APPENDIX A – PHYSICAL ENVIRONMENT

A1 INTRODUCTION

This appendix assesses the potential impacts on the physical environment of the catchment surrounding the River Wharfe at Lobwood during the period of implementation of the associated drought option.

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 Methodology[1].

This appendix is set out in the following sections:

Section A.2 Drought option

Section A.3 Study area

Section A.4 Physical environment effects – this includes:

1. Introduction
2. Setting
3. River flow regime
4. River habitat
5. River water quality
6. Summary of potential changes in the physical environment as a result of the drought option.

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

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

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

A2 DROUGHT OPTIONS

A2.1 RIVER WHARFE DROUGHT PERMIT

YWSL is currently operating within the terms and conditions of the licence agreement held with the Environment Agency under licence number 2/27/19/129/R01 (the Lobwood Licence). YWSL is also permitted to abstract water from the River Wharfe at Arthington, West Yorkshire under abstraction licence number 2/27/20/196/R01 (the Arthington Licence). The licence conditions for the abstraction at Arthington also impose an obligation for YWSL to support abstractions from Lobwood and/or Arthington with releases from Grimwith Reservoir. This clause will be amended in the Arthington Licence for the duration of the drought permit, if granted.

Currently, YWSL is authorised to abstract water from the River Wharfe at Lobwood for supply to customers under the terms stated in the abstraction licence. YWSL are permitted to abstract a maximum of 5,060 cubic metres per hour, 93,200 cubic metres per day and 27,392,000 cubic metres per year, at an instantaneous rate not exceeding 1,406 litres per second.

The daily abstraction limit varies depending on flow conditions (bands) in the River Wharfe and upstream releases from Grimwith Reservoir. Under the conditions of the Lobwood Licence, during periods of low flow in the River Wharfe, YWSL are required to support abstraction at Lobwood by releasing water from Grimwith Reservoir. When river flows are above 389 megalitres per day (Ml/d) (Bands A and B in the licence), YWSL do not have to provide any support. When river flows are between 252 and 389 Ml/d (Band C in the licence), YWSL are permitted to abstract the volume of water being released from Grimwith Reservoir plus an additional 6.8 Ml/d. When river flows are below 252 Ml/d (Band D in the licence), YWSL are permitted to abstract the volume of water being released from Grimwith Reservoir less 22.7 Ml/d, up to a maximum of 88.6 Ml/d.

The drought option is to reduce the required Grimwith Reservoir support in the lowest flow band from 22.7Ml/d more than abstraction, to an amount equal to abstraction. This protects reservoir stocks at Grimwith, allowing storage to be maximised during a drought.

Under the terms of an impoundment licence (NE/027/0019/011) issued by the Environment Agency, YWSL must release flow from Grimwith Reservoir to compensate the downstream water course, the River Dibb, a tributary to the River Wharfe. The required volume of flow is dependent on seasonal variations and are by flow trial agreement, with 15.1Ml/d being released between 1st November and 19th April (winter), 7.8Ml/d between 20th April and 10th May and 12th October and 31st October (spring and autumn) and 3.8 Ml/d between 11th May and 11th October (summer). These discharges occur in combination with the existing regulation releases which supports abstraction and the compensation flow can form part of the abstracted flow at Lobwood subject to the other licence conditions.

These conditions are set out in **Table A2.1**.

Table A2.1 River Wharfe at Lobwood drought permit description

Abstraction Water Source	NGR	Normal Abstraction Ml/d[2]	Proposed Drought Option Abstraction Ml/d	Benefit Ml/d
Wharfe	SE075519	88.6Ml/d may be abstracted from the River Wharfe at Lobwood subject to the following conditions: • When flow in the Wharfe (measured at Addingham downstream) is less than 252Ml/d YWSL must release the amount abstracted from the Wharfe at Lobwood (and at Arthington[3]) plus an additional 22.7Ml/d • When flow in the Wharfe (measured at Addingham downstream) is between 252Ml/d and 389Ml/d YWSL must release the amount abstracted from the Wharfe at Lobwood less 6.8Ml/d • When flow in the Wharfe (measured at Addingham downstream) is between 389Ml/d and 488Ml/d YWSL may abstract up to 88.6Ml/d (Grimwith releases not required) • When flow in the Wharfe (measured at Addingham downstream) is above 488Ml/d YWSL may abstract up to 93.2Ml/d (Grimwith releases not required)	88.6Ml/d may be abstracted from the River Wharfe at Lobwood subject to the following conditions: • When flow in the Wharfe (measured at Addingham downstream) is less than 252Ml/d YWSL must release the amount abstracted from the Wharfe at Lobwood (and at Arthington) (decrease in release of 22.7Ml/d) • When flow in the Wharfe (measured at Addingham downstream) is between 252Ml/d and 389Ml/d YWSL must release the amount abstracted from the Wharfe at Lobwood less 6.8Ml/d (NO CHANGE) • When flow in the Wharfe (measured at Addingham downstream) is between 389Ml/d and 488Ml/d YWSL may abstract up to 88.6Ml/d (Grimwith releases not required) (NO CHANGE) • When flow in the Wharfe (measured at Addingham downstream) is above 488Ml/d YWSL may abstract up to 93.2Ml/d (Grimwith releases not required) (NO CHANGE)	Up to 22.70 (when flows are less than 252Ml/d)

2 1Ml/d is 1 million litres per day

3 When flow at Addingham gauge is lower than 252Ml/d, YWSL must also release from Grimwith Reservoir at least what they intend to abstract from Arthington (location of abstraction is indicated on Figure 4.1 in the main EAR). They may abstract up to 25Ml/d from Arthington when flow at Addingham is less than 488Ml/d.

A3 STUDY AREA

The zone of influence associated with the drought option is defined through hydrological effects. Within the overall zone of influence, the reach is defined on a hydrological basis. YWSL's Drought Plan 2027 Environmental Assessment Methodology[4] sets out this approach in detail in Section 3.4. The zone of influence for assessment of impacts is set out in **Section A3.1** below. Information on the likely timing of the drought option is set out in **Section A3.2** below.

A3.1 ZONE OF INFLUENCE OF THE DROUGHT OPTIONS

The hydrological impact of the drought option was considered as part of the screening exercise. This determined what the timing, magnitude, zone of influence, nature of change and duration of the drought option would be. **Table A3.1** provides details of these reaches, and the reaches are illustrated in main EAR **Figures 4.1**-**4.2** and in a schematic below in **Figure A3.1**.

Figure A3.1 River Wharfe at Lobwood schematic

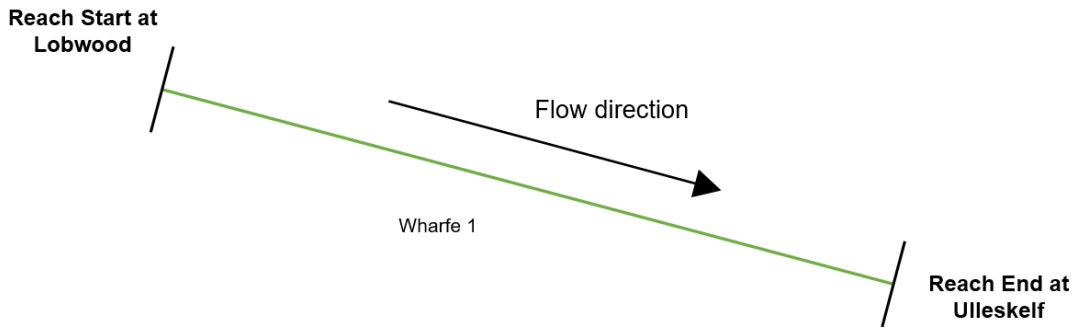

Table A3.1 Wharfe at Lobwood reach details

Reach name	Watercourse name	Reach start	Reach end	Downstream reach	Drought option: Wharfe at Lobwood
Wharfe 1	River Wharfe	Lobwood	Ulleskelf	N/A	✓

The study area starts downstream of YWSLs Lobwood abstraction intake. Drought permit conditions would lead to reduction in the releases from Grimwith Reservoir in periods where regulation releases were being made to support the abstraction at the Lobwood intake. This would lead to flows in the River Dibb and River Wharfe being reduced in these river regulation periods. At times without river regulation, the flows in the River Dibb and River Wharfe (between the River Dibb and the Lobwood intake) would

4 Ricardo Energy & Environment (2025). Yorkshire Water Drought Plan 2027. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. March 2025.

be lower, but unaffected by the drought option. Therefore, drought permit flows upstream of the Lobwood intake will remain within the range of managed flows from normal operation.

The end of each study area has been defined previously as the normal tidal limit at Ulleskelf. The tidal River Wharfe flows into the tidal River Ouse, which with the tidal River Trent forms the River Humber and ultimately the Humber Estuary, which is designated as SSSI/SAC/SPA and Ramsar Site. A 10% reduction in freshwater low flows (annual Q95) into the River Ouse from the River Wharfe (as would be likely considering the 10% reductions identified in Section A4.2.3 as occurring mid-reach) is within the WFD standards[5] for main river freshwater inflows into transitional waterbodies such as that of the Humber Estuary. Assessment of the impacts of drought option implementation on the integrity of the Humber Estuary SAC/SPA concluded that there would be no significant effect of implementing one or all of the drought permits on relevant features of the Humber Estuary SAC/SPA, i.e. there would be no adverse effect on the integrity of the interest features for which the Humber Estuary SAC/SPA is designated[6].

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 Methodology[7], 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.

A3.3 CUMULATIVE REACHES WITH OTHER EARS

The hydrological impacts of the simultaneous deployment of the Wharfe at Lobwood abstraction drought option and the Lindley Wood drought option on flows in the River Wharfe from the confluence with the River Washburn to the tidal limit are outlined below.

The River Washburn, which Lindley Wood Reservoir spills into, joins the River Wharfe approximately halfway down the Wharfe 1 reach. On the River Wharfe downstream of the River Washburn confluence the summer Q95 is 205.1 Ml/d and the summer Q99 is 155.7 Ml/d. As a result of the cumulative impact between the Wharfe at Lobwood and Lindley Wood reservoir drought permits there would be a 17.0% and 22.4% reduction in these statistics, respectively. This remains a **moderate** hydrological impact which is the same impact as the Wharfe at Lobwood is assessed at for this reach in summer conditions (see **Section A4.2.3**).

Year round Q95 and year round Q50 statistics at the River Wharfe downstream of the River Washburn confluence are 233.9 Ml/d and 894.9 Ml/d, respectively. There would be no cumulative impact between the Lindley Wood and Wharfe at Lobwood drought permits at year round Q50 conditions due to the Wharfe at Lobwood permit not applying to flows >252 Ml/d at the Addingham gauge. A 14.9% reduction in year round Q95 flows would be observed. This hydrological impact is assessed as **minor** for the cumulative impact on this reach which is consistent with the hydrological impact on the reach associated with the Wharfe at Lobwood license alone.

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5 Entec (2007) Water Resource Standards for Freshwater Flows to Transitional Waterbodies *WFD 83* Table 7.5. The lower Wharfe is moderate ecological potential (note it is a heavily modified waterbody) All larger transitional water bodies for example the Thames, Severn and Humber fall into the low sensitivity category. Therefore, the appropriate proposed standard for main river inflows at low flow (<Q95) is a 50% change in flow. This is used for indication purposes only, as this has not been adopted by DEFRA.

6 Scott Wilson (2011). Yorkshire Water Drought Plan: Assessment of Possible Impact on Humber Estuary SPA/SAC. Final Report Revision 2 February 2011. Report for Yorkshire Water.

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

There is no change between the hydrological impacts associated with the cumulative impacts of the Wharfe at Lobwood and Lindley Wood drought permits and the hydrological impacts associated with the Wharfe at Lobwood permit alone. Thus, additional cumulative assessment is not required.

As the hydrological impact of the Wharfe Annual drought permit is considered negligible, it can be concluded that it's inclusion as a drought option would not increase the hydrological impacts beyond those already identified in other option assessments.

Furthermore, the potential cumulative flow reduction from these drought options into the Humber Estuary would remain within the WFD standards[8] for main river freshwater inflows into transitional waterbodies such as that of the Humber Estuary.

[8] Entec (2007) Water Resource Standards for Freshwater Flows to Transitional Waterbodies *WFD 83* Table 7.5. The lower Wharfe is moderate ecological potential (note it is a heavily modified waterbody) All larger transitional water bodies for example the Thames, Severn and Humber fall into the low sensitivity category. Therefore, the appropriate proposed standard for main river inflows at low flow (<Q95) is a 50% change in flow. This is used for indication purposes only, as this has not been adopted by DEFRA.

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 habitat (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 the zone of influence is then provided.

YWSL's Drought Plan 2027 Environmental Assessment Methodology[9] provides details of the approach in Section 3.5. The approach has been developed to ensure compliance with the Environment Agency's March 2025 (DPG2025)[10] This also includes an updated draft of the supplementary guidance on the environmental assessment for water company drought planning.

A4.2 WHARFE 1

A4.2.1 Reach introduction

A summary of physical environment information for Wharfe 1 is provided in **Figure A4.1**. The reach includes part of the following river waterbodies:

- River Wharfe from Barben Beck/ River Dibb to Hundwith Beck (GB104027064257)
- River Wharfe from Hundwith Beck to River Washburn (GB104027064258)
- River Wharfe from River Washburn to Collingham Beck (GB104027064254)
- River Wharfe from Collingham Beck to Tadcaster Weir (GB104027064255)
- River Wharfe from Tadcaster Weir to River Ouse (GB104027064256).

A4.2.2 Reach setting

Wharfe 1, located on main EAR **Figure 4.1,** comprises a 68.4 km stretch of the River Wharfe. The reach has an additional catchment area of 497 km^2 along its length.

A4.2.3 River flow regime

Flows on the Wharfe 1 reach are measured at Addingham gauging station, a short distance downstream of YWSLs abstraction intake. In order to achieve a representative baseline series, the gauged data for 1990-2023 was adapted to remove the influences from the drought permit conditions in August-November 1995. Additionally, the series was adjusted to account for the current compensation regime at Grimwith Reservoir which has been in place since 2015. As such, whenever the measured YWSL flow at Grimwith Reservoir outflow was less than the current (variable) compensation flow, the difference in flow was identified and that flow added on to the Addingham gauged data on the same date to provide the reference condition dataset.

At low flows below 252 Ml/d the combined drought option flow reduction on this reach is 22.7 Ml/d. This represents flow reductions of 14.9% and 18.0% in the summer Q95 and Q99 flow statistics of 152.1 Ml/d

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

10 Environment Agency (2024) Water company drought plan guideline. Final, March 2025..

and 126.1 Ml/d respectively and would therefore be assessed as a **moderate** hydrological impact on this reach during the summer months of April to September inclusive.

During the winter months, the year round Q95 flow statistic of 167.6 Ml/d is also affected by a flow reduction of 22.7 Ml/d. This equates to a flow reduction of 13.5%. At the year round Q50 flow statistic of 575.2 Ml/d at the Addingham gauge, no regulation releases are required and, therefore, there would be no flow reduction under this drought permit at Q50 flows (or above). A reduction of 13.5% in the year round Q95 flow statistic, combined with no change to the year round Q50 flow statistic, would be assessed as a **minor** hydrological impact during the winter months of October to March inclusive. There is high confidence in this hydrological assessment with the assessment being derived from gauged data with no flow transposition required.

An additional mid-reach assessment point has been included downstream of the River Washburn. When assessed alone, the Wharfe at Lobwood drought permit would lead to a reduction of 22.7 Ml/d in summer Q95 and Q99 flows of 11.1% and 14.6% respectively. This would still remain a **moderate** hydrological impact in the summer.

As above, the Wharfe at Lobwood drought permit would lead to a 22.7 Ml/d reduction in year round Q95 flows of 233.9 Ml/d which equates to a 9.7% reduction. There would be no impact on year round Q50 flows of 759.0 Ml/d as a result of the Wharfe at Lobwood drought permit. This combined with a 10.0% reduction in year round Q95 flows equates to the hydrological impact for the winter reduced to **negligible**.

There are two significant flow pressures influencing flow in Wharfe 1, one non-consumptive abstraction for energy production, with a peak daily licensed abstraction rate of 864 Ml/d without a hands-off-flow condition ('River Wharfe – Burley in Wharfedale') with potential flow impacts, however it is understood that the hydroelectric plant is not able to operate during low flow periods. There is one further abstraction for paper and printing, 'River Wharfe – Pool in Wharfedale' with a maximum daily rate of 14.4 Ml/d. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

A4.2.4 River habitats

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

Wharfe 1 is sinuous reach surrounded by extensive floodplains. The reach falls ~91m over 71.6 km, a slope of ~0.07°, and channel width generally varies between 30-40m (with the greatest widths usually observed upstream and downstream of weirs). It is notable that the channel width is significantly narrower around, and downstream of, Tadcaster with widths between 21-26m due to extensive levees around the channel and resectioning. Tree cover varies from none to continuous due to the length of the reach though, on average, cover varies between isolated to semi-continuous Extant aerial imagery shows a wide array of in-channel features with 26 mid channel bars (17 of which are vegetated), 61 side bars (14 of which are vegetated) and 26 point bars (5 of which are vegetated). A total of 9 islands have also been identified, with several located downstream of weirs. There are four RHS sites in the upper ~20 km of the reach, RHS site ID 26875, 20407, 25062, and 21472. The data from these surveys observed 10 pools, nine riffles as well as one unvegetated point bar at site 25062. The surveys also noted no channel realignment, over deepening or impoundment of the channel, apart from at RHS site 26875 where it was noted that <33% of the channel had been artificially ponded. In the middle section of the reach, there are three RHS sites, site ID 7982, 23932 and 258. The data from these surveys observed no pools, and two riffles as well as two unvegetated point bars at RHS site 258. The lower section of the reach, there are a further three more RHS sites, site ID 7984, 25063 and 4331. The data from these surveys observed two pools, and five riffles as well as two unvegetated point bars. The surveys also noted no channel realignment, over deepening or impoundment of the channel, apart from at RHS site 4331 where it was noted that >33% of the channel had been artificially ponded. The presence of sediment bar features throughout the reach suggest particle sizes of pebble and cobble and greater; this is confirmed by RHS Sites 7982 and 23932. The presence of boulders protruding through the flow surface is common, particularly in the upper to mid sections of the reach. Exposed bedrock and boulders were noted at one mid reach RHS site (20407). Two small deltas were identified in the river around Ilkley in the mid sections of the reach. These were both situated at the mouth of

tributary channels. Within-channel features decrease in number as distance downstream increases. At least 119 areas of broken flow have been identified in the reach which are likely caused by riffles, supported by RHS data from site 7982 which indicates rippled flow is dominant in this RHS reach. The remainder of the channel surface indicates smooth flow. There is likely to be a wide range of flow types, e.g. upwelling, unbroken and broken standing waves etc., throughout the reach given the features present as confirmed by RHS site 20407.

Bank erosion is extensive throughout much of the reach, many of the banks showing numerous failure zones and areas of poaching (e.g. site 20407). Due to the nature of failure and the vegetation present, banks are apparently composed of earth and data for the upper, mid and lower RHS sites confirm this. RHS site 33479 showed significant variation in bank material and bedrock, brick, cobble and earth was observed. At the mid sites, 7982 and 20407 steep banks (>45°) and vertical banks with toe are extensive on both sides. At the lower site steep banks (>45°) and composite banks are present along with some reinforced toe and poaching on the right bank. Bank vegetation types were variable at the RHS sites. At the upper site, left banks were predominantly simple vegetation and right banks were a mixture of simple and complex vegetation. At site 7982, left bank vegetation was mostly simple while the right bank was composed wholly of uniform vegetation. Left bank top vegetation ranged from predominantly simple, uniform and complex at upper, mid and lower RHS sites respectively. Right bank top vegetation was predominantly complex at the upper RHS site and uniform at the mid and lower RHS sites.

The surrounding land-use throughout the reach is a mixture of improved grassland, rough pasture, tilled, broadleaf woodland and suburban/urban development. Tilled land is increasingly dominant from the mid reaches to the end of the reach. RHS data is generally in agreement but tall herbs and rank vegetation were noted at the upper and lower sites and tall herbs, scrub and shrubs at the mid site.

The reach supports geomorphological features typical of a lowland watercourse, with a shallow valley slope and extensive floodplain connectivity. As is typical in watercourses of this type, low energy environments are present, as indicated by the extensive presence of depositional features, and high energy environments, as indicated by the extensive bank erosion, which provide different habitat opportunities. The presence of marginal silt deposits is likely to occur in this watercourse, with sediment provided by the bank erosion, providing suitable habitat opportunities for fine-lined pea mussel and juvenile lamprey. The decrease in depositional features downstream suggests the presence of marginal silts may be limited to the upper parts of the reach. The soft earth banks are suitable for the creation of burrows by white-clawed crayfish, water vole and otter and the presence of reinforcement may provide additional habitat opportunities for white-clawed crayfish and otter. The complex and simple vegetation structures within the riparian corridor suggest that there is sufficient cover and food source for water voles.

There is potential for spawning habitat to be present, with the potential presence of riffles identified and suitable substrate likely to be present in discrete patches. Cover for juvenile and adult fish and white-clawed crayfish is available from the larger substrate types, extensive vertical banks and presence of flow deflectors in the watercourse. The varied presence of trees in the riparian habitat will also provide some cover for fish, refuge opportunities for otter and white-clawed crayfish and an input of allochthonous energy. There are a number of extensive woodlands within the reach that could support breeding otter. The presence of 15 weirs in the reach may have impacts upon the migration/movement of fish and sediment.

The drought options reduction in flow could lead to several potential impacts along the Wharfe 1:

- Minor, short-duration risk of changes in the energy of the system associated with up to 18% reduction in flow for the duration of drought option.
- 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 duration of drought option.
- Potentially moderate risk of change in available aquatic habitat (flow velocity reduction and depth reduction) for duration of drought option, with retention of pool riffle sequences.
- Minor risk to longitudinal connectivity.

- 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. Coarse sediment dynamics are unlikely to be affected.

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

A4.2.5 River water quality

The fifth most downstream water quality monitoring location in the reach has been used due to its data quality: Wharfe at Denton Bridge, Ben Rhydding (NE-49700247). This has been selected due to its superior data quality. There are six frequently operating CSOs which potentially present an environmental risk in the reach. A summary description of the potential risks to water quality in the Wharfe 1 as a result of drought options is presented in **Table A4.1**.

Further, there is one designated inland bathing water site on this reach: Wharfe at Cromwheel, Ilkley. At this site, sampling has classified the bathing water as Poor quality and advice against swimming has been in place since it's designation in 2021. The implementation of the Wharfe at Lobwood Drought Permit would not lead to further risks to the status of this inland bathing water.

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

	Total ammonia	Oxygen	Phosphate
General quality	Ammonia concentrations were consistent with High (0.2 mg/l) WFD status throughout the monitoring period	Dissolved oxygen saturation (%) values were consistent with High WFD status (80%) throughout the monitoring period	Orthophosphate concentrations were mostly consistent with High (0.031 mg/l) and Good (0.061 mg/l) WFD status, however, when samples are taken under flow conditions below Q80, these samples have recorded Moderate (0.158 mg/l) WFD status.
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 option associated with CSO discharge.	Moderate risk from drought option associated with CSO discharge	Moderate risk from drought option

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

An overall summary of potential changes in the physical environment of the Wharfe 1 as a result of drought option is presented in **Table A4.2**.

Table A4.2 Summary of potential changes in the physical environment of Wharfe 1 as a result of drought option

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
River flows *Moderate impacts (summer/autumn)* *Minor impacts (winter)*	• Short duration reductions of up to 18% in river flows in summer and dry autumn conditions, reducing along the length of the reach.
Flow depleted reaches *None*	• There are no flow depleted reaches within Wharfe 1.
River habitats *Moderate risk*	• The moderate reduction in flow will change the energy of the system with the potential for moderate risk to total wetted aquatic habitat and available habitat for different species. Risk to longitudinal connectivity and sediment dynamics is assessed as minor.
Water quality *Moderate risk*	• SRP quality is not consistent with Good status with moderate flow sensitivity, therefore a moderate risk to water quality has been assessed associated with change in dilution of diffuse pollution pressures to SRP. • Risk of short term acute, infrequent, temporary water quality pressures locally downstream of six listed CSO during rainfall events. • Reported water quality is consistent with High status for dissolved oxygen and ammonia with no apparent flow sensitivity. • No continuous water quality pressures have been identified.

Insert Figure A4.1

ANNEX 1 – REGULATED ABSTRACTIONS IN THE WHARFE 1 REACH

DP reach	Licence No.	Use Description	NGR 1	Max Annual Quantity (m^3)	Max Daily Quantity (m^3)	Significant Flow Pressure
Wharfe 1	2/27/19/206/R01	Electricity Production	SE1655047390	315000000	864000	Yes
Wharfe 1	2/27/20/038	General Agriculture	SE45194562 SE45994562 SE45424594 SE45974606 SE46644584	27277	681.82	No
Wharfe 1	2/27/20/096	General Agriculture	SE365461	30000	286.41	No
Wharfe 1	2/27/20/151	Paper and Printing	SE236455	4318790	14398	Yes
Wharfe 1	2/27/20/183	General Agriculture	SE427470	4546	227.3	No
Wharfe 1	2/27/20/191	General Agriculture	SE315462	20480	512	No
Wharfe 1	2/27/20/195	General Agriculture	SE42304662 SE43224576	19000	227	No
Wharfe 1	2/27/20/313/R01	General Agriculture	SE36004582 SE37174622	8000	918	No
Wharfe 1	2/27/20/314/R01	General Agriculture	SE3200046300	6100	206	No
Wharfe 1	NE/027/0020/025	General Agriculture	SE3930046240	12000	411	No
Wharfe 1	NE/027/0020/002/R01	Electricity Production	SE2333245552	N/A	N/A	No
Wharfe 1	NE/027/0020/026	Other Environmental Improvements	SE4216747295	N/A	N/A	No

ANNEX 2 – WATER QUALITY PRESSURES CONSIDERED IN THE ASSESSMENT

Name	Permit Reference	Outfall NGR	Significant Water Quality Pressure	Intermittent/ Continuous
Hardisty's Farm	2108	SE1450048100	No	Continuous
Pool Paper Mill	1	SE2373045540	No	Continuous
Wheatley Lane	27/19/0042	SE1370048120	No	Continuous
Ben Rhydding (Ilkley) WPC Works, St	27/19/0044	SE1447047480	No	Continuous
Ilkley STW	27/19/0045	SE1254048390	No	Continuous
Otley STW	27/20/0046	SE2227346324	No	Continuous
Wetherby STW	27/20/0054	SE4180747052	No	Continuous
Samuel Smith Old Brewery	27/20/0055	SE4875043300	No	Continuous
High Mills	27/20/0061	SE2402045490	No	Continuous
Thorp Arch STW	27/20/0068	SE4511045760	No	Continuous
Pool WPC Works	27/20/0069	SE2621045540	No	Continuous
Tadcaster WPC Works	27/20/0073	SE4957042710	No	Continuous
Langwith Valley SPS	27/20/0083	SE3732045940	No	Continuous
Britannia CSO	27/20/0114	SE4884043370	No	Continuous
Private	27/20/0127	SE3615046070	No	Continuous
Kearby STW	27/20/0128	SE3287046740	No	Continuous
Weeton STW	27/20/0129	SE2966046120	No	Continuous
Sso 250 Metres Downstream	3166(SS)	SE1170048000	No	Continuous
High Mill (Addingham)	C4186	SE0820050100	No	Continuous
Stac Polly	C4239	SE3820046400	No	Continuous
Burley/Menston (Sheffield) STW	E164	SE1860045900	No	Continuous
Otley Sailing Club	EPRCP3828XV	SE1863945756	No	Continuous
Hadfield Farm Barns & Farm House	QC.27/19/0027	SE1050048400	No	Continuous
A Residential Development	QC.27/20/0012	SE3120046100	No	Continuous
Esscroft	QR.27/19/0032	SE1530047250	No	Continuous
Esscroft Cottage	QR.27/19/0033	SE1530147250	No	Continuous
The Woodhall Hotel	QR.27/20/0022	SE3711046600	No	Continuous
Otley Angling Club Silver Mill	WA6080	SE1880045400	No	Continuous
Newton Kyme Hall	WA6243	SE4660045100	No	Continuous
Tadcaster Weir SSO	WADC615	SE4855043650	No	Continuous
Ilkley Road	WADC640	SE1963945309	No	Continuous
Bridge Street SSO	WADC757	SE2017545770	No	Continuous
Wetherby High Street CSO	1553	SE4043048052	No	Intermittent
Wyvil Crescent CSO	27/19/0019	SE1354748017	No	Intermittent
Low Mill Lane 179 CSO	27/19/0092	SE0871049560	No	Intermittent
Kirkby Wharfe/CSO	27/20/0065	SE50734099	No	Intermittent
Warren Lane Otley/CSO	27/20/0079	SE26214498	No	Intermittent
West Busk Lane No 2 CSO	27/20/0101	SE1883645012	No	Intermittent
Arthington Lane CSO	27/20/0130	SE2480045330	No	Intermittent
Wattle Syke CSO	27/20/0161	SE3944046420	No	Intermittent
Boston Spa High St/CSO	C4576	SE4324645665	No	Intermittent
Wheatley Lane CSO, Ben Rhydding Il	QC.27/19/0018	SE1360048120	No	Intermittent
Leeds Road Ilkley No2 CSO	QC.27/19/0024	SE1286848142	No	Intermittent

Name	Permit Reference	Outfall NGR	Significant Water Quality Pressure	Intermittent/ Continuous
Scott Lane CSO	WADC1313	SE4030248075	No	Intermittent
Wetherby Bypass CSO	WADC1477	SE4064947691	No	Intermittent
Crook Farm CSO	WADC861	SE2522445342	No	Intermittent
Burley Lodge CSO	WRA6863	SE1713846121	No	Intermittent
Ebor Way/CSO	WA 5855	SE4407045290	Yes	Intermittent
Tadcaster West CSO	27/20/0112	SE4884843374	Yes	Intermittent
Tadcaster East (Britannia Inn) CSO	27/20/0113	SE4877043450	Yes	Intermittent
Wyvill Road CSO	QC.27/19/0025	SE1340248106	Yes	Intermittent
Billams Hill/CSO	WADC717	SE2009945880	Yes	Intermittent
Rivadale View CSO	3166(SS)	SE1192448068	Yes	Intermittent

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