	X	X

B2.19.4.3WFD waterbody status

Table B2.63 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.63** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.63 WFD classifications

Waterbody ID & Name				GB104027062610 Cragg Brook from Source to River Calder	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)				Major	
RBMP Cycle 3 Status/ Potential	Overall			Moderate	
	Fish			High	Medium
	Macroinvertebrates			Good	Medium
Hydro-morph designation				Heavily modified	
RBMP3 Waterbody Objective	Overall			Good	
	Fish			Good	
	Macroinvertebrates			Good	
Waterbody Measures				None	

B2.19.5 Invasive non-native species (INNS)

Table B2.64 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.64**).

Table B2.64 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.19.6 Landscape, navigation, recreation and heritage

Table B2.65 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.65**).

Table B2.65 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Calderdale Way - National Trail	Major	The route of Calderdale Way runs alongside Cragg Brook and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Angling in Cragg Brook	Major	Casual angling only so impacts unlikely to be significant	Low	No

B2.20 CRAGG BROOK T2

B2.20.1 Statutory designated sites

Table B2.66 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.66**).

Table B2.66 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 - SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No

B2.20.2 NERC and local wildlife sites

Table B2.67 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.67**).

Table B2.67 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats - Grass moorland -376355 -376353	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Blanket bog -11552	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
-11594 -11596 -11551 -4122 -4128 -11557 -11558 -11540 -11446 -11554 -11528 -8721 -4111				
NERC Priority Habitats - Good quality semi-improved grassland -362730 -362735	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Deciduous woodland -198551, 197972, 198551, 198260, 198536, 198575, 198853, 198494,	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors. Species include English oak (<i>Quercus robur</i>), ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), hazel (<i>Corylus avellana</i>), hawthorn (<i>Crataegus monogyna</i>), holly (<i>Ilex aquifolium</i>), soft rush (<i>Juncus effusus</i>), common reedmace (<i>Typha latifolia</i>), and reed sweet grass (<i>Glyceria maxima</i>)	Not sensitive	No
NERC Priority Habitats – Ancient woodland - Bank Top Wood, Knowle/ Higher House Woods, Deacon Hill Woods	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.20.3 NERC and other protected species

Table B2.68 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

White-clawed crayfish are a NERC Act Section 41 species and are sensitive to habitat modification from the management of waterbodies. Data obtained from the Environment Agency and YWSL, as well as a review of available data from NBN gateway was used inform the assessment of the receptor in the impacted reach. However, no information from survey findings was available for white-clawed crayfish, therefore it was not possible to conclusively rule out their presence. Based on the available information this receptor is considered to be susceptible to drought option impacts and has an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used to inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otter are considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used to inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) and one notable fish species (bullhead) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.68 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrates <i>Paraleptophlebia cincta</i>	Major	This species is moderately sensitive to changes in flow and water levels, typically inhabiting well-oxygenated streams but capable of tolerating some reduction in flow. Its burrowing behaviour and generalist feeding habits allow it to persist during periods of moderate hydrological stress.	Low	Yes
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting	Uncertain	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Water vole (<i>Arvicola amphibious</i>)		areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.		
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	High	Yes
Notable Species – Fish - Bullhead (<i>Cottus gobio</i>)	Moderate	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Swallow (<i>Hirundo rustica</i>)	Not sensitive	No

B2.20.4WFD receptors

B2.20.4.1Macroinvertebrates

The WFD waterbody GB104027062610 Cragg Brook from Source to River Calder classified as ‘good’ for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, U/S Railway bridge (ID 1303), which is located downstream of the impacted reach (Cragg Brook 1), classified as ‘good’, last classified in 2016.

Baseline macroinvertebrate data is provided by one Environment Agency monitoring site, D/S Pumping Station (ID 157413). D/S Pumping Station had baseline survey data for two seasonal samples for 2010, 2021, 2022 and 2023 while only one seasonal sample was taken in 2020.

The WFD status of the macroinvertebrate community in Cragg Brook T2 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Cragg Brook T2 is highly sensitive to reduced flows (**Figure B2.8**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency’s online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR’s are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.8**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 6.05 and 7.15, averaging 6.64, with the lowest WHPT_{ASPT} score of 6.05 at Site 157413 in Autumn 2023, and the highest score of 7.15 at Site 157413 in Autumn 2010. The WHPT_{ASPT} expected score for this site is 7.44, with 2 of the 9 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.83 and 0.98, averaging 0.9, with the lowest WHPT_{ASPT} EQR of 0.83 at Site 157413 in Autumn 2023, and the highest EQR of 0.98 at Site 157413 in Autumn 2010.

In Cragg Brook T2 data from the sites identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 10 and 20, averaging 15, with the lowest WHPT_{NTAXA} score of 10 at Site 157413 in Autumn 2020, and the highest score of 20 at Site 157413 in Autumn 2023. The WHPT_{NTAXA} expected score for this site is 21.23, with 3 of the 9 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.49 and 0.97, averaging 0.72, with the lowest WHPT_{NTAXA} EQR of 0.49 at Site 157413 in Autumn 2020, and the highest EQR of 0.97 at Site 157413 in Autumn 2023.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.13 and 8, averaging, averaging 7.48, with the lowest LIFE_{FAMILY} score of 7.13 at Site 157413 in Spring 2022, and the highest score of 8 at Site 157413 in Autumn 2022. The LIFE_{FAMILY} expected score for this site is 7.84, with 4 of the 9 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.91 and 1.02, averaging 0.95, with the lowest LIFE_{FAMILY} EQR of 0.91 at Site 157413 in Spring 2022, and the highest EQR of 1.02 at Site 157413 in Autumn 2022.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 50 and 92.59, averaging 70.06, with the lowest PSI_{FAMILY} score of 50 at Site 157413 in Spring 2022, and the highest score of 92.59 at Site 157413 in Autumn 2021. The PSI_{FAMILY} expected score for this site is 76.37, with 6 of the 9 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.65 and 1.21, averaging 0.91, with the lowest PSI_{FAMILY} EQR of 0.65 at Site 157413 in Spring 2022, and the highest EQR of 1.21 at Site 157413 in Autumn 2021.

No INNS species were recorded during the monitoring period.

A single designated species, *Paraleptophlebia cincta*, was recorded at Site 157413 between 2010 to 2020.

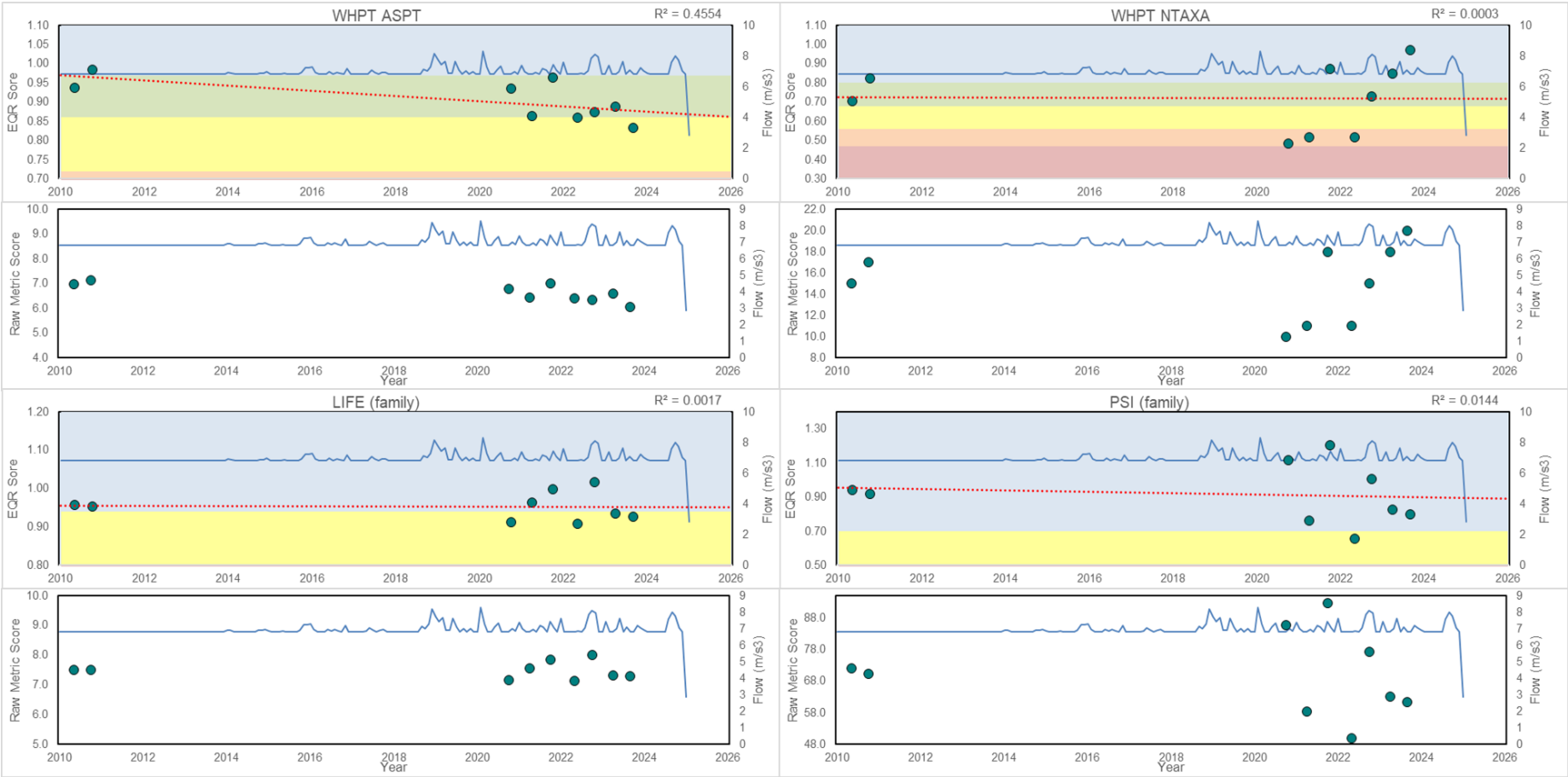
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.69 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
157413	SD9929021181	9	2010 to 2023	0.91 - 1.02 (0.95)	7.13 - 8 (7.48)	0.65 - 1.21 (0.91)	50 - 92.59 (70.06)	0.83 - 0.98 (0.9)	M - H (G)	6.05 - 7.15 (6.64)	0.49 - 0.97 (0.72)	P - H (G)	10 - 20 (15)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.8 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key
157413

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.20.4.2Fish

Waterbody GB104027062610 Cragg Brook from Source to River Calder is classified under Cycle 3(2022) as 'high', improving from 'moderate' in 2019. The classification is informed by one site, Mytholmroyd (ID 11867), classified as 'high', improving from 'moderate' in 2019.

Baseline fisheries data is informed by three YWSL monitoring sites, D/S Pumping Station (ID YW35), Green Bank (ID YW10031) and U/S Confluence (ID YW10032). All sites were surveyed in 2015 through to 2018, with additional surveys at D/S Pumping Station and U/S Confluence in 2021, with Green Bank receiving an additional survey in 2024. No Environment Agency monitoring sites were present in the impacted reach.

Table B2.70 details survey sites within the Cragg Brook T2 reach.

The WFD status of the fish community in Cragg Brook T2 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The current classification site Mytholmroyd, as well as previous classification site Withens Clough are not located within the impacted reach.

The site Mytholmroyd is individually classified as 'good' with an EQR value of 0.5522 based on the FCS2 EQR scores from the 2024 survey, improving from 'moderate' in 2015 with an EQR score of 0.3488. The site has relatively good diversity, with three species from an expected four observed. The EQR score for brown trout is moderate with an EQR score of 0.4353, with the observed density lower than the expected density. Bullhead and stone loach were counted in numbers that significantly exceeded their expected densities with an EQR score of 1. Minnow were expected to be present but none were counted. The higher-than-expected density of bullhead and stone loach and presence of brown trout contributed to the 'good' overall classification.

The site Withens Clough is individually classified as poor with a site EQR of 0.0596, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively low diversity, with only one species present from an expected three species. The EQR score for trout is low, at 0.1503, the observed densities are significantly lower than expected at the site. which has an overall effect on the site's EQR value. This difference in classification between the sites can be attributed to low EQR score of trout, although species richness, which was poorer at this site, is a contributing factor to the classification.

Brown trout and bullhead were the only two species counted, with brown trout present at every site for every survey year and bullhead present at U/S Confluence only in 2015 through to 2018. Bullhead were present in low numbers, whilst brown trout were present in mainly low abundances. The highest count for brown trout was 40 in 2021 at U/S Confluence, whilst the lowest count of 1 was at the same site in 2018, however, the lowest count was recorded during a survey utilising a single-catch depletion methodology. No fish were recorded in any year at the D/S Pumping Station monitoring site.

Table B2.71 details species presence by year across all sites within the Cragg Brook T2 reach. All fish counts are available in Annex 1 to this appendix.

With Mytholmroyd being located downstream of the impacted reach in Cragg Brook 1, the site recorded an increased number of trout when compared to upstream. The fish community at Mytholmroyd is significantly different to that of the sites surveyed in the impacted reach, and therefore not representative of sensitivity of the fish community in the impacted reach.

Based on the available information within Cragg Brook T2 the fish community is considered to be susceptible to drought permit impacts and have a **high** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.70 Cragg Brook T2 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
35	D/S Pumping Station	SD9929021181	Electric Fishing (AC, PDC and DC)	5	2015	2021

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
YW10031	Green bank	SE001222	Electric Fishing (AC, PDC and DC)	5	2015	2024
YW10032	u/s confluence	SE000231	Electric Fishing (AC, PDC and DC)	9	2015	2021

Table B2.71 Cragg Brook T2 Fish Survey Results

Tolerance Category ³	Species Name	2015	2016	2017	2018	2021	2024
Low tolerance	Bullhead	X	X	X	X		
Low tolerance	Brown trout	X	X	X	X	X	X

B2.20.4.3WFD waterbody status

Table B2.72 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.72** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.72 WFD classifications

Waterbody ID & Name		GB104027062610 Cragg Brook from Source to River Calder	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	High	High
	Macroinvertebrates	Good	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Good	
	Fish	Good	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.20.5 Invasive non-native species (INNS)

Table B2.73 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.73**).

Table B2.73 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – terrestrial plants -Himalayan balsam <i>(Impatiens glandulifera)</i> -Japanese knotweed <i>(Fallopia japonica)</i>	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.20.6 Landscape, navigation, recreation and heritage

Table B2.74 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.74**).

Table B2.74 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calderdale Way - National Trail	Major	The route of Calderdale Way runs alongside Cragg Brook and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Angling in Cragg Brook	Major	Casual angling only so impacts unlikely to be significant	Low	No
Caravan site at Hoo Hall	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No

B2.21 CRAGG BROOK 1

B2.21.1 Statutory designated sites

Table B2.75 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.75**).

Table B2.75 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 - SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No

B2.21.2 NERC and local wildlife sites

Table B2.76 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.76**).

Table B2.76 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Parrock Clough LWS	Major	A wooded valley/clough consisting of ancient semi-natural woodland and species rich acid woodland, with good fern diversity. Site is unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
Rochdale Canal LWS	Major	Unlikely to be in connectivity with impacted reach.	Not sensitive	No
NERC Priority Habitats –	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Lowland dry acid grassland -513035, 513027				
NERC Priority Habitats – Deciduous woodland -199567, 199741, 199622, 199436, 199978, 199493, 200304, 199597, 199383, 199081, 198551, 198853	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors. Species include English oak (<i>Quercus robur</i>), ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), hazel (<i>Corylus avellana</i>), hawthorn (<i>Crataegus monogyna</i>), holly (<i>Ilex aquifolium</i>), soft rush (<i>Juncus effusus</i>), common reed (mace) (<i>Typha latifolia</i>), and reed sweet grass (<i>Glyceria maxima</i>)	Not sensitive	No
NERC Priority Habitats – Ancient woodland -Deacon Hill Wood, Lord Whams and Paper Mill Woods, Hollin Hey/ Holderness Woods	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.21.3 NERC and other protected species

Table B2.77 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

White-clawed crayfish are a NERC Act Section 41 species and are sensitive to habitat modification from the management of waterbodies. Data obtained from the Environment Agency and YWSL, as well as a review of available data from NBN gateway was used inform the assessment of the receptor in the impacted reach. However, no information from survey findings was available for white-clawed crayfish, therefore it was not possible to conclusively rule out their presence. Based on the available information this receptor is considered to be susceptible to drought option impacts and has an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach, although data does identify that suitable habitat is present in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otter likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otter are considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed historic records of water vole presence within 500m of the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) and one notable fish species (bullhead) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.77 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	Uncertain	Yes
NERC Species – Invertebrates Water snipe fly - <i>Atherix ibis</i>	Major	<i>Atherix ibis</i> are moderately sensitive to changes in flow and water levels, typically inhabiting well-oxygenated streams but capable of tolerating some reduction in flow. Its burrowing behaviour and generalist feeding habits allow it to persist during periods of moderate hydrological stress.	Low	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Otters use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Medium	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
Notable Species – Fish - Bullhead (<i>Cottus gobio</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
There are many bird species present across the region		drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Swallow (<i>Hirundo rustica</i>)		

B2.21.4 WFD receptors

B2.21.4.1 Macroinvertebrates

The WFD waterbody GB104027062610 Cragg Brook from Source to River Calder classified as 'good' for macroinvertebrates in 2022, Cycle 3. The classification is informed by one site, U/S Railway bridge (ID 1303), which is located downstream of the impacted reach (Cragg Brook 1), classified as 'good', last classified in 2016.

Baseline macroinvertebrate data is provided by one Environment Agency monitoring sites, U/S Railway bridge (ID 1303). U/S Railway bridge had baseline survey data for two seasonal samples for 2013, 2014, 2021, 2022 and 2023, and only one seasonal sample for 2020.

The WFD status of the macroinvertebrate community in Cragg Brook 1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Cragg Brook 1 is highly sensitive to reduced flows (**Figure B2.9**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, **Figure B2.9**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 5.57 - 7.26 (6.69) with the lowest WHPT_{ASPT} score of 5.57 at Site 1303 in Autumn 2021, and the highest score of 7.26 at Site 1303 in Spring 2014. The WHPT_{ASPT} expected score for this site is 7.352, with 2 of the 11 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.78 - 0.99 (0.93) with the lowest WHPT_{ASPT} EQR of 0.78 at Site 1303 in Autumn 2021, and the highest EQR of 0.99 at Site 1303 in Spring 2014.

In Cragg Brook 1 data from the sites identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 9 - 27 (20.09) with the lowest WHPT_{NTAXA} score of 9 at Site 1303 in Autumn 2020, and the highest score of 27 at Site 1303 in Autumn 2023. The WHPT_{NTAXA} expected score for this site is 23.121, with 3 of the 11 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.41 - 1.22 (0.89) with the lowest WHPT_{NTAXA} EQR of 0.41 at Site 1303 in Autumn 2020, and the highest EQR of 1.22 at Site 1303 in Autumn 2023.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.55 - 8.43 (7.95) with the lowest LIFE_{FAMILY} score of 7.55 at Site 1303 in Autumn 2022, and the highest score of 8.43 at Site 1303 in Autumn 2021. The LIFE_{FAMILY} expected score for this site is 7.826, with all samples above the 'Good/Moderate boundary'. LIFE_{FAMILY} EQR scores ranged between 0.97 - 1.09 (1.02) with the lowest LIFE_{FAMILY} EQR of 0.97 at Site 1303 in Autumn 2022, and the highest EQR of 1.09 at Site 1303 in Autumn 2021.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 64.3 - 100 (80.46) with the lowest PSI_{FAMILY} score of 64.3 at Site 1303 in Autumn 2022, and the highest score of 100 at Site 1303 in Autumn 2021. The PSI_{FAMILY} expected score for this site is 74.858, with 2 of the 11 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.88 - 1.37 (1.09) with the lowest PSI_{FAMILY} EQR of 0.88 at Site 1303 in Autumn 2022, and the highest EQR of 1.37 at Site 1303 in Autumn 2021.

A total of two INNS species, including *Potamopyrgus antipodarum* and *Chelicorophium curvispinum* were recorded as present at Site 1303 between 2020 to 2023, with *Crangonyx pseudogracilis* recorded as present within the NBN data search.

A single designated species, *Atherix ibis*, was recorded at Site 1303 in 2021.

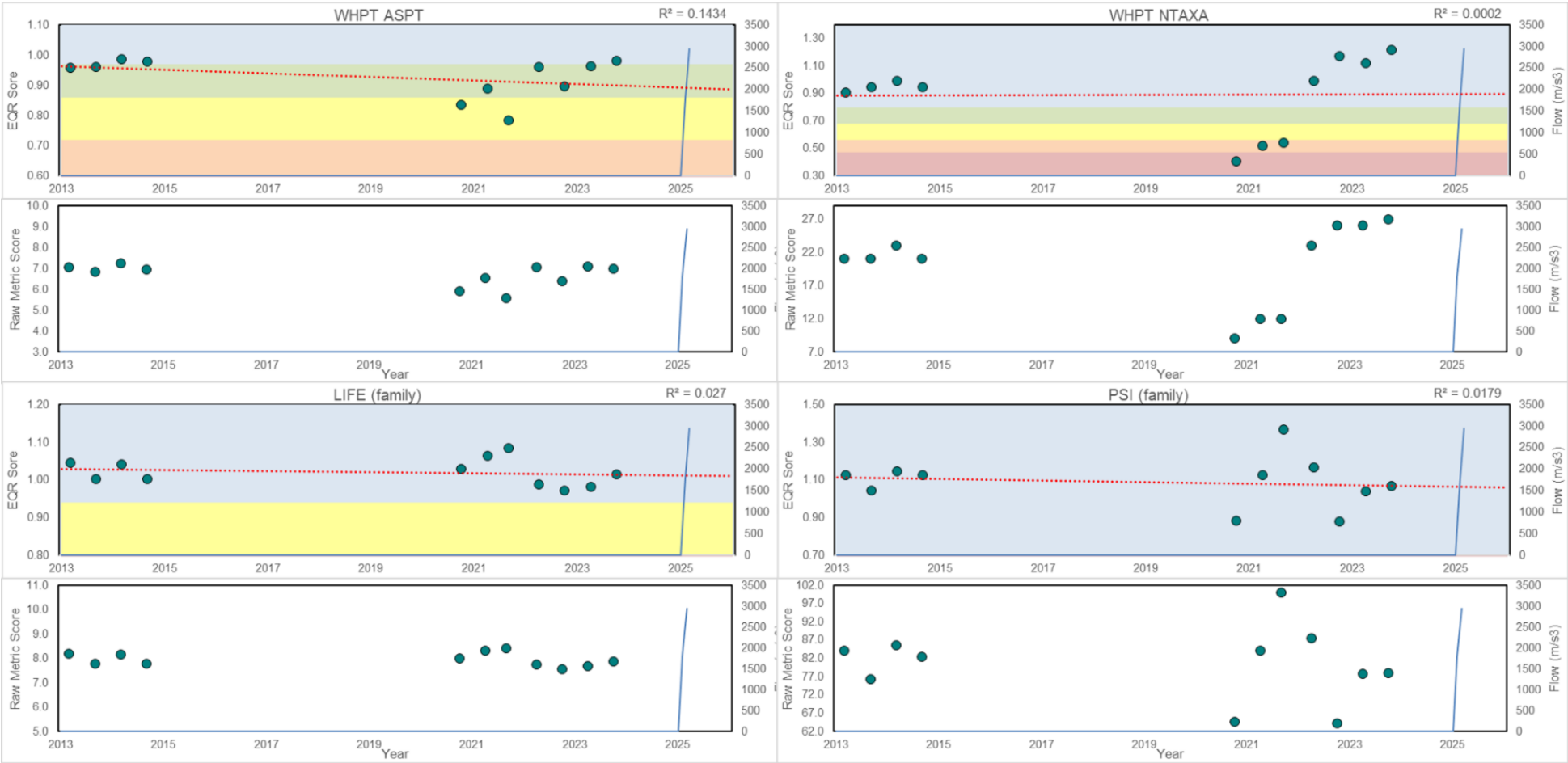
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.78 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
1303	SE0120325864	11	2013 to 2023	0.97 - 1.09 (1.02)	7.55 - 8.43 (7.95)	0.88 - 1.37 (1.09)	64.3 - 100 (80.46)	0.78 - 0.99 (0.93)	M - H (G)	5.57 - 7.26 (6.69)	0.41 - 1.22 (0.89)	B - H (H)	9 - 27 (20)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.9 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key
1303

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.21.4.2 Fish

Waterbody GB104027062610 Cragg Brook from Source to River Calder is classified under Cycle 3(2022) as 'high', improving from 'moderate' in 2019. The classification is informed by one site, Mytholmroyd (ID 11867), classified as 'high', improving from 'moderate' in 2019.

Baseline fisheries data is available for one site, Mytholmroyd, surveyed in 2015 and 2021.

YWSL commissioned additional monitoring at four sites, Mytholmroyd, DS Cragg Road (ID 76443), Cragg Vale Spa (ID YW139) and U/S Weir Cragg Hall Wood (ID YW140). All four sites were sampled in 2016 through to 2018. Mytholmroyd received additional surveys in 2022 through to 2024.

Table B2.79 details survey sites within the Cragg Brook 1 reach.

The WFD status of the fish community in Cragg Brook 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Mytholmroyd is individually classified as 'good' with an EQR value of 0.5522 based on the FCS2 EQR scores from the 2024 survey, improving from 'moderate' in 2015 with an EQR score of 0.3488. The site has relatively good diversity, with three species from an expected four observed. The EQR score for brown trout is moderate with an EQR score of 0.4353, with the observed density lower than the expected density. Bullhead and stone loach were counted in numbers that significantly exceeded their expected densities with an EQR score of 1. Minnow were expected to be present but none were counted. The higher-than-expected density of bullhead and stone loach and presence of brown trout contributed to the 'good' overall classification.

Brown trout were the only species counted at every site for every survey year, with brown trout the only species captured at Cragg Vale Spa and U/S Weir Cragg Hall Wood. Bullhead and stone loach were counted at Mytholmroyd and D/S Cragg Road. Stone loach were counted in low numbers, whilst bullhead were counted in low to high numbers. The highest count of bullhead was 310 at Mytholmroyd in 2023, compared to 11 in 2017. Surveys at Mytholmroyd between 2015 and 2018 were all employed a single-catch methodology instead of the catch-depletion method used in 2021 onward, however, the single catch.

Table B2.80 details species presence by year across all sites within the Cragg Brook 1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.79 Cragg Brook 1 Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
139	Cragg Vale Spa	SE0021923509	Electric Fishing (AC, PDC and DC)	3	2016	2018
140	U/S Weir Cragg Hall Wood	SE0078725141	Electric Fishing (AC, PDC and DC)	3	2016	2018
11867	Mytholmroyd	SE0115225821	Electric Fishing (AC, PDC and DC)	9	2015	2024
76443	DS Cragg Road	SE0121225870	Electric Fishing (AC, PDC and DC)	1	2021	2021

Table B2.80 Cragg Brook 1 Survey Results

Tolerance Category ³	Species Name	2015	2016	2017	2018	2021	2022	2023	2024
Medium tolerance	Stone loach			X	X	X	X	X	X

Low tolerance	Bullhead	X	X	X	X	X	X	X	X
Low tolerance	Brown trout	X	X	X	X	X	X	X	X

B2.21.4.3WFD waterbody status

Table B2.81 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.81** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.81 WFD classifications

Waterbody ID & Name		GB104027062610 Cragg Brook from Source to River Calder	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	High	Medium
	Macroinvertebrates	Good	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Good	
	Fish	Good	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.21.5 Invasive non-native species (INNS)

Table B2.82 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.82**).

Table B2.82 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp <i>(Crangonyx pseudogracilis)</i> -New Zealand mud snail <i>(Potamopyrgus antipodarum)</i> -Caspian Mud Shrimp <i>-Chelicorophium curvispinum</i>	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Pink purslane (<i>Claytonia sibirica</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No

B2.21.6 Landscape, navigation, recreation and heritage

Table B2.83 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.83**).

Table B2.83 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calderdale Way - National Trail	Major	The route of Calderdale Way runs alongside Cragg Brook and the River Calder. The rivers form part of the landscape setting of several trails in the region.	Not sensitive	No
Angling in Cragg Brook	Major	Casual angling only so impacts unlikely to be significant	Low	No
Caravan site at Hoo Hall	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No

B2.22 CALDER 3

B2.22.1 Statutory designated sites

Table B2.84 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.84**).

Table B2.84 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Scarr and Long Woods – Local Nature Reserve	Major	No water dependent receptors	Not sensitive	No
Milner Royd – Local Nature Reserve	Major	No water dependent receptors	Not sensitive	No
Sparrow Wood – Local nature Reserve	Major	No water dependent receptors	Not sensitive	No

B2.22.2 NERC and local wildlife sites

Table B2.85 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.85**).

Table B2.85 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Rochdale Canal LWS	Major	Unlikely to be in connectivity with impacted reach.	Not sensitive	No
Swamp Dam LWS	Major	The site supports a rich assemblage of amphibians. Unlikely to be in connectivity with impacted reach	Not sensitive	No
Calder and Hebble Canal / Navigation -LWS	Major	Unlikely to be in connectivity with impacted reach.	Not sensitive	No
Elland Park Wood LWS	Major	Site hosts a large expanse ancient semi-natural woodland, species rich neutral woodland and mixed species rich acid woodland. Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Strangstry Wood LWS	Major	An area of woodland with possible moorland/fen. Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Lowland dry acid grassland -403833	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Deciduous woodland -326385 -326386	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Lowland fens -413501 -413500 -413503 -413502 -413497 -413504 -413429 -413428 -413427	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.22.3 NERC and other protected species

Table B2.86 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. Review of EA records did not indicate the presence of otter within impacted reach, however YWSL identified their historic presence within the impacted reach. The data identifies that suitable habitat is present in the impacted reach. The distribution of information and survey data for the species was considered to be limited, Therefore, otters are considered likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used to inform the assessment of water vole in the impacted reach. Review of EA records did not indicate the presence of water vole within impacted reach, however information obtained from the West Yorkshire Biological Records Centre identified their presence within the impacted reach. The distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Several NERC Act Section 41 and notable fish species have been identified as present in the impacted reach, including one NERC Act Section 41 fish species (brown trout) and two notable fish species (bullhead and grayling).

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.86 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Medium	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
Notable Species – Fish	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact	Medium	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
-Bullhead (<i>Cottus gobio</i>) -Grayling (<i>Thymallus thymallus</i>)		spawning, migration, provision of cover, predation, inter and intra-species competition etc.		
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Swallow (<i>Hirundo rustica</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Common Tern (<i>Sterna hirundo</i>) - House Martin (<i>Delichon urbica</i>)	Not sensitive	No

B2.22.4WFD receptors

B2.22.4.1 Macroinvertebrates

The WFD waterbody GB104027062641 (Calder from Colden Water to Ryburn Confluence) classified as 'good' for macroinvertebrates in 2022, Cycle 3 and GB104027062642 (Calder from Ryburn Confluence to River Colne) classified as 'good' for macroinvertebrates in 2022, Cycle 3. The classification for GB104027062641 (Calder from Colden Water to Ryburn Confluence) is informed by three sites, D/S Hebden Bridge (ID 57) (classified as 'good', last classified in 2016), D/S Brearley Weir (ID 1406) (classified as 'good', last classified in 2015) and Site 1150 (classified as 'good', last classified in 2016). The classification for GB104027062642 (Calder from Ryburn Confluence to River Colne) is informed by two sites, D/S Brearley Weir (ID 1406) (classified as 'good', last classified in 2015) and U/S Black Brook (ID 1174) (classified as 'good', last classified 2019).

Baseline macroinvertebrate data is provided by four Environment Agency monitoring sites, D/S Brearley Weir (ID 1406), U/S Black Brook (ID 1174), Site 1167 and Copley (d/s bridge) (ID 65). D/S Brearley Weir had baseline survey data for two seasonal samples for 2021 and 2022, and only one seasonal sample for 2015 and 2023. U/S Black Brook had baseline survey data for two seasonal samples for 2017 and 2020, three seasonal samples for 2021 and 2022, and only one seasonal sample for 2023. Copley (d/s bridge) had baseline survey data for two seasonal samples for 2021 and 2022, and one seasonal sample for 2023. Site 1167 had baseline survey data for two seasonal samples for 2012 only.

The WFD status of the macroinvertebrate community in Calder 3 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Calder 1 is medium to highly sensitive to reduced flows (**Figure B2.10**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.10**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 2.5 - 7.14 (5.71) with the lowest WHPT_{ASPT} score of 2.5 at Site 1174 in Autumn 2021, and the highest score of 7.14 at Site 1406 in Spring 2021. The WHPT_{ASPT} expected scores for ranged between 6.47 to 7.02 across the sites, with 16 of the 39 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.39 - 1.07 (0.85) with the lowest WHPT_{ASPT} EQR of 0.39 at Site 1174 in Autumn 2021, and the highest EQR of 1.07 at Site 1174 in Autumn 2020.

In Calder 3 data from the site identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 4 - 30 (18.15) with the lowest WHPT_{NTAXA} score of 4 at Site 1174 in Autumn 2021, and the highest score of 30 at Site 1174 in Autumn 2014. The WHPT_{NTAXA} expected scores ranged between 23.16 to 26.03 across the sites, with 13 of the 39 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.17 - 1.28 (0.75) with the lowest WHPT_{NTAXA} EQR of 0.17 at Site 1174 in Autumn 2021, and the highest EQR of 1.28 at Site 1174 in Autumn 2014.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 5.5 - 8.78 (7.38) with the lowest LIFE_{FAMILY} score of 5.5 at Site 1174 in Autumn 2021, and the highest score of 8.78 at Site 1406 in Spring 2022. The LIFE_{FAMILY} expected scores ranged between 7.51 to 7.85 across the sites, with 12 of the 39 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.73 - 1.14 (0.96) with the lowest LIFE_{FAMILY} EQR of 0.73 at Site 1174 in Autumn 2021, and the highest EQR of 1.14 at Site 1406 in Spring 2022.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 12.5 - 83.3 (63.59) with the lowest PSI_{FAMILY} score of 12.5 at Site 1174 in Autumn 2023, and the highest score of 83.3 at Site 1406 in Spring 2022. The PSI_{FAMILY} expected scores ranged between 64.42 to 71.16 across the sites, with 18 of the 39 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.19 - 1.27 (0.94) with the lowest PSI_{FAMILY} EQR of 0.19 at Site 1174 in Autumn 2023, and the highest EQR of 1.27 at Site 65 in Autumn 2021.

A total of 3 INNS species, including *Potamopyrgus antipodarum*, *Crangonyx pseudogracilis* and *Chelicorophium curvispinum* were recorded as present at three sites between 2013 to 2023, with *Pacifastacus leniusculus* being recorded within the NBN data search.

A single designated species, *Potamophylax rotundipennis*, was recorded at Site 1174 in 2014.

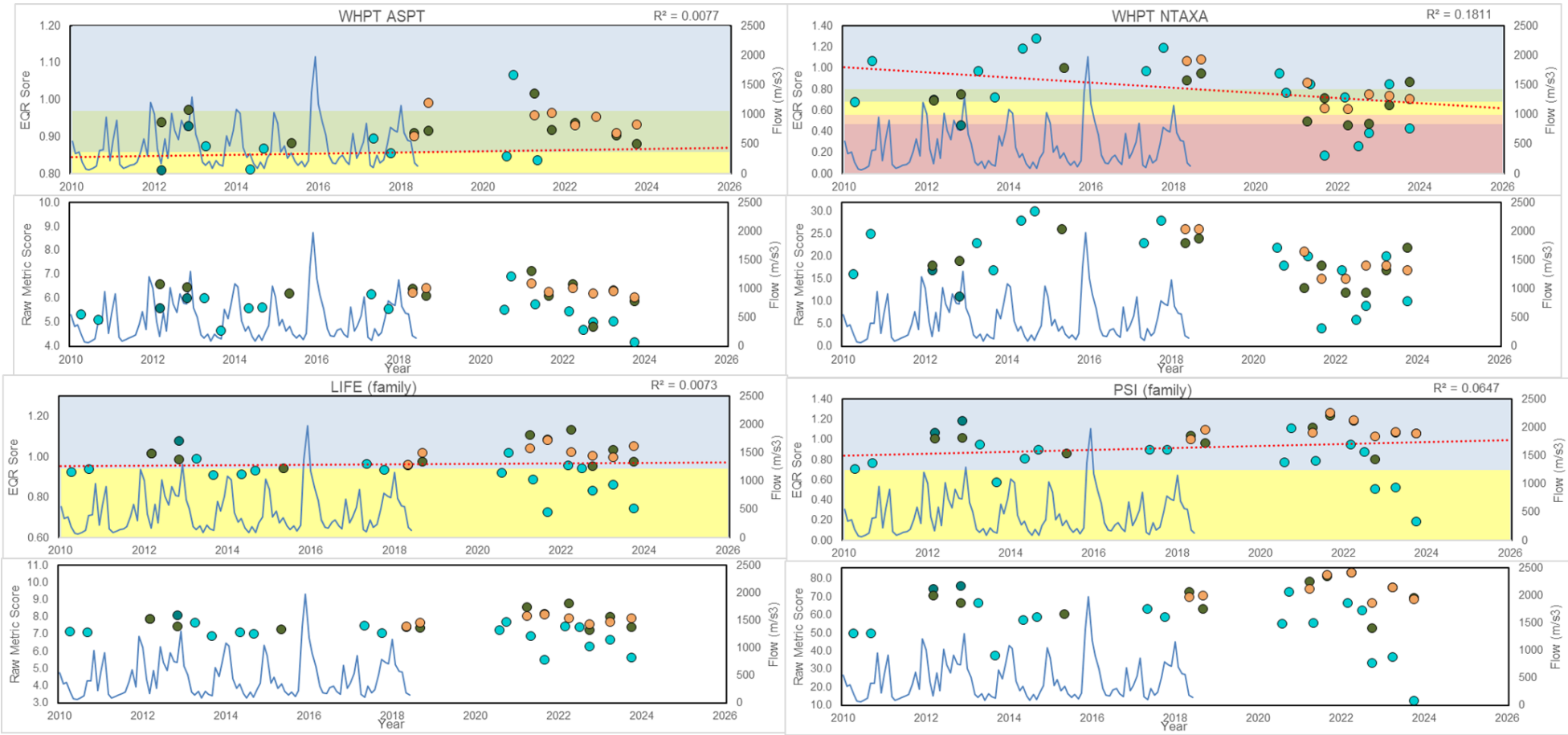
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.87 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
1167	SE0597923519	2	2012	1.02 - 1.08 (1.05)	7.86 - 8.11 (7.99)	1.07 - 1.18 (1.13)	74.19 - 76.19 (75.19)	0.81 - 0.93 (0.87)	M - G (G)	5.6 - 6.02 (5.81)	0.46 - 0.7 (0.58)	B - G (M)	11 - 17 (14)
1174	SE1000721504	18	2010 to 2023	0.73 - 1.02 (0.9)	5.5 - 7.69 (6.88)	0.19 - 1.12 (0.77)	12.5 - 72.7 (52.35)	0.39 - 1.07 (0.77)	B - H (M)	2.5 - 6.93 (5.1)	0.17 - 1.28 (0.76)	B - H (G)	4 - 30 (18)
1406	SE0273125902	11	2012 to 2018	0.94 - 1.14 (1.02)	7.22 - 8.78 (7.78)	0.8 - 1.24 (1.03)	52.6 - 83.3 (70.34)	0.72 - 1.02 (0.91)	M - H (G)	4.82 - 7.14 (6.24)	0.46 - 1 (0.72)	B - H (G)	12 - 26 (19)
65	SE0849322371	8	2021 to 2018	0.96 - 1.08 (1.02)	7.45 - 8.15 (7.81)	1 - 1.27 (1.1)	66.7 - 83.3 (73.86)	0.9 - 0.99 (0.94)	G - H (G)	6.06 - 6.62 (6.32)	0.62 - 1.08 (0.81)	M - H (H)	15 - 26 (20)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.10 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key			
1167	1174	1406	65

*Flow data not available for post 2018 due to gauging station (27088 - Calder at Mytholmroyd) closure for Flood Alleviation Scheme works

B2.22.4.2 Fish

The WFD waterbody GB104027062641 (Calder from Colden Water to Ryburn Confluence) is classified under cycle 3 (2022) as 'good' for fish, an improvement from 'moderate' in 2019. The classification is informed by two sites, Hebble End (Co-op Car Park) (ID 34544) classified as 'good' and Hebden Bridge Train Station classified as 'good' in 2022, improving from 'moderate' in 2019.

GB104027062642 Calder from Ryburn Confluence to River Colne are classified under Cycle 3 (2022) as 'moderate'. The classification is informed by two sites, both of which were last classified in 2019. Cornmill Weir (ID 8359) was classified as 'moderate' in 2019 and Elland Power Station D/S (ID 8303) was classified as 'good'.

No Environment Agency fisheries monitoring sites were present in the impacted reach, FCS2 data was provided by Hebble End (Co-op Car Park) (ID 34544), located upstream of the impacted reach (Calder 2) and Elland power station d/s (ID 8303), located downstream of the impacted reach (Calder 4). Additional baseline monitoring was undertaken at three sites, Brearley Weir (ID 56), Hollins Mill Lane Weir (ID 57) and Luddenden Foot (ID 58).

YWSL commissioned additional monitoring at three sites, Brearley Weir (ID YW10050), Hollins Mill Lane Weir (ID YW10051), and Luddenden Foot (ID YW10052). All three sites were surveyed in 2015, 2017, 2018 and 2021. Brearley Weir and Hollins Mill Lane Weir were also surveyed in 2024.

Table B2.88 details survey sites within the Calder 3 reach.

The WFD status of the fish community in Calder 3 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Hebble End (Co-op Car Park) is individually classified as 'good' with a site EQR of 0.4892 based on the FCS2 EQR scores from the 2023 survey. The site had moderate diversity with three species were observed of the expected five. The site has a moderate diversity, with only three species present from an expected five species. The EQR score for brown trout was moderate at 0.4503, with observed density lower than the expected density. The EQR score for bullhead and stone loach was high with observed densities significantly higher than expected. Minnow and grayling were expected to be present but were not observed. The presence of brown trout along with the higher-than-expected densities of bullhead and stone loach contributed to the sites overall 'good' classification.

The site Elland power Station d/s is individually classified as moderate with a site EQR of 0.5362, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively good diversity, with six species present from an expected eight species. Trout had a low EQR score of 0.2973, trout had lower observed density compared to the expected density at the site. Grayling had a high EQR score of 0.746, grayling had a slightly higher observed density compared to the expected density at the site. Bullhead, minnow and stone loach are observed at increased numbers, with EQR scores of 1. Additionally, gudgeon were present at similar densities to the expected densities. Though pike and chub are expected to be present at the site, both at a moderate prevalence of 0.50 and 0.57 respectively, neither species were observed. The low EQR score for trout had an effect in the overall site classification, however the generally good diversity of the site positively contributed to the 'moderate' overall site classification.

Bullhead were the only species counted at all sites during every survey year, with abundance ranging from low to high. Abundance typically increased with survey year, with the highest count of 120 in 2021 at Brearley Weir, whereas the lowest count of 2 was in 2017 at Hollins Mill Lane Weir. Brown trout were present in primarily low abundance, but were not counted during some years at sites. Brown trout were not counted at Brearley Weir and Hollins Mill Lane Weir in 2016, as well as in 2021 at Hollins Mill Lane Weir. Grayling were counted in low abundances at all sites during more recent surveys, with Minnow displaying a similar pattern with the exception of not being counted at Luddenden Foot. 3-spined stickleback have been counted sporadically at each site in very low abundance, whilst perch were counted for the first time in 2024 at Brearley Weir with two individuals.

Table B2.89 details species presence by year across all sites within the Calder 3 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.88 Calder 3 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
YW10050	Brearley Weir	SE028259	Electric Fishing (AC, PDC and DC)	6	2015	2024
YW10051	Hollins Mill Lane Weir	SE053239	Electric Fishing (AC, PDC and DC)	6	2015	2024
YW10052	Luddenden Foot	SE036250	Electric Fishing (AC, PDC and DC)	5	2015	2021

Table B2.89 Calder 3 Fish Survey Results

Tolerance Category ³	Species Name	2015	2016	2017	2018	2021	2024
High tolerance	3-spined stickleback	X	X		X	X	X
High tolerance	Perch						X
Medium tolerance	Minnow	X	X		X	X	X
Medium tolerance	Stone loach	X	X	X	X	X	X
Low tolerance	Bullhead	X	X	X	X	X	X
Low tolerance	Brown trout	X	X	X	X	X	X
Low tolerance	Grayling	X		X	X	X	X

B2.22.4.3WFD waterbody status

Table B2.90 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.90** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.90 WFD classifications

Waterbody ID & Name		GB104027062641 Calder from Colden Water to Ryburn Confluence	GB104027062642 Calder from Ryburn Confluence to River Colne	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major		
RBMP Cycle 3 Status/ Potential	Overall	Moderate	Moderate	
	Fish	Good	Moderate	Medium
	Macroinvertebrates	Good	Good	Medium
Hydro-morph designation		Heavily modified		
RBMP3 Waterbody Objective	Overall	Good	Moderate	
	Fish	Moderate	Good	
	Macroinvertebrates	Good	Good	
Waterbody Measures		None		

B2.22.5 Invasive non-native species (INNS)

Table B2.91 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.91**).

Table B2.91 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Signal Crayfish (<i>Pacifastacus leniusculus</i>) -Northern Crangonyctid (<i>Crangonyx pseudogracilis</i>) -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>) -Caspian mud shrimp (<i>Chelicorophium curvispinum</i>)	Major	The implementation of this drought permit is not anticipated to increase the spread of invasive non-native species.	Not sensitive	No
Invasive non-native species – mammals -American mink (<i>Neovision vision</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
Invasive non-native species – Terrestrial and Aquatic plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Canadian pondweed (<i>Elodea canadensis</i>)	Major	The implementation of this drought permit is not anticipated to increase the spread of invasive non-native species.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Invasive non-native species – Fish -Rainbow trout (<i>Oncorhynchus mykiss</i>)	Major	The implementation of this drought permit is not anticipated to increase the spread of invasive non-native species.	Not sensitive	No

B2.22.6 Landscape, navigation, recreation and heritage

Table B2.92 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.92**).

Table B2.92 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Angling – River Calder	Major	Casual angling only	Not sensitive	No
Recreation (Canoeing)	Major	Canoeing may still be suitable under drought conditions. However, the impact of the drought option is unlikely to be significant against a baseline of drought conditions.	Not sensitive	No

B2.23 LUDDENDEN BROOK 1

B2.23.1 Statutory designated sites

Table B2.93 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.93**).

Table B2.93 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
South Pennine Moors SAC	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors Phase 2 - SPA	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
South Pennine Moors SSSI	Major	None. The gradients between the moor and the valley are sufficiently steep that there would be no hydrodynamic connectivity between channel and the moor, particularly during dry conditions.	Not sensitive	No
Jerusalem Farm-LNR	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

B2.23.2 NERC and local wildlife sites

Table B2.94 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.94**).

Table B2.94 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Jerusalem Farm LWS / Wade Wood LWS	Major	Site hosts semi-natural, woodland, species rich acid woodland, species rich acid woodland and grassland. Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
Rochdale Canal LWS	Major	Unlikely to be in connectivity with impacted reach.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitats - Grass moorland -376906 -376907 -376963	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Blanket bog -4098	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Blanket -11327 -11358 -11365 -11367 -11370 -11376	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Grass moorland -369016	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – Upland heathland -491918 -501096	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – No main habitat but additional habitats present (<i>Blanket and valley bog (upland)</i>) -462714 -462715	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
NERC Priority Habitats – No main habitat but additional habitats present (<i>North Atlantic wet heath with Erica Tetralix</i>) -462641	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Priority Habitat – Deciduous woodland -204236, 204590, 204740, 205041, 205262, 204739, 204724, 204641, 204669, 207782, 205079, 204857, 204134, 204190, 204369, 203938, 203657, 202525, 201838, 201681, 201536, 201784	Major	Unlikely to be in connectivity with impacted reach or support aquatic receptors. Species include English oak (<i>Quercus robur</i>), ash (<i>Fraxinus excelsior</i>), silver birch (<i>Betula pendula</i>), hazel (<i>Corylus avellana</i>), hawthorn (<i>Crataegus monogyna</i>), holly (<i>Ilex aquifolium</i>), soft rush (<i>Juncus effusus</i>), common reedmace (<i>Typha latifolia</i>), and reed sweet grass (<i>Glyceria maxima</i>)	Not sensitive	No

B2.23.3 NERC and other protected species

Table B2.95 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. Surveys conducted by the Environment Agency in 2013 and 2014, and YWSL in 2016 have identified the presence of white-clawed crayfish within the reach. The Environment Agency noted it is likely a small population, with juveniles present, additionally YWSL observed an abundance of potential habitat present. Based on the available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have a **high** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. Review of EA records did not indicate the presence of otter within impacted reach, however YWSL identified their historic presence within the impacted reach. The data identifies that suitable habitat is present in the impacted reach. The distribution of information and survey data for the species was considered to be limited. Therefore, otters are considered likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.95 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrates Black-legged Alderfly - <i>Sialis nigripes</i>	Major	This species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. There will be no likely impacts on the species as a result of water quality pressures.	Low	Yes
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	White-clawed crayfish are known to use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows.	High	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Otters use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	High	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Grey Wagtail (<i>Motacilla cinerea</i>) - House Martin (<i>Delichon urbica</i>) - Swallow (<i>Hirundo rustica</i>) - Little Ringed Plover Bird (<i>Charadrius dutius</i>) - Redshank (<i>Tringa tetanus</i>) - Snipe (<i>Gallinago gallinago</i>)	Not sensitive	No

B2.23.4 WFD receptors

B2.23.4.1 Macroinvertebrates

The WFD waterbody GB104027062770 Luddenden Brook from source to River Calder classified as 'high' for macroinvertebrates in 2022, Cycle 3. The classification for GB104027062770 Luddenden Brook from source to River Calder is informed by one site, Luddenden (ID 474), classified as 'high', last classified in 2016. Luddenden (ID 474) is located within the Luddenden Brook reach.

Baseline macroinvertebrate data is provided by two Environment Agency monitoring sites, Luddenden (ID 474) and Low Bridge (ID 1481). Environmental parameters used to calculate EQR scores were not available for Low Bridge, but environmental parameters from Ricardo survey data was available for this site. Luddenden had baseline survey data for two seasonal samples for 2013, 2021, 2022 and 2023, and only one seasonal sample for 2020. Low Bridge had baseline survey data for two seasonal samples for 2013, 2021, 2022 and 2023.

The WFD status of the macroinvertebrate community in Luddenden Brook 1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Luddenden Brook 1 is highly sensitive to reduced flows (Error! Reference source not found.). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer, and Ricardo survey data for Site 1481. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.11**.

Data from the monitoring site shows the WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 5.93 - 7.57 (6.99) with the lowest WHPT_{ASPT} score of 5.93 at Site 474 in Autumn 2020, and the highest score of 7.57 at Site 474 in Spring 2022. The WHPT_{ASPT} expected scores for ranged between 7.05 to 7.45 across the sites, with 1 of the 17 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.84 - 1.04 (0.96) with the lowest WHPT_{ASPT} EQR of 0.84 at Site 474 in Autumn 2020, and the highest EQR of 1.04 at Site 474 in Autumn 2013.

In Luddenden Brook 1 data from the site identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 9 - 25 (19.29) with the lowest WHPT_{NTAXA} score of 9 at Site 474 in Autumn 2020, and the highest score of 25 at Site 1481 in Autumn 2010. The WHPT_{NTAXA} expected scores ranged between 21.03 to 24.12 across the sites, with 1 of the 17 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.39 - 1.19 (0.86) with the lowest WHPT_{NTAXA} EQR of 0.39 at Site 474 in Autumn 2020, and the highest EQR of 1.19 at Site 1481 in Autumn 2010.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7.57 - 8.38 (7.97) with the lowest LIFE_{FAMILY} score of 7.57 at Site 1481 in Autumn 2010, and the highest score of 8.38 at Site 1481 in Spring 2021. The LIFE_{FAMILY} expected scores ranged between 7.81 to 7.89 across the sites, with all samples above the 'Good/Moderate boundary'. LIFE_{FAMILY} EQR scores ranged between 0.96 - 1.06 (1.01) with the lowest LIFE_{FAMILY} EQR of 0.96 at Site 1481 in Autumn 2010, and the highest EQR of 1.06 at Site 1481 in Spring 2021.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 64.7 - 97.1 (80.21) with the lowest PSI_{FAMILY} score of 64.7 at Site 474 in Autumn 2020, and the highest score of 97.1 at Site 1481 in Autumn 2021. The PSI_{FAMILY} expected scores ranged between 72.2 to 76.67 across the sites, with 4 of the 17 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.89 - 1.27 (1.07) with the lowest PSI_{FAMILY} EQR of 0.89 at Site 474 in Spring 2023, and the highest EQR of 1.27 at Site 1481 in Autumn 2021.

A total of two INNS species, including *Crangonyx pseudogracilis* and *Potamopyrgus antipodarum* were recorded as present at Site 474 between 2021 to 2023.

A total of two designated species, including *Sialis nigripes* and *Austropotamobius pallipes* were recorded as present at two sites between 2010 to 2013.

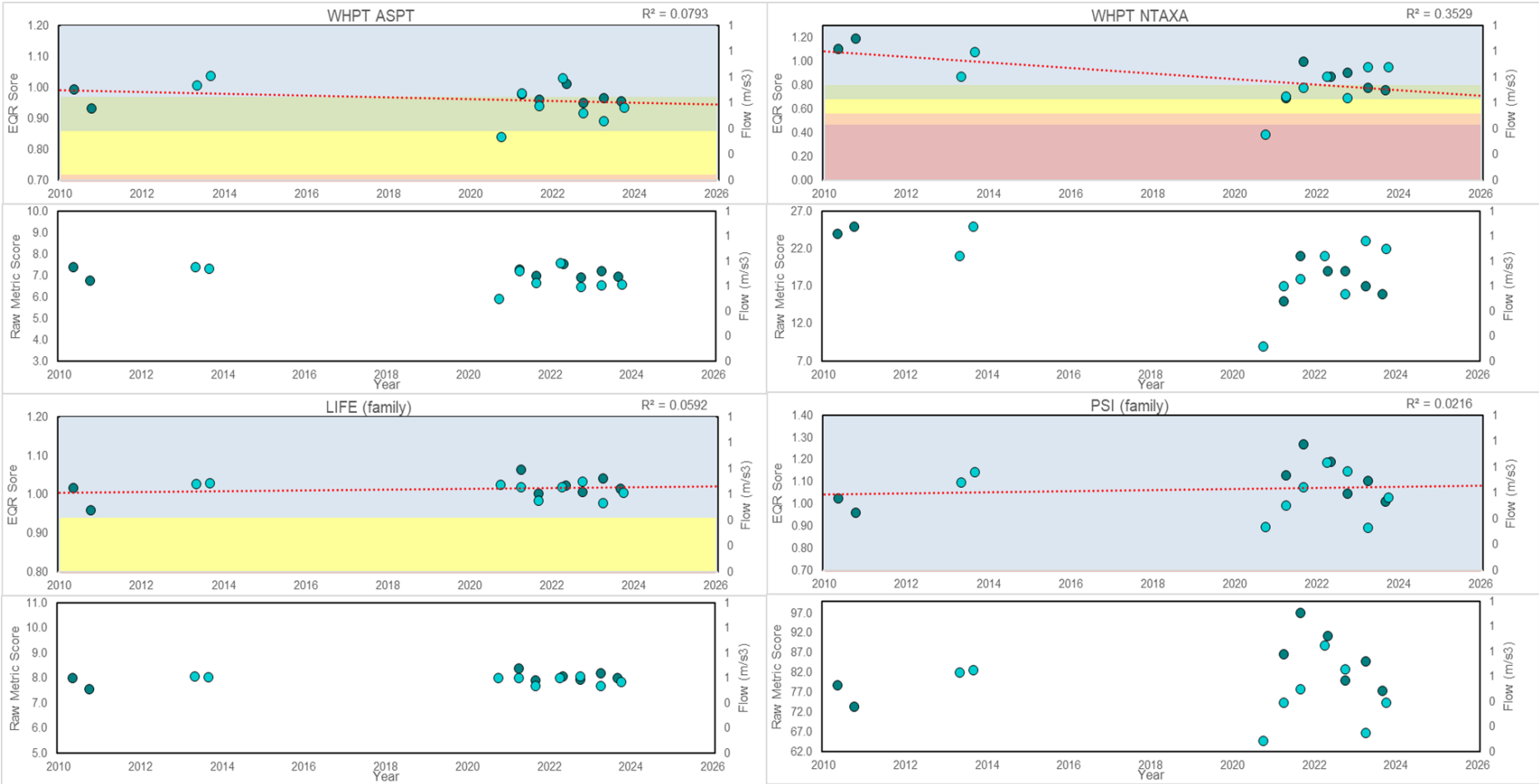
Based on the available information, the macroinvertebrate community is considered to be susceptible to drought permit impacts and has a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.96 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
1481	SE0225729165	8	2010 to 2023	0.96 - 1.06 (1.02)	7.57 - 8.38 (8.01)	0.96 - 1.27 (1.09)	73.33 - 97.1 (83.66)	0.93 - 1.01 (0.97)	G - H (G)	6.78 - 7.54 (7.13)	0.69 - 1.19 (0.91)	G - H (H)	15 - 25 (20)
474	SE0415726223	9	2013 to 2023	0.98 - 1.03 (1.01)	7.68 - 8.07 (7.93)	0.89 - 1.19 (1.05)	64.7 - 88.9 (77.14)	0.84 - 1.04 (0.95)	M - H (G)	5.93 - 7.57 (6.86)	0.39 - 1.08 (0.81)	B - H (H)	9 - 25 (19)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.11 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key	
474	1481

B2.23.4.2 Fish

Waterbody GB104027062770 Luddenden Brook from source to River Calder is classified under Cycle 3 (2022) as 'poor'. The classification is informed by one site, Luddenden (ID 11927), which was last classified as 'poor' in 2019.

Baseline fisheries data is available for one site, Luddenden, surveyed in 2015. YWSL commissioned additional surveys at Luddenden in 2020 through to 2022. **Table B2.97** details survey sites within the Luddenden Brook 1 reach.

The WFD status of the fish community in Luddenden Brook 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Luddenden is individually classified as poor with a site EQR of 0.14, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively poor diversity, with only one species present from an expected four species. Trout had a EQR score of 0.5967, with a lower observed density than expected at the survey site. Though stone loach and bullhead are expected to be present at the site, neither species were observed. The poor diversity of the site significantly contributed to the 'poor' overall site classification.

Brown trout are present in moderate to high abundance, with counts typically increasing year on year. The highest count of 203 was in 2022, whilst the lowest count of 33 was in 2020. **Table B2.98** details species presence by year across all sites within the Luddenden Brook 1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **high** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.97 Luddenden Brook 1 Fish Survey Site Information

Site Name	Method Grouped		Min Survey Year	Max Survey Year		
11927	Luddenden	SE0413126048	Electric Fishing (AC, PDC and DC)	4	2015	2022

Table B2.98 Luddenden Brook 1 Fish Survey Results

Tolerance Category ³	Species Name	2015	2020	2021	2022
Low tolerance	Brown trout	X	X	X	X

B2.23.4.3 WFD waterbody status

Table B2.99 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.99** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.99 WFD classifications

Waterbody ID & Name		GB104027062770 Luddenden Brook from source to River Calder	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	Poor	High
	Macroinvertebrates	High	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Moderate	
	Fish	Moderate	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.23.5 Invasive non-native species (INNS)

Table B2.100 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.100**).

Table B2.100 INNS Receptors

Site/Receptor and designation				Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>) -Freshwater Shrimp (<i>Crangonyx pseudogracilis</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive		No		
INNS – terrestrial plants -Japanese knotweed (<i>Fallopia japonica</i>) -Himalayan Balsam (<i>Impatiens glandulifera</i>) -Rhododendron (<i>Rhododendron ponticum</i>) -Montbretia (<i>Crocasmia pottsii x aurea</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive		No		

B2.23.6 Landscape, navigation, recreation and heritage

Table B2.101 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation. No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.101**).

Table B2.101 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Calderdale Way – National Trail	Major	The route of the trail runs alongside Luddenden Beck. The river forms part the landscape setting of the trail.	Not sensitive	No
Camp site at Booth	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling on Luddenden Brook	Major	Casual angling only	Low	No

B2.24 BOOTH DEAN CLOUGH 1

B2.24.1 Statutory designated sites

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment.

B2.24.2 NERC and local wildlife sites

Table B2.102 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.102**).

Table B2.102 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Meg Scar Wood-LWS	Major	Site supports species rich acid woodland which is unlikely to be in connectivity with impacted reach or support aquatic receptors.	Not sensitive	No
Booth Wood and Turner Wood - LWS	Major	The site hosts ancient and semi-natural woodland and species rich acid grassland which is unlikely to be in connectivity with impacted reach or support aquatic receptors	Not sensitive	No

Habitat NERC and other protected species

Table B2.103 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

The nationally scarce diving beetle *Stictonectes Lepidus* and Caddisfly *Rhyacophila septentrionis* were both recorded within the reach between the years 2021 to 2023. Based on the available information these receptors are considered to be susceptible to drought option impacts and has a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted. The data showed no surveys or records have been recorded in the impacted. Based on an assessment of habitat, during an Environment Agency walkover survey, no suitable habitat was observed. Based on the absence of suitable habitat in the impacted reach, the receptor is not considered at risk from the drought permit. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted. The data showed no surveys or records have been recorded in the impacted. Based on an assessment of habitat, during an Environment Agency walkover survey, no suitable habitat was observed. Based on the absence of suitable habitat in the impacted reach, the receptor is not considered at risk from the drought permit. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) has been identified as present within the reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.103 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Invertebrates Green sedge <i>Rhyacophila septentrionis</i> Diving Beetle <i>Stictonectes lepidus</i>	Major	<i>Rhyacophila septentrionis</i> is highly sensitive to flow and water level changes, favouring cold, fast-flowing, well-oxygenated streams with stable substrates. It relies on constant high flow for its predatory larvae, making it vulnerable to drought and flow reductions. <i>Stictonectes Lepidus</i> favour clean, unpolluted freshwater systems with low nutrient levels. Most commonly found in shallow pools. Potentially making them vulnerable if these areas are dissipated through drought and flow reductions.	Moderate	Yes

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Water beetle <i>Stictonectes lepidus</i>		<i>S. lepidus</i> is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. There will be no likely impacts on the species as a result of water quality pressures.	Low	
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially to use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otter are not likely to be present in the impacted reach as identified by an assessment of habitat during an Environment Agency walkover survey.	Not sensitive	No
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole are not likely to be present in the impacted reach as identified by an assessment of habitat during an Environment Agency walkover survey.	Not sensitive	No
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Swallow (<i>Hirundo rustica</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Common Tern (<i>Sterna hirundo</i>) - House Martin (<i>Delichon urbica</i>)	Not sensitive	No

B2.24.3 WFD receptors

B2.24.3.1 Macroinvertebrates

The WFD waterbody GB104027062520 Booth Dean Clough from Source to River Ryburn classified as 'good' for macroinvertebrates in 2022, Cycle 3. The classification for GB104027062520 Booth Dean Clough from Source to River Ryburn is informed by one site, Site 1170, classified as 'good', last classified in 2022. Site 1170 is located within the Booth Dean Clough 1 reach.

Baseline macroinvertebrate data is provided by two Environment Agency monitoring sites: D/S Booth Dean Clough Reservoir (ID 74826) and Site 1170. Site 74826 had regular seasonal Environment Agency baseline

survey data in 2010, 2012 to 2019, 2021, and 2023, supplemented by additional YWSL monitoring in 2020, 2022, and 2024. Site 1170 had regular seasonal Environment Agency baseline survey data in 2012 to 2021 and 2023, with additional YWSL monitoring in 2024. In addition, YWSL monitoring was undertaken at Rishworth Mill (ID 69) for two seasonal samples in 2021, and for one seasonal sample in both 2020 and 2022.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Booth Dean Clough 1 is highly sensitive to reduced flows (**Figure B2.12**). See **Table B2.4** for guidance in interpreting raw LIFE scores. $WHPT_{ASPT}$ and $WHPT_{NTAXA}$ scores are available for the site. $WHPT$ and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for $WHPT_{NTAXA}$ and $WHPT_{ASPT}$, see **Figure B2.12**.

Data from the monitoring site shows variation in $WHPT_{ASPT}$ scores ranged between 5.6 - 8.23 (6.83) with the lowest score of 5.6 at Site 74826 in Autumn 2020, and the highest score of 8.23 at Site 1170 in Spring 2013. The $WHPT_{ASPT}$ expected scores ranged between 6.9 to 7.45 across the sites, with five of the 53 samples below the 'Good/Moderate boundary'. $WHPT_{ASPT}$ EQR scores ranged between 0.79 - 1.11 (0.94) with the lowest EQR of 0.79 at Site 74826 in Autumn 2020, and the highest EQR of 1.11 at Site 1170 in Spring 2013.

In Booth Dean Clough 1 data from the site identifies macroinvertebrate communities which significantly varies in terms of diversity. $WHPT_{NTAXA}$ scores ranged between 9 - 35 (23.21) with the lowest score of 9 at Site 74826 in Autumn 2022, and the highest score of 35 at Site 1170 in Spring 2017. The $WHPT_{NTAXA}$ expected scores ranged between 22.09 to 25.29 across the sites, with eight of the 53 samples below the 'Good/Moderate boundary'. $WHPT_{NTAXA}$ EQR scores ranged between 0.38 - 1.51 (0.99) with the lowest EQR of 0.38 at Site 74826 in Autumn 2022, and the highest EQR of 1.51 at Site 1170 in Spring 2017.

$LIFE_{FAMILY}$ EQRs are not used to determine WFD classification but provide an indication of the flow preferences of the macroinvertebrate communities at the sites. $LIFE_{FAMILY}$ scores ranged between 7.24 - 8.33 (7.69) with the lowest score of 7.24 at Site 74826 in Autumn 2010, and the highest score of 8.33 at Site 74826 in Spring 2022. The $LIFE_{FAMILY}$ expected scores ranged between 7.81 to 7.88 across the sites, with 5 of the 53 samples below the 'Good/Moderate' boundary. $LIFE_{FAMILY}$ EQR scores ranged between 0.92 - 1.06 (0.98) with the lowest EQR of 0.92 at Site 1170 in Autumn 2021, and the highest EQR of 1.06 at Site 74826 in Spring 2022.

Similarly, PSI_{FAMILY} EQRs are not used to determine WFD classification but provide an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 50 - 100 (72.48), with the lowest score of 50 at Site 74826 in Autumn 2020, and the highest score of 100 at Site 74826 in Spring 2022. The PSI_{FAMILY} expected scores ranged between 71.78 to 76.3 across the sites, with 30 of the 53 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.7 - 1.33 (0.98) with the lowest EQR of 0.7 at Site 74826 in Autumn 2020, and the highest EQR of 1.33 at Site 74826 in Spring 2022.

A total of three INNS species, including *Potamopyrgus antipodarum* and *Crangonyx pseudogracilis/floridanus* were recorded as present at three sites between 2010 to 2024. The NBN data search also highlighted the presence of *Gammarus tigrinus* recorded within the reach.

A total of two designated species, including *Rhyacophila septentrionis* and *Stictonectes lepidus* were recorded as present at two sites between 2021 to 2023.

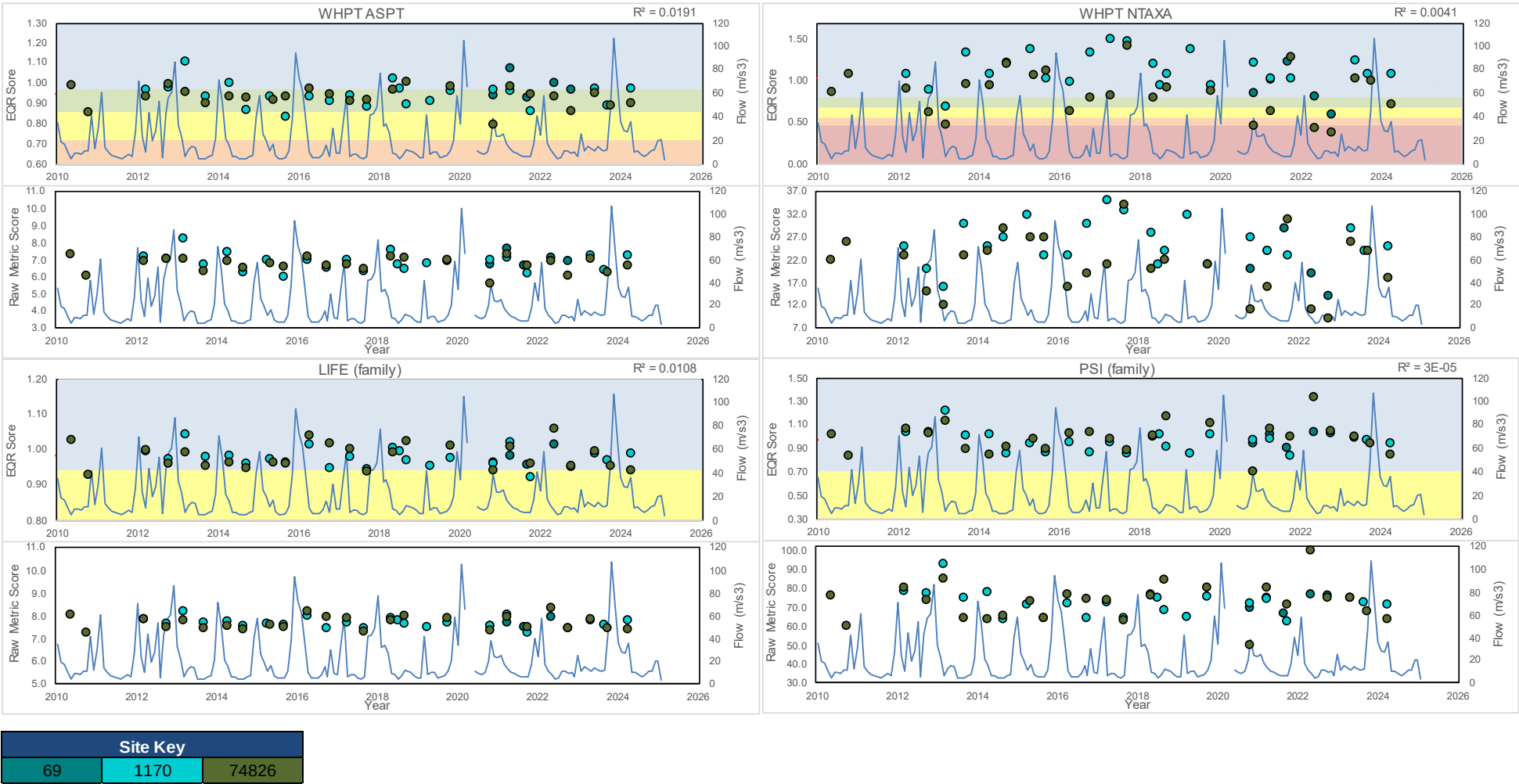
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.104 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
69	SE0361117977	5	2020 to 2022	0.95 - 1.01(0.97)	7.46 - 7.94 (7.63)	0.9 - 1.03 (0.98)	66.67 - 76.5 (72.81)	0.93 - 1.08 (0.98)	G - H (H)	6.63 - 7.68 (7.01)	0.6 - 1.23 (0.9)	M - H (H)	14 - 29 (21)
1170	SE0348018791	23	2012 to 2024	0.92 - 1.04 (0.98)	7.25 - 8.21 (7.7)	0.84 - 1.22 (0.96)	62.5 - 92.86 (72.23)	0.83 - 1.11 (0.94)	M - H (G)	5.99 - 8.23 (6.88)	0.69 - 1.51 (1.14)	G - H (H)	16 - 35 (26)
74826	SE0362816895	25	2010 to 2020	0.93 - 1.06 (0.98)	7.24 - 8.33 (7.68)	0.7 - 1.33 (0.99)	50 - 100 (72.64)	0.79 - 1.01 (0.93)	M - H (G)	5.6 - 7.34 (6.74)	0.38 - 1.42 (0.86)	B - H (H)	9 - 34 (21)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.12 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



B2.24.3.2 Fish

Waterbody GB104027062520 Booth Dean Clough from Source to River Ryburn is classified under Cycle 3 (2022) as 'poor', a deterioration from 'moderate' in cycle 2 (2016). The classification is informed by one site, Booth Dean Clough Res (ID 11983), classified as 'poor' in 2019.

Baseline data is available for one site, D/S Booth Dean Clough Res, surveyed in 2015.

YWSL commissioned additional surveys at five sites, Works U/S (ID YW10055), Works D/S (ID YW10054), U/S Stone Masons (ID BDC2), U/S Rishworth Mill (ID BDC1) and Ripponden (ID BDC3). Ripponden, Works D/S and Works U/S were all surveyed in 2015 through to 2018. Ripponden, U/S Rishworth Mill and U/S Stone Masons were surveyed in 2020 and 2021, along with Works U/S in 2021. U/S Rishworth Mill was also surveyed in 2022 and Ripponden in 2024.

The WFD status of the fish community in Booth Dean Clough 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.105 details survey sites within the Booth Dean Clough 1 reach.

FCS2 data was provided by D/S Booth Dean Clough Res (ID 11983). D/S Booth Dean Clough Res is individually classified as poor with a site EQR of 0.1786, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively poor diversity, with only one species present from an expected three species. Trout had a good EQR score of 0.6543, with a higher observed density than expected at the survey site. Though stone loach and bullhead are expected to be present at the site, neither species were observed. The poor diversity of the site significantly contributed to the 'poor' overall site classification.

Brown trout were the only species counted at every site during every survey year. Abundance ranged from low to high, with a highest count of 266 in 2021 at Ripponden. The lowest count of 19 was at two sites, Works D/S in 2015 and U/S Stone Masons in 2020. A low abundance of rainbow trout were counted at Ripponden in 2021 and 2018. Two minnow were counted at Ripponden in 2020.

Table B2.106 details species presence by year across all sites within the Booth Dean Clough 1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.105 Booth Dean Clough 1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
11983	D/S Booth Dean Clough Res	SE0358317932	Electric Fishing (AC, PDC and DC)	1	2015	2015
BDC1	u/s Rishworth Mill	SE0357517899	Electric Fishing (AC, PDC and DC)	3	2020	2022
BDC2	u/s Stone Masons	SE0353118575	Electric Fishing (AC, PDC and DC)	3	2020	2021
BDC3	Ripponden	SE0347218795	Electric Fishing (AC, PDC and DC)	7	2015	2024
YW10054	Works d/s	SE035187	Electric Fishing (AC, PDC and DC)	4	2015	2018
YW10055	Works u/s	SE035185	Electric Fishing (AC, PDC and DC)	5	2015	2021

Table B2.106 Booth Dean Clough 1 Fish Survey Results

Tolerance Category ³	Species Name	2015	2016	2017	2018	2020	2021	2022	2024
Medium tolerance	Minnow					X			
Low tolerance	Brown trout	X	X	X	X	X	X	X	X
Low tolerance	Rainbow trout				X		X		

B2.24.3.3WFD waterbody status

Table B2.107 summarises the WFD classification of waterbody which contain the impacted reach **Table B2.107** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.107 WFD classifications

Waterbody ID & Name				GB104027062520 Booth Dean Clough from Source to River Ryburn	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)				Major	
RBMP Cycle 3 Status/ Potential	Overall			Moderate	
	Fish			Poor	Medium
	Macroinvertebrates			Good	Medium
Hydro-morph designation				Heavily modified	
RBMP3 Waterbody Objective	Overall			Moderate	
	Fish			Poor	
	Macroinvertebrates			Good	
Waterbody Measures				None	

B2.24.4 Invasive non-native species (INNS)

Table B2.108 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.108**).

Table B2.108 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis/floridanus</i>) - New Zealand mud snail (<i>Potamopyrgus antipodarum</i>) - Tiger scud (<i>Gammarus tigrinus</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Rhododendron (<i>Rhododendron ponticum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
alnvasive non-native species -Rainbow trout (<i>Oncorhynchus mykiss</i>)	Major	The implementation of this drought option is not expected to increase the distribution of this INNS	Not sensitive	No

B2.24.5 Landscape, navigation, recreation and heritage

Table B2.109 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.109**).

Table B2.109 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calderdale Way - National Trail	Major	The route of Calderdale Way runs alongside the River Ryburn. The river forms part of the landscape setting of several trails in the region.	Not sensitive	No
Recreation (Canoeing)	Major	Canoeing may still be suitable under drought conditions. However, the impact of the drought option is unlikely to be significant against a baseline of drought conditions.	Not sensitive	No

B2.26 RYBURN 1

B2.26.1 Statutory designated sites

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment.

B2.26.2 NERC and local wildlife sites

Table B2.110 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.110**).

Table B2.110 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Rough Hey, Ryburn Valley LWS	Major	Site supports ancient semi-natural woodland, species rich acid woodland and native bluebell populations, which are unlikely to be in connectivity with impacted reach or support aquatic receptors	Not sensitive	No

B2.26.3 NERC and other protected species

Table B2.111 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted. However, the data identifies that suitable habitat is present in the impacted reach. The distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otters likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

One NERC Act Section 41 fish species (brown trout) have been identified as present in the impacted reach.

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.111 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially to use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows	uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially to use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Swallow (<i>Hirundo rustica</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Common Tern (<i>Sterna hirundo</i>) - House Martin (<i>Delichon urbica</i>)	Not sensitive	No

B2.26.4WFD receptors

B2.26.4.1Macroinvertebrates

The WFD waterbody GB104027062540 Ryburn from Source to Booth Dean Clough classified as 'high' for macroinvertebrates in 2022, Cycle 3. The classification for GB104027062540 Ryburn from Source to Booth Dean Clough is informed by one site U/S Booth Dean Clough (ID 254), classified as 'high', last classified in 2022. U/S Booth Dean Clough (ID 254) is located in the Ryburn 1 reach.

Baseline macroinvertebrate data is provided by three Environment Agency monitoring sites, Bar Lane (ID 192093), U/S Booth Dean Clough (ID 254) and U/S Paper Mill (ID 1172). Environmental parameters used to calculate EQR scores were not available for Bar Lane or U/S Paper Mill, therefore no site specific EQR value could be calculated in RICT3 (Ricardo survey data also unavailable). Bar Lane had baseline survey data for one seasonal sample for 2018 and 2020, and two seasonal samples for 2021 and 2022. U/S Booth Dean Clough had baseline survey data for two seasonal samples for 2010-2019, and one seasonal sample for 2024. U/S Paper Mill had baseline survey data for one seasonal sample for 2020 and two seasonal samples for 2021 and 2022.

The WFD status of the macroinvertebrate community in Ryburn 1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Ryburn 1 which has medium to high sensitivity to reduced flows (**Figure B2.13**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer, except site Bar Lane or U/S Paper Mill where this data was not available. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.13**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 4.4 - 7.71 (6.42) with the lowest WHPT_{ASPT} score of 4.4 at Site 1172 in Autumn 2022, and the highest score of 7.71 at Site 254 in Spring 2019. The WHPT_{ASPT} expected scores for ranged between 6.81 to 7.4 across the sites, with 8 of the 31 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.62 - 1.04 (0.89) with the lowest WHPT_{ASPT} EQR of 0.62 at Site 1172 in Autumn 2022, and the highest EQR of 1.04 at Site 254 in Spring 2019.

In Ryburn 1 data from the site identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 7 - 32 (22.32) with the lowest WHPT_{NTAXA} score of 7 at Site 1172 in Autumn 2022, and the highest score of 32 at Site 254 in Autumn 2015. The WHPT_{NTAXA} expected scores ranged between 23.73 to 25.24 across the sites, with 8 of the 31 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.29 - 1.33 (0.91) with the lowest WHPT_{NTAXA} EQR of 0.29 at Site 1172 in Autumn 2022, and the highest EQR of 1.33 at Site 254 in Autumn 2015.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 6.46 - 8.46 (7.6) with the lowest LIFE_{FAMILY} score of 6.46 at Site 1172 in Autumn 2020, and the highest score of 8.46 at Site 254 in Spring 2013. The LIFE_{FAMILY} expected scores ranged between 7.81 to 7.87 across the sites, with 6 of the 31 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.83 - 1.08 (0.97) with the lowest LIFE_{FAMILY} EQR of 0.83 at Site 1172 in Autumn 2020, and the highest EQR of 1.08 at Site 254 in Spring 2013.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 32 - 89.74 (68.86) with the lowest PSI_{FAMILY} score of 32 at Site 1172 in Autumn 2020, and the highest score of 89.74 at Site 254 in Spring 2019. The PSI_{FAMILY} expected scores ranged between 71.66 to 74.99 across the sites, with 20 of the 31 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.44 - 1.21 (0.94) with the lowest PSI_{FAMILY} EQR of 0.44 at Site 1172 in Autumn 2020, and the highest EQR of 1.21 at Site 254 in Autumn 2012.

A total of three INNS species, including *Potamopyrgus antipodarum*, *Gammarus tigrinus* and *Crangonyx pseudogracilis* were recorded as present at two sites between 2010 to 2024.

No designated species were recorded during the monitoring period.

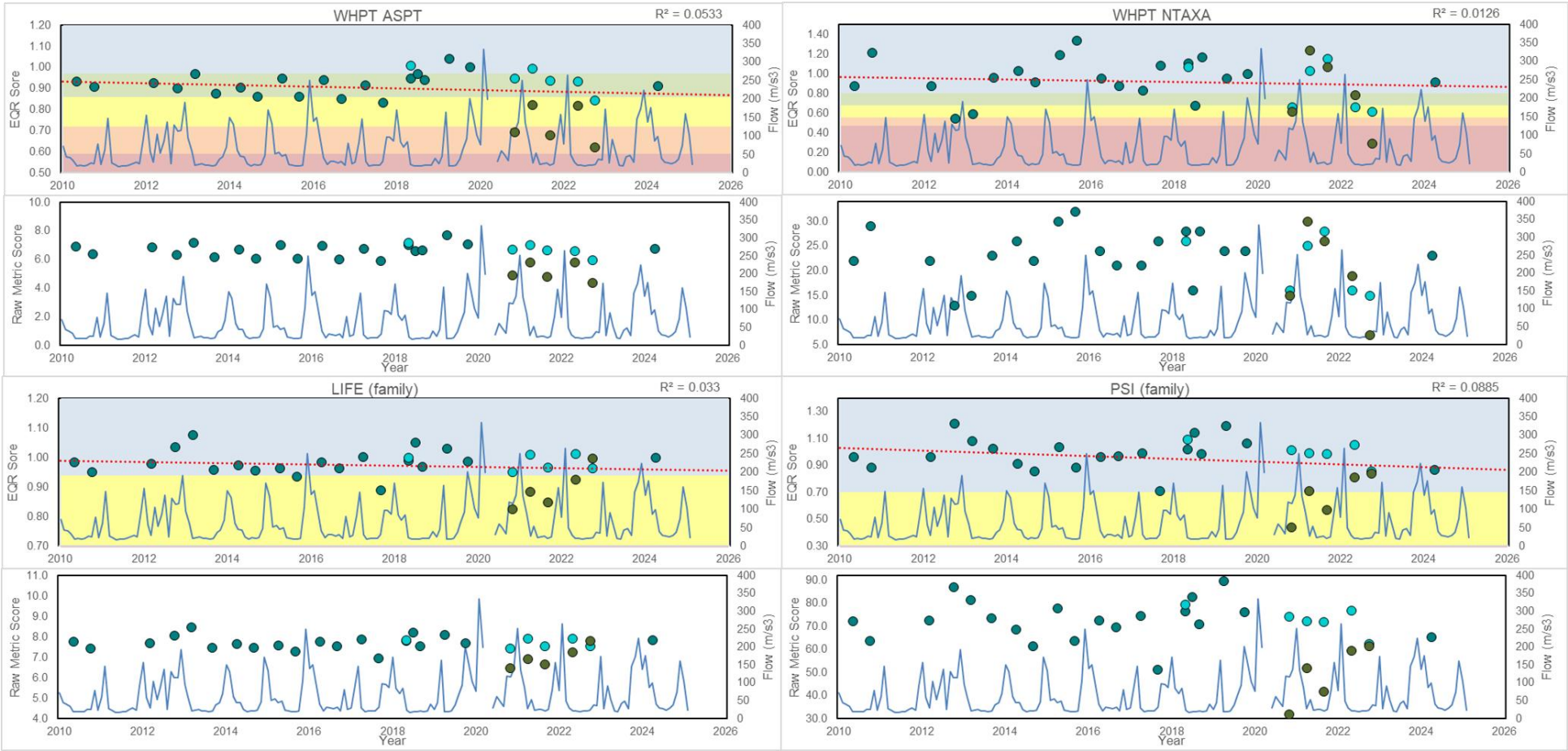
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.112 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
254	SE0341618775	20	2010 to 2024	0.89 - 1.08 (0.98)	6.95 - 8.46 (7.71)	0.71 - 1.21 (0.99)	51.11 - 89.74 (72.55)	0.83 - 1.04 (0.92)	M - H (G)	5.89 - 7.71 (6.66)	0.54 - 1.33 (0.95)	P - H (H)	13 - 32 (23)
192093	SE0331018708	6	2018 to 2022	0.95 - 1.01 (0.98)	7.44 - 7.93 (7.7)	0.86 - 1.09 (1)	62.5 - 79.59 (72.9)	0.85 - 1.01 (0.94)	M - H (G)	5.99 - 7.16 (6.69)	0.62 - 1.15 (0.86)	M - H (H)	15 - 28 (21)
1172	SE0250018600	5	2020 to 2022	0.83 - 1 (0.9)	6.46 - 7.8 (7.01)	0.44 - 0.84 (0.68)	32 - 61.5 (49.27)	0.62 - 0.82 (0.73)	P - M (M)	4.4 - 5.82 (5.15)	0.29 - 1.23 (0.8)	B - H (G)	7 - 30 (19)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.13 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key		
254	192093	1172

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.26.4.2 Fish

Waterbody GB104027062540 Ryburn from Source to Booth Dean Clough is classified under Cycle 3 (2022) as 'moderate', improving from 'poor' in 2019. The classification is informed by one site, Bar Lane (U/S Booth Dean Clough) (WR) (ID 11990), classified as 'moderate' in 2022, improving from 'poor' in 2019.

Baseline fisheries data is available for one site, Bar Lane (U/S Booth Dean Clough) (WR), surveyed in 2010 through to 2013, 2015, 2017, 2019 and 2023.

YWSL commissioned additional survey as three sites, D/S Weir (ID RY1), U/S Bar Lane Joiners (ID RY2), and Bar Lane Joiners (ID RY3). All three sites were surveyed in 2020 and 2021.

Table B2.113 details survey sites within the Ryburn 1 reach.

The WFD status of the fish community in Ryburn 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Bar Lane (u/s Booth Dean Clough) (WR) is individually classified as 'poor' with a site EQR of 0.1132 based on FCS2 data from the 2024 survey. This represents a degradation of the 'moderate' 2022 classification, with site EQR lower than the 0.1892 from the 2017 survey. The site has a relatively low diversity, with only one species observed from an expected three species. Brown trout have a moderate individual EQR score of 0.292 with observed density significantly lower than expected. Bullhead and stone loach were expected to be present but were not observed. The low density of brown trout along with absence of bullhead and stone loach contributed to the 'poor' overall site classification.

Brown trout were counted at every site in every survey year, with counts typically lower in more recent surveys relative to the highest count of 128 at Bar Lane (U/S Booth Dean Clough) (WR) in 2010 and 2013. The lowest count of brown trout was 18 in 2020 at Bar Lane Joiners. A moderate abundance of rainbow trout have been recorded at Bar Lane (U/S Booth Dean Clough) (WR), however numbers have decreased since the highest count of 34 in 2011, with none counted in 2023. Brown trout x rainbow trout hybrids were counted in recent surveys at Bar Lane (U/S Booth Dean Clough) (WR). A small number of rainbow trout were counted at U/S Bar Lane Joiners in 2021 and at Bar Lane Joiners in 2020 and 2021. Single individuals of 3-spined stickleback and roach have been counted occasionally.

Table B2.114 details species presence by year across all sites within the Ryburn 1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.113 Ryburn 1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	Electric Fishing (AC, PDC and DC)	9	2010	2023
RY1	d/s weir	SE0258418630	Electric Fishing (AC, PDC and DC)	3	2020	2021
RY2	u/s Bar Lane Joiners	SE0268518639	Electric Fishing (AC, PDC and DC)	2	2020	2021
RY3	Bar Lane Joiners	SE0324218646	Electric Fishing (AC, PDC and DC)	2	2020	2021

Table B2.114 Ryburn 1 Fish Survey Results

Tolerance Category ³	Species Name	2010	2011	2012	2013	2015	2017	2019	2020	2021	2023
High tolerance	3-spined stickleback								X		
High tolerance	Roach									X	
Medium tolerance	Stone loach								X	X	
Low tolerance	Brown trout	X	X	X	X	X	X	X	X	X	X
Low tolerance	Rainbow trout	X	X	X	X	X	X	X	X	X	
Unclassified tolerance	Brown trout x rainbow trout hybrid						X	X			X

B2.26.4.3WFD waterbody status

Table B2.115 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.115** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.115 WFD classifications

Waterbody ID & Name		GB104027062540 Ryburn from Source to Booth Dean Clough	Sensitivity (<i>Uncertain, High, Medium, Low, Not Sensitive</i>)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Good	
	Fish	Moderate	Medium
	Macroinvertebrates	High	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Good	
	Fish	Poor	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.26.5 Invasive non-native species (INNS)

Table B2.116 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.116**).

Table B2.116 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates	Major	The implementation of this drought option is not	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
-Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) - New Zealand mud snail (<i>Potamopyrgus antipodarum</i>) -Tiger scud (<i>Gammarus tigrinus</i>)		expected to increase the distribution of these INNS		
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Rhododendron (<i>Rhododendron ponticum</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
Invasive non-native species -Rainbow trout (<i>Oncorhynchus mykiss</i>)	Major	The implementation of this drought option is not expected to increase the distribution of this INNS	Not sensitive	No

B2.26.6 Landscape, navigation, recreation and heritage

Table B2.117 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.117**).

Table B2.117 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calderdale Way - National Trail	Major	The route of Calderdale Way runs alongside the River Ryburn. The river forms part of the landscape setting of several trails in the region.	Not sensitive	No
Angling on River Ryburn	Major	Flows during a drought will be low such that further reduction in flows would not be likely to further reduce the angling quality of the reach	Low	No
Other watersports	Major	Canoeing may still be suitable under drought conditions. However, the impact of the drought option is unlikely to be significant against a baseline of drought conditions.	Low	No

B2.27 RYBURN 2

B2.27.1 Statutory designated sites

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment.

B2.27.2 NERC and local wildlife sites

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment.

B2.27.3 NERC and other protected species

Table B2.118 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider white-clawed crayfish likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information white-clawed crayfish are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted. However, the data identifies that suitable habitat is present in the impacted reach. The distribution of information and survey data for the species was considered to be limited, Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otters likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted. However, the distribution of information and survey data for the species was considered to be limited. Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider water vole likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information water vole are considered to be susceptible to drought permit impacts and have an **uncertain** sensitivity to the physical environment impacts identified in **Appendix A**.

Several NERC Act Section 41 and notable fish species have been identified as present in the impacted reach, including one NERC Act Section 41 fish species (brown trout) and one notable fish species (bullhead).

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.118 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish could potentially use the impacted reach. White-clawed crayfish are sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows	Uncertain	Yes
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Uncertain	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	High	Yes
Notable Species – Fish - Bullhead (<i>Cottus gobio</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species present across the region	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Swallow (<i>Hirundo rustica</i>) - Reed Bunting (<i>Emberiza schoeniclus</i>) - Common Tern (<i>Sterna hirundo</i>) - House Martin (<i>Delichon urbica</i>)	Not sensitive	No

B2.27.4 WFD receptors

B2.27.4.1 Macroinvertebrates

The WFD waterbody GB104027062580 Ryburn from Booth Dean Clough to R Calder classified as 'moderate' for macroinvertebrates in 2022, Cycle 3. The classification for GB104027062580 Ryburn from Booth Dean Clough to R Calder is informed by two sites, U/S Ripponden STW (ID 255) (classified as 'moderate', last classified in 2016) and Site ID 253 (classified as 'moderate', last classified in 2016). Both sites are located in the Ryburn 2 reach.

Baseline macroinvertebrate data is provided by three Environment Agency monitoring sites, Ripponden (Ryburn) (ID 1482), U/S Ripponden STW (ID 255) and Site ID 253. Ripponden (Ryburn) had baseline survey data for two seasonal samples for 2010 and 2012 to 2019, six seasonal samples for 2021, and one seasonal sample for 2023 and 2024. U/S Ripponden STW had baseline survey data for two seasonal samples for 2010 and 2014. Site 253 had baseline survey data for two seasonal samples for 2012, 2014, 2021, 2022 and 2023.

The WFD status of the macroinvertebrate community in Ryburn 2 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Ryburn 2 has a medium to high sensitivity to reduced flows (**Figure B2.14**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.14**.

Data from the monitoring sites show variation in WHPT_{ASPT} EQR scores over the period. WHPT_{ASPT} scores ranged between 4.93 - 7.9 (6.4) with the lowest WHPT_{ASPT} score of 4.93 at Site 253 in Spring 2012, and the highest score of 7.9 at Site 1482 in Spring 2013. The WHPT_{ASPT} expected scores for ranged between 6.8 to 7.41 across the sites, with 16 of the 43 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.69 - 1.08 (0.9) with the lowest WHPT_{ASPT} EQR of 0.69 at Site 253 in Spring 2012, and the highest EQR of 1.08 at Site 1482 in Spring 2013.

In Ryburn 2 data from the sites identifies macroinvertebrate communities which significantly varies in terms of diversity. WHPT_{NTAXA} scores ranged between 6 - 35 (24.14) with the lowest WHPT_{NTAXA} score of 6 at Site 253 in Autumn 2022, and the highest score of 35 at Site 1482 in Autumn 2019. The WHPT_{NTAXA} expected scores ranged between 23.36 to 27.07 across the sites, with 6 of the 43 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.24 - 1.38 (0.93) with the lowest WHPT_{NTAXA} EQR of 0.24 at Site 253 in Autumn 2022, and the highest EQR of 1.38 at Site 1482 in Autumn 2019.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 6.96 - 8.46 (7.66) with the lowest LIFE_{FAMILY} score of 6.96 at Site 1482 in Autumn 2010, and the highest score of 8.46 at Site 1482 in Spring 2013. The LIFE_{FAMILY} expected scores ranged between 7.65 to 7.87 across the sites, with 3 of the 43 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.9 - 1.08 (0.99) with the lowest LIFE_{FAMILY} EQR of 0.9 at Site 1482 in Autumn 2010, and the highest EQR of 1.08 at Site 1482 in Spring 2013.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 48.4 - 92.59 (68.94) with the lowest PSI_{FAMILY} score of 48.4 at Site 253 in Spring 2023, and the highest score of 92.59 at Site 1482 in Spring 2013. The PSI_{FAMILY} expected scores ranged between 67.53 to 75.32 across the sites, with 25 of the 43 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.67 - 1.26 (0.97) with the lowest PSI_{FAMILY} EQR of 0.67 at Site 253 in Spring 2023, and the highest EQR of 1.26 at Site 1482 in Spring 2013.

One INNS species (*Potamopyrgus antipodarum*) was recorded during the monitoring data at two sites between 2010 to 2024, with *Crangonyx pseudogracilis* and *Gammarus tigrinus* being present in the reach through the NBN data search.

No designated species were recorded during the monitoring period.

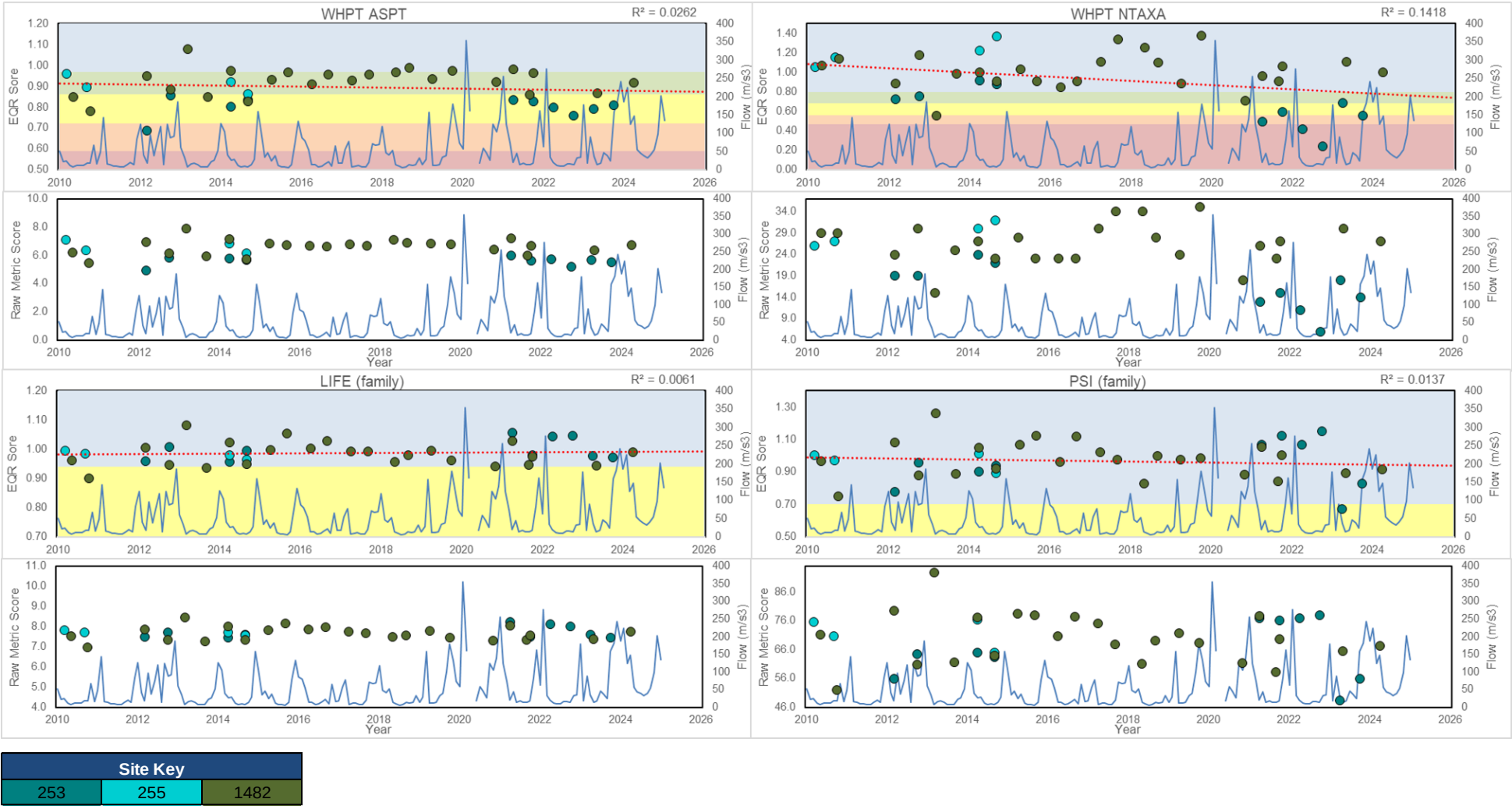
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts

Table B2.119 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
253	SE0585223334	10	2012 to 2023	0.96 - 1.06 (1)	7.45 - 8.22 (7.71)	0.67 - 1.15 (0.95)	48.4 - 77.8 (66.07)	0.69 - 0.85 (0.8)	P - M (M)	4.93 - 5.98 (5.58)	0.24 - 0.92 (0.63)	B - H (M)	6 - 24 (16)
255	SE0452320437	4	2010 to 2014	0.96 - 1 (0.98)	7.54 - 7.83 (7.7)	0.89 - 1.01 (0.97)	64.91 - 76.27 (71.82)	0.86 - 0.96 (0.91)	G - G (G)	6.13 - 7.11 (6.61)	1.06 - 1.37 (1.2)	H - H (H)	26 - 32 (29)
1482	SE0404819773	29	2010 to 2024	0.9 - 1.08 (0.98)	6.96 - 8.46 (7.64)	0.75 - 1.26 (0.97)	52 - 92.59 (69.53)	0.78 - 1.08 (0.93)	M - H (G)	5.43 - 7.9 (6.65)	0.55 - 1.38 (1)	P - H (H)	15 - 35 (26)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.14 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.27.4.2Fish

Waterbody GB104027062580 Ryburn from Booth Dean Clough to R Calder is classified under Cycle 3 (2022) as 'moderate'. The classification is informed by one site, Ripponden (Hodgsons Chemicals) (ID11956), classified as 'moderate' in 2019.

Baseline fisheries data is available for three sites, Lee Mill Ind Est (ID 11856), Ripponden (Hodgsons Chemicals) and Kebroyd (ID 29623). All three sites were surveyed in 2012, with Lee Mill Ind Est and Ripponden (Hodgsons Chemicals) receiving an additional survey in 2015.

YWSL commissioned additional surveys at three sites, D/S Booth Dean Clough (ID RY4), Kebroyd, Ripponden (Hodgsons Chemicals) and Silk Mill (ID RY5). D/S Booth Dean Clough, Ripponden (Hodgsons Chemicals) and Silk Mill were all surveyed in 2020 and 2021. Kebroyd was surveyed in 2021 through to 2023.

Table B2.120 details survey sites within the Ryburn 2 reach.

The WFD status of the fish community in Ryburn 2 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Ripponden (Hodgsons Chemicals) is individually classified as moderate with a site EQR of 0.3152, based on the FCS2 EQR scores from the 2015 survey. The site has a relatively low diversity, with only two species present from an expected four species. Trout had a high EQR score of 0.866, with a higher observed density than expected at the survey site. Though stone loach and bullhead are expected to be present at the site, neither species were observed. 3-Spined-Stickleback were also recorded at the site at increased numbers, with EQR scores of 1, which increased the overall site diversity.

Brown trout were the only species counted at every site for every survey year, with abundance ranging from low to high. The highest count of brown trout was 172 at Ripponden (Hodgsons Chemicals) in 2012 and Kebroyd in 2021. The lowest count of 8 was at D/S Booth Dean Clough in 2020. Bullhead were recorded at Lee Mill Ind Est with a large count of 238 in 2015, but have not been counted any other time. Stone loach and three-spined stickleback have been counted sporadically in low abundance. Rainbow trout have been counted in low abundance at Kebroyd, D/S Booth Dean Clough and Silk Mill.

Table B2.121 details species presence by year across all sites within the Ryburn 2 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **high** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.120 Ryburn 2 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
11856	Lee Mill Ind Est	SE0547822945	Electric Fishing (AC, PDC and DC)	2	2012	2015
11956	Ripponden (Hodgsons Chemicals)	SE0380719497	Electric Fishing (AC, PDC and DC)	4	2012	2021
29623	kebroyd	SE0450021100	Electric Fishing (AC, PDC and DC)	4	2012	2023
RY4	d/s Booth Dean Clough	SE0349018843	Electric Fishing (AC, PDC and DC)	3	2020	2021
RY5	Silk Mill	SE0363019185	Electric Fishing (AC, PDC and DC)	3	2020	2021

Table B2.121 Ryburn 2 Fish Survey Results

Tolerance Category ³	Species Name	2012	2015	2020	2021	2022	2023
High tolerance	3-spined stickleback		X		X	X	X
Medium tolerance	Stone loach		X		X	X	X
Low tolerance	Bullhead		X				
Low tolerance	Brown trout	X	X	X	X	X	X
Low tolerance	Rainbow trout	X		X	X		

B2.27.4.3WFD waterbody status

Table B2.122 summarises the WFD classification of waterbody which contain the impacted reach. **Table B2.122** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.122 WFD classifications

Waterbody ID & Name		GB104027062580 Ryburn from Booth Dean Clough to R Calder	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	Moderate	High
	Macroinvertebrates	Moderate	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Good	
	Fish	Good	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.27.5 Invasive non-native species (INNS)

Table B2.123 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.123**).

Table B2.123 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Freshwater shrimp (<i>Crangonyx pseudogracilis</i>) - New Zealand mud snail (<i>Potamopyrgus antipodarum</i>) -Tiger scud (<i>Gammarus tigrinus</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
INNS – terrestrial plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>)	Major	The implementation of this drought option is not expected to increase the distribution of these INNS	Not sensitive	No
Invasive non-native species -Rainbow trout (<i>Oncorhynchus mykiss</i>)	Major	The implementation of this drought option is not expected to increase the distribution of this INNS	Not sensitive	No

B2.27.6 Landscape, navigation, recreation and heritage

Table B2.124 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.124**).

Table B2.124 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Calderdale Way - National Trail	Moderate	The route of Calderdale Way runs alongside the River Ryburn. The river forms part of the landscape setting of several trails in the region.	Not sensitive	No
Ryburn Golf Club	Moderate	Unlikely to be impacted over the duration of the drought options implementation	Not sensitive	No
Ripponden (or Waterloo) Bridge – Scheduled Ancient Monument	Moderate	Unlikely to be impacted over the duration of the drought options implementation	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (<i>Major, Moderate, Minor, Negligible</i>)	Susceptibility to flow and level impacts	Sensitivity (<i>Uncertain, High, Medium, Low, Not sensitive</i>)	Further Consideration Required (Y/N)
Angling on River Ryburn	Moderate	Flows during a drought will be low such that further reduction in flows would not be likely to further reduce the angling quality of the reach	Low	No

B2.28 HEBBLE BROOK 1

B2.28.1 Statutory designated sites

Table B2.125 summarises the sites of international/national importance (SSSI, SAC, SPA, Ramsar, Marine Conservation Zone, NNR, LNR) which are in hydrological connectivity with the impacted reach.

No statutory designated sites that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.125**).

Table B2.125 Statutory designated sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Ogden Water - Local Nature Reserve	Major	65ha mosaic of NERC habitats, including heather moorland, blanket bog and wet and oak-birch woodland, around Ogden Reservoir. Site is upstream of impacted reaches.	Not sensitive	No
Shibden Park and Cunnery Wood – Local Nature Reserve	Major	Unlikely to be impacted over the duration of the drought options implementation. The park has 2 lakes and a stream running through that joins the hydrological reach. The woodland provides habitats for species.	Not sensitive	No

B2.28.2 NERC and local wildlife sites

Table B2.126 summaries the NERC Act Section 41 and other notable and/or protected habitats (e.g. LWS) which are located on or within 500m of the impacted reach.

No NERC Act Section 41 or other notable and/or protected habitats that are sensitive or susceptible to drought permit impacts have been identified for detailed assessment (see **Table B2.126**).

Table B2.126 NERC habitats and local wildlife sites

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Ogden Reservoir, Woodland and Cloughs LWS	Major	The site hosts a mix of habitats including dry heath, open water, heath and acid grassland, fen, secondary woodland and the large expanse of standing water of Ogden reservoir. Located upstream of the impacted reach.	Not sensitive	No
Rochdale Canal LWS	Major	Unlikely to be in connectivity with impacted reach.	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calder and Hebble Canal / Navigation LWS	Major	Unlikely to be in connectivity with impacted reach.	Not sensitive	No

B2.28.3 NERC and other protected species

Table B2.127 summaries the NERC Act Section 41 and other protected species which are located on or within 500m of the impacted reach.

The nationally scarce species of Caddisfly, *Potamophylax rotundipennis* have been identified as being present in Hebble Brook 1. The species was identified in routine sampling carried out by the Environment Agency at the site 1573 in 2015. Based on the available information these receptors are considered to be susceptible to drought option impacts and has a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of white-clawed crayfish in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. Based on an assessment of habitat, during an Environment Agency walkover survey, no suitable habitat was observed. White-clawed crayfish have been screened out based on a targeted survey carried out in 2019 by YWSL and 2008 by the Environment Agency, which did not find any white-clawed crayfish but confirmed the presence of signal crayfish. Based on the absence of suitable habitat and presence of signal crayfish in the impacted reach, the receptor is not considered at risk from the drought permit. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of otter in the impacted reach. The data showed no surveys or records have been recorded in the impacted reach. However, the data identifies that suitable habitat is present in the impacted reach. The distribution of information and survey data for the species was considered to be limited, Therefore, absence cannot be confirmed. It was considered appropriate, following the precautionary principle, to consider otters likely to be present in the reach at the time of the implementation of a drought permit. Based on the limited available information otters considered to be susceptible to drought permit impacts and have a **low** sensitivity to the physical environment impacts identified in **Appendix A**.

Data obtained from the Environment Agency, YWSL and a review of available data from NBN gateway was used inform the assessment of water vole in the impacted reach. The data showed no surveys or records have been recorded in the impacted. The data showed no surveys or records have been recorded in the impacted. Based on an assessment of habitat, during an Environment Agency walkover survey, no suitable habitat was observed. Based on the absence of suitable habitat in the impacted reach, the receptor is not considered at risk from the drought permit. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Several NERC Act Section 41 and notable fish species have been identified as present in the impacted reach, including one NERC Act Section 41 fish species (brown trout) and one notable fish species (bullhead).

Several NERC Act Section 41 and notable bird species have been identified as present in water dependent habitats which rely on the impacted reach. Based on the available information these species are considered not to be susceptible to drought order impacts and **not sensitive** to the physical environment impacts identified in **Appendix A**.

Table B2.127 NERC Act Section 41 and other protected species

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Notable Species – Macroinvertebrates Large Cinnamon Sedge (<i>Potamophylax rotundipennis</i>)	Major	<i>Potamophylax rotundipennis</i> , from family <i>Limnephilidae</i> have a tolerance for moderate flow conditions. Found in a variety of substrates, with clean, well-oxygenated water.	Medium	Yes
NERC Species – Crustacea White-clawed crayfish (<i>Austropotamobius pallipes</i>)	Major	Limited data is available for the impacted reach. White-clawed crayfish are not likely to be present in the impacted reach as signal crayfish are identified as present during a targeted survey.	Not sensitive	No
NERC Species – mammals Otter (<i>Lutra lutra</i>)	Major	Limited data is available for the impacted reach. Otters could potentially to use the impacted reach. Further consideration would be necessary to determine to what extent or how they may be impacted by reduced flows caused by the drought option.	Low	Yes
NERC Species – mammals Water vole (<i>Arvicola amphibious</i>)	Major	Limited data is available for the impacted reach. Water vole could potentially to use the impacted reach. Changes in water level are the most important factor influencing water vole populations, with species readily inhabiting areas of slow flowing and standing water. As such hydrological and associated impacts as a result of this drought permit may reduce habitat availability and alter the species food supply.	Not sensitive	Yes
NERC Species – Fish - Brown trout (<i>Salmo trutta</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, migration, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
Notable Species – Fish - Bullhead (<i>Cottus gobio</i>)	Major	Potentially susceptible as duration of impacts could include all seasons, and thus could impact spawning, provision of cover, predation, inter and intra-species competition etc.	Medium	Yes
NERC and Notable species – Birds There are many bird species	Major	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted severely from implementation of the drought option against a baseline of reduced flows characteristic of drought: - Eurasian Curlew (<i>Numenius arquata</i>) - Swallow (<i>Hirundo rustica</i>)	Not sensitive	No

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
present across the region		- Reed Bunting (<i>Emberiza schoeniclus</i>) - Common Tern (<i>Sterna hirundo</i>) - House Martin (<i>Delichon urbica</i>)		

B2.28.4 WFD receptors

B2.28.4.1 Macroinvertebrates

The WFD GB104027062780 Hebble Brook from Source to River Calder classified as 'good' for macroinvertebrates in 2022, Cycle 3. The classification for GB104027062780 Hebble Brook from Source to River Calder is informed by two sites, D/S Salterhebble (ID 172) (classified as 'moderate', last classified 2016) and U/S Ovenden Brook (ID 173) (classified as 'good', last classified 2016). Both sites are located in the Hebble Brook 1 reach.

Baseline macroinvertebrate data is provided by nine Environment Agency monitoring sites, D/S Ogden Reservoir (ID 1573), U/S Ovenden Brook (ID 173), D/S Salterhebble (ID 172), Site 210211, Site 210231, Site 216194, Site 216211, Site 216212, and Site 216213. D/S Ogden Reservoir had baseline survey data for two seasonal samples for 2010, 2012 to 2022, and only one sample season for 2023 and 2024. U/S Ovenden Brook had baseline survey data for two seasonal samples for 2013, 2021, and 2022. D/S Salterhebble had baseline survey data for two seasonal samples for 2013, 2021, 2022 and 2023. Site 210211, Site 210231, had baseline survey data for two seasonal samples for 2021, 2022 and 2023. All other sites had baseline survey data for two seasonal samples for 2023 only.

The WFD status of the macroinvertebrate community in Hebble Brook 1 may be impacted by the implementation of this drought permit. However, low flow impacts of drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only) and therefore impacts of the drought permit must be considered in the context of environmental drought.

Assessment of the hydrological sensitivity of the macroinvertebrate community was undertaken by analysis of recorded LIFE scores. Baseline data indicates that under present conditions, the macroinvertebrate community in Hebble Brook 1 which has medium to high sensitivity to reduced flows (**Figure B2.15**). See **Table B2.4** for guidance in interpreting raw LIFE scores. WHPT_{ASPT} and WHPT_{NTAXA} scores are available for the site. WHPT and PSI EQR scores are calculated based on available environmental parameters provided by the Environment Agency's online Ecology & Fish Data Explorer. Data which comprises of spring and autumn sampling occasions for a given year generate WFD classifications, these EQR's are displayed for WHPT_{NTAXA} and WHPT_{ASPT}, see **Figure B2.15**.

Data from the monitoring site shows variation in WHPT_{ASPT} scores over the monitoring period. WHPT_{ASPT} scores ranged between 4.9 - 7.79 (6.44) with the lowest WHPT_{ASPT} score of 4.9 at Site 172 in Autumn 2013, and the highest score of 7.79 at Site 173 in Spring 2013. The WHPT_{ASPT} expected scores for ranged between 6.59 to 7.46 across the sites, with 14 of the 60 samples below the 'Good/Moderate boundary'. WHPT_{ASPT} EQR scores ranged between 0.71 - 1.06 (0.89) with the lowest WHPT_{ASPT} EQR of 0.71 at Site 172 in Autumn 2013, and the highest EQR of 1.06 at Site 173 in Spring 2013.

In Hebble Brook 1 data from the site identifies macroinvertebrate communities which varies in terms of diversity. WHPT_{NTAXA} scores ranged between 8 - 25 (18.33) with the lowest WHPT_{NTAXA} score of 8 at Site 1573 in Summer 2020, and the highest score of 25 at Site 1573 in Spring 2015. The WHPT_{NTAXA} expected scores ranged between 21.08 to 25.89 across the sites, with 15 of the 60 samples below the 'Good/Moderate boundary'. WHPT_{NTAXA} EQR scores ranged between 0.38 - 1.14 (0.8) with the lowest WHPT_{NTAXA} EQR of 0.38 at Site 1573 in Summer 2020, and the highest EQR of 1.14 at Site 1573 in Spring 2015.

LIFE_{FAMILY} EQRs are not used to determine WFD classification but provides an indication of the flow preferences of the macroinvertebrate communities at the sites. LIFE_{FAMILY} scores ranged between 7 - 8.8 (7.97)

with the lowest LIFE_{FAMILY} score of 7 at Site 172 in Autumn 2013, and the highest score of 8.8 at Site 1573 in Summer 2020. The LIFE_{FAMILY} expected scores ranged between 7.62 to 7.9 across the sites, with 2 of the 60 samples below the 'Good/Moderate' boundary. LIFE_{FAMILY} EQR scores ranged between 0.89 - 1.13 (1.02) with the lowest LIFE_{FAMILY} EQR of 0.89 at Site 210211 in Spring 2023, and the highest EQR of 1.13 at Site 1573 in Summer 2020.

Similarly, PSI EQRs are not used to determine WFD classification but provides an indication of the level of sedimentation and eutrophication at the sites. PSI_{FAMILY} scores ranged between 44.83 - 91.18 (74.58) with the lowest PSI_{FAMILY} score of 44.83 at Site 172 in Autumn 2013, and the highest score of 91.18 at Site 173 in Spring 2013. The PSI_{FAMILY} expected scores ranged between 65.19 to 76.78 across the sites, with 26 of the 60 above the expected PSI_{FAMILY} score for their respective season. PSI_{FAMILY} EQR scores ranged between 0.64 - 1.23 (1.01) with the lowest PSI_{FAMILY} EQR of 0.64 at Site 172 in Autumn 2013, and the highest EQR of 1.23 at Site 172 in Autumn 2022.

A total of three INNS species, including *Potamopyrgus antipodarum*, *Pacifastacus leniusculus* and *Crangonyx pseudogracilis/floridanus* were recorded as present at nine sites between 2010 to 2024, with *Gammarus tigrinus* and *Physella* sp being recorded as present in the reach through the NBN data search.

A single designated species, *Potamophylax rotundipennis*, was recorded at Site 1573 in 2015.

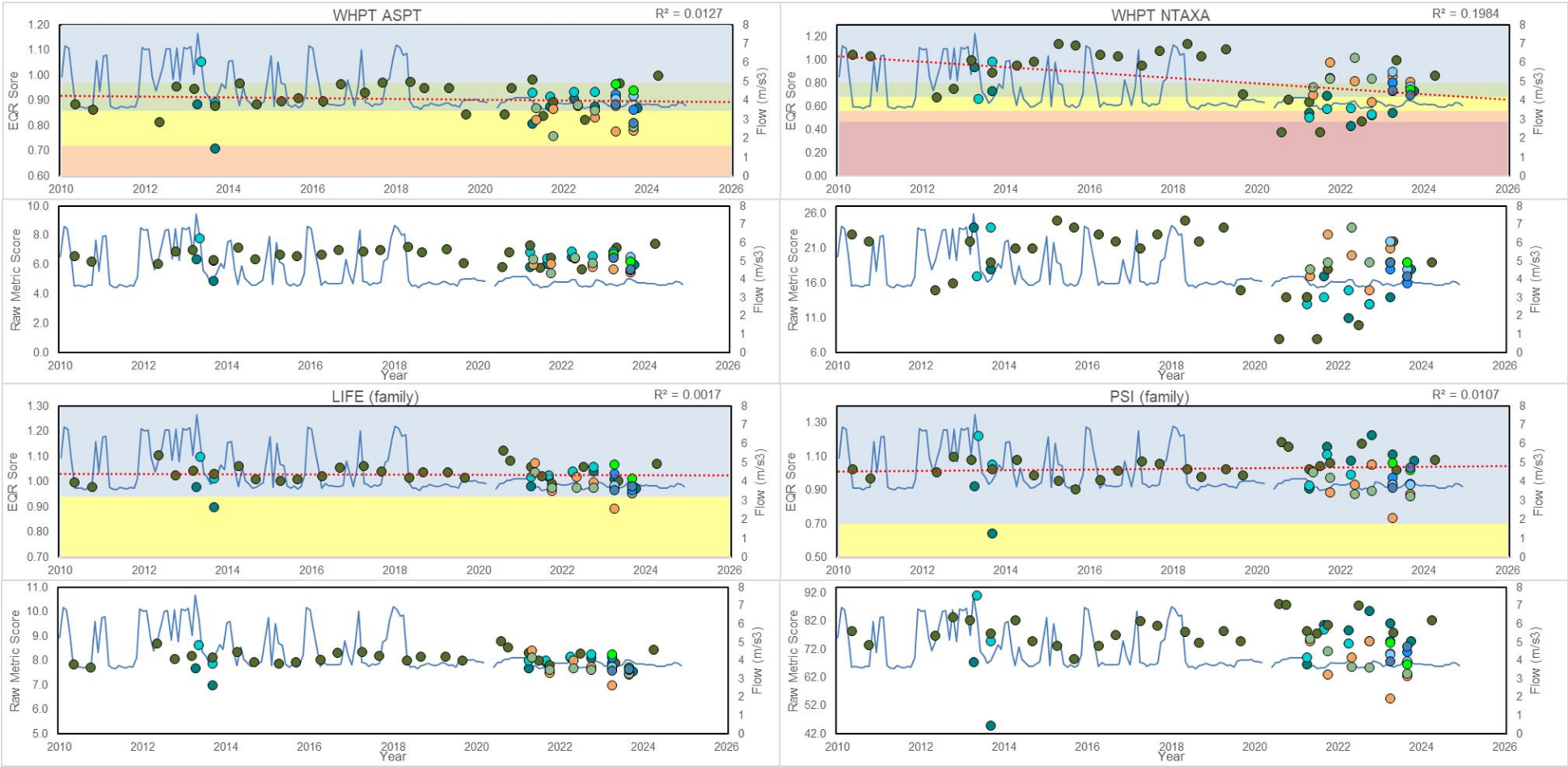
Based on the available information the macroinvertebrate community is considered to be susceptible to drought permit impacts and have a medium sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.128 Macroinvertebrate Observed and EQR Summary

Site ID	Site NGR	Survey count	Survey Range	LIFE _{Family} EQR Score	LIFE _{Family} Score	PSI _{Family} EQR Score	PSI _{Family} Score	WHPT _{ASPT} EQR Score	WHPT _{ASPT} EQR Class	WHPT _{ASPT} Score	WHPT _{NTAXA} EQR Score	WHPT _{NTAXA} EQR Class	WHPT _{NTAXA} Score
172	SE0993623059	8	2013 to 2023	0.9 - 1.04 (0.99)	7 - 8.13 (7.75)	0.64 - 1.23 (1.02)	44.83 - 85.7 (72.6)	0.71 - 0.92 (0.86)	P - G (M)	4.9 - 6.63 (6.05)	0.43 - 0.94 (0.64)	B - H (M)	11 - 24 (16)
173	SE0709726560	6	2013 to 2022	1.01 - 1.1 (1.04)	7.89 - 8.64 (8.16)	0.93 - 1.22 (1.06)	69.2 - 91.18 (77.28)	0.89 - 1.06 (0.94)	G - H (G)	6.28 - 7.79 (6.81)	0.51 - 0.99 (0.64)	P - H (M)	13 - 24 (16)
1573	SE0630729955	26	2010 to 2024	0.98 - 1.13 (1.04)	7.72 - 8.8 (8.16)	0.91 - 1.18 (1.04)	68.75 - 88.2 (78.94)	0.82 - 1 (0.92)	M - H (G)	5.69 - 7.45 (6.68)	0.38 - 1.14 (0.88)	B - H (H)	8 - 25 (19)
210211	SE0985322932	6	2021 to 2023	0.89 - 1.07 (0.98)	7 - 8.42 (7.68)	0.74 - 1.05 (0.92)	54.55 - 75 (66.57)	0.78 - 0.88 (0.83)	M - G (M)	5.47 - 6.42 (5.91)	0.64 - 0.98 (0.8)	M - H (H)	15 - 23 (19)
210231	SE0997323144	6	2021 to 2023	0.95 - 1.04 (0.98)	7.46 - 8.15 (7.71)	0.86 - 1.01 (0.93)	63.33 - 75.76 (68.78)	0.76 - 0.88 (0.84)	M - G (M)	5.41 - 6.49 (6.1)	0.75 - 1.02 (0.84)	G - H (H)	17 - 24 (19)
216194	SE0646629127	2	2023	0.97 - 1.03 (1)	7.64 - 8.13 (7.89)	0.94 - 0.98 (0.96)	70.97 - 75 (72.99)	0.86 - 0.92 (0.89)	G - G (G)	6.26 - 6.9 (6.58)	0.74 - 0.8 (0.77)	G - H (G)	16 - 18 (17)
216211	SE0752026394	2	2023	0.98 - 0.99 (0.98)	7.71 - 7.76 (7.74)	0.93 - 0.93 (0.93)	67.74 - 70.27 (69.01)	0.91 - 0.92 (0.91)	G - G (G)	6.53 - 6.71 (6.62)	0.77 - 0.9 (0.83)	G - H (H)	18 - 22 (20)
216212	SE0771226319	2	2023	1.01 - 1.07 (1.04)	7.73 - 8.27 (8)	1.02 - 1.06 (1.04)	66.67 - 74.36 (70.52)	0.94 - 0.97 (0.95)	G - G (G)	6.21 - 6.75 (6.48)	0.73 - 0.75 (0.74)	G - G (G)	19
216213	SE0984023337	2	2023	0.97 - 0.98 (0.98)	7.6 - 7.67 (7.64)	0.91 - 1.03 (0.97)	67.74 - 73.08 (70.41)	0.81 - 0.88 (0.85)	M - G (M)	5.68 - 6.48 (6.08)	0.7 - 0.74 (0.72)	G - G (G)	17 - 19 (18)

Data presented in the format Min - Max (AVG.) and B - Bad / P - Poor / M - Moderate / G - Good / H - High

Figure B2.15 Macroinvertebrate EQR scores (Top) and observed scores (Bottom) for WHPT_{NTAXA}, WHPT_{ASPT}, LIFE_{FAMILY} and PSI_{FAMILY} scores



Site Key							
172	173	1573	210211	210231	216194	216211	216212

*PSI EQR scores are not used to inform the WFD status of macroinvertebrates, instead these values are used to provide supplementary information to the assessment

B2.28.4.2 Fish

Waterbody GB104027062780 Hebble Brook from Source to River Calder is classified under Cycle 3 (2022) as 'moderate', improving from 'poor' in 2019. The classification is informed by three sites, Bottoms Bridge (ID 75823) classified as 'poor', Larch Close (ID 34543) classified as 'good' and Salterhebble (ID 34545) classified as 'poor'.

Baseline fisheries data is available for three sites, Bottoms Bridge, Larch Close and Salterhebble. Larch Close was surveyed in 2015. Salterhebble was surveyed in 2010. All three sites were surveyed in 2021, with Salterhebble and Bottoms Bridge also surveyed in 2022.

YWSL commissioned additional surveys at three sites, Larch Close, Salterhebble and Halifax Golf Club (Drought Site 12) (WR) (ID 11984). Larch Close was surveyed in 2020 and 2022, Salterhebble in 2022 and 2023, and Halifax Golf Club (Drought Site 12) (WR) in 2021 through to 2023.

Table B2.129 details survey sites within the Hebble Brook 1 reach.

The WFD status of the fish community in Hebble Brook 1 may be impacted by drought permit implementation. However, low flow impacts of the drought option implementation would occur against a baseline of drought conditions (i.e. compensation flow only), and therefore impacts of drought permit implementation must be considered in the context of environmental drought.

The site Salterhebble is individually classified as 'poor' with a site EQR of 0.0474 based on surveys in 2022, decreasing from the site EQR of 0.1034 based on the FCS2 EQR scores from the 2015 survey. The site has a relatively low diversity, with only two species present from an expected six species. Trout had a low EQR score of 0.043, with none observed on site despite being expected. Bullhead and stone loach were observed at increased numbers, with EQR scores of 1. Though 3-spined stickleback, chub brown trout and minnow are expected to be present at the site, none were observed. The low EQR score for trout and generally poor diversity of the site contributed to the 'poor' overall site classification.

The site Larch Close is individually classified as 'good', with a site EQR of 0.4888 based on surveys in 2021, improving from 'moderate' with an EQR of 0.2756 based on surveys in 2015. The site has relatively good diversity, with two species present from an expected three species. Trout had a moderate EQR score of 0.4927, with a lower observed density than expected at the survey site. Bullhead were also observed at increased numbers, with EQR scores of 1. Stone loach were expected to be present at the site but were not observed. The improvement in EQR score for trout had an effect in the overall site classification, with the generally good diversity of the site along with high EQR score for bullhead and improved EQR score for brown trout contributing to the 'good' overall site classification.

The site Bottoms Bridge is individually classified as 'moderate', with a site EQR of 0.279 based on 2022 survey data. The site was moderately diverse, with three species observed from an expected six. Brown trout had a moderate EQR score of 0.3137 with a lower observed density than expected. Bullhead and stone loach both exceeded expected density, with an EQR of 1. Minnow, three-spined stickleback and chub were expected to be observed at site, but none were observed. The moderate diversity with higher than expected densities of bullhead and stone loach contributed to the 'moderate' classification, despite the low density of brown trout.

Brown trout and bullhead were counted during every survey year and at most sites. The highest count for brown trout was 73 in 2021 at Halifax Golf Club (Drought Side 12) (WR), whilst the lowest of one was 2022 at Salterhebble. The highest count for bullhead was 133 in 2023 at Salterhebble, whilst the largest log abundance was 100-999 at Bottoms Bridge in 2022. The lowest count of bullhead was one in 2022 at Halifax Gold Club (Drought Side 12)(WR), the only record for bullhead at this site. Stone loach were present at Salterhebble for every survey in low abundance, and at Bottoms Bridge in 2022 in low abundance. One record of seven minnow was counted at Salterhebble in 2022.

Table B2.130 details species presence by year across all sites within the Hebble Brook 1 reach. All fish counts are available in Annex 1 to this appendix.

Based on the available information the fish community is considered to be susceptible to drought permit impacts and have a **medium** sensitivity to the physical environment impacts identified in **Appendix A**.

Table B2.129 Hebble Brook 1 Fish Survey Site Information

Site ID	Site Name	Survey NGR	Method Grouped	Survey Count	Min Survey Year	Max Survey Year
11984	Halifax Golf Club (Drought Site 12) (WR)	SE0646530123	Electric Fishing (AC, PDC and DC)	3	2021	2023
34543	Larch Close	SE0705126603	Electric Fishing (AC, PDC and DC)	4	2015	2022
34545	SalterHebble	SE0981822897	Electric Fishing (AC, PDC and DC)	6	2010	2023
75823	Bottoms Bridge	SE0997323203	Electric Fishing (AC, PDC and DC)	2	2021	2022

Table B2.130 Hebble Brook 1 Fish Survey Results

Tolerance Category ³	Species Name	2010	2015	2020	2021	2022	2023
Medium tolerance	Minnow					X	
Medium tolerance	Stone loach	X			X	X	X
Low tolerance	Bullhead	X	X	X	X	X	X
Low tolerance	Brown trout	X	X	X	X	X	X

B2.28.4.3WFD waterbody status

Table B2.131 summarises the WFD classification of waterbody which contain the impacted reach **Table B2.131** also displays the objective status for 2022 (Cycle 3) or the predicted status in 2022 where objective to meet good status is in 2027. This is displayed for overall, fish and macroinvertebrate elements and provides comparison with 2022 status, the table also displays the measures which have been assigned to the waterbody in order to reach their objective.

Table B2.131 WFD classifications

Waterbody ID & Name		GB104027062780 Hebble Brook from Source to River Calder	Sensitivity (Uncertain, High, Medium, Low, Not Sensitive)
Physical Environment Impact at Location (Major, Moderate, Minor, Negligible)		Major	
RBMP Cycle 3 Status/ Potential	Overall	Moderate	
	Fish	Moderate	Medium
	Macroinvertebrates	Good	Medium
Hydro-morph designation		Heavily modified	
RBMP3 Waterbody Objective	Overall	Moderate	
	Fish	Moderate	
	Macroinvertebrates	Good	
Waterbody Measures		None	

B2.28.5 Invasive non-native species (INNS)

Table B2.132 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No INNS receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.132**).

Table B2.132 INNS Receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
INNS – macroinvertebrates -Signal Crayfish (<i>Pacifastacus leniusculus</i>) -Freshwater shrimp <i>Crangonyx pseudogracilis/floridanus</i> -New Zealand mud snail (<i>Potamopyrgus antipodarum</i>) -Tiger scud (<i>Gammarus tigrinus</i>) -Bladder snail (<i>Physella sp.</i>)	Major	The implementation of this drought permit is not anticipated to increase the spread of invasive non-native species.	Not sensitive	No
Invasive non-native species – Terrestrial and Aquatic plants -Himalayan balsam (<i>Impatiens glandulifera</i>) -Japanese knotweed (<i>Fallopia japonica</i>) -Canadian pondweed (<i>Elodea canadensis</i>)	Major	The implementation of this drought permit is not anticipated to increase the spread of invasive non-native species.	Not sensitive	No

B2.28.6 Landscape, navigation, recreation and heritage

Table B2.133 summarises the wider receptors which should be taken into account in determining the potential impacts of drought option implementation.

No receptors that are sensitive or susceptible to drought permit impacts have been identified (see **Table B2.133**).

Table B2.133 Landscape, navigation, recreation and heritage receptors

Site/Receptor and designation	Hydrological Impact at Location (Major, Moderate, Minor, Negligible)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Not sensitive)	Further Consideration Required (Y/N)
Calderdale Way – National Trail	Major	The route of the trail runs alongside Hebble Brook. The river forms part the landscape setting of the trail.	Not sensitive	No
Mill Gas Plant, Shaw Lodge Mills – Scheduled Ancient Monuments	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
The Gibbet Platform – Scheduled Ancient Monuments	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Ventilation chimney and furnace house – Scheduled Ancient Monuments	Major	Unlikely to be impacted over the duration of the drought options implementation.	Not sensitive	No
Angling on Hebble Brook	Major	Casual angling only	Low	No

B3 ENVIRONMENTAL RECEPTORS SCREENING SUMMARY

Table B3.1 Environmental receptors summary of the Upper Calder Area

Reach	Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Associated Drought Options	Gorple Lower Reservoir	Widdop Reservoir	Gorple Lower Reservoir; Widdop Reservoir	Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir	Gorpley Reservoir; Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Withens Clough Reservoir; White Holme Reservoir	Withens Clough Reservoir	Withens Clough Reservoir; White Holme Reservoir	Withens Clough Reservoir; White Holme Reservoir	Gorpley Reservoir; Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Ogden Reservoir; Withens Clough Reservoir; White Holme Reservoir; Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Warley Moor Reservoir	Booth Wood Reservoir	Ryburn Reservoir	Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Ogden Reservoir
WFD Waterbody	GB104027062840 Graining Water from Widdop Resr to Hebden Water			GB104027062850 Alcomden Water - Walshaw Dean Resrs to Widdop	GB104027062731 Hebden Water from Widdop Beck to R Calder	GB104027062641 Calder from Colden Water to Ryburn Confluence	GB104027062610 Cragg Brook from Source to River Calder			GB104027062641 Calder from Colden Water to Ryburn Confluence GB104027062642 Calder from Ryburn Confluence to River Colne	GB104027062770 Luddenden Brook from source to River Calder	GB104027062520 Booth Dean Clough from Source to River Ryburn	GB104027062540 Ryburn from Source to Booth Dean Clough	GB104027062580 River Ryburn from Booth Dean Clough to River Calder	GB104027062780 Hebble Brook from Source to River Calder
Statutory Designated Sites															
SSSI	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SPA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SAC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
NERC Habitat and Local Wildlife Sites															
Local Wildlife Sites	X	X	X	X	✓	X	X	X	X	X	X	X	X	X	X
NERC Habitat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
NERC and Other Protected/ Notable Species Receptors															
White-clawed crayfish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X
Otter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓
Water vole	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓

Reach	Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Notable macroinvertebrates	x	x	✓	x	✓	✓	✓	✓	✓	x	✓	✓	x	x	✓
Atlantic salmon	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Barbel	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brook lamprey	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Brown trout	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bullhead	x	x	x	x	✓	✓	x	✓	✓	✓	x	x	x	✓	✓
Grayling	x	x	x	x	x	✓	x	x	x	✓	x	x	x	x	x
Birds	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
WFD Waterbody WFD Status Receptors															
Fish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Invertebrates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
INNS															
INNS – macroinvertebrates	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
INNS – plants	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
INNS – fish	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
INNS – mammals	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Landscape, navigation, recreation, and heritage															
Receptors	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Further assessment required = ✓ No further assessment required = x

B4 RECEPTORS ASSESSMENT

Details regarding the approaches/methodologies used for the assessment of the impacts associated with drought option implementation are presented in Section 3.7 of YWSL's Drought Plan 2022 Environmental Assessment Methodology⁴. The potential changes to the physical environment as a result of drought option implementation are described in **Appendix A**.

B4.13 GRAINING WATER T1

B4.13.1 Receptor assessment

B4.13.1.1 NERC and other protected species

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Graining Water T1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.1**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.1 Impacts on white-clawed crayfish in Graining Water T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.2**.

Table B4.2 Impacts on otter in Graining Water T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

⁴ Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Graining Water T1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.3**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.3 Impacts on water vole in Graining Water T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as minor and will not impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level⁵. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times⁶ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.4 Impacts on NERC and notable fish species in Graining Water T1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered minor. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). • Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration.	National	Medium	Moderate

⁵ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

⁶ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
	- Stranding of individuals is unlikely as the risk to longitudinal connectivity is moderate. - Increased mortality (density dependant) as a result of increased predation.			

B4.13.1.2 WFD receptors

The implementation of the drought option is expected to result in changes to the physical environment within Graining Water T1, a short (~0.6 km) reach of WFD water body GB104027062840 – Graining Water from Widdop Reservoir to Hebden Water. These predicted changes include:

- A **major** reduction in river flows of up to 67%, potentially occurring at any time of year (**Appendix A**);
- A **moderate** risk to river habitat from altered flow energy, reduced wetted area, and disruption to longitudinal connectivity;
- A **minor** risk to water quality, primarily due to reduced dilution capacity for diffuse inputs of ammonia, phosphate, and dissolved oxygen;
- No existing flow-depleted reaches or significant pressures from abstractions or discharges.

Despite the scale of change within this localised reach, its limited length and minor contribution to the wider water body and catchment mean that the potential influence on overall WFD classification outcomes is considered low.

The current WFD classification status for this water body reflects High status for macroinvertebrates (Cycles 2 and 3, 2013–2022) and a decline in the fish element, with moderate status through most of Cycle 2 and Poor status in 2022.

Macroinvertebrates

The macroinvertebrate community within the reach is characterised by high diversity (as indicated by WHPT_{NTAXA} EQRs) and sensitivity to flow and water quality pressures, with historically high LIFE and WHPT_{ASPT} scores.

Given the predicted flow reductions and habitat changes summarised in **Appendix A**, the community may experience a moderate risk of impact from reduced habitat heterogeneity and changes to velocity-dependent niches. However, the reach currently experiences no significant flow pressures, and the risk from water quality deterioration is considered minor. Recovery potential is high due to effective recolonisation traits of macroinvertebrate assemblages^{7,8}.

The overall risk to the macroinvertebrate element of the WFD classification is considered **minor**, with high confidence based on the number and spatial distribution of surveys relative to the size of the reach.

The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.5**. The overall confidence in the macroinvertebrate data and subsequent assessment has been classed as high due to the number of surveys relative to the size of the reach.

⁷ Williams, D. D. (1977) Movements of benthos during the re-colonisation of temporary streams. *Oikos* 29, pp 306 – 312.

⁸ Mackay, R. J. (1992) Colonisation by lotic macroinvertebrates: a review of process and patterns. *Canadian Journal of Fisheries and Aquatic Science* 49, pp 617 – 628.

Table B4.5 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Loss of marginal habitats, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Minor	High

Fish

There is no WFD fish classification site located within the affected reach, but the wider water body has shown a declining trend, reaching Poor ecological status in 2022. Fish are considered sensitive to changes in flow and connectivity, particularly under low-flow conditions that may disrupt movement and reduce available habitat as detailed in **Appendix A**.

Based on the predicted physical changes in **Appendix A**, a minor risk is identified for the fish component of the water body. This reflects the limited spatial extent of impact, the short duration of implementation (up to six months), and the absence of major existing pressures in the reach.

The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.6**. Confidence in the assessment is high, supported by available historic fisheries data.

Table B4.6 Impacts on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Minor	High

B4.13.2 Summary of impacts

Table B4.7 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.7 Summary of impacts identified in Graining Water T1's environmental receptors assessment

Reach	Graining Water T1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
WFD Status Receptors- GB104027062840 Graining Water from Widdop Resr to Hebden Water		
Invertebrates	Minor	No
Fish	Minor	No

B4.14 GRAINING WATER 1

B4.14.1 Receptor assessment

B4.14.1.1 NERC and other protected species

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Graining Water 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.8**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.8 Impacts on white-clawed crayfish in Graining Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.9**.

Table B4.9 Impacts on otter in Graining Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Graining Water 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.10**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.10 Impacts on water vole in Graining Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as minor and will not impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level⁹. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times¹⁰ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.11**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.11 Impacts on NERC and notable fish species in Graining Water 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered minor. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). • Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration • Stranding of individuals is unlikely as the risk to longitudinal connectivity is minor. • Increased mortality (density dependant) as a result of increased predation	National	Medium	Moderate

⁹ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

¹⁰ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

B4.14.1.2 WFD receptors

The implementation of the drought option is expected to result in significant changes to the physical environment within Graining Water 1, a 2.2 km reach extending from the outflow of Widdop Reservoir to the confluence with Gorple Lower Brook. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year;
- A **moderate** risk to river habitat, including altered flow energy, reduced wetted area, and disruption to longitudinal connectivity;
- A **minor** risk to water quality, primarily from reduced dilution capacity for diffuse pollutants (ammonia, phosphate, and dissolved oxygen);
- No existing flow-depleted reaches or significant pressures from abstraction or discharge.

These changes (see **Appendix A**) affect a substantial proportion of WFD water body GB104027062840 – Graining Water from Widdop Reservoir to Hebden Water, and therefore have the potential to influence the overall WFD classification.

This water body has consistently achieved High status for macroinvertebrates during Cycles 2 and 3 (2013–2022), whereas the fish component has declined, with both classification sites currently at Poor status.

Macroinvertebrates

The macroinvertebrate community within Graining Water 1 is of moderate diversity, with high LIFE scores indicating sensitivity to flow velocity. The predicted physical changes (see **Appendix A**) present risks of reduced habitat availability and loss of velocity-dependent taxa, particularly due to reductions in wetted area and flow energy. The WHPT_{ASPT} scores suggest the community is also sensitive to water quality, though the risk from water quality changes is considered minor.

Overall, the drought option presents a major risk to the macroinvertebrate community within the reach. Given the spatial extent of the reach relative to the water body, this has the potential to contribute to WFD status deterioration. However, the recovery potential is expected to be relatively high due to the community's ability to recolonise. Therefore, the overall risk of WFD deterioration is assessed as **moderate**, with high confidence based on survey coverage and data quality. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.12**.

Table B4.12 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
• Reduction in species diversity due to loss of flow-sensitive taxa. • Loss of marginal habitats due to decreased wetted area, leading to a decrease in the abundance and distribution of species that rely on these habitats. • Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

Graining Water 1 contains two WFD classification sites, both currently assessed as Poor status for fish. The physical changes predicted (see **Appendix A**), particularly flow reduction and disrupted connectivity, may inhibit recovery to Moderate status and limit habitat availability. The steep gradient of the channel further increases the potential for flow alteration to fragment habitats or act as a barrier to movement.

A **moderate** risk is therefore identified for the fish component of the water body, as detailed in **Table B4.13**. While the spatial extent of the impact is considerable, and classification sites lie within the affected reach, recovery may be delayed by habitat limitations and seasonal constraints. The level of confidence in this assessment is medium, reflecting limitations in the temporal coverage and age of the most recent fisheries data.

Table B4.13 Impacts on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Moderate	High

B4.14.2 Summary of impacts

Table B4.14 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.14 Summary of impacts identified in Graining Water 1's environmental receptors assessment

Reach	Graining Water 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
WFD Status Receptors - GB104027062840 Graining Water from Widdop Resr to Hebden Water		
Fish	Moderate	Yes
Invertebrates	Moderate	Yes

B4.15 GRAINING WATER 2

B4.15.1 Receptor assessment

B4.15.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.15**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes.

Table B4.15 Impacts on notable macroinvertebrates in Graining Water 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Ameletus inopinatus</i>	- The species is associated with moderate/fast flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Graining Water 2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.16**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.16 Impacts on white-clawed crayfish in Graining Water 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.17**.

Table B4.17 Impacts on otter in Graining Water 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Graining Water 2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.18**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.18 Impacts on water vole in Graining Water 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	- Risk of deterioration in water quality has been identified as minor and will not impact on this receptor - Species has a preference for waterbodies that do not have extreme fluctuations in water level¹¹. - Increased predation as a result of decreased water width and exposure of burrows. - The reduction in wetted width could result in an increased distance between water vole food source and the burrows. - Impacts could occur throughout the breeding season for this species. - Alteration to food supply could occur although the species has been known to feed upon crayfish at times¹² and the potentially increased density of this species could lead to increased predation efficiency - Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. - There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.19**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed

¹¹ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

¹² Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

as high due to the number of surveys and age of the most recent survey. The limited number of sites is off-set by the short impacted reach.

Table B4.19 Impacts on NERC and notable fish species in Graining Water 2

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered minor. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration - Stranding of individuals is unlikely as the risk to longitudinal connectivity is minor. - Increased mortality (density dependant) as a result of increased predation	National	Medium	Moderate

B4.15.1.2 WFD receptors

The implementation of the drought option is predicted to result in changes to the physical environment within Graining Water 2, a 1.4 km reach extending from the confluence with Gorple Lower Brook to the confluence with Alcomden Water. The anticipated changes include:

- A **major** reduction in river flows (between 29% and 61%) for up to six months, potentially occurring at any time of year;
- A **moderate** risk to river habitat, including reduced total wetted area, loss of species-specific habitat niches, and a minor risk to longitudinal connectivity and sediment dynamics;
- A **minor** risk to water quality, relating to reduced dilution capacity for diffuse nutrient inputs (ammonia, phosphate, and dissolved oxygen);
- No existing flow-depleted reaches or significant pressures from abstraction or discharge.

These changes (see **Appendix A**) affect a significant portion of WFD water body GB104027062840 – Graining Water from Widdop Reservoir to Hebden Water, including the downstream extent. The potential for deterioration in ecological condition and influence on the overall WFD classification is therefore elevated.

The water body has consistently achieved High status for macroinvertebrates during Cycles 2 and 3 (2013–2022), whereas the fish element has declined from Moderate to Poor status, with recent deterioration evident at local classification sites.

Macroinvertebrates

The macroinvertebrate community in this reach displays good to high diversity, supported by strong WHPT_{NTAXA} and WHPT_{ASPT} scores and high LIFE indices, indicating sensitivity to both hydraulic and water quality conditions.

Based on the predicted physical changes (**Appendix A**), the community is at risk from habitat loss, reduced flow velocity, and diminished suitability for flow-dependent taxa. Although the reach does not experience significant existing flow pressures, the sensitivity of the macroinvertebrate community suggests it may be vulnerable to reduced flow and habitat conditions.

The overall risk to the macroinvertebrate component of the water body is assessed as major, due to the reach's ecological sensitivity and the magnitude of change. However, recovery is expected to be relatively rapid following cessation of the drought option, due to effective recolonisation mechanisms. Therefore, the risk of deterioration in WFD classification is considered **moderate**, with high confidence based on recent and well-distributed survey data. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.20**.

Table B4.20 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Loss of marginal habitats due to decreased wetted area, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

Although the affected reach comprises a smaller area of the water body than Graining Water 1, it contains a WFD fish classification site (Bridge D/S Reservoir) that has recently declined from Moderate to Poor status. This suggests a sensitive and potentially vulnerable fish community, particularly in response to additional pressures.

The physical changes associated with the drought option (**Appendix A**) may further reduce available habitat and, while there are no significant barriers to movement within the reach, there remains a minor risk to connectivity during low-flow conditions. Continued pressures may delay recovery and prevent the site from returning to Moderate status, thereby influencing the overall fish classification for the water body.

The risk to the fish component is assessed as **moderate**, and the level of confidence in the assessment is high, based on the frequency and quality of fisheries monitoring data within the reach. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.21**.

Table B4.21 Impacts on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Moderate	High

B4.15.2 Summary of impacts

Table B4.22 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.22 Summary of impacts identified in Graining Water 2's environmental receptors assessment

Reach	Graining Water 2	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Ameletus inopinatus</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes

Reach	Graining Water 2	
WFD Status Receptors - GB104027062840 Graining Water from Widdop Resr to Hebden Water		
Fish	Moderate	Yes
Invertebrates	Moderate	Yes

B4.16 HEBDEN WATER T1

B4.16.1 Receptor assessment

B4.16.1.1 NERC and other protected species

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Walsden Water 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.23**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.23 Impacts on white-clawed crayfish in Hebden Water T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.24**.

Table B4.24 Impacts on otter in Hebden Water T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Hebden Water T1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as mink, stoat, and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.25**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.25 Impacts on water vole in Hebden Water T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as minor and will not impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level¹³. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times¹⁴ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.26**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.26 Impacts on NERC and notable fish species in Hebden Water T1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered minor. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). • Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration • Stranding of individuals is unlikely as the risk to longitudinal connectivity is moderate. • Increased mortality (density dependant) as a result of increased predation	National	Medium	Moderate

¹³ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

¹⁴ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

B4.16.1.2 WFD receptors

The implementation of the drought option is expected to result in changes to the physical environment within Hebden Water T1, a 2.0 km reach extending from the outflow of Walshaw Dean Lower Reservoir to the confluence with Graining Water. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year;
- A **moderate** risk to river habitat, including loss of species-specific habitats, reduced wetted area, and a minor risk to longitudinal connectivity and sediment dynamics;
- A **minor** risk to water quality, associated with reduced dilution of diffuse pollutants (ammonia, phosphate, and dissolved oxygen);
- No existing flow-depleted reaches or significant pressures from abstraction or discharge.

These changes (see **Appendix A**) affect the entirety of WFD water body GB104027062850 – Alcomden Water: Walshaw Dean Reservoirs to Widdop, and therefore present a high risk of influencing the overall WFD classification.

The water body has consistently achieved High status for macroinvertebrates (Cycles 2 and 3, 2019–2022). The fish element has declined from Good to Moderate status between 2019 and 2022, indicating increased sensitivity to environmental pressures.

Macroinvertebrates

The macroinvertebrate community within this reach shows good to high diversity, supported by strong WHPT NTAXA and WHPT ASPT scores and high LIFE scores, indicating sensitivity to flow and water quality pressures.

Based on the predicted changes (**Appendix A**), the community is at risk from reduced habitat availability and a decline in flow velocity, which may impact species dependent on higher energy conditions. Although there are no significant abstractions or discharges affecting flow in this reach, the extent and magnitude of flow changes pose a major risk to community structure.

The overall risk to the macroinvertebrate component is assessed as major, but due to the community's high recolonisation potential, the risk of WFD classification deterioration is considered **moderate**. Confidence in this assessment is high based on the quality and extent of survey data. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.27**.

Table B4.27 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
• Reduction in species diversity due to loss of flow-sensitive taxa. • Loss of marginal habitats, leading to a decrease in the abundance and distribution of species that rely on these habitats. • Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

This reach includes the sole fish classification site for the water body, Alcomden Water (Drought Site 2), which has declined from Good to Moderate status since 2019. This suggests the fish community is sensitive to environmental change and may be vulnerable to additional pressures from drought option implementation.

The physical changes (see **Appendix A**) pose a moderate risk to available habitat and connectivity, particularly given the steep gradient of the channel. Continued disturbance could inhibit recovery to Good status and impact the overall fish classification for the water body.

The overall risk to the fish component is therefore assessed as **moderate**, with high confidence in the assessment based on the frequency and recency of fisheries surveys. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.28**.

Table B4.28 Impacts on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Moderate	High

B4.16.2 Summary of impacts

Table B4.29 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.29 Summary of impacts identified in Hebden Water T1's environmental receptors assessment

Reach	Hebden Water T1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
WFD Status Receptors - GB104027062850 Alcomden Water - Walshaw Dean Resrs to Widdop		
Fish	Moderate	Yes
Invertebrates	Moderate	Yes

B4.17 HEBDEN WATER 1

B4.17.1 Receptor assessment

B4.17.1.1 Statutory designated sites/Local wildlife sites

Hardcastle Craggs LWS

The site hosts neutral and acid grassland, ancient woodland and species rich neutral, acid and wet woodland. Wet woodlands are known to be affected by the lowering of water-tables through drainage or water abstraction, resulting in change to drier woodland types, however groundwater during a drought will be low such that any further reduction in groundwater levels or slight delays in recharge rates would not be likely to further reduce the quality of wet woodland outside of normal drought conditions. These receptors are considered to have low sensitivity to drought permit implementation over and above the impacts of the baseline environmental drought. Hebden Water flows through the Hardcastle Craggs LWS, with potential changes to the physical environment presented in **Appendix A**. **Appendix A** highlights the potential for a potential minor risk of reduction in total wetted aquatic habitat in the reach, and moderate risk of changes in available habitat for different species requirements. As such, the risk from the implementation of the drought option to Hardcastle Craggs LWS is deemed to be **minor**.

B4.17.1.2 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.30**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes.

Table B4.30 Impacts on notable macroinvertebrates in Hebden Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Oulimnius troglodytes</i>	- The species is associated with fast flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor
<i>Potamophylax rotundipennis</i>	- The species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Hebden Water 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.31**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.31 Impacts on white-clawed crayfish in Hebden Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	low	Moderate

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Hebden Water 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as mink, stoat, and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.32**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.32 Impacts on water vole in Hebden Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	- Risk of deterioration in water quality has been identified as moderate and may impact on this receptor - Species has a preference for waterbodies that do not have extreme fluctuations in water level¹⁵. - Increased predation as a result of decreased water width and exposure of burrows. - The reduction in wetted width could result in an increased distance between water vole food source and the burrows. - Impacts could occur throughout the breeding season for this species. - Alteration to food supply could occur although the species has been known to feed upon crayfish at times¹⁶ and the potentially increased density of this species could lead to increased predation efficiency - Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. - There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

¹⁵ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

¹⁶ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.33**

Table B4.33 Impacts on otter in Hebden Water 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in , with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout and bullhead has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.34 Impacts on NERC and notable fish species in Hebden Water 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered minor. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration. - Increased mortality (density dependant) as a result of increased predation. - It is noted that depth of water is not critical to bullhead¹⁷. - There is a major risk to the loss of longitudinal connectivity in this reach. This will impact on the movement of salmonids between habitats (e.g. spawning to nursery) and movement between feeding grounds.	National	High	Major
Bullhead	- Stranding of individuals is likely as the risk to longitudinal connectivity is major. - Mortality as a result of water quality deterioration (oxygen stress, gill clogging, temperature)	Regional	Medium	Moderate

B4.17.1.3WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Hebden Water 1, a 7.5 km reach extending from the confluence of Graining Water and Alcomden Water downstream to the River Calder. The predicted changes include:

- A **major** reduction in river flows (up to 61%) for up to six months, potentially occurring at any time of year;

¹⁷ Tomlinson, M. L. and Perrow, M. R. (2003) Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

- A **major** risk to river habitats, including loss of energy in the system, disruption to longitudinal connectivity (due to the presence of 12 weirs), and moderate risks to habitat extent and suitability for flow-dependent species;
- A **moderate** risk to water quality, primarily due to the potential for short-term acute effects downstream of a listed CSO during rainfall events. Baseline water quality (ammonia, phosphate, DO) is otherwise consistent with High or Good status;
- Two potentially flow-depleted reaches (approximately 150 m and 25 m), where zero flow may occur without mitigation;
- No continuous water quality pressures present within the reach.

These changes (see **Appendix A**) affect the entirety of WFD water body GB104027062731 – Hebden Water from Widdop Beck to River Calder, and therefore present a high risk of influencing the overall WFD classification.

This water body has consistently achieved Good status for macroinvertebrates (2013–2022), while the fish component has remained at Moderate status across both WFD Cycles 2 and 3.

Macroinvertebrates

The macroinvertebrate community in Hebden Water 1 displays good to high diversity and sensitivity to flow and water quality pressures, supported by strong WHPT_{NTAXA}, WHPT_{ASPT}, and LIFE scores.

The predicted changes (**Appendix A**) pose risks to habitat availability, hydraulic diversity, and short-term water quality, particularly downstream of the CSO. The community may also be impacted in localised sections where zero flow could occur in the absence of mitigation. However, due to high recolonisation potential, rapid recovery is expected following cessation of the drought option.

Although the potential ecological impact may be significant, the risk of WFD classification deterioration is considered **moderate**, reflecting the likely temporary and spatially limited nature of the impact and the resilience of the community. Confidence in this assessment is high, based on the number and quality of available survey records. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.35**.

Table B4.35 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
• Reduction in species diversity due to loss of flow-sensitive taxa. • Reduction in species diversity due to loss of water quality-sensitive taxa. • Loss of marginal habitats due to decreased wetted area, leading to a decrease in the abundance and distribution of species that rely on these habitats. • Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

All three WFD fish classification sites lie within the impacted reach, and the water body has remained at Moderate status since 2013. The predicted physical changes (**Appendix A**) may directly affect habitat availability and present a major risk to longitudinal connectivity due to the presence of 12 weirs. Additional short-term water quality pressures downstream of the CSO may further affect fish resilience during low flows.

The potential for zero-flow conditions in two discrete sections could further fragment habitat and delay recovery. As such, the drought option presents a **major risk** to the fish component of the water body and is likely to influence the overall classification outcome. Confidence in this assessment is **high**, based on recent and spatially comprehensive fisheries data.. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.36**.

Table B4.36 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation. - Mortality as a result of moderate risk of water quality deterioration (acute toxicity of ammonia and oxygen sags).	High	Major	High

B4.17.2 Summary of impacts

Table B4.37 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.37 Summary of impacts identified in Hebden Water 1's environmental receptors assessment

Reach	Hebden Water 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Oulimnius troglodytes</i>	Minor	No
<i>Potamophylax rotundipennis</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Major	Yes
Bullhead	Moderate	Yes
WFD Status Receptors - GB104027062731 Hebden Water from Widdop Beck to R Calder		
Fish	Major	Yes
Invertebrates	Moderate	Yes

B4.18 CALDER 2

B4.18.1 Receptor assessment

B4.18.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.38**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes.

Table B4.38 Impacts on notable macroinvertebrates in Cragg Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Tinodes unicolor</i>	- The species is associated with moderate/fast flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Calder 2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.39**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.39 Impacts on white-clawed crayfish in Calder 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.40**.

Table B4.40 Impacts on otter in Calder 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Calder 2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.41**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.41 Impacts on water vole in Calder 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	- Risk of deterioration in water quality has been identified as moderate and may impact on this receptor - Species has a preference for waterbodies that do not have extreme fluctuations in water level¹⁸. - Increased predation as a result of decreased water width and exposure of burrows. - The reduction in wetted width could result in an increased distance between water vole food source and the burrows. - Impacts could occur throughout the breeding season for this species. - Alteration to food supply could occur although the species has been known to feed upon crayfish at times¹⁹ and the potentially increased density of this species could lead to increased predation efficiency - Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. - There are uncertainties relating to the presence of this species with the impacted reach.	National	Low	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.42**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout, grayling and

¹⁸ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

¹⁹ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

bullhead has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.42 Impacts on NERC and notable fish species in Calder 2

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered minor. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools).	National	Low	Moderate
Bullhead	- Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration. - Increased mortality (density dependant) as a result of increased predation.	Regional	Low	Minor
Grayling	- It is noted that depth of water is not critical to bullhead¹⁷. - Stranding of individuals is unlikely as the risk to longitudinal connectivity is minor.	County	Low	Minor

B4.18.1.2 WFD receptors

The implementation of the drought option is predicted to result in a moderate change to the physical environment within Calder 2, a 5.8 km reach of the River Calder from its confluence with Hebden Water to its confluence with Cragg Brook. The predicted changes include:

- A **moderate** reduction in river flows (up to 19%), occurring in both summer/autumn and winter refill periods;
- **Minor** risks to river habitat, including reduced wetted area and energy, with potential for localised impacts to longitudinal connectivity and sediment dynamics;
- A **moderate** risk to water quality due to the potential for acute, short-term deterioration downstream of two listed CSOs during rainfall events, and sensitivity to phosphate under reduced dilution conditions;
- No significant flow-depleted reaches or continuous discharges.

These changes (see **Appendix A**) affect a substantial proportion of WFD water body GB104027062641 – Calder from Colden Water to Ryburn Confluence, and may therefore influence overall WFD classification outcomes.

Macroinvertebrates

The macroinvertebrate community within Calder 2 displays moderate to high diversity, with WHPT_{NTAXA} and WHPT_{ASPT} EQRs indicating sensitivity to habitat and water quality conditions. High LIFE scores suggest additional vulnerability to reductions in flow velocity.

The predicted physical changes (**Appendix A**) may reduce habitat availability and niche diversity, particularly for flow-dependent taxa. Additionally, short-term water quality deterioration may occur downstream of two listed CSOs during rainfall events. However, the overall impacts are expected to be localised and temporary.

The drought option presents a moderate risk to the macroinvertebrate component. Given the resilience of macroinvertebrate communities and their ability to recolonise effectively, the risk of WFD status deterioration is considered **minor**, with high confidence based on recent and well-distributed monitoring data. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.43**.

Table B4.43 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Loss of marginal habitats due to decreased wetted area, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Minor	High

Fish

A fish classification site is located within the impacted reach, and the extent of the affected area is large relative to the water body as a whole. This increases the potential for drought-related changes to influence overall classification.

The predicted flow reductions (up to 22% in summer/autumn) present a minor risk to habitat availability and connectivity. The risk to water quality is moderate, with potential for acute effects from ammonia and oxygen sags during CSO operation and sensitivity to phosphate loading under reduced dilution conditions.

Overall, the drought option presents a **minor** risk to the fish component of the water body. This reflects the relatively modest physical changes, the spatially limited water quality risks, and the current improving trend in fish status. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.44**. Confidence in the assessment is high, based on the quality and frequency of survey data.

Table B4.44 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation. - Mortality as a result of moderate risk of water quality deterioration (acute toxicity of ammonia, oxygen sags and diffuse phosphate pollution).	Low	Minor	High

B4.18.2 Summary of impacts

Table B4.45 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.45 Summary of impacts identified in Calder 2's environmental receptors assessment

Reach	Calder 2	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Tinodes unicolor</i>	Minor	No
White-clawed crayfish	Moderate	Yes

Reach	Calder 2	
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
Bullhead	Minor	No
Grayling	Minor	No
WFD Status Receptors - GB104027062641 Calder from Colden Water to Ryburn Confluence		
Fish	Minor	No
Invertebrates	Minor	No

B4.19 CRAGG BROOK T1

B4.19.1 Receptor assessment

B4.19.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.46**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes. The overall confidence in the notable macroinvertebrate data and subsequent assessment has been classed as low due to the small number of surveys completed where the species were observed.

Table B4.46 Impacts on notable macroinvertebrates in Cragg Brook T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Sialis nigripes</i>	- The species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures	County	Low	Minor
<i>Paraleptophlebia cincta</i>				

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Cragg Brook T1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.47**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.47 Impacts on white-clawed crayfish in Cragg Brook T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.48**.

Table B4.48 Impacts on otter in Cragg Brook T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Cragg Brook T1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.49**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.49 Impacts on water vole in Cragg Brook T1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	- Risk of deterioration in water quality has been identified as minor and will not impact on this receptor - Species has a preference for waterbodies that do not have extreme fluctuations in water level²⁰. - Increased predation as a result of decreased water width and exposure of burrows. - The reduction in wetted width could result in an increased distance between water vole food source and the burrows. - Impacts could occur throughout the breeding season for this species. - Alteration to food supply could occur although the species has been known to feed upon crayfish at times²¹ and the potentially increased density of this species could lead to increased predation efficiency - Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. - There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in , with drought option impacts on the physical environment summarised in **Appendix A**. The

²⁰ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

²¹ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

overall confidence in the data and subsequent assessment for brown trout has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.50 Impacts on NERC and notable fish species in Cragg Brook T1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered minor. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration. - Stranding of individuals is unlikely as the risk to longitudinal connectivity is moderate. - Increased mortality (density dependant) as a result of increased predation.	National	Medium	Moderate

B4.19.1.2 WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Cragg Brook T1, a 1.6 km reach of Withens Clough, extending from the outflow of Withens Clough Reservoir to its confluence with Turvin Clough. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year;
- A **moderate** risk to river habitats, including changes in flow energy, reduced habitat availability, and minor risks to longitudinal connectivity and sediment dynamics;
- A **minor** risk to water quality, associated with reduced dilution capacity for diffuse pollution (ammonia, phosphate, and dissolved oxygen);
- No continuous or intermittent discharges or existing flow pressures.

These changes (see **Appendix A**) occur within a tributary that contributes to WFD water body GB104027062610 – Cragg Brook from Source to River Calder, meaning the reach has direct ecological and classification relevance. Impacts are therefore likely to influence the overall WFD status.

The water body has consistently achieved Good status for macroinvertebrates from 2014 through 2022. The fish component has shown fluctuations, ranging from High status in early Cycle 2 to Moderate and Good, with the most recent (2022) classification recorded as High status.

Macroinvertebrates

The macroinvertebrate community in Cragg Brook T1 displays good to high diversity and sensitivity to flow and water quality, supported by strong WHPT_{NTAXA}, WHPT_{ASPT}, and LIFE scores.

The predicted changes (**Appendix A**) present a risk to hydraulic conditions and localised habitat diversity, particularly for flow-sensitive taxa. Although the overall wetted area reduction is likely to be minor, the intensity of flow change could reduce the availability of suitable niches. The community is also sensitive to water quality, though the risk of deterioration is considered minor, and no additional pressure from abstraction or discharge is present.

The drought option is predicted to present a major risk to the macroinvertebrate community, primarily due to the magnitude of the physical changes. However, due to the community's strong recolonisation capacity and the spatially limited nature of the pressures, the risk of WFD classification deterioration is considered **moderate**, with high confidence based on the frequency and quality of survey data. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.51**.

Table B4.51 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Loss of suitable niches due to changes in flow condition, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

Although there are no fish classification sites within the affected reach, a substantial proportion of the overall WFD water body is impacted. The drought option is therefore likely to influence the fish component of the classification.

The predicted flow reductions (**Appendix A**) pose a moderate risk to available aquatic habitat and to longitudinal connectivity, particularly given the steep nature of the channel. Sediment transport changes are expected to be minor. No significant pressures from water quality or discharge are anticipated.

The overall risk to the fish component is assessed as **moderate**, reflecting the magnitude of predicted hydrological change and the ecological connectivity of the system, as identified in . Confidence in this assessment is high, based on the number of surveys completed and the age of the most recent data.

Table B4.52 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Moderate	High

B4.19.2 Summary of impacts

Table B4.53 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.53 Summary of impacts identified in Cragg Brook T1's environmental receptors assessment

Reach	Cragg Brook T1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Sialis nigripes</i>	Minor	No
<i>Paraleptophlebia cincta</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes

Reach	Cragg Brook T1	
Brown trout	Moderate	Yes
WFD Status Receptors - GB104027062610 Cragg Brook from Source to River Calder		
Fish	Moderate	Yes
Invertebrates	Moderate	Yes

B4.20 CRAGG BROOK T2

B4.20.1 Receptor assessment

B4.20.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.54**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes. The overall confidence in the notable macroinvertebrate data and subsequent assessment has been classed as low due to the small number of surveys completed where the species were observed.

Table B4.54 Impacts on notable macroinvertebrates in Cragg Brook T2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Paraleptophlebia cincta</i>	- The species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Cragg Brook T2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.55**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.55 Impacts on white-clawed crayfish in Cragg Brook T2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.56**.

Table B4.56 Impacts on otter in Cragg Brook T2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Cragg Brook T2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.57**.

Table B4.57 Impacts on water vole in Cragg Brook T2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	- Risk of deterioration in water quality has been identified as minor and will not impact on this receptor - Species has a preference for waterbodies that do not have extreme fluctuations in water level²². - Increased predation as a result of decreased water width and exposure of burrows. - The reduction in wetted width could result in an increased distance between water vole food source and the burrows. - Impacts could occur throughout the breeding season for this species. - Alteration to food supply could occur although the species has been known to feed upon crayfish at times²³ and the potentially increased density of this species could lead to increased predation efficiency - Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. - There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.58**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout and bullhead has been classed as high due to the number of surveys and the age of the most recent surveys completed.

²² English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

²³ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

Table B4.58 Impacts on NERC and notable fish species in Cragg Brook T2

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered moderate. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk.	National	High	Major
Bullhead	- Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration - Stranding of individuals is likely as risk to longitudinal connectivity is major. - Increased mortality (density dependant) as a result of increased predation - It is noted that depth of water is not critical to bullhead¹⁷.	Regional	Medium	Moderate

B4.20.1.2 WFD receptors

The implementation of the drought option is predicted to result in significant physical environment changes within Cragg Brook T2, a 2.6 km reach of Turvin Clough extending from the Turvin Clough intake to its confluence with Withens Clough. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year;
- A **major** risk to river habitats, including reduced flow energy, decreased wetted area, fragmentation of aquatic habitat, and a moderate risk to sediment dynamics;
- A **minor** risk to water quality, related to reduced dilution of diffuse inputs (ammonia, phosphate, dissolved oxygen);
- No continuous or intermittent discharges or significant flow pressures in the reach.

These changes (see **Appendix A**) affect a tributary that contributes directly to WFD water body GB104027062610 – Cragg Brook from Source to River Calder, and therefore have the potential to influence its WFD classification status.

Macroinvertebrates

The macroinvertebrate community in Cragg Brook T2 exhibits a variable but generally moderate to high level of diversity, with WHPT_{NTAXA} and WHPT_{ASPT} EQRs reflecting sensitivity to both flow and water quality. High LIFE scores indicate susceptibility to reductions in flow velocity and hydraulic heterogeneity.

The predicted changes (Appendix A) present a major risk to habitat quality and availability, particularly for taxa requiring high flow velocities or specialised niches. Despite the absence of continuous or significant flow pressures, the intensity of the flow reduction could lead to loss of species diversity in affected areas. Water quality risks are considered minor.

The drought option is therefore predicted to present a major risk to the macroinvertebrate community. However, due to strong recovery potential following flow restoration, the risk of deterioration in WFD classification is assessed as **moderate**, with high confidence based on monitoring frequency and data quality. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.59**.

Table B4.59 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Loss of suitable niches due to changes in flow condition, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

Although no fish classification sites are located within Cragg Brook T2, the reach represents a significant contributing section of the overall water body, meaning any ecological change may influence the water body's WFD classification outcome.

The predicted flow reductions (**Appendix A**) pose a major risk to aquatic habitat and longitudinal connectivity, particularly due to the steep gradient of the channel. A moderate risk to sediment dynamics also exists, with potential implications for salmonid spawning substrates. While water quality changes are predicted to be minor, the overall effect of flow and habitat modification could temporarily limit recruitment and movement.

The drought option is therefore considered to pose a **major** risk to the fish component of the WFD water body, as identified in **Table B4.60**. The confidence in this assessment is high, based on the breadth of historical fisheries data and the age of the most recent surveys

Table B4.60 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	High	Major	High

B4.20.2 Summary of impacts

Table B4.61 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.61 Summary of impacts identified in Cragg Brook T2's environmental receptors assessment

Reach	Cragg Brook T2	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Paraleptophlebia cincta</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Major	Yes
Bullhead	Moderate	Yes

Reach	Cragg Brook T2	
WFD Status Receptors - GB104027062610 Cragg Brook from Source to River Calder		
Fish	Major	Yes
Invertebrates	Moderate	Yes

B4.21 CRAGG BROOK 1

B4.21.1 Receptor assessment

B4.21.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.62**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes.

Table B4.62 Impacts on notable macroinvertebrates in Cragg Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Atherix ibis</i>	- The species is associated with moderate/fast flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Cragg Brook 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.63**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.63 Impacts on white-clawed crayfish in Cragg Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Cragg Brook 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.64**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.64 Impacts on water vole in Cragg Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as minor and will not impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level²⁴. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times²⁵ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.65**

Table B4.65 Impacts on otter in Cragg Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	• Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. • Species could remain within the reach for longer. Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.66**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout and bullhead has been classed as high due to the number of surveys and the age of the most recent surveys completed.

²⁴ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

²⁵ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

Table B4.66 Impacts on NERC and notable fish species in Cragg Brook 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered minor. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk.	National	Medium	Moderate
Bullhead	- Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration - Stranding of individuals is unlikely as risk to longitudinal connectivity is moderate. - Increased mortality (density dependant) as a result of increased predation . - It is noted that depth of water is not critical to bullhead²⁶ .	Regional	Low	Minor

B4.21.1.2WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Cragg Brook 1, a 3.6 km reach extending from the confluence of Withens Clough and Turvin Clough to the confluence with the River Calder at Mytholmroyd. The predicted changes include:

- A **major** reduction in river flows (up to 62%) for up to six months, potentially occurring at any time of year;
- A **moderate** to **major** risk to river habitats, including reduced total wetted area, habitat availability, and longitudinal connectivity, with minor risk to sediment dynamics;
- A **minor** risk to water quality, associated with reduced dilution of diffuse inputs (ammonia, phosphate, and dissolved oxygen);
- No existing flow-depleted reaches or significant abstraction/discharge pressures.

These changes (see **Appendix A**) occur across a large proportion of WFD water body GB104027062610 – Cragg Brook from Source to River Calder, and are likely to directly influence the overall WFD classification.

The water body has consistently achieved Good status for macroinvertebrates from 2014 to 2022. The fish component has fluctuated from High to Moderate/Good, with the most recent Cycle 3 (2022) classification again recording High status.

Macroinvertebrates

The macroinvertebrate community in Cragg Brook 1 displays a wide range in diversity (Bad to High), with WHPT_{NTAXA} and LIFE scores indicating sensitivity to both habitat quality and hydraulic conditions.

The predicted changes (**Appendix A**) are expected to reduce habitat availability and hydraulic variability, particularly affecting flow-sensitive taxa. Although there are no continuous pressures from abstraction or discharge, the scale of flow reduction could result in localised habitat contraction. Water quality impacts are expected to be minor, but temporary impacts cannot be ruled out.

Although the drought option may result in short-term impacts to the macroinvertebrate community, particularly through reduced flow velocities, habitat availability, and temporary water quality pressures, the overall risk of

²⁶ Tomlinson, M. L. and Perrow, M. R. (2003) Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

deterioration in WFD status is considered **moderate**. This reflects the temporary and seasonal nature of the pressure, the community's capacity for recovery through recolonisation, and the generally robust ecological condition observed in recent monitoring. Confidence in this assessment is high, based on the number and quality of survey data available. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.67**.

Table B4.67 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Loss of suitable niches due to changes in flow condition, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

Cragg Brook 1 covers a substantial part of the WFD water body and includes a WFD fish classification site. As such, any ecological impact is likely to influence the WFD classification outcome.

The predicted flow reductions (**Appendix A**) pose a moderate risk to aquatic habitat and longitudinal connectivity, particularly due to the steep channel profile. There is also a minor risk of sediment-related changes, which may impact habitat structure for fish species. Water quality risks remain low and no flow-depleted reaches are present.

The drought option is assessed to present a moderate risk to the fish component of the water body, as identified in **Table B4.68**. The confidence in this assessment is high, supported by recent, high-coverage survey data.

Table B4.68 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Moderate	High

B4.21.2 Summary of impacts

Table B4.69 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.69 Summary of impacts identified in Cragg Brook 1's environmental receptors assessment

Reach	Cragg Brook 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Atherix ibis</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No

Reach	Cragg Brook 1	
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
Bullhead	Minor	No
WFD Status Receptors - GB104027062610 Cragg Brook from Source to River Calder		
Fish	Moderate	Yes
Invertebrates	Moderate	Yes

B4.22 CALDER 3

B4.22.1 Receptor assessment

B4.22.1.1 NERC and other protected species

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Calder 3 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.70**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.70 Impacts on white-clawed crayfish in Calder 3

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.71**.

Table B4.71 Impacts on otter in Calder 3

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Calder 3 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.72**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.72 Impacts on water vole in Calder 3

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as moderate and may impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level²⁷. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times²⁸ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.73**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout, grayling and bullhead has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.73 Impacts on NERC and notable fish species in Calder 3

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered minor. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools).	National	Low	Moderate
Bullhead	• Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration. • Increased mortality (density dependant) as a result of increased predation.	Regional	Low	Minor
Grayling	• It is noted that depth of water is not critical to bullhead¹⁷. • Stranding of individuals is unlikely as the risk to longitudinal connectivity is minor.	Regional	Low	Minor

²⁷ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

²⁸ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

B4.22.1.2 WFD receptors

The implementation of the drought option is predicted to result in moderate physical changes within Calder 3, an 11.8 km reach of the River Calder from the confluence with Cragg Brook to the confluence with Black Brook. The predicted changes include:

- A **moderate** reduction in river flows (up to 25%), with greater reductions during summer/autumn than in winter;
- **Minor** risks to river habitat, including slight reductions in flow energy, wetted area, connectivity, and sediment dynamics;
- A **moderate** risk to water quality, primarily due to potential short-term deterioration downstream of six listed CSOs during rainfall events and flow-sensitive phosphate loading;
- No significant abstractions or flow-depleted reaches, though one flow addition is present in the reach.

These changes (see **Appendix A**) affect two WFD water bodies:

- GB104027062641 – Calder from Colden Water to Ryburn Confluence, where the reach comprises a substantial proportion; and
- GB104027062642 – Calder from Ryburn Confluence to River Colne, where only the upper section is affected.

Water body GB104027062641 has consistently achieved Good status for macroinvertebrates and has shown progressive improvement in fish status from Poor to Good between Cycle 2 and Cycle 3 (2013–2022).

Water body GB104027062642 has also improved, with macroinvertebrate status progressing from Poor/Moderate in early Cycle 2 to consistently Good in Cycle 3. The fish component also improved from Moderate in early Cycle 2 to Good status by 2022, indicating a positive trend in ecological condition.

Macroinvertebrates

The macroinvertebrate community in Calder 3 shows a wide range of diversity (Bad to High), with WHPT_{NTAXA} and LIFE scores indicating sensitivity to flow velocity and substrate conditions. WHPT_{ASPT} scores suggest a moderate to high sensitivity to water quality pressures.

The predicted changes (**Appendix A**) are likely to reduce flow velocity and wetted habitat, potentially displacing flow-sensitive taxa. Water quality may also deteriorate temporarily downstream of six CSOs during rainfall events, contributing to acute short-term pressure.

Although the drought option may result in short-term impacts to the macroinvertebrate community, particularly through reduced flow velocities, habitat availability, and temporary water quality pressures, the overall risk of deterioration in WFD status is considered **minor**. This reflects the temporary and seasonal nature of the pressure, the community's capacity for recovery through recolonisation, and the generally robust ecological condition observed in recent monitoring. Confidence in this assessment is high, based on the number and quality of survey data available. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.74**.

Table B4.74 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
• Reduction in species diversity due to loss of flow-sensitive taxa. • Reduction in species diversity due to loss of water quality-sensitive taxa. • Loss of marginal habitat due to decrease in wetted habitat, leading to a decrease in the abundance and distribution of species that rely on these habitats. • Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Minor	High

Fish

No WFD fish classification sites fall within the affected reach. However, the reach spans a large area of GB104027062641 and a smaller section of GB104027062642, and is therefore likely to influence classification outcomes.

The predicted flow reductions (**Appendix A**) present a minor risk to aquatic habitat and connectivity due to the moderate scale of change. The risk of water quality deterioration is moderate, driven by short-term CSO discharges and diffuse phosphate loading under reduced dilution capacity.

Overall, the drought option is considered to pose a **minor** risk to the fish components of both WFD water bodies, as identified in **Table B4.75**. The confidence in this assessment is high, based on recent and well-distributed fisheries monitoring data.

Table B4.75 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation. - Mortality as a result of moderate risk of water quality deterioration (acute toxicity of ammonia, oxygen sags and diffuse phosphate pollution).	Low	Minor	High

B4.22.2 Summary of impacts

Table B4.76 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.76 Summary of impacts identified in Calder 3's environmental receptors assessment

Reach	Calder 3	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
Bullhead	Minor	No
Grayling	Minor	No
WFD Status Receptors:		
-GB104027062641 Calder from Colden Water to Ryburn Confluence		
-GB104027062642 Calder from Ryburn Confluence to River Colne		
Fish	Minor	No
Invertebrates	Minor	No

B4.23 LUDDENDEN BROOK 1

B4.23.1 Receptor assessment

B4.23.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.77**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes. The overall confidence in the notable macroinvertebrate data and subsequent assessment has been classed as low due to the small number of surveys completed where the species were observed.

Table B4.77 Impacts on notable macroinvertebrates in Luddenden Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Sialis nigripes</i>	- The species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Luddenden Brook 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.78**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.78 Impacts on white-clawed crayfish in Luddenden Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Medium	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.79**.

Table B4.79 Impacts on otter in Luddenden Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Luddenden Brook 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.80**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.80 Impacts on water vole in Luddenden Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	- Risk of deterioration in water quality has been identified as minor and will not impact on this receptor - Species has a preference for waterbodies that do not have extreme fluctuations in water level²⁹. - Increased predation as a result of decreased water width and exposure of burrows. - The reduction in wetted width could result in an increased distance between water vole food source and the burrows. - Impacts could occur throughout the breeding season for this species. - Alteration to food supply could occur although the species has been known to feed upon crayfish at times³⁰ and the potentially increased density of this species could lead to increased predation efficiency - Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. - There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.81**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed

²⁹ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

³⁰ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

as medium due to the number of surveys and the age of the most recent surveys completed, however, there is poor spatial coverage relative to the size of the reach.

Table B4.81 Impacts on NERC and notable fish species in Luddenden Brook 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered moderate. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk. - Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration - Stranding of individuals is likely as risk to longitudinal connectivity is major. - Increased mortality (density dependant) as a result of increased predation.	National	High	Major

B4.23.1.2WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Luddenden Brook 1, a 9.1 km reach extending from the outflow of Warley Moor Reservoir to the confluence with the River Calder. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year
- A **major** risk to river habitat, including loss of total wetted area, habitat diversity, and connectivity, with a moderate risk to sediment dynamics
- A **minor** risk to water quality, primarily associated with reduced dilution capacity for diffuse pollution (ammonia, phosphate, and dissolved oxygen)
- No existing flow-depleted reaches or significant abstraction or discharge pressures

These changes (see **Appendix A**) affect the entire extent of WFD water body GB104027062770 – Luddenden Brook from source to River Calder, meaning any ecological impacts will directly influence the overall WFD classification.

This water body has consistently achieved High status for macroinvertebrates during Cycles 2 and 3 (2014 to 2022). The fish component has remained at Poor status throughout this period, with no improvement between 2013 and 2022.

Macroinvertebrates

The macroinvertebrate community within Luddenden Brook 1 displays good to high diversity, with WHPT_{NTAXA}, WHPT_{ASPT}, and LIFE scores indicating sensitivity to both water quality and hydraulic conditions. The predicted flow reductions and associated habitat loss (**Appendix A**) may displace flow-dependent taxa and reduce ecological resilience.

Water quality changes are expected to be minor, and no other significant flow pressures are present. However, the scale of hydraulic change means the community may still experience temporary disruption.

Although the drought option may result in short-term impacts to the macroinvertebrate community, the overall risk of deterioration in WFD status is considered **moderate**. This reflects the temporary and seasonal nature of the pressure, the community's effective recolonisation potential, and the strength of the existing ecological

condition. Confidence in this assessment is high, based on the number and quality of survey data available. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.82**.

Table B4.82 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

The entire WFD water body is affected by the drought option, including the one WFD fish classification site. Given the scale of impact and the long-standing Poor status of the fish component, any additional pressure is likely to constrain recovery and may influence classification.

The predicted flow reductions (**Appendix A**) present a major risk to available aquatic habitat and longitudinal connectivity due to the steep gradient of the channel. There is also a moderate risk to sediment dynamics, including the potential for siltation of salmonid spawning gravels. Water quality risks are minor in this reach.

The drought option is therefore considered to pose a **major** risk to the fish component of the water body, as identified in **Table B4.83**. Confidence in this assessment is high, based on the number of surveys completed and the age of the most recent data.

Table B4.83 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	High	Major	Medium

B4.23.2 Summary of impacts

Table B4.84 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.84 Summary of impacts identified in Luddenden Brook 1's environmental receptors assessment

Reach	Luddenden Brook 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Sialis nigripes</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole/	Moderate	Yes
Brown trout	Major	Yes
WFD Status Receptors - GB104027062770 Luddenden Brook from source to River Calder		
Fish	Major	Yes
Invertebrates	Moderate	Yes

B4.24 BOOTH DEAN CLOUGH 1

B4.24.1 Receptor assessment

B4.24.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.85**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes.

Table B4.85 Impacts on notable macroinvertebrates in Booth Dean Clough 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Rhyacophila septentrionis</i>	The species is associated with fast flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor
<i>Stictonectes lepidus</i>	- The species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Booth Dean Clough 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.86**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.86 Impacts on white-clawed crayfish in Booth Dean Clough 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered minor and water quality related impacts are considered unlikely.	National	Low	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.87**, with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed as high due to the number of surveys and the age of the most recent surveys.

Table B4.87 Impacts on NERC and notable fish species in Booth Dean Clough 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	- The risk to siltation of spawning gravels is considered minor. - Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). - Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk. - Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration - Stranding of individuals is unlikely as risk to longitudinal connectivity is moderate. - Increased mortality (density dependant) as a result of increased predation	National	Medium	Moderate

B4.24.1.2 WFD receptors

The implementation of the drought option is predicted to result in a significant change to the physical environment within Booth Dean Clough 1, a 3.0 km reach extending from the outflow of Booth Wood Reservoir to the confluence with the River Ryburn. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year
- A **moderate** risk to river habitat, including reductions in habitat availability and longitudinal connectivity, with minor risk to wetted width and sediment dynamics
- A **minor** risk to water quality, primarily due to reduced dilution of diffuse inputs (ammonia, phosphate, and dissolved oxygen)
- No significant abstractions, discharges, or flow-depleted reaches within the reach

This reach occupies a large proportion of WFD water body GB104027062520 – Booth Dean Clough from Source to River Ryburn, and any changes to its ecological condition are expected to influence the WFD classification outcome.

The water body has consistently achieved Good status for macroinvertebrates from Cycle 2 (2013) through Cycle 3 (2022), with a High status recorded in 2014. The fish component has remained at Poor status across most of this period, with the exception of a single Moderate classification in 2016.

Macroinvertebrates

The macroinvertebrate community within Booth Dean Clough 1 is characterised by good to high diversity and high sensitivity to flow velocity and water quality pressures, as indicated by WHPT_{NTAXA}, WHPT_{ASPT}, and LIFE scores. The predicted flow reductions and changes in habitat structure may reduce the availability of suitable conditions for flow-dependent taxa.

Water quality risks are minor and no other significant pressures are present within the reach. However, the magnitude of flow change may still result in temporary habitat disruption.

Although the drought option may result in short-term impacts to the macroinvertebrate community, the overall risk of deterioration in WFD status is considered **moderate**. This reflects the temporary and seasonal nature of the pressure, the community's effective recolonisation potential, and the strength of the existing ecological condition. Confidence in this assessment is high, based on the number and quality of survey data available. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.88**.

Table B4.88 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

The fish component of the water body has consistently been classified as Poor across both WFD cycles, with only limited signs of recovery. Although no WFD fish classification site is located within Booth Dean Clough 1, the reach constitutes a large part of the overall water body and is therefore likely to influence classification outcomes.

The predicted flow reductions pose a moderate risk to aquatic habitat and connectivity, particularly given the steep topography of the channel. Sediment dynamics may also be affected, although the risk is considered minor. Water quality impacts are low, with no significant CSO or continuous discharges present.

The drought option is assessed to present a **moderate** risk to the fish component of the WFD water body, as identified in **Table B4.89**.

Table B4.89 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation.	Medium	Moderate	High

B4.24.2 Summary of impacts

Table B4.90 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.90 Summary of impacts identified in Booth Dean Clough 1's environmental receptors assessment

Reach	Booth Dean Clough 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
<i>Rhyacophila septentrionis</i>	Minor	No
<i>Stictonectes lepidus</i>	Minor	No
White-clawed crayfish	Moderate	Yes
Brown trout	Moderate	Yes
WFD Status Receptors - GB104027062520 Booth Dean Clough from Source to River Ryburn		
Fish	Moderate	Yes
Invertebrates	Moderate	Yes

B4.26 RYBURN 1

B4.26.1 Receptor assessment

B4.26.1.1 NERC and other protected species

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Ryburn 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.91**.

Table B4.91 Impacts on white-clawed crayfish in Ryburn 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered moderate and water quality related impacts are considered likely.	National	Medium	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.92**.

Table B4.92 Impacts on otter in Ryburn 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Ryburn 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible (**Table B4.93**).

Table B4.93 Impacts on water vole in Ryburn 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as moderate and may impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level³¹. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times³² and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in , with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed as medium due to the number of surveys and the age of the most recent surveys.

Table B4.94 Impacts on NERC and notable fish species in Ryburn 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered moderate. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). • Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk. • Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration • Stranding of individuals is likely as risk to longitudinal connectivity is major.	National	High	Major

³¹ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

³² Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
	Increased mortality (density dependant) as a result of increased predation			

B4.26.1.2 WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Ryburn 1, a 1.4 km reach of the River Ryburn from the outflow of Ryburn Reservoir to the confluence with Booth Dean Clough. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year
- A 450 m flow-depleted reach where in-combination pressures could reduce flow by up to 87% without mitigation
- Major** risks to river habitats, including longitudinal connectivity and available aquatic habitat, and moderate risk to sediment dynamics
- A **moderate** risk to water quality, linked to discharges from an unregulated fish farm, particularly under low-flow conditions
- No significant intermittent pressures or continuous permitted discharges within the reach

These changes (see **Appendix A**) affect a large proportion of WFD water body GB104027062540 – Ryburn from Source to Booth Dean Clough, meaning the impacts are likely to directly influence its WFD classification.

The water body has shown improvement in macroinvertebrate classification, ranging from Moderate and Good during Cycle 2 to Good and High in Cycle 3 (2019 and 2022). In contrast, the fish component has remained at Moderate or Poor, with the most recent 2022 assessment recording Moderate status.

Macroinvertebrates

The macroinvertebrate community in Ryburn 1 shows moderate to high diversity, with sensitivity to both hydraulic and water quality pressures indicated by WHPT_{NTAXA}, WHPT_{ASPT}, and LIFE scores. The predicted flow reductions and habitat changes may displace flow-sensitive taxa, particularly within the flow-depleted section where loss of velocity and habitat structure is expected.

Although water quality risks from diffuse inputs are considered minor, additional risk arises from the unregulated fish farm, which may discharge effluent at a 2:1 ratio to river flow under low-flow conditions. No other significant point-source pressures are identified within the reach.

Although the drought option may result in short-term impacts to the macroinvertebrate community, the overall risk of deterioration in WFD status is considered **major**. This reflects the temporary and seasonal nature of the pressure, the community's effective recolonisation potential, and the improving ecological condition recorded in recent assessments. Confidence in this assessment is high, based on the number and quality of survey data available. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.95**.

Table B4.95 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Loss of habitat due leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Major	High

Fish

The large area of the WFD waterbody impacted along with classification site for the WFD waterbody means any impact of drought order implementation is likely to influence WFD classification. The duration of impacts could be up to 6 months and occur at any time of the year and therefore affect all seasons.

A major risk of change in the energy of the system associated with up to 67% reduction in flow for the periods of time during the drought option poses a major risk to available aquatic habitat and longitudinal connectivity due to the steep nature of the channel within the reach, with a moderate risk of change to sediment dynamics potentially resulting in the siltation of salmonid spawning gravels.

Ryburn Trout Farm holds a license for abstraction which in-combination with drought options would reduce flow by 87% and result in a potential 450 m flow depleted reach (with potential for zero flow without mitigation). The resulting effluent from the trout farm also poses a moderate risk of water quality deterioration with elevated ammonia, phosphates and low dissolved oxygen.

The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are predicted to present a **major** risk to the fish component of the WFD GB104027062540 Ryburn from Source to Booth Dean Clough (associated with Ryburn 1). The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.96**.

The overall confidence in the fisheries data and subsequent assessment has been classed as high due to the number of surveys and the age of the most recent surveys completed.

Table B4.96 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation. - Mortality as a result of moderate risk of water quality deterioration (toxicity of ammonia, oxygen sags and phosphate pollution).	High	Major	Medium

B4.26.2 Summary of impacts

Table B4.97 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.97 Summary of impacts identified in Ryburn 1's environmental receptors assessment

Reach	Ryburn 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Major	Yes
WFD Status Receptors - GB104027062540 Ryburn from Source to Booth Dean Clough		
Fish	Major	Yes
Invertebrates	Major	Yes

B4.27 RYBURN 2

B4.27.1 Receptor assessment

B4.27.1.1 NERC and other protected species

White-clawed crayfish

In the absence of quantitative data on populations of white-clawed crayfish a detailed assessment of impact in Ryburn 2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, it is possible that individuals will become stranded as river levels reduce and habitats become exposed.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.98**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.98 Impacts on white-clawed crayfish in Ryburn 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
White-clawed crayfish	- Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width. - Increased mortality (density dependant) as a result of increased predation. - Increased competition for resources as habitat availability reduces. - Water quality risks are considered moderate and water quality related impacts may impact this receptor.	National	Low	Moderate

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.99**.

Table B4.99 Impacts on otter in Ryburn 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and white-clawed crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Ryburn 2 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as stoat and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.100**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.100 Impacts on water vole in Ryburn 2

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as moderate and may impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level³³. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times³⁴ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in , with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout has been classed as medium due to the number of surveys and the age of the most recent surveys. The overall confidence in the assessment for bullhead has been classed as low due to only being observed at one site which was last surveyed in 2015.

Table B4.101 Impacts on NERC and notable fish species in Ryburn 2

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered moderate. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). • Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk. • Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration	National	High	Major

³³ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

³⁴ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Bullhead	- Stranding of individuals is likely as risk to longitudinal connectivity is major. - Increased mortality (density dependant) as a result of increased predation - It is noted that depth of water is not critical to bullhead³⁵	Regional	Medium	Moderate

B4.27.1.2WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Ryburn 2, a 6.2km stretch of the River Ryburn from the confluence with Boot Dean Clugh down to the confluence with the River Calder. The predicted changes include:

- A **major** reduction in river flows (up to 67%) for up to 6 months, potentially occurring at any time of year.
- A **major** risk to river habitats, including longitudinal connectivity due to the presence of 11 weirs, and moderate risk to available aquatic habitat and sediment dynamics
- A **moderate** risk to water quality, particularly downstream of Ripponden Wood WwTW and seven listed CSOs during rainfall events
- One significant flow addition within the reach from a water company discharge.
- No identified significant abstractions or flow-depleted reaches

These changes (see Appendix A) affect a large proportion of WFD water body GB104027062580 – Ryburn from Booth Dean Clough to River Calder, meaning the impacts are likely to directly influence its WFD classification.

The macroinvertebrate component of this water body has consistently held Moderate status throughout Cycle 2 and Cycle 3. The fish component improved from Poor in early Cycle 2 to Moderate in later Cycle 2 and Cycle 3, including the most recent 2022 assessment.

Macroinvertebrates

The macroinvertebrate community in Ryburn 2 exhibits moderate diversity, with sensitivity to both hydraulic and water quality pressures as indicated by WHPT NTAXA, ASPT, and LIFE scores. Reductions in flow and available habitat may reduce taxonomic richness and affect species reliant on higher flow velocities. While diffuse water quality pressures present a minor risk, short-term acute pressures from CSOs and chronic pressures downstream of Ripponden Wood WwTW pose a moderate risk, particularly under reduced dilution capacity during drought.

Although the drought option may result in short-term impacts to the macroinvertebrate community, the overall risk of deterioration in WFD status is considered **moderate**. This reflects the temporary and seasonal nature of the pressure, the community's effective recolonisation potential, and the resilience observed in long-term monitoring data. Confidence in this assessment is high, based on the number and quality of available survey data. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in Table **B4.102**.

³⁵ Tomlinson, M. L. and Perrow, M. R. (2003) Ecology of the Bullhead. Conserving Natura 2000 Rivers Ecology Series No. 4. English Nature, Peterborough.

Table B4.102 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

The fish component is likely to be affected due to both habitat fragmentation and water quality deterioration. A major reduction in flow presents a moderate risk to available aquatic habitat and a major risk to longitudinal connectivity, with 11 weirs acting as barriers to movement under low-flow conditions. There is also a moderate risk of sediment deposition affecting spawning gravels.

The most significant water quality risk is from Ripponden Wood WwTW, where ammonia toxicity and oxygen sags may occur under reduced dilution capacity. Additional short-term pressures from multiple CSOs during storm events contribute further to this risk.

The combined physical environment changes (river flows, river habitat and water quality) are predicted to present a major risk to the fish component of the WFD GB104027062580 Ryburn from Booth Dean Clough to River Calder (associated with Ryburn 2). The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.103**.

The overall confidence in the fisheries data and subsequent assessment is medium, based on the number of surveys and the age of the most recent data.

Table B4.103 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation. - Mortality as a result of moderate risk of water quality deterioration (toxicity of ammonia and oxygen sags).	High	Major	Medium

B4.27.2 Summary of impacts

Table B4.104 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.104 Summary of impacts identified in Ryburn 2's environmental receptors assessment

Reach	Ryburn 2	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)
NERC and Notable Species Receptors		
White-clawed crayfish	Moderate	Yes
Otter	Negligible	No
Water vole	Moderate	Yes

Reach	Ryburn 2	
Brown trout	Major	Yes
Bullhead	Moderate	Yes
WFD Status Receptors - GB104027062580 Ryburn from Booth Dean Clough to R Calder		
Fish	Major	Yes
Invertebrates	Major	Yes

B4.28 HEBBLE BROOK 1

B4.28.1 Receptor assessment

B4.28.1.1 NERC and other protected species

Notable Macroinvertebrates

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.105**. These impacts are evaluated using species' LIFE score categories, which classify invertebrates based on their reliance on specific flow conditions and their ability to tolerate changes in flow regimes.

Table B4.105 Impacts on notable macroinvertebrates in Hebble Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
<i>Potamophylax rotundipennis</i>	- The species is associated with moderate flows therefore any reduction in flow could potentially impact habitat availability. However, reductions in flow will be temporary and will occur against a baseline of drought conditions. - There will be no likely impacts on the species as a result of water quality pressures.	County	Low	Minor

Otter

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.106**.

Table B4.106 Impacts on otter in Hebble Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Otter	- Increased efficiency in predation as a result of higher densities of prey species (fish and crayfish) as species are forced into smaller areas. - Species could remain within the reach for longer. - Otter likely to move to unaffected reaches.	International	Negligible	Negligible

Water vole

In the absence of quantitative data on populations of water vole a detailed assessment of the impact in Hebble Brook 1 as a result of the implementation of the drought option is not feasible. However, as suitable habitat is present within the reach, in particular suitable habitat in the banks, burrows may potentially become exposed leading to an increased susceptibility to predators such as mink, stoat, and weasels.

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in **Table B4.107**. The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are considered to be short-term and reversible.

Table B4.107 Impacts on water vole in Hebble Brook 1

Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Water vole	• Risk of deterioration in water quality has been identified as moderate and may impact on this receptor • Species has a preference for waterbodies that do not have extreme fluctuations in water level³⁶. • Increased predation as a result of decreased water width and exposure of burrows. • The reduction in wetted width could result in an increased distance between water vole food source and the burrows. • Impacts could occur throughout the breeding season for this species. • Alteration to food supply could occur although the species has been known to feed upon crayfish at times³⁷ and the potentially increased density of this species could lead to increased predation efficiency • Although the impacts are restricted to the reach, the effects of increased predation upon the species could have long-term impacts. • There are uncertainties relating to the presence of this species with the impacted reach.	National	Medium	Moderate

Fish

The likely impacts arising from the hydrological changes as a result of the implementation of the drought option are identified in , with drought option impacts on the physical environment summarised in **Appendix A**. The overall confidence in the data and subsequent assessment for brown trout and bullhead has been classed as medium due to the number of surveys and the age of the most recent surveys.

Table B4.108 Impacts on NERC and notable fish species in Hebble Brook 1

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Brown trout	• The risk to siltation of spawning gravels is considered minor. • Reduced flow and wetted width could result in exposure/loss of important habitats (spawning gravels, nursery habitat, resting pools). • Reduced flow during downstream and upstream migration of brown trout and movement from spawning to nursery areas could be impeded due to lower flows. As flows could be reduced at any time of the year, all life stage are considered to be at risk.	National	Medium	Moderate

³⁶ English Nature, the Environment Agency and the 1998 Wildlife Conservation Research Unit Water vole Conservation Handbook. George Street Press Ltd.

³⁷ Strachan, R. and Moorhouse, T. (2006) Water Vole Conservation Handbook. 2nd Edition. Wildlife Conservation Research Unit, Oxford.

NERC/ notable Receptor	Impact	Ecological Value of Receptor	Impact Magnitude	Significance of Impact
Bullhead	- Increased stress and competition could result in decreased growth, morphological change and/or alteration to feeding and migration - Stranding of individuals is likely as risk to longitudinal connectivity is major. - Increased mortality (density dependant) as a result of increased predation. - It is noted that depth of water is not critical to bullhead¹⁷.	Regional	Low	Minor

B4.28.1.2WFD receptors

The implementation of the drought option is predicted to result in significant changes to the physical environment within Hebble Brook 1, a 12.4 km stretch of Hebble Brook from the outflow of Ogden Reservoir to the confluence with the River Calder. This includes:

- A major reduction in river flows (up to 67%) for up to six months, potentially occurring at any time of year
- Moderate to major risks to river habitats, particularly to longitudinal connectivity due to weirs and culverts
- A moderate risk to water quality due to temporary pressures downstream of three listed CSOs during rainfall events
- No flow-depleted reaches or significant abstractions identified within the reach
- One significant flow addition from a wastewater discharge

These changes (see Appendix A) affect a large proportion of WFD water body GB104027062780 – Hebble Brook from Source to River Calder, and all three classification sites fall within the affected reach. As such, any impacts are highly likely to influence WFD classification outcomes.

The macroinvertebrate component of this waterbody has consistently scored Good in both Cycle 2 and Cycle 3. The fish component has shown some variation, with Poor to Moderate status reported across Cycles 2 and 3, and a Moderate status recorded most recently in Cycle 3.

Macroinvertebrates

The macroinvertebrate community in Hebble Brook 1 shows moderate to high diversity, with evidence of sensitivity to both hydraulic and water quality pressures based on WHPT NTAXA, ASPT and LIFE scores. The predicted reduction in flow is likely to reduce wetted width and depth, resulting in some loss of available habitat and a reduction in flow velocity. This may temporarily affect species reliant on faster-flowing conditions. Additionally, a moderate risk of water quality deterioration exists due to short-term, rainfall-associated pressures from three CSOs.

Although the drought option may result in substantial short-term impacts to the macroinvertebrate community, the overall risk of deterioration in WFD status is considered **moderate**. This reflects the temporary and seasonal nature of the pressure, the community's ability to recover through effective recolonisation, and the resilience demonstrated in recent monitoring data. Confidence in this assessment is high based on the number and quality of available surveys. The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.109**.

Table B4.109 Impacts on macroinvertebrate communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Reduction in species diversity due to loss of flow-sensitive taxa. - Reduction in species diversity due to loss of water quality-sensitive taxa. - Loss of marginal habitat due to decrease in wetted habitat, leading to a decrease in the abundance and distribution of species that rely on these habitats. - Reduction in species diversity and abundance resulting from decreased recruitment opportunities.	Medium	Moderate	High

Fish

All three classification sites fall within the affected section of Hebble Brook, meaning any impact from drought permit implementation is likely to influence WFD classification. The potential flow reduction of up to 67% presents a moderate risk to aquatic habitat availability and a major risk to longitudinal connectivity due to the presence of weirs and culverts. Sediment transport is also likely to be moderately affected, potentially impacting spawning gravels.

The risk of water quality deterioration is considered moderate due to potential acute pressures downstream of the three listed CSOs, particularly during storm events when ammonia levels and oxygen sags may exceed ecological thresholds.

The overall confidence in the fisheries data and subsequent assessment is medium, based on the number of surveys and the age of the most recent data.

The combined physical environment changes (river flows, river habitat and water quality) as a result of the implementation of the drought option are predicted to present a **moderate** risk to the fish component of the WFD GB104027062780 Hebble Brook from Source to River Calder (associated with Hebble Brook 1). The likely impacts arising from the hydrological changes as a result of the drought permit are identified in **Table B4.110**.

Table B4.110 Impact on fish communities

Impact	Impact Magnitude	Significance of Impact	Level of Confidence
- Delays and potential cessation of migration due to reduced flows. - Reduction in brown trout spawning and juvenile survival due to habitat loss. - Increased risk of stress and predation. - Mortality as a result of moderate risk of water quality deterioration (toxicity of ammonia and oxygen sags).	Medium	Moderate	Medium

B4.28.2 Summary of impacts

Table B4.111 summarises the outcomes of the environmental receptors assessment and includes deterioration to fish and invertebrate receptors within WFD waterbodies and significance of impacts to statutory designated sites, NERC Act Section 41 receptors and other significant receptors.

Table B4.111 Summary of impacts identified in Hebble Brook 1's environmental receptors assessment

Reach	Hebble Brook 1	
	Risk of Deterioration/Significance of Impact	Mitigation Required (Y/N)

Reach	Hebble Brook 1	
NERC and Notable Species Receptors		
<i>Potamophylax rotundipennis</i>	Minor	No
Otter	Negligible	No
Water vole	Moderate	Yes
Brown trout	Moderate	Yes
Bullhead	Minor	No
WFD Status Receptors - GB104027062780 Hebble Brook from Source to River Calder		
Fish	Moderate	Yes
Invertebrates	Major	Yes

B5 ENVIRONMENTAL RECEPTORS ASSESSMENT SUMMARY

Table B5.1 Environmental Receptors Assessment Summary of the South West Area – Upper Calder Reservoirs

River Reach	Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Associated Drought Options	Gorple Lower Reservoir	Widdop Reservoir	Gorple Lower Reservoir; Widdop Reservoir	Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Warley Moor Reservoir; Withens Clough Reservoir; Turvin Clough Prescribed Flow	Withens Clough Reservoir	Turvin Clough Prescribed Flow	Withens Clough Reservoir; Turvin Clough Prescribed Flow	Gorple Lower Reservoir; Widdop Reservoir; Walshaw Dean Lower Reservoir; Ogden Reservoir; Turvin Clough Prescribed Flow; Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Warley Moor Reservoir	Booth Wood Reservoir	Ryburn Reservoir	Ryburn Reservoir; Booth Wood Reservoir; Siltheroe Bridge Maintained Flow	Ogden Reservoir
WFD Waterbody	GB104027062840 Graining Water from Widdop Resr to Hebden Water			GB104027062 850 Alcomden Water - Walshaw Dean Resrs to Widdop	GB104027062 731 Hebden Water from Widdop Beck to R Calder	GB104027062 641 Calder from Colden Water to Ryburn Confluence	GB104027062610 Cragg Brook from Source to River Calder			GB104027062 641 Calder from Colden Water to Ryburn Confluence GB104027062 642 Calder from Ryburn Confluence to River Colne	GB104027062 770 Luddenden Brook from source to River Calder	GB104027062 520 Booth Dean Clough from Source to River Ryburn	GB104027062 540 Ryburn from Source to Booth Dean Clough	GB104027062 580 River Ryburn from Booth Dean Clough to River Calder	GB104027062 780 Hebble Brook from Source to River Calder
Statutory Designated Sites/Local Wildlife Sites															
N/A															
NERC and Notable Species Receptors															
White-clawed crayfish <i>Austropotamobius pallipe</i>	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	N/A
Otter <i>Lutra lutra</i>	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	N/A	Negligible	Negligible	Negligible
Water vole <i>Arvicola amphibious</i>	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	N/A	Moderate	Moderate	Moderate
<i>Ameletus inopinatus</i>	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Atherix ibis</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A
<i>Oulimnius troglodytes</i>	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Paraleptophlebia cincta</i>	N/A	N/A	N/A	N/A	N/A	N/A	Minor	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Potamophylax rotundipennis</i>	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor
<i>Rhyacophila septentrionis</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A
<i>Sialis nigripes</i>	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A
<i>Stictonectes lepidus</i>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A
<i>Tinodes unicolor</i>	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout <i>Salmo trutta</i>	Moderate	Moderate	Moderate	Moderate	Major	Moderate	Moderate	Major	Moderate	Moderate	Major	Moderate	Major	Major	Moderate
Bullhead <i>Cottus gobio</i>	N/A	N/A	N/A	N/A	Moderate	Minor	N/A	Moderate	Minor	Minor	N/A	N/A	N/A	Moderate	Minor
Grayling <i>Thymallus thymallus</i>	N/A	N/A	N/A	N/A	N/A	Minor	N/A	N/A	N/A	Minor	N/A	N/A	N/A	N/A	N/A
WFD Waterbody WFD Status Receptors															

River Reach	Graining Water T1	Graining Water 1	Graining Water 2	Hebden Water T1	Hebden Water 1	Calder 2	Cragg Brook T1	Cragg Brook T2	Cragg Brook 1	Calder 3	Luddenden Brook 1	Booth Dean Clough 1	Ryburn 1	Ryburn 2	Hebble Brook 1
Fish	Minor	Moderate	Moderate	Moderate	Major	Minor	Moderate	Major	Moderate	Minor	Major	Moderate	Major	Major	Moderate
Invertebrates	Minor	Moderate	Moderate	Moderate	Moderate	Minor	Moderate	Moderate	Moderate	Minor	Moderate	Moderate	Major	Major	Major

B6 MONITORING AND MITIGATION

Onset of drought, in-drought and post-drought monitoring and mitigation has been specified for all impacted reaches following identification of environmental receptors within the reaches susceptible to the drought option(s) implementation. The baseline monitoring programme to inform the susceptibility, sensitivity and assessment of environmental receptors has also been reviewed; On the assumption that otter and water vole can be potentially be present in all impact reaches, no further baseline monitoring surveys have been included for these species. Mitigation measures and protection for sensitive species such as brown trout which are screened in should provide adequate protection where required of water levels and flows to ensure that riparian species such as water vole and otter are adequately protected for the duration of the drought permits in the impacted reaches.

Walkover surveys and non-invasive techniques are the preferred method to establish the impacts of drought options and to target mitigation. Where appropriate this would be supplemented by quantitative survey during the on-set of drought and post-drought; but in the interests of avoiding further distress to the riverine ecology, not in-drought. Existing long-term monitoring of the physical environment would continue (flow gauging and water quality monitoring).

The onset of drought, in-drought and post-drought monitoring would establish the need for and appropriate type of mitigation for drought option impacts.

Full details of monitoring and mitigation requirements for all impacted reaches can be found in **Appendix A.3-1** of YWSL's Drought Plan EMP and a summary is provided in the main EAR Section 6.2.

Reach specific actions are included in **Appendix A.3-1** for significant water quality pressures related to YWSL WwTWs and other pressures:

- **Ryburn 1**, the assessment has identified the return of water abstracted by the non-consumptive fish farm abstraction will potentially exert a local water quality pressure on oxygen balance and ammonia concentration which may be exacerbated by implementation of the drought option. YWSL are investigating the status of this fish farm which may no longer be operational. The assessment will be updated when further information is available. In the interim monitoring and mitigation remains specified for this pressure
- **Ryburn 2**: the assessment has identified a significant water quality pressure in these reaches associated with Ripponden Wood WwTW.

YWSL have identified that for the period of implementation of the drought option, sewage treatment can be enhanced, reducing the water quality pressure on the impacted receptors from ammonia, and oxygen balance. Further information can be found in the YWSL WwTW optimisation plan³⁸ which provides details on enhancement for WwTW that discharge into rivers where compensation flows may be reduced under drought permit implementation.

During any future on-set of drought periods (14 weeks before drought control lines are crossed) YWSL will consult with the Environment Agency regarding any WwTWs not identified as significant water quality pressures at the time of the writing of this EAR, but which may be a cause for concern. Additional sites will be added to the priority list of sites for optimisation as required.

A 'Combined Sewer Overflows Optimisation and Maintenance for Drought Plan' has also been developed by YWSL, which identifies all significant intermittent water quality pressures identified in this EAR. During any future drought onset period YWSL will also consult with the Environment Agency and additional sites could be identified as required.

³⁸ YWSL (2025) Wastewater Treatment Works Optimisation and Maintenance for Drought Plan.

ANNEX 1 FULL FISH SURVEY COUNTS

Reach	Site ID	Site Name	Survey NGR	Year	Survey Method	Survey Strategy	Low tolerance			Medium tolerance		High tolerance			Unclassified tolerance	Brown / sea trout x rainbow trout hybrid
							Brown / sea trout	Rainbow trout	Bullhead	Grayling	Minnow	Stone loach	3-spined stickleback	Perch	Roach	
Graining Water T1	YW10020	Gorple Cottages	SD946314	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	10									
Graining Water T1	YW10020	Gorple Cottages	SD946314	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	18									
Graining Water T1	YW10020	Gorple Cottages	SD946314	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	27									
Graining Water T1	YW10020	Gorple Cottages	SD946314	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	33									
Graining Water T1	YW10020	Gorple Cottages	SD946314	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	1									
Graining Water T1	YW10020	Gorple Cottages	SD946314	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	26									
Graining Water T1	YW10021	Gorple Lower Reservoir outfall	SD945314	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	4									
Graining Water T1	YW10021	Gorple Lower Reservoir outfall	SD945314	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	5									
Graining Water T1	YW10021	Gorple Lower Reservoir outfall	SD945314	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	6									
Graining Water T1	YW10021	Gorple Lower Reservoir outfall	SD945314	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	25									
Graining Water T1	YW10021	Gorple Lower Reservoir outfall	SD945314	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	12									
Graining Water 1	28948	d/s Greave Clough	SD9456032351	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	34									
Graining Water 1	28948	d/s Greave Clough	SD9456032351	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	35									
Graining Water 1	28948	d/s Greave Clough	SD9456032351	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	38									
Graining Water 1	28950	u/s Greave Clough	SD9447232402	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	26									
Graining Water 1	28950	u/s Greave Clough	SD9447232402	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	17									
Graining Water 1	28950	u/s Greave Clough	SD9447232402	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	15									
Graining Water 1	28950	u/s Greave Clough	SD9447232402	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	25									
Graining Water 1	28950	u/s Greave Clough	SD9447232402	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	24									
Graining Water 1	28950	u/s Greave Clough	SD9447232402	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	25									
Graining Water 1	YW10019	U/S Graining Water	SD9477931543	2015	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	14									
Graining Water 1	YW10019	U/S Graining Water	SD9477931543	2016	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	19									
Graining Water 1	YW10019	U/S Graining Water	SD9477931543	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	23									
Graining Water 1	YW10019	U/S Graining Water	SD9477931543	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	29									
Graining Water 1	YW10019	U/S Graining Water	SD9477931543	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	22									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	76									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	40									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	94									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	47									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	78									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2023	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	41									
Graining Water 2	11939	Bridge d/s Reservoir	SD9579331320	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	125									
Hebden Water T1	11954	Alcomden Water (Drought Site 2)	SD9558532250	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	63									
Hebden Water T1	11954	Alcomden Water (Drought Site 2)	SD9558532250	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	36									
Hebden Water T1	11954	Alcomden Water (Drought Site 2)	SD9558532250	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	76									
Hebden Water T1	11954	Alcomden Water (Drought Site 2)	SD9558532250	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	53									
Hebden Water T1	11954	Alcomden Water (Drought Site 2)	SD9558532250	2023	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	58									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	222									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2011	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	148									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2011	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	76									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2012	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	68									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	81									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	78									

							Low tolerance			Medium tolerance		High tolerance			Unclassified tolerance	
Reach	Site ID	Site Name	Survey NGR	Year	Survey Method	Survey Strategy	Brown / sea trout	Rainbow trout	Bullhead	Grayling	Minnow	Stone loach	3-spined stickleback	Perch	Roach	Brown / sea trout x rainbow trout hybrid
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	190									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2019	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	69									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	133									
Hebden Water 1	8297	Gibsons Mill	SD9733729781	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	77									
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	36		0							
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	14		70			1				
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	75		158							
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	47		160			2				
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	49		158			11				
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2023	Electric Fishing (AC, PDC and DC)	CPUE	17		52							
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	13		53			4				
Hebden Water 1	28947	Hebden Bridge	SD9917927259	2024	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	6		50			3				
Hebden Water 1	76444	Foster Mill Bridge	SD9917727832	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	49		227							
Hebden Water 1	76444	Foster Mill Bridge	SD9917727832	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	35		52							
Calder 2	51863	Hebden Bridge Train Station	SD9952926875	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	16		102			1				
Calder 2	51863	Hebden Bridge Train Station	SD9952926875	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	19		31	1		1				
Calder 2	51863	Hebden Bridge Train Station	SD9952926875	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	9		4	1		1				
Calder 2	51863	Hebden Bridge Train Station	SD9952926875	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	19		90			6				
Calder 2	51863	Hebden Bridge Train Station	SD9952926875	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	13		185			1	9†			
Calder 2	51863	Hebden Bridge Train Station	SD9952926875	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	9		245			11				
Calder 2	YW10048	Hawks Clough	SE002264	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	6		37			1				
Calder 2	YW10048	Hawks Clough	SE002264	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	1		35			4				
Calder 2	YW10048	Hawks Clough	SE002264	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	2		4	5						
Calder 2	YW10048	Hawks Clough	SE002264	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	6		168	1		4				
Calder 2	YW10048	Hawks Clough	SE002264	2021	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	12		100							
Calder 2	YW10048	Hawks Clough	SE002264	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	72		258	2		8				
Calder 2	YW10049	Caldene Avenue	SE007263	2015	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	23		161	4		3				
Calder 2	YW10049	Caldene Avenue	SE007263	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE			12			1				
Calder 2	YW10049	Caldene Avenue	SE007263	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE			5	1						
Calder 2	YW10049	Caldene Avenue	SE007263	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	27		164	4		6				
Cragg Brook T1	36582	Withens Clough	SD9989623175	2010	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	18									
Cragg Brook T1	36582	Withens Clough	SD9989623175	2015	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	12									
Cragg Brook T1	36582	Withens Clough	SD9989623175	2016	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	4									
Cragg Brook T1	36582	Withens Clough	SD9989623175	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	3									
Cragg Brook T1	36582	Withens Clough	SD9989623175	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	1									
Cragg Brook T1	YW10034	Housing estate off Rudd Lane	SD997231	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	14									
Cragg Brook T1	YW10034	Housing estate off Rudd Lane	SD997231	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	1									
Cragg Brook T1	YW10034	Housing estate off Rudd Lane	SD997231	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	1									
Cragg Brook T1	YW10034	Housing estate off Rudd Lane	SD997231	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	4									
Cragg Brook T1	YW10034	Housing estate off Rudd Lane	SD997231	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	22									
Cragg Brook T2	YW10032	u/s confluence	SE000231	2015	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	18		15							
Cragg Brook T2	YW10032	u/s confluence	SE000231	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	13									
Cragg Brook T2	YW10032	u/s confluence	SE000231	2016	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	33		18							
Cragg Brook T2	YW10032	u/s confluence	SE000231	2017	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	13		9							
Cragg Brook T2	YW10032	u/s confluence	SE000231	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	3									
Cragg Brook T2	YW10032	u/s confluence	SE000231	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	8		11							
Cragg Brook T2	YW10032	u/s confluence	SE000231	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	1									
Cragg Brook T2	YW10032	u/s confluence	SE000231	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	40									
Cragg Brook T2	YW10031	Green bank	SE001222	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	2									
Cragg Brook T2	YW10031	Green bank	SE001222	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	5									

							Low tolerance			Medium tolerance		High tolerance			Unclassified tolerance	
Reach	Site ID	Site Name	Survey NGR	Year	Survey Method	Survey Strategy	Brown / sea trout	Rainbow trout	Bullhead	Grayling	Minnow	Stone loach	3-spined stickleback	Perch	Roach	Brown / sea trout x rainbow trout hybrid
Cragg Brook T2	YW10031	Green bank	SE001222	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	3									
Cragg Brook T2	YW10031	Green bank	SE001222	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	12									
Cragg Brook T2	YW10031	Green bank	SE001222	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	16									
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	56		28							
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	13		43							
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	43		11			3				
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	33		37			12				
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	83		305			4				
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	27		273			14				
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2023	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	148		310			16				
Cragg Brook 1	11867	Mytholmroyd	SE0115225821	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	98		97			19				
Cragg Brook 1	139	Cragg Vale Spa	SE0021923509	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	16									
Cragg Brook 1	139	Cragg Vale Spa	SE0021923509	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	54									
Cragg Brook 1	139	Cragg Vale Spa	SE0021923509	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	72									
Cragg Brook 1	140	U/S Weir Cragg Hall Wood	SE0078725141	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	18									
Cragg Brook 1	140	U/S Weir Cragg Hall Wood	SE0078725141	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	8									
Cragg Brook 1	140	U/S Weir Cragg Hall Wood	SE0078725141	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	37									
Cragg Brook 1	76443	DS Cragg Road	SE0121225870	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	49		279			8				
Calder 3	YW10050	Brearley Weir	SE028259	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	12		25			3				
Calder 3	YW10050	Brearley Weir	SE028259	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE			15			3				
Calder 3	YW10050	Brearley Weir	SE028259	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	3		22			1				
Calder 3	YW10050	Brearley Weir	SE028259	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	6		124		2	14				
Calder 3	YW10050	Brearley Weir	SE028259	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	13		120	12	10	8				
Calder 3	YW10050	Brearley Weir	SE028259	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	144		100	32	28	80	4	2		
Calder 3	YW10051	Hollins Mill Lane Weir	SE053239	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	23		7	8	7					
Calder 3	YW10051	Hollins Mill Lane Weir	SE053239	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE			2		2	2				
Calder 3	YW10051	Hollins Mill Lane Weir	SE053239	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	6		12	1		1				
Calder 3	YW10051	Hollins Mill Lane Weir	SE053239	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	18		24	4	9	8				
Calder 3	YW10051	Hollins Mill Lane Weir	SE053239	2021	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE			91		100	19	3			
Calder 3	YW10051	Hollins Mill Lane Weir	SE053239	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	68		60	10	78	42				
Calder 3	YW10052	Luddenden Foot	SE036250	2015	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	28		37	2		1	1			
Calder 3	YW10052	Luddenden Foot	SE036250	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	1		24			2	1			
Calder 3	YW10052	Luddenden Foot	SE036250	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	3		3							
Calder 3	YW10052	Luddenden Foot	SE036250	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	54		89	2		15	1			
Calder 3	YW10052	Luddenden Foot	SE036250	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	63		107	7		9	4			
Luddenden Brook 1	11927	Luddenden	SE0413126048	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	44									
Luddenden Brook 1	11927	Luddenden	SE0413126048	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	33									
Luddenden Brook 1	11927	Luddenden	SE0413126048	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	98									
Luddenden Brook 1	11927	Luddenden	SE0413126048	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	203									
Booth Cean Clough 1	11983	D/S Booth Dean Clough Res	SE0358317932	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	63									
Booth Cean Clough 1	BDC1	u/s Rishworth Mill	SE0357517899	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	21									
Booth Cean Clough 1	BDC1	u/s Rishworth Mill	SE0357517899	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	112									
Booth Cean Clough 1	BDC1	u/s Rishworth Mill	SE0357517899	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	54									
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2015	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	71									
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2016	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	31									
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2017	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	144									
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2018	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	235	6								
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	58				2					
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	266	14								

							Low tolerance			Medium tolerance		High tolerance			Unclassified tolerance	
Reach	Site ID	Site Name	Survey NGR	Year	Survey Method	Survey Strategy	Brown / sea trout	Rainbow trout	Bullhead	Grayling	Minnow	Stone loach	3-spined stickleback	Perch	Roach	Brown / sea trout x rainbow trout hybrid
Booth Cean Clough 1	BDC3	Ripponden	SE0347218795	2024	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	230									
Booth Cean Clough 1	YW10055	Works u/s	SE035185	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	30									
Booth Cean Clough 1	YW10055	Works u/s	SE035185	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	20									
Booth Cean Clough 1	YW10055	Works u/s	SE035185	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	55									
Booth Cean Clough 1	YW10055	Works u/s	SE035185	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	50									
Booth Cean Clough 1	YW10055	Works u/s	SE035185	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	28									
Booth Cean Clough 1	YW10054	Works d/s	SE035187	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	49									
Booth Cean Clough 1	YW10054	Works d/s	SE035187	2016	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	19									
Booth Cean Clough 1	YW10054	Works d/s	SE035187	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	57									
Booth Cean Clough 1	YW10054	Works d/s	SE035187	2018	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	69									
Booth Cean Clough 1	BDC2	u/s Stone Masons	SE0353118575	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	19									
Booth Cean Clough 1	BDC2	u/s Stone Masons	SE0353118575	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	52									
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2010	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	128	20								
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2011	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	80	19								
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2011	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	83	34								
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2012	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	84	4								
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2013	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	128	12								
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	51	10								
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2017	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	81	1								13
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2019	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	68	4								6
Ryburn 1	11990	Bar Lane (u/s Booth Dean Clough) (WR)	SE0326918660	2023	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	19									4
Ryburn 1	RY1	d/s weir	SE0258418630	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	38					3	1			
Ryburn 1	RY1	d/s weir	SE0258418630	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	66									
Ryburn 1	RY2	u/s Bar Lane Joiners	SE0268518639	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	42						1			
Ryburn 1	RY2	u/s Bar Lane Joiners	SE0268518639	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	84	4				1				
Ryburn 1	RY3	Bar Lane Joiners	SE0324218646	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	18	5								
Ryburn 1	RY3	Bar Lane Joiners	SE0324218646	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	52	2							1	
Ryburn 2	11856	Lee Mill Ind Est	SE0547822945	2012	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	65									
Ryburn 2	11856	Lee Mill Ind Est	SE0547822945	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	25		238			6				
Ryburn 2	11956	Ripponden (Hodgsons Chemicals)	SE0380719497	2012	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	172									
Ryburn 2	11956	Ripponden (Hodgsons Chemicals)	SE0380719497	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	103						4			
Ryburn 2	11956	Ripponden (Hodgsons Chemicals)	SE0380719497	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	63									
Ryburn 2	11956	Ripponden (Hodgsons Chemicals)	SE0380719497	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	142									
Ryburn 2	29623	kebroyd	SE0450021100	2012	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	103	1								
Ryburn 2	29623	kebroyd	SE0450021100	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	172					2	1			
Ryburn 2	29623	kebroyd	SE0450021100	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	101					2	1			
Ryburn 2	29623	kebroyd	SE0450021100	2023	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	108					1	2			
Ryburn 2	RY4	d/s Booth Dean Clough	SE0349018843	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	8	1								
Ryburn 2	RY4	d/s Booth Dean Clough	SE0349018843	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	32	2								
Ryburn 2	RY5	Silk Mill	SE0363019185	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	26									
Ryburn 2	RY5	Silk Mill	SE0363019185	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	86	3								
Hebble Brook 1	34545	SalterHebble	SE0981822897	2010	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	3		99†			9†				
Hebble Brook 1	34545	SalterHebble	SE0981822897	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	3		10			14				
Hebble Brook 1	34545	SalterHebble	SE0981822897	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	1		93		7	18				
Hebble Brook 1	34545	SalterHebble	SE0981822897	2022	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE			99†			9†				
Hebble Brook 1	34545	SalterHebble	SE0981822897	2023	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	20		133			17				
Hebble Brook 1	34543	Larch Close	SE0705126603	2015	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	19		38							
Hebble Brook 1	34543	Larch Close	SE0705126603	2020	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	9		44							
Hebble Brook 1	34543	Larch Close	SE0705126603	2021	Electric Fishing (AC, PDC and DC)	SINGLE CATCH SAMPLE	54		23							
Hebble Brook 1	34543	Larch Close	SE0705126603	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	25		23							

							Low tolerance			Medium tolerance		High tolerance			Unclassified tolerance	
Reach	Site ID	Site Name	Survey NGR	Year	Survey Method	Survey Strategy	Brown / sea trout	Rainbow trout	Bullhead	Grayling	Minnow	Stone loach	3-spined stickleback	Perch	Roach	Brown / sea trout x rainbow trout hybrid
Hebble Brook 1	75823	Bottoms Bridge	SE0997323203	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	51		77							
Hebble Brook 1	75823	Bottoms Bridge	SE0997323203	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	15		999†			9†				
Hebble Brook 1	11984	Halifax Golf Club (Drought Site 12) (WR)	SE0646530123	2021	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	73									
Hebble Brook 1	11984	Halifax Golf Club (Drought Site 12) (WR)	SE0646530123	2022	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	54		1							
Hebble Brook 1	11984	Halifax Golf Club (Drought Site 12) (WR)	SE0646530123	2023	Electric Fishing (AC, PDC and DC)	CATCH DEPLETION SAMPLE	14									

† Values represents the estimated observed abundance for the completed survey, ranging from 0-9,10-99,100-999, 1000+



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