

M54 to M6 Link Road TR010054 Volume 6 6.3 Environmental Statement Appendices Appendix 13.3 Assessment of Routine Road Runoff and Accidental Spillage Risk (HEWRAT)

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## Infrastructure Planning

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# M54 to M6 Link Road

Development Consent Order 202[]

## 6.3 Environmental Statement Appendices Appendix 13.3 Assessment of Routine Road Runoff and Accidental Spillage Risk (HEWRAT)

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# 1 Introduction

## 1.1 Background to the report

- 1.1.1 Highways England are developing a link road between the M54 and M6 to provide a link between Junction 1 of the M54, M6 North and the A460 to Cannock. The M54 to M6 Link Road (herein referred to as 'the Scheme') aims to reduce congestion on local / regional routes, particularly the A449 and A460, and deliver improved transport links to encourage the development of the surrounding area. This Appendix has been prepared to support the impact assessment provided in Chapter 13: Road Drainage and the Water Environment of the Environmental Statement (ES) [TR010054/APP/6.1]). Please also refer to Figure 13.1 [TR010054/APP/6.2] of the ES throughout.
- 1.1.2 The report presents a summary of the water quality assessment undertaken to assess the impacts of routine runoff and accidental spillage risk to surface watercourses and groundwater as a result of the Scheme.

## 1.2 Approach

- 1.2.1 This assessment of routine runoff has been undertaken using the Highways England Water Risk Assessment Tool (HEWRAT), as referred to in the Design Manual for Roads and Bridges (DMRB), LA113 Road Drainage and the Water Environment (formerly HD45/09) (Ref 1.1).
- 1.2.2 The assessment of accidental spillage risk has been undertaken using the methodology within LA113 (Ref 1.1).
- 1.3 Drainage networks, strategy and treatment trains
- 1.3.1 A description of the Scheme is presented in Chapter 2: The Scheme of the ES [TR010054/APP/6.1].
- 1.3.2 The proposed drainage strategy for the Scheme is presented in Appendix 13.2 [TR010054/APP/6.3]. The strategy adopted for drainage has taken into consideration the requirements of the DMRB (Ref 1.1), as well as stakeholder consultation with the Environment Agency and Staffordshire County Council, as the Lead Local Flood Authority (LLFA).
- 1.3.3 The proposed drainage network in the area of the M54 Junction 1, M6 Junction 11 and the existing A460 would utilise some existing outfalls (i.e. proposed road catchments 1, 2, 4, 6, 7, and 9, 11, 14, 15 and 16) with some new outfalls being constructed to drain the Scheme and remodelled junctions (i.e. road catchments 3, 5, 8, 10 and 14). Catchment 8 drains to existing outfall for Watercourse 3. Catchments 12 and 13 are drainage networks for Scheme permeable areas only (i.e. embankment runoff). All road network catchments are shown on Figure 2.1 in Appendix 13.2: Drainage Strategy [TR010054/APP/6.3]. The Figure also illustrates the location of each of the 17 road network catchments.



- 1.3.4 The with Scheme road catchments (i.e. road catchments 3, 5, 8, 10 and 14) are discharged to wet attenuation ponds for the purpose of balancing the flow, to provide treatment for pollutants in road runoff, and provide a final means of capturing any significant chemical spillage on the carriageway upstream of the final discharge to the receiving watercourse. Other treatment measures are also provided in combination with these ponds.
- 1.3.5 For some existing catchments, where there is a need and it can be reasonably delivered by the Scheme, new treatment measures are proposed. These are existing catchments 1, 2, 9, 15, 16 and 17. More information on the proposed treatment trains for each road network catchment is provided in Table 1.1.

Road network catchment and description	Existing or new road catchment	Receiving waterbody (Watercourse =WC)	Existing treatment	Proposed additional treatment train	Other measures considered but discounted
1 - M54 westwards only	Existing	Drains to existing M54 drainage westwards to WC 7	Filter Drains within existing M54 drainage	Hydrodynamic Vortex Separator (HVS) connecting into existing M54 drainage.	Further mitigation options for example ditches/swales were considered; however, due to the site constraints of existing highway features, these were considered not viable.
2 - M54 eastwards only	Existing	Drains to existing M54 drainage westwards to WC 7	Filter Drains within existing M54 drainage	HVS connecting into existing M54 drainage.	Further mitigation options for example ditches/swales were considered; however, due to the site constraints of existing highway features, these were considered not viable.
3 - New roundabout and link roads north of M54 J1	New road catchment, which was part of existing catchment 3	Discharge to WC 1 new outfall	No current treatment – new catchment	Penstock upstream of wet attenuation Pond followed by a swale/grassed channel (lined) (approximately 70- 80m) via open ditch.	Further mitigation options for example ditches/swales were considered; however, due to the site constraints of existing highway features, these were considered not viable.
4 - New roundabout and link roads south side of M54 J1	New road catchment, which was part of existing catchment 3	WC 1 - existing	No current treatment – new catchment	HVS and filter drains.	Further mitigation options for example ditches/swales were considered; however, due to the site constraints of existing highway features, these

#### Table 1.1: Treatment train for road network catchments



Road network catchment and description	Existing or new road catchment	Receiving waterbody (Watercourse =WC)	Existing treatment	Proposed additional treatment train	Other measures considered but discounted
					were considered not viable.

#### Table 1.2: Treatment train for road network catchments - continued

Road network catchment and description	Existing or new road catchment		Existing treatment	Proposed additional treatment train	Other measures considered but discounted
5 - Remodelled roundabout north east of M54 J1	New road catchment, which was part of existing catchment 3	WC 2 new outfall	No current treatment – new catchment	Penstock upstream of wet attenuation pond.	No comment.
6 - Section A460	Existing	WC 2 existing outfall	No current treatment – new catchment	None required.	No comment.
7 - Section of A460	Existing	WC 3 existing outfall	No current treatment – existing catchment	None as part of Scheme, The A460 is part of SCC network.	No comment.
8 - Link road from new roundabout to existing A460	New road catchment	WC 3 new outfall	No current treatment – new catchment	Penstock upstream of wet attenuation pond.	No comment.
9 - A460, with remodelled Hilton Lane flyover	Existing- modified	WC 4 existing outfall	No current treatment – new catchment	Length of filter drain on altered Hilton Lane.	Further mitigation options for example ditches/swales were considered; however, due to the site constraints of existing highway features, these were considered not viable.
10 - Main line of Scheme	New road catchment	WC 4 new outfall	No current treatment – new catchment	Filter drains where possible to approximately 60-70 m grass swale / ditch channel leading to a penstock then wet attenuation pond. Pond	No comment.



Road network catchment and description	Existing or new road catchment		Existing treatment	Proposed additional treatment train	Other measures considered but discounted
				discharging via a ditch.	
11 - A460	Existing	WC 5 existing outfall	No current treatment – new catchment	None required.	No Comment
12 - Permeable only	N/A	WC 5 New outfall A	No current treatment – new catchment	None as not draining highway (embankment only) but separate outfall.	No comment
13 - Permeable only	N/A	WC 5 New outfall B	No current treatment – new catchment	None as not draining highway (embankment only) but separate outfall.	No comment

#### Table 1.3: Treatment train for road network catchments - continued

Road network catchment and description	Existing or new road catchment		Existing treatment	Proposed Additional treatment train	Other measures considered but discounted
14 - Mainline Scheme and slip road to existing A460	New rod catchment	WC 5 New outfall C	No current treatment – new catchment	Filter drains to penstock, to wet attenuation pond.	Required mitigation was included within the design
15 - A460 north of M6 J11	Existing catchment – modified by the Scheme	WC 6	filter drains	Filter drains and roadside ditch.	Further mitigation options for example ponds were considered; however, due to minor attenuation being required this was not considered necessary.
16 - West roundabout and slip roads of M6 J11	5 - West undabout ad slip roads M6 J11 Existing catchment – modified by the Scheme Via M6 northbound drainage northwards to WC 6		Filter drains within the new remodelled roundabout, and followed by swales on base of slip roads (serving slip roads). Mainline not included in new drainage provision). The	Further mitigation options for example ponds were considered; however, due to site constraints of existing highway features, these were not considered viable.	



Road network catchment and description	Existing or new road catchment		Existing treatment	Proposed Additional treatment train	Other measures considered but discounted
				swales will only take a proportion of the runoff from the roundabout, and half the mitigation potential of these has been used in the calculations accordingly.	
17 - East roundabout and slip roads of M6 J11	Existing catchment – modified by the Scheme	Via M6 southbound drainage northwards to WC 6	Existing filter drains within the mainline M6	As above.	Further mitigation options for example ponds were considered; however, due to site constraints of existing highway features, these were not considered viable



# 2 Methodology

#### 2.1 Assessment guidance and approach

- 2.1.1 The assessment has been undertaken using guidance presented within LA113 (Ref 1.1) and the downloadable HEWRAT V2.0.4 and DMRB, Volume 4, Section 2, Part 3 Geotechnics and Drainage (CG501) (Ref 1.2). Specifically, a Method A Step 3 Tier 1 HEWRAT assessment has been carried out for the proposed road catchment outfalls to determine the potential impact of road runoff on the local water environment, the effect of dilution in the watercourse, and the need for treatment measures.
- 2.1.2 Where watercourses discharge to ditches with little to no regular flow, a groundwater assessment from HEWRAT has also been undertaken to determine the risk to groundwater. This applies to road catchment 3 (Watercourse 1) and Catchment 9 (Watercourse 4) only.
- 2.1.3 The outputs of the HEWRAT assessment procedure are as follows;
  - Whether the impact of the routine road runoff results in an accumulation of sediment bound pollutants which is unacceptable (i.e. over 100 deposition index);
  - Whether there is a risk of acute dissolved metal impact; and
  - An estimation of the annual average dissolved metal concentration from the routine runoff, taking into account the dilution within the receiving watercourse.
- 2.1.4 The following assessment outcomes and actions are presented in Table 2.1.

Acute soluble and chronic sediment impacts	Annual average concentrations (compliance with EQS)	Action
Pass	Pass	1) No further action
Fail	Pass	<ol> <li>Factor in effects of proposed mitigation and re assess</li> </ol>
		<ol> <li>Determine implications of redesign and reassess</li> </ol>
		3) Weight up benefits over whole project
		<ol> <li>Discuss with Overseeing Organisation and EPA and agree action</li> </ol>
Pass	Fail	<ol> <li>Factor in effects of proposed mitigation and re assess</li> </ol>
		<ol> <li>Check Sensitivity of modelling to inpu parameters (e.g. Q95)</li> </ol>
		<ol> <li>Discuss with Overseeing Organisation and EPA and agree action</li> </ol>

#### Table 2.1: Assessment of output from HEWRAT



Acute soluble and chronic sediment impacts	Annual average concentrations (compliance with EQS)	Action
Fail	Fail	<ol> <li>Factor in effects of proposed mitigation and re- assess</li> <li>Redesign and reassess</li> <li>Discuss with Overseeing Organisation and EPA and agree action.</li> </ol>

- 2.1.5 To establish the current drainage conditions and water quality risks, a HEWRAT analysis of the existing road outfalls was undertaken (i.e. for road catchments serving the existing M54 motorway (road catchments 1 and 2) and M6 motorway (road catchments 16 and 17) and the A460 (road catchment 15). Existing attenuation and treatment are initially not included in the analysis to highlight the background risk to the water environment, and then any existing or proposed treatment measures are considered.
- 2.1.6 The existing A460 road catchments (to the southwest of the M6) 6, 7, 9 and 11 have an Annual Average Daily Traffic (AADT) flow of less than 10,000 AADT per day. Pollution impacts from routine runoff depends on a large number of variables and confident correlations are difficult to establish. However, generally the risk of a significant impact increases with increasing AADT, and where the AADT exceeds 10,000 vehicles per day (although other factors such as the sensitivity of the receiving water environment are important considerations).
- 2.1.7 Traffic flows along the A460 are also much larger in the base year than they are predicted to be in the design year of 2039 with Scheme scenario, where the traffic flows are estimated to decrease in the region of 70-80%. As the traffic is less than the 10,000 AADT per day threshold, these existing road catchments (i.e. 6, 7, 9 and 11) have been assessed with a conservative traffic band of >10,000 to < 50,000 AADT (i.e. the lowest traffic band available in HEWRAT). The implementation of the Scheme will result in a decrease in traffic to these road catchments, and therefore represents a reduction in the risk to water quality from routine runoff, albeit the limitations of the HEWRAT assessment prevent this from being modelled directly.

## 2.2 Road runoff and spillage risk – Simple assessment

#### Surface Water Runoff Assessment

2.2.1 HEWRAT assesses the impact of routine runoff on receiving surface waters by considering the short-term water quality impacts from key parameters found in highway runoff; the longer term dissolved metal impacts (using copper and zinc as a proxy for a range of metals typically found in highway runoff); and the potential for chronic sediment impact on the receiving WC (and associated sediment-bound pollutants such as certain hydrophobic polyaromatic hydrocarbons (PAHs)).



- 2.2.2 Where the assessment indicates that discharges from the highway outfalls are failing to meet standards, then treatment measures must be considered. The efficiency of various treatment systems in terms of sediment removal, treatment of dissolved metals and hydrocarbons is described in the DMRB CG501 (Ref 1.2) and DMRB HA103/06 Vegetated Drainage Systems for Highway Runoff (Ref 1.3). These treatment efficiencies are based on previous water quality monitoring and testing undertaken by Highways England.
- 2.2.3 For those outfalls that are within 1 km of neighbouring outfalls that discharge to the same watercourses, cumulative assessments have been undertaken for the risk from dissolved metals. Where outfalls discharge to the same watercourse within 100 m of each other the cumulative assessment considers both metals and sediment-bound pollutants. This follows the approach given in DMRB (Ref 1.1).
- 2.2.4 Road catchments 12 and 13 are earthworks drainage catchments with no direct highway runoff and thus no quantitative assessment of these catchments has been undertaken.
- 2.2.5 The data used for the assessment of routine road runoff is summarised in Tables A1-A3 in Annex A.

#### Groundwater Assessment

- 2.2.6 Within the HEWRAT assessment system, the groundwater assessment considers the risk to groundwater through assessment of the generic processes that influence the level of groundwater protection inherent to different source and pathway characteristics. The risk assessment procedure is based on examination of the 'Source-Pathway-Receptor' protocol. The principle applied is that all elements of the source-pathway-receptor linkage must have to be present to create a pollutant linkage. The presence of the pollutant itself does not pose a risk to groundwater if there is no identifiable pathway.
- 2.2.7 Weighting factors are applied to each of the components in the assessment to reflect the fact that some of these components have a greater or lesser influence on the magnitude of the risk to groundwater. For example, in most circumstances, the depth of the unsaturated zone has a greater influence on risk than the soil organic matter or organic carbon, and so is weighted more heavily. The risk level for each component is then established (low risk = score 1, medium risk = score 2, high risk = score 3) and the relevant score multiplied by the weighting factor to provide component scores for all categories. The component scores are summed to give an overall risk score, with a lowest score of 100 and a highest score of 300. Scores below 150 show a low risk of impact to groundwater, scores of 150-250 show medium risk to groundwater, and scores over 250 indicate a high risk to groundwater.
- 2.2.8 Finally, the data used for the assessment of impacts to groundwater are provided in Tables A8 and A9, together with the results of the assessment.

#### Spillage risk

2.2.9 Within HEWRAT, the risk of an accidental spillage resulting in a serious pollution incident on a receiving water body is contained within the 'spillage risk assessment'. This also guides the need for spillage containment measures.



- 2.2.10 WCs should be protected so that the risk of a serious pollution incident has an annual probability of less than 1% (equivalent to a return period of 1 in 100 years), unless they are considered to be sensitive (e.g. covered by a SSSI designation), in which case a more stringent annual probability of 0.5% is applied (equivalent to a return period of 1 in 200 years). Where the risk is greater than the allowable standard, spillage containment measures can be designed into the drainage catchment to reduce the risk.
- 2.2.11 The data used for the spillage risk assessment is similar to that for the routine road runoff assessment and is summarised in Tables A1-A3 in Annex A.

#### **Presentation of Results**

- 2.2.12 The data used for the assessment of accidental spillage risk, and the results, are summarised in Table A10 in Annex A.
- 2.3 Detailed surface water assessment: metal bioavailability assessment tool (M-BAT)
- 2.3.1 The metal bioavailability tool (M-BAT), which was developed under the Water Framework Directive (WFD), helps to determine how bioavailable some dissolved metals are in the aquatic environment (Ref 3.1).
- 2.3.2 The bioavailability of a metal depends on several physico-chemical factors, which govern both metal behaviour and the interactions of the toxic forms of the metals with a biological receptor. For example, if the metal ions bind to carbonate ions or dissolved organic carbon (DOC), they are less 'bioavailable' and thus less likely to be able to bind to the organism and have an adverse effect.
- 2.3.3 The output from the M-BAT tool has been used to determine the maximum total copper concentration output from the HEWRAT assessment which would then lead to the maximum permitted bioavailable copper concentration of 1  $\mu$ g/l, when combine with average ambient copper concentrations and taking into account other water quality factors. These are tabulated within Table A7 within Annex A.
- 2.3.4 From the results, the watercourses with the greater concentration of DOC are the watercourses where there may be a greater concentration of total copper within the stream before the permitted limit of  $1 \mu g/l$  bioavailable copper is reached.

#### 2.4 Assumptions and limitations

- 2.4.1 The assessment has been undertaken in November 2019 using best available data and the drainage design from Figure 2.1 within Appendix 13.2 [TR010054/APP/6.3], and details incorporated into the preliminary design of the Scheme, as described in Chapter 2: The Scheme of the ES [TR010054/APP/6.1].
- 2.4.2 The assessment has been undertaken with reference to the baseline data, information and records pertaining to the water quality derived from desk study sources. These were subsequently validated and enhanced through field surveys where land access was obtained from landowners.



- 2.4.3 The assessment is based on the best available known background water quality data provided by the Environment Agency (for Saredon Brook only), supplemented by project water quality monitoring undertaken between February 2019 to November 2019. Where access and flow in the channel permitted, samples have been collected on four occasions. The data from these samples represents those conditions at the time of the sampling only and the prevailing conditions. Water quality will vary constantly and over time and thus this data only provides an indication of a 'snap-shot' of water quality. However, some data was required to inform aspects of the HEWRAT and M-BAT assessments and this number of samples was considered appropriate, when interpreted in the context of background monitoring data held by the Environment Agency.
- 2.4.4 Water quality data from sampling of Watercourse 2 is being used as a proxy for Watercourses 1 and 7. Watercourse 2 is considered comparable to Watercourses 1 and 7 due to its nearby catchment location and proximity, land use, topography and geological factors. The sampling point for Watercourse 2 is also upstream of the assessment location for Watercourse 7. All three watercourses share the same underlying superficial and solid geology, with similar mainly rural catchments, with some inputs from the transport network.
- 2.4.5 The baseline monitoring had a limit of detection of <3 µg/l dissolved copper. In order to obtain baseline information for copper to add into the M-BAT assessment, the assumption has been made that where a data point is classed as '<' a numerical figure, this has been taken to be equal to the limit of detection for a conservative assessment.
- 2.4.6 As watercourse flow data is unavailable for any of the potentially impacted watercourses, calculation of Q95 low flows (i.e. the flow that is equalled or exceeded 95% of the time) has been undertaken through a desk-based exercise using catchment data and Wallingford Hydrosolutions Ltd LowFlows software. This is an estimation method that can be used for a first order estimate of the natural Q95 flow. The estimated flow data is therefore a best estimate. Locations for all low flow estimations are shown on Figure 13.2 of the Environmental Statement.
- 2.4.7 Road catchments 1 and 2 are known to drain westwards and have been assumed to discharge into Watercourse 7 as the likely recipient of drainage in this area due to the topography of the area. A drainage survey was commissioned to confirm drainage assumptions in June 2019. The drainage survey results confirmed that catchment 4 outfalls into Watercourse 1.
- 2.4.8 Estimates of channel width used in the assessment have been based on estimates obtained during a combination of a site visit undertaken on 25th July 2019, and from online aerial imagery, including Multi-agency Geographical Information for the Countryside (MAGIC) online maps (Ref 2.4).



- 2.4.9 The application of the likely treatment performance of different SuDS methods is based on advice reported in DMRB (Ref 1.1). The treatment performance of individual components of the treatment train is based on available data and best practice guidance contained in the DMRB (Ref 1.2). These are estimates, and professional judgement has been used when deciding on the percentage treatment a particular option may provide, taking into account the design of the SuDS feature and whether it is considered to be optimum or sub-optimum due to other constraints. SuDS and treatment trains are always bespoke and therefore some variance in treatment performance exists when compared to these indicative values. There may also be changes in the treatment performance over time, which is subject to the effectiveness and diligence of any maintenance regime and also to changes in the nature of traffic movements. For example, the conversion to more hybrid cars and the UK Government's policy (Ref 2.3) to ban new petrol and diesel cars by 2040 will reduce the risk from highway runoff as a significant source of highway derived pollutants from vehicle emissions and minor leaks of oil.
- 2.4.10 It is assumed that the ongoing maintenance of the HE assets will be maintained according to their best practice and maintenance schedules.
- 2.4.11 For the assessment of impacts to groundwater, the groundwater assessment used information from the ground investigation water monitoring for unsaturated zone depth. Flow type, effective grain size and lithology have been based on provisional results obtained from a Ground Investigation undertaken for the Scheme (Appendix 9.1 [TR010054/APP/6.3]). Further data on organic carbon, pH of the unsaturated zone and drainage area ratio were provided by the Ground Investigation and the drainage team respectively.
- 2.4.12 Where there are separate outfalls for each direction of travel along a section of trunk road or motorway, only the one-way AADT has been used (i.e. road catchments 16 and 17 draining the M6).



# **3** Assessment findings

## 3.1 Method A results

#### Assessment of existing drainage (without treatment)

- 3.1.1 The Step 1 Runoff quality assessment indicates that for all existing outfalls, runoff at the point of discharge prior to any dilution from receiving waters would be expected to have concentrations over the toxicity thresholds for both soluble metals and sediment-bound pollutants ('Fail'). Due to this result, a Step 2 River Impacts assessment has been undertaken in order to consider dilution in the WC.
- 3.1.2 For Step 2 HEWRAT requires input of ambient dissolved copper concentrations. There is limited background water quality data available from the Environment Agency. An Environment Agency sampling point for Latherford Brook upstream of Hilton Sewage Treatment Works (STW) and the Scheme (sampling point MD-72838180) has a monthly water quality record between 2000 and 2007 (77 samples) and recorded a dissolved copper range of between 2.53 μg/l (7th September 2005) to 17.2 μg/l (on 21st August 2006) with an average of 5.4 μg/l.
- 3.1.3 Ambient copper concentrations used in the HEWRAT assessment are based on watercourse specific water quality monitoring undertaken for the project and reported in Appendix 13.5 Water Quality Monitoring Results [TR010054/APP/6.3]. For all road catchments at Step 2, monitoring data for dissolved copper had a limit of detection of < 3 µg/l, which is above the 1 µg/l EQS concentration for copper. This means that it is not possible to confirm whether ambient dissolved copper concentrations are on average below the EQS of 1 µg/l. However, the nearest background Environmental Agency monitored data would suggest that dissolved copper copper data exceeding the EQS, all outfalls will automatically fail the short term dissolved copper test in HEWRAT.
- 3.1.4 The results of the Step 2 River Impacts assessment are presented in Table A4 in Annex A and is summarised below:
  - The *existing* M54 road catchments 1 and 2 with no mitigation individually pass the HEWRAT assessment process for sediment-bound pollutants, acute metals and annual average copper concentration (using the MBAT assessment for annual average copper in Table A7 in Annex A).
  - Cumulatively, *existing* M54 road catchments 1 and 2 with no mitigation fail the soluble acute impact assessment for copper (2.2 annual exceedances) and pollutant sediment-bound pollutants (47% mitigation required to pass).
  - *Existing* road catchment 7 (part of the A460) and 8 (A460 north of M6 J11) fails the HEWRAT assessment process for sediment-bound pollutants (63% and 51% settlement required, respectively).
  - Existing Road catchment 15 (existing northbound A460 from the M54-M6 / M6 roundabout) fails the HEWRAT assessment process for sediment-bound pollutants (51% settlement required).



- *Existing* Road catchments 16 (west portion of the roundabout and slip roads forming M6 J11) and 17 (east portion of the roundabout and slip roads forming M6 J11) both fail the HEWRAT assessment process soluble acute impact assessment for copper (2.2 and 2.5 annual exceedances, respectively) and sediment-bound pollutants (79% and 82% settlement required, respectively).
- Cumulatively, *existing* M6 road catchments 15, 16 and 17 also fail the assessment process for acute soluble copper (6.3 Exceedances, 47% mitigation required for a pass).
- 3.1.5 The annual average EQS values are 1 µg/l for dissolved bioavailable copper and 10.9 µg/l for dissolved bioavailable zinc. When using the M-BAT results included in Table A7 in Annex A which shows the maximum total dissolved copper for the watercourse before the maximum permitted bioavailable copper is reached, all annual average total dissolved copper concentrations pass the assessment.

#### Assessment of Scheme drainage (without treatment)

- 3.1.6 The Step 1 Runoff quality assessment indicates that for all proposed new or modified outfalls, runoff at the point of discharge prior to any dilution from receiving waters would be expected to have concentrations over the toxicity thresholds for both soluble metals and sediment-bound pollutants ('Fail'). Due to this result, a Step 2 River Impacts assessment has been undertaken in order to consider dilution in the receiving watercourse.
- 3.1.7 The results of the Step 2 River Impacts assessment of the pollutant risk from routine road runoff from the Scheme is shown in Table A4 in Annex A, and screenshot images from the HEWRAT are presented in Annex B. The results are summarised below from Table A4 in Annex A:
  - With Scheme individual road catchments 3, 4 7, 9, 10, 14,15, 16, and 17 all fail to meet the sediment-bound pollutants calculation and require the following percentage of treatment: 84%, 65%, 59%, 56%, 79%, 64%, 69%, 84%, and 82%, respectively. Road catchments 7 and 9 are the original A460 catchments to which little change is being made by the Scheme. Road catchments 15, 16 and 17 are existing and also failed this test in the base scenario without the Scheme.
  - With Scheme individual proposed road catchments 1, 2, 5, 6, 7, 8, 11 and 14 pass the HEWRAT assessment for soluble acute impact from dissolved metals. The following are the original M54 or A460 road catchments: 1, 2, 6, 7, 8, 11 and 14.
  - With Scheme individual road catchments 3, 4, 9, 10, 15, 16 and 17 fail the HEWRAT assessment for soluble acute impact from dissolved copper (note that road catchments 3 and 4 are modified catchment within J1 M54. Road catchments 9, 15, 16 and 17 are existing road catchments and also failed this test in the base scenario without the Scheme. Road catchment 15 passed in the existing scenario due to a smaller impermeable area (1.3 ha existing compared to 2 ha with Scheme).



- All road catchments pass the HEWRAT assessment for short term dissolved zinc and annual average copper and zinc concentrations. For the annual average copper test, this is based on M-BAT analysis and comparison with the maximum permissible dissolve copper concentrations as listed in Table A7 in Annex A.
- Cumulatively, road catchments 1+2, 3+4, 9+10, 15+16+17 fail the HEWRAT assessment for soluble acute impact from dissolved copper (note that road catchment 1+2 and 15+16+17 also fails this test in the base scenario); for catchment 9+10, the traffic predicted with the scheme along road catchment 9 is well below the 10,000 minimum AADT required for HEWRAT and thus the assessment is a conservative calculation and the real risk would be expected to be less and potentially not significant.
- For road catchments 1+2 cumulative, the acute soluble copper test is failed in the existing situation with a potential 2.2 exceedances per year (with 2 allowable) for both the existing and the proposed with Scheme situation. Therefore, there is no change to the existing situation. For road catchments 15+16+17 cumulatively, the acute soluble copper test is failed for the existing situation with potentially 6.3 exceedances per year (2 allowable). With the scheme but including mitigation the number of potential exceedance per year decreases to 4.8. Though a sensitivity analysis with an assessment point upstream of Saredon Brook shows just 3.7 exceedances per year for soluble acute copper.
- As shown in Table A4 in Annex A, no mitigation, for road catchments 3+4, 9+10 and 15+16+17 cumulatively, as the outfalls are further than 100 m apart there are no required for a sediment-bound pollutant assessment. For road catchment 1+2 cumulatively, the sediment-bound pollutant test is failed but there is a decrease in risk illustrated by the reduced treatment that is now required with the Scheme (i.e. from 47% to 41%). Road catchments 7+8 cumulative also fail the sediment-bound pollutant test with the Scheme requiring 67% treatment.
- 3.1.8 Therefore, the mitigation is required to address the failures described above as much as possible.

#### Assessment of Scheme drainage (with mitigation)

- 3.1.9 The treatments trains included for each road catchment are summarised in Table 1.1. A summary of the assessment with the assessments plus sensitivity analysis is included in Table 4.1.
- 3.1.10 The initial assessment has been repeated for outfalls failing to meet all HEWRAT tests with the incorporation of mitigation measures, using the treatment efficiencies outlined in DMRB CG501 (Ref 1.2), and summarised below in Table A5 in Annex A.



- 3.1.11 All results initially show a failure of the long-term copper EQS for reasons explained earlier. These results have been compared with the detailed M-BAT assessment included in Table A7 in Annex A. This shows the maximum concentrations of dissolved copper within the watercourse before the maximum permissible concentration of bioavailable copper of 1  $\mu$ g/l is reached. All annual average dissolved copper and zinc concentrations predicted by HEWRAT for each outfall are below the EQS.
- 3.1.12 Results of the assessment of routine road runoff including mitigation are shown in Table A6 in Annex A. Most individual road catchments with the Scheme and mitigation now pass the assessment for acute dissolved copper impacts, with the exception of individual catchment 4 and 9. Sensitivity analysis of these two catchments with an assessment point upstream of the confluence with Saredon Brook results in a Pass in the HEWRAT assessment with the included mitigation.
- 3.1.13 Cumulative road catchments 1+2, 3+4, and 15+16+17 also fail against the acute dissolved copper test. In all cases, these road catchments also failed in the existing base scenario (for road catchments 3+4 this is based on the outcome of existing road catchment 3 as road catchment 4 is within the modified new J1 M54). Road catchment 9 also fails to meet the sediment-bound pollutant test.
- 3.1.14 Individual catchment 4 has mitigated the sediment-bound pollutants to an acceptable level of risk with filter drains and HVS. However, these do not provide any treatment of dissolved metals. The acute copper test results for road catchment 4 suggest that there is the potential for 7.5 exceedances per year. The original point of assessment for this road catchment was selected close to the outfall location, which is also close to the head of the catchment, and thus the estimate low flows are very small (i.e. a Q95 of just 1 l/s). A sensitivity analysis to repeat this assessment at a point slightly further downstream where there will be more dilution has been undertaken as is presented in Section 3.4 Sensitivity Analysis, and Table A6 in Annex A. With sensitivity analysis, Catchment 4 passes the HEWRAT assessment.
- 3.1.15 Individual catchment 9 is the current A460, with an AADT in 2039 predicted to be just 3338 vehicles. The lowest available traffic band used within the HEWRAT assessment is <10,000 to < 50,000 vehicles. It therefore considerably overestimates the risk resulting in a very conservative assessment. Additionally, the exceedances of acute dissolved copper in the existing situation are calculated to be 2.5 times annually, which is the same as the proposed situation. In terms of sediment-bound pollutants, the residual treatment needed once new filter drains along Hilton Lane have been taken into account is 13%, an improvement from 54% for the base scenario. Therefore, the Scheme does not worsen the current situation, and in reality, probably reduces the risk, albeit assessment limitation prevents this from being illustrated accurately in the results. Cumulative assessment of the existing road catchments 1+2 includes consideration of the existing filter drains alongside the M54, the proposed filter drains within the remodelled M54 Junction 1, and new HVS on both individual road catchments to reduce potential impact from suspended solids (including particulate metals and any adsorbed hydrocarbons associated with sediments). However, HVS do not provide any treatment of dissolved metals, and thus there is still a failure against



the acute copper EQS. However, as there is no increase in the number of potential exceedances of short-term copper per year with the Scheme, the Scheme does not worsen the situation. The inclusion of the HVS also provides a trap for any floating plastic waste to stop it reaching the watercourse. The works being carried out within this road catchment area is limited to new signage only and will not have any impact on the pollution risk from highway runoff. This road catchment could be considered as a candidate for designated funds for a future project to address the existing highway runoff risk. Only 4% of treatment of dissolved metals would lead to a pass against the acute soluble copper HEWRAT test. This could be provided by changing the filter media within the filter drains to a substance which adsorbed soluble copper (e.g. zeolite).

- 3.1.16 The cumulative assessment for road catchments 15+16+17 still shows a failure for acute copper concentrations. In the existing situation, the results suggest that there is a potential for 8.2 exceedances per year (which is more than the two allowable exceedances per year). In the proposed Scheme scenario, it is predicted that only 4.8 exceedances per year may occur. However, the chosen assessment location for this assessment was a point near the head of the catchment with a low Q95 flow, a sensitivity analysis has been undertaken. This uses a point upstream of the Saredon Brook confluence. When using this assessment point further downstream, the number of exceedances per year target, it is a significant decrease on the existing potential 8.2 exceedances per year.
- 3.1.17 Additionally, the cumulative assessment point for road catchments 15+16+17 is close to the Scheme location, which is towards the head of the catchment, with a resultant low Q95 flow. This catchment is therefore chosen to be a re-assessed using a sensitivity analysis for a point further downstream. Please see Section 3.4 Sensitivity Analysis.

#### 3.2 Comparison of with and without Scheme for existing road catchments

- 3.2.1 The HEWRAT assessment has also been applied to existing road catchments that are affected by the proposed Scheme. The outcome of this HEWRAT assessment has identified some failures for existing road catchments with existing treatment measures. This is described in Table 3.2.
- 3.2.2 Some additional treatment measures have been added, that reduce the risk, but it has not been possible to resolve all the existing failures. The addition of the following represents an improvement in the mitigation provided for the existing outfalls:
  - Addition of a HVS to existing road catchments 1 and 2.
  - Addition of filter drains to the section of Hilton Lane being altered within road catchment 9.
  - Addition of filter drains and roadside ditches for existing road catchment 15.
  - Addition of swales at the base of embankments for existing road catchments 16 and 17.



3.2.3 Table 1.1 provides further information on alternative treatments that were considered and why they were not included in the drainage design.

#### Table 3.2: Comparison of Existing Road Outfalls HEWRAT Results with and without the Scheme (for Design Year)

Road Catchment (Watercourse)	Description of road catchment	Existing HEWRAT outcome without Scheme and mitigation (Design Year)	Description of Proposed Mitigation	HEWRAT outcome with Scheme and mitigation (Design Year)
1+2 (Watercourse)	M54 east and west bound, west of J1	Sediment-bound pollutants failure (47% mitigation required to pass the assessment), and acute dissolved copper concentration (2.2 exceedances per year – 8% mitigation required to pass assessment).	Existing filter drains to be enhanced with HVS to decrease impact from sediment bound pollutants	Acute dissolved copper concentration (2.2 exceedances per year – 4 % mitigation required to pass assessment)
3 (Watercourse 2)	M54 J1 roundabout	Sediment-bound pollutants failure (93% mitigation required for a pass) and acute dissolved copper concentration (8.8 exceedances per year – 53% mitigation required to pass the assessment)	Penstock to catch any spillages, wet attenuation pond and a length of swale	Pass
3+4 (with 4 only existing in the With Scheme) (Watercourse 2)	M54 remodelled J1 roundabout	Failure of acute dissolved copper concentration (10.9 exceedances per year – 53% mitigation required to pass the assessment)	Penstock to catch any spillages, wet attenuation pond and a length of swale to catchment 3, and filter drains and HVS to catchment 4	PASS with 22% treatment for soluble metals included: and with sensitivity analysis with point further downstream Q <sub>95</sub>
9 (Watercourse 4)	Section of A460 including Hilton Lane	Existing failure of sediment-bound pollutants (54% mitigation required for a pass), and acute dissolved copper concentrations (2.5 exceedances per year - 13% mitigation required to pass the assessment)	Filter drains to be installed on the remodelled Hilton Lane towards the A460. No other mitigation possible.	Failure of sediment-bound pollutants (43% mitigation required for a pass), and acute dissolved copper concentrations (2.5 exceedances per year). However, a conservative assessment has been undertaken as HEWRAT does not have traffic bands as low as the predicted traffic along this road catchment. Improvement in suspended solids from the catchment.



# Table 3.2: Comparison of Existing Road Outfalls HEWRAT Results with and without the Scheme (for Design Year) - continued

Road Catchment (Watercourse)	Description of road catchment	Existing HEWRAT outcome without Scheme and mitigation (Design Year)	Description of Proposed Mitigation	HEWRAT outcome with Scheme and mitigation (Design Year)
15 (Watercourse 6)	A460 north of M6 J11	Sediment-bound pollutants (51% mitigation required for a pass).	Filter drains and roadside ditch alongside remodelled carriageway	Pass
16 (Watercourse 6)	West roundabout and slip roads of M6 J11	Sediment-bound pollutants (79% mitigation required for a pass). Acute copper 2.2 exceedances (requires 4% mitigation for a pass). Sediment-bound pollutants failure.	Filter drains and swales next to slip roads	Pass
17 (Watercourse 6)	East roundabout and slip roads of M6 J11	Sediment-bound pollutants (82% mitigation required for a pass). Acute copper 2.5 exceedances (requires 12% mitigation for a pass).	Filter drains and swales next to slip roads	Pass
15+16+17 (Watercourse 6)	As above	Acute copper 6.3 exceedances (requires 47% mitigation for a pass).	Filter drains and swales next to slip roads for catchment 16+17, filter drains and roadside ditch for road catchment 15	Acute copper 4.8 exceedances (requires an extra 30% treatment to pass but improvement on existing)



# 3.3 Detailed surface water assessment: Metal bioavailability assessment tool (M-BAT)

- 3.3.1 Due to failure of the HEWRAT simple assessment, this has triggered the use of the M-BAT tool.
- 3.3.2 Table A7 in Annex A tabulates the results of the assessment. The risk characterisation ratio represents a ratio to show the predicted bioavailable copper divided by the bioavailable copper of 1  $\mu$ g/l. If the risk ratio exceeds the value of 1, this demonstrates a failure, whereby the predicted bioavailable copper is greater than the EQS and may adversely affect biological receptors.
- 3.3.3 Using the M-BAT tool, it is demonstrated that no further mitigation measures are necessary, as the risk characterisation ratio for all relevant road catchments with the Scheme and proposed treatment (See Table 1.1), are below 1.

#### 3.4 Sensitivity analysis

- 3.4.1 For road catchments 4, cumulatively 3+4, and cumulatively 15+16+17, an assessment location was chosen close to the outfall location. However, as these are close to the head of the catchment a low Q95 of 1 l/s was calculated, which increases the risk of a failure. HEWRAT was not designed to assess the risk in drainage ditches, but there is also limited guidance as to where to locate the point of assessment. As per LA113 (Ref. 1.1), the sensitivity of the modelling to Q95 has been examined, as it may be showing failure due to a location near to the head of the stream catchment being chosen. The outcome of this sensitivity analysis is presented in Table A5 in Annex A and summarised below.
- 3.4.2 For road catchment 4 and cumulatively 3+4, a downstream location near the confluence with Watercourse 7 has been chosen. This has a Q95 of 6 l/s. The results of the sensitivity analysis are included within Table A6 in Annex A. At this location road catchment 4 and road catchments 3 + 4 cumulatively pass all the HEWRAT tests. the assessment using a point slightly further downstream.
- 3.4.3 For cumulative road catchment 15+16+17 a point close to the head of the catchment was also assessed and as such a low Q95 value was calculated and used in the original assessment. As a result, a sensitivity analysis was repeated for this cumulative catchment using a Q95 value calculated for a point further downstream near the watercourses' confluence with Saredon Brook. Using the downstream point of assessment, there is still a failure for dissolved acute copper, although the number of annual exceedances reduces from approximately 8.2 per year to approximately 3.7 per year.

#### 3.5 Groundwater assessment

3.5.1 Results of the Method C assessment for road catchments 3, 8 and 9 are shown in Tables A8 and A9 in Annex A. All of the sites are assessed as presenting a medium risk to groundwater, due to being located on granular deposits of sand with gravel with a low clay content and a thin unsaturated zone.



- 3.5.2 As the groundwater risk assessment returns the result of a medium risk to groundwater further assessment is required to determine the potential risk to groundwater in the area of Watercourse 1 and Watercourse 4. Additionally, the risk to groundwater from infiltration in the area of M6 Junction 11 has been assessed due to the use of grassed channels/swales in this area.
- 3.5.3 Based on the results of the groundwater level monitoring between July and November 2019, it is considered that the groundwater in the superficial deposits and in the sandstone aquifer is in continuity with the existing surface water system and that groundwater provides baseflow discharge to the watercourses. Accordingly, in most situations the groundwater level is above the water level in the ditch and water in the ditch, including road drainage, cannot infiltrate to the groundwater. In this situation, the ditch does not perform as a soakaway and the groundwater assessment is invalid.
- 3.5.4 In the upper reaches of the ditches, it is possible that the invert of the ditch is above the groundwater level especially during drought periods. In this situation, it is likely that the ditches are dry and could act as a soakaway during road runoff events. However further downstream (possibly only a few 10 m/s), the invert of the ditch will intercept the groundwater level and any water that has infiltrated upstream will discharge to the ditchcourse as baseflow. Accordingly, it is considered that any impacts on groundwater in this situation will be negligible and limited to the short section of the dry ditchcourse.
- 3.5.5 As the sites are of medium risk of road runoff, mitigation measures should be considered to protect groundwater. As described above, treatment measures have been identified for these networks in Appendix 13.2 [TR010054/APP/6.3], and HD33/16 indicates that the use of attenuation ponds and swales are suitable mitigation. Therefore, the mitigation measures identified in Section 13.8 would provide protection of both groundwater resources as well as surface watercourses.

## 3.6 Accidental spillage risk

- 3.6.1 The probability that an accidental spillage would lead to a serious pollution incident has been calculated for each road catchment and for the cumulative outfalls identified in Section 3. The data used for the assessment of accidental spillage risk is summarised in Table A10 in Annex A.
- 3.6.2 The results are also shown in Table A10 in Annex A for each road catchment in the absence of mitigation. These indicate that the annual probability of a spillage incident is lower than the minimum acceptable standard of 1% (1 in 100 years) in all cases.
- 3.6.3 The road catchments posing the most risk to the receiving water environment are the existing outfalls to Watercourse 6, where the risk of spillage is 1 in 443 and 1 in 477 for road catchments 16 and 17, respectively. This was determined in the absence of mitigation, which indicated that the probability would be further reduced with treatment measures incorporated into the Scheme design. Reductions in the probability of spillage related to the various mitigation measures are as follows, as outlined in DMRB CG501 (Ref 1.2):



- Filter drain 40%;
- Wetland 50%;
- Swale 40%;
- Vegetated ditch 30%;
- Penstock/valve 60%; and
- Oil separator 50%.
- 3.6.4 All the catchments have returned as acceptable standard of spillage risk, as shown in table A10 in Annex A.



# 4 Conclusions

- 4.1.1 A HEWRAT assessment of potential impacts of the Scheme on the water environment, including impacts on surface water and groundwater due to routine runoff and an assessment of accidental spillage risk, has been undertaken in accordance with DMRB guidance (Ref 1.1, Ref 1.2).
- 4.1.2 The Scheme design includes a mix of proprietary and sustainable drainage measures reflecting planning policy and site-specific constraints. Depending on the road catchment, filter drains, ponds, and lengths of grassed swales are all included, as shown in Table 1.1.
- 4.1.3 A summary of the assessment process is included in Table 4.1. All of the with Scheme outfalls (individually and cumulatively) for the new link road between the M6 and the M54 pass all aspects of the HEWRAT assessment (i.e. road catchments 3, 4, 5, 8, 10, and 14. For outfalls 4 and 3+4 this is at an assessment point slightly further downstream of the initial discharge, due to this being at the head of a first order ditch where there is very limited dilution. The with Scheme scenario is also an improvement on the current situation.
- 4.1.4 The HEWRAT assessment has also been applied to existing road catchments that are affected by the proposed Scheme. The outcome of this HEWRAT assessment has identified some failures for existing road catchments. Some additional treatment measures have been added by this Scheme that reduce the risk, but it has not been possible to resolve all the existing failures. The comparison of the existing failures with the 'With Scheme' assessment are shown in Table 3.2. This shows that for road catchments 1+2 cumulatively the result for with and without the Scheme for acute copper is the same, a failure with potentially 2.2 exceedances per year. However, the Scheme includes HVSs which will help to treat sediment-bound pollutants. By using a downstream assessment point for sensitivity analysis, the HEWRAT assessment passes for road catchments 1+2 cumulatively. Please note that the only works being undertaken in road catchments 1+2 are improvements to existing road signs.
- 4.1.5 The existing road catchment 3 (M54 Junction 1 roundabout) is currently failing with 93% mitigation required for sediment-bound pollutants, and a predicted 8.8 acute copper exceedance per year. Within the remodelled roundabout, road catchments 3+4 (cumulatively) outfall to Watercourse 1. However, with the mitigation measures proposed the potential acute dissolved copper exceedances is a Pass with 24% treatment for soluble metals included with Scheme measures.
- 4.1.6 Watercourse 4, road catchment 9, currently has a potential failure of sedimentbound pollutants (54% mitigation required for a Pass), and 2.5 potential acute copper exceedances per year. The Scheme will add filter drains on part of Hilton Lane, which will decrease the amount of sediment-bound pollutants discharging to Watercourse 4 and represent an improvement over the existing situation. As illustrated by the sensitivity analysis, using a point slightly further downstream for the assessment, road catchment 9 passes all the HEWRAT assessment. The reach over which the HEWRAT failure applies is therefore small, and is not surprising given the small nature of the receiving watercourses in the headwaters of the catchment.



Additionally, for road catchment 9, the assessment uses a conservation traffic flow band of <10,000 - <50,000 vehicles per day, the lowest available in HEWRAT. As traffic flows are predicted to be significantly lower it is likely that the risk to the receiving watercourse is lower than it has been possible to estimate using HEWRAT.

- 4.1.7 For cumulative road catchment 15+16+17, the existing situation is failure for acute copper with a predicted 6.3 exceedances per year. However, although the failure to meet the test is not eliminated, with the Scheme and mitigation measures the number of exceedances estimated each year falls by almost half to 4.8. The outcome of a sensitivity analysis shows a further decrease to a potential 3.7 exceedances when an assessment point further downstream is used. This is an improvement over the existing situation.
- 4.1.8 Watercourses 1 and 4 (which are discharged to by road catchments 3, 4, 9 and 10) all discharge to minor drainage ditches and have low Q95 flows below 0.001 m<sup>3</sup>/s, and therefore were assessed as soakaways using Method C. All of the sites have been assessed as representing a medium risk to groundwater. DMRB CG501 (Ref 1.2) indicates that the use of lined swales and constructed wet attenuation ponds in medium groundwater risk areas; therefore, these mitigation measures have been incorporated in the design of the Scheme to also provide protection to groundwater.
- 4.1.9 The assessment has confirmed that all road catchments pass the assessment of accidental spillage risk.



#### Table 4.1 Summary matrix of results of Proposed Scheme with mitigation

Proposed road catchment, and description	HEWRAT short term metal and chronic sediment-bound pollutant tests	Assessment against annual average EQS
Proposed road catchment 1+2	Failure for Acute copper at 2.2 exceedances (2 acceptable). Existing situation is also 2.2	PASS
Sensitivity assessment of proposed road catchment 1+2	PASS	PASS
Road catchment 3 (new roundabout and link roads north of M54 J1 (this is a new road catchment, which was part of existing road catchment 3))	PASS	PASS
Road catchment 4 (new roundabout and link roads south side of M54 J1 (this is a new road catchment, which was part of existing road catchment 3))	Failure of acute copper at 7.5 exceedances (2 acceptable). Existing situation is 8.8 exceedances for the existing roundabout catchment.	PASS
Sensitivity analysis for road catchment 4 (new roundabout and link roads south side of M54 J1 (this is a new road catchment, which was part of existing road catchment 3))	With sensitivity analysis using a point downstream: PASS	PASS
Proposed cumulative road catchment 3+4	Failure of acute copper at 4.4 exceedances (2 acceptable). Existing situation is 8.8 exceedances for the existing roundabout catchment	PASS
Sensitivity analysis of proposed cumulative road catchment 3+4	PASS	PASS
Road catchment 5 - Remodelled roundabout north east of M54 J1 (this is a new catchment, which was part of existing catchment 3)	PASS	PASS
Road catchment 6 - Section of existing A460	PASS	PASS
Road catchment 7 - Section of existing A460	PASS	PASS
Road catchment 8 - Link road from new roundabout to existing A460 (no existing road in this area)	PASS	PASS
Proposed road catchment 7+8, with mitigation on road catchment 8	PASS	PASS



#### Table 4.1 Summary matrix of results of Proposed Scheme with mitigation – continued

Proposed road catchment, and description	HEWRAT short term metal and chronic sediment-bound pollutant tests	Assessment against annual average EQS
Road catchment 9 - Existing A460, with remodelled Hilton Lane flyover	Failure of acute copper at 2.5 exceedances (2 acceptable) Existing situation is 2.5 exceedances for the existing catchment	PASS
Road catchment 9 Sensitivity assessment of existing A460	PASS	PASS
Road catchment 10 - Main line of Scheme (new road catchment as proposed as the Scheme)	PASS	PASS
Cumulative road catchment 9+10	Failure of acute copper at 2.8 exceedances (2 acceptable). Existing situation is 2.5 exceedances for road catchment 9	PASS
Sensitivity analysis of road catchment 9+10	PASS	PASS
Road catchment 11 - Existing A460	PASS	PASS
Road catchment 12 - Permeable only	n/a	n/a
Road catchment 13 - Permeable only	n/a	n/a
Road catchment 14 - Mainline Scheme and slip road to existing A460 (new road catchment as proposed as the Scheme)	PASS	PASS
Road catchment 15 - A460 north of M6 J11 (existing catchment, which is modified)	PASS	PASS
Road catchment 16 - West roundabout and slip roads of M6 J11 (existing catchment, which is modified)	PASS	PASS
Road catchment 17 – East roundabout and slip roads of M6 J11 (existing catchment, which is modified)	PASS	PASS



#### Table 4.1 Summary matrix of results of Proposed Scheme with mitigation – continued

Proposed road catchment, and description	HEWRAT short term metal and chronic sediment-bound pollutant tests	Assessment against annual average EQS
Cumulative for road catchment 15+16+17	Failure of acute copper at 4.8 exceedances (2 acceptable). Existing situation is 6.3 exceedances for catchment 15+16+17. This is an improvement over existing situation	PASS
Sensitivity analysis for cumulative road catchment 15+16+17	Failure of acute copper at 3.7 exceedances (2 acceptable). Existing situation is 6.3 exceedances for catchment 15+6+17.	PASS



## 5 References

- Ref 1.1 Design Manual for Roads and Bridges (DMRB) LA113 Road Drainage and the Water Environment (formerly HD45/09). Highways Agency (2019).
- Ref 1.2 Design Manual for Roads and Bridges, Volume 4, Section 2, Part 3 Design of Highway Drainage Systems (CG501). Highways England (2019).
- Ref 1.3 Design Manual for Roads and Bridges, Volume 4, Section 2, Part 1 Vegetated Drainage Systems for Highway Runoff (HA103/06). Highways Agency (2006).
- Ref 2.1 British Geological Survey's Geoindex website. Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html (accessed October 2019).
- Ref 2.2 Cranfield University's Soilscapes website. Available at: http://www.landis.org.uk/soilscapes (accessed October 2019).
- Ref 2.3 UK Government, 2017 Policy Paper: Air quality plan for nitrogen dioxide (NO<sub>2</sub>) in UK. Department for Environment, Food & Rural Affairs (2017).
- Ref 2.4 Multi-agency Geographical Information for the Countryside website. Available at: https://magic.defra.gov.uk (last accessed December 2019).
- Ref 3.1 The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. The Stationary Office (2015).
- Ref 3.2 UKTAG, 2014. 'UKTAG River and Lake Assessment Method Specific Pollutants (Metals): Metal Bioavailability Assessment Tool (M-BAT), UK Technical Advisory Group on the Water Framework Directive.'



# Annex A: HEWRAT data and assessment results

The following tables present the data used within the HEWRAT assessment, and the analysis of the results of the assessment, as referenced in Sections 1 to 3 of this report.

WC	Q95 estimated from LowFlows Software	Sensitivity Analysis
1	0.001 m <sup>3</sup> /s	As WC 7: 0.006 m <sup>3</sup> /s
2	0.003 m³/s	As WC 7: 0.006 m <sup>3</sup> /s
3	0.003 m <sup>3</sup> /s	Upstream of Saredon Brook 0.006 m <sup>3</sup> /s
4	0.001 m <sup>3</sup> /s	Upstream of Saredon Brook 0.01 m <sup>3</sup> /s
5 (WFD Latherford Brook)	0.004 m <sup>3</sup> /s	Upstream of Saredon Brook 0.01 m <sup>3</sup> /s
6	0.002 m <sup>3</sup> /s	0.003 m³/s
7	0.006 m <sup>3</sup> /s	0.006 m³/s

Table A1: Q95 flow data for the WCs receiving discharge



#### Table A2: Drainage Data for the catchments (from HE514465-ACM-HDG-M54\_SW\_PR\_Z-D|R-CD-0004 P03.1 rcvd 22<sup>nd</sup> November 2019)

Water- course	Existing Road catchment	Proposed Road catchment	Description	Proposed impermeable (ha)	Proposed permeable (ha)	Notes
7	1	1	Existing M54 west bound and remodelled Junction 1 M54	1.274	1.209	M54 west
7	2	2	Existing M54 eastbound and remodelled Junction 1 M54	1.063	0.176	M54 east
1	3	3	New roads part of remodelled Junction1 M54 and northbound M54-M6 link	3.189	5.004	WC 1 new outfall
2	n/a	4	New roads part of remodelled Junction1 M54 and southbound M54-M6 link	5.511	5.097	WC 2
2 -	3	5	New roads part of remodelled Junction1 M54 and northbound M54-M6 link	1.151	1.460	WC2 new highway outfall
	4	6	Existing A460 south near J1 M54	0.121	0.082	WC 2 highway outfall
	5	7	Existing A460 in area of Hilton Lane	1.816	0.115	WC 3 Existing
3	n/a	8	New Link road J1 to A460	0.474	0.783	WC 3 New
	6	9	Existing A460	1.644	1.035	WC 4 existing
4	n/a	10	New M54-M6 Link road mainline	3.353	4.050	WC 4 new
	7	11	Existing A460	0.351	0.017	WC 5 existing
F	n/a	12	Permeable area only	0	0.513	WC 5 New A
5	n/a	13	Permeable area only	0	0.515	WC 5 new B
	n/a	14	New M54-M6 Link road mainline	3.492	3.285	WC 5 new C



#### Table A2: Drainage Data for the catchments (from HE514465-ACM-HDG-M54\_SW\_PR\_Z-D|R-CD-0004 P03.1 rcvd 22<sup>nd</sup> November 2019) - continued

Water- course	Existing Road catchment	Proposed Road catchment	Description	Proposed impermeable (ha)	Proposed permeable (ha)	Notes
6	8	15	A460 north from Junction 11 M6 roundabout	2.000	0.798	WC 6
	9	16	Existing M6 northbound and western side of remodelling Junction 11 M6	3.780	3.574	M6 northbound outfall to WC 6
	10	17	Existing M6 southbound and eastern side of remodelling Junction 11	3.964	4.169	M6 southbound outfall to WC 6



Table A3: Data used within the HEWRAT assessment for the Sc	neme
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Parameter	Source	Data
Location description	M54 – M6 Link	Scheme drawings.
AADT BAND	Max AADT: Catchment 1: >50,000-<100,000 (westbound carriageway M54) Catchment 2: >50,000-<100,000 (eastbound carriageway M54) Catchment 3: >50,000-<100,000 (mainline section) Catchment 4: >10,000-<50,000 (southbound from eastern dumb-bell) Catchment 5: >10,000-<50,000 (J1 to A460 road) Catchment 6: 10,000-<50,000 (J1 to A460 road) Catchment 7: <10,000 NO HEWRAT REQUIRED (A460) Catchment 8: >10,000-<50,000 (J1 to A460 road) Catchment 9: <10,000 NO HEWRAT REQUIRED (A460) Catchment 10: >50,000 - <100,000 (mainline M54- M6 link) Catchment 11: <10,000 NO HEWRAT REQUIRED (A460) Catchment 12: Permeable area only NO HEWRAT REQUIRED Catchment 13: Permeable area only NO HEWRAT REQUIRED Catchment 14: >50,000 - <100,000 (mainline M54- M6 link) Catchment 15: >50,000 - <100,000 (A460 north from J11 M6) Catchment 16: >10,000 - <50,000 (soutbound M6 only) Catchment 17: >10,000 - <50,000 (soutbound M6 only)	Traffic (updated) SATURN Plots received by email 8 <sup>th</sup> August 2019. Do something 2039 AADT, % HGV traffic flows,
Climatic Region	Warm/dry	Embedded in HEWRAT programme
Rainfall Site	Birmingham	Embedded in HEWRAT programme
Impermeable Road Area Drained	See Table of impermeable/permeable areas	Figure 2.1 of Appendix 13.2 [TR010054/APP/6.3]
Permeable Road Area Drained	See Table of impermeable/permeable areas	As above



#### Table A3: Data used within the HEWRAT assessment for the Scheme - continued

Parameter	Source	Data
Annual Q95 flow (m³/s)	<ul> <li>WC 1: 0.001m<sup>3</sup>/s, use WC 7 point further downstream for sensitivity analysis</li> <li>WC 2: 0.003 m<sup>3</sup>/s, use WC 7 point further downstream for sensitivity analysis</li> <li>WC 3: 0.003 m<sup>3</sup>/s, sensitivity analysis upstream of Saredon Brook, 0.006 m<sup>3</sup>/s</li> <li>WC 4: 0.001 m<sup>3</sup>/s, sensitivity analysis upstream of Saredon Brook, 0.01 m<sup>3</sup>/s</li> <li>WC 5: 0.004 m<sup>3</sup>/s, sensitivity analysis upstream of Saredon Brook, 0.01 m<sup>3</sup>/s</li> <li>WC 5: 0.002 m<sup>3</sup>/s, sensitivity analysis upstream of Saredon Brook, 0.01m<sup>3</sup>/s</li> <li>WC 6: 0.002 m<sup>3</sup>/s, sensitivity analysis upstream of Saredon Brook, 0.003m<sup>3</sup>/s</li> <li>WC 7: 0.006 m<sup>3</sup>/s</li> </ul>	Calculated using Wallingford Hydrosolutions Ltd LowFlows software
Baseflow Index (BFI)	0.5	No specific data. Adopted default value as suggested by HEWRAT Manual
Average of monitored dissolved Copper Concentration from March, June and September 2019 Monitoring	WC 1: as WC 2 WC 2: 3 ug/l WC 3: 4 ug/l WC 4: 3 ug/l WC 5: 5 ug/l WC 6: 4 ug/l WC 7: 3 ug/l Where the concentration is <lod, is="" taken<br="" the="" value="">to be equal to the LOD.</lod,>	Site specific monitoring Data.
Proximity to Area of Ecological Conservation	Lower Pool SBI, the pond (Upstream of Road Drainage outfall) Brookfield Farm SBI, wet woodland (Upstream of Road Drainage outfall)	Ecology Chapter of ES Report
Water Hardness	High >200 mg CaCO₃/L.	Environment Agency Data at Saredon/Wyrley/Wash Brook at Wedges Mill. Downstream data on River Penk at Lower Green Coven on WIMS website <sup>1</sup>
Proximity to Downstream Structure	Based on site surveys	

<sup>&</sup>lt;sup>1</sup> https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3356

Planning Inspectorate Scheme Ref: TR010054 Application Document Ref: TR010054/APP/6.3



#### Table A3: Data used within the HEWRAT assessment for the Scheme - continued

Parameter	Source	Data
Estimated River Width	<ul> <li>WC 1: 1 m (from MAGIC map), 2.5m for sensitivity analysis</li> <li>WC 2: 0.5 m (from onsite observation), 2.5m for sensitivity analysis</li> <li>WC 3: 1 m (from onsite observation), 2.5 m for sensitivity analysis (from MAGIC map)</li> <li>WC 4: 1.5 m (from onsite observation), , 2.5 m for sensitivity analysis (from MAGIC map)</li> <li>WC 5: 2.5 m (from onsite observation) , 2.5 m for sensitivity analysis (from MAGIC map)</li> <li>WC 5: 1 m (from onsite observation) , 2.5 m for sensitivity analysis (from MAGIC map)</li> <li>WC 6: 1 m (from onsite observation), 1.5 m for sensitivity analysis (from MAGIC map)</li> <li>WC 7: 2.5 m (from MAGIC map)</li> </ul>	Approximated at site visit by hydromorphologist, and measured from MAGIC map

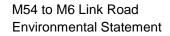
M54 to M6 Link Road Environmental Statement



#### Table A4: HEWRAT assessment results for outfalls to be used in the Scheme

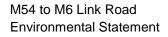
			Step 2 Tier 1								
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Acute	Sediment Chror Annual Average				Annual Average Cu	Annual Average Soluble Zn	
		Copper	impact Zinc	Accumulating?	Extensive?	Deposition Index		EQS: 1 µg/l	EQS: 10.9 µg/l		
Existing Ca	isting Catchment 1										
1	WC 7 Existing Outfall	WC 7	Pass	Pass	Yes	No	87	n/a	3.22 (less than 5.75 μg/l is a pass using M-BAT for WC 7 – see Table A7)		
Proposed C	atchment 1 (	No mitigatio	on)								
1	M54 West Outfall	WC 7	Pass	Pass	Yes	No	92	n/a	3.23 (less than 5.75 $\mu$ g/l is a pass using M-BAT for WC 7 – see Table A7)		
Existing Ca	tchment 2										
2	WC 7 Existing Outfall	WC 7	Pass	Pass	Yes	Yes	100		3.24 (less than 5.75 μg/l is a pass using M-BAT for WC 7 – see Table A7)		
Proposed C	atchment 2 (	No mitigatio	on)								
2	M54 East Outfall	WC 7	Pass	Pass	Yes	No	77		3.21 (less than 5.75 $\mu$ g/l is a pass using M-BAT for WC 7 – see Table A7)		

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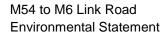


			Step 2 Tier 1							
Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chron Annual Average	•			Annual Average Cu	Annual Average Soluble Zn
			Copper	impact Zinc	Accumulating?	Extensive?	Deposition Index	Sediment settlement needed	EQS: 1 µg/l	EQS: 10.9 μg/Ι
Existing Cumulative Catchments 1 + 2										
Existing Cumulative Catchment 1 + 2	WC 7	WC 7	Fail (2.2 exceedances, 2 acceptable)	Pass	Yes	Yes	187	47%	3.66 (less than 5.75 μg/l is a pass using M-BAT for WC 7 – see Table A7)	2.59
Proposed C	umulative Ca	atchments 1	+ 2 (No mitiga	ation)						
1 and 2 (M54 east and west)	WC 7 – assumed south and north outfall – within 100m	WC 7	Fail (2.2 exceedances, 2 acceptable)	Pass	Yes	Yes	169	41%	2.12 (less than 5.75 μg/l is a pass using M-BAT for WC 7 – see Table A7)	2.39
Existing Catchment 3 (No mitigation) This is equivalent to Proposed Catchment 3 + 4 as existing roundabout catchment split with Scheme.										
9	WC 1 New Outfall	WC 1	Fail (8.8 exceedances, 2 acceptable)	Pass	Yes	Yes	1276		4.93 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	5.53
	atchment (No	o mitigation	a)							



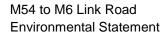


			Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chror Annual Average	-			Annual Average Cu	Annual Average Soluble Zn
			Connor	impact Zinc	Accumulating?	Extensive?	Deposition Index		EQS: 1 μg/l	EQS: 10.9 μg/Ι
	WC 1 New Outfall	WC 1	Fail (4.7 exceedances, 2 acceptable)	Pass	Yes	Yes	608	84%	4.35 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	3.89
```	WC 1 New Outfall	WC 1	Fail (2.6 Exceedances, 2 acceptable)	Pass	Yes	Yes	264	65%	3.84 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	2.37
Cumulative	Assessment	Catchment	t 3 + 4 (excludi	ng Sedirr	nent) of Proposed	d Catchment	(No Mitigati	on)		<u>-</u>
Catchment 3 + 4 (200m) (south & north of M54 J1)	WC 1 existing outfall	WC 1	Fail (10.9 exceedances, 2 acceptable)	Pass	Not Required				5.13 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	6.09
Proposed C	atchment 5 (	No mitigatio	on)							
Catchment 5 (northeast of M54 J1)	WC 2 Highway Outfall	WC 2	Pass	Pass	Yes	No	59	n/a	3.28 (less than 5.75 $\mu$ g/l is a pass using M-BAT for WC 2 – see Table A7)	0.74



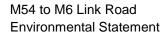


			Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chror Annual Average	•			Annual Average Cu	Annual Average Soluble Zn
			Conner	impact Zinc	Accumulating?	Extensive?	Deposition Index		t ht EQS: 1 μg/l	EQS: 10.9 µg/l
Proposed C	atchment 6 (	No mitigatio	on)							
Catchment 6 (A460 – no changes)	WC Highway Outfall	WC 2	Pass	Pass	Yes	No	6	n/a	3.28 (less than 5.75 μg/l is a pass using M-BAT for WC 2 – see Table A7)	0.09
Cumulative	Assessment	(including	Sediment) of P	roposed	Catchment 5 + 6	(No Mitigati	on)		-	
Cumulative assessment of catchment 5 + 6	WC 2	WC 2	Pass	Pass	Not Required				3.31 (less than 5.75 μg/l is a pass using M-BAT for WC 2 – see Table A7)	0.81
Existing Cat	chment 7									
Catchment 7 (A460)	WC 3 New Outfall	WC 3	Pass	Pass	Yes	Yes	264	63%	4.45 (less than 17.8 μg/l is a pass using M-BAT for WC 3 – see Table A7)	1.21
Proposed C	atchment 7 (	No mitigatio	on)						·	



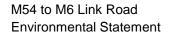


			Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chror Annual Average	-			Annual Average Cu	Annual Average Soluble Zn
			Copper	impact Zinc	Accumulating?	Extensive?	Deposition Index		EQS: 1 µg/l	EQS: 10.9 µg/l
Catchment 7 (A460)	WC 3 New Outfall	WC 3	Pass	Pass	Yes	Yes	239	59%	4.42 (less than 17.8 μg/l is a pass using M-BAT for WC 3 – see Table A7)	1.12
Existing Cate	chment 8 (No	mitigation)								
	WC 6 Existing Highway Outfall	WC 6	Pass	Pass	Yes	Yes	204	51%	4.50 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	
Proposed C	atchment 8 (	No mitigatio	on)							
Catchment 8 (A460 link to junction)	WC 3 new outfall	WC 3	Pass	Pass	Yes	No	64	n/a	4.32 (less than 17.8 μg/l is a pass using M-BAT for WC 3 – see Table A7)	
Cumulative	Assessment	(including	Sediment) of P	roposed	Catchment 7 + 8	(No Mitigati	ion)			
Cumulative assessment of 7 + 8 (within 100m)	WC 3	WC 3	Pass	Pass	Yes	Yes	301	67%	3.78 (less than 17.8 μg/l is a pass using M-BAT for WC 3 – see Table A7)	



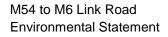


			Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble	Soluble Acute impact	Sediment Chror Annual Average	-			Annual Average Cu	Annual Average Soluble Zn
Existing Catchment 9			Zinc	Accumulating?	Extensive?	Deposition Index		EQS: 1 µg/l	EQS: 10.9 µg/l	
Existing Cat	tchment 9									
Catchment 9 (A460 and Hilton Lan e)	WC 4 New Outfall	WC 4	Fail (2.5 exceedances, 2 acceptable)	Pass	Yes	Yes	217	54%	4.77 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)	2.22
Proposed C	atchment 9 (	No mitigatio	on)							
Catchment 9 (A460 and Hilton Lane)	WC 4 New Outfall	WC 4	Fail (2.5 exceedances, 2 acceptable)	Pass	Yes	Yes	224	56%	3.80 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)	2.25
Proposed Ca	atchment 10 (I	No mitigation	n)							
Catchment 10 (Scheme mainline)	WC 4 New Outfall	WC	Fail (5.1 exceedance, 2 acceptable)	Pass	Yes	Yes	456	79%	4.44 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)	4.11



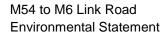


			Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chror Annual Average	•		Annual Average Cu	Annual Average Soluble Zn	
			Copper	impact Zinc	Accumulating?	Extensive?	Deposition Index		t EQS: 1 μg/l	EQS: 10.9 μg/l
Cumulative	Assessment	(including	Sediment) of F	roposed	Catchment 9 + 1	0 (No Mitiga	tion)			
Cumulative assessment of 9 + 10	WC 4	WC 4	Fail (8.1 Exceedances, 2 acceptable)	Pass	Not Required	4.78 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)				
Existing Cat	chment 11									
11 (A460)	WC 5 existing	WC 5	Pass	Pass	Yes	No	68	n/a	3.20 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	
Proposed C	atchment 11	(No mitigat	tion)							
11 (A460)	WC 5 existing	WC 5	Pass	Pass	Yes	No	27		5.14 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	
12	No assessme	ent and pern	neable embank	ment drai	nage only					
13	No assessme	ent and pern	neable embank	ment drai	nage only					
Proposed C	atchment 14	(No mitigat	tion)							





		:	Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chror Annual Average	•		Annual Average Cu	Annual Average Soluble Zn	
		Copper	impact Zinc	Accumulating?	Extensive?	Deposition Index		EQS: 1 µg/l	EQS: 10.9 µg/l	
	WC 5 New Outfall C	WC 5	Pass	Pass	Yes	Yes	273	64%	5.61 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	1.80
Existing Cat	chment 15 A	460 (No Mi	tigation)							
15 (A460 north of J11 M6)	WC 6 Existing Highway Outfall	WC 6	Pass	Pass	Yes	Yes	204	51%	4.50 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	1.42
Proposed C	atchment 15	A460 (No n	nitigation)							
	WC 6 Proposed Highway Outfall	WC 6	Fail (2 exceedances, 2 acceptable)	Pass	Yes	Yes	322	69%	4.71 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.04
Existing Cat	chment 16									
	M6 Northbound Outfall	WC 6	Fail (2.2 exceedances, 2 acceptable)	Pass	Yes	Yes	475	79%	4.68 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.02





			Step 2 Tier 1							
Road Catchment	Outfall/s	Receiving WC	Soluble Acute Impact	Soluble Acute	Sediment Chror Annual Average	-			Annual Average Cu	Annual Average Soluble Zn
			Conner	impact Zinc	Accumulating?	Extensive?	Deposition Index		EQS: 1 µg/l	EQS: 10.9 µg/l
Proposed C	atchment 16	(No mitigat	ion)							
16	M6 Northbound Outfall	WC 6	Fail (2.6 exceedances, 2 acceptable)	Pass	Yes	Yes	608	84%	4.82 than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.41
Existing Ca	tchment 17									
17	M6 Southbound Outfall	WC 6	Fail (2.5 exceedances, 2 acceptable)	Pass	Yes	Yes	542	82%	4.75 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.21
Proposed C	atchment 17	(No mitigat	ion)							
17	M6 Southbound Outfall	WC 6	Fail (2.7 exceedances, 2 acceptable)	Pass	Yes	Yes	642	85%	4.84 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.47
Cumulative	Assessment	Existing 15	5 + 16 + 17							
15 +16 + 17	M6 northbound and southbound outfall	WC 6	Fail (6.3 exceedances, 2 acceptable)	Pass	Not required.				4.82 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	4.4



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			Step 2 Tier 1						
Road Catchment	Outfall/s	Receiving WC	Acute Impact	Acute	Sediment Chror Annual Average			Annual Average Cu	Annual Average Soluble Zn
			Copper	impact Zinc	Accumulating?	Extensive?	Deposition Index	EQS: 1 µg/l	EQS: 10.9 μg/Ι
Cumulative	Assessment	Proposed	15 + 16 + 17 (n	o mitigat	ion)		•	•	
15, 16 and 17	M6 Northbound Outfall, M6 Southbound Outfall and WC 6 Existing Highway Outfall (within 1km)		Fail (8.2 exceedances, 2 acceptable)	Pass	Not required.			5.07 less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	



#### Table A5: Indicative treatment efficiencies of drainage systems (Ref 1-2]

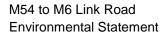
Treatment System Type	Suspended Solids (% removal)	Dissolved Copper (% removal)	Dissolved Zinc (% removal)
Swales and Grassed Channels	80	50	50
Dry/Detention Ponds	50	0	0
Wet/Retention Ponds	60	40	30
Wetlands (Surface Flow)	60	30	50
Vortex Grit Separators	40	0	15
Sediment Tanks	40	0	0
Oil Separators	0	0	0
Reservoir Pavements/Porous Asphalt	50	0	0
Vegetated Filter Strips	25	15	15
Filter Drains	60	0	45
Ditches	25	15	15



### Table A6: HEWRAT With Mitigation Steps, and comparison with MBAT maximum from Table A7

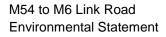
			Step 2 Tier 1							
Road Catchment	Outfall/s	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment	Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
		(WC)	Acute A Impact ir Copper* Z	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 μg/l
Proposed Catchn	nent 1 + 2 w	ith Mitigati	on: Passes se	ediments v	vith existin	g filter drains	: fails copp	er acute me	tals	
With Existing Filter Drains (60% sediment bound pollutants)	WC 7	WC 7	Fail (2.2 exceedance s)	Pass	Yes	No	68	N/a	3.62 (less than 5.75 μg/l is a pass using M-BAT for WC 7 – see Table A7)	2.39
Sensitivity analysis with point downstream before confluence with River Penk	WC7	WC7	PASS	PASS	Yes	No	34	n/a	3.22 (less than 5.75 μg/l is a pass using M-BAT for WC 7 – see Table A7)	0.74
Proposed Catchn	nent 3 with M	Mitigation:	Passes acute	metals, se	ediments a	nd long tern E	EQS with a	pond and a	dded short length of s	swale
	WC 1 New Outfall	WC 1	Fail (2.1 Exceedance s)	Pass	Yes	Yes	243	24%	3.71 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	2.37

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	ad ochment Outfall/s Receivin g Water- course (WC) In C	Step 2 Tier 1								
Road Catchment		g Water-	Soluble Acute	Soluble Acute	Sediment	Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
		Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 μg/l	
Mitigation 2: Attenuation Pond plus short length of swale (1/2 mitigation amount allowed as short length) (40+25% dissolved metals, 60+40% suspended solids)	WC 1 New Outfall	Water- course 1	Pass	Pass	Yes	No	0	n/a	3.32 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	
Proposed Catchn	nent 4 with r	nitigation:	With HVS and	d filter drai	ns passes	sediments an	d long terr	n EQS but fa	ails short term coppe	r
Mitigation 1: Addition of HVS (40% reduction of suspended solids)	-	WC 1	Fail (7.5 exceedance s)	Pass	Yes	Yes	708	52%	4.69 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	





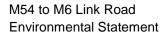
			Step 2 Tier 1							
Road Catchment			Soluble Acute	Soluble Acute	Sediment	Chronic Impa	ict		Annual Average Cu	Annual Average Soluble Zn
		(WC) Imp	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
Mitigation 2: Addition of filter drains (100% reduction of sediment bound pollutants)	WC 1 highway outfall	WC 1	Fail (7.5 exceedance s)	Pass	Yes	No	n/a	N/a	4.69 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	4.70
Sensitivity analysis using point at WC 7 confluence	WC 7 highway outfall	WC 7	Pass	Pass	Yes	No	n/a	N/a	3.60 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	1.65



			Step 2 Tier 1							
Road Catchment	Outfall/s	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment Chronic Impact				Annual Average Cu	Annual Average Soluble Zn
		(WC)	Impact Copper*	impact Zinc	Acute Sediment		EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l		
	ails short te								ment 4, and pond and as all at the assessme	
Mitigation catchment 4: HVS and filter drains with no dissolved metal mitigation, Catchment 3 wet pond and length of swale. Ratios work out with 22% mitigation for dissolved metals overall	outfall	WC 1	Fail (4.4 exceedance s)	Pass	N/a				4.18 (less than 5.75 μg/l is a pass using M-BAT for WC 1 – see Table A7)	3.68
Sensitivity Analysis using point at WC7 confluence	WC7	WC7	Pass	Pass	N/a				3.45	1.46

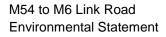


			Step 2 Tier 1	I						
Road Catchment	oad Outfall/s g Water-	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment	: Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
		(WC)	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
further downstream										
									proposed. Outfalls to	5 WC 2
with 3.28 μg/l anr Proposed Catchn with 3.28 μg/l anr	nual average nent 6: Pass nual average nent 7: Pass	e copper EC ses sedime e copper EC ses sedime	QS. Less than nt bound poll QS. Less than nt bound poll	1 5.75 μg/l ι lutants and 1 5.75 μg/l ι lutants and	maximum i I short tern maximum i I short tern	n Table A7, th n dissolved m n Table A7, th n dissolved m	erefore par etals so no erefore par etals so no	sses EQS te o mitigation sses EQS te o mitigation	st also. proposed. Outfalls to st also. proposed. Outfalls to	WC 2
with 3.28 μg/l anr Proposed Catchr with 3.28 μg/l anr Proposed Catchr with 4.42μg/l ann	nent 6: Pass nent 6: Pass nual average nent 7: Pass ual average nent 8: Pass	e copper EC ses sedime e copper EC ses sedime copper EQ ses sedime	QS. Less than nt bound poll QS. Less than nt bound poll QS. Less than nt bound poll	i 5.75 μg/l ι lutants and 5.75 μg/l ι lutants and 17.8 μg/l n lutants and	maximum i I short tern maximum i I short tern naximum ir	n Table A7, th n dissolved m n Table A7, th n dissolved m n Table A7, the n dissolved m	erefore par etals so no erefore par etals so no erefore pas etals, so n	o mitigation sses EQS te mitigation ses EQS tes o mitigation o mitigation	st also. proposed. Outfalls to st also. proposed. Outfalls to	WC 2 WC 3
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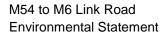


		Step 2 Tier 1							
Outfall/s	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment	Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
pond (circa	(WC)	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
						other impi	rovements p	ossible as A460 is m	anaged
WC 4 new outfall	WC 4	Fail (2.5 exceedance s)	Pass	Yes	Yes	195	43%	3.68 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	2.06
	upstream of	Pass	Pass	Yes	No	84	n/a	3.10 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	0.33
	WC 4 new outfall WC4/5 downstrea m point of	Outfall/sg Water-course (WC)g Water-course (WC)nent 9: Existing A460. I y SCC road and is notWC 4 new outfallWC 4WC 4/5 downstrea m point of assessmenWC 4/5 upstream of Saredon	Outfall/sReceivin g Water- course (WC)Soluble Acute Impact Copper*Dent 9: Existing A460. Filter drain pr y SCC road and is not being improvWC 4 new outfallWC 4WC 4/5 downstrea m point of assessmenFail (2.5 exceedance s)	Outfall/sReceivin g Water- course (WC)Soluble Acute Impact Copper*Soluble Acute impact ZincOutfall/sReceivin g Water- course (WC)Soluble Acute Impact Copper*Soluble Acute impact ZincDent 9: Existing A460. Filter drain proposed all sCC road and is not being improved by theWC 4 new outfallWC 4Fail (2.5 exceedance s)PassWC 4/5 downstrea m point of 	Outfall/sReceivin g Water- course (WC)Soluble Acute Impact Copper*Soluble Acute impact ZincSediment Acute impact ZincDent 9: Existing A460. Filter drain proposed alongside Hi y SCC road and is not being improved by the proposed alongside Hi y SCC road and is not being improved by the proposed alongside Hi solutfallWC 4Fail (2.5 exceedance s)PassYesWC 4/5 downstrea m point of assessmenWC 4/5 upstream of SaredonPassPassYes	Outfall/sReceiving WC 4Soluble Acute Impact Copper*Soluble Acute impact ZincSediment Chronic Impact Acute impact ZincSediment Chronic Impact Acute impact Acute impact ZincSediment Chronic Impact Acute impact Acute impact Acute impact Acute impact ZincSediment Chronic Impact Acute impact Acute impact Acute impact Acute impact ZincSediment Chronic Impact Acute impact Acute impact Acute impact Acute impact ZincSediment Chronic Impact Acute impact Acute impact Acute impact Acute Acute impact Acute impact Acute impact Acute Acute impact Acute impact Acute impact Acute Acute impact Acute impact Acute impact Acute Acute impact Acute impact Acute impact Acute Acute impact Acute impact Acute Acute impact Acute impact Acute impact Acute Acute impact Acute impact Acute impact Acute Acute impact Acute Acute Acute Acute impact Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute Acute <b< td=""><td>Outfall/s       Receivin g Water- course (WC)       Soluble Acute Impact Copper*       Soluble Acute Impact       Soluble Acute Impact       Sediment Chronic Impact         Accum- ulating?       Extensive?       Depositi on Index         Depositi on Index       Impact       Impact       Impact         WC 4       Fail       (2.5) exceedance       Pass       Yes       Yes       195         WC4/5 downstrea m point of assessmen       WC 4/5 Saredon       Pass       Pass       Yes       No       84</td><td>Outfall/s       Receiving Water-course (WC)       Soluble Acute Impact Copper*       Soluble Acute Impact Copper*       Soluble Acute Impact Copper*       Soluble Acute Impact Copper*       Accum-ulating?       Extensive?       Depositi on Index       Sediment settlement settlement needed         Nemt 9: Existing A460. Filter drain proposed alongside Hilton Lane; No other improvements p y SCC road and is not being improved by the proposed Scheme.       Image: Soluble Acute Impact Copper*       Yes       195       43%         WC 4 new outfall       WC 4       Fail (2.5 exceedance s)       Pass       Yes       No       84       n/a</td><td>Outfall/s       Receivin g Water- course (WC)       Soluble Acute Impact Copper*       Soluble Acute Impact Zinc       Sediment Chronic Impact       Annual Average Cu         Accum- ulating?       Extensive?       Depositi on Index       Sediment settlement needed       EQS: 1 µg/l – takes into account the M- BAT results from Table A7         Text 9: Existing A460. Filter drain proposed alongside Hilton Lane; No other improvements possible as A460 is may sy SCC road and is not being improved by the proposed Scheme.       Impact Scheme       3.68 (less than 13.1 µg/l is a pass using M-BAT for WC 5 – see Table A7)         WC 4 new outfall       WC 4, by Stream of Saredon       Fail (2.5 exceedance s)       Pass       Yes       Yes       195       43%       3.68 (less than 13.1 µg/l is a pass using M-BAT for WC 5 – see Table A7)</td></b<>	Outfall/s       Receivin g Water- course (WC)       Soluble Acute Impact Copper*       Soluble Acute Impact       Soluble Acute Impact       Sediment Chronic Impact         Accum- ulating?       Extensive?       Depositi on Index         Depositi on Index       Impact       Impact       Impact         WC 4       Fail       (2.5) exceedance       Pass       Yes       Yes       195         WC4/5 downstrea m point of assessmen       WC 4/5 Saredon       Pass       Pass       Yes       No       84	Outfall/s       Receiving Water-course (WC)       Soluble Acute Impact Copper*       Soluble Acute Impact Copper*       Soluble Acute Impact Copper*       Soluble Acute Impact Copper*       Accum-ulating?       Extensive?       Depositi on Index       Sediment settlement settlement needed         Nemt 9: Existing A460. Filter drain proposed alongside Hilton Lane; No other improvements p y SCC road and is not being improved by the proposed Scheme.       Image: Soluble Acute Impact Copper*       Yes       195       43%         WC 4 new outfall       WC 4       Fail (2.5 exceedance s)       Pass       Yes       No       84       n/a	Outfall/s       Receivin g Water- course (WC)       Soluble Acute Impact Copper*       Soluble Acute Impact Zinc       Sediment Chronic Impact       Annual Average Cu         Accum- ulating?       Extensive?       Depositi on Index       Sediment settlement needed       EQS: 1 µg/l – takes into account the M- BAT results from Table A7         Text 9: Existing A460. Filter drain proposed alongside Hilton Lane; No other improvements possible as A460 is may sy SCC road and is not being improved by the proposed Scheme.       Impact Scheme       3.68 (less than 13.1 µg/l is a pass using M-BAT for WC 5 – see Table A7)         WC 4 new outfall       WC 4, by Stream of Saredon       Fail (2.5 exceedance s)       Pass       Yes       Yes       195       43%       3.68 (less than 13.1 µg/l is a pass using M-BAT for WC 5 – see Table A7)



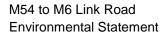


			Step 2 Tier 1							
Road Catchment	Outfall/s	Receivin g Water- course	Soluble Acute	Soluble Acute	scute				Annual Average Cu	Annual Average Soluble Zn
		(WC)	Impact i	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
	WC 4 new outfall	WC 4	Fail (2.3 Exceedance s)	Pass	Yes	Yes	182	19%	3.74 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)	
Mitigation 2: Attenuation pond and short length of swale (40+25% dissolved metals, 60+40% suspended solids)		WC 4	Pass	Pass	Yes	No	0	n/a	3.34 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)	1.44
Proposed Catchn	nent 9 + 10 -	- with mitig	ation on Cato	hment 10	•					
Mitigation of wet attenuation pond and ditches on Catchment 10 only (44%	WC 4 new outfall	WC 4	Fail (2.8 Exceedance s)	Pass					3.86 (less than 7.45 µg/l is a pass using M-BAT for WC 4 – see Table A7)	



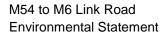


			Step 2 Tier 1	l						
Road Catchment	Outfall/s	Receivin g Water- course	Soluble Acute	Acute Acute				Annual Average Cu	Annual Average Soluble Zn	
		(WC)	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index		EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
reduction of dissolved metals). No mitigation on Catchment 9.										
Sensitivity analysis of above using downstream analysis point	WC 4/5 upstream of Saredon Brook	WC 4/5	Pass Pass µg/l is a M-BAT fo		3.18 (less than 7.45 μg/l is a pass using M-BAT for WC 4 – see Table A7)	0.65				
				ediment, long term l naximum in Table A7				tfalls to WC	5 with 5.14 µg/l annua	al
Proposed Catchn	nent 12: Per	meable are	a only, no as	sessment	ent required.					
Proposed Catchn	nent 13: Per	meable are	a only, no as	sessment	nt required.					
Proposed Catchn drains	nent 14 with	mitigation	: Passes sed	iment bou	nd pollutar	nts, acute solu	ble metals	and long te	rm EQS with pond an	d filter



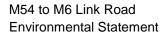


		\$	Step 2 Tier 1							
Road Catchment	d Outfall/s g Water-	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment	Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
		(WC)	Acute Impact	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index		EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
Mitigation 1: With wet pond (60% suspended solids, 40% dissolved metal)	WC 5 new outfall c	WC 5	Pass	Pass	Yes	Yes	109	4%	5.25 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	1.08
Mitigation 2: Pond and filter drains	WC 5 new outfall c	WC 5	Pass	Pass	Yes	No	0	n/a	5.25 (less than 13.1 μg/l is a pass using M-BAT for WC 5 – see Table A7)	1.08
Proposed Catchn ditchcourse	nent 15 with	mitigation	: Passes sedi	ment boui	nd pollutan	ts, acute meta	als and lon	g term EQS	with filter drains and	new
Mitigation 1: With filter drains	WC 6 existing	WC 6	Fail (2 exceed- ances)	Pass	Yes	Yes	129	9%	4.71 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.04



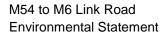


			Step 2 Tier 1							
Road Catchment		g Water- course	Soluble Acute	Soluble Acute	Acute		act		Annual Average Cu	Annual Average Soluble Zn
		•	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l	
Mitigation 2: With filter drains and roadside ditch	WC 6 existing	WC 6	Pass	Pass	Yes	No	48	n/a	4.53 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	
Catchment 16 wit along slip roads	h mitigation	: Passes s	ediment bour	nd pollutan	ts, acute n	netals and lon	g term EQ	S with filter of	drains and additional	swales
Mitigation 1: With existing filter drains (60% suspended solids)	WC 6	WC 6	Fail (2.6 exceedance s)	Pass	Yes	Yes	243	24%	4.82 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.41



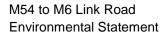


		:	Step 2 Tier 1							
Road Catchment	Outfall/s	course Acu		Soluble Acute	Sediment	Chronic Impa		Annual Average Cu	Annual Average Soluble Zn	
	ment course A (WC) II	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index		EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 μg/l	
Mitigation 2: With Filter drains adding lengths of swale at base of embankment which drain half the area of the catchment (100% suspended solids, 25% dissolved copper)	WC 6	WC 6	Pass	Pass	Yes	No	0	n/a	4.51 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	
Propose Catchmo lengths of swale				nent bound	d pollutants	s, acute metal	s and long	term EQS w	vith existing filter dra	ins and
With Existing Filter Drains (60% suspended solids)		WC 6	Fail (2.7 Exceedance s)	Pass	Yes	Yes	255	25%	4.83 (less than 42.5 $\mu$ g/l is a pass using M-BAT for WC 6 – see Table A7)	





			Step 2 Tier 1							
Road Catchment	oad htchment (WC)	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment	Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
		(WC)	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 μg/l
With Filter drains and adding lengths of swale at base of embankment which drain half the area of the catchment (100% suspended solids, 25% dissolved copper)	WC 6	WC 6	Pass	Pass	Yes	No	0	n/a	4.52 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	
CUMULATIVE Pro year is 8.2)	oposed Cato	hment 15	+ 16 + 17 with	mitigation	(note that	the existing o	cumulative	15+16+17 a	cute copper exceeda	nce per
With lengths of swale for catchments 16 and 17, and roadside ditch in 15 (23% mitigation for soluble metals)	WC 6	WC 6	Fail (4.8 exceedance s)	Pass	Not applic	able			5.20 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	3.91





			Step 2 Tier 1							
Road Catchment	Outfall/s	Receivin g Water- course	Soluble Acute	Soluble Acute	Sediment	Chronic Impa	act		Annual Average Cu	Annual Average Soluble Zn
		(WC)	Impact Copper*	impact Zinc	Accum- ulating?	Extensive?	Depositi on Index	Sediment settlement needed	EQS: 1 µg/I – takes into account the M- BAT results from Table A7	EQS: 10.9 µg/l
Sensitivity analysis using point further downstream before Saredon Brook	WC 6	WC 6	Fail (3.7 exceedance s)	Pass	Not applicable				4.937 (less than 42.5 μg/l is a pass using M-BAT for WC 6 – see Table A7)	2.10

Note: EQS for acute soluble copper is two exceedances per year only.



#### Table A7: M-BAT Results

Road Catchment/s and description of road catchment	Watercourse (WC)	Maximum dissolved copper concentration in the WC for a 1 μg/l Pass Bioavailable Copper Concentration
3: M54 J1 4: M54 J1	WC 1	5.75
5: M54 J1 6: A460	WC 2	5.75
7: A460 8: A460	WC 3	17.8
9: A460 10: Scheme mainline	WC 4	7.45
11: A460 14: Scheme mainline to J11 M6	WC 5	13.1
15: A460 north of J11 M6 16: M6 northbound and western half of J11 M6 17: M6 southbound and eastern half of J11 M6	WC 6	42.5
1: M54 west, 2: M54 east	WC 7	5.75

Note: Catchments 12 and 13 are permeable only and not included within calculations



# Table A8: Method C (groundwater) analysis of Road Catchment 3 (WC 1)

Com numl	ponent ber	Weighting Factor	Property or Parameter	Source	Risk Score	Component Score	Weighted Compone nt Score
1		10	Traffic Flow	From traffic data	>50,000 - <100,000	2	20
2		10	Rainfall depth (annual average)	From rainfall data in HEWRAT	740-1060	2	20
3	Source	10	Drainage area ratio	From drainage team	>150	3	30
4		15	Infiltration method	Receiving WC estimated to have low flow and thus may act like a soakaway	Continuous/ shallow	1	15
5		20	Unsaturated Zone	BH06 Monitored at 3.52 – 3.47 m bgl July / August 2019	Depth to water table < 5 m	3	60
6		20	Flow Type (incorporate flow type and effective grain size)	Mixed: Flow type from table C1.3 in HD45/09, dual permeability with High matric porosity, but low permeability, e.g. Sherwood Sandstone.	Mixed fracture and intergranular flow (e.g. medium to coarse sand)	2	40
7		5	Unsaturated Zone Clay content	>15% clay minerals, based on glacial till overlying the solid geology	>15% clay minerals	1	5
8	5 Organic Carbon		•	Organic Carbon is measured at 1.6% in BH03 at 1.5 m bgl	<15% to >1% SOM	2	10
9	Pathway	5	Unsaturated zone pH	BH03, at 1.5m ph 7.9	pH <8 to > 5	2	10
Total	Total Score:						210
Risk Screeni		g Level:					Medium



# Table A9: Method C (groundwater) analysis of Road Catchments 8 and 9 (WC 4)

Comp numb	oonent oer	Weighting Factor	Property or Parameter	Source	Risk Score	Component Score	Weighted Component Score
1		10	Traffic Flow	From traffic data	>50,000 - <100,000	2	20
2		10	Rainfall depth (annual average)	From rainfall data in HEWRAT	740-1060	2	20
3	Source	10	Drainage area ratio	From drainage team	>150	3	30
4		15	Infiltration method	Receiving WC estimated to have low flow and thus may act like a soakaway	Continuous/ shallow	1	15
5		20	Unsaturated Zone	BH20 Monitored at 12.8 to 12.96m bgl July / August 2019	Depth to water table <15 m to >5 m	2	40
6		20	Flow Type (incorporate flow type and effective grain size)	Mixed: Flow type from table C1.3 in HD45/09, dual permeability with High matric porosity, but low permeability, e.g. Sherwood Sandstone.	Mixed fracture and intergranular flow (e.g. medium to coarse sand)	2	40
7		5	Unsaturated Zone Clay content	>15% clay minerals, based on glacial till overlying the solid geology	>15% clay minerals	1	5
8		5	Organic Carbon	Organic Carbon is measured at 1.6% in BH20 at 0.5 m bgl	<15% to >1% SOM	2	10
9	Pathway	5	Unsaturated zone pH	BH20, at 0.5m pH 7.0	pH <8 to > 5	2	10
Total	Score:						190
Risk S	Screening	g Level:					Medium



#### Table A10 Data used in the assessment of accidental spillage risk

Road Catchment	Length of carriageway (m)	Traffic (AADT, %HGV)	Calculation Total	Calculation Totals as a Return Period (years)	Acceptable standard (1 in 100 years for non-sensitive sites
1	705	51871, 12%	0.0003	2890	YES
2	640	52022, 11%	0.0003	3463	YES
3	1375	29334, 8%	0.005	2161	YES
	405	18146, 10%			
	475	4825, 6%			
	185	17218, 6%			
4	1348	60535, 14%	0.0016	611	YES
	771	18146, 10%			
	610	3987, 9%			
	160	26491, 7%			
	175	31832, 7%			
	350	31332, 7%			
5	400	18146, 7%	0.0001	7426	YES
	250	4825, 6%			
	400	3833, 12%			
6	220	6	0.000	77091	YES
7	870	6212, 5%	0.0000	54510	YES
8	300	10138, 10%	0.000	37562	YES
	90	6212, 11%			
	25	4966, 8%			
9	750	5198, 6	0	41967	YES
	770	3801, 4			
10	980	58210, 9%	0.0004	2261	YES
	330	7777, 5%			
	360	10730, 7%			
11	375	3351, 5%	0	201873	YES
12	No road draina	ige			Not applicable
13	No road draina	ige			Not applicable



#### Table A10 Data used in the assessment of accidental spillage risk - continued

Road Catchment	Length of carriageway (m)	Traffic (AADT, %HGV)	Calculation Total	Calculation Totals as a Return Period (years)	Acceptable standard (1 in 100 years for non-sensitive sites
14	280 855 835	3351, 5% 29334, 8% 28876, 9%	0.0003	2960	YES
15	500 150	68926, 10% 21880, 11%	0.0002	4043	YES
16	440 360 1200 300	11742, 4% 47173, 11% 41945, 23% 11796, 13%	0.0023	443	YES
17	380 1230 390 335	12507, 4% 40844, 24% 45862, 9% 11578, 8%	0.0021	477	YES



# **Annex B: HEWRAT Outputs**

The following screenshots present the HEWRAT assessment calculations, as referenced in Section 3 of this report.

# Individual outfall assessments

#### **Road Catchment 1**

**Existing Area** 

Soluble         Sediment - Chronic Impact           Vector Lance Construction         Rest           Set and Arrange Grassestration         Rest           Set and Arrange Grassestration         Rest           Set and Arrange Grassestration         Rest         Rest         Rest           Set and Arrange Grassestration         Rest         Rest         Rest         Rest         Rest         Rest         Set and arrange Grassestration         Rest         Rest <th>highwa</th> <th>ays</th> <th>Hisburgers England</th> <th>Water Rick Assessment 1</th> <th>[ee]</th> <th></th> <th>Version 2.0.4 June 2</th> <th></th> <th></th> <th></th> <th></th>	highwa	ays	Hisburgers England	Water Rick Assessment 1	[ee]		Version 2.0.4 June 2					
Rest Interview           Rest Interview <th colspan<="" th=""><th>england</th><th>1</th><th>nignways England</th><th></th><th>001</th><th></th><th>version 2.0.4 June 2</th><th></th><th></th><th></th><th></th></th>	<th>england</th> <th>1</th> <th>nignways England</th> <th></th> <th>001</th> <th></th> <th>version 2.0.4 June 2</th> <th></th> <th></th> <th></th> <th></th>	england	1	nignways England		001		version 2.0.4 June 2				
Image: Control of the second secon	<u> </u>									Sediment -	Chronic Impact	
Seve 1       11       12       21       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12       12							Acute Imp	rect			Paul	
See 2       To table documentation of assessment of control in the sesses ment of cont					nati		Gammer	Zine				
See 3     ••     ••     ••       PRod number     MS 54     HE Area /DBFO number       Assessment too     Nor-cumulative assessment (sincle outbill)     Northing     S04467       So at a felemone of oudel anucuum initia     Basing     S02235     Northing     S04467       So at a felemone of oudel anucuum initia     Basing     S02235     Northing     S04467       So at a felemone of oudel anucuum initia     Basing     S02235     Northing     S04467       So at a felemone of oudel anucuum initia     MS 40 outbill West C aborhement 1     S04667     S04467       So at a felemone of outbill anucuum initia     MS 40 outbill West C aborhement 1     S04667       So at a felemone of outbill anucuum initia     MS 40 outbill West C aborhement 1     S04667       So at a felemone of outbill anucuum initia     MS 40 outbill West C aborhement 1     S04667       So at a felemone of outbill anucuum initia     MS 40 outbill West C aborhement 1     S04667       So at a felemone of outbill anucuum initia itia     Million 1000     DSH       Data on thomatal Dan inter flow (mVils)     Climatic region     West 50 on fassessment       Step 1 Runoff Quality     Annual Oan inter flow (mVils)     Execution of aborbill initia     Execution of aborbill initia       Step 2 River Interactal     Interaction ontertalinitia     Interactinitia     Interactinia	Stap			0.04	94F				S.	diment deparition	fur this site is judged as:	
See-9       Vit       Vit< <t< th=""><th></th><th>M-BAT test), a</th><th>r Stop 3 mitigatiun.</th><th></th><th></th><th></th><th>Parr</th><th>Perr</th><th>A.</th><th></th><th></th></t<>		M-BAT test), a	r Stop 3 mitigatiun.				Parr	Perr	A.			
Raid number       M 54       HE Area / DEP Onumber         Readmant for       Non-cumulative assessment (sincle outB in OS and effection of satessment contrimined assessment (sincle outB in OS and effection of collisit auduation in Eastinine) (S32739       Northine 304487         Otabil mumber       M 54 OutB il Wutter, in Eastinine (S32739)       Northine 304487         OutBil mumber       M 54 OutBil Wutter, outBil Wutter, outBil il S32739       Northine 304487         Durbil mumber       M 54 OutBil Wutter, OutBil Wutter, OutBil il S32739       Northine 304487         Durbil mumber       M 54 OutBil Wutter, OutBil Wutter, OutBil Wutter, OutBil il S32739       Northine 304487         Durbil mumber       M 54 OutBil Wutter, Ou				-	uq/l				6	tourivo? Hu	\$7 Deparition Index	
Ausessment funder Seisen Step 1: Seisen Structure (m) Step 1: Runoff Guality Step 2: River Impacts Step 1: Runoff Guality AADT ===================================	Stap	• 3										
Ausessment file/file in curvature in the sessessment file/ole out50 horting 02/467 Sof of defende of sessessment of the sessessment file/ole out50 horting 02/467 Sof of defende of sessessment of the sessessment is and the sessessment is accessed of the sesses of the sessessment is accessed of the sessessmen												
OS and sensor of assessment toohirm       Ession       382735       Northin       09487         Ordel structure (m)       Ession       382735       Northin       09487         Ordel structure (m)       Ession       382735       Northin       09487         Ordel structure (m)       M54 Outbill West Catchment 1       List of ordeling in ourmative assement       09487         Detail Internet       Watercourse 7       Assessment       000092019       Version of assessment         Date of assessment       000092019       Version of assessment       1         Notes       Impermable read and addition       DEH         Step 2 River impacts       Annual Out (her flow (m'ls))       Essee framework (D)       Impermable read and addition (n)         Step 2 River impacts       Annual Out (her flow (m'ls))       Essee for assessment       1         Notes       Impermable read and additing to outfail (ha)       Impermable read and additing to outfail (ha)       Impermable read additing to outfail (ha)         Step 2 River impacts       Manual Out (her with (m)       Impermable read additing to outfail (ha)       Impermable read additing to outfail	Road nun	nber		M54			HE Area / DBFO nu	mber				
OG of disense of cutalitatuctue (m)       Easting       592733       Norming       304487         Optimumber       M 54 Out 511 West Clashment 1       List of cutality in ournative assessment       304487         Reality maker cutality       Water course 7       Assessment 1       1110 million       001010 million         Reality maker cutality       Account on same cutality       Optimumber       001092019       Version of assessment       001092019         Step 1 Runoff Quality       Account on same cutality       Account on same cutality       Account on same cutality       Impermetable race dama framed (ha)       <					nt (single outfall)						•	
OutBill Amplet       MS40 UtBIL Viest Castomert 1       List of outBills in admassive admassical (admassixe admassive admassive admassixe admissive									304487			
			ture (m)						304487			
Viral Provise Viral and Outse     Viral Provise / Assessor and a fillation     OEI 0     OE					nent 1			mulative				
Date of sasesament       00//09/2019       Version of assesament       3         Nores       00//09/2019       Version of assesament       3         Step 1 Runoff Quality       AADT       >*800000 and +100.000       Climatic region       Warm Drv       Rainfall site       Bimmingham (BAAR 750mm)       •         Step 2 River Impacts       Annual Quit five flow (m <sup>1</sup> /s)       ©       Freshwater EQS limits:       Bioavailable dissolved copper (ugf)       1       ©         Impermable area daming to outfall (ha)       1200       Bioavailable dissolved copper (ugf)       1       ©       ©       For dissolved copper (ugf)       1       ©       ©       ©       ©       ©       Extended area daming to outfall (ha)       1200       Bioavailable dissolved copper (ugf)       1       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©       ©				Watercourse 7								
Notes       Decode CO       Preservative CO       P         Step 1 Runoff Quality       AADT       >>80.000 Me <100.000			er Network ID							DSH		
Step 1. Runoff Quality       ADT       >>80000000000000000000000000000000000		ssessment		06/09/2019			Version of assessm	rent		1		
Aul       ************************************												
Clear zero in Annal Qu, mer flow (m/s)       Extor         Inter flow too to assess Step 1 number on the same drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         Permable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         Permable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         Permable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         Permable area drained too       Impermable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         Permable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         Base Flow Index (BFI)       Impermable area drained (ha)       Impermable area drained (ha)       Impermable area drained (ha)         For dissolved zinc only       Water hardness       Impermable area drained (ha)       Impermable area drained (ha)         For dissolved zinc only       Water hardness       Impermable area drained (ha)       Impermable area drained (ha)         For dissolved zinc only       Water hardness       Impermable area drained (ha)       Impermable area drained (ha)         Step 3 Mitigation       Impermable area draine	Step 1	Runon Quanty	AADT >=50,000 and <	100,000	Climatic region	Warm 0	ky -	Rainfall site	Birm	ingham (SAAR 750mm)	•	
Inter-flow box to assess Step 1 nord quality       Permeable area draining to outfall (ha)       1277       Bioavailable disolved zinc (µg))       Image: Comparison of a protected site for conservation?         For dissolved zinc only       Water hardness       Main * 200mq Circl0034       For dissolved copper only       Ambient background concentration (µg1)         For dissolved zinc only       Usater a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Comparison of a protected site for conservation?       Image: Comparison of a protected site for conservation?         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Comparison of a protected site for conservation (µg1)       Image: Comparison of a protected site for conservation (µg1)         Step 3 Mitigation       Image: Comparison of the comparison of	Step 2	River Impacts	Annual Q <sub>25</sub> river flow (m <sup>3</sup> /s)		0.006	Fresh	water EQS limits:					
Sign 1 monti quality       Permeable area diaming to outfall (he)       1277       Bloavailable disolved zinc (µd)       155       Image: Constraint of the constraint of			Impermeable road area drai	ned (ha)	1.208		Bioavailable dissolv	ved copper (µg/l)		1 D		
Base Flow index (EFr)       Los       Is the discharge in or within 1 km upstream of a protected site for conservation?       Image: Text of the second site for conservation?       Image: Text of	Step 1 r		Permeable area draining to	outfall (ha)	1.273		Bioavailable dissolv	/ed zinc (µg/l)		10.9		
For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No         * Tier 1       Extinated river velocity       No       Image: State Structure (State Structure)         Step 3 Mitigation       Image: State Structure (State Structure)       State Structure (State Structure)         Brief description       Image: State Structure (Structure)       Statement of Statement (Structure)         Existing measures       Image: State Structure)       Image: Statement (Structure)	only)		Base Flow Index (BFI)		0.5	Is the d	ischarge in or within	n 1 km upstream of	a protected s	ite for conservation	? No -	
A Tier 1       Estimated river width (m)       25         A Tier 2       Bed width (m)       1       Manning's ( Star Directory S	For dis	solved zinc only	Water hardness	High = > 200mg CaCO3/	•	Fo	r dissolved coppe	ronly Ambien	background of	oncentration (µg/l)	3	
A Tier 1       Estimated river width (m)       25         A Tier 2       Bed width (m)       1       Manning's ( Star Directory S	For sec	diment impact only	Is there a downstream struc	ture, lake, pond or canal that re-	duces the velocity wit	thin 100	n of the point of disc	charge?		No 💌 D		
Step 3 Mitigation     Estimated effectiveness       Brief description     Teatment for solubles (%)       Existing measures     No measures								-				
Step 3 Mitigation         Estimated effectiveness           Teament for         Attraution for solubles         Settement of restructed obtainer area (ii b): sedtement of solubles(%)           Existing measures         0         No restruction         0         0			* Fier 1 Estimated n	ver widen (m)	2.5							
Brief description         O         O         No         Settlements           Existing or resulting         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0			C Tier 2 Bed width (r	n)	3 Man	ning's n	0.07 D	Sid	e slope (m/m)	0.5 Lo	ng slope (m/m)	
Brief description         O         O         No         Settlements           Existing or resulting         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	Step 3	Mitigation										
Brief description         solubles (%)         restricted discharge rate (Us)         sediments (%)           Existing measures         0         0         No matriction         0         0	50000											
Existino measures												
				Brief description		9	nuures( /s) [res	urueu ursonarge ra	12(1/5) 98	uments (76)		
	Existing	measures				0	D No	restriction -	0 0	0		
						0	D No	restriction	D 0			

## Proposed Area

highways england										
		Solu	ble					Sediment - Chronic Impact		
Stap 2 Tier 1 fail. Ga te	EQS - Annual Avorago Cr Seppar 3.23 Fliar 2 (aving UK TAG r Step 3 mitigatinn.	nacoastratina Ziac 0.56 -	uqfi uqfi		Acuto I Cuppor Parr	npact Zinc Parr	•	adimont dopu accumulating? xtonrivo?		<mark>ikir zita ir judgad ar:</mark> 0.01 Lauflau Valmiz 92 Deparition Index
Road number		M54			HE Area / DBFO	number				
Assessment type			sessment (single outfa	D.						
DS orid reference of assessmen	ntpoint(m)		92739			Northing	304487			
DS and reference of outfall struc	dure (m)		92739			Northing	304487			
Outfall number			Catchment 1 propos	sed	List of outfalls in	cumulative				
Receiving watercourse		Watercourse 7			assessment					
EA receiving water Detailed Riv	er Network ID				Assessor and aff	liation		DSH		
Date of assessment		06/09/2019			Version of asses	sment		1		
Step 1 Runoff Quality	AADT	20 and a 100 000	Climatic re	egion Mr.o.		Rainfall site		iminaham	/E A A D 3	750mm1 💌
<u>Step 1 Runoff Quality</u> <u>Step 2 River Impacts</u> (Enter zero in Annual Q <sub>ad</sub> river flow box to assess	AADT Control of the second sec	i)	Climatic re		hwater EQS limits		•	1	D	7E0mm\ 🔽
Step 2 River Impacts	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s	ained (ha)		Fresi	hwater EQS limits Bioavailable diss Bioavailable diss	: olved copper (µg/l)		1	D	<b>750mm) V</b>
Step 2 River Impacts (Enter zero in Annual Q <sub>25</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>is</sub> river flow (m <sup>3</sup> /s Impermeable road area dr Permeable area draining t	ained (ha)	4 00 0 4 70 4 1 000 0 5	Fresi	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or wit	: olved copper (µg/l) olved zinc (µg/l)	of a protected s	10.9 site for conserv	D vation?	
Step 2 River Impacts (Enter zero in Annual Q <sub>sti</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s Impermeable road area dr Permeable area draining t Base Flow Index (BFI)	s) ained (ha) o outfall (ha) <u>Uinh</u>	4 000 4 000 1 000 0 E	Fresi	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or with or dissolved cop m of the point of d	: olved copper (µg/l) olved zinc (µg/l) hin 1 km upstream c per only Ambier lischarge?	of a protected s	1 0.9 File for conserv	vation?	
Step 2 River Impacts (Enter zero in Annual Q <sub>10</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>48</sub> river flow (m <sup>3</sup> /s Impermeable read area dr Permeable area draining t Base Flow Index (BFI) Water hardness Is there a downstream stru ( T T: Estimated	s) ained (ha) o outfall (ha) <u>Uinh</u>	• • • • • • • • • • • • • • • • • • •	Fresi     Is the c     Friday in the control of the control o	hwater EQS limits Bicavailable diss Bicavailable diss discharge in or wit or dissolved cop m of the point of d m of the point of d	iolved copper (µg/l) olved zinc (µg/l) hin 1 km upstream o per only Ambier ischarge? Sii Estimated effective Atternation for sol estinded discharge r	of a protected s nt background de slope (m/m)	1 0.9 File for conserv	vation?	



#### **Existing Area**

	EQS - Annual Average Con				Acute Imp	pact			
Cop		Zinc						Fail. Try Tier 2	
3.: Step 2 Tier 1 fail. Go to Tie	24 ior 2 (using UK TAG	0.61	ugil		Copper	Zinc	1 64	Settlement needed : Iiment deposition for t	1 %, proposed = 0 %
M-BAT tool), or S					Pass	Pass		cumulating? Yes	0.01 Low flow Vel m/s
	-	-	ligu					ensive? Yes	100 Deposition Index
Step 3				_					
Road number		M54			HE Area / DBFO nu	umber			
Assessment type			assessment (single or	off all)	Inc Address on				
OS grid reference of assessment p	point (m.)	Easting	392740			Northing	304522		
OS grid reference o foutfall structure		Easting	392740			Northing	304522		
Outfall number	- ()		st Catchment 2 exist	tina	List of outfalls in cu		001022		
Receiving watercourse					assessment				
EA receiving water D etailed River N	Network ID				Assessor and affilia	ation		D SH	
Date of assessment		06/09/2019			Version of assessm	nent		1	
Notes									
		1							
Step 1 Runoff Quality	AADT >=50,000 and <1	100,000	<ul> <li>Climati</li> </ul>	c region Wan	m Dry 💌	Rainfall site	Birmir	ngham (SAAR 750mm)	-
Step 2 River Impacts	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)		0.008	Fre	eshwater EQS limits:				
(Enter zero in Annual Q <sub>95</sub> I river flow box to assess	Impermeable road area drair	ned (ha)	1.385		Bioavailable dissol	ved copper (µg/l)		1 D	
	Permeable area draining to	outfall (ha)	0.968		Bioavailable dissol	(unit) anim (unit)			
E					Dicavallable dissol	ved zinc (µg/i)		10.9 D	
	Base Flow Index (BFI)		0.5	D Is the	e discharge in or withir	.,	a protected site		No 💌 D
For dissolved zinc only	Base Flow Index (BFI) Water hardness	High = >200mg CaC0		■ □ Is the		1 km upstream of	-		No • D
	Water hardness		D3/I		e discharge in or withir For dissolved coppe	n 1 km upstream of er only Ambient	-	e for conservation?	
For sediment impact only	Water hardness Is there a downstream struct	ure, lake, pond or ca	D34		e discharge in or withir For dissolved coppe	n 1 km upstream of er only Ambient	-	e for conservation?	
For sediment impact only	Water hardness	ure, lake, pond or ca	D3/I		e discharge in or withir For dissolved coppe	n 1 km upstream of er only Ambient	-	e for conservation?	
For sediment impact only	Water hardness Is there a downstream struct	ure, lake, pond or ca ver width (m)	D34		e discharge in or withir For dissolved coppe 30m of the point of disc	a 1 km upstream of er only Ambient charge?	-	e for conservation? oncentration (µg/l)	
For sediment impact only	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m)	D34 inal that reduces the ve	locity within 10	e discharge in or withir For dissolved coppe 30m of the point of disc	a 1 km upstream of er only Ambient charge?	background c	e for conservation? oncentration (µg/l)	3
For sediment impact only	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m)	D34 inal that reduces the ve	locity within 10	e discharge in or withir For dissolved coppe 00m of the point of disc in 007 D	n 1 km upstream of er only Ambient charge? Side	l background c	e for conservation? oncentration (µg/l)	3
For sediment impact only	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m)	D34 inal that reduces the ve	locity within 10	e discharge in or withir For dissolved coppe 00m of the point of disc : n 007 D	n 1 km upstream of er only Ambient charge? Side	e slope (m/m)	e for conservation? oncentration (µg/) No  C Long si	3
For sediment impact only	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m) n)	D34 inal that reduces the ve	locity within 10	e discharge in or within For dissolved coppe D0m of the point of disc in 0.007 0 E Treatment for 0	n 1 km upstream of er only Ambient charge? Side Estimated effectiven Attenuation for solut	e slope (m/m) less ples - Se	e for conservation? oncentration (µg/l) No v D Long si tlement of	3
For sediment impact only	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m)	D34 inal that reduces the ve	locity within 10	e discharge in or within For dissolved coppe D0m of the point of disc in 0.07 E Treatment for	n 1 km upstream of er only Ambient charge? Side	e slope (m/m) less ples - Se	e for conservation? oncentration (µg/) No  C Long si	3
For sediment impact only	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m) n)	D34 inal that reduces the ve	locity within 10	e discharge in or within For dissolved coppe 10m of the point of disc in 007 D E Treatment for solubles (%) res	n 1 km upstream of er only Ambient charge? Side Estimated effectiven Attenuation for solut	e slope (m/m) iess bles - Se te (l/s) sed	e for conservation? oncentration (µg/l) No v D Long si tlement of	3
For sediment impact only i	Water hardness Is there a downstream struct Ŷ Tier 1 Estimated m	ure, lake, pond or ca ver width (m) n)	D34 inal that reduces the ve	Manning's	e discharge in or within For dissolved copper 00m of the point of dis- in 007 0 E Treatment for solubles (%) res	n 1 km upstream of r only Ambient charge? Sidu Situated effectiven Attenuation for solut tricted discharge ra	e slope (m/m) eess Diess te (I/s) Sed	e for conservation? oncentration (µg/l) No v D C5 Long si tilement of iments (%)	3

## Proposed Area

regiand									Version 2.0.4 June	2018			
Г					S	oluble						Sediment	- Chronic Impact
	Stop 2	M-BAT tuni), nr Stop 3 mitigatinn.		• C=== c •	ntratinn Zinc 0.43		uqfl		Acuto In Cappor Parz	npact Zinc Parz		Sodimont dopuriti Accumulating? Tr Extonrivo? Hi	
L	Stop 3												
R	oad numb	er			M54				HE Area / DBFOr	number			
A	ssessmen	ttupe			Non-cumulative	assessment (	single outf	al)					
o	S arid refe	ence of assessmen	ntpoint(m)		Easting	392740				Northing	304522		
o	S arid refe	erence of outfall struc	ture (m)		Easting	392740				Northing	304522		
0	utfall numb	er			M 54 Outfall Ea	ast Catchmen	t 2 propos	se d	List of outfalls in o	umulative			
		atercourse							assessment				
		o water Detailed Riv	er Network ID						Assessor and affi	iation		DSH	
	ate of asse	essment			06/09/2019				Version of assess	ment		1	
4	itep 1 R	unoff Quality	AADT ULEA	000 or	od -100 000	•	Climatic r	egion 147 -	m Dor 🗵	Rainfall site		Piminaham /P	AAD 750mm)
5	itep 2 R	iver Impacts	Annual Q <sub>as</sub> river flow (r	m³/s)			0.000	Fres	hwater EQS limits:				
		o in Annual Q <sub>25</sub> box to assess	Impermeable road area	a draine	d (ha)		4.000		Bioavailable disso	lved copper (µg/l)		1 D	
		off quality	Permeable area draini	ng to ou	tfall (ha)		0.476		Bioavailable disso	lved zinc (µg/l)		10.9 D	
	onlý)		Base Flow Index (BFI)				0.5	D Is the	discharge in or with	in 1 km upstream o	f a protected	site for conservatio	n? <u>NI</u>
	For disso	lved zinc only	Water hardness	[	High - son	0ma 0a001	<u>.</u>	F	or dissolved copp	eronly Ambier	nt backgroun	d concentration (µg/	0
	For sedin	nent impact only	Is there a downstream			canal that reduc		tity within 100	m of the point of di	scharge?		No.	
					r width (m)		75						
			C -⊤: Bed wi	dth (m)			0	Manning's r		Sic	de slope (m/r	m) <u>n c</u> L	ong slope (m/m)
	itep 3 M	litigation			Brief description	n			ieatment for iolubles (%)	Estimated effective Attenuation for solu istricted discharge r	ubles -	Settlement of sediments (%)	
		measures								lo restriction			
L				_									



## Cumulative catchments 1 and 2 Existing

	EQS - Annual Average Cor	ncentration			Acute Im	pact				
Step 2 Tier 1 fail. Go to	Copper 3.55 5 Tier 2 (using UK TAG or Step 3 mitigation.	Zine 2,59 -	ugil ugil		Copper r Fails Tozicity . Try mitigation	Zinc Pass		Settlemen	t needed = sition for t	for Velocity           47 %, proposed = 0 %           this site is judged as:           0.01           Low flow Vel m/s           187
Road number		M54			HE Area / DBFO n	umber				
Assessment type		Cumulative assessment incl	luding sedim	ents (outfalls	within 100m)			_		
OS grid reference of assessmer	nt point (m )	Easting 392740				Northing	304522			
OS grid reference of out fall struc	sture (m)	Easting				Northing				
Outfall number		M54 Outfall : Catchments	1 and 2 Exi	sting	List of outfalls in c	umulative	1	2		
Receiving watercourse		Watercourse 7			assessment					
EA receiving water Detailed Riv	er Network ID				Assessor and affili	ation		D SH		
Date o fassessment		09/09/2019			Version of assess	ment		1		
Step 1 Runoff Quality	AADT >= 100,000		Climatic re	egion Warm [	Dry 🔽	Rainfall site	В	Sirmingham (SAAR )	750mm)	T
	AADT →= 100,000 Annual Q <sub>65</sub> river flow (m <sup>3</sup> /s)		Climatic re		Dry	Rainfall site	В	Sirmingham (SAAR	750mm)	¥
Step 2 River Impacts (Enter zero in Annual Q <sub>95</sub>							B	irmingham (SAAR	750mm)	
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>s5</sub> river flow (m <sup>3</sup> /s)	ined (ha)	0.008		hwater EQS limits:	lved copper (µg/l)	B	irmingham (SAAR		v
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai	ined (ha)	0.006	Fres	hwater EQS limits: Bioavailable dissol	lved copper (µg/l) lved zinc (µg/l)		1	D	• No •
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>es</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to	ined (ha)	0.008 2.593 2.241	Fresi	hwater EQS limits: Bioavailable dissol Bioavailable dissol	ved copper (μg/l) ved zinc (μg/l) n 1 km upstream of	a protected	1	D D vation?	
Step 2 River Impacts (Enter zero in Annual Q <sub>ss</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>spr</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI) Water hardness	ined (ha) • outfall (ha)	0.006 2.593 2.241 0.5	Fresl	hwater EQS limits: Bioavailable dissol Bioavailable dissol lischarge in or withi or <b>dissolved</b> copp	ived copper (μg/l) ived zinc (μg/l) n 1 km upstream of er only Ambien	a protected	1 10.9 d site for conserv	D vation?	No v
Step 2 River Impacts           (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality only)           For dissolved zinc only	Annual Q <sub>sc</sub> tiver flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ined (ha) outfall (ha) Hgh = >200mg CaCO34	0.006 2.593 2.241 0.5	Fresl	hwater EQS limits: Bioavailable dissol Bioavailable dissol lischarge in or withi or <b>dissolved</b> copp	ived copper (μg/l) ived zinc (μg/l) n 1 km upstream of er only Ambien	a protected	1 10.9 d site for conserr ad concentration	D vation?	No v
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>sc</sub> tiver flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ined (ha) outfall (ha) Hgh=>200mg CaCO34 :ture, lake, pond or canal that redu iver width (m)	0.008 2.593 2.241 0.5	Fresl	hwater EQS limits: Bioavailable dissol Bioavailable dissol iischarge in or withi or dissolved copp m of the point of dis	ved copper (μg/l) ived zinc (μg/l) n 1 km upstream of er only Ambien charge?	a protected	1 10.9 d site for conser nd concentration	D vation?	No v
Step 2 River Impacts           (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality only)           For dissolved zinc only	Annual Q <sub>sc</sub> fiver flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc ° Tier 1 Estimated ri	ined (ha) outfall (ha) Hgh=>200mg CaCO34 :ture, lake, pond or canal that redu iver width (m)	0.008 2.593 2.241 0.5	Fresi     Fresi     Fresi     Fresi     Fresi     Fresi     Manning's n     T	hwater EQS limits: Bioavailable dissol Bioavailable dissol lischarge in or within or dissolved copp m of the point of dis	ved copper (μg/l) ived zinc (μg/l) n 1 km upstream of er only Ambien charge?	a protected t backgroun le slope (m/	1 10.9 d site for conser nd concentration	D vation?	<u>Ne</u> []
Step 2 River Impacts           (Enter zero in Annual Q <sub>sto</sub> river flow box to assess Step 1 runoff quality only)           For dissolved zinc only           For dissolved zinc only           For sediment impact only	Annual Q <sub>sc</sub> fiver flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc ° Tier 1 Estimated ri	ined (ha) outfall (ha) Hgh=>200mg CaCO34 :ture, lake, pond or canal that redu iver width (m) m)	0.008 2.593 2.241 0.5	Fresi     Fresi     Fresi     Fresi     Fresi     Fresi     Manning's n     T	water EQS limits: Bioavailable dissol Bioavailable dissol iischarge in or withi or dissolved copp m of the point of dis 007 0 reatment for olubies (%) rest	ved copper (µg/l) ved zinc (µg/l) n 1 km upstream of er only Ambien charge? Sid E stimated effective Attenuation for so lu	a protected t backgroun le slope (m/	1 109 d site for conservation No v m) 05 Settlement of sediments (%)	D vation?	<b>No v</b>

# Cumulative catchments 1 and 2 Proposed

	highw england	ays	Highways Engl	and Water Risk Asse	ssment Tool			Version 2.0.4 June 20	918			
				So	oluble						Sediment -	- Chronic Impact
	_		EQS - Annual Average					Acute Imp	ect			
			apper	Zinc								ier 2 fur Velucity
	Sta	2 Tier 1 fail, Sa ta	2.12 Tier 2 (string UK TAG	2.39	uqf			Cupper Zinc				død – 41 %, proporød – 0 % n for thir site ir judgød ar:
			r Step 3 mitigation.					River Fails Ricity Test. Try Pars			Accumulating? Te	
	Ste	, 3	-	-	uqfl			nitiqatinn		•   ·	Extensive? Tee	x 169 Deparition Index
١ī	Road nur	nber		M54				HE Area / DBFO nu	mber			
H	Assessm	enttype			essment includ ind sed	limer	nts (outfalls					•
	OS arid r	eference of assessmer	ntpoint(m)	Easting	392740				Northing	304522		
	OS arid r	eference of outfall struc	dure (m)	Easting					Northing			
	Outfall nu	mber		M 54 Outfall : Ca	atchments 1 and 2 F	Prop	osed	List of outfalls in ou	mulative	1	2	
	Receivin	watercourse		Watercourse 7				assessment				
	EA recei	ing water Detailed Riv	er Network ID					Assessor and affilia	tion		DSH	
	Date of a	ssessment		09/09/2019				Version of assessm	ent		1	
	Notes					_						
		Runoff Quality River Impacts	AADT Annual Q <sub>25</sub> river flow (r	n <sup>3</sup> /s)	Climat	_		hwater EQS limits:	Rainfall site		liminaham /CA	AD 750mm \
		tero in Annual Q <sub>25</sub> w box to assess	Impermeable road area	a drained (ha)	0.00	<b>1</b> 7		Bioavailable dissolv	ed copper (µg/l)		1 D	
	Step 1	runoff quality	Permeable area drainir	ng to outfall (ha)	4.90			Bioavailable dissolv	ed zinc (μg/l)		10.9 D	
	onlý)		Base Flow Index (BFI)		0.5		Is the d	lischarge in or within	1 km upstream of	f a protected	site for conservation	1? NI -
	For dis	solved zinc only	Water hardness	Hisb - soon	ma CaCO2/I	•	F	or dissolved coppe	ronly Ambien	t background	d concentration (µg/l)	)
	For se	diment impact only	Is there a downstream	structure, lake, pond or ca	anal that reduces the ve	elocity	within 100	m of the point of disc	harge?		Ma	
			🖲 🛨 : 💷 Estima	ted river width (m)	25							
			○ ┯: Bed wi	dth (m)	0	_ !	Manning's n	0.07	Sid	le slope (m/n	n) <u>n c</u> Lo	ong slope (m/m)
ľ	Step 3	Mitigation							stimated effective			
				Brief description					Attenuation for solu tricted discharge ra		Settlement of ediments (%)	
	Existin	o measures					0	D No	restriction -	D 0	D	
	Proces	ed measures					•	No	restriction -			
٦l	_											



#### **Existing Area**

	EQS - Annual Average Con		Acute Impact								
	Copper	Zinc						Fail. Try	Tier 2 for Velocity		
	4.93 Step 2 Tier 1 fail. Go to Tier 2 (using UK TAG M-BAT tool), or Step 3 mitigation.		ugil		Copper er Fails Toxicity t. Try mitigation	Zine Pass	Acc	liment depositio sumulating?	eded = 93 %, proposed = 0 % on for this site is judged as: es 0.01 Low flow Vel m/s es 1276 Deposition Index		
Step 3		•	ug/l				Est	ensive? Y	es 1276 Deposition Index		
Road number		M54/M6 Link road			HE Area / DBFO n	umber					
Assessment type		Non-cumulative assessment (	single outf	ali)					-		
OS grid reference of assessmen	nt point (m.)	Easting 393410				Northing	304709				
OS grid reference of outfall struc	ture (m)	Easting				Northing					
Outfall number		Watercourse 1 Catchment 3	3		List of outfalls in cu	umulative					
Receiving watercourse		Watercourse 1			assessment						
EA receiving water D etailed Riv	erNetwork ID				Assessor and afflia	ation		D SH			
Date o fassessment		06/09/2019			Version of assessm	ment		1			
Step 1 Runoff Quality	AADT >=50,000 and <1	•	Climatic r	region Warm	Dry 💌	Rainfall site	Birmir	ngham (SAAR 750m	nm) 💌		
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.001	Fres	hwater EQS limits:						
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area drain	ied (ha)	6.689	]	Bioavailable dissol	ved copper (µg/l)		1 D			
Step 1 runoff quality only)	Permeable area draining to o	outfall (ha)	9.856	Bioavailable dissolved zinc (µg/l) 10.9 D							
	Base Flow Index (BFI)		0.5	Is the discharge in or within 1 km upstream of a protected site for conservation?							
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	F	or dissolved coppe	er only Ambient	background c	oncentration (µg	J(I) 3		
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that reduce	es the velo	city within 100	m of the point of dis	charge?		No 🔻 D			
	• Tier 1 Estimated riv	rer width (m)	1								
	C Tier 2 Bed width (m	1)	3	Manning's r	0.07 D	Sid	e slope (m/m)	0.5	Long slope (m/m) 0.0001		
Step 3 Mitigation					reatment for	Estimated effectiver Attenuation for solub	oles - Se	ttlement of			
		Briefdescription			solubles (%) res	stricted discharge ra	te (Ins) sed	iments (%)			
Existing measures				0	D No	restriction -	D O	D			
Proposed measures				0		restriction -	D 0	D			
L					<b>-</b>				]		

# Proposed Area

highways england	Highways Englan	d Water Risk Asses	sment Tool		Version 2.0.4 June :	2019						
		Sol				Sediment - Chronic Impact						
Stap 2 Tier 1 fail. Go to	EQS - Annual Avorego C Impor 4.35 Tior 2 (uring UK TAG r Stop 3 mitigatiun.	uncontratiun Zinc 3.89 -	uqfi		Acuto Im Cappor River Faile Taxicity Tat. Try mitigatian	Impect Zinc Pazz		Teil. Try Vier 2 for Velocity Settlement no ded - 14 x, propared Sediment deputition for this site indep Accumulation of the site of the site Entensive?				
Road number		M 54/M 6 Link roa	ad		HE Area / DBFO n	umber						
Assessment type			ssessment (single out	ál)					•			
OS and reference of assessmen	ntpoint(m)	Easting	393410			Northing	304709					
OS and reference of outfall struc	ture (m)	Easting				Northing						
Outfall number		Watercourse 1 N	lewOutfall Catchme	nt 3	List of outfalls in o	umulative						
Receiving watercourse		Watercourse 1			assessment							
EA receiving water Detailed Riv	er Network ID				Assessor and affili			DSH				
Date of assessment Notes		06/09/2019			Version of assess	ment		1				
Step 1 Runoff Quality Step 2 River Impacts (Enter zero in Annual Q <sub>16</sub> river flow box to assess Step 1 runoff quality only)	2 River Impacts     Annual Q <sub>26</sub> fiver flow (m <sup>1</sup> /s)     Inord area drained (ha)     rezero in Annual Q <sub>26</sub> Impermeable road area drained (ha)     reconstructions     reconstruction					Image: Second						
For dissolved zinc only	Water hardness	High - 200r			For dissolved copp	-	t background c					
For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Compact only       Image: Compact only												
Step 3 Mitigation Exist no measures Proposed measures		Brief description			Treatment for solubles (%)	Estimated effectives Attenuation for solu stricted discharge ra prestriction - o restriction -	bles - Se	etfement of diments (%)				



Proposed Area (new road)

highways Highways England Water Risk Assessment Tool Version 2.0.4 June 2019													
			Soluble					Sediment - Chronic Impact					
	EQS - Annual Average	Cuncentration			Acuto Im	pact							
	apper .	Zinc								or 2 far Volacity			
	3.84	2.3	7	uqfi		Capper	Zinc			dod - 65 %, prupurod - 0 %			
	r Tier 2 (aring UK TAG Ir Step 3 mitigatinn.					River Fails isity Test, Try	Parr		diment depurition cumulating? Ter	• fur this site is judged as: • • • • Louflou Velmis			
Step 3	-	-		uqfl		nitigation Parr			tonrivo? Tor				
Road number		M54/M6 Link	mad			HE Area / DBFO n	umber						
Assessment type			ve assessment (si	nale out	a D					•			
OS grid reference of assessment	ntpoint(m)	Easting	394400				Northing	304770					
OS grid reference of outfall struc	ture (m)	Easting					Northing						
Outfall number			2 NewOutfall C	atchme	nt 4	List of outfalls in ou							
Receiving watercourse		Watercourse		atomic		assessment							
EA receiving water Detailed Riv	er Network ID	Watercourse	2			Assessor and afflia	ation		DSH	_			
Date of assessment		06/09/2019				Version of assessm			1				
Notes		00/00/2010											
Step 1 Runoff Quality													
	AADT	000 and 250 000	<b>T</b>	Climatic r	region Ma	m Dor 🔳	Rainfall site	D :,	minaham /PA	AD 750mm)			
Step 2 River Impacts	Annual Q <sub>25</sub> river flow (n	n <sup>a</sup> /s)		0.000	Fres	hwater EQS limits:							
(Enter zero in Annual Q <sub>35</sub> river flow box to assess	Impermeable road area	drained (ha)	ed (ha)			Bioavailable dissolved copper (µg/l)							
Step 1 runoff quality only)	Permeable area drainin	g to outfall (ha)	butfall (ha)			Bioavailable dissolved zinc (µg/l)							
	Base Flow Index (BFI)			0.5	□ Is the o	s the discharge in or within 1 km upstream of a protected site for conservation?							
For dissolved zinc only	Water hardness	High = 50	00ma CacO2/	· •	For dissolved copper only Ambient background concentration (µg/l)								
For sediment impact only	Is there a downstream	structure, lake, pond or	canal that reduces	the velo	city within 100	m of the point of dis	charge?		Mo D				
	• Estimat	ed river width (m)	Γ	0 5									
	Orress Bed wid	tth (m)		0	Manning's n	0.07	Sid	de slope (m/m)	n c Lo	ng slope (m/m)			
Step 3 Mitigation							Estimated effective	ness					
					T		Attenuation for solu		ttementof				
		Brief description	on				tricted discharge ra		liments (%)				
Existing measures					0	0 D No restriction D 0 D							
Proposed measures					0								
L	-												

#### **Cumulative Assessments**

Road Catchments 3+4 Proposed

highways england	Highways England Water Risk Assessment Tool Version 2.0.4 June 2019												
		So	luble					Sediment - Chronic Impact					
	EQS - Annual Avorago	Cuncontration			Acuto im	pact							
	Jupper	Zinc											
Stop 2 Tior 1 fail. Go to	5.13 Tier 2 (wring UK TAG	6.09	uqfl		Cappor	Ziac			fur this site is judged as:				
	r Step 3 mitigation.				River Feilr Insists Test, Tra	Page		ccumulating?	Louflou Velmtz				
	-	-	ugfl		mitigation			ztenrive?	Deparition Index				
Stop 3							-						
Road number		M54/M6 Link roa	he		HE Area / DBFOn	umber							
Assessment type			ssment excluding sed	iments (out					•				
OS orid reference of assessme	ntpoint(m)	Easting	393410			Northing	304709						
OS and reference of outfall struc	ture (m)	Easting				Northing							
Outfall number		Watercourse 1 (	Cumulative Catchm	ent 3 and	4 List of outfalls in α	unulative							
Receiving watercourse		Watercourse 1			assessment								
EA receiving water Detailed Riv	er Network ID				Assessor and affilia	ation		DSH					
Date of assessment		06/09/2019			Version of assessr	ment		1					
Notes													
Step 1 Runoff Quality													
step i Runon quanty	AADT	000 and < 100 000	<ul> <li>Climatic</li> </ul>	region 📊	Vorm Dine 🔳	Rainfall site		iminaham /CAA	D 750mm)				
Step 2 River Impacts	Annual Q <sub>25</sub> river flow (m	<sup>3</sup> /s)	0.00	F	reshwater EQS limits:								
(Enter zero in Annual Q <sub>25</sub>	Impermeable road area	drained (ha)	0.40	Bioavailable dissolved copper (µg/l)									
river flow box to assess Step 1 runoff quality	Permeable area drainin	to outfall (ba)	10.60										
only)		g to oddall (na)	46 60										
	Base Flow Index (BFI)		Is the discharge in or within 1 km upstream of a protected site for conservation?										
For dissolved zinc only	Water hardness	High = \$200	ma Caco2/I	For dissolved copper only Ambient background concentration (µg/l)									
For sediment impact only	Is there a downstream s	tructure, lake, pond or car	nal that reduces the vel	ocity within	100m of the point of dis	charge?		No y D					
		ed river width (m)		7				61 O					
			1										
	Gran Bed wid	th (m)	0	Manning	is n <u>n n 7</u> D	Sic	de slope (m/m)	) <u>n c</u> Long	slope (m/m)				
01													
Step 3 Mitigation						Estimated effective	iness						
						Attenuation for solu		Settlement of					
		Brief description			solubles (%) res	stricted discharge n	ate (l/s) se	ediments (%)					
Existing measures						restriction	0 0						
Proposed measures					0 D No restriction - D 0 D								
r roused measures					n m								



#### Proposed Area (new road)

	EQS - Annual Average Con			Acute Imp	oact								
	Copper	Zinc						Pass					
	3.28 Tier 2 (using UK TAG or Step 3 mitigation.	0.74			Copper Pass	Zinc Pass	Acc	Sediment deposition fo Accumulating? Yes Extensive? No			s judged as: Low flow Vel m/s Deposition Index		
Step 5													
Road number		M54/M6 Link road			HE Area / DBFO nu	umber							
Assessment type		Non-cumulative assessmen	t (single outf	all)							-		
OS grid reference o fassessmer	t point (m )	Easting 394210				Northing	304907						
OS grid reference o foutfall struc	ture (m)	Easting				Northing							
Outfall number		Watercourse 2 New Outfa	II C atchmer	nt 5	List of outfalls in cu	mulative							
Receiving watercourse		Watercourse 2			assessment								
EA receiving water Detailed Riv	erNetwork D				Assessor and affilia	D SH							
Date of assessment		06/09/2019			Version of assessm	ient		1					
Notes -													
Step 1 Runoff Quality	AADT >10,000 and <50	.000 -	Climatic r	egion Warm	Dry 💌	Rainfall site	Birmin	ngham (SAAR 75	i0mm)		•		
Step 2 River Impacts	Annual Q <sub>s5</sub> river flow (m <sup>3</sup> /s)		0.003	Fres	hwater EQS limits:								
(Enter zero in Annual Q <sub>95</sub>	Impermeable road area drain	ned (ha)	1.151		Bioavailable dissolved copper (µg/l)								
river flow box to assess Step 1 runoff quality	Permeable area draining to o	outfall (ha)	1.460		Bioavailable dissolved zinc (µg/l)								
only)	Base Flow Index (BFI)		0.5	Is the discharge in or within 1 km upstream of a protected site for conservation?							No 🔻 D		
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	-	F	For dissolved copper only Ambient background concentration (µg/l) 3								
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that redu	uces the velo	city within 100	m of the point of disc	charge?		No 💌	D				
	• Tier 1 Estimated riv	rer width (m)	0.5	0.5									
	C Tier 2 Bed width (m	1)	3	Manning's n	0.07 D	Side	e slope (m/m)	0.5	Long slo	ope (m/n	n) 0.0001		
Step 3 Mitigation		Briefdescription			reatment for A	stimated effectiver Attenuation for solut tricted discharge ra	oles - Se	ttlem ent of iments (%)	]				
Existing measures				0 D No restriction V D 0 D									
Proposed measures				0	D No	restriction 👻	DO	D	1				

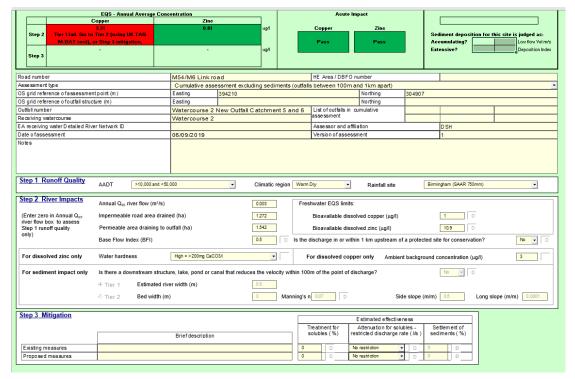
#### **Road Catchment 6**

No HEWRAT required as traffic below 10,000 AADT. Used traffic band >10,000 - <50,000 for conservative assessment

r –			EQS - Annual Avera	ae Conc					Acu	ite Impact								
			opper		Zinc								Pas	55				
	Step 2	Tim 1 (vil) Contra	3.38 Tier 2 (using UK TAG		0.09		ug/l		Copper	Zinc		Sediment deposition for this site is ju						
	Step 2		or Step 3 mitigation.						Pass	Pass		umulating?	Yes	0.08	Low flow Vel mis			
							ug/l					ensive?	No	6	Deposition Index			
	Step 3						1			_								
Roa	d numb	er			A460				HE Area / DB	FO number								
Ass	essmen	t type			Non-cumulative :	Non-cumulative assessment (single outfall)												
0S	grid refe	rence o fassessmer	t point (m )		Easting													
OS	grid refe	erence o foutfall struc	ure (m)		Easting					Northing								
_	all numb				catchment 6					in cumulative								
		atercourse			watercourse 2				assessment									
		g water D etailed Riv	er Network ID						Assessor and									
		essment			15/11/2019				Version of as	sessment								
Note	s																	
Ste	ep 1 R	unoff Quality		0 and < 50		_				<ul> <li>Rainfall site</li> </ul>								
-			AADT >10,00	0 and < 50.	000	•	Climatic r	egion War	n Diy	<ul> <li>Rainfall site</li> </ul>	Birmin	igham (SAAR 7	oumm)		•			
Ste	ep 2 R	iver Impacts	Annual O Lot of Ann	(				<b>_</b>										
			Annual Q <sub>s5</sub> river flow	(m³/s)		0.003 Freshwater EQS limits:												
		o in Annual Q <sub>95</sub>	Impermeable road a	ea drain	ed (ha)	0.121 Bioavailable dissolved copper (µg/l)												
		box to assess off quality	Permeable area drai	Permeable area draining to outfall (ha)				0.082 Bioavailable dissolved zinc (µq/l)										
	ly)																	
			Base Flow Index (BF		0.5 D Is the discharge in or within 1 km upstream of a protected site for conservation?													
6	r diana	lved zinc only	Water hardness		High = >200mg CaCO									3.3				
	n uisso	aved zinc only	vvater naruness		High = >200 Hig Calco	73/			For dissolved	copper only Ambient	background co	oncentration	(µg/I)		3.3			
Fo	or sedin	nent impact only	Is there a downstrea	m structu	ire, lake, pond or ca	nal that reduc	es the velo	city within 1	0m of the point	of discharge?		No 👻	D					
			⊙ Tier 1 Estir	nated riv	er width (m)		0.5											
					. ,													
			CTier 2 Bed	width (m	)		3	Manning's	n 0.07	D Side	e slope (m/m)	0.5	Long s	slope (m/n	0.0001			
Ľ																		
Ste	ep 3 M	litigation								Estimated effective n	e.ss							
									Treatment for	Attenuation for solub		tlem ent of	11					
					Briefdescription				solubles (%)	restricted discharge rat		iments (%)						
													41					
		neasures						0	D	No restriction	D 0	D	- 1					
민	roposed	measures						0	D	No restriction -	D O	D						
													_					



#### Cumulative Catchments 5 + 6





## **Road Catchment 7 Existing**

No HEWRAT required as traffic below 10,000 AADT. Used traffic band >10,000 - <50,000 for conservative assessment

	EQS - Annual Average Cone	entration			Acute Im	pact			
	Copper	Zinc						Fail. Trg Tier 2	
Step 2 Tier 1 fail. Go to	4.45 Tier 2 (using UK TAG	1.21	ug/l		Copper	Zinc	Sed	Settlement needed = liment deposition for	63 %, proposed = 0 % this site is judged as:
	or Step 3 mitigation.				Pass	Pass		sumulating? Yes	0.03 Low flow Vel m/s
		· · · ·	ug/l				Eat	ensive? Yes	264 Deposition Index
Step 3									
Road number		A460			HE Area / DBFO n	umber			
Assessment type			assessment (single out	'all)					•
OS grid reference of assessmer		Easting	394240			Northing	304990		
OS grid reference o foutfall struc	ture (m)	Easting			List of outfalls in co	Northing			
Outfall number Receiving watercourse		Catchment 7			List of outfalls in co assessment	umulative			
EA receiving watercourse	e Natural ID	Watercourse 3			Assessor and affili			0.000 450.000	
Date of assessment	ST IVELVIOTK ID	23/01/2020			Version of assess			D SH AEC OM	
Notes		23/01/2020			version of assessi	inen.		<u>,                                     </u>	
1023									
Step 1 Runoff Quality	AADT >10.000 a	nd <50.000	- Climatic		m Dry 🔫	Rainfall site	Bin	mingham (SAAF	750mm) <b>*</b>
Step 2 River Impacts	Annual Q <sub>et</sub> river flow (m <sup>3</sup> /s)		0.003	Fres	hwater EQS limits:				
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area drain	ed (na)	2 011		Bioavailable disso	lved copper (µg/l)		1	
Step 1 runoff quality	Permeable area draining to o	utfall (ha)	0 115		Bioavailable dissol	lved zinc (µg/l)		10.9 D	
only)	Base Flow Index (BFI)		0.5	Is the o	discharge in or withi	n 1 km upstream of	a protected site	e for conservation?	N 🔻 D
				11	<i>y</i>				
For dissolved zinc only	Water hardness	High = >200	ma CaCO3/I	F F	or dissolved copp	eronly Ambien	t background c	oncentration (µg/l)	Λ
For sediment impact only	Is there a downstream struct	ne lake need or ea	and that reduces the use	eitu withie 400	m of the point of dis	ahama?		No 💌 🖻	
I or sediment impact only				1	in or the point of the	charge :			
	Estimated riv		1	]					
	C Tion Bed width (m	)	2	Manning's r	0 07 D	Sid	e slope (m/m)	0.5 Long s	slope (m/m)
Step 3 Mitigation						Estimated effective	ness		
						Attenuation for solu		tiem ent of	
		Brief description			solubles (%) res	stricted discharge ra	ite (I/s) sed	iments (%)	
Existing measures				0	D N	restriction -			
Proposed measures						restriction -			
Li repetetet matadica	1								

# **Road Catchment 7 Proposed**

hig en	hway: jand	l de la companya de la	Highways Engl	and W	ater Risk Asses	sment Tool			Version 2.0.4 June 20	19				
					So	luble						Sedimen	t - Chronic Impact	
			EQS - Annual Average	e Conce			_		Acute Imp	act				
I F			Copper		Ziac							Fail. Try Tier 2 for Velocity		
	4.42 Step 2 Tier 1 fail. Go to Tier 2 (neing UK TAG M-BAT tool), or Step 3 mitigation.				1.12		v9/1		Copper	Zinc		Sediment depositio	tded = 53 %, proposed = 0 % a for this site is judged us: (es 0.03 Low flow Vel m/s	
	itep 3		•				ugil					Extensive? Y	es 233 Deposition Index	
Road	numbe	ĸ		1	M54-M8 Link				HE Area / DBFO n	umber				
Asse	ss ment	type			Non-cumulative a	assessment (si	ingle out	fall)					•	
OS g	rid refe	rence of assessme	ent point (m)		Easting	394240				Northing	304990			
OS o	rid refe	rence of outfall stri	ucture (m)		Easting					Northing				
Outfa	I numb	xer			Catchment 7	-			List of outfalls in o	umulative				
Rece	iving w	atercourse			Waercourse 3				ass ess ment					
EAre	ceiving	water Detailed Riv	ver Network ID						Assessor and affile	ation		DSH		
Date	of asse	essment			09/09/2019				Version of assessn	nent		1		
Ste	01 R	unoff Quality												
			AADT >10,000 ar	vd < 50,000		-	Climatic r	region War	m Dry •	Rainfall site	8	Birmingham (SAAR750m	•	
Ste	2 R	ver Impacts	Annual Q <sub>ss</sub> river flow (m	n <sup>3</sup> /s)		Γ	0.003	Fr	eshwater EQS limits:					
		o in Annual Q <sub>35</sub> ox to assess	Impermeable road area				1.816		Biosvailable dissolv			1		
Ste	p 1 run	off quality only)	Permeable area drainin	g to out	fall (ha)		0.115		Bicavailable dissolv	ed zinc (µg/l)		10.9		
			Base Flow Index (BFI)			Γ	0.5	○ Is th	e discharge in or within	1 km upstream of a	protected	site for conservation	? No •	
For	disso	ved zinc only	Water hardness	ſ	High = >200mg CaCO	<b>3</b> 4	•		For dissolved copper	only Ambient	backgroun	d concentration (µg/		
For	sedim	ent impact only	Is there a downstream s	structure	, lake, pond or can	al that reduces th	he veloci	ty within 100	m of the point of dische	rge?		No •		
			* Tier 1 Estimat	ted river	width (m)	E	1							
								Manada	0.07			m) 0.5	and draw for last	
			CTier 2 Bed wid	307 (M)			3	Manning's		510	e slope (m/r	m)   us	Long slope (m/m) 0.0001	
Ste	0 3 M	itigation						_					1	
1										stimated effectiven				
					Brief description			- [		Attenuation for solut ricted discharge rat		Settlement of sediments (%)		
Ex	sting m	e 25 UT 65						0	O No	restriction -	0	0		
Pro	cosed	measures						0	D No	restriction	0 0	0		
L											1 I I		]	

## **Road Catchment 8 Existing**



#### **Road Catchment 8 Proposed**

highways england	highways Highways England Water Risk Assessment Tool Version 2.0.4 June 2019								
		Soluble				Sediment -	Chronic Impact		
	EQS - Annual Average Co			Acute Imp	pact				
	Copper	Zisc					Pass		
Step 2 Tier 1 fail. Go to	4.32 Tier 2 (using UK TAG	0.87	ug/l	Copper	Zinc	Padimant dan salting f	or this site is judged as:		
	or Step 3 mitigation.			Pass	Pass	Accumulating? Yes			
						Extensive? No	64 Deposition Index		
Step 3									
Road number		A460		HE Area / DBFO n	umber				
Assessment type		Non-oumulative assessment	t (single outfall)				•		
OS grid reference of assessme	ent point (m)	Easting			Northing				
OS grid reference of outfall stri	ucture (m)	Easting			Northing				
Outfall number		Catchment 8		List of outfails in o	cumulative				
Receiving water course		Watercourse 3		ass ess ment					
EA receiving water Detailed Riv	ver Network ID			Assessor and affili	ation	HJ AECOM			
Date of assessment		09/12/2019		Version of assess	ment				
Notes									
Step 1 Runoff Quality	AADT >10,000 and <5	0,000 -	Climatic region	Warm Dry .	Rainfall site	Birmingham (SAAR750mm)			
Step 2 River Impacts	Annual Q <sub>16</sub> river flow (m <sup>3</sup> /s)		0.001	Freshwater EQS limits:					
(Enter zero in Annual Q <sub>55</sub>	Impermeable road area drai	ined (ha)	0.474	Bioavailable dissolv	ved copper (µg1)	1			
river flow box to assess Step 1 runoff quality only)	Permeable area draining to	outfall (ba)	0.783	Bioavailable dissolv	(line) only here	10.9			
Step ( for on quarry only)	-	00000 (10)		L					
	Base Flow Index (BFI)		0.5	Is the discharge in or within	1 km upstream of a protecte	ed site for conservation?	No 🔹 🖻		
For dissolved zinc only	Water hardness	High = >200mg CaCO3.1	•	For dissolved coppe	r only Ambient backgro	und concentration (µg/I)	4		
For sediment impact only	Is there a downstream struct	ture, lake, pond or canal that reduc	es the velocity with	in 100m of the point of dische	arge?	No 💌 🔍			
	* Tier 1 Estimated ri	iver width (m)	1.5						
	Tier 2 Bed width (r	m)	3 Mar	ning's n 0.07	Side slope (n	m/m) 05 100	g slope (m/m) 0.0001		
	<ul> <li>THEF ∠</li> <li>Deci woon (i</li> </ul>		- Ninda		Side solve (i		A sobe (usual account		
Step 3 Mitigation									
July 2 million		Brief description		Treatment for	Attenuation for solubles - tricted discharge rate ( Vs )	Settlement of sediments (%)			
Existing measures	-			0 D	restriction	0 0			
Proposed measures	-				restriction	0 0			

#### Cumulative Catchments 7 + 8

	EQS - Annual Average Con	centration			Acute In	npact			
	Copper	Zinc							r 2 for ¥elocity
	3.78 o Tier 2 (using UK TAG or Step 3 mitigation.	1.32	ugil		Copper Pass	Zinc Pass		liment deposition fo cumulating? Yes	d = 67 %, proposed = 0 % or this site is judged as: 0.03 Low flow Vel m/s
Step 3	-		ugłi				Eat	ensive? Yes	301 Deposition Index
Road number		M54-M6 Link			HE Area / DBFO r	umber			
Assessment type		Cumulative assessment inclu				Iumper			
OS grid reference o fassessmi	entraint (m)	Easting 394240	uaing seam	nents (outraits	within Toom)	Northing	304990		
OS grid reference of outfall stru		Easting 394240				Northing	304990		
Os grid relerence o routiali situ Outfall number	cure (m)				List of outfalls in c				
		Catchment 7 and 8			assessment	umulative			
Receiving watercourse		Waercourse 3			Assessor and affili			-	
EA receiving water D etailed Ri	Ver Network ID							DSH	
Date of assessment Notes		09/09/2019			Version of assess	ment		1	
Step 1 Runoff Quality	AADT >10,000 and <50	0,000 -	Climatic r	region Warm I	Dry 🔹	Rainfall site	Birmir	ngham (SAAR 750mm)	•
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.003	Fres	hwater EQS limits:				
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area drai	ned (ha)	2.29		Bioavailable disso	lved copper (µg/l)		1 D	
Step 1 runoff quality only)	Permeable area draining to	outfall (ha)	0.898		Bioavailable disso	lved zinc (µg/l)		10.9 D	
	Base Flow Index (BFI)		0.5	D Is the d	lischarge in or with	in 1 km upstream of	a protected sit	e for conservation?	No 🔻 D
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	F	or dissolved copp	er only Ambient	background c	oncentration (µg/l)	3.3
For sediment impact only	Is there a downstream struct	ture, lake, pond or canal that reduc	ces the velo	city within 100	m of the point of di	scharge?		No 🔻 D	
	Tier 1 Estimated rive	ver width (m)	1						
	C Tier 2 Bed width (n	n)	3	Manning's n	0.07 D	Sid	e slope (m/m)	0.5 Long	g slope (m/m) 0.0001
Step 3 Mitigation						Estimated effectiver			
					reatment for	Attenuation for solut		ttlem ent of	
		Briefdescription				stricted discharge ra		liments (%)	
Existing measures				0	D N	lo restriction 👻	D 0	D	
Proposed measures				0	D N	o restriction 👻	D 0	D	



## **Road Catchment 9 Existing**

	EQS - Annual Average Co	ncentration		Acute In	npact		
Step 2 Tier 1 fail. Go to	4.77 5 Tier 2 (using UK TAG or Step 3 mitigation.	Zinc 2.22	ug/l	Copper River Fails Toxicity Test. Try mitigation	Zinc Pass	Settlement Sediment deposi Accumulating?	ry Tier 2 for Velocity needed = 54 %, proposed = 0 % tion for this site is judged as: Yes 0.00 Low flow Velmi's Yes 217 Denosition Index
Step 3	-	-	ugłi			Extensive?	Yes 217 Deposition Index
Road number		M54 Northbound		HE Area / DBFO r	number		
Assessment type		Non-cumulative asses	ssment (single outfall)				
OS grid reference of assessme	ntpoint (m )	Easting			Northing		
DS grid reference of outfall strue	cture (m)	Easting			Northing		
Dutfall number		Catchment 9		List of outfalls in o	umulative		
Receiving watercourse		Watercourse 4		assessment			
A receiving water D etailed Riv	verNetwork ID			Assessor and affi	iation	D SH AEC ON	4
Date o fassessment		23/01/2020		Version of assess	ment	1	
Step 1 Runoff Quality	AADT >10 000	and <50 000	Climatic region	Warm Dry	Rainfall site	Rimingham	(SAAR 750mm)
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)	1	0.001	Freshwater EQS limits:			
(Enter zero in Annual Q <sub>95</sub>	Impermeable road area dra	ined (ha)	1 507	Bioavailable disso	lved copper (µg/l)	1	D
river flow box to assess Step 1 runoff quality	Permeable area draining to	outfall (ha)	0 798	Bioavailable disso	lved zinc (µg/l)	10.9	D
only)	Base Flow Index (BFI)		0.5 D	Is the discharge in or with	in 1 km upstream of a p	rotected site for conserva	ation?
For dissolved zinc only	Water hardness	High = >200mg		For dissolved copp	er only Ambient ba	ckground concentration (	(µg/l) /
For sediment impact only	Is there a downstream struc		at reduces the velocity w	ithin 100m of the point of di	scharge?	No.	D
	Estimated r	iver width (m)	15				
	C Tion Bed width (	m)	्र Ma	nning's n 0 07	Side sl	ope (m/m) <u>05</u>	Long slope (m/m)
Step 3 Mitigation		Briefdescription		Treatment for	E stimated effectiveness Attenuation for solubles stricted discharge rate (	- Settlement of	
Existing measures				0 D N	b restriction	D O D	
Proposed measures							

# Road Catchment 9: Proposed :

1	EQS - Annual Average Conc	entration		Acute I	mpact		
	Copper	Zinc				Fail. Trg	Tier 2 for Velocity
	3.80	2.25	ugil	Copper	Zinc		eded = 56 %, proposed = 0 %
	Tier 2 (using UK TAG			<b>River Fails Toxicity</b>			es 0.00 Lowflow Vel m/s
M-BAT toolj.	or Step 3 mitigation.			Test. Try mitigation	Pass		es 0.00 Low flow Vel m/s es 224 Deposition Index
Step 3	-	-	ugil			Extensive?	Es 227 Deposition index
Road number		A460		HE Area / DBFO	number		
Assessment type		Non-cumulative assessmen	t (single outfall)		las au		
OS grid reference of assessmen		Easting			Northing		
OS grid reference of outfall struc	ture (m)	Easting			Northing		
Outfall number		catchment 9		List of outfalls in assessment	cumulative		
Receiving watercourse		watercourse 4					
EA receiving water D etailed Riv	er Network ID			Assessor and aff			
Date of assessment		15/11/2019		Version of asses	sment		
Notes							
Step 1 Runoff Quality							
	AADT >10,000 and <50	.000 👻	Climatic regio	n Warm Dry 💌	Rainfall site	Birmingham (SAAR 750m	(m)
Step 2 River Impacts							
Step 2 River impacts	Annual Q <sub>s5</sub> river flow (m <sup>3</sup> /s)		0.001	Freshwater EQS limits			
(Enter zero in Annual Qas	Impermeable road area drain	ed (ha)	1.644	Bioavailable diss	olved copper (µg/l)	1 D	
river flow box to assess		. ,					
Step 1 runoff quality only)	Permeable area draining to o	utfall (ha)	1.035	Bioavailable diss	olved zinc (µg/l)	10.9 D	
only)	Base Flow Index (BFI)		0.5	Is the discharge in or with	hin 1 km upstream of a pr	otected site for conservation	on? No 🔻 D
				-			
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	For dissolved cop	per only Ambient bac	ckground concentration (µg	/1) 3
For sediment impact only	is there a downstream struct	ure, lake, pond or canal that redu	uces the velocity	vithin 100m of the point of d	lischarge?	No 🔻 D	
	• Tier 1 Estimated riv	er width (m)	1.5				
	C Tier 2 Bed width (m	)	3 M	anning's n 0.07 D	Side slo	ope (m/m) 0.5 I	ong slope (m/m) 0.0001
Ctore 2 Mittlenetien							1
Step 3 Mitigation					E stimated effectiveness		
1				Treatment for	Attenuation for solubles		
1		Briefdescription		solubles (%)	estricted discharge rate (I	l/s) sediments(%)	
Ender and a second seco					No restriction		
Existing measures Proposed measures				0 D 1	NO restriction 👻	D O D	
				0 0	No restriction	D O D	



#### **Road Catchment 10: Proposed**

	EQS - Annual Average		Acute Impact							
	Copper 4 44	Zine 4.11	ligu		Copper	Zinc			rg Tier 2 fo	r Velocity X, proposed = 0 %
Step 2 Tier 1 fail. Go to	Tier 2 (using UK TAG	4.0	ugn			Zinc	l s			s site is judged as:
	or Step 3 mitigation.				r Fails Toxicity	Pass				0.00 Low flow Vel mi
			ugil				Б	itensive?	Yes	456 Deposition Inde
Step 3										
ad number		M54-M6 Link Road			HE Area / DBFO r	number				
sessment type		Non-cumulative asses	ssment (single outf	all)						
S grid reference o fassessmer	ntpoint (m )	Easting 3951	70			Northing	306270			
S grid reference o foutfall struc	cture (m)	Easting				Northing				
utfall number		Watercourse 4 new outfi	all: catchment 10		List of outfalls in o	umulative				
eceiving watercourse		Watercourse 4			assessment					
A receiving water Detailed Riv	er Network ID				Assessor and affil	iation		D SH		
ate o fassessment		09/09/2019			Version of assess	ment		1		
tes										
en 1 Runoff Quality				_						
· · ·	AADT >=50	000 and <100 000	Climatic r	region \\/a	m Drv 💌	Rainfall site	R	iminoham	SAAR7	50mm) <u>-</u>
Step 1 Runoff Quality Step 2 River Impacts	AADT >=50 Annual Q <sub>95</sub> river flow (n		Climatic r	-	m Drv 💌	Rainfall site	R	iminoham		50mm) 💌
· · ·		nº/s)		Fres			R			50mm)
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>95</sub> river flow (n	n³/s) drained (ha)	0.001	Fres	hwater EQS limits:	lved copper (µg/l)	R	1		50mm\▼
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess	Annual Q <sub>95</sub> river flow (n	n³/s) drained (ha)	0.001	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso	lved copper (µg/l)		1	D	50mm) 💌
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>95</sub> river flow (n Impermeable road area Permeable area drainin	n³/s) drained (ha)	0 001 2 252 4 05 0 5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream o	a protected s	1	D D ation?	
Step 2 River Impacts (Enter zero in Annual Q <sub>es</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>es</sub> river flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness	n <sup>5</sup> /s) drained (ha) ig to outfall (ha)		Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream of er only Ambien	a protected s	1 10.9 ite for conserva	D ation?	
Center zero in Annual Q <sub>es</sub> (Enter zero in Annual Q <sub>es</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>sc</sub> river flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream	drained (ha) g to outfall (ha) Hinh = >200mm f		Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream of er only Ambien	a protected s	1 10.9 ite for conserva concentration (	D ation?	
Center zero in Annual Q <sub>es</sub> (Enter zero in Annual Q <sub>es</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	r <sup>3/5</sup> ) drained (ha) ig to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th led river width (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream o' er only Ambler scharge?	a protected s	1 10.9 ite for conservation (	D D ation? (µg/l)	N
Center zero in Annual Q <sub>es</sub> (Enter zero in Annual Q <sub>es</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>sc</sub> river flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream	r <sup>3/5</sup> ) drained (ha) ig to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th led river width (m)		Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream o' er only Ambler scharge?	a protected s	1 10.9 ite for conservation (	D D ation? (µg/l)	
Step 2 River Impacts (Finer zero in Annual Q <sub>es</sub> (Finer flow box. To assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	r <sup>3/5</sup> ) drained (ha) ig to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th led river width (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream o' er only Ambler scharge?	a protected s	1 10.9 ite for conservation (	D D ation? (µg/l)	N
Center zero in Annual Q <sub>es</sub> (Enter zero in Annual Q <sub>es</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	r <sup>3/5</sup> ) drained (ha) ig to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th led river width (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis	lved copper (μg/l) lved zinc (μg/l) in 1 km upstream o' er only Ambler scharge?	a protected s t background le slope (m/m	1 10.9 ite for conservation (	D D ation? (µg/l)	N
Step 2 River Impacts (Finer zero in Annual Q <sub>es</sub> (Finer flow box. To assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	r <sup>3/5</sup> ) drained (ha) ig to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th led river width (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis 0 0 07	lived copper (µg/l) lived zinc (µg/l) in 1 km upstream o' er only Ambien scharge? Sic	a protected s t background le slope (m/m ness bles - S	1 109 ite for conserva- concentration ( No. • ) 0.5	D D ation? (µg/l)	N
Step 2 River Impacts (Finer zero in Annual Q <sub>es</sub> (Finer flow box. To assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	r <sup>3/5</sup> ) drained (ha) ig to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th led river width (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis n n n n n or reatment for	lved copper (µg/l) lved zinc (µg/l) in 1 km upstream of er only Ambler scharge? Sic E stimated effective	a protected s t background le slope (m/m ness bles - S	1 10.9 ite for conservation ( No 1 0 0.5	D D ation? (µg/l)	N
Step 2 River Impacts (Enter zero in Annual Q <sub>in</sub> vier flow box to assess Step 1 runoff quality For dissolved zinc only For sediment impact only Step 3 Mitigation	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	drained (ha) drained (ha) g to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th ded river width (m) th (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of di n n n7 0 reatment for colubles (%) re	lived copper (µg/l) lived zinc (µg/l) in 1 km upstream o' er only Ambien scharge? Sic Estimated effective Attenuation for solu stricted discharge re	i a protected s t background le slope (m/m ness bles - ste (//s ) se	1 10.9 10.9 concentration ( Nn 0 5 cetiem ent of diments (%)	D D ation? (µg/l)	N
Step 2 River Impacts (Finer zero in Annual Q <sub>es</sub> (Finer flow box. To assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>iss</sub> fiver flow (n Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness Is there a downstream C Tior Estimat	drained (ha) drained (ha) g to outfall (ha) Hinh = >200mm f structure, lake, pond or canal th ded river width (m) th (m)	(	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis no no no no no no no no no no no reatment for olubies (%) re	lived copper (µg/l) lived zinc (µg/l) in 1 km upstream of er only Ambien scharge? Sic Estimated effective Attenuation for solo	a protected s t background le slope (m/m ness bles - S	1 109 ite for conserva- concentration ( No. • ) 0.5	D D ation? (µg/l)	N

# Cumulative catchments 9 + 10: Proposed

	EQS - Annual Average Cone		Acute Impact						
C	Copper	Zinc							
	4.78	5.07	ug/l		Copper	Zinc			
	Tier 2 (using UK TAG			Birro	r Fails Toxicity				or this site is judged as:
M-BAT tool), o	or Step 3 mitigation.		_		. Try mitigation	Pass		umulating?	Low flow Vel m/s
	-	-	ug/l				Ext	ensive?	Deposition Index
Step 3									
load number		M54-M6 Link Road			HE Area / DBFO n	umber			
ssessment type		Cumulative assessment exclu	iding sedir	ments (outfalls	between 100m a	nd 1km apart)			•
)S grid reference of assessmen	t point (m )	Easting 395170		(		Northing	306270		
)S grid reference o foutfall struc		Easting				Northing			
)utfall number		Watercourse 4 new outfall:	catchmen	t 9 and 10	List of outfalls in c		<u> </u>		
teceiving watercourse		Watercourse 4			assessment		<u> </u>		
A receiving water D etailed Rive	er Network ID				Assessor and affilia	ation		DSH	
ate o fassessment		09/09/2019			Version of assess	nent		1	
lotes									
Step 1 Runoff Quality	AADT >= 50,000 and <1	• • • • • • • • • • • • • • • • • • • •	or	1				ngham (SAAR 750mm)	
	AADT >= 50,000 and <1	• • • • • • • • • • • • • • • • • • • •	Climatic r	region Warm [	Dry 🔫	Rainfall site	Birmir	igham (SAAR 750mm)	
Step 2 River Impacts									
Step 2 River impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.001	Fres	hwater EQS limits:				
(Enter zero in Annual Qee	Impermeable road area drain	ed (ha)	4.997		Bioavailable dissol	ved copper (ug/l)		1 D	
river flow box to assess									
Step 1 runoff quality only)	Permeable area draining to c	outfall (ha)	5.085		Bioavailable dissol	ved zinc (µg/l)		10.9 D	
oniy)	Base Flow Index (BFI)		0.5	D Is the d	lischarge in or withi	n 1 km upstream of	a protected sit	e for conservation?	No 👻 D
					-	•	-		
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	E F	or dissolved copp	er only Ambient	t background c	oncentration (µg/I)	3
						,, , , , , , , , , , , , , , , , ,	r buonground o	onoona aaon (agn)	
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that reduc	es the velo	city within 100	m of the point of dis	charge?		No 🔻 D	
	Tier 1 Estimated riv	and the fact has been a second s	1.5						
	Iter 1 Esumated nv	er width (m)	1.5						
	Tier 2 Bed width (m	1)	3	Manning's n	0.07 D	Side	e slope (m/m)	0.5 Lon	g slope (m/m) 0.0001
Step 3 Mitigation									
						Estimated effectiven			
						Attenuation for solut		tiem ent of	
		Briefdescription		s	olubles (%) res	stricted discharge ra	te (1/s) Sed	iments (%)	
Existing measures				0		restriction -	D O	D	
Proposed measures						restriction -	D 0	D	



## **Road Catchment 11: Existing**

highways england	Highways Engla	ind Water Risk Asses	ssment Tool		Version 2.0.4 June 2	2019			
		Sol	luble					Sedimen	t - Chronic Impact
	EQS - Annual Average	Concentration		Acut					
	Copper	Zinc							Pass
	3.20	0.46	ug/l	_	Copper	Zinc			
	Tier 2 (using UK TAG				Pass	Pass		diment depositi cumulating? Y	ion for this site is judged as: es 0.01 Low flow Vel m/s
M-BAT (OOI),	or Step 3 mitigation.		ugil		r ass	F 455		tensive? N	
Step 3		-	ugn					tensive?	Deposition index
Road number		A460			HE Area / DBFO n	umber			
Assessment type			ssessment (single out	all)					•
OS grid reference of assessme	nt point (m)	Easting				Northing			
OS grid reference of outfall struc	ture (m)	Easting				Northing			
Outfall number		catchment 10			List of out fails in ci	umulative			
Receiving watercourse		watercourse 5			assessment				
EA receiving water Detailed Riv	erNetwork ID				Assessor and a filia	ation			
Date of assessment		15/11/2019			Version of assess	ment		i	
Notes								,	
Step 1 Runoff Quality	AADT >10,000 and	1<50,000	<ul> <li>Climatic r</li> </ul>	egion Warm	Dry •	Rainfall site	Birmi	ngham (SAAR 750m	m) -
Step 2 River Impacts	Annual $Q_{95}$ river flow (m	<sup>3</sup> /s)	0.004	Free	shwater EQS limits:				
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area	drained (ha)	0.873		Bioavailable dissol	lved copper (µg/l)		1 D	
Step 1 runoff quality	Permeable area draining	g to outfall (ha)	0.466		Bioavailable dissol	lved zinc (µg/l)		10.9 D	
only)	Base Flow Index (BFI)		0.5	D Is the	discharge in or withi	n 1 km upstream of	a protected sit	te for conservatio	on? No 🔻 D
For dissolved zinc only	Water hardness	High = >200mg CaCO	3/1	F	or dissolved copp	er only Ambient	t background c	oncentration (µg	p(I) 3
For sediment impact only	is there a downstream s	tructure, lake, pond or car	nal that reduces the velo	ity within 100	m of the point of dis	charge?		No •	
	CTier 1 Estimate	ed river width (m)	2.5						
	C Tier 2 Bed wid	ith (m)	3	Manning's	0.07 D	Side	e slope (m/m)	0.5 L	.ong slope (m/m) 0.0001
Step 3 Mitigation									1
step 5 Milligation						Estimated effectiven	ess		
				-	Freatment for	Attenuation for solut	bles - Se	ttement of	
		Briefdescription			solubles (%) res	stricted discharge ra	te(Vs) sed	liments (%)	
Existing measures									
Proposed measures				0		o restriction •		D	

## **Road Catchment 11: Proposed**

highways england	Highways Engla	and Water Risk Assessment To	loc	,	version 2.0.4 June 20	19			
		Soluble						Sediment - C	hronic Impact
Step 2 Tier 1 fail. Go to	EQS - Asses) Average Concentration           Copper         Ziac           2         Stat         0.20           4         Test 1 fail. Ge to Tier 2 (saing UK TAG)         0.20				Acute Inp Copper	Zisc			this site is judged as:
M-BAT toolj, Step 3	or Step 3 mitigation. -	-	ug/l		Pass	Pass		cumulating? Yes tensive? No	0.01 Low flow Vel m/s 27 Deposition Index
Road number		A460			HE Area / DBFO n	umber			
Assessment type		Non-cumulative assessmen	nt (single outfall	)				•	•
OS grid reference of assessme	nt point (m)	Easting 395170				Northing	306270		
OS grid reference of outfall stru	ucture (m)	Easting				Northing			
Outfall number		WC 5 Existing Outfall			List of outfalls in o	umulative			
Receiving water course		Watercourse 5			ass ess ment				
EA receiving water Detailed Riv	er Network ID				Assessor and affilia	ation		HJ AECOM	
Date of assessment Notes		09/12/2019			Version of assessn	nent		1	
Step 1 Runoff Quality	AADT >10,000 ar	nd <50,000	Climatic regi	on Warm Dr	y 💌	Rainfall site	Birmir	ngham (SAAR750mm)	•
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m	<sup>3</sup> /s)	0.004	Fresh	water EQS limits:				
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area	drained (ha)	0.351		Bioavailable dissolv	ed copper (µg/l)		1	
Step 1 runoff quality only)	Permeable area draining	g to outfall (ha)	0.017		Bioavailable dissolv	ed zinc (μg/l)		10.9	
	Base Flow Index (BFI)		0.5	Is the dis	scharge in or within	1 km upstream of a	protected site	for conservation?	No 💿 🖻
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	— Fo	r dissolved copper	ronly Ambient	background co	oncentration (µg/l)	5
For sediment impact only	Is there a downstream s	tructure, lake, pond or canal that redu	ces the velocity w	vithin 100m o	f the point of discha	rge?		No 🔹 🗈	
	Tier 1 Estimate	ed river width (m)	2.5						
	ੇ Tier 2 Bed wid	lth (m)	3 N	/lanning's n	0.07	Side	slope (m/m)	0.5 Long s	slope (m/m) 0.0001
Ľ									
Step 3 Mitigation		Brief description			atment for	stimated effectivene Attenuation for solut ricted discharge rat	oles - Sel	ttlement of iments ( %)	
Existing measures	-			0	D No	restriction -	D 0	D	
Proposed measures				0	No	restriction -	0		



# Road Catchment 12 No HEWRAT required as embankment drainage only. Road Catchment 13 No HEWRAT required as embankment drainage only.

## Road Catchment 14 : Proposed Area (new road)

EQS - Assest Average Coaccentration         Acste Impact           Copper         Zinc           5.61         1.80         vg/l         Copper         Zinc	diment – Chronic Impact II. Try Tier 2 for Yelocity eat acceded = 64 2, proposed = 0 2 position for this site is judged as:
Copper         Zinc         F           5.61         1.00         vgl         Copper         Zinc           Step 2         Tier I fail. Ge to Tier 2 (scing UK TAG MGAT teau), or Step 3 mitigation.         1.00         vgl         Pass         Pass           MGAT teau), or Step 3 mitigation.         ugl         ugl         Pass         Pass         Extensive	ent needed = 64 %, proposed = 0 %
Road number M54-M6 Link Road HE Area / DBFO number Assessment (single outfall)	
Assiessment type Non-cumulative assessment (single outfall) OS grid reference of assessment point (m) Easting 336440 Northing 306680	•
OS prior tentence of outstanding point (III) Easting 300400 (Northing 200000)	
Outfall number Watercourse 5 new Outfall C: Catchment 14 List of outfalls in ournulative	
Receiving watercourse Watercourse 5 - Latherford Brook as essment	
EA receiving water Detailed River Network ID As sessor and affiliation HU AECC	MC
Date of assessment 09/12/2019 Version of assessment 1	
Step 1 Runoff Quality         AADT         >50000 and <100,000	R 750mm)
Step 2 River Impacts Annual Q <sub>igt</sub> river flow (m <sup>3</sup> /s)	
(Enter zero in Annual Q <sub>66</sub> Impermeable road area drained (ha) 3492 Bioavailable dissolved copper (µg/l)	D
river flow box to assess	
Step 1 runoff quality only) Permeable area draining to outfall (ha) 1285 Bioavailable dissolved zinc (µg/l) 10.9	
Base Flow Index (BFI)  0.5  Is the discharge in or within 1 km upstream of a protected site for conser	rvation? No 💽 🔍
For dissolved zinc only Water hardness Hahe >200mg CaCO31 For dissolved copper only Ambient background concentration	on (µg/l) 5
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	
# Tier 1 Estimated river width (m) 25	
C Tier 2         Bed width (m)           3         Manning's n           0.077         D           Side slope (m/m)         0.5	Long slope (m/m) 0.0001
Step 3 Mitigation         Estimated effectiveness           Brief description         Treatment for solubles (%)         Attenuation for solubles - restricted discharge rate (1s)         Settlement of solubles (%)           Fristmonesures         0         Nonstriction         0         0	
Existing measures         0         0         No restriction         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 <th< th=""><td></td></th<>	
Proposed measures	



## Road Catchment 15 A460

#### **Existing Area**

highways england	Highways England	Water Risk Assessme	ent Tool		Version 2.0.4 June 20	19				
		Soluble	2					Sediment -	Chronic Impact	
	EQS - Annual Average Co			Acute Impact						
	Copper	Zinc						Fail. Try Tier 2 for Velocity		
	4.50	1.42	ug/l	_	Copper Zinc			Settlement needed = 51 2, proposed =		
	Tier 2 (using UK TAG				Pass	Pass		diment deposition fo cumulating? Yes	or this site is judged as: 0.02 Low flow Vel m/s	
m-bai (doi).	tool), or Step 3 mitigation.			F455	P 455		tensive? Yes	204 Deposition Index		
Step 3	-		· · · ·					<u></u>	Deposition much	
Road number		A460 north of J11 N	48		HE Area / DBFO n	mber		1		
Assessment type		Non-cumulative asset		10						
OS grid reference of assessme	ent point (m)	Easting 3955				Northing	307320			
OS grid reference of outfall str		Easting				Northing	307 320			
Outfall number		Watercourse 6: Cat	chment 14 Existin		List of outfalls in cu					
Receiving water course		viace of the of the of the	onment 14 Existin	N .	assessment					
EA receiving water Detailed Riv	ver Network ID				Assessor and affilia	ation		DSH		
Date of assessment		09/09/2019			Version of assessn			1		
Notes		00/00/2010						r		
Step 1 Runoff Quality Step 2 River Impacts	AADT →=50,000 and < Annual Q <sub>act</sub> river flow (m <sup>3</sup> /s)	100,000	Climatic reg	gion Warm C	-	Rainfall site	Birmi	ngham (SAAR750mm)		
				Fres	water EQS limits:					
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area drai	ned (ha)	1.268		Bioavailable dissolv	ed copper (μg/l)		1		
Step 1 runoff quality only)	Permeable area draining to	outfall (ha)	0.968		Bioavailable dissolv	ed zinc (µg/l)		10.9		
	Base Flow Index (BFI)		0.5	Is the d	ischarge in or within	1 km upstream of a	protected site	for conservation?	No - D	
For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	•	F	or dissolved copper	only Ambient	background co	oncentration (µg/l)	4	
For sediment impact only	Is there a downstream struc	ture, lake, pond or canal tha	t reduces the velocity	within 100m	of the point of discha	rge?		No 🔹 🗅		
	Tier 1 Estimated ri	ver width (m)	1							
					0.07					
	C Tier 2 Bed width (r	n)	3	Manning's n	0.07 D	Sidi	e slope (m/m)	0.5 Lon	g slope (m/m) 0.0001	
Step 3 Mitigation		Brief des cription			reatment for A rest	stimated effectiven Attenuation for solul ricted discharge ra	bles - Se	ttlement of iments (%)		
11. Spored measures				1	- NO			1-		

#### Proposed Area

highways england	Highways England	Water Risk Assessment T	ool		Version 2.0.4 June 20	19			
		Soluble						Sediment -	Chronic Impact
E6 Copper 4.71 Step 2 Tier 1 fail, Go to Tier 3 M-BAT tool), or Step Step 3	e (using UK TAG	Ziac Ziac 2.04	ug/i		Acute Imp Copper r Fails Toxicity . Try mitigation	vact Zinc Pass	Λ.	Settlement neede	1 2 for Velocity       d = 63 2, proposed = 0 2       or this site is judged as:       0.02       322       Deposition Index
Step 3									
Road number		A460 north of J11 M6			HE Area / DBFO n	umber			
Assessment type		Non-cumulative assessme	ent (single outfi	all)				1	•
OS grid reference of assessment poin	it (m)	Easting 395955				Northing	307320		
OS grid reference of outfall structure (	(m)	Easting				Northing			
Outfall number		Watercourse 6: Catchm	ent 15 Propo	sed	List of outfalls in cu	umulative			
Receiving water course		Watercourse 6			ass ess ment				
EA receiving water Detailed River Net	work ID				Assessor and affilia			HJ AECOM	
Date of assessment Notes		09/12/2019			Version of assessn	nent		1	
Step 1         Runoff Quality         AAE           Step 2         River Impacts         Ann	)T →=50,000 and < ual Q <sub>int</sub> river flow (m <sup>3</sup> /s)	100,000 -	Climatic re	gion Warm D	wy •	Rainfall site	Birmir	ngham (SAAR750mm)	•
				riesi					
(Enter zero in Annual Q <sub>95</sub> Impo river flow box to assess	ermeable road area drair	ned (ha)	2		Bioavailable dissolv	ed copper (µg/l)		1	
	meable area draining to	outfall (ha)	0.798		Bioavailable dissolv	ed zinc (µg/l)		10.9	
Bas	e Flow Index (BFI)		0.5	□ Is the d	ischarge in or within	1 km upstream of	a protected site	for conservation?	No 🔹 🖻
For dissolved zinc only Wat	er hardness	High = >200mg CaCO3/		- E	or dissolved copper	only Ambien	t background or	oncentration (µg/l)	4
			_		or unssolved copper	Ambien	i background oc	лоеппацоп (µgл)	
		ure, lake, pond or canal that redu	uces the velocity	within 100m	of the point of discha	rge?		No 🔹 🗅	
	ier 1 Estimated riv	/er width (m)	1						
∩ті	ier 2 Bed width (n	n)	3	Manning's n	0.07	Sid	ie slope (m/m)	0.5 Lon	g slope (m/m) 0.0001
Step 3 Mitigation		Brief des cription			reatment for A	stimated effectiven Attenuation for solu ricted discharge ra	ibles - Se	ttlement of iments (%)	
Existing measures				0	D No	restriction .	• • •	D	
Proposed measures				0	D No:	restriction •	- D 0	D	
L									



#### **Existing Area**

highways england	Highways England	I Water Risk Asses	sment Tool		Version 2.0.4 June 20	19			
		Sol	uble					Sediment	t - Chronic Impact
	EQS - Annual Average Co				Acute Imp	act			
	Copper	Zinc			_				Tier 2 for Velocity
Step 2 Tier 1 fail. Go to	4.68 Tier 2 (asing UK TAG	2.02	ugit		Copper	Ziac			ded = 79 %, proposed = 0 % for this site is judged as:
	or Step 3 mitigation.				r Fails Toxicity	Pass		ccumulating?	
	· .	-	ng/l	"	. Try mitigation		E	rtensive? Y	es 475 Deposition Index
Step 3									
Road number		A460			HE Area / DBFO nu	mber			
Ass essment type		Non-cumulative a	ssessment (single out	fall)					
OS grid reference of assessme	nt point (m)	Easting	395687			Northing	307352		
OS grid reference of outfall stru	ucture (m)	Easting				Northing			
Outfall number		M6 Northbound	Outfall, Catchment 1	6 existing	List of outfalls in ou	umulative			
Receiving water course		Watercourse 6			ass ess ment				
EA receiving water Detailed Riv	er Network ID				Assessor and affilia	ation		DSH	
Date of assessment		09/09/2019			Version of assessm	hent		1	
Notes									
Step 1 Runoff Quality	AADT >10,000 and <5	80,000	Climatic n	egion Warm I	Dry 💌	Rainfall site	Birm	ningham (SAAR 750mm	•
Step 2 River Impacts	Annual Q <sub>35</sub> river flow (m <sup>3</sup> /s)		0.002	Fres	hwater EQS limits:				
(Enter zero in Annual Q <sub>05</sub>	Impermeable road area drai	ned (ha)	2.951		Bicavailable dissolv	ed copper (µg/l)		1	
river flow box to assess Step 1 runoff quality only)	Permeable area draining to	outfall (ha)	3.692		Bioavailable dissolv	ed zinc (µg/l)		10.9	
	Base Flow Index (BFI)		0.5	Is the d	lischarge in or within	1 km upstream of a	protected site	e for conservation?	No 🔹 💿
For dissolved zinc only	Water hardness	High = >200mg CaCO3		F	or dissolved copper	only Ambient	background c	concentration (µg/l)	4
For sediment impact only	Is there a downstream struc	ture, lake, pond or cans	I that reduces the velocit	ty within 100m	of the point of discha	rpe?		No 🔹 💿	
		iver width (m)	1						
	C Tier 2 Bed width (r		3	Manoino's o	0.07	Cide	e slope (m/m)	0.5	ong slope (m/m) 0.0001
L	- THE & DEC WORLD	,			-		and the (ment)		and make (many
Step 3 Mitigation				_					1
						stimated effectivene			
						Attenuation for solut		ettlement of	
		Brief description		1	olubles (%) rest	ricted discharge rat	e(15) 5e	diments (%)	
Existing measures	-			0	O No	restriction -	0 0	D	
Proposed measures	-			0		restriction •	0	0	
							11-1-		

# Proposed Area

highways england										
		Soluble						Sedim	ent – Chronic	Impact
Step 2 Tier 1 fail. Go to	EQS - Asseal Average Co Copper 4.82 7 Tier 2 (exists UK TAG or Step 3 mitigation.	oscentration Zinc 2.41 -	ug/l		Acute In Copper Fails Toxicity Try mitigation	Zinc Zinc Pass	4		Yes 0.02	roposed = 0 2
Road number		M6 Northbound			HE Area / DBFO n	umber				
Assessment type		Non-cumulative assessn	ment (single outfa	ID				_		
OS grid reference of assessme	ent point (m)	Easting 395687				Northing	307352			
OS grid reference of outfall str		Easting				Northing				
Outfall number		M6 Northbound Outfall	Catchment 16		List of outfalls in o					
Receiving watercourse		Watercourse 6	, catomical To		assiess ment					
EA receiving water Detailed Riv	ver Network ID	valercourse o			Assessor and affili	ation		HL AECOM		
Date of assessment		00/10/0010			Version of assess			NU AECOM		
Jate of assessment		09/12/2019			version of assessi	CRETE.		1		
Step 1 Runoff Quality	AADT >10,000 and <	50,000 •	Climatic reg	gion Warm D	ry 💽	Rainfall site	Bir	mingham (SAAR75)	Jmm)	•
Step 1 Runoff Quality Step 2 River Impacts	AADT >10,000 and < Annual Q <sub>05</sub> river flow (m <sup>3</sup> /s)		Climatic reg		iry 💽	Rainfall site	Bin	mingham (SAAR756	Dmm)	•
Step 2 River Impacts		)			-		Bir	mingham (SAAR 750	2mm)	
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)	) ained (ha)	0.002		water EQS limits:	red copper (µg/l)	Bir	1	2mm) 	v
Step 2 River Impacts	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s)	) ained (ha)	0.002 3.78 3.574	Fresh	water EQS limits: Bioavailable dissolv	red copper (μg/l) red zinc (μg/l)		1		•
Step 2 River Impacts	Annual Q <sub>35</sub> river flow (m <sup>3</sup> /s) Impermeable road area dra Permeable area draining to	) ained (ha)	0.002 3.78 3.574	□ Is the d	water EQS limits: Bioavailable dissolv Bioavailable dissolv	red copper (μg/l) red zinc (μg/l) 1 km upstream of	f a protected si	1	D D D D D	
Step 2 River Impacts (Enter zero in Annual Q <sub>os</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>05</sub> river flow (m <sup>3</sup> /s) Impermeable road area dra Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	) sined (ha) c outfall (ha)	0.002 3.78 3.574 0.5	Fresh     Is the d     Fc	water EQS limits: Bioavailable dissolv Bioavailable dissolv ischarge in or within or dissolved coppe	red copper (µg/l) red zinc (µg/l) 1 km upstream of r only Ambier	f a protected si	1 10.9	□   □   □   □   □   □   □   □   □   □	No •
Step 2 River Impacts (Enter zero in Annual Q <sub>ris</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>05</sub> river flow (m <sup>3</sup> /s) Impermeable road area dra Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	) ined (ha) o cutfall (ha) Hah = >200mp CaCO34 cture, lake, pond or canal that re river width (m)	0.002 3.78 3.574 0.5 v iduces the velocity 1	Fresh     Is the d     Fresh     within 100m d	water EQS limits: Bioavailable dissolv Bioavailable dissolv ischarge in or within or dissolved coppe	red copper (μg/l) red zinc (μg/l) 1 km upstream of r only Ambier rge?	f a protected si	1 [10.9 ] ite for conservati	□   □   □   □   □   □   □   □   □   □	No
Step 2 River Impacts (Enter zero in Annual Q <sub>ris</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area dra Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream stru * Tier 1 Estimated	) ined (ha) o cutfall (ha) Hah = >200mp CaCO34 cture, lake, pond or canal that re river width (m)	0.002 3.78 3.574 0.5 v iduces the velocity 1	Fresh     Is the d     Fresh     Known of the second	water EQS limits: Bioavailable dissolv Bioavailable dissolv ischarge in or within or dissolved coppe of the point of dische atomet for	red copper (μg/l) red zinc (μg/l) 1 km upstream of r only Ambier rge?	f a protected si nt background de slope (m/m ness ubles -	1 [10.9 ] ite for conservati	0           0           0n?           ig/l)           0	No 💽 🖻
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area dra Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream stru * Tier 1 Estimated		0.002 3.78 3.574 0.5 v iduces the velocity 1	Fresh     Is the d     Fresh     Known of the second	water EQS limits: Bioevailable dissolv Bioevailable dissolv ischarge in or within or dissolved coppe of the point of discha or coppe of the point of discha or coppe of the point of discha coppe of the point of discha rest	red copper (µgil) red zinc (µgil) 1 km upstream of r only Ambiei rge? Si Stimated effective Attenuation for sol	f a protected si nt background de slope (m/m ness ubles -	1 10.9 1 10.9 1 ite for conservation (µ No 1 1 0.0 0.5 1 Settlement of	0           0           0n?           ig/l)           0	No



#### **Existing Area**

	<b>5</b> osed = 0 %
Copper     Zisc       8tep 2     Tits (1 field). Dis to Tite 2 (seing UK TAG.     2.21       With AT tool), or Size 2 (seing UK TAG.     2.21       9gl     Pair Toiling       100     Pair Toiling       101     Pair Toiling       102     Pair Toiling       103     Pair Toiling       104     Pair Toiling       105     Pair Toiling </th <th>osed = 0 2 udged as: ow flow Vel m/s</th>	osed = 0 2 udged as: ow flow Vel m/s
Step 2     4.15     2.21     upil       3tep 2     Tot 14.16. cito 150*2 (sing up total) MAAK teet), or Xtep 3 antigative.     upil     Pass     Sectionest exceeds 30.2, program       Step 3	osed = 0 2 udged as: ow flow Vel m/s
Step 2       Tite I fail. Box Tite 2 [ Staing UK TAG       Sediant deposition for this site 12 [ Accessiting 12 [ Staing UK TAG         Step 3       wgR       Wer Fail: Torging UK TAG       Accessiting 12 [ Staing UK TAG         Step 3       wgR       Wer Fail: Torging UK TAG       Accessiting 12 [ Staing UK TAG         Step 3       wgR       Wer Fail: Torging UK TAG       Accessiting 12 [ Staing UK TAG         Step 3       wgR       Wer Fail: Torging UK TAG       Accessiting 12 [ Staing UK TAG         Road number       Md       HE Area / DBFO number       Accessiting 12 [ Staing UK TAG         As eas ment tope       Non-cumulative assessment (single outfall)       Northing       307 169         OS grid reference of assessment point (m)       Easting       395500       Northing       307 169         Oddaf number       Md Southbound: Catchment 17 existing       List of outfalls in cumulative       437 17       Accessiting water Detailed River Network ID       Assessment       437 17       Accessiting water Detailed River Network ID       Assessment       H AccoM         Date of assessment       09/12/20 19       Version of assessment       1       Nother         Notes       were non dationed - source of assessment       1       Sediant deposition for under       Sediant deposition for under         Step 1 Runoff Quality       ADT<	<b>edged as:</b> ow flow Vel m <i>is</i>
Step 3       M0       HE Area / DBFO number         Assessment type       Non-cumulative assessment (single outfall)       OS of inference of assessment coint (m)         OS of inference of data structure (m)       Easting       260500       Northing       207169         Outfall number       M8 Southbound: Catchment 17 existing       List of outfalls in cumulative assessment       43717         Receiving water Outse       M8 Southbound: Catchment 17 existing       List of outfalls in cumulative assessment       43717         Receiving water Outse       Wateroourse 0       Basiss sen nut       1       1         EA receiving water Outse       09/12/2019       Version of as sessment       1       1         Notes       Step 1 Runoff Quality       AADT       >10,000 and <50,000       Climatic region       Warm Dry       Rainfall site       Birmingtum (BAAR750mm)	leposition Index
As as ament type     Non-cumulative assessment (single outfall)       OS ard inference of assessment coint (m)     Easting       OS ard inference of outfalls tructure (m)     Easting       Outfall number     M6 Southbound: Catchment 17 existing       Receiving water Outse     Wateroou se 0       Exercision     HJ Assessor and affiliation       Ex of assessment     09/12/2019       Version of assessment     1       Notes     Step 1 Runoff Quality       AADT     >10,000 and <50,000	
OS grid reference of assessment point (m)     Easting     385580     Northing     307169       OS grid reference of outfall structure (m)     Easting     Northing     Northing     Northing       Otfall runber     M6 Southbourds:     catchment 17 existing     List of outfalls in cumulative     43717       Receiving water course     Watercourse 6     essessment     9     43717       EA receiving water Detailed River Network ID     Assess or and affiliation     HU AECOM       Date of assessment     09/12/2019     Version of assessment     1       Notes     1     Climatic region     Warm Dry     Reinfall site	• • •
OS grid reference of outfalls structure (m)     Easting     Northing       Outfall in number     Mid Southbound: Catchiment 17 existing     List of outfalls in oundative     43717       Receiving water course     Watercourse 6     assessment     43717       EA receiving water Detailed River Network ID     Assessor and affiliation     HJ AECOM       Date of assessment     09/12/2019     Version of assessment     1	
Outfail number         M8 Southbound: Catchment 17 existing         List of cutfails in cumulative         43717           RaceWing wateroourse         Wateroourse 0         ess ess ment         1           Ex receiving water Detailed River Network ID         As sets or and affiliation         HJ AECOM           Date of assessment         09/12/2019         Version of as sets ment         1           Notes          Step 1 Runoff Quality         AADT         >10.00 and <50.000	
Receiving water course     Water course 6     as essment       EAr receiving water Detailed River Network ID     As sets or and affiliation     HJ AECOM       Date of assessment     09/12/2019     Version of as sets ment     1       Notes     09/12/2019     Version of as sets ment     1	
Receiving water Detailed River Network ID     As sets or and affiliation     HJ AECOM       Date of assessment     09/12/2019     Version of as sets ment     1       Notes	
Date of assessment     09/12/2019     Version of as sessment     1       Notes     Image: Comparison of assessment     1       Step 1 Runoff Quality     AADT     >10.000 and <50.000	
Notes           Step 1 Runoff Quality         AADT         >10.000 and <50.000         Climatic region         Warm Dry         Rainfall site         Birminduam (BAAR750mmt)           Step 2 River Impacts         Step 2 River Impacts         Step 2 River Impacts         Step 3 River Impacts         Step 3 River Impacts	
Step 1 Runoff Quality         AADT         >10.000 and <50.000         Climatic region         Warm Dry         Reinfall site         Birminshum (SAAR 750mm)           Step 2 River Impacts	
AADT 10.000 and <50.000 Climatic region Warm Dry Reinfall site Birmindham (SAAR750mm)	
Step 2 River Impacts         Annual Q <sub>in</sub> river flow (m <sup>3</sup> /s)         0.002         Freshwater EQS limits:	•
(Enter zero in Annual Q <sub>85</sub> Impermeable road area drained (ha) 337 Bioavailable dissolved copper (µg/l) 1	
river flow box to assess Step 1 runof rousity only) Permeable area draining to outfall (ha) 398 Bioavailable dissolved zinc (µg/l) 10.9 0	
Base Flow Index (BFI) 0.5 Is the discharge in or within 1 km upstream of a protected site for conservation?	No 🔹 💿
Date From index (or i) = is the distingly in the water in a protected size for conservation in	· • •
For dissolved zinc only Water hardness High= >200mg CaCO31 For dissolved copper only Ambient background concentration (µg/l)	4
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	
* Tier 1 Estimated river width (m)	
C Tier 2 Bed width (m) I Manning's n 007 O Side slope (m/m) 05 Long slope (m/m)	0.0001
1	
Step 3 Mitigation	
Estimated effectiveness Treatment for Attenuation for solubles - Settlement of	
Interaction     Interacti	
Existing measures 0 0 No resticion • 0 0 0	
Proposed measures 0 0 0 0 0	

#### Proposed Area

highways england										
		Solu	ble					Sedin	nent – Chr	onic Impact
	EQS - Annual Average				Acute Is	apact				
	Copper	Zinc							Try Tier 2 f	
Step 2 Tier 1 fail. Go t	4.84	2.47	ug/l	L _	Copper	Zinc	_			5 2. proposed = 0 2
	to Tier 2 (using UK TAG , or Step 3 mitigation.				er Fails Toxicity	Pass		Sediment depos Accumulating?		is site is judged as: 0.02 Low flow Velr
m-DAT (001).	, or step 5 mitigation.		ug/l	Tes	t. Try mitigation	P 455		Extensive?	Yes	642 Deposition Inc
Step 3			a di la calendaria di la c				-	Litterstre:		beposidon inc
								-		
load number		M6 Southbound			HE Area / DBFO	number				
ssessment type			sessment (single out	tfall)						
S grid reference of assessm			95560			Northing	307169			
OS grid reference of outfall st	ructure (m)	Easting				Northing				
Dutfall number			Catchment 17 prop	posed	List of outfalls in	cumulative		43717		
Receiving water course		Watercourse 6								
5A receiving water Detailed R	iver Network ID				Assessor and aff			HJ AECOM		
ate of assessment		09/12/2019			Version of asses	sment		1		
Step 1 Runoff Quality	AADT >10,000 ar	nd <50,000	Climatic	region Warm	Dry 💽	Rainfall site	1	3irmingham (SAAR7)	50mm)	•
· · · ·			-		_	Rainfall site	1	Birmingham (SAAR 76	50mm)	·
Step 1 Runoff Quality Step 2 River Impacts	Annual Q <sub>as</sub> river flow (m	i <sup>3</sup> /s)	0.002		shwater EQS limits:		1	Sirmingham (SAAR 7	50mm)	×
Step 2 River Impacts (Enter zero in Annual Q <sub>66</sub> river flow box to assess	Annual Q <sub>as</sub> river flow (m	<sup>3</sup> /s) drained (ha)	0.002		shwater EQS limits: Bioavailable disso	olved copper (µg/l)		1		•
Step 2 River Impacts	Annual Q <sub>as</sub> river flow (m Impermeable road area Permeable area drainin	<sup>3</sup> /s) drained (ha)	0.002	Fre	shwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) olved zinc (μg/l)		1		
Step 2 River Impacts (Enter zero in Annual Q <sub>65</sub> river flow box to assess	Annual Q <sub>as</sub> river flow (m	<sup>3</sup> /s) drained (ha)	0.002	Fre	shwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (µg/l)		1		No •
Step 2 River Impacts (Enter zero in Annual Q <sub>65</sub> river flow box to assess	Annual Q <sub>as</sub> river flow (m Impermeable road area Permeable area drainin	<sup>3</sup> /s) drained (ha)	0.002	Free Is the	shwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of	a protected	1	D tion?	
Step 2 River Impacts (Enter zero in Annual Q <sub>at</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>as</sub> river flow (m Impermeable road area Permeable area drainin Base Flow Index (BFI) Water hardness	<sup>2</sup> /s) drained (ha) g to outfall (ha)	0.002 3994 4.169 0.5	Fre	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or withi For dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of <b>per only</b> Ambier	a protected	1 [ 10.9 [ site for conservat	о ition?	
Step 2 River Impacts (Enter zero in Annual Q <sub>int</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ig</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s	3/s) drained (ha) g to outfall (ha) High=>200mg CaCO34	0.002 3994 4.169 0.5	Fre	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or withi For dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of <b>per only</b> Ambier	a protected	1 [ 10.9 [ site for conservat	о ition?	
Step 2 River Impacts (Enter zero in Annual Q <sub>int</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	<sup>2</sup> /s) drained (ha) g to outfall (ha) Hah=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM	0.002 3994 4.169 0.5	Free Is the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or withi For dissolved copp	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambier harge?	a protected	1     [       10.9     [       site for conservat       id concentration (       No     [	р ition? µg/l)	ND . [
Center zero in Annual Q <sub>int</sub> (Enter zero in Annual Q <sub>int</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ig</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s	<sup>2</sup> /s) drained (ha) g to outfall (ha) Hah=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM	0.002 3994 4.169 0.5	Free Is the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or withi For dissolved copp	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambier harge?	a protected	1     [       10.9     [       site for conservat       id concentration (       No     [	р ition? µg/l)	
Step 2 River Impacts (Enter zero in Annual Q <sub>inf</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	<sup>2</sup> /s) drained (ha) g to outfall (ha) Hah=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM	0.002 3994 4.169 0.5	Free Is the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or withi For dissolved copp	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambier harge?	a protected	1     [       10.9     [       site for conservat       id concentration (       No     [	р ition? µg/l)	ND . [
Step 2 River Impacts (Enter zero in Annual Q <sub>int</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	<sup>2</sup> /s) drained (ha) g to outfall (ha) Hah=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM	0.002 3994 4.169 0.5	Free Is the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or within For dissolved copp n of the point of discl	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambier harge?	a protected nt backgrour de slope (m/	1     [       10.9     [       site for conservat       id concentration (       No     [	р ition? µg/l)	ND . [
Step 2 River Impacts (Enter zero in Annual Q <sub>inf</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	<sup>2</sup> /s) drained (ha) g to outfall (ha) Hah=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM	0.002 3994 4.169 0.5	Free Is the I the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or within For dissolved copp an of the point of discl an 007 C	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of eer only Ambier harge? Sii Estimated effective Attenuation for sol	a protected t backgrour de slope (m/ mess ubles -	1     [       10.9     [       site for conservat       id concentration (       No     [       m)     0.5   Settlement of	р ition? µg/l)	ND . [
Step 2 River Impacts (Enter zero in Annual Q <sub>inf</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	<sup>2</sup> /s) drained (ha) g to outfall (ha) Hah=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM Hoh=>200mc CaCCOM	0.002 3994 4.169 0.5	Free Is the I the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or within For dissolved copp an of the point of discl an 007 C	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambier harge? Sk Estimated effective	a protected t backgrour de slope (m/ mess ubles -	1     [       10.9     [       site for conservation (       No     •       [       No     •       [	р ition? µg/l)	ND . [
Step 2 River Impacts (Enter zero in Annual Q <sub>int</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only Step 3 Mitigation	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	J(s) drained (ha) g to outfall (ha) Hah=>200mcCaCO34 thructure, lake, pond or canal : ad river width (m) th (m)	0.002 3994 4.169 0.5	Free Is the I the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or within For dissolved copp or of the point of disch n 007 01 Treatment for solubles (%)	olved copper (µg/l) vlved zinc (µg/l) in 1 km upstream of eer only Ambier harge? Sin Estimated effective Attenuation for sol- stricted discharge re-	a protected Int background de slope (m/ ness ubles - ste ( Vs )	1     []       10.9     []       site for conservation (       No     []       m)     0.5       Settlement of sediments (%)	р ition? µg/l)	ND . [
Step 2 River Impacts (Enter zero in Annual Q <sub>inf</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>10</sub> river flow (m Impermeable road area Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream s * Tier 1 Estimati	J(s) drained (ha) g to outfall (ha) Hah=>200mcCaCO34 thructure, lake, pond or canal : ad river width (m) th (m)	0.002 3994 4.169 0.5	Free Is the I the	shwater EQS limits: Bioavailable disso Bioavailable disso discharge in or withi For dissolved copp at of the point of disol of the point of disol Treatment for solubles ( %) re	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of eer only Ambier harge? Sii Estimated effective Attenuation for sol	a protected t backgrour de slope (m/ mess ubles -	1     1       10.9     1       site for conservation (     No       No     1       m)     0.5   Settlement of sediments (%)	р ition? µg/l)	ND . [



## Cumulative Road Catchments 15,16 and 17 – existing

Leg 2       Copper 1 at 11 to 110 To		EQS - Annual Average Con	centration			Acute In	npact			
see 2       test table loss for 2 leaving KL MAB         see 3       test table loss for 2 leaving KL MAB         see 3       test table loss for 2 leaving KL MAB         see 3       test table loss for 2 leaving KL MAB         Brid number       A460/MAB         Add number       A460/MAB         Cumulative assessment loss       Cumulative assessment excluding sediments (outflats between 100m and 1km apart)         Seg of thereoze of sessessmel point (m)       E assing         Seg of thereoze of foldit structure (m)       E assing         Seg of thereoze of foldit structure (m)       E assing         Seg of thereoze of foldit structure (m)       E assing         Seg of thereoze of foldit structure (m)       E assing         Seg of thereoze of foldit structure (m)       E assing         Seg of thereoze of foldit structure (m)       E assing         Seg of thereoze of foldit structure (m)       D Assessment         O DA0 S/20 19       Version of assessment         Notes       O DA0 S/20 19         Version of assessment       Immediate assessment         Notes       Immediate assessment (m)         Seg of thereoze of assessment       Immediate assessment         Notes       Immediate assessment         Seg of thereoze (assessess       Permeable area drain		Copper	Zinc							
Bit Rol Locki, un Obeg 2 analysation.     Part of all register in Annual Description Marking in Control of Section Part of Part of Section Part of S			4.40	ug/l		Copper	Zinc	.		
International and the second secon					Bive	r Fails Toxicite				
Biere 3       A460/M6       HE Area / DBFO number         Road number       A460/M6       HE Area / DBFO number         Assessment type       Cumulative assessment excluding sediments (outfalls between 100m and 1km apan).       OS grid reference of assessment point (m)       Easting         OS grid reference of outfall structure (m)       Easting       Nothing       Nothing         OS grid reference of outfall structure (m)       Easting       Nothing       Nothing         Dide of farsessment       Easting       Nothing       Itel orduits in number       Itel orduits in number         Re consing valete Oralle       Watercourse 6       Assessment       Itel orduits in number       Itel orduits in number         Re consing valete Oralle       Obj0/92.019       Venion of assessment       DSH         Notes       Obj0/92.019       Venion of assessment       Itel orduits in number       Itel orduits in number         Step 1 Runoff Quality       AbDT       >=00.000       Climatic region       Rainfall site       Bimmegiam (BAAR 700m)       Itel orduits in number         Notes       Step 1 Runoff Quality       AbDT       >=00.000       Climatic region       Rainfall site       Bimmegiam (BAAR 700m)       Itel orduits in number         Step 1 Runoff Quality       AbDT       >=00.0000       Climatic region with number <th>M-BAT tool).</th> <th>or Step 3 mitigation.</th> <th></th> <th></th> <th></th> <th></th> <th>Pass</th> <th></th> <th></th> <th></th>	M-BAT tool).	or Step 3 mitigation.					Pass			
Road number       A460/M6       HE Area/DBFO number         Road number       A460/M6       HE Area/DBFO number         Assessment fyee       Curnabitive assessment excluding sediments (outfals between 100m and 11wn aport)       •         OS gid reference of sutal structure (m)       Easting       985500       Ioothing       07169         Outfals number       Catchment 15 16 17 Existing       Ioothing       10       15       16         Re obing watercourse       Watercourse 6       Assessment       Ioothing       DSH       Ioothing         A the obing watercourse       Watercourse 6       Assessment       I       Ioothing       DSH         Date of assessment       09/09/2019       Version of assessment       1       Ioothing       Ioothi	Stan 2	·	-	ug/l				Est Est	ensive?	Deposition Index
Assessment type       Currulative assessment excluding sediments (outfalls between 100m and Hm apatt)       •         OS gnd reference of sasessment point (m)       Easting       355560       Nothing       307169         OS gnd reference of sasessment point (m)       Easting       16 offning       10       10         Outfal structure (m)       Catchment 15 16 17 Existing       List of outfals in currulative       14       15       16         Rocking waterOurse       WaterCourse 6       Assessment       05 H       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       15       16       16       16       16       16       16       16       16       16       16       <	Step 3									
Assessment type       Currulative assessment excluding sediments (outfalls between 100m and Hm apatt)       •         OS gnd reference of sasessment point (m)       Easting       355560       Nothing       307169         OS gnd reference of sasessment point (m)       Easting       16 offning       10       10         Outfal structure (m)       Catchment 15 16 17 Existing       List of outfals in currulative       14       15       16         Rocking waterOurse       WaterCourse 6       Assessment       05 H       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       15       16       16       16       16       16       16       16       16       16       16       <										
OS grid reference of Sessessment plort (m)       Easting       395560       Northing       307169         OS grid reference of odstal structure (m)       Easting       List of outsits in cumulative       14       15       16         OG grid reference of odstal structure (m)       Catchment 15       16       16       16       16         Rec Ming waterCourse       Watercourse 6       Assessor and stillation       DSH       16         Ex ce bing waterCourse       Watercourse 6       Assessor and stillation       DSH       16         Date of assessment       09/09/2019       Version of assessment       1       16         Step 1 Runoff Quality       AADT       >=0000 and <1000000	Road number		A460/M6			HE Area / DBFO r	number			
OS grid reference of Sessessment plort (m)       Easting       199560       Nothing       307169         OS grid reference of oddal structure (m)       Easting       Nothing       1007100       Nothing         OG grid reference of oddal structure (m)       Easting       List of outfals in cumulative       1       15         Roc Ming waterCourse       Watercourse 6       Assessor and stillation       DSH         Ex ne pMing waterCourse       Watercourse 6       Assessor and stillation       DSH         Date of assessment       09/09/2019       Version of assessment       1         Notes        Step 1 Runoff Quality       AADT       >=0000 and <100.000	Assessment type		Cumulative assessment exclu	udina sedi	ments (outfall:	s between 100m a	and 1km apart)			•
OutBit number       Catchment 15 16 17 Existing       List of outBits in cumulative       11       15       16         Receiving valercourse       Valetercourse 6       Assessment       Image: Sessment	OS grid reference o fassessmer	nt point (m )						307169		
Reserving value course       Watercourse 6       assessment       Dimensional and a fill at on       D SH         Date of assessment       09/09/2019       Version of assessment       D SH         Notes       Step 1. Runoff Quality       AADT       >=60.000 and <100.000	OS grid reference o foutfall struc	ture (m)	Easting				Northing			
Receiving valerourse       Waterourse 6       assessment       D H         EA receiving valer Detailed River Network ID       Assessor and affiaison       D SH         Date of assessment       09/09/2019       Version of assessment       1         Notes       Step 1. Runoff Quality       AADT       >=50,000 and <100.000	Outfall number		Catchment 15 16 17 Existin	na		List of outfalls in o	umulative	14	15	16
EA re country valuer D etailed River Network ID       Assessor and affiliation       DSH         Date of assessment       09/09/2019       Version of assessment       1         Notes       Step 1 Runoff Quality       AADT       >=00.000 and +100.000       Climatic region       Warm Dry       Rainfall alle       Birmingham (SAAR 720mm)       >         Step 1 Runoff Quality       AADT       >=00.000 and +100.000       Climatic region       Warm Dry       Rainfall alle       Birmingham (SAAR 720mm)       >         Step 2 River Impacts       Annual Que river flow (m <sup>1</sup> /s)       00000       Freshwater EOS limits:       Bioavailable dissolved copper (ug/l)       1       D         For dissolved zinc only       Permeable road area drained (ha)       7538       Bioavailable dissolved copper (ug/l)       1       D         For dissolved zinc only       Water hardness       Hgh =>200mg GaC034       For dissolved copper only       Ambient background concentration (ug/l)       33         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image of the solubles - Settement of resolubles (the ress.         Step 3 Mitigation       Brief description       S       Image of the solubles - Settement of resolubles (the ress.         Brief description       Image of the solubles - Settement of resolubl	Receiving watercourse					assessment				
Date of fassessment       09/09/2019       Version of assessment       1         Notes       Step 1 Runoff Quality       AADT       >=50,000 and <100,000		er Network ID				Assessor and affil	iation		D SH	
Notes       Step 1 Runoff Quality       AADT       >=50.000 or       Climatic region       Warm Dry       Rainfall site       Birmingham (SAAR 700mm)       ✓         Step 2 River Impacts       Annual Q <sub>in</sub> river flow (m <sup>1</sup> /s)       0000       Freshwater ECOS limits:       Bioavailable dissolved copper (ug/l)       Impermeable road area drained (ha)       7555         Permeable road area drained (ha)       7555       Bioavailable dissolved copper (ug/l)       Impermeable road area draining to outfall (ha)       844         Bioavailable dissolved zinc (ug/l)       Impermeable road area draining to outfall (ha)       844       Bioavailable dissolved zinc (ug/l)       Impermeable road area draining to outfall (ha)         Base Flow Index (BFI)       05       Is the discharge in or within 1 km upstream of a protected site for conservation?       No w v v         For dissolved zinc only       Water hardness       Hgh=>200mg GaCO34       For dissolved copper only       Ambient background concentration (ug/l)       3.3         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Impermeable area dislowed in the model of the point of discharge?       Impermeable area         Step 3 Mitigation       Existing measures       Brief description       Impermeable (hg)       Impermeable (hg)       Impermeable (hg)         Existing measures       Br			09/09/2019						1	
Step 1 Runoff Quality       AAD * >>0.000 * Climatic region       Warm Dy       Rainfall site       Birningham (SAAR 700mm)         Step 2 River Impacts       Annual Q <sub>int</sub> river flow (m <sup>1</sup> /s)       0.000       Freshwater EOS limits:       Impermeable road area draining to outfall (ha)       7258         Bioavailable dissolved copper (ug/l)       1       0       0       0       0         Permeable area draining to outfall (ha)       264       Bioavailable dissolved zinc (ug/l)       10       0         For dissolved zinc only       Water hardness       Hgh=>200mg CacO34       For dissolved copper only       Ambient background concentration (ug/l)       33         For dissolved zinc only       Water hardness       Hgh=>200mg CacO34       For dissolved copper only       Ambient background concentration (ug/l)       33         For dissolved zinc only       Water hardness       Hgh=>200mg CacO34       For dissolved copper only       Ambient background concentration (ug/l)       33         For dissolved within 100m of the point of discharge?       Image: Comparison of the point of discharge?       Image: Comparison of the point of discharge?       Image: Comparison of the point of discharge are (ug/l)       Image: Comparison of the point of discharge are (ug/l)       Image: Comparison of the point of discharge are (ug/l)       Image: Comparison of the point of discharge are (ug/l)       Image: Comparison of the point of discharge are (ug/l) <td< td=""><td></td><td></td><td>00/00/2010</td><td></td><td></td><td>1010101101000000</td><td></td><td></td><td>P</td><td></td></td<>			00/00/2010			1010101101000000			P	
ADD1       >>>000000000000000000000000000000000	1000									
ADD       >>0000000000000000000000000000000000										
ADD       >>0000000000000000000000000000000000										
ADD       >>0000000000000000000000000000000000										
Step 2. River Impacts       Annual Q <sub>ist</sub> fiver flow (m <sup>3</sup> /s)       0.0002       Freshwater EOS limits:         (Enter zero in Annual Q <sub>ist</sub> fiver flow (m <sup>3</sup> /s)       0.0002       Bioavailable dissolved copper (ug/l)       1         wret flow box to assess Step 1 runofi quality only       Permeable area draining to outfall (ha)       7555       Bioavailable dissolved zinc (ug/l)       1       0         For dissolved zinc only       Water hardness       Hgh =>200mg CacO34       For dissolved copper only       Ambient background concentration (ug/l)       3.3         For dissolved zinc only       Water hardness       Hgh =>200mg CacO34       For dissolved copper only       Ambient background concentration (ug/l)       3.3         For dissolved zinc only       Us there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       For dissolved copper (m/m)       3.3         For dissolved copper 1       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       For dissolved copper (m/m)       5.0000         Step 3. Mitigation       Existing measures       Brief description       Stelement of solubles - Settement of solubles - Settement of solubles (%)       Settement of solubles - Settement of (%)         Existing measures       Brief description       Image: Settement of Settement of Settement of Settement of Settement of solubles - Settement of (%)       Image:	Step 1 Runoff Quality									
Annual Q <sub>in</sub> mer flow (m*s)       0000       Freshwater EQS limits:         Exter zaro in Annual Q <sub>in</sub> mer flow (m*s)       0000       Freshwater EQS limits:         Impermeable road area drained (ha)       75559       Bioavailable dissolved copper (ug/l)       1         Permeable area draining to outfall (ha)       844       Bioavailable dissolved zinc (ug/l)       033         Base Flow Index (BFI)       05       Is the discharge in or within 1 km upstream of a protected site for conservation?       N         For dissolved zinc only       Water hardness       Hgh =>200mg Cac0031       For dissolved copper only       Ambient background concentration (ug/l)       3.3         For sediment impact only       Is there a downstream structure, lake, pond or conall that reduces the velocity within 100m of the point of discharge?       Image: Compact C		AAD1 >= 50,000 and <	• • •	Climatic	region Warm	- Ury	Rainfall site	Birmi	ngham (SAAR /50mm)	-
Annual Q <sub>in</sub> mer flow (m*s)       0000       Prestivuator E QS limits:         Exter zaro in Annual Q <sub>in</sub> mer flow (m*s)       0000       Prestivuator E QS limits:         Impermeable road area drained (ha)       75559       Bioavailable dissolved zinc (upl)       Impermeable area draining to outfall (ha)         Step 1 montf quality       Base Flow Index (BFI)       05       Is the discharge in or within 1 km upstream of a protected site for conservation?       No         For dissolved zinc only       Water hardness       Hgh =>200mg Cac0031       For dissolved copper only       Ambient background concentration (upl)       3.3         For dissolved zinc only       Us there a downstream structure, lake, pond or conall that reduces the velocity within 100m of the point of discharge?       No       0         For sediment impact only       Is there a downstream structure, lake, pond or conall that reduces the velocity within 100m of the point of discharge?       No       0         Grade Time 1       Estimated river width (m)       5       Side slope (m/m)       5       0         Step 3       Mittigation       Brief description       The meth of of schubles - Settement of solubles (%)       Settement of (%)       1       1       1         Existing measures       Brief description       0       0       0       0       0       0       0       0 <th>Step 2 River Impacts</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	Step 2 River Impacts									
Invertigive box to assess only)       Permeable area draining to outfall (ha)       864       Bioanalable dissolved inc (rugh)       03       Image: Conservation (happen)         For dissolved zinc only       Water hardness       Hgh=>200mg CaCO33       For dissolved coper only       Ambient background concentration (ugh)       33         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Conservation (ugh)       33         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Conservation (ugh)       33         Step 3. Mitigation       Image: Conservation (ugh)       Image: Conse	Step 2 Niver impacts	Annual Q <sub>s5</sub> river flow (m <sup>3</sup> /s)		0.002	Fres	hwater EQS limits:				
Invertigive box to assess only)       Permeable area draining to outfall (ha)       864       Bioanalable dissolved inc (rugh)       03       Image: Conservation (happen)         For dissolved zinc only       Water hardness       Hgh=>200mg CaCO33       For dissolved coper only       Ambient background concentration (ugh)       33         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Conservation (ugh)       33         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Conservation (ugh)       33         Step 3. Mitigation       Image: Conservation (ugh)       Image: Conse	(Enter zero in Annual Q	Impermeable road area drai	ned (ha)	7.589	1	Bioavailable disso	lived conner (ua/l)		1 D	
only)       Base Flow Index (BF)       05       Is the discharge in or within 1 km upstream of a protected site for conservation?       No         For dissolved zinc only       Water hardness       Hgh=>200mg GaC034       For dissolved copper only       Ambient background concentration (up/l)       3.3         For sediment impact only       is there a downstream structure, take, pond or canal that reduces the velocity within 100m of the point of discharge?       No       0       0       Is there a downstream structure, take, pond or canal that reduces the velocity within 100m of the point of discharge?       No       0       0       Is there a downstream structure, take, pond or canal that reduces the velocity within 100m of the point of discharge?       No       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0	river flow box to assess									
Base Flow Index (BFI)       0.5       Is the discharge in or within 1 km upstream of a protected site for conservation?       No       0         For dissolved zinc only       Water hardness       Hgh==200mg CacO31       For dissolved copper only       Ambient background concentration (up1)       3.3         For dissolved zinc only       Water hardness       Hgh==200mg CacO31       For dissolved copper only       Ambient background concentration (up1)       3.3         For sediment impact only       Is there a downstream structure, take, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: CacO31       Image		Permeable area draining to	outfall (ha)	8.64	J	Bioavailable disso	olved zinc (µg/l)		10.9 D	
For dissolved zinc only       Water hardness       Hgh =>200mg CacO34       For dissolved copper only       Ambient background concentration (µgf)       3.3         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Iso       Iso         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Iso       Iso         Image: Ima	only)	Base Flow Index (BFI)		0.5	D Is the o	discharge in or with	in 1 km upstream of	a protected sit	te for conservation?	No 👻 D
For sediment impact only     Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?     Impact only     Impact onl					1					
For sediment impact only     Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?     Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Image: Step 1 Mitigation     Image: Step 2 Mitigation     Image: Step 2 Mitigation       Image: Step 3 Mitigation     Image: Step 3 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 3 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation     Image: Step 4 Mitigation     Image: Step 4 Mitigation       Image: Step 4 Mitigation <td< th=""><th>For dissolved zinc only</th><th>Water hardness</th><th>High = &gt;200mg CaCO3/</th><th></th><th>I F</th><th>or dissolved conn</th><th>eronly Ambient</th><th>background c</th><th>concentration (unll)</th><th>3.3</th></td<>	For dissolved zinc only	Water hardness	High = >200mg CaCO3/		I F	or dissolved conn	eronly Ambient	background c	concentration (unll)	3.3
Image: Step 3 Mitigation       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5       5 </th <th>,</th> <th></th> <th></th> <th>_</th> <th></th> <th>or allocorrou copp</th> <th>Ambient</th> <th>background c</th> <th>oncentration (µg/i)</th> <th></th>	,			_		or allocorrou copp	Ambient	background c	oncentration (µg/i)	
Step 3 Mitigation     Brief description       Brief description     Treatment for solubles (%)       Brief description	For sediment impact only	Is there a downstream struct	ture, lake, pond or canal that reduc	ces the velo	city within 100	m of the point of di	scharge?		No 🔻 D	
Step 3 Mitigation     Brief description       Brief description     Treatment for solubles (%)       Brief description					1					
Step 3. Mitigation     E stimated effectiveness       Briefdescription     Treatment for solubles (%)     Stellment of restincted discharer rate (/s)       Existing measures     0     0     No matridien		Tier 1 Estimated r	ver width (m)	0	J					
Brief description     Treatment for solubles (%)     Attenuation for solubles restricted discharge rate (IA)     Settimment of sediments (%)       Existing measures     0     0     No restriction     0     0     0		Tier 2 Bed width (r	n)	3	Manning's n	0.07 D	Side	e slope (m/m)	0.5 Long	slope (m/m) 0.0001
Brief description     Treatment for solubles (%)     Attenuation for solubles restricted discharge rate (Ib,)     Settement of setiments (%)       Existing measures     0     0     No restriction     0     0     0	L				-	·				
Brief description     Treatment for solubles (%)     Attenuation for solubles restricted discharge rate (Ib,)     Settement of setiments (%)       Existing measures     0     0     No restriction     0     0     0	Step 3 Mitigation									
Brief description         restricted discharge rate (lb,)         sediments (%)           Existing measures         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	step a minigation						E stimated effectiven	e ss		
Existing measures 0 0 0 0 0 0										
			Brief description		s	olubles (%) re	stricted discharge ra	te (I/s) sed	liments (%)	
	Evictor measures						b restriction -			
	-				-					
	r ropo se u med sures									

#### *Cumulative Road Catchments 15,16 and 17 – Proposed With Scheme*

	EQS - Annual Average Con-	centration			Acute I	mpact			
	Copper	Zinc							
	5.07 Tier 2 (using UK TAG or Step 3 mitigation.	5.08 -	ug/i ug/i	<b>River</b> Fai	per s Tozicity mitigation	Zinc Pass	Ac	diment deposition for cumulating?	r this site is judged as: Low flow Vel m/s Deposition Index
				· · · · · · · · · · · · · · · · · · ·					
Road number		A460/M6			Area / DBFO				
Assessment type		Cumulative assessment exclu	iding sedir	ments (outfalls bet	veen 100m				•
OS grid reference o fassessmer		Easting 395560				Northing	307169		
OS grid reference o foutfall struc	ture (m)	Easting				Northing			
Outfall number		Catchment 15 16 17 Propos	sed		of outfalls in	cumulative	14	15	16
Receiving watercourse		Watercourse 6			ssment				
EA receiving water D etailed Riv	er Network ID			Ass	essor and aff	fliation		D SH	
Date of assessment		09/09/2019		Ven	ion of asses	sment		1	
Step 1 Runoff Quality	AADT >= 50,000 and <1	00,000	Climatic	region Warm Dry	•	Rainfall site	Birmi	ngham (SAAR 750mm)	
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.002		r EQS limits				
(Enter zero in Annual Q <sub>95</sub>	Impermeable road area drain	ed (ha)	9.744	Bioa	vailable diss	olved copper (µg/l)		1 D	
river flow box to assess Step 1 runoff quality	Permeable area draining to o	outfall (ha)	8.541	] Bioa	vailable diss	olved zinc (µg/l)		10.9 D	
only)	Base Flow Index (BFI)		0.5	D Is the discha	rge in or wit	hin 1 km upstream of	a protected sit	e for conservation?	No 🔻 D
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	-	For di	solved cop	per only Ambient	background c	oncentration (µg/l)	3.3
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that reduce	es the velo	city within 100m of	he point of d	lischarge?		No 💌 D	
	Tier 1 Estimated riv	er width (m)	5	]					
	© Tier 2 Bed width (m	)	3	Manning's n 0.07	D	Side	e slope (m/m)	0.5 Long	slope (m/m) 0.0001
Step 3 Mitigation		Brief description		soluble		E stimated effectiven Attenuation for solub estricted discharge rai	te (I/s) Se	ttlem ent of liments (%)	
Existing measures				0		No restriction 👻	D 0	D I	
Proposed measures				0	D	No restriction -	D 0		



# HEWRAT Screenshots with Mitigation solutions Cumulative Road Catchments 1 + 2: with existing Filter Drains

🏓 hi	ghways gland		Highways Engl	and Wat	ter Risk Asse	ssment Too	d.		Version 2.0.4 Jun	e 2019			
					Se	oluble						Sediment	- Chronic Impact
			EQS - Annual Average	. Cancon	tration				Acuto I	Impact			
			appar		Zinc								Para
			3.62 Tier 2 (wring UK TAG		2.39		uqfi	_	Cupper	Zinc	- I		nn fur thir site ir judged ar:
	Stap 2		Tier 2 (uring UK TAG r Step 3 mitigation.						River Fails icity Test. Try	Parr		Accumulating?	
		H-DHI (BBI), B	r Stop 5 mittigatinn.				vari		mitigation	· • • • •		Extensive? H	
	Stap 3		-				adu	_					- Copuridaninaex
-									Lun			_	
_	d number				54				HE Area / DBFO	) number			
	essmentt				Cumula tive also		dina sedim	ents (outfall	swithin 100m)	Luc as			•
		ence of assessmen			astino	392740				Northina	304522		
_		ence of outfall struc	ture (m)		astino					Northing			
	all numbe				54 Outfall : Ca		and 2 Pro	posed	List of outfalls in assessment	oumulative	1	2	
		tercourse		W	/atercourse 7								
_		water Detailed Rive	er Network ID						Assessor and af			DSH	
Date	ofasses	sment		09	9/09/2019				Version of asses	sment		1	
Ste	p1Ru	noff Quality	AADT	0.000		•	Climatic re	egion 📊	m Dni 💌	Rainfall site		Diminaham (C	AAD 750mm)
Ste	p2Riv	ver Impacts	Annual Qas river flow (r	m <sup>3</sup> /s)			0.000	Free	hwater EQS limits	E:			
		in Annual Q <sub>25</sub> x to assess	Impermeable road area	a drained (	(ha)		0.007		Bioavailable diss	solved copper (µg/l)		1	
	ep 1 runo		Permeable area drainir	ng to outfa	all (ha)		4 905		Bioavailable diss	solved zinc (µg/l)		10.9 D	
oni	ý)		Base Flow Index (BFI)				0.5	Is the	discharge in or wit	thin 1 km upstream o	f a protected	d site for conservatio	n? <u>N</u>
Fo	r dissolv	ved zinc only	Water hardness		Uish - sonr	ma 0a003	<u>, T</u>	F	or dissolved cop	oper only Ambien	it backgroun	id concentration (µg	ŋ <u>-</u> [
Fo	r sedime	ent impact only	Is there a downstream	structure,	lake, pond or ca	anal that reduc	es the veloc	ity within 10	Im of the point of a	discharge?		Ma T	
			🖲 🛨 Estimat	ted river v	vidth (m)		25						
			◯ ┳: Bed wig	dth (m)			0	Manning's	0.07	Sic	ie slope (m/	m) <u>n c</u> L	ong slope (m/m)
Ste	n 3 Mit	tigation											
									is atment for	Estimated effective Attenuation for solu		Settement of	
					Brief description				reatment for solubles (%)	E stimated effective Attenuation for solu restricted discharge ra	bles -	Settlement of sediments (%)	
				E	Brief description				solubles (%) r	Attenuation for solu restricted discharge ra	bles -		
	kistina me	asures	With Existing Filter	E	Brief description				solubles(%) r	Attenuation for solu	bles -	sediments (%)	

Sensitivity analysis using downstream assessment location upstream of River Penk

	EQS - Annual Average Co	oncentration			Acute II	mpact				
	Copper	Zine							Pass	
	3.22	0.74	ugil		Copper	Zine	_			
	o Tier 2 (using UK TAG								ion for this site is	
M-BAT tool).	or Step 3 mitigation.				Pass	Pass		_		ov flow Vel m/s
Step 3	·	-	ugil				E	tensive?	NO 34	Deposition Index
Step 3										
Road number		M54			HE Area / DBFO	number				
Assessment type		Cumulative as:	sessment including sedin	nents (outfalls	within 100m)					-
OS grid reference of assessme	nt point (m )	Easting	392740			Northing	304522			
OS grid reference o foutfall struc	cture (m)	Easting				Northing				
Outfall number		M54 Outfall : C	atchments 1 and 2 Pro	oposed	List of outfalls in	cumulative	1	2		
Receiving watercourse		Watercourse 7	,		assessment			-		
EA receiving water Detailed Riv	ver Network ID				Assessor and affi	iliation		D SH		
Date o fassessment		09/09/2019			Version of assess			1		
Notes		3010012010								
Step 1 Runoff Quality										
	AADT >=100 (	000	- Climatic	region \//a	m Drv 🚬	Rainfall site	Ri	mingham (	SAAR 750mm	<u>∖</u> <u></u>
Step 2 River Impacts										
Step 2 River impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s	5)	0 022	Fres	hwater EQS limits:					
(Enter zero in Annual Q <sub>a5</sub>	Impermeable road area dr	spined (ha)			Discussion in the state			1		
river flow box to assess	impermeable road area di	aineu (na)	2 227	1	Bioavailable diss	olved copper (µg/l)				
Step 1 runoff quality	Permeable area draining t	lo outfall (ha)	1 385		Bioavailable diss	olved zinc (µg/l)		10.9	)	
only)	Deep Flow Index (DFI)			D Is the o	dia akarana ina ana dik					
	Base Flow Index (BFI)		0.5		discharge in or with	nin 1 km upstream of	r a protected si	te for conserva	uon?	N D
For dissolved zinc only										
	Water hardness	High = >20	0mr CaCO3/I	F F	or dissolved cop	peronly Ambien	t background o	concentration (j	.ug/l) [/gu	2
							t background o			2
For sediment impact only	ls there a downstream stru						t background o	No.		3
For sediment impact only	Is there a downstream stru						t background o			3
For sediment impact only	Is there a downstream stru	ucture, lake, pond or c I river width (m)	anal that reduces the velo	city within 100	m of the point of d	ischarge?		No	5	
For sediment impact only	Is there a downstream stru	ucture, lake, pond or c I river width (m)	anal that reduces the velo		m of the point of d	ischarge?	it background (	No		
For sediment impact only	Is there a downstream stru	ucture, lake, pond or c I river width (m)	anal that reduces the velo	city within 100	m of the point of d	ischarge?		No	5	
For sediment impact only Step 3 Mitigation	Is there a downstream stru	ucture, lake, pond or c I river width (m)	anal that reduces the velo	city within 100	m of the point of d	ischarge? Sic	le slope (m/m)	No	5	
	Is there a downstream stru	ucture, lake, pond or c I river width (m)	anal that reduces the velo	city within 100 ] ] Manning's n	m of the point of d	ischarge? Sic E stimated effective	le slope (m/m) ness	No	5	
	Is there a downstream stru	ucture, lake, pond or o I river width (m) I (m)	anal that reduces the velo	city within 100 ] Manning's n	m of the point of d	ischarge? Sid E stimated effective Attenuation for solu	le slope (m/m)	No	5	
	Is there a downstream stru	ucture, lake, pond or c I river width (m)	anal that reduces the velo	city within 100 ] Manning's n	m of the point of d	ischarge? Sic E stimated effective	le slope (m/m)	No	5	
	Is there a downstream stru	ucture, lake, pond or o I river width (m) I (m)	anal that reduces the velo	city within 100 ] Manning's n	reatment for solubles (%)	ischarge? Sid E stimated effective Attenuation for solu	le slope (m/m)	No	5	
Step 3 Mitigation	Is there a downstream stru	ucture, lake, pond or o I river width (m) I (m)	anal that reduces the velo	city within 100 ] Manning's n T S	reatment for solubles (%)	ischarge? Sic E stimated effective Attenuation for solu estricted discharge ra	le slope (m/m) ne ss bles - St ste (Js ) sec	ettiement of diments (%)	5	



Step 1: with Wet Pond

	EQS - Annual Average Cor	centration			Acute In	nnact				
	Copper	Zinc			Acate III	inpuot		Fail T	ra Tier 2 fo	or Velocite
	4.38	3,95	ugil		Copper	Zine				%, proposed = 60 %
Step 2 Tier 1 fail. Go to	p Tier 2 (using UK TAG	0.00		Dive	Fails Toxicite	Lino				s site is judged as:
	or Step 3 mitigation.				st. Tru more	Pass			Yes	0.01 Low flow Vel m
	3.71	2.37	ligu		mitigation		- I F	ztensive?	Yes	243 Deposition Ind
Step 3 Tier 1 fail. Go to	D Tier 2 (using UK TAG						•   •			
	crease Step 3 mitigation.									
oad number		M54/M6 Link road			HE Area / DBFO r	number				
asessment type			1.6.1.1.1.1.1.	10		number				
ssessment type IS orid reference o fassessme		Easting 393		an)		IN US				
			410			Northing	304709			
OS grid reference of outfall struc	cture (m)	Easting				Northing				
Dutfall number		Watercourse 1 New	Outfall C atchment	t 3	List of outfalls in o	cumulative				
Receiving watercourse		Watercourse 1			assessment					
A receiving water Detailed Riv	ver Network ID				Assessor and affil	liation		D SH		
) ate o fassessment		06/09/2019			Version of assess	sment		1		
lotes										
tep 1 Runoff Quality	AADT >=50.000 and s	100.000	<ul> <li>Climatic re</li> </ul>	wion Warm		Dainfall oite	Bir	mindham (SAAR 75	() ()	
	AADT >=50,000 and <	100,000	Climatic re	gion Warm	Dry 💌	Rainfall site	Bir	mingham (SAAR 75	0mm)	•
	AADT >=50,000 and < Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	100,000	Climatic re	-	Dry 💽	Rainfall site	Bir	mingham (SAAR 75	0mm)	T
Step 2 River Impacts (Enter zero in Annual Q <sub>95</sub>				-	hwater EQS limits:	Rainfall site	Bir		0mm)	×
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	ned (ha)	0.001	-	hwater EQS limits:	blved copper (µg/l)	Bir	1	_	Ţ
river flow box to assess	Annual Q <sub>ss</sub> river flow (m³/s) Impermeable road area drai	ned (ha)	0.001	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso	blved copper (µg/l)		1	D	v No v
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>es</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to	ned (ha)	0.001 3.189 4.388	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of	a protected	1	D D ation?	
Step 2 River Impacts (Enter zero in Annual Q <sub>ss</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>es</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI)	ned (ha) outfall (ha) Hgh =>200mg CaCO34	0.001 3.189 4.388 0.5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of per only Ambien	a protected	1 109 site for conserva d concentration (	D D ation?	Nov
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>set</sub> river flow (m <sup>5</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha) Hgh =>200mg CaCO34	0.001 3.189 4.388 0.5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of per only Ambien	a protected	1 109 site for conserva d concentration (	D ntion?	Nov
Step 2 River Impacts (Enter zero in Annual Q <sub>es</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>set</sub> river flow (m <sup>5</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha) Hgh =>200mg CaCO31 ture, lake, pond or canal th ver width (m)	0.001 3.189 4.388 0.5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of di	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of <b>per only</b> Ambien scharge?	a protected	1 10.9 site for conserva d concentration ( No •	D ntion?	No v [
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>eef</sub> river flow (m <sup>5</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc ~ Tier 1 Estimated ri	ned (ha) outfall (ha) Hgh =>200mg CaCO31 ture, lake, pond or canal th ver width (m)	0.001 3.189 4.388 0.5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of di	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Amblen scharge? Sic E stimated effective	f a protected t background le slope (m/n	1 10.9 site for conserva d concentration ( No • n) 0.5	μg/l)	No v [
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> fiver flow box 1o assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>eef</sub> river flow (m <sup>5</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc ~ Tier 1 Estimated ri	ned (ha) outfall (ha) Hgh =>200mg CaCO31 ture, lake, pond or canal th ver width (m)	0.001 3.189 4.388 0.5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of dis or the point of display the point of d	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of ver only Ambien scharge? Sic	i a protected t background le slope (m/m ness bles -	1 10.9 site for conserva d concentration ( No •	μg/l)	No v [
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> fiver flow box 1o assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>eef</sub> river flow (m <sup>5</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc ~ Tier 1 Estimated ri	ned (ha) outfall (ha) Hgh = >200mg CaCO31 ture, lake, pond or canal th ver width (m) π)	0.001 3.189 4.388 0.5	Fres	hwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp m of the point of di over the point of dissolved copp m of the point of the point of dissolved copp m of the point o	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambien scharge? Sic Estmated effective Attenuation for solu	i a protected t background le slope (m/m ne ss bies - te (l/s) s	1 10.5 site for conserva d concentration ( No v n) 0.5 Settlement of	μg/l)	No v [

Step 2, added short length of swale (using half mitigation for swale)

	EQS - Annual Average Con	centration		Acute	Impact		
	Copper	Zinc					Pass
	4.38	3.95	ugil	Copper	Zinc	_	
	Tier 2 (using UK TAG				_		osition for this site is judged as:
M-BAT tool), (	or Step 3 mitigation.			Pass	Pass	Accumulating	
Step 3 Tier 1 fail. Go to	3.32	1.38	ugil			Extensive?	No 0 Deposition Index
	Tier 2 (using UK TAG						
M-BAT toolj, of in	crease Step 3 mitigation.						
Road number		M54/M6 Link road		HE Area / DBFC	O number		
Assessment type		Non-cumulative assessme	nt (single outfall)				-
OS grid reference of assessmer	it point (m )	Easting 393410			Northing	304709	
OS grid reference o foutfall struc	ture (m)	Easting			Northing		
Outfall number		Watercourse 1 New Outf	all Catchment 3	3 List of outfalls in	cumulative		
Receiving watercourse		Watercourse 1		assessment			
EA receiving water D stailed Riv	er Network ID			Assessor and a	filiation	D SH	
Date of assessment		06/09/2019		Version of asse		1	
Notes		00/00/2010					
1003							
Step 1 Runoff Quality					1		
	AADT >=50,000 and <1	• 00,000	Climatic regi	on Warm Dry 🔹	Rainfall site	Birmingham (SAA	R 750mm)
Step 2 River Impacts							
step z River impacts	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s)		0.001	Freshwater EQS limit	s:		
(Enter zero in Annual Qer	Impermeable road area drair	und (ha)	3,189	Disavailable die	solved copper (ug/l)		
river flow box to assess	impermeable road area drain	ieu (iia)	3.165	Dioavailable dis	solved copper (µg/I)		
Step 1 runoff quality	Permeable area draining to o	outfall (ha)	4.388	Bioavailable dis	solved zinc (µg/l)	10.9	
only)	Base Flow Index (BFI)		0.5	Is the discharge in or wi	ithin 4 km unatra am of	f a protected site for cons	ervation?
	Dase Flow Index (DFI)		0.0	Is the discharge in or will	unin i kin upsiream or	a protected site for cons	
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•				
For dissolved zinc only	water hardness	righ = 2200mg Caciosi	<u> </u>	For dissolved co	pper only Ambien	t background concentrati	on (µg/l)
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that red	duces the velocity	within 100m of the point of	discharge?	No -	
	Tier 1 Estimated riv				2		
	• Her 1 Esumated in	er widen (m)					
	Tier 2 Bed width (m)	1)	3 N	Manning's n 0.07 D	Sid	le slope (m/m) 0.5	Long slope (m/m) 0.0001
						<u>.</u>	
Step 3 Mitigation							
					E stimated effectiver		
				Treatment for	Attenuation for solul		
		Briefdescription		solubles (%)	restricted discharge ra	ate (I/s) sed iments (%	
Evicting measures		Briefdescription			,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,, ,,		
Existing measures Proposed measures	With wet Attenuation P ond within			0 D	No restriction		



Step 1, with HVS

1		C	Copper		Zinc						Fail. Tr	y Tier 2 for	Velocit	
1			4.69		4.70	ug/l		Copper	Zinc		Settlement no			
1	Step 2		Tier 2 (using UK TAG				Dim	r Fails Toxicity			diment deposit			
1		M-BAT tool), o	or Step 3 mitigation.					. Try mitigation	Pass					ow flow Vel m/s
1			-		-	ugłi				Est	tensive?	Yes	708	eposition Index
	Step 3													
De	ad numb			145.4.04	6 Link road			HE Area / DBEO	number					
_	sessmen				mulative assessme	at (single audf	elD		number					-
		erence o fassessmen	t point (m)	Easting	394400	nı (single outi	aii)		Northing	304770				
	-	erence o foutfall struc		Easting	334400				Northing	304770				
	iffall numb		uie (iii)		ourse 1 New Outf			List of outfalls in			1			
		watercourse			ourse 1	all Catchine	11.4	assessment	Carraiative	<u> </u>	+			
		iq water D etailed Rive	ar Naturad: ID	vatero	ourse i			Assessor and aff	laton		D SH			
	te o fass			07/14	0.40			Version of assess			USH			
	tes	essment		27/11/2	2019			version or assess	snen		1			
NO	les													
S	ten 1 B	Runoff Quality												
-		tanon ataany	AADT >10,000	and <50,000	•	Climatic r	egion Warm	Dry 👻	Rainfall site	Birmir	ingham (SAAR 750	)mm)		-
		River Impacts												
2	tep z R	dver impacts	Annual Q <sub>s5</sub> river flow (	m³/s)		0.001	Fres	hwater EQS limits:						
		ro in Annual Q <sub>95</sub>	Impermeable road are	a drained (ha)		6.185		Bioavailable diss	olved copper (µg/l)		1	)		
s	Step 1 rur	box to assess noff quality	Permeable area draini	ng to outfall (ha)		2.645		Bioavailable diss	olved zinc (µg/l)		10.9	)		
0	inly)		Base Flow Index (BFI)			0.5	D Is the	lischarge in or with	nin 1 km upstream of	a protected sit	te for conserva	tion?	[	No 🛨 D
F	For disso	olved zinc only	Water hardness	High = >:	200mg CaCO3/I	•	F	or dissolved cop	per only Ambient	t background c	concentration (µ	ug/l)		3
F		ment impact only	le there a downetream	structure, lake,	pond or canal that rec	luces the velo	city within 100	m of the point of d	ischarge?		No 🔻 🛛	)		
	or seam	ment impact only	is nere a downstream											
	or seair	ment impact only		ted river width (I	m)	1								
	or sear	ment impact only	Tier 1 Estima		n)	1	Manning's r	0.07	Sid	a elona (m/m)	0.5	Long elon	a (m/m)	0.0001
	or sear	ment impact only	Tier 1 Estima	ted river width (i dth (m)	m)	3	Manning's r	0.07 D	Sid	e slope (m/m)	0.5	Long slop	e (m/m)	0.0001
			Tier 1 Estima		m)	3	Manning's r	0.07 D	Sid	e slope (m/m)	0.5	Long slop	e (m/m)	0.0001
5		Aitigation	Tier 1 Estima		n)	3	Manning's r	0.07 D	Sid Estimated effectiver		0.5	Long slop	e (m/m)	0.0001
5			Tier 1 Estima		n)	3		reatment for	Estimated effectiver Attenuation for solut	ess bles - Se	ettlem ent of	Long slop	e (m/m)	0.0001
5			Tier 1 Estima	dth (m)	n)	3		reatment for	E stimated effectiver	ess bles - Se		Long slop	e (m/m)	0.0001
	tep 3 N	<u>Aitigation</u>	Tier 1 Estima	dth (m)		3		reatment for olubles (%)	E stimated effectiver Attenuation for solut estricted discharge ra	less bles - Se te (I/s) sed	attlement of diments (%)	Long slop	e (m/m)	0.0001
	tep 3 N		Tier 1 Estima	dth (m)		3		re atment for resolubles (%)	Estimated effectiver Attenuation for solut	ess bles - Se	ettlem ent of	Long slop	e (m/m)	0.0001

Step 2, with HVS and filter drains

highways england		Soluble				Sediment - Chronic Impact
						Sediment - Chronic impact
	EQS - Annual Average Co Copper	ncentration Zinc		Acute Ir	npact	Pass
	4.69	4.70	ugil	Copper	Zinc	1 455
Step 2 Tier 1 fail. Go to	Tier 2 (using UK TAG		-9	Biver Fails		Sediment deposition for this site is judged
M-BAT tool),	or Step 3 mitigation.			Toxicity Test. Try	Pass	Accumulating? Yes 0.01 Low flow Vel
Step 3	· ·	-	ug/l	mitigation		Extensive? No 0 Deposition In
Step 5						
oad number		M54/M6 Link road		HE Area / DBFO	number	
ssessment type		Non-cumulative a ssessme	et (einele outfall)	Inc Addression	number	
S grid reference of assessme	nt point (m)	Easting 394400	nic (single outidit)		Northing	304770
IS grid reference of outfall strue		Easting			Northing	504770
outfall number		Watercourse 1 New Outf	all Catchment 4	List of out fails in o		
teceiving watercourse		Watercourse 1	as obterment 4	assessment		
A receiving water Detailed Riv	verNetwork ID	Watercourse 1		Assessor and a ff	liation	DSH
ate of assessment		06/09/2019		Version of assess		1
Step 1 Runoff Quality	AADT >10,000 and <5	i0,000 <u>-</u>	Climatic region	Warm Dry	Rainfall site	Birmingham (SAAR 750mm)
						Birmingham (SAAR 750mm) •
Step 2 River Impacts	Annual Q <sub>s5</sub> river flow (m <sup>3</sup> /s)		0.001	Freshwater EQS limits:		
Step 2 River Impacts	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s)	ned (ha)	0.001 6.185	Freshwater EQS limits: Biosvailable disso	blved copper (µg/l)	
Step 2 River Impacts	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to	ned (ha)	0.001 6.185 2.645	Freshwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) plved zinc (μg/l)	1 D 109 D
Step 2 River Impacts (Enter zero in Annual Q <sub>85</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s)	ned (ha)	0.001 6.185	Freshwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) plved zinc (μg/l)	
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to	ned (ha)	0.001 6.185 2.645	Freshwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) plved zinc (μg/l) nin 1 km upstream of	1 D 109 D
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>10</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness	ned (ha) outfall (ha)	0.001 6.185 2.645 0.5	Freshwater EQS limits: Bioavailable disso Bioavailable disso Is the discharge in or with For dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of per only Ambien	1 D 10.9 D 1a protected site for conservation? No v
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>10</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struct	ned (hs) outfall (hs) Hgh=>200mg CaCC3/	0.001 6.185 2.645 0.5	Freshwater EQS limits: Bioavailable disso Bioavailable disso Is the discharge in or with For dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of per only Ambien	1 D 1a protected site for conservation? No y t background concentration (µg/l) 3
Step 2 River Impacts (Enter zero in Annual Q <sub>as</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>10</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struct	ned (ha) outfall (ha) Hgh = >200mg CaCO3/ ture, lake, pond or canal that red wer width (m)	0.001 6.165 2.645 0.5 D	Freshwater EQS limits: Bioavailable disso Bioavailable disso Is the discharge in or with For dissolved copp	olved copper (µg/l) olved zinc (µg/l) iin 1 km upstream of oper only Ambien scharge?	1 D 1a protected site for conservation? No y t background concentration (µg/l) 3
Center zero in Annuel Q <sub>15</sub> (Enter zero in Annuel Q <sub>15</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>std</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc IN Tier 1 Estimated ri	ned (ha) outfall (ha) Hgh = >200mg CaCO3/ ture, lake, pond or canal that red wer width (m)	0.001 6.165 2.645 0.5 D	Freshwater EQS limits: Bioavailable diss: Bioavailable diss: Is the discharge in or with For dissolved copp thin 100m of the point of di uning's n 007	olved copper (µg/l) olved zinc (µg/l) iin 1 km upstream of oper only Ambien scharge?	1     0       10.9     0       11 a protected site for conservation?     No       12 a protected site for conservation?     No       14 a protected site for conservation?     No       15 a protected site for conservation?     No       16 a protected site for conservation?     No       16 a protected site for conservation?     No       16 a protected site for conservation?     No       17 a protected site for conservation?     No       18 a protected site for conservation?     No       19 a protected site for conservation?     No       10 a protected site for conservation?     No </td
Step 2 River Impacts (Enter zero for Annual Oge inter from box Annual Oge Step 1 nunoff quality only) For dissolved zinc only For sediment impact only Step 3 Mitigation	Annual Q <sub>std</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc IN Tier 1 Estimated ri	ned (ha) outfall (ha) Hgh = >200mg CaCO31 fure, lake, pond or canal that red ver width (m) π)	0.001 6.165 2.645 0.5 D	Freshwater EQS limits: Bioavailable diss: Bioavailable diss: Is the discharge in or with For dissolved copp thin 100m of the point of di ming's n 007 0 Treatment for solubles (%) re	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of per only Ambien scharge? Sid Estimated effectiver Attenuation for solu	1     0       1a protected site for conservation?     No       It background concentration (up?)     3       It background concentration (up?)     0       It background concentration (up?)     0
river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>std</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc IN Tier 1 Estimated ri	ned (ha) outfall (ha) Hgh = >200mg CaCO31 fure, lake, pond or canal that red ver width (m) π)	0.001 6.165 2.645 0.5 D	Freshwater EQS limits:       Bioavailable diss:       Bioavailable diss:       Bioavailable diss:       Is the discharge in or with       For dissolved copp       thin 100m of the point of distributions       ming's n 007       Treatment for solubles (%)       0     N	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of ser only Ambien scharge? Sid Estimated effectiver Attenuation for solu	1     0       10.9     0       11 a protected site for conservation?     No       12 a protected site for conservation?     No       14 a protected site for conservation?     No       15 a protected site for conservation?     No       16 a protected site for conservation?     No       16 a protected site for conservation?     No       16 a protected site for conservation?     No       17 a protected site for conservation?     No       18 a protected site for conservation?     No       19 a protected site for conservation?     No       10 a protected site for conservation?     No </td

Step 1 Runoff Quality

Step 2 River Impacts

(Enter zero in Annual Q<sub>95</sub> river flow box to assess Step 1 runoff quality only)

For dissolved zinc only

For sediment impact only

Step 3 Mitigation

Existing measures Proposed measures AADT

>10,000 and <50,000

Annual Q<sub>95</sub> river flow (m<sup>3</sup>/s)

Base Flow Index (BFI)

Water hardness

C Tier 2

with HVS and filter drains

Impermeable road area drained (ha) Permeable area draining to outfall (ha)

Tier 1 Estimated river width (m)

Bed width (m)



	hig eng	hways and	Highways Engl	and V	Vater Risk Asse	ssment Tool			Version 2.0.4 June	2019				
					So	luble						Sediment - Chronic Impact		
			EQS - Annual Averag	e Con	centration				Acute Im	npact				
		Copper			Zinc							Pas	s	
		3.60			1.65		ug/l		Copper	Zinc				
	S	tep 2	Tier 1 fail. Go to Tier 2 (using UK TAG M-BAT tool), or Step 3 mitigation.						Pass	Pass		Sediment deposition fo Accumulating? Yes	this site is judged as: 0.01 Low flow Vel m/s	
							ug/l					Extensive? No	0 Deposition Index	
	S	tep 3									-			
	Deed	number			M54/M6 Link ro	- 4			HE Area / DBFO n	umbor				
									The Aleanobion	MINU CI				
		smentt			Non-cumulative		iqle ou	tfall)					· ·	
	OS qr	id refere	ence of assessment point (m)		Easting	394400				Northing	304770			
	OS qr	id refere	ence of outfall structure (m)		Easting					Northing				
	Outfal	numbe	r		Watercourse 1	New Outfall Ca	atchme	ent4	List of out falls in c	umulative				
	Recei	ving wat	ter course		Watercourse 1,	WC7 sensitivi	ity		assessment					
	E A re	ceiving	water Detailed River Network ID						Assessor and a fili	iation		DSH		
	Date	fasses	sment		06/09/2019				Version of assess	ment		1		
	Notes													
1														

Climatic region Warm Dry

3 Manning's n 0.07 D

Freshwater EQS limits:

Treatment for solubles (%)

0.006

6.185

2.645

•

2.5

Rainfall site

0.5 D Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved copper only Ambient background concentration (µg/l)

Estimated effectiveness Attenuation for solubles restricted discharge rate (Vs) sediments (%)

•

Bioavailable dissolved copper (µg/l)

Bioavailable dissolved zinc (µg/l)

No

Birmingham (SAAR 750mm)

1 D

10.9 D

No - D

D

100

Side slope (m/m) 0.5 Long slope (m/m) 0.0001

٠

No 🔫

\*

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

High = >200mg CaCO3/I

Briefdescription

#### Sensitivity analysis of catchment 4, using downstream WC 7 Q95



# Cumulative Road Catchments 3 + 4 (HVS and filter drains on Catchment 4, and Pond and length of swale on Catchment 3) Ratio method = 24% mitigation on dissolved metals.

Catchment	Impermeable area (ha)	Treatment	Mitigation percentage (as a proportion)	
M54				
Catchment				
3	3.189	Pond and swale	0.65	2.07285
M54				
Catchment				
4	5.511			0
			0	0
			0	0
Total Area	8.7		Total Mitigation	2.07285
			Mitigation Percentage for metals	0.24

highways england	Highways England	Water Risk Assessment To	ol	Version 2.0.4 June 2018
		Soluble		Sediment - Chronic Impact
	EQS - Annual Average Can	contration		Acuto Impact
	appor	Zinc		
	4.71	4.84	uqfi	Capper Zinc
	Tier 2 (uring UK TAG r Step 3 mitigation.			River Feilz Tuxicity Text. Try Pazz Accumulating? LauflauVolm/z
H-Bal test), a	4.12	3.64	yadi	Bare mitigation
Step 3 Ties 1 fail fact	Tier 2 (srine UK TAG	3	uqri	
	reare Step 3 mitigation			
Road number		M54M6 Link road		HE Area / DBFO number
Assessment type			ludina sed in	nents (outfalls between 100 m and 1km a part)
OS orid reference of assessmen		Easting 394400		Northina 304770
OS and reference of outfall struc	ture (m)	Eastino		Northina
Outfall number		Watercourse 1 Catchment	3 and 4	List of outfalls in cumulative
Receiving watercourse		Watercourse 1		
EA receiving water Detailed Riv	er Network ID			Assessor and affiliation DSH
Date of assessment		06/09/2019		Version of assessment 1
Step 1         Runoff Quality           Step 2         River Impacts           (Enter zero in Annual Que river flow box to assess Step 1         runoff quality only)	AADT Annual Q <sub>45</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to Base Flow Index (BFI)			Freshwater EQS limits: Bioavailable dissolved copper (µg/l)
For dissolved zinc only	Water hardness	High = > 200mg Co Co		
		-		
For sediment impact only		ver width (m)	es the veloc	city within 100m of the point of discharge?
Step 3 Mitigation				Estimated effectiveness
		Brief description		Treatment for solubles rate discourses solubles set ment of solubles (%) settlement of solubles (%)
Existino measures				0 D No restriction - D 0 D
Proposed measures	with HVS and filter drains for cate	chment 4 and swale/pond catchment 3		No restriction  D 400



Sensitivity analysis on Cumulative Catchment 3 + 4 with Q95 of 0.006, at confluence with WC 7.

highways england	Highways England										
		Solul	ble					Sedim	nent - Ch	nronic Impa	st
Stap 2 Tier 1 fail. So to	ESS - Anaxal Arazzeg Canacastratina           Oppose         Zine           0.44         3.45           H=0.11 tault, art tau jo.2 (uning UK TAG)         4.45				Acuto I Cuppor Parr	npect Zinc Parr		Sodimont dop Accumulating			idged ar: iou Velm/r
	3.45 • Tier 2 (wing UK TAG creare Step 3 mitigating	1,46	uqfi					Extensive?		Дор	rition Index
Road number		M54/M6 Link road			HE Area / DBFO	number					
Assessment type		Cumulative assess	ment excluding sed im	ents (outfalls	s between 100 m	and 1km a cart)					•
OS orid reference of assessment	ntpoint(m)	Eastino 39	94400			Northing	304770				
OS orid reference of outfall struc	ature (m)	Easting				Northing					
Outfall number		Watercourse 1 Ca	atchment 3 and 4		List of outfalls in assessment	cumulative					
Receiving watercourse		Watercourse 1									
EA receiving water Detailed Riv	er Network ID				Assessor and aff			DSH			
Date of assessment		06/09/2019			Version of assess	sment		1			
Step 1 Runoff Quality Step 2 River Impacts	AADTAnnual Q <sub>25</sub> river flow (m <sup>3</sup> /s)	and <50.000	Climatic re		m Dox 💌	Rainfall site		Dimincham	. /C A A D	750mm1	
Step 2 River Impacts	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s)				hwater EQS limits			Diminaham		750mm)	
	Annual Q <sub>25</sub> river flow (m <sup>3</sup> /s)	ned (ha)			hwater EQS limits Bioavailable diss	: olved copper (µg/l)		1	D	750mm\	•
Step 2 River Impacts (Enter zero in Annual Q <sub>25</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s)	ned (ha)			hwater EQS limits	: olved copper (µg/l)		1		1 75Amm \	•
Step 2 River Impacts (Enter zero in Annual Q <sub>36</sub> river flow box to assess	Annual Q <sub>25</sub> river flow (m <sup>3</sup> /s)	ned (ha)		Fres	hwater EQS limits Bioavailable diss Bioavailable diss	: olved copper (µg/l)	of a protecte	1	0		
Step 2 River Impacts (Enter zero in Annual Q <sub>25</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to	ned (ha)	0.400 0.400 10.000	Fresi	hwater EQS limits Bioavailable diss Bioavailable diss	: olved copper (µg/l) olved zinc (µg/l) hin 1 km upstream c	-	1	rvation?		
Step 2 River Impacts (Enter zero in Annual Q <sub>46</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>15</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha)		Fresi	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or wit or dissolved cop	olved copper (μg/l) olved zinc (μg/l) hin 1 km upstream c per only Ambier	-	1 10.9 ad site for conser nd concentration	rvation?	N	
Step 2 River Impacts           (Enter zero in Annual Q <sub>36</sub> river flow box to assess Step 1 runoff quality only)           For dissolved zinc only	Annual Q <sub>15</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha)		Fresi	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or wit or dissolved cop	olved copper (μg/l) olved zinc (μg/l) hin 1 km upstream c per only Ambier	-	1 10.9 ad site for conser nd concentration	rvation?	N	
Step 2 River Impacts           (Enter zero in Annual Q <sub>36</sub> river flow box to assess Step 1 runoff quality only)           For dissolved zinc only	Annual Q <sub>15</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha) Uich = c 200m / ture, lake, pond or canal ver width (m)		Fresi	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or with or dissolved cop m of the point of d	olved copper (پو(ا) olved zinc (پو(ا) hin 1 km upstream c per only Ambier ischarge?	-	1 10.9 ad site for conser nd concentration	νation?	N	
Step 2 River Impacts           (Enter zero in Annual Que river flow box to assess Step 1 runofi quality only)           For dissolved zinc only           For sediment impact only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc () Estimated ri	ned (ha) outfall (ha) Uich = c 200m / ture, lake, pond or canal ver width (m)		Fres	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or with or dissolved cop m of the point of d	iolved copper (μg/l) olved zinc (μg/l) hin 1 km upstream c per only Ambier ischarge? Sit	nt backgrou de slope (m	1 10.9 ad site for conser nd concentration	νation?		
Step 2 River Impacts           (Enter zero in Annual Q <sub>36</sub> river flow box to assess Step 1 runoff quality only)           For dissolved zinc only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc () Estimated ri	ned (ha) outfall (ha) Uich = c 200m / ture, lake, pond or canal ver width (m)		Fres	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or wit or dissolved copp m of the point of d	olved copper (µg/l) olved zinc (µg/l) hin 1 km upstream c per only Ambier ischarge? Si Estmated effective	de slope (m	1 10.9 ed site for conser ind concentration int	νation?		
Step 2 River Impacts           (Enter zero in Annual Que river flow box to assess Step 1 runofi quality only)           For dissolved zinc only           For sediment impact only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc () Estimated ri	ned (ha) outfall (ha) Link _ <700m / ture, lake, pond or canal ver width (m) n)		Fres     Is the o     Is the o     Is the o     Manning's n     T	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or with or dissolved copp m of the point of d	iolved copper (µg(l) olved zinc (µg(l) nin 1 km upstream c per only Ambier ischarge? Sin Estmated effects Atternation for sol	de slope (m eness ubles -	1 10.9 ad site for conservation nd concentration (m) Settlement of	rvation?		
Step 2 River Impacts           (Enter zero in Annual Que river flow box to assess Step 1 runofi quality only)           For dissolved zinc only           For sediment impact only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc () Estimated ri	ned (ha) outfall (ha) Uich = c 200m / ture, lake, pond or canal ver width (m)		Fres     Is the o     Is the o     Is the o     Manning's n     T	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or with or dissolved copp m of the point of d	olved copper (µg/l) olved zinc (µg/l) hin 1 km upstream c per only Ambier ischarge? Si Estmated effective	de slope (m eness ubles -	1 10.9 ed site for conser ind concentration int	rvation?		
Step 2 River Impacts           (Enter zero in Annual Que river flow box to assess Step 1 runofi quality only)           For dissolved zinc only           For sediment impact only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc () Estimated ri	ned (ha) outfall (ha) Link _ <700m / ture, lake, pond or canal ver width (m) n)		Fres     Is the o     Is the o     Is the o     Manning's n     T	hwater EQS limits Bioavailable diss Bioavailable diss discharge in or with or dissoftved copp m of the point of d	iolved copper (µg(l) olved zinc (µg(l) nin 1 km upstream c per only Ambier ischarge? Sin Estmated effects Atternation for sol	de slope (m eness ubles -	1 10.9 ad site for conservation nd concentration (m) Settlement of	rvation?		

Road Catchment 5 – Passes so no mitigation proposed Road Catchment 6 – Passes so no mitigation proposed Road Catchment 7 – Passes so no mitigation proposed Road Catchment 8 – Passes so no mitigation proposed



Road Catchment 7 + 8 – Wet attenuation pond and circa 290m ditches on catchment 8, filter drains on catchment 7 – ratios used, provides 68% mitigation for suspended solids and 8% for dissolved metals.

	EQS - Annual Average Concentration				Acute Im	pact			
Step 2 Tier 1 fail. Go to	Copper 3.78 Tier 2 (using UK TAG or Step 3 mitigation. 3.69	Zinc 1.32	ug/l		opper Pass	Zinc Pass	Ac	diment depositio cumulating? Ye tensive? No	
	Tier 2 (using UK TAG crease Step 3 mitigation.	1.22	ogn						Depositorindes
Road number		M54-M6 Link		н	Area / DBFO n	umber			
Assessment type		Cumulative assessment in	ncluding sedimer	nts (outfalls wi	:hin 100m)				-
OS grid reference of assessme	ntpoint (m)	Easting 394240				Northing	304990		
OS grid reference of outfall struc	ture (m)	Easting				Northing			
Outfall number		Catchment 7 and 8			stofoutfalls in α sessment	umulative			
Receiving watercourse		Waercourse 3				-			
EA receiving water Detailed Riv	er Network ID				sessor and afflia			DSH	
Date of assessment Notes		09/09/2019		V	ersion of assess	nent		1	
Step 1 Runoff Quality	AADT >10 000 a	and <50 000	Climatic regi	ion Warm	Drv 💌	Rainfall site	Ri	minaham (S	∆∆R 750mm) _
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0 003	Freshw	ater EQS limits:				
(Enter zero in Annual Q <sub>95</sub>	Impermeable road area drai	ned (ha)	2 20	Bi	oavailable dissol	ved copper (µg/l)		1 D	
river flow box to assess Step 1 runoff quality only)	Permeable area draining to	outfall (ha)	0 202	Ві	oavailable dissol	ved zinc (µg/l)		10.9 D	
ony	Base Flow Index (BFI)		0.5	Is the disc	harge in or within	n 1 km upstream of	a protected si	te for conservatio	n? N D
For dissolved zinc only	Water hardness	High = >200mg CaC	: <u>03/I</u>	For	dissolved coppe	er only Ambient	t background o	concentration (µg	l) <u>२२</u>
For sediment impact only	Is there a downstream struct	ture, lake, pond or canal that re	duces the velocity	within 100m	of the point of dis	charge?		No. D	
	Estimated ri	ver width (m)	1						
	C Tion Bed width (r	n)	<u>२</u> N	Manning's n	0 07 D	Sid	e slope (m/m)	<u>05</u>	ong slope (m/m)
Step 3 Mitigation		Briefdescription			tment for	Estimated effectiver Attenuation for solut stricted discharge ra	bles - Se	ettlement of diments (%)	
Existing measures				0		restriction -			
Proposed measures	wet attenuation pond and ditches	on catch8, filter drains on catch 7 exit	sting: ratio used	8		restriction -			
L									

## Road Catchment 9 – A460 and Hilton Lane

With filter drains along part of Hilton Lane (50% of ditch parameters used)

	EQS - Annual Average Concentration				Acute Impact				
	Copper	Zinc					Fail. T	rg Tier 2 for Velocity	
	3.80	2.25	ugil		Copper	Zinc		eeded = 56 %, proposed = 13 %	
	Tier 2 (using UK TAG				<b>River Fails Toxicity</b>			tion for this site is judged as:	
M-BAT tool).	or Step 3 mitigation.				Test. Try more	Pass		Yes 0.00 Low flow Vel m/s	
	3.68	2.07	ugil		mitigation		Eztensive?	Yes 195 Deposition Index	
	Tier 2 (using UK TAG								
M-BAT tool), or in	crease Step 3 mitigation.								
Road number		A460			HE Area / DBF	O number			
Assessment type			issessment (single out	tfall)				-	
OS grid reference of assessme	nt point (m )	Easting				Northing			
OS grid reference of outfall struc	ture (m)	Easting				Northing			
Outfall number		catchment 9			List of outfalls in	n cumulative			
Receiving watercourse		watercourse 4			assessment				
EA receiving water Detailed Riv	er Network ID				Assessor and a	affliation			
Date of assessment		15/11/2019			Version of asse	essment			
Notes									
L									
Step 1 Runoff Quality	AADT >10,000 a	and <50 000	▼ Climatic		Mam Day	Rainfall site			
	>10 000 a	and <50 000	Ciintauc	regior	Wam Drv -	Rainfail site	Rimingham (	(SAAR 750mm) <u>▼</u>	
Step 2 River Impacts				-					
	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)		0.001	1	Freshwater EQS limi	its:			
(Enter zero in Annual Q <sub>95</sub>	Impermeable road area drain	ned (ha)	1 644	1	Bioavailable di	ssolved copper (µg/l)	1	D I	
river flow box to assess Step 1 runoff quality	Permeable area draining to o	outfall (ha)	1.035	-	Bioavailable di	ssolved zinc (µg/l)	10.9		
only)	-	Julian (Ind)							
	Base Flow Index (BFI)		0.5	D	Is the discharge in or w	rithin 1 km upstream of a protect	ted site for conserva	ition?	
For dissolved zinc only	Water hardness								
For dissolved zinc only	water naroness	High = >200	mi CaCO3/I		For dissolved co	opper only Ambient backgro	ound concentration (	µg/l) 2	
For sediment impact only	Is there a downstream struct	ure, lake, pond or car	nal that reduces the velo	ocity w	vithin 100m of the point of	f discharge?	No -	D III	
	Tion Estimated riv	ver width (m)	1.5	1					
				_					
	C Tion Bed width (m	1)	3	Ma	anning's n 🛛 🔿 🗇	Side slope (	(m/m) <u>೧</u> .5	Long slope (m/m)	
L									
Step 3 Mitigation						Estimated effectiveness			
							0.00		
					Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (1/s)	Settlement of sediments (%)		
		Briefdescription			Solubles ( 76)	reamous ansolarge rate (ins.)	acuments ( 76)		
Existing measures					0 D	No restriction 👻 D	0 D		
Proposed measures	ditch alongside Hilton Lane				8	No restriction 👻 D	12		



#### Road Catchment 9 – A460 and Hilton Lane

Sensitivity analysis using point downstream, upstream of Saredon Brook, Q95 0.01 m<sup>3</sup>/s

	EQS - Annual Average Con				Acute Im	pact			
	Copper	Zinc							Pass
Step 2 Tier 1 fail. Go to	3.16 Tier 2 (using UK TAG	0.36	ug/l	_	Copper	Zinc			for this site is judged as:
	or Step 3 mitigation.				Pass	Pass		cumulating? Yes	
M-BAT COOL	3.10	0.33			Pass	Pass		ensive? No	
Step 3 Tier 1 fail. Go to	3.10 Tier 2 (using UK TAG	0.33	ugłi				Ex(	ensive?	Ueposition index
	crease Step 3 mitigation.								
M-BAT (OOI), OT III	crease step s intigation,								
Road number		A460			HE Area / DBFO n	umber			
Assessment type		Non-cumulative a	assessment (single outfa	dD.					-
OS grid reference of assessmen	nt point (m.)	Easting				Northing			
OS grid reference of outfall struc	ture (m)	Easting				Northing			
Outfall number		catchment 9			List of outfalls in c				
Receiving watercourse					assessment				
EA receiving watercourse	an Madera de 10	watercourse 4			Assessor and affili				
	er Network ID								
Date of assessment		15/11/2019			Version of assess	nent			
Notes									
Step 1 Runoff Quality	AADT >10.000	and <50 000	<ul> <li>Climatic re</li> </ul>		m Dry	Rainfall site	Di		AR 750mm)
	51111013	and <50 000	- Olimatic Te	gion wa	milin/	Raimair site	BI	mindnam (S4	
Step 2 River Impacts									
	Annual Q <sub>55</sub> river flow (m <sup>3</sup> /s)		0.01	Fresh	water EQS limits:				
(Enter zero in Annual Qos	Impermeable road area drain	ned (ha)	1 644		Bioavailable dissol	had connor (unll)		1 D	
river flow box to assess	Impermeasie road area drai	nea (na)	1 644		Dioavaliable disso	ved copper (µg/i)			
Step 1 runoff quality	Permeable area draining to	outfall (ha)	1 035		Bioavailable dissol	ved zinc (µg/l)		10.9 D	
only)	Base Flow lader (DFI)			D Is the d	a share a la an uithi				
	Base Flow Index (BFI)		0.5	D is the d	ischarge in or withi	n 1 km upstream of	a protected sit	e for conservation	1? N 💌 D
		-							
For dissolved zinc only	Water hardness	High = >200	ma CaCO3/I 🔄	F	or dissolved copp	er only Ambien	t background c	oncentration (µg/l	) 2
For sediment impact only	Is there a downstream struct	ture, lake, pond or ca	nal that reduces the veloci	ty within 100	n of the point of dis	charge?		No. D	
	Tion Estimated m	ver width (m)	1.5						
		vor within (iii)							
	C Tion Bed width (n	n)	3	Manning's n	0 07 D	Sid	le slope (m/m)	0.5 Lo	ong slope (m/m)
Step 3 Mitigation									
Step 5 milligation						E stimated effective	ness		
						Attenuation for solu		tiem ent of	
		Briefdescription		s	olubles (%) res	stricted discharge ra	ate (I/s) sed	liments (%)	
Existing measures							DO		
Proposed measures	ditch alongside Hilton Lane					restriction -		D	



#### Step 1 wet pond

Coper         Zinc           9         1         1         1           9         1         1         1         1           9         1         1         1         1         1           9         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1<		EQS - Annual Average Con	centration		Acute I	mpact					
Step 2       Itel Ital, Bos Tare 2, Gang BK, KAD       2.44       upt       The of Lat Prance       Seement deposition for table size in global assisted accommutation of the size in global assofthe in global assiste		Copper	Zinc								
Maint solution       Accumulating:       Version of assessment point (m)       Accumulating:       Version of assessment (m)       Accumulating:       Accumulating:       Accumulating:       Accumulating:       Accumulating:       Accumulating:       Accumulating:       Accumulating:       Accumulating:       Accumulating			4.11	ug/l	Cc	pper	Zinc	.			
3.74       2.46       op/l       Immediation       Extensive?       Vex       182       Deposition Index         Road number       MS4.M6 Link Road       IHE Area / DBFO number											
Step 3       The Hall Note 2 Lawy UK 1 All MARK Kong, where we strep 3 many process the part Kong, where we strep 3 many process many process the part of the	M-BAT tool).						Pass				
Road Tunch and a locative taxes have analysisted         Road number       M64-M6 Link:Road       HE Area/DBFO number         Assessment for       Non-cumulative assessment (single outfall)       Infining         OS and reference of taxessament court (m)       Easting       B95170       Infining         OS and reference of outball structure (m)       Easting       B95170       Infining         Cutfal member       Watercourse 4 new outfall: catchment 10       Last for outballs in cumulative       Base Serier (Last could in a countable outball in cumulative)         BaceMing water: Detailed River Network ID       Assessor and affiliation       DSH         Date of assessment       09/09/2019       Version of assessment       1         Notes        Step 1 Runoff Quality       AADT       *50.000 and +100.000       Climatic region       Warm Dry       Rainfail site       Breingtain (BAAR 700mm)       Immingtain (BAAR 700mm) <th>Char 2</th> <th></th> <th>2.46</th> <th>ug/l</th> <th></th> <th>ation</th> <th></th> <th>Ex</th> <th>tensive?</th> <th>es R</th> <th>Deposition Inde</th>	Char 2		2.46	ug/l		ation		Ex	tensive?	es R	Deposition Inde
Road number       MS4-M6 Link Road       HE Area / DBFO number         Assessment toe       Non-cumdative assessment (sing)       95170         OS did reference of assessment boint (m)       Easting       Non-the assessment (sing)       Non-the assessment (sing)         OS did reference of assessment boint (m)       Easting       Non-the assessment (sing)       Non-the assessment (sing)       Non-the assessment (sing)         Outs in number       Watercourse 4       Watercourse 4       Assessor and affiliation       D SH         Date of assessment       Obj 09/20 19       Version of assessment       D SH         Date of assessment       09/09/20 19       Version of assessment       1         Notes       Step 1 Runoff Quality       AADT       >>5000 and <100.000       Climatic region       Water Curse (sing)       D SH         Step 2 River Impacts       Annual Q <sub>int</sub> fiver flow (m/ls)       0001       Freshwater EQS limits:       Bioavailable dissolved coper (µgh)       1       0         Writer flow too no assess       Site 1 runoff quality       AADT       >>20001       For dissolved coper (µgh)       1       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       <											
Assessment fues       Non-currutative assessment (single outfall)       Image: Control of the sement of assessment (single outfall)         OS and reference of assessment coint (m)       Easting       395170       Northung         OS and reference of assessment coint (m)       Easting       395170       Northung         Os and reference of assessment (ample outfall catchment 10]       List of outfalls in cumulative       Northung         Outfall number       Watercourse 4       Assessment       Seessment         EA mething water 0 etailed River Network D       Assessment       DSH         Date of assessment       09/09/2019       Version of assessment       DSH         Date of assessment       09/09/2019       Version of assessment       1         Notes       Impermeable road area drained (ha)       3355         Step 1. Runoff Quality       AADT       >>00000       Freshwater EQS limits:         (Enter zero in Annual Q <sub>int</sub> river flow (m/ls)       00001       Freshwater EQS limits:       Bioavailable dissolved copper (ug/l)       1       ©         fiver flow box to assess       Impermeable road area draining to outfall (ha)       405       Elsavailable dissolved copper (ug/l)       1       ©         for dissolved zinc outly       Water hardness       High=>20000 CoOSI       For dissolved copper only       Ambient backgrou	M-BAT COOL, OF IN	crease step 3 mitigation.									
OS did reference o fassessment point (m)       Easting       395170       Northing       306270         OS did reference o foulds structure (m)       Easting       395170       Northing       Northing         OS did reference o foulds structure (m)       Easting       395170       Northing       Northing         OS did reference o foulds structure (m)       Easting       Step 1       Northing       Northing         Cottal number       Watercourse 4 etc. outfall: catchment 10(       List of outfalls in cumulative       Assessment         Base of assessment       09/09/2019       Version of assessment       1         Date of assessment       09/09/2019       Version of assessment       1         Notes       Step 1       Runoff Quality       Annual Q <sub>ic</sub> river flow (m <sup>1</sup> /s)       0000       Freshwater EQS limits:         Elster zoro in Annual Q <sub>ic</sub> river flow (m <sup>1</sup> /s)       0000       Climatic region       Warm Dry       Rainfall site       Biningsam (SAAR 700mm)       ▼         Step 1       Runoff Quality       Annual Q <sub>ic</sub> river flow (m <sup>1</sup> /s)       0000       Freshwater EQS limits:       Biningsam (SAAR 700mm)       ▼         Step 1       Inorter advalue draining to outfall (ha)       3355       Bioavailable dissolved coper (iug/l)       I       D         For dissolved zinc only	Road number		M54-M6 Link Road		HE	Area / DBFO	number				
OS dof reference o fourbil structure (m)       Easting       Northing         Outfail number       Watercourse 4 new outfail: catchment 10       List of outfails in cumulative         Bace Wink waterD detailed River Network ID       Assessment       DS H         Date of assessment       09/09/2019       Version of assessment       D SH         Date of assessment       09/09/2019       Version of assessment       D SH         Notes       09/09/2019       Version of assessment       1         Notes       09/09/2019       Version of assessment       1         Notes       09/09/2019       Version of assessment       1         Step 1 Runoff Quality       AADT       >=50,000 and +100,000       Climatic region       Warm Dry       Rainfall site       Briningtam (SAAR 750mm)       Version of assessment         Step 1 Runoff Quality       AADT       >=50,000 and +100,000       Climatic region       Warm Dry       Rainfall site       Briningtam (SAAR 750mm)       Version of assessment         Step 1 Runoff Quality       AADT       >=50,000 and +100,000       Forstwater EQS limits:       Bioavailable dissolved copper (ug/l)       1       C         (Enter zero in Annual Que traver and raining to outfall (ha)       3355       Bioavailable dissolved zinc (ug/l)       103       C         Step	Assessment type		Non-cumulative assessmen	t (single outfa	AII)						
Outsit number       Watercourse 4       Ust of outsite in numulative seases in an affiliation       DSH         Reckmin watercourse       Vectorourse 4       Assession and affiliation       DSH         Date of assessment       09/09/2019       Version of assessment       1         Notes       Step 1 Runoff Quality       AADT       >=50,000 and <100,000	OS grid reference of assessme	nt point (m )	Easting 395170				Northing	306270			
Reaching watercourse       Watercourse 4       assessment       D         EA reciving water Detailed River Network ID       Assessor and affiliation       D SH         Date of sassessment       09/09/2019       Version of assessment       1         Notes       1       Step 1 Runoff Quality       AADT       >=50.000 and <100.000	OS grid reference of outfall struct	ture (m)	Easting				Northing				
Reaching watercourse       Watercourse 4       assessment       D         EA reciving water Detailed River Network ID       Assessor and affiliation       D SH         Date of sassessment       09/09/2019       Version of assessment       1         Notes       1       Step 1 Runoff Quality       AADT       >=50.000 and <100.000	Outfall number		Watercourse 4 new outfall: cate	hment 10	Lis	of outfalls in	cumulative				
EA resolving valer D'etailed River Network D       Assessor and affiliation       DSH         Date of assessment       09/09/2019       Version of assessment       1         Notes       Step 1. Runoff Quality       AADT       >>>0000       Climatic region       Warm Dry       Rainfail site       Birningtam (SAAR 750mm)         Step 1. Runoff Quality       AADT       >>0000       Climatic region       Warm Dry       Rainfail site       Birningtam (SAAR 750mm)          Step 2. River Impacts       Annual Qig river flow (m <sup>1</sup> /s)       0001       Freshwater EQS limits:           [Enter zero in Annual Qig river flow (m <sup>1</sup> /s)       0001       Freshwater EQS limits:              Step 1. runoff quality only       Base Flow Index (BFI)       0.5       Is the discharge in or within 1 km upstream of a protected site for conservation?       Ne       ©         For dissolved zinc only       Water hardness       High =>200mg GaCO34       For dissolved copper only       Ambient background concentration (ug/l)       3          For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       Ne       ©          % Tier 1       Estimated river width (m)       15       Site slope (m/m)	Receiving watercourse							<u> </u>			
Date of sassessment       09/09/2019       Version of assessment       1         Notes       Step 1 Runoff Quality       AADT       >=50,000 and <100.000	EA receiving water D stailed Riv	er Network ID			45	essor and af	fliation		D SH		
Notes       Climatic region       Warm Dy       Rainfall site       Birningham (SAAR 750mm)         Step 1 Runoff Quality       AADT       >=50,000 and <100,000       Climatic region       Warm Dy       Rainfall site       Birningham (SAAR 750mm)       Image: Climatic region         Step 2 River Impacts       Annual Q <sub>up</sub> river flow (m <sup>1</sup> /s)       0001       Freshwater EQS limits:       Image: Climatic region			09/09/2019						1		
Step 1 Runoff Quality       AADT       >=50.000 and <100.000			03/03/2013			0.011 01 00000	SHORE				
ADD       >>0.000       Climatic region       Warm Dy       Rainfall site       Emmapare (SAAR 70mm)         Step Z River Impacts       Annual Q <sub>et</sub> river flow (m <sup>1/s</sup> )s)       0.001       Freshwater EQS limits:         [Enter zero in Annual Q <sub>et</sub> river flow (m <sup>1/s</sup> )s)       0.001       Freshwater EQS limits:       Bioavailable dissolved copper (ug/h)       1       0         where flow box to assess       Permeable read draining to outfall (ha)       4.05       Bioavailable dissolved copper (ug/h)       10.9       0         For dissolved zinc (ug/h)       Base Flow index (BFI)       0.5       Is the discharge in or within 1 km upstream of a protected sile for conservation?       No	Notes										
ADD       >=20,000 and <100,000											
ADD       >=20,000 and <100,000       Climatic region       Warm Dy       Rainfall site       Bimingtam (SAR 700mm)         Step 2       River Impacts       Annual Q <sub>int</sub> river flow (m <sup>3</sup> /s)       0001       Freshwater EQS limits:         (Enter zoro in Annual Q <sub>int</sub> river flow (m <sup>3</sup> /s)       0001       Freshwater EQS limits:       Bioavailable dissolved copper (µg/l)       0         Where Two box to assess       Permeable area draining to outfall (ha)       4.05       Bioavailable dissolved zinc (µg/l)       0.5       0         For dissolved zinc only       Water hardness       Hgh =>200mg CaCO231       For dissolved copper only       Ambient background concentration (µg/l)       3         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       0         % Tier 1       Estimated river width (m)       15       0       Step 3       Step 4       Step 4         Brief description       Brief description       Brief description       Estimated flective ness       Step 1       Step 1       Step 1       Step 2											
ADD       >=20,000 and <100,000											
ADD       >=20,000 and <100,000	Stop 1 Pupoff Quality										
	step i reality	AADT >= 50,000 and <1	100,000	Climatic re	egion Warm Dry	-	Rainfall site	Birmi	ingham (SAAR 750m	ım)	-
(Enter zero in Annual Q <sub>se</sub> river flow box to assess Step 1 runoff quality only)       Impermeable road area drained (ha)       3355       Bioavailable dissolved copper (µg/l)       1       □         Permeable area draining to outfall (ha)       405       Bioavailable dissolved zinc (µg/l)       103       □         For dissolved zinc only       Water hardness       Hgh =>200mg GaCO34       For dissolved copper only       Ambient background concentration (µg/l)       3         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       □ $\stackrel{\circ}{\sim}$ Tier 1       Estimated river width (m)       15 $\stackrel{\circ}{\sim}$ Side slope (m/m)       0       0         Step 3       Mitigation       Brief description       Brief description       Settlement of resulties       Settlement of resulties	Step 2 River Impacts	Annual Q <sub>os</sub> river flow (m <sup>3</sup> /s)		0.001	Freshwat	er EQS limits	c				
inver flow box to assess Step 1 rundf quality only)       Permeable area draining to outfall (ha)       405       Bioavailable dissolved zinc (µg/l)       109       Image: Step 1 rundf quality         Step 1 rundf quality only)       Base Flow Index (BFI)       05       Is the discharge in or within 1 km upstream of a protected site for conservation?       No       Image: Step 1 rundf quality         For dissolved zinc only       Water hardness       Hgh = >200mg CaC034       For dissolved copper only       Ambient background concentration (µg/l)       3         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       Image: Comparison of the point of discharge?       No       Image: Comparison of the point of discharge?       Image: Comparison of the point of th											
Step 1 nunft quality only)       Permeable area draining to outfall (ha)       405       Bioavailable dissolved zinc (µg/l)       109         Base Flow Index (BFI)       05       Is the discharge in or within 1 km upstream of a protected sile for conservation?       No       Image: Conservation (µg/l)         For dissolved zinc only       Water hardness       Hgh = >200mg CaCO34       For dissolved copper only       Ambient background concentration (µg/l)       3         For sediment impact only       Is the e a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       Image: Conservation (Principle)         G Tier 1       Estimated river width (m)       15       Image: Conservation (Principle)       Image: Conservation (Principle)         Step 3       Mitigation       Estimated effective ness       Treatment for Attenuation for solubles - Solubles (%)       Settement of solubles (%)       Settement of solubles (%)       Settement of solubles (%)		Impermeable road area drain	ned (ha)	3.353	Bio	available diss	olved copper (µg/l)		1 D		
only)       Base Flow Index (BFI)       05       Is the discharge in or within 1 km upstream of a protected site for conservation?       No         For dissolved zinc only       Water hardness       Hgh =>200mg CaCO34       For dissolved copper only       Ambient background concentration (µg/l)         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       Image: CaCO34         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       Image: CaCO34         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       Image: CaCO34         Grave       Tier 1       Estimated river width (m)       15       Image: CaCO34       Image: CaCO34         Grave       Tier 2       Bed width (m)       3       Manning's n 007       Side slope (m/m)       5       Long slope (m/m)       00001         Step 3       Mitigation       Estimated effectiveness       Treatment for Attenuation for solubles - Settement of solubles (%)       Settement of solubles - Settement of solubles (%)       sedments (%)		Permeable area draining to g	outfall (ha)	4.05	Bio	available diss	olved zinc (ug/l)		10.9 D		
For dissolved zinc only       Water hardness       Hgh =>200mg CaCO34       For dissolved copper only       Ambient background concentration (ug/l)         For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No       Image: Cacobi and the point of discharge?         Image: Cacobi and the cacobi a		-									
For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No         © Tier 1       Estimated river width (m)       15         © Tier 2       Bed width (m)       3         Manning's n 007       © Side slope (m/m)       05         Long slope (m/m)       0       0001         Step 3       Mitigation       Estimated effectiveness         Brief description       Treatment for solubles (%)       Settement of solubles (%)		Base Flow Index (BFI)		0.5	D Is the disch	arge in or wit	hin 1 km upstream of	a protected sr	te for conservation	on?	No 👻 D
For sediment impact only       Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?       No         © Tier 1       Estimated river width (m)       15         © Tier 2       Bed width (m)       3         Manning's n 007       © Side slope (m/m)       05         Long slope (m/m)       0       0001         Step 3       Mitigation       Estimated effectiveness         Brief description       Treatment for solubles (%)       Settement of solubles (%)											
* Tier 1     Estimated river width (m)     1.5       .* Tier 2     Bed width (m)     3       Manning's n B07     Side slope (m/m)       Step 3     Mitigation         Estimated effectiveness         Treatment for       Solubles (%)         Settement of       Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Settement of         Subbles (%)         Settement of	For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	For d	ssolved cop	per only Ambient	t background o	concentration (µg	I/I)	3
Image: Step 3 Mitigation     Tier 2     Bed width (m)     15       Image: Step 3 Mitigation     Estimated effective ness       Image: Step 3 Mitigation	For and south south and a	to the set of design data and other sets					la - h 0		No.		
Step 3 Mitigation     Estimated effective ress       Brief description     Brief description	For sediment impact only	is there a downstream struct	ure, lake, pond or canal that redu	ces the veloci	ity within 100m of	the point of c	lischarge ?				
Step 3 Mitigation         Estimated effectiveness           Brief description         Treatment for solubles (%)         Satisment of restricted discharge rate (\lbs)         Satisment of solubles (%)		<ul> <li>Tier 1 Estimated riv</li> </ul>	ver width (m)	1.5							
Step 3 Mitigation         Estimated effective ress           Brief description         Treatment for solubles (%)         Attanuation for solubles. Settlements (%)		⊖ Tier 2 Bed width (m		3	Manning's n	7 D	Side	e slone (m/m)	0.5	ong slope	m/m) 0.0001
Brief description         Settlement of restricted discharge rate (Js)         Settlement of additional settlement of restricted discharge rate (Js)         Settlement of additional settlement of solubles (%)			''		Munning 5 n						
Brief description         Settlement of restricted discharge rate (Js)         Settlement of additional settlement of restricted discharge rate (Js)         Settlement of additional settlement of solubles (%)										Long slope	
Brief description solubles (%) restricted discharge rate (I/s.) sediments (%)	Step 2 Mitigation									1	
Direitoescription	Step 3 Mitigation						E stimated effectiven	ie ss		Long slope	
Existing measures 0 0 0 No restration - 0 0 0	Step 3 Mitigation						Attenuation for solut	oles - Se	ettlem ent of		
Existing measures D D D No restriction V D D	Step 3 Mitigation		Briefdescription				Attenuation for solut	oles - Se	ettlem ent of		
			Brief description		solub	es (%) r	Attenuation for solut estricted discharge ra	te (I/s) Se	attlement of fiments (%)		
Proposed measures With wet attenuation pond in design 40 No restriction - 0 60	Existing measures		-		solub 0	es (%) r	Attenuation for solut estricted discharge ra No restriction	bles - Se te (1/s) sec	attlement of fiments (%)		

## Step 2 wet pond and short length of swale

	EQS - Annual Average Con	centration			Acute Impact				
	Copper	Zinc						Pass	
	4.44	4.11	ug/l	Copper	Zinc	_			
	Tier 2 (using UK TAG						diment depositio		
M-BAT tool),	or Step 3 mitigation.			Pass	Pass		cumulating? Ye		
	3.34	1.44	llgu			Ezt	tensive? N	D 0	Deposition Index
	Tier 2 (using UK TAG								
M-BAT toolj, or in	crease Step 3 mitigation.								
Road number		M54-M6 Link Road		HE Area	/ DBFO number				
Assessment type		Non-cumulative assessme	nt (single outf	all)					•
OS grid reference of assessmer	nt point (m )	Easting 395170		,	Northing	306270			
OS grid reference o foutfall struc	ture (m)	Easting			Northing				
Outfall number		Watercourse 4 new outfa	II: catchment	t 10 List of ou	tfalls in cumulative				
Receiving watercourse		Watercourse 4		assessm	ent				
EA receiving water D stailed Riv	er Network ID			Asse sso	r and affliation		D SH		
Date o fassessment		23/01/2020		Version	ofassessment		1		
Notes									
Noica									
Step 1 Runoff Quality									
	AADT >=50 000	and <100 000	Climatic r	egion Warm Drv	<ul> <li>Rainfall site</li> </ul>	Ri	minaham (S	44 R 750n	nm) 🚬
Step 2 River Impacts									
Step 2 River impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.001	Freshwater EC	S limits:				
(Enter zero in Annual Qas	Impermeable road area drain	od (ha)		Discusila	ble disastrud serves (		1 D		
river flow box to assess	Impermeable road area drain	ieu (iia)	2 252	Dioavalia	ble dissolved copper (µg/l)				
Step 1 runoff quality	Permeable area draining to o	outfall (ha)	4 05	Bioavaila	ble dissolved zinc (µg/l)		10.9 D		
only)	Base Flow Index (BFI)		0.5	D Is the discharge	in or within 1 km upstream o	of a protected sit	te for conservatio	n?	N. D
For dissolved zinc only	Water hardness	High = >200mg CaC	03/1	For dissol	red copper only Ambie	nt background c	concentration (ug	4)	2
		<b>.</b>				-			
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that rec	duces the veloc	ity within 100m of the p	oint of discharge?		No.		
	Estimated riv	er width (m)	15						
		. ,							
	C Tion Bed width (m	)	2	Manning's n 🛛 🔿 🔿	D Si	de slope (m/m)	0.5	ong slope (m	/m) <u>0000</u>
Step 3 Mitigation					E stimated effective	De SS			
				Treatment			ettlem ent of		
		Briefdescription		solubles (			timents (%)		
		brier desemption							
Existing measures				0 D	No restriction	- D 0	D		
Proposed measures	Wtih wet attenuation pond in desig	gn, and short length ofswale (half% u	esd)	65	No restriction	- D 10			



## Cumulative Road Catchment 9 +10, outfalls over 100m

	EQS - Annual Average Con	centration			Acute in	npact				
	Copper	Zinc								
	4.78 o Tier 2 (using UK TAG or Step 3 mitigation.	5.07	ugil		Copper er Fails Toxicity est. Try more	Zinc		diment depositior cumulating?		judged as: Lowflow Vel m/s
	3.86 o Tier 2 (using UK TAG ccrease Step 3 mitigation.	2.84	ugil		mitigation		Es	tensive?		Deposition Index
Road number		M54-M6 Link Bo	ad		HE Area / DBFO r	number				
Assessment type		Cumulative asse	ssment excluding se	liments (outfal	s between 100m a	and 1km apart)				
DS grid reference o fassessme	nt point (m )		395170			Northing	306270			
DS grid reference of outfall struc	cture (m)	Easting				Northing				
Dutfall number		Watercourse 4 n	new outfall: catchme	nt 9 and 10	List of outfalls in o	cumulative				
Receiving watercourse		Watercourse 4			assessment					
EA receiving water Detailed Riv	ver Network ID				Assessor and affil	iation		D SH		
Date o fassessment		09/09/2019			Version of assess	ment		1		
Step 1 Runoff Quality	AADT >=50 000	) and <100 000	Climati	c region 🛛 🗤 s	im Drv 💌	Rainfall site	Ri	minoham (S <i>l</i>	∆ R 750mm	<mark>n) •</mark>
	AADT >=50 000 Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	) and <100 000	Climati		m Drv 💌	Rainfall site	Ri	minoham (S <i>l</i>	∆ R 750mn	<mark>n) 💌</mark>
Step 2 River Impacts	22 0000			I Free			Ri	mincham (S <i>l</i>	∆∆R 750mn	<mark>רו רו</mark>
Step 2 River Impacts (Enter zero in Annual Q <sub>95</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	ned (ha)		1 Fre:	hwater EQS limits:	olved copper (µg/l)	Ri		<u>۵۵ R 750mn</u>	<u>1)</u>
Step 2 River Impacts (Enter zero in Annual Q <sub>ac</sub> river flow box to assess	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	ned (ha)		1 Fre:	hwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (µg/l)		1 D 10.9 D		
Step 2 River Impacts (Enter zero in Annual Q <sub>95</sub> river flow box to assess Step 1 runoff quality	Annual Q <sub>sc</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to	ned (ha)		1 Free	hwater EQS limits: Bioavailable disso Bioavailable disso	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of	a protected si	1 D 10.9 D	n? [	
Step 2 River Impacts (Enter zero in Annual Q <sub>s6</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>est</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI)	ned (ha) outfall (ha) Hinh = >2001	0 0 0 4 00 5 05 6 0 5 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		thwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of per only Ambien	a protected si	1 D 10.9 D	n? [	N
Step 2 River Impacts (Enter zero in Annual Q <sub>so</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness	ned (ha) outfall (ha) Hinch = >2001 lure, lake, pond or car	0 0 0 4 00 5 05 6 0 5 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		thwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	olved copper (μg/l) olved zinc (μg/l) in 1 km upstream of per only Ambien	a protected si	1 D 10.9 D te for conservation concentration (µg/h	n? [	N
Step 2 River Impacts (Enter zero in Annual Q <sub>sc</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ec</sub> river flow (m <sup>2</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struct	ned (ha) outfall (ha) Hinh = >2001 ture, lake, pond or car ver width (m)		Free     Free	thwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with or dissolved copp	vlved copper (µg/l) vlved zinc (µg/l) in 1 km upstream o ver only Ambien scharge?	a protected si	1 0 109 0 te for conservation concentration (µg/n Nn_ 0	n? [	N
Step 2 River Impacts (Enter zero in Annual Q <sub>sc</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>iss</sub> fiver flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struct © Tior. Estimated rin	ned (ha) outfall (ha) Hinh = >2001 ture, lake, pond or car ver width (m)	A OC A OC	Free     Free	water EQS limits: Bioavailable disso Bioavailable disso discharge in or with for dissolved copp for of the point of di on on?	vlved copper (µg/l) vlved zinc (µg/l) in 1 km upstream o ver only Ambien scharge?	i a protected si t background of ie slope (m/m) ness bies - S	1 0 109 0 te for conservation concentration (µg/n Nn_ 0	n? [ I) [	N V D
Step 2 River Impacts (Enter zero in Annual Q <sub>66</sub> iver flow box to assess Step 1 nuoff quality only) For dissolved zinc only For asediment impact only Step 3 Mitigation	Annual Q <sub>iss</sub> fiver flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struct © Tior. Estimated rin	ned (ha) outfail (ha) Hinh = >2001s Hinh = >2001	A OC A OC	f Free f Free f I Is the loccity within 100 Manning's I	water EQS limits: Bioavailable disso Bioavailable disso discharge in or with for dissolved copp mo of the point of di mon 7	wheed copper (ug/l) wheed zinc (ug/l) in 1 km upstream of ter only Ambien scharge? Site Estimated effective Attenuation for solo stricted discharge re-	i a protected si t background of le slope (m/m) ness bles - S sec	1 0 109 0 te for conservation concentration (ug/A N/~~ 0 15 La ettiem ent of diments (%)	n? [ I) [	N
Step 2 River Impacts (Enter zero in Annual Q <sub>25</sub> iver flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>iss</sub> fiver flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struct © Tior. Estimated rin	hed (ha) outfall (ha) Hinh = >2ΩΩΩ Utre, lake, pond or cat wer width (m) a) Brief description	A OC A OC	Free     Free	ihwater EQS limits: Bioavailable disso Bioavailable disso discharge in or with 'or dissolved copp Im of the point of di On OT O Treatment for solubles (%) re	olved copper (µg/l) olved zinc (µg/l) in 1 km upstream of er only Ambien scharge? Sic Estimated effective Attenuation for solu	i a protected si t background of ie slope (m/m) ness bies - S	1 0 10.9 0 te for conservation concentration (ug/n Nr	n? [ I) [	N V D

Sensitivity Analysis for analysis point upstream of Saredon Brook, 0.10 m<sup>3</sup>/s

Cumulative Road Catchment 9 +10, outfalls over 100m

EQS - Annual Average Concent		ncentration			Acute Im	pact			
	Copper	Zinc							
	3.42	1.17	ugil		Copper	Zinc			
	Tier 2 (using UK TAG				_				for this site is judged as:
M-BAT tool), (	or Step 3 mitigation.				Pass	Pass		cumulating?	Low flow Vel m/s
Step 3 Tier 1 fail Go to	3.18	0.65	ug/l				Est	ensive?	Deposition Index
	Tier 2 (using UK TAG								
M-BAT COOL, OF THE	crease Step 3 mitigation.								
Road number		M54-M6 Link Roa	d	1	IE Area / DBFO n	umber			
Assessment type		Cumulative assess	ment excluding sedir	nents (outfalls	etween 100m a	nd 1km apart)			-
OS grid reference o fassessmer	nt point (m)		5170				306270		
OS grid reference o foutfall struc	ture (m)	Easting				Northing			
Outfall number		Watercourse 4 nev	w outfall: catchmen	19 and 10	ist of outfalls in c	umulative			
Receiving watercourse		Watercourse 4	outun outonnon		ssessment				_
EA receiving water D etailed Rive	er Network ID	Tatercourse 4			Assessor and affilia	ation		D SH	
Date of assessment		09/09/2019			/ersion of assess			4	
Notes		09/09/2019			70151011 01 0550531	licik		1	
Notes									
L									
Step 1 Runoff Quality	AADT								
	AADT >=50 000	1 and <100 000	- Climatic r	egion \//am	n Drv 🚬	Rainfall site	Rin	minaham (SA	<u>AR750mm)</u>
Step 2 River Impacts									
Step 2 Have impacts	Annual Q <sub>s5</sub> river flow (m <sup>3</sup> /s)		0.010	Fresh	vater EQS limits:				
(Enter zero in Annual Q <sub>95</sub>	Impermeable road area drai	ned (ha)	4 997	E	Bioavailable dissol	lved copper (µg/l)		1 D	
river flow box to assess									
Step 1 runoff quality only)	Permeable area draining to	outfall (na)	5 085	L I	Bioavailable dissol	lved zinc (µg/l)		10.9 D	
Sinyy	Base Flow Index (BFI)		0.5	Is the dis	charge in or withi	n 1 km upstream of	a protected sit	te for conservation?	? NI D
For dissolved zinc only	Water hardness	High = >200m	n CaC.O3/I	For	dissolved copp	er only Ambient	background c	concentration (µg/I)	2
For sediment impact only	Is there a downstream struc	ture, lake, pond or canal	that reduces the veloc	ity within 100m	of the point of dis	charge?		No - D	
	Estimated ri	ver width (m)	1.5						
	Tion Bed width (		2	Manning's n	0.07 D	Ci.d.	e slope (m/m)	0.5 Lor	ng slope (m/m)
	TINE Bed wider (i		3	wanning s n		310	s slope (m/m)	<u>15</u> E0	
Step 3 Mitigation									
step 5 miligation						Estimated effectiver	ie ss		
						Attenuation for solut		tiem ent of	
1		Brief description		50	ubles (%) res	stricted discharge ra	te (I/s) sed	liments (%)	
Fridade and an and a				0	- N	restriction -			
Existing measures	and attacked and and all and a	and a family				restriction •	D 0		
Proposed measures	wet attenuation pond and short le	ingth of swale			No	· restriction			



Road Catchment 11 Passes sediments and acute soluble metals, so no mitigation proposed.

Road Catchment 12 Permeable Area only, no assessment required

Road Catchment 13 Permeable Area only, no assessment required



#### Step 1 wet pond

highways england									
			luble					Sedi	ment - Chronic Impact
· · · ·	EQS - Annual Average Co			Acute In	pact		E-11	Tes Tire 9 for Velocity	
highways england	Highways England	Water Risk Assess	sment Tool		Version 2.0.4 June 20	19			
		Solu	uble					Sedim	ent – Chronic Impact
	Copper	Zinc							Pass
M-BAT tool). Step 3 Tier 1 fail. Go t	5.61 o Tier 2 (using UK TAG or Step 3 mitigation. 5.25 o Tier 2 (using UK TAG acresse Step 3 mitigation.	1.80	ug/l		Copper Pass	Ziac Pass	۸۵	diment deposi cumulating? tensive?	tion for this site is judged as: Yes 0.01 Low flow Vel m No 0 Deposition Inde
oad number		M54-M6 Link Ro	and .		HE Area / DBFO n	mbor		1	
ssessment type			ssessment (single ou	tfall)		ander			
OS grid reference of assessm	ent point (m)		395440	(1814)		Northing	306560		
S grid reference of outfall str		Easting				Northing			
Juffall number			new Outfall C: Cato	hment 13	List of outfalls in o				
eceiving watercourse			Latherford Brook	andera 10	ass ess ment				
A receiving water Detailed Ri	iver Network ID	- ateroourse 0 -	Contention Crook		Assessor and affilia	ation		DSH	
ate of assessment		09/09/2019	Version of as sessment					1	
· · · ·	AADT >=50,000 and -	100,000	Climatic	region Warm	Dry	Rainfall site	Birmi	ingham (SAAR750	0mm) 🔹
Step 1 Runoff Quality Step 2 River Impacts	AADT >= 50,000 and + Annual Q <sub>55</sub> river flow (m <sup>3</sup> /s)	100,000	- Climatic		Dry •	Rainfall site	Birmi	ingham (SAAR76/	Omm) 💽
Step 2 River Impacts	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s)	-	-		shwater EQS limits:		Birmi	ingham (SAAR750	amm) 💌
(Enter zero in Annual Q <sub>of</sub> river flow box to assess	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	ned (hs)	0.004		shwater EQS limits: Bioavailable dissolv	ed copper (µg/l)	Birmi	1	
Step 2 River Impacts (Enter zero in Annual Q <sub>of</sub> river flow box to assess	Annual Q <sub>85</sub> river flow (m <sup>3</sup> /s)	ned (hs)	0.004		shwater EQS limits:	ed copper (µg/l)	Birmi	1	
· · · ·	Annual Q <sub>ss</sub> river flow (m <sup>3</sup> /s)	ned (hs)	0.004	Fres	shwater EQS limits: Bioavailable dissolv	ed copper (μg/l) ed zinc (μg/l)		1	
Step 2 River Impacts (Enter zero in Annual Q <sub>of</sub> river flow box to assess	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s) Impermeable road area drai Permeable area draining to	ned (hs)	0.004 3.492 3.285 0.5	Fres	shwater EQS limits: Bioavailable dissolv Bioavailable dissolv	ed copper (μg/l) ed zinc (μg/l) 1 km upstream of a	protected site	1	□ □ on? <u>№ </u> □
(Enter zero in Annual Q <sub>in</sub> (Enter zero in Annual Q <sub>in</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ast</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI)	ned (ha) outfall (ha) Hgh=>200mg CaCO3/	0.004 3.492 3.285 0.5	Fres	shwater EQS limits: Bioavailable dissolv Bioavailable dissolv discharge in or within	ed copper (μg/l) ed zinc (μg/l) 1 km upstream of a only Ambient	protected site	1 10.9 for conservation	0 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
(Enter zero in Annual Q <sub>in</sub> (Enter zero in Annual Q <sub>in</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha) Hgh=>200mg CaCO3/	0.004 3.492 3.285 0.5	Fres	shwater EQS limits: Bioavailable dissolv Bioavailable dissolv discharge in or within	ed copper (μg/l) ed zinc (μg/l) 1 km upstream of a only Ambient	protected site	1 [10.9 ] for conservation (µ	0 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
(Enter zero in Annual Q <sub>in</sub> (Enter zero in Annual Q <sub>in</sub> river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Annual Q <sub>ist</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc	ned (ha) outfall (ha) High = >200mg CaCO31 ture, lake, pond or canal iver width (m)	0.004 3.492 3.285 0.5 4 4 1 that reduces the veloce	Fres	wwater EQS limits: Bioavailable dissolv Bioavailable dissolv discharge in or within for dissolved copper of the point of discha	ed copper (µg/l) ed zinc (µg/l) 1 km upstream of a : <b>only</b> Ambient rge?	protected site	1 [10.9 ] for conservation (µ	0 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0
Step 2 River Impacts (Enter zero in Annual O <sub>60</sub> miver flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>ips</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc * Tier 1 Estimated in	ned (ha) outfall (ha) High = >200mg CaCO31 ture, lake, pond or canal iver width (m)	0.004 3.492 3.285 0.5 4 4 1 that reduces the veloce	Fres	water EQS limits: Bioavailable dissolv Bioavailable dissolv discharge in or within for dissolved copper of the point of dische	ed copper (µg/l) ed zinc (µg/l) 1 km upstream of a : <b>only</b> Ambient rge? Side	protected site background or a slope (m/m)	1 [10.9 ] for conservation (µ	। on? No on? No )
Step 2 River Impacts (Enter zero in Annual Q <sub>of</sub> river flow box to assess Step 1 runoff quality only)	Annual Q <sub>ips</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc * Tier 1 Estimated in	ned (ha) outfall (ha) High = >200mg CaCO31 ture, lake, pond or canal iver width (m)	0.004 3.492 3.285 0.5 4 4 1 that reduces the veloce	Is the unit of the second seco	water EQS limits: Bicavailable dissolv Bicavailable dissolv discharge in or within for dissolved copper of the point of discha	ed copper (µg/l) ed zinc (µg/l) 1 km upstream of a ronly Ambient rge? Side	protected site background or e slope (m/m)	1 10.9 for conservation oncentration (µ No • [	। on? No on? No )
Iten 2 River Impacts (Filer zero in Annual Q <sub>in</sub> (river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>ips</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc * Tier 1 Estimated in	ned (ha) outfall (ha) Hah=>200mz CaCO31 ture, lake, pond or canal ture, lake, pond or canal we width (m) m)	0.004 3.492 3.285 0.5 4 4 1 that reduces the veloce	Fres	water EQS limits: Bioavailable dissolv Bioavailable dissolv discharge in or within for dissolved copper of the point of discha b 007 0 Featment for	ed copper (µg/l) ed zinc (µg/l) 1 km upstream of a : <b>only</b> Ambient rge? Side	protected site background ci e slope (m/m)	1 [10.9 ] for conservation (µ	। on? No on? No )
Iten 2 River Impacts (Enter zero in Annual Q <sub>so</sub> (Enter fow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only (tep 3 Mitigation	Annual Q <sub>ips</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc * Tier 1 Estimated in	ned (ha) outfall (ha) High = >200mg CaCO31 ture, lake, pond or canal iver width (m)	0.004 3.492 3.285 0.5 4 4 1 that reduces the veloce	Fres     Is the o     Is the o     Is the o     Is the o	water EQS limits: Bioavailable dissolv Bioavailable dissolv discharge in or within for dissolved copper of the point of discha a a a a a a a a a a a a a a a a a a a	ed copper (µg/l) ed zinc (µg/l) 1 km upstream of a only Ambient rge? Side stimated effectivent stimated effectivent ricted discharge rat	protected site background of e slope (m/m) sss sec sec sec	1     [       10.9     [       for conservation (µ     Nb       Nb     •       0.5	। on? No on? No )
Step 2 River Impacts (Enter zero in Annual O <sub>60</sub> miver flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Annual Q <sub>ips</sub> river flow (m <sup>3</sup> /s) Impermeable road area drain Permeable area draining to Base Flow Index (BFI) Water hardness Is there a downstream struc * Tier 1 Estimated in	ned (ha) outfail (ha) Itan = >20mc CaCO31 ture, lake, pond or canal iver width (m) m) Brief des cription	0.004 3.492 3.285 0.5 4 4 1 that reduces the veloce	Fres	invaster EQS limits:     Bioavailable dissolv     Bioavailable dissolv     discharge in or within     for dissolved copper     of the point of discha     a 007     C     Fastment for     to     Testment for     to     the context for     the	ed copper (µg/l) ed zinc (µg/l) 1 km upstream of a only Ambient rge? Side	protected site background of slope (m/m) ess bles - sec e ( Vs ) Sec	1     [       10.9     [       for conservation (µ     Nb       Nb     •       0.5	। on? No on? No )

Step 2 wet pond and filter drains



#### Step 1: Filter drains

	EQS - Annual Average Concentration					Acute Impact							
	Copper Zinc									Fail. Try Tier 2 for Velocity			
	4.71					Copper Zinc			Settlement needed = 69 %, proposed = 60 %				
	Tier 2 (using UK TAG				Bive	Fails Toxicity					nis site is judged as:		
M-BAT tool),	or Step 3 mitigation.					Try mitigation	Pass		cumulating?	Yes Yes	0.02 Low flow Vel m/s 129 Deposition Index		
Step 3	-	-	ug/l					E	tensive?	Tes	129 Deposition Index		
_													
ad number		A460 north of J				HE Area / DBFO	number						
sessment type			assessment (single o	outfall)									
grid reference of assessmen		Easting	395955				Northing	307320					
grid reference of outfall struc	ture (m)	Easting					Northing						
tfall number			Catchment 15 Pro	posed		List of outfalls in assessment	cumulative						
ceiving watercourse		Watercourse 6											
receiving water Detailed Riv	er Network ID					Assessor and aff			D SH				
te o fassessment		09/09/2019				Version of asses	sment		1				
tes													
4.0. ((0.1))													
tep 1 Runoff Quality	AADT >=50 000	and <100 000	▼ Climat	lic regio	n Mar	m Drv 🗾	Rainfall site	R	imingham	(SAAR	750mm) <u>▼</u>		
tep 2 River Impacts	Annual Q <sub>as</sub> river flow (m <sup>3</sup> /s)		0.0	0.2	Fresh	water EQS limits							
Enter zero in Annual Qos	Impermeable road area drain	ned (ha)								D			
ver flow box to assess													
itep 1 runoff quality nly)	Permeable area draining to	area draining to outfall (ha)			1 7QR Bioavailable dissolved zinc (µg/l)								
iny)	Base Flow Index (BFI)		0.5	D	Is the d	ischarge in or with	nin 1 km upstream of	a protected s	ite for conserva	ation?	NI D		
or dissolved zinc only	Water hardness	High = >200	mg CaCO3/I	-	Fo	r dissolved cop	peronly Ambien	t background	concentration	μg/l)	Λ		
or sediment impact only	Is there a downstream struct	ure, lake, pond or ca	anal that reduces the v	elocity v	vithin 100r	n of the point of d	ischarge?		No.	D			
or seament impact only	is note a downstream struct												
or seament impact only	Stiere a downstictum stude	ver width (m)	1	<b>_</b>									
or sectment impact only	S Tine Estimated riv		1					! ( (		11	(11/12)		
or seament impact only				Ma	anning's n	0 07 D	Sid	e slope (m/m	0.5	Long sl	ope (m/m) <u>0 000</u>		
tep 3 Mitigation	S Tine Estimated riv		1	Ma	anning's n	0 07 D			0.5	Long sl	ope (m/m)		
	S Tine Estimated riv		1	Ma			E stimated effective	ness		Long sl	ope (m/m)		
	S Tine Estimated riv		1	Ma	Tr	eatment for		ness bles - S	ettlement of diments (%)	Long sl	ope (m/m) <u>nnn</u>		
	S Tine Estimated riv	n)	1	Ma	Tr	eatment for plubles (%)	E stimated effective Attenuation for solu	ness bles - S	ettiem ent of	Long sl	ope (m/m)		
ep 3 Mitigation	S Tine Estimated riv	n)	1	Ma		eatment for plubles (%) n	E stimated effective Attenuation for solu estricted discharge ra	hess bles - S tte (1/s) se	ettlement of diments (%)	Long sk	ope (m/m)		

#### Step 2: filter drains and additional ditch

	EQS - Annual Average Concentration				Acute Impact						
	Copper	Zinc				· · · · · · · · · · · · · · · · · · ·			Pas	55	
	4.71	2.04	ugil		Copper	Zinc	.				
	Tier 2 (using UK TAG							liment deposi			
M-BAT tool).	or Step 3 mitigation.				Pass	Pass		cumulating?	Yes No	0.02	Low flow Vel m/s
Step 3 Tier 1 fail. Go to	4.53	1.73	ligu				Ext	ensive?	No	48	Deposition Index
	Tier 2 (using UK TAG										
M-BAI toolj, or inc	crease Step 3 mitigation.										
Road number		A460 north of J1	1 M6		HE Area / DBFO r	number					
Assessment type		Non-cumulative a	ssessment (single outf	all)							•
OS grid reference of assessmen	t point (m )	Easting	395955			Northing	307320				
OS grid reference o foutfall struc	ture (m)	Easting				Northing					
Outfall number		Watercourse 6:	Catchment 15 Propo	sed	List of outfalls in o	umulative					
Receiving watercourse		Watercourse 6			assessment						
EA receiving water Detailed Rive	er Network ID				Assessor and affi	iation		HJ AE COM			
Date of assessment		09/12/2019			Version of assess	ment		1			
Notes											
1000											
L											
Step 1 Runoff Quality	AADT	and <100.000	Climatic r		m Day	Rainfall site	-				
	>=50.000	and <100.000		egion ///a	m Drv 🚬	Raintali site	Bir	mingham	<u>(SAAR</u>	2750m	m) 💌
Step 2 River Impacts									-		
	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0 002	Fres	Freshwater EQS limits:						
(Enter zero in Annual Qas	Impermeable road area drain	ed (ha)	2		Bioavailable dissolved copper (µg/l)						
river flow box to assess											
Step 1 runoff quality	Permeable area draining to o	utfall (ha)	0 798		Bioavailable disso	olved zinc (µg/l)	10.9 D				
only)	Base Flow Index (BFI)		0.5	D Is the o	discharge in or with	in 1 km upstream of	a protected sit	e for conserva	ation?		N. D
					-		-				
For dissolved zinc only	Water hardness	High = >200	m CaCO3/I	F	or dissolved copp	eronly Ambient	background c	oncentration	(µg/l)		Λ
For sediment impact only	Is there a downstream struct	ure, lake, pond or car	al that reduces the velo	city within 100	m of the point of di	scharge?		No.	D		
	Estimated riv	er width (m)	1								
				Manning's n	0.07 P		!				
	C Tion Bed width (m	)	2	Manning's n	0.07	510	e slope (m/m)	0.5	Long s	slope (m/n	n) <u>0 00 0</u> (n
									_		
Step 3 Mitigation						Estimated effectiver	ie ss		1		
1				Т	reatment for	Attenuation for solut	oles - Se	tlem ent of	11		
1		Briefdescription				stricted discharge ra		iments (%)			
Existing measures				0		ko restriction 👻		D	4		
Proposed measures	Filter drains on A460, and added d	itch		15	; N	ko restriction 👻	D <u>85</u>				
1											



Step one: With filter drains

	EQS - Annual Average Concentration				Acute Impact							
	Copper	Zinc							Fail. Trg Tier 2 for Velocity			
	4.82	2.41		ug/l		Copper	Zinc			rd = 84 %, proposed = 60 %		
	o Tier 2 (using UK TAG or Step 3 mitigation.					Fails Toxicity	Pass		umulating? Yes	for this site is judged as: 0.02 Low flow Vel m/s		
Mi BAT (Oui).	or step 3 intigation.			ug/l	Test.	Try mitigation	r ass		ensive? Yes			
Step 3				ugn -						Depositioningen		
Road number		m6				HE Area / DBEO n	umber		1			
Assessment type		Non-cumulative a	opport (pir			HE Alea / DBFO II	umber			-		
OS grid reference o fassessme	nt n oint (m)	Easting	395687	igie oui a	an)		Northing	307352				
OS grid reference o foutfall strue		Easting	333001				Northing	301332				
Outfall number	1.00 (III)	M6 Northbound	Outfall Catch	ment 16	proposed	List of outfalls in cu						
Receiving watercourse		Watercourse 6	ourun, outon	inone ro		assessment						
EA receiving water D etailed Riv	er Network ID					Assessor and affilia	ation		HJ AE COM			
Date of assessment		09/12/2019				Version of assess	ment		1			
Notes												
Step 1 Runoff Quality	AADT >10 000 a	and <50,000	- (	Climatic re	egion Wan	m Dry 🔫	Rainfall site	Bir	mingham (SA	4 R 750mm)		
					-							
Step 2 River Impacts	Annual Q <sub>ast</sub> river flow (m <sup>3</sup> /s)			0.002	Fresh	water EQS limits:						
(Enter zero in Annual Q <sub>95</sub> river flow box to assess	Impermeable road area drain	ied (na)		2 70		Bioavailable dissol	ved copper (µg/l)		1 D			
Step 1 runoff quality	Permeable area draining to o	outfall (ha)	fall (ha) 3,674 Bioavailable dissolved zinc (µg/l) 109 0									
only)	Base Flow Index (BFI)		□ S the discharge in or within 1 km upstream of a protected site for conservation?									
	Dase Flow Index (DFI)			15		senarge in or main	in their upstroum of	a protocioù al	e lor conservation	KL I		
For dissolved zinc only	Water hardness	High = >200	mg CaCO3/I	-	Fo	r dissolved coppe	eronlv ∆mbien	t background c	oncentration (µg/l)			
· · ·							, / /unbion	r buonground o	onoonnaaton (agn)			
For sediment impact only	Is there a downstream struct	ure, lake, pond or ca	anal that reduces	the veloc	ity within 100m	n of the point of dis	charge?		No 🔻 D			
	Estimated riv	(er width (m)		1								
		• •		1	_							
	C Tion Bed width (m	1)		3	Manning's n	0 07 D	Sid	e slope (m/m)	0.5 Lo	ng slope (m/m)		
L												
Step 3 Mitigation							Estimated effective	00.00				
					Tra		Attenuation for solu		tlem ent of			
		Briefdescription				lubles (%) res	stricted discharge ra	ate (I/s)  sed	iments (%)			
		Briefdescription										
Existing measures Proposed measures	with fiter drains	Briefdescription			0	D Na	o restriction	ete (I/s) sed	iments (%)			

Step two: filter drains and adding length of swale at base of embankment

	EQS - Annual Average Concentration			Acute Impact							
	Copper Zinc							Pass			
Step 2 Tier 1 fail. Go to	4.82 Tier 2 (using UK TAG	2.41	ug/l		Copper	Zinc			or this site is judged as:		
	or Step 3 mitigation.				Pass	Pass		umulating? Yes	0.02 Low flow Vel m/s		
	4.51	1.80	ug/l					ensive? No	0 Deposition Index		
Step 3 Tier 1 fail. Go to	o Tier 2 (using UK TAG		-5	_			•				
M-BAT tool), or in	crease Step 3 mitigation.										
Road number		M6			HE Area / DBFO n	umber					
Assessment type			assessment (single out	fall)					•		
OS grid reference of assessmen	nt point (m )	Easting	395687			Northing	307352		_		
OS grid reference of outfall struc	ture (m)	Easting				Northing					
Outfall number		M6 Northbound	Outfall, Catchment 1	6 proposed	List of outfalls in c	umulative					
Receiving watercourse		Watercourse 6			assessment						
EA receiving water Detailed Riv	er Network ID				Assessor and affili	ation		HJAECOM			
Date of assessment		09/12/2019			Version of assess	ment		1			
Notes								·			
Step 1 Runoff Quality											
step r Kunon Quanty	AADT >10 000 a	ind <50.000	<ul> <li>Climatic</li> </ul>	region \//a	m Drv 🖃	Rainfall site	Rin	minoham (SAL	AR 750mm)		
Etan 2. Diversion ante											
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.003	Fres	hwater EQS limits:						
(Enter zero in Annual Qas	Impermeable road area drain	ed (ha)	2 78		Bioavailable disso	lved conner (ug/l)		1 D			
river flow box to assess	-										
Step 1 runoff quality only)	Permeable area draining to o	utfall (ha)	3 574	1	Bioavailable dissolved zinc (µg/l)						
oniy)	Base Flow Index (BFI)		0.5	D Is the	discharge in or withi	in 1 km upstream of	a protected sit	otected site for conservation?			
For dissolved zinc only	Water hardness	High = >200	ma_CaC_O3/I	I F	or dissolved copp	er only Ambient	t background c	oncentration (µg/l)	<u> </u>		
For sediment impact only	Is there a downstream struct	ure, lake, pond or ca	nal that reduces the velo	city within 100	m of the point of dis	scharge?		No. D			
	Estimated riv	er width (m)	1								
	C Tine Bed width (m	)	2	Manning's r	0.07	Sid	e slope (m/m)	0.5 Lon	g slope (m/m)		
Step 3 Mitigation											
step 5 milligation						Estimated effectiven	ne ss				
					reatment for	Attenuation for solut		tlem ent of			
		Briefdescription			olubles (%) re:	stricted discharge ra	ite (I/s) sed	iments (%)			
Existing measures				0		o restriction	0				
Proposed measures	with fiter drains, and adding length	s of swale along base of	embankments	24		o restriction +					



#### Step one: existing filter drains

Highways England Water Risk Assessment Tool Version 2.0.4 June 2015										
		Solu	ble						Sediment	- Chronic Impact
	- Annual Average Con-					Acute Imp	act			
Copper		Zinc								ier 2 for Velocity
4.83 Step 2 Tier 1 fail. Go to Tier 2 (		2.46	uş	3/1	_	Copper	Zinc			ed = 85 %, proposed = 60 % for this site is judged as:
M-BAT tool), or Step 3						r Fails Toxicity	Pass		cumulating? Ye	
- Step 3		-	uş	9/1	Test	Try mitigation			tensive? Ye	
Road number	I	Мө				HE Area / DBFO nu	mbor			
Assissment type		Non-cumulative as	conservant (single	outfo		INC ATES / DBFO IIL	mber			
OS grid reference of assessment point (	(m)		95560	outra	(III.)		Northing	307169		<u>`</u>
OS grid reference of outfall structure (m		Easting	35500				Northing	307103		
Outfall number	,	M6 Southbound:	Cetchment 17 r		sed	List of outfalls in cu			43717	
Receiving water course		Watercourse 6	Catchinent 17 p	n opo	iseu	assiess ment		_	457.17	
EA receiving water Detailed River Netwo	ark ID	Watercourse o				Assessor and affilia	tion		DSH	
Date of assessment		09/09/2019				Version of assessm			1	
Notes		00/00/2010							P	
Step 1 Runoff Quality AADT	>10,000 and <50	1,000	Clims	atic reg	gion Warm D	ky 💌	Rainfall site	Birm	ingham (SAAR750mm)	
Annus Annus	I Q <sub>as</sub> river flow (m <sup>3</sup> /s)		0.002	2	Fres	water EQS limits:				
(Enter zero in Annual Q <sub>95</sub> Impen river flow box to assess	meable road area drain	ed (ha)	3.964			Bioavailable dissolve	ed copper (μg/l)		1	
Step 1 runoff quality only) Perme	able area draining to o	outfall (ha)	4.169		Bioavailable dissolved zinc (µg/l)					
Base I	Flow Index (BFI)		0.5		Is the d	ischarge in or within	1 km upstream of a	protected site	for conservation?	No 💌 🗈
For dissolved zinc only Water	hardness	High = >200mg CaCO3/		•	- Fe	or dissolved copper	only Ambient	background c	oncentration (µg/I)	4
For sediment impact only Is the	e a downstream structu	ure, lake, pond or canal	that reduces the ve	elocity	within 100m	of the point of dischar	rge?		No 🔹 🗈	
@ Tie	1 Estimated riv	ver width (m)	1							
ांग	2 Bed width (m	1)	3		Manning's n	0.07 D	Side	e slope (m/m)	0.5 Le	ong slope (m/m) 0.0001
Step 3 Mitigation										
							timated effectiven			
		Brief description					ttenuation for solul ricted discharge ra		ettlement of diments (%)	
Existing measures					0	D Nor	restriction -	D 0	D	
Proposed measures Existin	g filter drains				0	D Nor	restriction -	0 60	<u> </u>	
									'	

Step two: filter drains and adding length of swale at base of embankment

EQS - Annual Average Concentration				Acute Impact							
	Copper	Zinc						Pass			
	4.83	2.46	ugil	Copper	Zinc						
	Tier 2 (using UK TAG				Pass		diment deposition cumulating? Yes		s judged as: Low flow Vel m/s		
M-BAT toolj.	or Step 3 mitigation.	1.84		Pass	Pass		cumulating? Tes tensive? No		Low How Vel m/s Deposition Index		
Step 3 Tier 1 fail Go to	4.52 Tier 2 (using UK TAG	1.84	ugil			E	tensive?		J Deposition index		
	crease Step 3 mitigation.										
		la se		Lus i usses			1				
Road number		M6		HE Area / DBFO nur	mber						
Assessment type	4 1 - 4 - 5	Non-cumulative assess			N				-		
OS grid reference of assessmer	<u> </u>	Easting 395560				807169					
OS grid reference of outfall struc	ture (m)	Easting			Northing						
Outfall number		M6 Southbound: Catch	ment 17 propose	d List of outfalls in cun assessment	nulative		43717				
Receiving watercourse		Watercourse 6									
EA receiving water D etailed Riv	er Network ID			Assessor and affiliat			D SH				
Date of assessment		09/09/2019		Version of assessme	ent		1				
Notes											
Step 1 Runoff Quality											
otop i Hunon quanty	AADT >10 000 :	and <50.000 🔄	Climatic regio	Mam Dry	Rainfall site	Ri	minaham (SA	Δ R 750mr	m) 💌		
Step 2 River Impacts											
step z River impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0 002	Freshwater EQS limits:							
(Enter zero in Annual Q <sub>as</sub>	Impermeable road area drair	ed (ha)	3 064	Bioavailable dissolve	ad copper (ug/l)		1 D				
river flow box to assess				Dicavallable dissolve							
Step 1 runoff quality	Permeable area draining to a	outfall (ha)	4 169	Bioavailable dissolve							
only)	Base Flow Index (BFI)		0.5	Is the discharge in or within	1 km upstream of a	protected si	te for conservation	2	N D		
				······				·	- NI		
For dissolved zinc only	Water hardness	High = >200 mg Ca	CO3/I -	For dissolved copper	only Ambient	ackground o	concentration (µg/l		1		
· · · · · · · · · · · · · · · · · · ·											
For sediment impact only	Is there a downstream struct	ure, lake, pond or canal that	reduces the velocity	within 100m of the point of discl	harge?		No. D				
	Estimated riv	or width (m)	1								
	S Tion Estimated in	er width (m)									
	C Tion Bed width (m	)	<u>٦</u> М	anning's n 0 07 D	Side	slope (m/m)	0.5 Lo	ng slope (m/n	n) 0 000		
(L											
Step 3 Mitigation				-							
					stimated effective ne						
					ttenuation for solub l ricted discharge rate		tettlement of diments (%)				
		Briefdescription			include anothing of full						
Existing measures				0 D Nor	estriction 👻	D 0	D				
Proposed measures	Existing filter drains, and adding le	ngths of swale at base of embankr	nent	25 No r	estriction -	D 10					



#### Road Catchments 15 +16 +17

With swales at base of embankment for catchments 15 and 16. Ratios used to calculate 23% mitigation from swales on 16 and 17, and roadside ditch on 15).

highways england	Highways England Water Risk Assessment Tool Version 2.0.4 June 2019										
		Soluble						Sediment	- Chronic Impact		
Step 2 Tier 1 fail. Go to M-BAT tool), e Step 3 Tier 1 fail. Go to	EQS - Asseal Average Conc opper 5.72 Titer 2 (esing UK TAG v Step 3 mitigation. 5.20 Titer 2 (esing UK TAG creares Step 3 mitigation.	centration Zinc 5.08 3.31	ug/l ug/l	River Fails Toxicity Test. Try more Pass		Λ.	Sediment deposition for this site is indged Accemulating? Low flow Extensive? Deposit				
Road number					HE Area / DBFO nu			1			
Assessment type		A460/M6									
OS grid reference of assessment	t a sint (as)	Cumulative assessment excl Easting 395560	uding sedim	ents (outfalls	s between 100m an	Northing	307169		<u> </u>		
OS grid reference of outfall stru		Easting 380000				Northing	307109				
Outfall number	ciale (m)	Catchment 15 16 17 Prop	and		List of outfalls in ou		15	16	17		
Receiving water course		Watercourse 6	osed		assessment	mulative	10	10	17		
EA receiving water Outse	er Network ID	Watercourse o			Assessor and affilia	tion		DSH			
Date of assessment		09/09/2019			Version of assessm			1			
Notes		03/03/2013			version of assessin			l'			
Step 1 Runoff Quality	AADT >=50,000 and <10	00,000 -	Climatic re	gion Warm D	iry 💽	Rainfall site	Birmir	ngham (SAAR 750mm)			
Step 2 River Impacts	Annual Q <sub>95</sub> river flow (m <sup>3</sup> /s)		0.002	Fresh	water EQS limits:				]		
(Enter zero in Annual Qos	Impermeable road area draine	ed (ha)	9.744		Bioavailable dissolve	ed cooper (ug/l)		1			
river flow box to assess			8.451			10.9					
Step 1 runoff quality only)	Permeable area draining to or	uttali (na)	0.401		Bioavailable dissolve	ed zinc (µg/l)		10.9			
	Base Flow Index (BFI)		0.5	<ul> <li>Is the d</li> </ul>	ischarge in or within '	1 km upstream of a	a protected site	for conservation?	No 🔹 🖻		
For dissolved zinc only	Water hardness	High = >200mg CaCO3/	•	Fo	or dissolved copper	only Ambient	t background co	oncentration (µg/I)	4		
For sediment impact only	Is there a downstream structu	ure, lake, pond or canal that reduce	s the velocity	within 100m	of the point of dischar	rge?		No 💌 D			
	* Tier 1 Estimated rive	er width (m)	5								
	© Tier 2 Bed width (m)	)	3	Manning's n	0.07 D	Sid	e slope (m/m)	0.5 Lo	ong slope (m/m)		
Step 3 Mitigation					Es	timated effectiven	ess				
				Tr	eatment for A	ttenuation for solu	bles - Se	ttlement of			
		Brief description		solubles (%) restricted discharge rate (Vs.) sediments (%)							
						restriction -					
Existing measures	In partice of purch for participar	-110					0 0	<u> </u>			
Proposed measures	lengths of swale for catchments 15 ar	nd 10		23	Nor	restriction -		1 9			

Sensitivity analysis of cumulative catchment 15 + 16 + 17 using watercourse 6 downstream Q95 value. WC 1: 4.76



Screenshot of MBAT spreadsheet with the following ambient Copper EQSs added:

- WC 1: 4.76 µg/l
- WC 4: 3.34 µg/l
- WC 5: 3.68 µg/l
- WC 6: 3.86 µg/l
- MBAT screen shot

