A57 Link Roads
TR010034
6.5 Appendices
Appendix 13.1 Water Environment Data and Assessments

APFP Regulation 5(2)(a)

Planning Act 2008 Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

June 2021

Table of Contents

Chapter Pages

Tables

1. Water Quality Data

1.1 Environment Agency sample data

1.1.1 Table 1-1 provides a summary of the data used to inform the baseline assessment for water quality.

Table 1-1 Water quality sample purpose, count and date range

Watercourse	EA sampling ID	EA sample purpose	Sample count	Oldest sample date	Newest sample date
WC_100 (River Etherow)	NW-88001841	Environmental Monitoring Statutory (EU Directives)	1349	20/01/2010	12/02/2020
		Monitoring (National Agency Policy)	36	23/07/2018	21/09/2018
		Planned Investigation (Local Monitoring)	55	03/09/2010	01/02/2011
		Planned Investigation (National Agency Policy)	16	07/05/2010	07/05/2010
WC_100 (River Etherow)	NW-88001826	Environmental Monitoring Statutory (EU Directives)	1087	20/01/2010	12/02/2020
		Monitoring (National Agency Policy)	48	13/07/2018	24/09/2018
		Planned Investigation (National Agency Policy)	16	07/05/2010	07/05/2010
		Statutory Failures (Follow ups at designated points)	683	22/01/2010	04/12/2012
WC_100 (River Etherow)	NW-88001836	Planned Investigation (Local Monitoring)	77	05/08/2010	01/02/2011
WC_400 (Glossop Brook)	NW-88001834	Environmental Monitoring Statutory (EU Directives)	1099	20/01/2010	12/03/2020
		Planned Investigation (Local Monitoring)	60	03/09/2010	01/02/2011
WC_500 (Hollingsworth Brook)	NW-88023190	Statutory Failures (Follow ups at designated points)	335	08/03/2013	26/11/2014
WC_100 (River Etherow)	NW-88001818	Environmental Monitoring Statutory (EU Directives)	1716	20/01/2010	07/01/2020
		Monitoring (National Agency Policy)	153	21/03/2014	12/03/2020
		Planned Investigation (Local Monitoring)	60	03/09/2010	01/02/2011
		Planned Investigation (National Agency Policy)	16	07/05/2010	07/05/2010
		Statutory Failures (Follow ups at designated points)	38	20/07/2011	26/11/2014

1.1.2 A summary of physico-chemical standards used to inform the water quality baseline assessment is provided in Table 1-2.

Table 1-2 Physico-chemical standards

Standard	Units	Statistic to test (as stated in WFD)	WFD category	NW-88001841	NW-88001826	NW-88001836	NW-88001834	NW-88023190	NW-88001818
				Etherow @ Railway Viaduct @ Broadbottom	Etherow Above Confl With Glossop Brk	Etherow Below Confl With Glossop Brk	Glossop Brook Above Conf With Etherow	Hollingworth Bk @ Millsbrook Bridge	River Etherow Below Bottoms Reservoir
				WC_100 (River Etherow)	WC_100 (River Etherow)	WC_100 (River Etherow)	WC_400 (Glossop Brook)	WC_500 (Hollingworth Brook)	WC_100 (River Etherow)
Altitude	m.a.s.l	N/A	N/A	136	118	120	119	140	130
Alkalinity	mg/l	N/A	N/A	31	18	22	31	45	11
Type	N/A	N/A	N/A	2	2	2	2	2	2
Pref	N/A	N/A	N/A	8.1	6.8	7.4	8.7	9.4	5.2
Reactive phosphorus	µg/l	Mean	High	14.4	12.4	13.3	15.4	16.6	9.7
			Good	31.1	27.2	29.0	32.9	35.0	22.0
			Moderate	94.5	85.3	89.6	98.5	103	72.5
			Poor	780	748	763	794	810	699
Dissolved oxygen, saturation	%	10th percentile	High	80	80	80	80	80	80
			Good	75	75	75	75	75	75
			Moderate	64	64	64	64	64	64
			Poor	50	50	50	50	50	50
BOD	mg/l	90th percentile	High	3	3	3	3	3	3
			Good	4	4	4	4	4	4
			Moderate	6	6	6	6	6	6
			Poor	7.5	7.5	7.5	7.5	7.5	7.5

Standard	Units	Statistic to test (as stated in WFD)	WFD category	NW-88001841	NW-88001826	NW-88001836	NW-88001834	NW-88023190	NW-88001818
				Etherow @ Railway Viaduct @ Broadbottom	Etherow Above Confl With Glossop Brk	Etherow Below Confl With Glossop Brk	Glossop Brook Above Conf With Etherow	Hollingworth Bk @ Millsbrook Bridge	River Etherow Below Bottoms Reservoir
				WC_100 (River Etherow)	WC_100 (River Etherow)	WC_100 (River Etherow)	WC_400 (Glossop Brook)	WC_500 (Hollingworth Brook)	WC_100 (River Etherow)
pH		5th & 95th percentile	High	>=6 to <=9	>=6 to <=9	>=6 to <=9	>=6 to <=9	>=6 to <=9	>=6 to <=9
			Good	>=6 to <=9	>=6 to <=9	>=6 to <=9	>=6 to <=9	>=6 to <=9	>=6 to <=9
			Moderate	4.7	4.7	4.7	4.7	4.7	4.7
			Poor	4.2	4.2	4.2	4.2	4.2	4.2
Temperature (Salmonid standards based on Brown Trout being present in River Etherow)	°C	98th percentile	High	20	20	20	20	20	20
			Good	23	23	23	23	23	23
			Moderate	28	28	28	28	28	28
			Poor	30	30	30	30	30	30
Ammonia	mg/l	90th percentile	High	0.2	0.2	0.2	0.2	0.2	0.2
			Good	0.3	0.3	0.3	0.3	0.3	0.3
			Moderate	0.75	0.75	0.75	0.75	0.75	0.75
			Poor	1.1	1.1	1.1	1.1	1.1	1.1

2. Groundwater Levels

2.1.1 A summary of available groundwater level data used to inform the groundwater baseline assessment is provided in Table 2-1.

Table 2-1 Summary of available groundwater level data

Observation borehole	Start monitoring period	End monitoring period	Maximum observed water level (m AOD)	Minimum observed water level (m AOD)	Average observed water level (m AOD)
Obs3	15/12/1994	15/06/2007	194.65	192.44	194.03
Obs7	15/12/1994	15/06/2007	196.5	193.87	194.79
Obs8	15/02/1995	15/06/2007	192.26	190.79	191.83
Obs10	15/12/1994	15/06/2007	198.47	197.66	198.15
Obs13	15/11/1994	15/06/2007	197.18	189.63	196.34
Obs16	15/11/1994	15/06/2007	193.25	186.84	192.74
Obs17	15/11/1994	15/06/2007	192.75	188.3	192.32
Obs18	15/11/1994	15/08/2007	191.88	190.69	191.11
Obs24	15/11/1994	15/08/2007	190.89	181.97	187.29
Obs27	15/11/1994	15/06/2004	199.92	198.29	199.45
Obs29	15/06/2002	15/06/2005	205.1	204.42	204.68
Obs33	15/11/1994	15/07/2007	209.7	208.6	209.09
Obs42	15/01/1995	15/08/2007	209.01	207.84	208.1
Obs43a	15/09/1995	15/07/2007	212.77	188.99	195.06
Obs44	15/11/2005	15/05/2007	212.28	212.06	212.14
Obs48	15/02/1995	15/04/2004	208.34	205.75	207.7
Obs49	15/02/1995	15/06/2007	210.54	206.27	208.5
Obs54	15/02/1995	15/06/2007	208.3	205.38	207.55
Obs59	15/12/1994	15/06/2007	207.67	203	206.65
Obs60	15/11/1994	15/08/2007	210.14	207.21	209.09
Obs61	15/11/1994	15/08/2007	215.86	211.77	214.06
Obs62	15/11/1994	15/07/2007	209.99	204.72	207.05
Obs63	15/12/1994	15/07/2007	207.37	204.42	206.56
Obs65	15/11/1994	15/08/2007	211.41	205.08	207.74
Obs68	15/11/1994	15/06/2007	207.65	202.53	206.37
Obs69	15/11/1994	15/08/2007	207.97	202.65	206.23
Obs76-1	15/01/1995	15/05/2004	206.66	197.86	201.2
Obs80	15/11/1994	15/11/2004	205.93	198.45	203.05
Obs82	15/11/1994	15/02/1995	209.7	208.4	208.8

Observation borehole	Start monitoring period	End monitoring period	Maximum observed water level (m AOD)	Minimum observed water level (m AOD)	Average observed water level (m AOD)
Obs92	15/02/1995	15/08/2007	208.59	201.97	204.59
Obs94	15/01/1995	15/08/2007	225.46	216.92	222.67
Obs101	15/02/1995	15/06/2007	171.6	168.89	170.63
Obs102	15/01/1995	15/06/2007	164.75	159.93	162.55
Obs104	15/01/1995	15/04/2007	160.62	156.02	157.9
Obs105	15/01/1995	15/06/2007	159.91	156.88	158.71
Obs106	15/02/1995	15/06/2007	158.19	156.18	157.09
Obs109	15/12/1994	15/11/1995	157.4	156.57	157.1
Obs110	15/01/1995	15/11/1995	163.76	162.93	163.31
Obs111	15/12/1994	15/02/2002	163.51	156.02	160.61
Obs115	15/12/1994	15/08/2007	179.07	175.48	176.73
Obs116	15/01/1995	15/06/2007	179.73	174.46	178.26
Obs118-1	15/01/1995	15/08/2007	174.6	170.76	174.05
Obs119	15/11/1995	15/06/2007	170.77	164.83	168.39
Obs122	15/12/1994	15/02/2007	173.63	160.4	168.29
Obs125	15/11/1994	15/06/2007	181.84	181.12	181.39
Obs135	15/11/1994	15/08/2007	195.36	191.91	194.89
Obs140	15/01/1995	15/06/2007	217.3	214.5	215.53
Obs142	15/11/2004	15/11/2004	219.78	219.78	219.78
Obs150-1a	15/11/1994	15/06/2007	194.56	192.72	194.09
Obs151	15/08/2000	15/03/2003	182.42	182.02	182.11
Obs155	15/01/1995	15/07/2007	168.43	164.91	167.78
Obs156	15/01/1995	15/08/2007	164.18	157.86	163.61
BH401	17/04/2018	25/07/2018	204.12	196.05	202.56
BH403	17/04/2018	25/07/2018	215.81	212.44	215.05
BH404	17/04/2018	25/07/2018	206.08	203.61	205.46
BH406	17/04/2018	25/07/2018	200.75	193.97	195.71
BH413	06/06/2018	06/06/2018	196.6	196.6	196.6
BH414	10/05/2018	25/07/2018	196.73	196.73	196.73
BH418	14/03/2018	25/07/2018	197.29	195.55	196.98
BH421	17/04/2018	25/07/2018	185.12	181.36	184.39
BH422	12/04/2018	05/07/2018	164.87	152.55	158.5

3. HEWRAT Assessment

3.1 Introduction

3.1.1 The Scheme proposes six new surface water outfalls at five receptors, Table 3-1, within the study area. Details of these discharges are provided in the following sections. In order to understand the impacts to receptors, a water quality assessment has been undertaken using the Highways England Water Risk Assessment Tool (HEWRAT).

3.1.2 The HEWRAT assessment includes the following assessment methods:

- Effects of routine runoff on surface waters
  - Sequential Metal – Bioavailability Assessment Tool (M-BAT) test
- Pollution impacts from accidental spillages.

3.1.3 A groundwater assessment may also be required the Q95 is less than 0.001m^3/s, and this is included within the HEWRAT tool.

3.2 HEWRAT Assessment

Study Area and discharge assessments

3.2.1 Figure 13-5 shows the drainage catchments and outfalls proposed for this Scheme. Details of these catchments are provided in Table 3-1.

Table 3-1 Drainage catchment and outfall summary

Catchment	Outfall location (NGR and receiving watercourse)	Impermeable Area (Ha)	Permeable Area (Ha)	Road Length Drained (m)
Catchment 1	SJ 98622 95422 Hurstclough Brook	2.264	1.544	680
Catchment 2	SJ 99900 95693 WC_200	4.33	3.742	1070
Catchment 3	SK 00818 95465 WC_130	2.426	2.569	1230
Catchment 3a	SK 00914 95553 River Etherow	0.069	0.220	0[1]
Catchment 4	SK 01035 95481 River Etherow	0.428	0.031	230
Catchment 5	SK 00193 95563 WC_150	0.156	0.257	176

Table notes: 1 – A small network to the west of the Etherow comprising a public footpath that drains for 250m

3.2.2 Assessments have been undertaken as per the methodology within the Design Manual for Roads and Bridges (DMRB) LA 113 Road drainage and the water environment[1] and the Highways England HEWRAT V2.0 Help Guide[2]. Following

[1] DMRB LA 113 Road drainage and the water environment March 2020 (formerly HD 45/09)
[2] http://www.haddms.com/publicdownloads/Downloads.aspx

this standard and guidance the following assessments, as summarised by Table 3-2, have been undertaken.

Table 3-2 Assessment summary

Assessment	Receiving Watercourse	Catchments	Notes
1	Hurstclough Brook	1	
2	Tara Brook	2	
3	River Etherow	3-5	Cumulative impact undertaken due WC_130[3] and WC_140 being identified as drainage ditches and assessment to be undertaken on main river (River Etherow). Outfalls to WC_130 and WC_140 also included for groundwater assessment due to connectivity in catchment indicative of expected losses to groundwater

HEWRAT input data

3.2.3 To determine Q95, the annual Q95 at River Etherow, Compstall[4], taken from the National Rivers Flow Archive (NRFA) has been scaled (based on catchment areas) as presented in Table 3-3.

3.2.4 Data used to undertake the routine surface water assessment is presented in Table 3-4 to

[3] See Chapter 13 – Section 13.4 Road drainage and water environment chapter (Chapter 13) of the ES (application document TR010034/APP/6.3) for numbering system used for unnamed watercourses within the Study Area.
[4] NRFA (accessed February 2021) https://nrfa.ceh.ac.uk/data/station/info/69015

3.2.6 Table 3-6 for each assessment outlined in Table 3-2.

3.2.7 Environment Agency data as described within Section 13.7 of the Road drainage and water environment chapter (Chapter 13) of the ES (TR010034/APP/6.3) has been used to determine background concentrations of dissolved copper and zinc.

Table 3-3 Catchment Area Scaling

Assessment	Input Value	Approximate catchment area (km2)	Percentage of Etherow catchment	Scaled Q95 (m3/s)
Etherow at Compstall	River Etherow	156	100%	0.812
Assessment 1	Hurstclough Brook	0.9	0.58%	0.005
Assessment 2	Tara Brook	0.3	0.19%	0.002
Assessment 3	River Etherow	1.27	0.81%	0.007

Table 3-4 HEWRAT input data – Assessment 1

Parameter	Input Value	Notes
Road Number	A57	
Assessment type	Non-cumulative	Single outfall to Hurstclough Brook
OS grid reference of assessment point	X = 398622.3 Y = 395422.0	
OS grid reference of outfall point	X = 398622.3 Y = 395422.0	
Outfall number	1	
Receiving Watercourse	Hurstclough Brook	
EA receiving water Detailed River Network ID	Left Blank	Not identified
Date of assessment	23/02/2021	
Notes	Catchment data used as provided by John Grayston email (29/01/2021)[5]	
List of outfalls in cumulative assessment	N/A	
Assessor and affiliation	R Surdevan	
Version of assessment	2.04	
Step 1 - Runoff quality		
AADT	>10,000 and <50,000	As per AADT data in Appendix 2.1 of the ES (TR010034/APP/6.5)

[5] J Grayston Email (29th January 2021)

Parameter	Input Value	Notes
Climatic Region	Colder wet	Manchester
Rainfall site	Warrington	Most local site
River Impacts		
Annual Q95	0.005	As per Table 3-3
Impermeable road area drained (Ha)	2.264	Data received from drainage design team (29/01/2021)[5]
Permeable area draining to outfall (Ha)	1.544	Data received from drainage design team (29/01/2021) [5]
BFI	0.5	Default value used in absence of data
Bioavailable dissolved copper	1	Default value
Bioavailable dissolved zinc	10.9	Default value
Is discharge in or within 1km upstream of a protected site for conservation	No	As per baseline desk study
Ambient background concentration (for copper only)	1.8	No data available for Hurstclough Brook, available data within study area averages 1.8ug/l).
Water hardness (for zinc)	Low	No data available for Hurstclough Brook, available data within study area averages.
Step 2 - Sediment impact		
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	No	As per baseline desk study
Tier 1		
River width	1	Assumed value based on hydromorphology descriptions provided in Table 3-17, Section 13.7 within the Road drainage and water environment chapter (Chapter 13) of the ES (TR010034/APP/6.3).
Step 3 - Mitigation		
Existing measures	-	New discharge
Proposed measures	Detention pond with sediment forebay, catchpits throughout catchment	Data received from drainage design team (29/01/2021)[5]
Existing treatment for solubles	-	New discharge
Existing attenuation	-	New discharge

Parameter	Input Value	Notes
Existing settlement of sediment	-	New discharge
Proposed treatment for soluble	50	As per CG 501 Design of highway drainage systems (Table 8.6.4N3)[6]
Proposed attenuation	No restriction	
Proposed settlement of sediment	90	As per CG 501 Design of highway drainage systems (Table 8.6.4N3)[6]

Table 3-5 HEWRAT input data – Assessment 2

Parameter	Input Value	Notes
Road Number	A57	
Assessment type	Non-cumulative	Single outfall to Tara Brook
OS grid reference of assessment point	X = 399900.2 Y = 395693.8	
OS grid reference of outfall point	X = 399900.2 Y = 395693.8	
Outfall number	1	
Receiving Watercourse	Tara Brook WC_200	
EA receiving water Detailed River Network ID	-	
Date of assessment	23/02/2021	
Notes	Catchment data used as provided by John Grayston email (29/01/2021)[5]	
List of outfalls in cumulative assessment	N/A	
Assessor and affiliation	R Surdevan	
Version of assessment	2.04	
Step 1 - Runoff quality		
AADT	>10,000 and <50,000	As per February 2021 ADDT data
Climatic Region	Colder wet	Manchester
Rainfall site	Warrington	Most local site
River Impacts		
Annual Q95	0.002	As per Table 1-7

[6] CG 501 Design of highway drainage systems, version 2, March 2020 (formally HD33/16, TA 80/99), DRMB, Highways England (https://www.thenbs.com/PublicationIndex/documents/details?DocID=327979)

Parameter	Input Value	Notes
Impermeable road area drained (Ha)	4.333	Data received from drainage design team (29/01/2021)[5]
Permeable area draining to outfall (Ha)	3.742	Data received from drainage design team (29/01/2021)[5]
BFI	0.5	Default value used in absence of data
Bioavailable dissolved copper	1	Default value
Bioavailable dissolved zinc	10.9	Default value
Is discharge in or within 1km upstream of a protected site for conservation	No	As per baseline desk study
Ambient background concentration (for copper only)	1.8	No data available for Tara Brook, available data within study area averages 1.8ug/l).
Water hardness (for zinc)	Low	No data available for Tara Brook, available data within study area averages.
Step 2 - Sediment impact		
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	No	
Tier 1		
River width	1	Assumed value based on hydromorphology descriptions provided in Table 13-17 Section 13.7 within the Road drainage and water environment chapter (Chapter 13) of the ES (TR010034/APP/6.3).
Step 3 - Mitigation		
Existing measures	-	New discharge
Proposed measures	Detention pond with sediment forebay, catchpits throughout catchment. Grassed channel to outfall	Data received from drainage design team (29/01/2021)[5]
Existing treatment for soluble	-	New discharge
Existing attenuation	-	New discharge
Existing settlement of sediment	-	New discharge

Parameter	Input Value	Notes
Proposed treatment for soluble	50	As per CG 501 Design of highway drainage systems (Table 8.6.4N3)[6]
Proposed attenuation	No restriction	
Proposed settlement of sediment	90	As per CG 501 Design of highway drainage systems (Table 8.6.4N3)[6]

Table 3-6 HEWRAT input data – Assessment 3

Parameter	Input Value	Notes
Road Number	A57	
Assessment type	Cumulative	Outfall 3 discharges to WC_130 which discharges to River Etherow Outfall 4 discharges to River Etherow Outfall 5 discharges to WC_140[3] which discharges to River Etherow
OS grid reference of assessment point	X = 400380 Y = 394420	Assessment for outfalls 3 and 5 should be for Main watercourse and so assessment point is downstream of confluence with WC_150[3]
OS grid reference of outfall point	Outfall 3 X = 400818.1 Y = 395465.5 Outfall 4 X = 401035.6 Y = 395481.8 Outfall 5 X = 400193.8 Y = 395563.1\	
Outfall number	1	
Receiving Watercourse	WC_130	
EA receiving water Detailed River Network ID	-	
Date of assessment	23/02/2021	
Notes	Catchment data used as provided by John Grayston email (29/01/2021)[5]	
List of outfalls in cumulative assessment	N/A	
Assessor and affiliation	R Surdevan	
Version of assessment	2.04	
Step 1 - Runoff quality		
AADT	>10,000 and <50,000	As per AADT data in Appendix 2.1 of the ES (TR010034/APP/6.5)
Climatic Region	Colder wet	Manchester
Rainfall site	Warrington	Most local site
River Impacts		

Parameter	Input Value	Notes
Annual Q95	0.007	As per Table 1.7
Impermeable road area drained (Ha)	2.426	Data received from drainage design team (29/01/2021)[5]
Permeable area draining to outfall (Ha)	2.569	Data received from drainage design team (29/01/2021)[5]
BFI	0.5	Default value used in absence of data
Bioavailable dissolved copper	1	Default value
Bioavailable dissolved zinc	10.9	Default value
Is discharge in or within 1km upstream of a protected site for conservation	No	As per baseline desk study
Ambient background concentration (for copper only)	2.07	Sampling point d/s of Glossop Brook closest to discharge point
Water hardness (for zinc)	Low	Available River Etherow data ranges between 18-27mg/l
Step 2 - Sediment impact		
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	No	As per baseline desk study
Tier 1		
River width	1	Assumed value based on hydromorphology descriptions provided in Table 13-17, Section 13.7 within the Road drainage and water environment chapter (Chapter 13) of the ES (TR010034/APP/6.3).
Step 3 - Mitigation		
Existing measures	-	New discharge
Proposed measures	Detention pond, catchpits, grassed ditches, filter drains	Data received from drainage design team (29/01/2021)[5]
Existing treatment for solubles	-	New discharge
Existing attenuation	-	New discharge
Existing settlement of sediment	-	New discharge
Proposed treatment for soluble	15	As per CG 501 Design of highway drainage systems (Table 8.6.4N3)[6]
Proposed attenuation	No restriction	

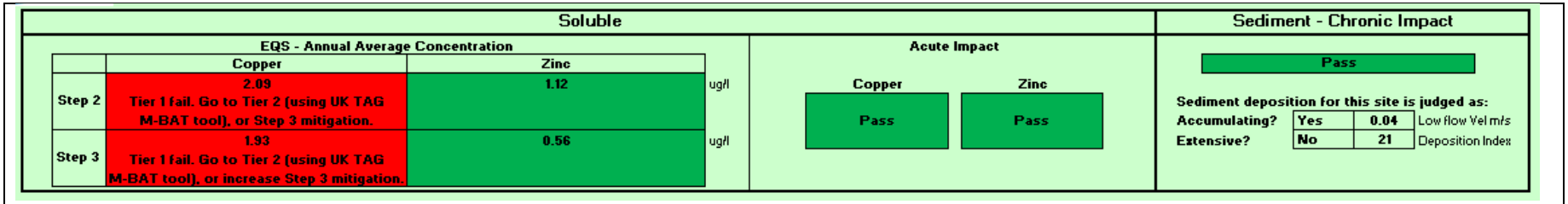
Parameter	Input Value	Notes
Proposed settlement of sediment	63	As per CG 501 Design of highway drainage systems (Table 8.6.4N3)[6]

3.3 Results

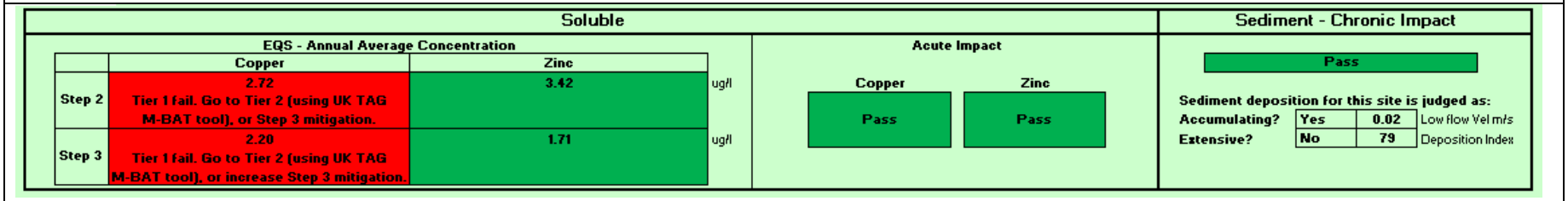
3.3.1 Results from the Tier 1 assessment, which application of mitigation measures are presented as screenshots from HEWRAT are presented in Table 3-7. These results indicate that all catchment outfalls, receptors fail to meet copper Environmental Quality Standards (EQS), whereas zinc concentrations are met at all receptors. In terms of acute impacts and chronic impacts from sediments, the test passes for all assessments.

3.3.2 Where failures have been identified, further tests are required, and these are presented in the following sections.

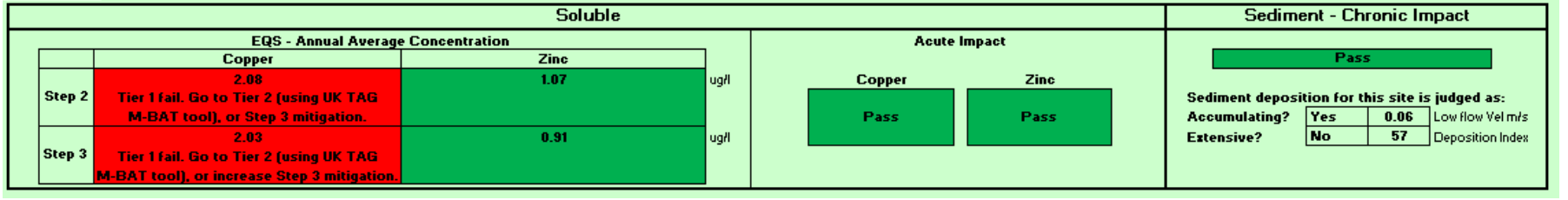
Table 3-7 HEWRAT Results



a) Assessment 1



b) Assessment 2



c) Assessment 3

3.4 Sequential Input data –M-BAT assessment

3.4.1 Following the results of the initial assessment, further sequential tests were required for all assessments for water quality, using UKTAG M-BAT and a Tier 2 sediment impact assessment. Input data for these tests are presented in Table 3-8. Data from the River Etherow (upstream of Glossop Brook) was used to undertake the assessment for all catchments/ outfalls due to a lack of data for other receptors. This approach follows guidance within the M-BAT for where data is unavailable.

Table 3-8 M-BAT data (screenshot)

INPUT DATA										
ID	Location	Waterbody	Date	Measured Cu Concentration (dissolved) (µg l^{-1})	Measured Zn Concentration (dissolved) (µg l^{-1})	Measured Mn Concentration (dissolved) (µg l^{-1})	Measured Ni Concentration (dissolved) (µg l^{-1})	pH	DOC	Ca
1	Mottram	River Etherow	0802/2021	1.67	9.78			7.5	5.57	7.16

M-BAT Results

3.4.2 Results from M-BAT are presented in Table 3.9 (as a screenshot from M-BAT) and indicate low risk (risk characterisation ratio <1) from both copper and zinc.

Table 3.9 M-BAT results

RESULTS (Copper)				RESULTS (Zinc)			
Site-specific PNEC Dissolved Copper (µg l^{-1})	BioF	Bioavailable Copper Concentration (µg l^{-1})	Risk Characterisation Ratio	Site-specific PNEC Dissolved Zinc (µg l^{-1})	BioF	Bioavailable Zinc Concentration (µg l^{-1})	Risk Characterisation Ratio
24.03	0.04	0.07	0.07	27.26	0.40	3.91	0.36

Spillage Assessment

3.4.3 Input data and results of the HEWRAT spillage assessment are provided in Table 3-10. Results indicate low risk of impacts on water receptors from spillage.

Table 3-10 HEWRAT spillage assessment

	Catchment 1	Catchment 2	Catchment 3	Catchment 4	Catchment 5
Water body type	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse
Length of road draining to outfall (m)	680	1,070	1,230	230	176
Road Type (A-road or Motorway)	A	A	A	A	A
If A road, is site urban or rural?	Rural	Rural	Rural	Rural	Rural
Junction type	Roundabout	Roundabout	Roundabout	Roundabout	Roundabout
Location (response time for emergency services)	<20 Mins	<20 Mins	<20 Mins	<20 Mins	<20 Mins
Traffic flow (AADT two way)	30,495	39,330	20,917	20,917	20,917
% HGV	9	7	5	5	5
Spillage factor (no/109HGVkm/year)	3.09	3.09	3.09	3.09	3.09
Risk of accidental spillage	0.00210	0.00332	0.00145	0.00027	0.00021
Probability factor	0.45	0.45	0.45	0.45	0.45
Risk of pollution incident	0.00095	0.00150	0.00065	0.00012	0.00009
Is risk greater than 0.01?	**No**	**No**	**No**	**No**	**No**
Return period without pollution reduction measures	0.00095	0.00150	0.00065	0.00012	0.00009
Existing measures factor	1	1	1	1	1
Return period with existing pollution reduction measures	0.00095	0.00150	0.00065	0.00012	0.00009
Proposed measures factor	1	1	1	1	1
Residual with proposed Pollution reduction measures	0.00095	0.00150	0.00065	0.00012	0.00009

3.5 Groundwater Assessment

3.5.1 Due to the connectivity within the study area, receptors for outfalls at catchments 3 and 5 may result in loses to groundwater. Therefore, it was considered beneficial to undertake a groundwater risk assessment. The assessment, and results are presented in Table 3-11.

3.5.2 Results from this assessment indicate a medium risk to groundwater and therefore warrant a detailed groundwater assessment.

Table 3-11 Groundwater Assessment

Component Number		Weighting Factor	Property or Parameter	Risk Score	Component score	Weighted component score
1	SOURCE	10	Traffic flow	<=50,000 AADT	1	10
2		10	Rainfall depth (annual averages)	>740 to <1060 mm rainfall	2	20
3		10	Drainage area ratio	>50 to <150	2	20
4	PATHWAY	15	Infiltration method	"Continuous", shallow linear (e.g. unlined ditch, swale, grassed channel)	1	15
5		20	Unsaturated zone	Depth to water table <=5 m	3	60
6		20	Flow type (Incorporates flow type an effective grain size)	Mixed fracture and intergranular flow (e.g. consolidated deposits or unconsolidated deposits of medium – coarse sand)	2	40
7		5	Unsaturated Zone Clay Content	>=15% clay minerals	1	5
8		5	Organic Carbon	<15% to >1% SOM	2	10
9		5	Unsaturated zone soil pH	pH <8 to >5	2	10

TOTAL SCORE	**190**
RISK SCREENING LEVEL	**0**

Detailed Groundwater Assessment

3.5.3 Based on the 'medium risk' assigned to groundwater quality posed by the disposal of routine road runoff in the simple groundwater assessment, a more rigorous assessment of the potential impacts has been conducted, as per DMRB LA 113. This has been completed through the development of a conceptual hydrogeological model and the identification of viable Potential Pollutant Linkages (PPLs). A PPL exists when a plausible pathway is present between a potential source of contamination and a receptor.

Receptors

3.5.4 A receptor is something that could be adversely affected by a contaminant. In the context of this groundwater assessment, this will be groundwater contained within superficial or bedrock aquifers. The potential receptors that could be impacted from the identified sources are:

- Groundwater within the superficial geological deposits, predominantly consisting of glacial till with some underlying glaciofluvial deposits at the eastern end of the Scheme.
- Groundwater within bedrock geology, which consists of the Marsden Formation (mudstone and siltstone) and Fletcher Bank Grit Formation (sandstone).

3.5.5 The superficial glaciofluvial deposits and the bedrock deposits have been categorised as Secondary A aquifers, which are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers. These are generally aquifers formerly classified as minor aquifers.

3.5.6 The superficial glacial till deposits have been categorized as Secondary Undifferentiated, which are strata that have not been possible to attribute to either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

3.5.7 The Environment Agency, for the purpose of protecting groundwater resources, has defined Source Protection Zones (SPZs) for groundwater sources in the UK that are used for the supply of public drinking water. There are three categories of SPZs:

- Inner zone (Zone 1) – Defined as the 50-day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres
- Outer zone (Zone 2) – Defined by a 400-day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstractions
- Total catchment (Zone 3) – Defined as the total recharge area around a source.

3.5.8 A review of the Environment Agency data[7] has identified that there are no source protection zones within the Development Consent Order (DCO) boundary[8]. This signifies that there are no important groundwater abstractions from the aquifers in the vicinity of the Scheme.

Sources

3.5.9 Sources are substances which have the potential to cause harm or to cause pollution of the water environment. The source in this case is any contamination present in routine road runoff. A broad range of potential pollutants, such as hydrocarbons (i.e. fuel and lubricants, fuel additives) metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These materials can be washed off the road during rainfall events potentially polluting the groundwater if a viable migration pathway from the carriageway to groundwater exists.

Pathways

3.5.10 Pathways are one or more routes through which a receptor might be affected by a source. The identified pathways present are:

- infiltration of surface water runoff into superficial aquifers
- infiltration of surface water runoff and then vertical migration into bedrock aquifers.

Groundwater discussion

3.5.11 The hydraulic conductivity of the geology underlying the Scheme will determine the time it takes for the contaminants to reach the groundwater receptors and also the attenuation potential of the unsaturated zone. The superficial deposits have hydraulic conductivity values within the range of zero (i.e. no flow) to 0.019 metres per day (m/d), and the bedrock geology has hydraulic conductivity values within the range of zero to 0.063 m/d[9]. These values are considered low and are reflected in Groundwater Vulnerability Mapping within the Highways Agency Drainage Data Management System (HADDMS) that identifies areas with glacial till deposits as ‘minor aquifer with low groundwater vulnerability’ and areas with glaciofluvial deposits as ‘minor aquifer with high groundwater vulnerability’. The status of these aquifers as ‘minor’ refers to their potential for water supply and the ‘vulnerability’ status relates to the potential for pollutant discharge at ground level to reach groundwater.

3.5.12 NRFA data was used to calculate annual Q95 low flows of <0.001 m^3/s from these outflow locations, indicating that runoff will be intermittent throughout the year and that there will not be a continuous supply of potentially polluted surface water runoff into the outflow locations.

3.5.13 The identified PPL have been assessed in Table 3-12.

[7] DEFRA, Magic Map, https://magic.defra.gov.uk/home.htm [Accessed 19/02/2021]
[8] The DCO boundary incorporates land required temporarily and permanently for the construction, operation and maintenance of the Scheme.
[9] Hyder Consulting, 2007. A57/A628 Mottram Tintwistle Bypass and A628/A616 Route Restraint Measures. A Geotechnical Report on the Assessment of Potential Settlement due to Tunnel Construction.

Table 3-12 Conceptual groundwater model

Potential sources	Potential pathways	Potential Receptors	Consequence	Probability	Risk category
Routine runoff	Infiltration	Superficial glacial till aquifer	Low	Unlikely	**Very low risk** – receptor is considered a minor aquifer with low hydraulic conductivity
		Superficial glaciofluvial aquifer	Low	Moderate	**Low risk** – receptor is considered minor aquifer
	Infiltration followed by vertical migration	Bedrock aquifer	Low	Unlikely	**Very low risk** – receptor is considered minor aquifer. Overlying glacial tills with low hydraulic conductivity reduce the likelihood of pollutants migrating to aquifer

3.6 Summary

3.6.1 The simple groundwater assessment (Section 3.5) generated a Moderate Risk and required a more rigorous assessment of the potential impacts. This detailed groundwater assessment reviewed the potential sources, pathways, and receptors at the Scheme and indicated that the Moderate Risk presented in the initial groundwater evaluation was overly conservative. Considering the following lines of evidence, it is unlikely that potential pollution within the routine runoff would represent a significant risk to the identified groundwater receptor:

- Superficial and bedrock aquifers are considered minor with low groundwater abstraction potential
- Low outflows indicate that discharge of surface water to groundwater will be intermittent
- Superficial deposits with low hydraulic conductivity are widespread across the site, reducing the likelihood that pollution within surface water runoff will migrate to deeper aquifers.

4. Conclusions

4.1 Results

4.1.1 HEWRAT has been used in accordance with the DMRB LA 113 standard and associated methodology. The results of the assessment are summarised for water courses receiving drainage outfalls in Table 4-1. The results indicate low risk to all receiving water receptors from highways drainage.

Table 4-1 Receptor impact summary

Receptor	Impact summary/ Potential risk
Hurstclough Brook	Routine runoff: Copper fail, all other tests pass M- BAT test – copper and zinc pass Spillage test – low risk Risk to water quality- Low
Tara Brook	Routine runoff: Copper fail, all other tests pass M- BAT test – copper and zinc pass Spillage test – low risk Risk to water quality- Low
River Etherow	Routine runoff: Copper fail, all other tests pass M- BAT test – copper and zinc pass Spillage test – low risk Risk to water quality- Low
Groundwater	Medium risk from outfalls at WC_130 and WC_140 Detailed assessment indicates low risk to deeper aquifers

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