# A83 Rest and Be Thankful

## LTS EIAR VOLUME 4, APPENDIX 19.5 - WATER QUALITY ASSESSMENT

Transport Scotland

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# A19-5. Surface Water Resources and Water Quality Assessment

## A19-5.1. Introduction

A19-5.1.1. This technical appendix provides the assessment of potential impacts (construction and operational) on surface water resources and water quality, in respect of the Proposed Scheme (Chapter 4: The Proposed Scheme) and the Proposed Scheme drainage design; within the context of relevant legislation, policy and guidance, Volume 4 Appendix 19.1 Road Drainage and Water Environment Legislation, Policy and Guidance.

A19-5.1.2. Potential impacts are assessed cognisant of embedded mitigation, Section A19-5.6. Residual effects are then identified, and consideration is given to any requirement for specific mitigation measures to avoid, minimise, restore or offset these.

## A19-5.2. Legislation, Policy, and Guidance

A19-5.2.1. Legislation, policy, and guidance relevant to the assessment of potential impacts on surface water resources and water quality, construction and operational, is described in Volume 4, Appendix 19.1 Road Drainage and the Water Environment Legislation, Policy and Guidance.

A19-5.2.2. The European Union (EU) Water Framework Directive (WFD) is the principal driver for the assessment of potential impacts on water quality; under which the status of water is assessed using a range of quality indicators (physico-chemical, biological and hydromorphological), to give a holistic assessment of aquatic ecological health.

A19-5.2.3. The WFD includes five quality classes (High, Good, Moderate, Poor and Bad) and establishes a requirement to identify and monitor a range of existing pressures on water bodies which may threaten the objectives of the WFD. The

objective of the WFD is for all water bodies to achieve or maintain an overall status of 'good' by 2027.

A19-5.2.4. Guidance on the requirements for assessment and management of the impacts that road projects can have on the water environment is provided in the Design Manual for Roads and Bridges (DMRB) document, LA 113 (LA 113); and is supported by Scottish Environment Protection Agency (SEPA) guidance document WAT-SG-53 which provides guidance on environmental and discharge standards for surface water; and regulatory method WAT-RM-08 which provides guidance on the regulation of surface water discharges from built developments including roads. Further guidance on the control of water pollution is also provided in the Construction Industry Research and Innovation Association (CIRIA) documents, C532 and C648.

## A19-5.3. Assessment Methods

### Surface Water Resources

A19-5.3.1. Potential impacts on surface water resources (public and private water supplies) have (informed by baseline data) been evaluated qualitatively based on a source-pathway-receptor (SPR) approach to determine potential hydrological linkages between construction of the Proposed Scheme and water supply sources (public mains/surface abstractions), supply infrastructure (e.g. pipework) and supplies (e.g. properties and taps, etc).

### Water Quality

A19-5.3.2. For construction the assessment is based on qualitative values.

A19-5.3.3. For operation, DMRB-compliant routine runoff and accidental spillage assessments were undertaken for the A83 mainline (not for the temporary improvements to the OMR), in accordance with LA 113.

## HEWRAT Routine Runoff Assessment

A19-5.3.4. The assessment of routine runoff is comprised of a Highways England [now National Highways] Water Risk Assessment Tool' (HEWRAT) assessment and an Environmental Quality Standards (EQS) assessment, described below:

- HEWRAT Assessment: a Microsoft Excel application that assess the short-term (related to the intermittent nature of road runoff) risks associated with temporary 'acute' (soluble) and permanent 'chronic' (sediment bound) pollution impacts on aquatic ecology.
- EQS Assessment: the maximum permissible annual average concentrations of potentially hazardous chemicals, defined under the WFD. Long-term risks over the period of one year are assessed by comparing the assessed annual average concentration of pollutants within discharges with published EQS for those pollutants, e.g. copper and zinc.

A19-5.3.5. Both assessments require data pertaining to Proposed Scheme points of discharge into receiving watercourses, permeable and impermeable areas of drainage networks, traffic volumes, $Q_{95}$ flows (flow exceeded 95 % of the time), and channel dimensions including bed width, side slope and slope.

A19-5.3.6. HEWRAT is a tiered consequential system which involves up to three assessment stages:

- Step 1 determines pollutant concentrations in surface runoff without sustainable drainage systems (SuDS) mitigation or in-river dilution
- Step 2 determines in-river pollutant concentrations after in-river dilution and dispersion without SuDS mitigation and
- Step 3 considers the in-river pollutant concentrations with active SuDS mitigation.

A19-5.3.7. Outfalls are first assessed on an individual (non-cumulative) basis and must pass both the soluble pollutants and sediment-bound pollutants aspects of the assessment. HEWRAT also applies for any cumulative assessments (two types noted below) dependent on the relative proximity of outfalls:

- Cumulative assessment including sediments (outfalls within 100m) and
- Cumulative assessment for solubles only (outfalls between 100m and 1km apart).

A19-5.3.8. For soluble pollutants, HEWRAT calculates in-river concentrations of soluble copper and zinc for approximately 1000 stochastically generated rainfall events. For each rainfall event, the calculated soluble copper and zinc concentrations are compared with in-built thresholds, and the number of exceedances across the 1000 rainfall events calculated. This is then compared with in-built exceedance thresholds, which vary depending on whether there are sensitive sites such as Sites of Special Scientific Interest (SSSI) located downstream of the proposed discharge location. For less sensitive locations it is considered acceptable for the 24 hour copper and zinc concentration thresholds to be exceeded twice a year on average, however if a SSSI was located within 1km downstream of the discharge, the number of exceedances considered acceptable in a year on average, would be halved to once per year. The number of exceedances determines whether the proposed discharge passes or fails the soluble pollutants aspect of the assessment.

A19-5.3.9. For sediment-bound pollutants, the ability of the receiving watercourse to disperse sediments is considered and, if sediment is expected to accumulate, the potential extent of sediment coverage is also considered. The HEWRAT assessment estimates the river velocity under low flow conditions and assumes that sediment arriving in the river when the velocity is less than 0.1m/s accumulates. A basic estimation of velocity is calculated iteratively using the cross-sectional area of the river channel and the flow volume during low flow conditions. The extent of deposition is evaluated by calculating the deposition index (DI) value. As such, to pass the sediment assessment within HEWRAT, the discharge under assessment must pass both the solubles and sediments aspects.

A19-5.3.10. Where failures occur, mitigation measures in the form of SuDS should be considered. The pollutant removal efficiency (expressed as a percentage reduction in pollutant concentration) of the SuDS treatment-train can then be

applied to the calculations and the assessment re-run. Where necessary, the drainage design is modified until each of the drainage networks achieves an overall assessment 'pass' for all aspects of including

A19-5.3.11. Indicative treatment efficiency values applied within the assessment are based on those documented [*Table 8.3.2 N1 Pollution and flow control measures options*, CG501] and summarised in Table 19-5.1, below, specific to measures identified for the Proposed Scheme.

**Table 19-5.1 Indicative Treatment Efficiencies of Drainage systems**

| Name of measure and indicative treatment efficiencies | Suspended Solids (% removal) | Dissolved Copper (% removal) | Dissolved Zinc (% removal) |
|---|---|---|---|
| Filter drain | 60 | 0 | 45 |
| Dry detention basin | 50 | 0 | 0 |

A19-5.3.12. HEWRAT also calculates the annual average concentration (AAC) of soluble copper and soluble zinc for the proposed discharge; these are then compared with published EQS (below) to determine pass or failure of the EQS assessment:

- Copper: an AAC of 1 µg/l for bioavailable copper and
- Zinc: an AAC of 10.9 µg/l for bioavailable zinc.

A19-5.3.13. Comparing these calculated values with the bioavailable EQS generally indicates this process provides a very conservative assessment of the routine runoff impacts, with a degree of comfort in the Method A assessment. In exceptional circumstances this approach can be overly conservative leading to very onerous mitigation requirements, particularly as the bioavailable proportion of soluble metals (which can cause toxic effect) is often substantially lower than the total soluble value calculated in HEWRAT.

### Accidental Spillage Assessment

A19-5.3.14. The LA 113 Appendix D Spillage Assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:

- the probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway and
- the probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

A19-5.3.15. The probability of a serious spillage occurring is dependent on factors including; traffic volumes, percentage of heavy goods vehicles in the traffic volumes, whether the road is motorway, rural or urban trunk road, the road type categories within the road drainage catchment under assessment i.e. 'no junction', 'slip road', 'crossroad' or 'roundabout' and the length of each road type within the catchment. The probability, of a serious spillage subsequently causing a serious pollution incident, is dependent on the proximity of a receiving surface water body and the response time of the emergency services, i.e. less than 20 minutes, less than one hour, or greater than one hour.

A19-5.3.16. An annual probability of 1% (i.e. a 1 in 100 chance of a serious pollution incident occurring in any one year) is typically considered an acceptable risk; however, where an outfall discharges within 1km of a sensitive receptor such as a nationally designated conservation site e.g. a SSSI, a higher level of protection is required, such that the risk has no greater annual probability than 0.5% i.e. a 1 in 200 chance of occurring in any one year.

### Limitations

A19-5.3.17. The following limitations in the use of HEWRAT are acknowledged:

- HEWRAT uses two-way Annual Average Daily Traffic (AADT) volumes in the estimation of pollutant build-up on the road, where AADT data is entered in broad bands of 10,000 to 50,000, 50,000 to 100,000, and >100,000. Given that the (high estimate) AADT for the Proposed Scheme

of 8,948 is less than the lowest traffic band, overestimation of the pollutant concentrations in the road runoff is likely.

- Treatment percentages returned by HEWRAT are very precise, however the guidance on the treatment efficiency of SuDS provided in CG501 can only be used as broad indicator of performance; therefore a degree of pragmatism is needed when designing and assessing road drainage networks and treatment-trains.
- It is necessary to select a rainfall site from an embedded list of 21 sites across the UK, of which only three are in Scotland. The closest and most representative site is Ardtalnaig (near Aberfeldy). The standard annual average rainfall (SAAR) at Ardtalnaig is given as 1343.9mm; however, a review of National River Flow Archive (NRFA) rainfall data in proximity to the Luss Water at Luss monitoring station ~ 17km to the northwest, indicates that the SAAR for the Proposed Scheme is approximately 3000mm. This difference means that flows from road drainage networks and within receiving watercourses are being underestimated (with associated higher dilution levels), leading to pollutant concentration levels being overestimated; though this should provide a more conservative assessment.
- Recognising that the carriageway treatment area (CTA) for Proposed Scheme drainage network 1 – as described Volume 4, Chapter 4, The Proposed Scheme - will largely be under the cover of the debris flow shelter (DFS), it is considered that this area may only receive a third of any precipitation; as such, the rainfall site used to assess the discharge from Network 1 is Keighley, which has a SAAR value of 1000mm. This theoretical level of precipitation input may be higher than realised, if so, lower precipitation inputs would increase contaminant concentration levels, due to lower dilution within drainage network. This potential elevation in contaminant levels is likely partially or wholly offset by the more conservative aspects of the process undertaken, listed above.

## A19-5.4. Baseline Conditions

A19-5.4.1. Baseline conditions of sensitive (surface water resources and water quality) receptors (including private water supplies (PWS) and watercourses) considered to be at risk of potential construction and operational impacts, because of the Proposed Scheme, are detailed Volume 4, Appendix 19.3 Road Drainage and the Water Environment, Baseline.

A19-5.4.2. Baseline sensitivities, described below, have been determined using the importance criteria within Table A19-2.1, Volume 4, Appendix 19.2 Road Drainage and the Water Environment, Methodology.

### Surface Water Resources

A19-5.4.3. The nearest public mains water supply in proximity to the Proposed Scheme is near Arrochar, approximately 7km southeast; as such, public water supplies have been scoped out of the assessment of impacts.

A19-5.4.4. A PWS was identified at High Glen Croe serving a single property at the head of Glencroe. This PWS is sourced from a watercourse with a catchment on the southeast aspect of Beinn Luibhean.

A19-5.4.5. At the time of writing in August 2024, the exact location of the PWS source is unconfirmed, with a site visit to confirm the details delayed at landowner request, conservative assumptions for this PWS have been applied whilst verification is awaited. It is understood to be located downstream of the existing A83, with the location of associated infrastructure between the existing source and the supply property, also currently unconfirmed.

A19-5.4.6. The existing A83 does not have formal treatment of surface runoff, this results in untreated over-edge runoff passing on to adjacent hillslope and entering watercourses. This includes channels upslope of the High Glen Croe property, the assumed surface water source of the PWS. As the High Glen Croe PWS serves a single property, the baseline sensitivity is assessed as medium.

### Water Quality

A19-5.4.7. The Croe Water, which is the only WFD watercourse identified with a Proposed Scheme discharge, received an overall WFD classification of Moderate (2022); as such, the sensitivity of the Croe Water is assessed as high.

A19-5.4.8. All remaining watercourses (tributaries to the Croe Water and Kinglas Water, flowing into Loch Restil) that would receive Proposed Scheme discharges are therefore considered to have a baseline sensitivity of medium.

A19-5.4.9. The watercourses crossed by the OMR are generally tributaries of the Croe Water, with one crossing of the Croe Water channel.

**Table 19-5.2 Watercourse Baseline Conditions**

| Drainage Network | Receiving Watercourse | Baseline Importance/Sensitivity |
|---|---|---|
| 1 | Croe Water (A83_015) | High |
| 2A | Tributary of Croe Water (A83_29) | Medium |
| 2B | Tributary of Croe Water (A83_31) | Medium |
| 3A | Tributary of Kinglas Water | Medium |
| 3B | Tributary of Kinglas Water (A83_34) | Medium |
| 3C | Tributary of Kinglas Water | Medium |

A19-5.4.10. As per surface water resources, the existing A83 and OMR do not have formal treatment of surface runoff, this results in untreated over-edge runoff passing on to adjacent hillslope and entering watercourses.

## A19-5.5. Proposed Scheme Drainage Design

A19-5.5.1. Drainage of the existing A83 is 'over-the-kerb' with no provision of a formal SuDS and therefore no treatment for the removal of soluble and sediment-bound pollutants. The Proposed Scheme drainage design and strategy, including assumptions, constraints and departures from standard, are detailed within Volume 4, Chapter 4, The Proposed Scheme.

A19-5.5.2. Carriageway runoff shall be separately managed to DFS roof, hillslope and watercourse flows, with the former being discussed in terms of treatment below. The roof drainage, intercepted hillslope and watercourse channels shall be collected and transferred downslope without mixing with potentially contaminated carriageway runoff.

A19-5.5.3. The Proposed Scheme for A83 upgrade has six drainage networks collecting carriageway runoff (Table 19-3 and Volume 3, Figure 19-3 The Proposed Scheme and Watercourses); each consisting of permeable and impermeable areas. Once treated, routine runoff is discharged into the nearest watercourse where it is diluted and dispersed.

A19-5.5.4. The OMR improvements shall continue to convey runoff without formal treatment to nearest surface water channel.

A19-5.5.5. Recognising spatial and topographical constraints, the Proposed Scheme drainage networks have been designed to be compliant (so far as reasonably practicable) with statutory requirements; whereby in Scotland, "*it is generally considered that two levels of SUDS are expected by SEPA prior to discharge, and three levels may be required for particularly sensitive receptors*" (LA 113) to control and treat surface water runoff, where feasible.

A19-5.5.6. Discussions held with SEPA (during the development of the DMRB Stage 3 design) highlighted the challenging topography surrounding the Proposed Scheme, with betterment agreed as provided by a single level of (SuDS) treatment that meets the HEWRAT 'Pass' threshold, in comparison to the currently untreated runoff generated by the existing A83. Additional treatment is

considered to introduce higher risk to the water environment, in terms of substantial earthwork requirements on steep slopes, during construction. Table 19.5-3 notes discharge locations for operational runoff from the A83.

A19-5.5.7. These discussions with SEPA also outlined that OMR improvements were not being undertaken to meet DMRB LA 113 standards, given the temporary function of this upgraded road and intention to minimise engineering works. The OMR improvements will continue to collect and transfer runoff to nearby surface water channels, with no formal treatment installed. Due to temporary traffic use, the OMR drainage networks have not been assessed for discharge compliance with LA113 standard, but proposed works are overall deemed to be a betterment compared to existing conditions

A19-5.5.8. The Active Travel Route incorporated into the Proposed Scheme adjacent to the B828 has a number of dedicated drainage networks (4A-4G), this function is not applicable for assessment against LA113 standard.

**Table 19-5.3 Proposed A83 Drainage Networks**

| Drainage Network No. | SuDS | Receiving Watercourse | Outfall (Easting) | Outfall (Northing) | Network Description |
|---|---|---|---|---|---|
| 1 | Detention Basin | Croe Water (A83_015) | 223994 | 705861 | Gully under DFS, draining to detention basin and discharging to Croe Water |
| 2A | Filter Drain | A83_29, Tributary of Croe Water | 223469 | 707202 | Filter drain discharging to tributary of Croe Water |
| 2B | Filter Drain | A83_31, Tributary of Croe Water | 223343 | 707344 | Filter drain discharging to tributary of Croe Water |
| 3A | Filter Drain | Tributary to Loch Restil | 222970 | 707497 | Filter drain discharging to tributary of Loch Restil (Kinglas Water) |
| 3B | Filter Drain | A83_34, Tributary to Loch Restil | 222977 | 707546 | Filter drain discharging to tributary of Loch Restil (Kinglas Water) |
| 3C | Filter Drain | Tributary to Loch Restil | 222991 | 707682 | Filter drain discharging to tributary of Loch Restil (Kinglas Water) |

## A19-5.6. Impact Assessment

A19-5.6.1. Potential impacts (construction and operational), on surface water resources and water quality, are assessed cognisant of embedded mitigation e.g. embedded design features and compliance with good practice guidance, relevant legislation and regulations; without which, consent for the construction and operation of the Proposed Scheme could not be obtained.

A19-5.6.2. As regards potential impacts described below, the magnitude of impact has been determined using the criteria within Table A19-2.3, Volume 4, Appendix 19.2 Road Drainage and the Water Environment, Methodology; and significance of effect has determined using the criteria within Table A19-2.4, Volume 4, Appendix 19.2 Road Drainage and the Water Environment, Methodology.

### Construction Impacts

A19-5.6.3. Impacts during construction are temporary, however they can result in permanent effects e.g. on the quality of a surface water resource, with potential implications for aquatic ecology and riparian habitats.

A19-5.6.4. Construction impacts are attributable to the activities carried out to construct the Proposed Scheme. Typical activities include site clearance, demolition, operation of site welfare facilities, disposal of waste, storage and handling of chemicals/fuels, plant movements, site deliveries, earthworks excavations, storage of soils, asphalt and concrete works, installation and erection of structures (e.g. culverts and bridges), and discharge of construction surface runoff.

A19-5.6.5. Silt and sediment-laden surface runoff, generated by construction activities such as soil stripping and earthworks excavations, can have a detrimental impact if allowed to enter watercourses untreated. Fine sediments can increase water turbidity and smother stream beds, affecting water quality and causing harm to fish, aquatic invertebrates and plants by interfering with feeding, respiration and spawning. The effects of sediment release can also extend considerable distances downstream.

A19-5.6.6. During construction, pollution pathways (linkages between sources and receptors) typically include formalised temporary construction SuDS and informal uncontrolled/accidental discharges e.g. those which enter the water environment without passing through a temporary construction SuDS.

A19-5.6.7. Furthermore, spillages of pollutants such as oils, fuels, concrete, cement/cement-wash and sewage from construction sites, storage compounds and welfare facilities can occur during construction. Oils can form a film on the surface of water and can coat organisms, blocking respiration, photosynthesis and feeding. Biodegradation of oils in aquatic systems can further lead to oxygen depletion; and many hydrocarbons are toxic, persistent and bioaccumulate in the environment i.e. they build-up in the body tissue both directly and from feeding on other contaminated organisms. Concrete and cement are also highly alkaline and harmful to aquatic organisms if the pH of receiving waters is altered.

A19-5.6.8. Construction impacts on PWS, typically include impacts on the quality and quantity of a resource where construction activities have the potential to affect sources i.e. points of abstraction and supply infrastructure i.e. pipelines, or both. Furthermore, construction activities such as earthworks excavations and dewatering, can have temporary and permanent impacts on surface resources, where these are hydrologically dependent on groundwater flows; whilst pollution associated with construction contaminants e.g. sediments, chemicals/fuels, can also have temporary and permanent impacts on the quality of a PWS source.

### Embedded Mitigation

A19-5.6.9. Embedded mitigation is the individual measures adopted to avoid, minimise, restore or offset potentially adverse impacts on surface water resources and water quality; and is a key consideration at all life-stages of a project including throughout design, construction and operation.

A19-5.6.10. Earthworks for the Proposed Scheme cross steep and unstable slopes, over an extended construction timeframe, in an area subject to intense and prolonged rainfall events, with effective sediment management is a key issue.

A19-5.6.11. During construction, the contractor shall be responsible for identifying and locating all assets associated with the High Glen Croe PWS prior to construction; and for protecting the quality, quantity and continuity of the PWS during this period.

A19-5.6.12. A full list of embedded mitigation measures is provided in Chapter 19, Road Drainage and the Water Environment (Table 19-1).

### Surface Water Resources

A19-5.6.13. Proposed Scheme construction activities could result in temporary impacts on the quality and quantity associated with the High Glen Croe PWS, taking a precautionary approach (based on assumptions and unconfirmed supply details) at the time of writing.

A19-5.6.14. Cognisant of embedded mitigation, the magnitude of potential impacts on the High Glen Croe PWS (medium sensitivity) during construction is assessed as moderate adverse, with a moderate adverse (significant) effect.

### Water Quality

A19-5.6.15. Proposed Scheme construction activities could result in temporary or permanent impacts on watercourses and the wider Croe Water catchment, with particular concern in relation to sediment management on the tributary channels of the Croe Water which are directly crossed by the A83 mainline where the planned debris flow shelter shall be installed.

A19-5.6.16. Loch Restil is downstream of the Kinglas Water tributary channels that are crossed in the area north of the R&BT Car Park, these locations have less complicated earthworks (outwith DFS zone), limited to carriageway and improvements.

A19-5.6.17. Cognisant of embedded mitigation, the magnitude of potential impacts on the Croe Water (high sensitivity) during construction is assessed as moderate adverse, with a large adverse (significant) effect.

A19-5.6.18. Taking account of embedded mitigation, the magnitude of potential impacts on the tributary watercourses of the Croe Water (medium sensitivity) during construction is assessed as major adverse, with a moderate adverse (significant) effect.

A19-5.6.19. With embedded mitigation, the magnitude of potential impacts on the tributary watercourses of the Kinglas Water (medium sensitivity) during construction is assessed as minor adverse, with a slight adverse (non-significant) effect.

A19-5.6.20. Applying embedded mitigation to the inflowing tributary watercourses within the upper Kinglas Water catchment, the magnitude of potential impacts on Loch Restil (high sensitivity) during construction is assessed as minor adverse, with a moderate adverse (significant) effect.

### Operational Impacts

A19-5.6.21. Operational effects relate to ongoing use of the Proposed Scheme, with key concerns relating to routine runoff and accidental spillages by vehicles on the A83 carriageway, with the OMR Improvements not designed to the LA 113 standard given their temporary function and minimal interventions planned.

### Embedded Mitigation

A19-5.6.22. As for construction, embedded mitigation is the individual measures adopted to avoid, minimise, restore or offset potentially adverse impacts on surface water resources and water quality. During operation, embedded mitigation is considered to encompass the SuDS measures that have been incorporated into the design of the Proposed Scheme (A83 mainline) to avoid adverse impacts and effects on water quality from routine runoff and accidental spillages.

### Surface Water Resources

A19-5.6.23. As for construction, operational activities could also result in temporary/permanent impacts on the quality and quantity associated with the High Glen Croe PWS. With filter drains providing treatment as part of the Proposed Scheme design, this will improve the quality of runoff from the A83 carriageway. However, the drainage design for Networks 2A and 2B shall outfall to discrete locations including channels upslope of the assumed source for the High Glen Croe PWS. This runoff may intermittently have elevated levels of contaminants associated with A83 road operations and maintenance activities.

A19-5.6.24. Cognisant of embedded mitigation, the magnitude of effect on High Glen Croe PWS (medium sensitivity) is assessed as minor adverse, with a slight adverse (non-significant) effect.

### Water Quality

A19-5.6.25. The assessment of routine runoff to surface waters from the A83 carriageway has been undertaken using the three-step HEWRAT method described Volume 3, Appendix 19.3 Road Drainage and the Water Environment Baseline. This establishes that, if the toxicity levels, in respect of Copper/Zinc yield an assessment ‘pass’ at any step relative to the respective environmental quality standards (EQS), no further assessment is required. In cases where a ‘‘failure’’ has been predicted during Step 2, mitigation has been applied at Step 3 and if necessary, Step 3 is repeated with ‘enhanced’ treatment options until all failures are eliminated.

A19-5.6.26. The assessment is comprised of an assessment of individual outfalls and a cumulative assessment any outfalls within 100 m.

A19-5.6.27. Results from the HEWRAT assessment of routine runoff are summarised Table 19-5.4 and screenshots images of assessment outputs are provided Section A19-5.10. In summary, all individual and cumulative outfalls pass the relevant HEWRAT assessment criteria for acute and chronic impacts; demonstrating the

positive effect Proposed Scheme SuDS will provide, in comparison with currently untreated discharges.

A19-5.6.28. Cognisant of embedded mitigation and consideration of catchment-wide effects, the potential magnitude of impact from routine runoff on the Croe Water (high sensitivity) is assessed as moderate beneficial, assessed as a moderate beneficial (significant) effect. For the tributary watercourses of the Croe Water and Kinglas Water (both medium sensitivity) as well as for Loch Restil (high sensitivity) taking account of both individual and cumulative assessments, there is a magnitude of impact of minor beneficial with a slight beneficial (non-significant) effect.

A19-5.6.29. The accidental spillage assessment method (Volume 3, Appendix 19.3 Road Drainage and the Water Environment Baseline) 'estimates the risk that there will be an incident causing the spillage of a potentially polluting substance somewhere on the length of road being assessed. It then calculates the risk, assuming a spillage has occurred, that the pollutant will reach and impact on the receiving watercourse or groundwater'. Furthermore, DMRB LA 113 also states the following in relation to the level of assessed risk:

- for risk of a serious pollution incident to be acceptable the calculated annual probability of such an incident shall not be greater than 1% and
- for risk of a serious pollution incident to be acceptable the calculated annual probability shall not be greater than 0.5% where spillage has the potential to affect a: 1) SSSI; 2) source protection zones (SPZ); 3) protected area; 4) drinking water supply; or 5) commercial activity abstracting from the watercourse.

A19-5.6.30. Results from the assessment of accidental spillages from the A83 carriageway are summarised Table 19-5.5 and screenshots images of assessment outputs are provided SectionA19-5.10. In summary, all proposed A83 outfalls returned an accidental spillage percentage (ASP) substantially below 0.5% (200 year return period), which is considered the threshold for having a potential effect on a designated/protected site, e.g. Loch Restil, within Beinn an Lochain SSSI.

A19-5.6.31. Cognisant of embedded mitigation and consideration of catchment-wide effects the potential magnitude of impact from accidental spillage, with these measures in place and A83 carriageway drainage directed via SuDS, the impact on the Croe Water (high sensitivity) is assessed as minor beneficial, with a slight beneficial (non-significant) effect. For tributary watercourses of the Croe Water and Kinglas Water (both medium sensitivity) and for Loch Restil (high sensitivity) there is an equivalent magnitude of impact of minor beneficial, all with a slight beneficial (non-significant) effect.

**Table 19-5.4 HEWRAT (Step 3) Routine Runoff Assessment**

| Drainage Network | Soluble (EQS) Annual Average Dissolved Copper - Value (µg/l) | Soluble (EQS) Annual Average Dissolved Copper - Pass/Fail | Annual Average Dissolved Zinc - Value (µg/l) | Annual Average Dissolved Zinc - Value (µg/l) – Pass/Fail | Acute Impact - River Toxicity Test Pass/Fail (Copper) | Acute Impact - River Toxicity Test Pass/Fail (Zinc) | Sediment (Chronic) Impacts Assessment | Low Flow Value (m3/s) | Deposition Index | Magnitude of Impact | Significance of Effect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.25 | Pass | 0.89 | Pass | Pass | Pass | Pass | 0.14 | n/a | Moderate beneficial | Moderate beneficial |
| 2A | 0.27 | Pass | 0.45 | Pass | Pass | Pass | Alert. D/S Structure | 0.20 | n/a | Minor beneficial | Slight beneficial |
| 2B | 0.89 | Pass | 0.64 | Pass | Pass | Pass | Alert. D/S Structure | 0.23 | n/a | Minor beneficial | Slight beneficial |
| 3A | 0.32 | Pass | 0.53 | Pass | Pass | Pass | Alert. Protected Area & D/S Structure | 0.19 | n/a | Minor beneficial | Slight beneficial |
| 3B | 0.10 | Pass | 0.16 | Pass | Pass | Pass | Alert. Protected Area & D/S Structure | 0.19 | n/a | Minor beneficial | Slight beneficial |
| 3C | 0.15 | Pass | 0.25 | Pass | Pass | Pass | Alert. Protected Area & D/S Structure | 0.09 | 2 | Minor beneficial | Slight beneficial |
| 3A & 3B Cumulat. | 0.38 | Pass | 0.63 | Pass | Pass | Pass | Alert. Protected Area & D/S Structure | 0.19 | n/a | Minor beneficial | Slight beneficial |

**Table 19-5.5 HEWRAT Accidental Spillages Risk Assessment**

| Drainage Network No. | Receiving Watercourse | Accidental Spillage Percentage % | Return Period (Years) without pollution reduction | Return Period (Years) with any applicable pollution reduction from SuDS | Magnitude of Impact | Significance of Effect |
|---|---|---|---|---|---|---|
| 1 | Croe Water | 0.0003 | 3,192 | 3,192 | Minor beneficial | Slight beneficial |
| 2A | Tributary of Croe Water | <0.0001 | 36,660 | 61,100 | Minor beneficial | Slight beneficial |
| 2B | Tributary of Croe Water | <0.0001 | 39,059 | 65,098 | Minor beneficial | Slight beneficial |
| 3A | Tributary to Loch Restil | <0.0001 | 41,692 | 69,486 | Minor beneficial | Slight beneficial |
| 3B | Tributary to Loch Restil | <0.0001 | 195,519 | 325,865 | Minor beneficial | Slight beneficial |
| 3C | Tributary to Loch Restil | <0.0001 | 130,346 | 217,244 | Minor beneficial | Slight beneficial |

## A19-5.7. Mitigation

A19-5.7.1. Embedded mitigation is considered at the start of the impact assessment, with the effects of additional specific mitigation measures, to address key challenges in relation to the water environment, reported below.

A19-5.7.2. Specific mitigation measures are additional measures to minimise, restore or offset potential impacts on surface water resources and water quality which cannot otherwise be addressed via embedded mitigation measures.

A19-5.7.3. Specific mitigation will encompass environmental commitments unique to individual receptors.

### Specific Mitigation (Construction)

A19-5.7.4. During Construction, adherence with environmental good practice including compliance with (but not limited to): guidance for pollution prevention (GPPs); SEPA guidance and CAR regulatory regimes including construction runoff permits; discharge of planning conditions; and compliance with relevant construction environmental management plans (CEMP) and pollution prevention plans (PPP) will be made.

A19-5.7.5. As the location of the A83 mainline is spatially constrained by steep and unstable topography either side of the existing A83 carriageway, limited space is available to accommodate local construction SuDS to manage sediment. Given these very challenging and unusual working conditions, a series of generally escalating measures have been described below, with requirements dependent on further GI information, detailed design and local environmental performance during construction. All measures would be subject to pre-approval from SEPA and other relevant regulatory bodies and written into the Construction Environmental Management Plan by the Appointed Contractor:

- It will be necessary to suspend construction works during periods of elevated debris flow risk in all areas that have to potential to be impacted by such flow events.

- Agreed expectations of thresholds for total suspended solids (TSS) as a maximum sediment level allowable for discharge to surface waters, furthermore, consideration of threshold levels for in-channel sediment levels taking account of baseline conditions (i.e. sediment uplift from the development).
- Temporary interception, upstream of the construction zone, with over-pumping and diversion to adjacent watercourse(s) will reduce the incoming flows from hillslopes and channels. Channel flows would be reinstated following completion of local works including downstream scour and bank protection.
- Construction of temporary settlement basins, where topography and earthwork programming allow, to provide retention of runoff from disturbed areas prior to entering watercourse channels, these shall not be positioned within areas susceptible to flood risk, avoiding 200 Annual Exceedance Period with climate change (200 AEP + CC) zones.
- Where settlement basins are not feasible, mechanical settlement devices shall be considered to enable treatment for local discharge. These portable devices would be deployed at appropriate locations to reduce construction sedimentation risk as the construction programme progresses.
- Construction of other source control methods, such as sediment fences and straw bale filters (downslope of disturbed areas and stockpiles) as required.
- To achieve sediment control, pre-approval from SEPA shall be sought for application of coagulants and flocculants as a contingency measure to promptly aid settlement of suspended solids. In accordance with pre-requisite sediment conditions and methodologies; including chemical type, dosage level and location.
- Sediment control directly within tributary channels may be appropriate as a further contingency measure, should excess sediment entrainment linked to construction activities occur or be predicted. Ongoing GI and detailed design inputs will inform this requirement, to supplement other

sediment control measures. This shall involve the installation of temporary settlement ponds or other engineering interventions to tributaries of Croe Water. These would be positioned on slopes with shallower gradient, either as online (in-channel) or offline (adjacent to channel) features, with the intention to reduce sediment load in minor channels prior to their confluence with the Croe Water. Pre-approval from SEPA for such interventions would enable site preparation ahead of requirement (preferred approach) or initiation of a prompt response, with associated design details provided, taking account of local channel characteristics and constraints (including groundwater level and with avoidance of flood risk 200 AEP + CC zones) to determine location, footprint, maintenance plan and reinstatement method.

### Specific Mitigation (Operation)

A19-5.7.6. None identified for the OMR improvements.

A19-5.7.7. During operation, should sediment and/or particulates require cleansing from the covered A83 carriageway within the DFS, due to lack of washing effect from reduced precipitation, this will be collected directly from the road surface primarily for safety concerns This process will reduce sediment input into the drainage network (which shall improve environmental performance) but shall introduce the requirement for appropriate waste management approvals prior to collection and disposal.

## A19-5.8. Residual Effects

A19-5.8.1. Residual effects (construction and operational) on surface water resources and water quality are assessed below, cognisant of the additional (specific) mitigation identified.

### Construction Effects

### Surface Water Resources

A19-5.8.2. Based on the Contractor maintaining supply continuity during construction via an agreed temporary or permanent alternative supply source to High Glen

Croe (medium sensitivity), there would be no loss of water supply during construction. This new source shall not receive potentially contaminated runoff, a betterment over the baseline status.

A19-5.8.3. As such, the residual magnitude of residual effects is assessed as minor beneficial, with residual effect is assessed as slight beneficial (non-significant).

### Water Quality

A19-5.8.4. With additional mitigation applied, management of sediment is considered to remain challenging on this complex construction site, with limited available space for settlement measures and an escalating series of interventions.

A19-5.8.5. Taking account of specific mitigation items for construction, the magnitude of potential impacts to water quality on the Croe Water (high sensitivity) during construction is reduced to minor adverse, with the significance of residual effects reduced to moderate adverse (significant). The magnitude of residual impacts on the water quality of the tributaries of the Croe Water (medium sensitivity) during construction is reduced to moderate adverse, with the significance of residual effects remaining as moderate adverse (significant). The tributaries of the Kinglas Water (medium sensitivity) and Loch Restil (high sensitivity) are considered to remain at minor adverse magnitude, with a slight adverse (non-significant) effect applied to both sets of receptors from the specific mitigation applied.

## Operational Effects

### Surface Water Resources

A19-5.8.6. As per construction, based on the Contractor maintaining supply continuity via an agreed permanent alternative supply source to High Glen Croe PWS (medium sensitivity), there would be no loss of water supply during operation.

A19-5.8.7. As this new source would not receive road drainage or associated contaminants from Proposed Scheme surface runoff originating from the A83, this is a long-term betterment over the baseline status; as such, the operational (i.e. long-term) residual magnitude of effects is assessed as

moderate beneficial; and the significance of effect is assessed as moderate beneficial (significant).

### Water Quality

A19-5.8.8. In respect of routine runoff from the A83 carriageway (with no specific mitigation identified, beyond the SuDS embedded in the design), the residual operational effects on the Croe Water (high sensitivity) are unchanged, with a magnitude of impact of moderate beneficial and a moderate beneficial (significant) effect. Likewise, residual operational effects on the Croe Water and Loch Restil tributaries (medium sensitivity) are unchanged with a magnitude of impact of minor beneficial and a slight beneficial (non-significant) effect.

A19-5.8.9. In respect of accidental spillages (with no specific mitigation identified, beyond the SuDS embedded in the design), the residual operational effects on the Croe Water (high sensitivity) from the A83 carriageway are also unchanged, with a magnitude of impact of minor beneficial and a slight beneficial (non-significant) effect. Likewise, residual operational effects on the Croe Water and Loch Restil tributaries (medium sensitivity) are unchanged, with a magnitude of impact of minor beneficial and a slight beneficial (non-significant) effect.

## A19-5.9. Conclusions

A19-5.9.1. The status of the water environment adjacent to the existing A83 is affected by an absence of runoff treatment, with uncontrolled over-the-kerb discharges to adjacent hillslopes and waterbodies including the Croe Water, tributaries of both the Croe Water and Kinglas Water, Loch Restil, plus the High Glen Croe PWS.

A19-5.9.2. Construction of the Proposed Scheme would be required to take place within a site that is spatially and topographically constrained, with steep ground above and below the carriageway, likely to result in temporary and significant adverse effects. To minimise these, the contractor shall be required to follow good environmental practice (embedded mitigation) and to implement

additional mitigation (including CEMP and further sediment management measures) to protect sensitive receptors from elevated levels of erosion and/or sedimentation, with contingency planning covering an extended period of earthworks.

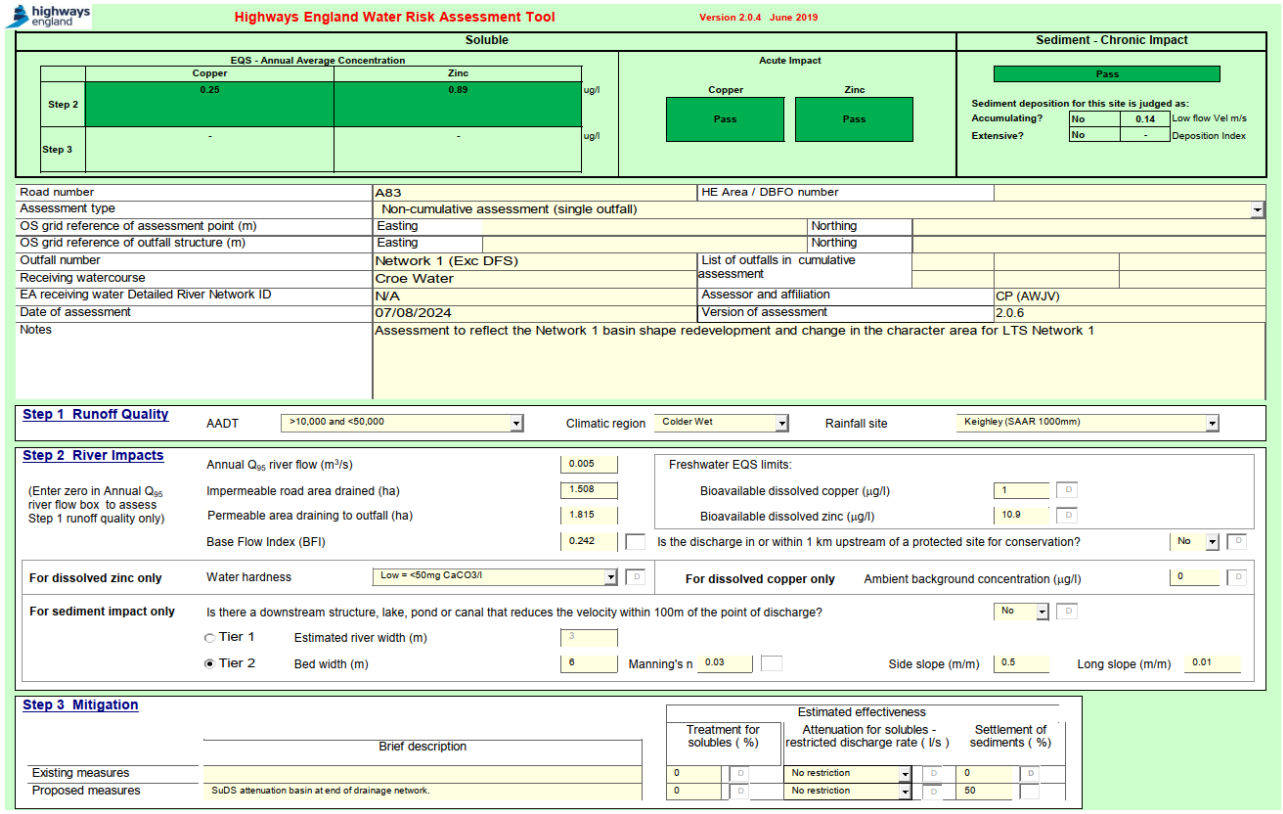
A19-5.9.3. Residual construction effects for water resources (High Glen Croe PWS) are assessed as slight beneficial (non-significant) on the basis of provision of an alternative temporary or permanent supply source. Residual construction effects for water quality are assessed as moderate adverse (significant), applying the precautionary principle and with recognition of the challenging terrain in managing sediment for the Proposed Development.

A19-5.9.4. The operation of the Proposed Scheme would introduce SuDS measures to intercept, attenuate and treat surface runoff from the A83 carriageway prior to it being discharged into the water environment. The provision of SuDS will reduce sediment, sediment-bound pollutants and soluble metal contaminants reaching receiving waters - improving the buffering capacity of watercourses. Furthermore, the installed SuDS provide attenuation, treatment and a degree of containment for contaminants released in the unlikely event of an accidental spillage.

A19-5.9.5. Residual operational effects for water resources are assessed as moderate beneficial (significant) in relation to High Glen Croe PWS, based on provision of a permanent alternative supply source. A residual moderate beneficial (significant) effect has also been assessed for the Croe Water in relation to permanent improvement in water quality of the routine runoff discharged. Residual slight beneficial (non-significant) effects were assessed for tributary channels to the Croe Water, Kinglas Water and Loch Restil for both routine runoff and in relation to accidental spillages across all receptors.

# A19-5.10. HEWRAT Assessment Output Screenshot Images

## Image 19-5.1 Network 1 HEWRAT Interface Assessment Results



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**Highways England Water Risk Assessment Tool** Version 2.0.4 June 2019

| Soluble | | | Sediment - Chronic Impact |
|---|---|---|---|
| EQS - Annual Average Concentration | Acute Impact | | Pass |
| Copper / Zinc | Copper | Zinc | Sediment deposition for this site is judged as: |
| Step 2: 0.25 / 0.89 ug/l | Pass | Pass | Accumulating? No 0.14 Low flow Vel m/s |
| Step 3: - / - ug/l | | | Extensive? No - Deposition Index |

| | | | |
|---|---|---|---|
| Road number | A83 | HE Area / DBFO number | |
| Assessment type | Non-cumulative assessment (single outfall) | | |
| OS grid reference of assessment point (m) | Easting | Northing | |
| OS grid reference of outfall structure (m) | Easting | Northing | |
| Outfall number | Network 1 (Exc DFS) | List of outfalls in cumulative assessment | |
| Receiving watercourse | Croe Water | | |
| EA receiving water Detailed River Network ID | N/A | Assessor and affiliation | CP (AWJV) |
| Date of assessment | 07/08/2024 | Version of assessment | 2.0.6 |
| Notes | Assessment to reflect the Network 1 basin shape redevelopment and change in the character area for LTS Network 1 | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Keighley (SAAR 1000mm)

**Step 2 River Impacts**

(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

| | | Freshwater EQS limits: | |
|---|---|---|---|
| Annual $Q_{95}$ river flow ($m^3/s$) | 0.005 | Bioavailable dissolved copper (µg/l) | 1 |
| Impermeable road area drained (ha) | 1.508 | Bioavailable dissolved zinc (µg/l) | 10.9 |
| Permeable area draining to outfall (ha) | 1.815 | | |
| Base Flow Index (BFI) | 0.242 | Is the discharge in or within 1 km upstream of a protected site for conservation? | No |

**For dissolved zinc only** — Water hardness: Low = <50mg CaCO3/l

**For dissolved copper only** — Ambient background concentration (µg/l): 0

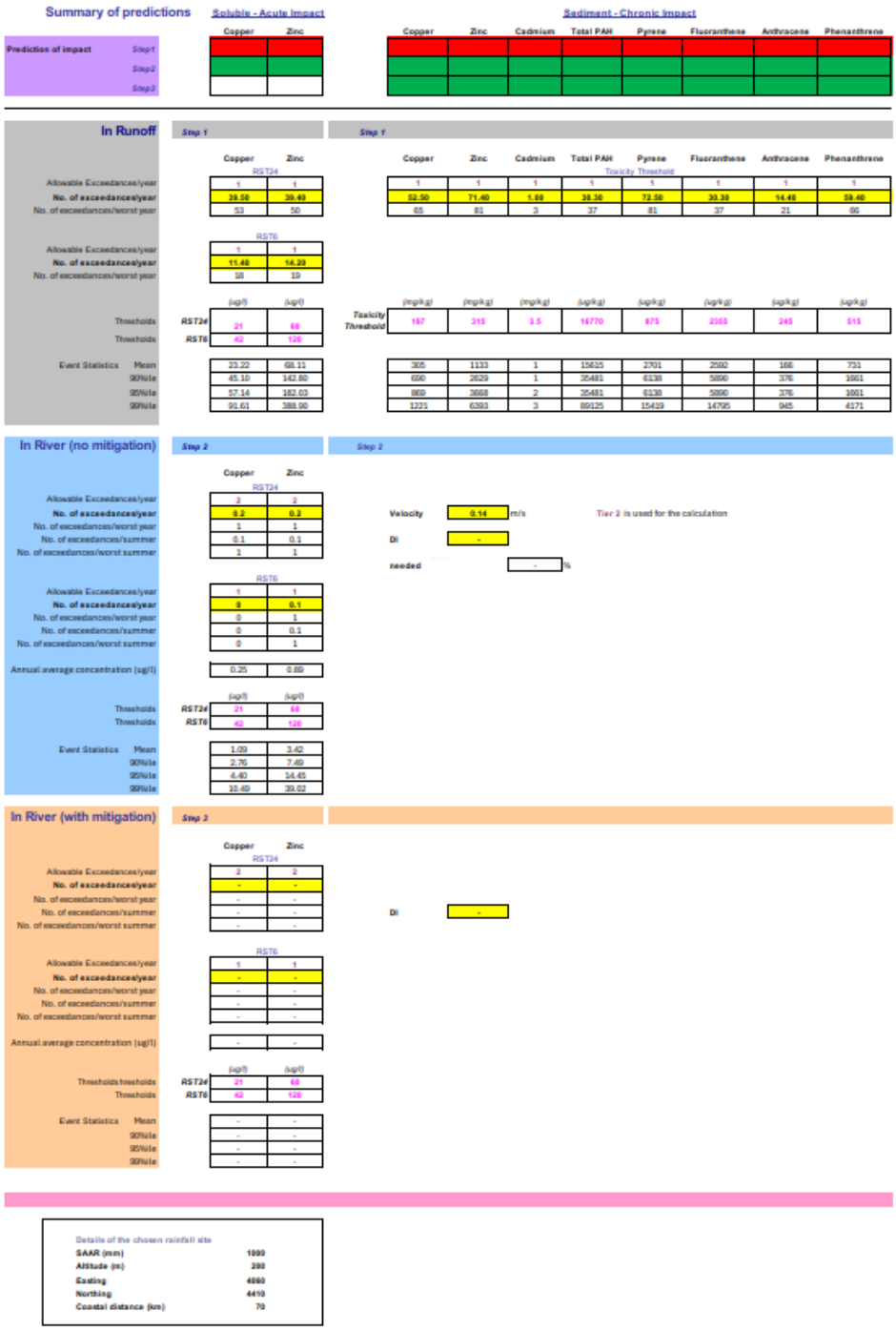
**For sediment impact only** — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No

- Tier 1 — Estimated river width (m): 3
- Tier 2 — Bed width (m): 6; Manning's n: 0.03; Side slope (m/m): 0.5; Long slope (m/m): 0.01

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | | 0 | No restriction | 0 |
| Proposed measures | SuDS attenuation basin at end of drainage network. | 0 | No restriction | 50 |

## Image 19-5.2 Network 1 HEWRAT Detailed Assessment Results



Summary of predictions

Soluble - Acute Impact

| Prediction of impact | Copper | Zinc |
|---|---|---|
| Step1 | | |
| Step2 | | |
| Step3 | | |

Sediment - Chronic Impact

| Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**In Runoff**

Step 1

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 39.58 | 39.40 |
| No. of exceedances/worst year | 53 | 50 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 11.40 | 14.20 |
| No. of exceedances/worst year | 18 | 19 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 69 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 23.22 | 68.11 |
| 90%ile | 45.10 | 142.80 |
| 95%ile | 57.14 | 182.03 |
| 99%ile | 91.61 | 388.90 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| Toxicity Threshold | | | | | | | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 52.50 | 71.40 | 1.00 | 38.30 | 72.50 | 30.30 | 14.40 | 59.40 |
| | 65 | 81 | 3 | 37 | 81 | 37 | 21 | 66 |
| | (mg/kg) | (mg/kg) | (mg/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) |
| Toxicity Threshold | 197 | 315 | 3.5 | 16770 | 875 | 2355 | 245 | 515 |
| | 305 | 1133 | 1 | 15625 | 2701 | 2592 | 166 | 731 |
| | 690 | 2629 | 1 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 869 | 3668 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 1221 | 6393 | 3 | 89125 | 15429 | 14795 | 945 | 4171 |

**In River (no mitigation)**

Step 2

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 2 | 2 |
| No. of exceedances/year | 0.2 | 0.2 |
| No. of exceedances/worst year | 1 | 1 |
| No. of exceedances/summer | 0.1 | 0.1 |
| No. of exceedances/worst summer | 1 | 1 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0 | 0.1 |
| No. of exceedances/worst year | 0 | 1 |
| No. of exceedances/summer | 0 | 0.1 |
| No. of exceedances/worst summer | 0 | 1 |
| Annual average concentration (ug/l) | 0.25 | 0.89 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 69 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 1.09 | 3.42 |
| 90%ile | 2.76 | 7.49 |
| 95%ile | 4.40 | 14.45 |
| 99%ile | 10.49 | 39.02 |

Step 2

Velocity 0.14 m/s — Tier 2 is used for the calculation

DI -

needed - %

**In River (with mitigation)**

Step 2

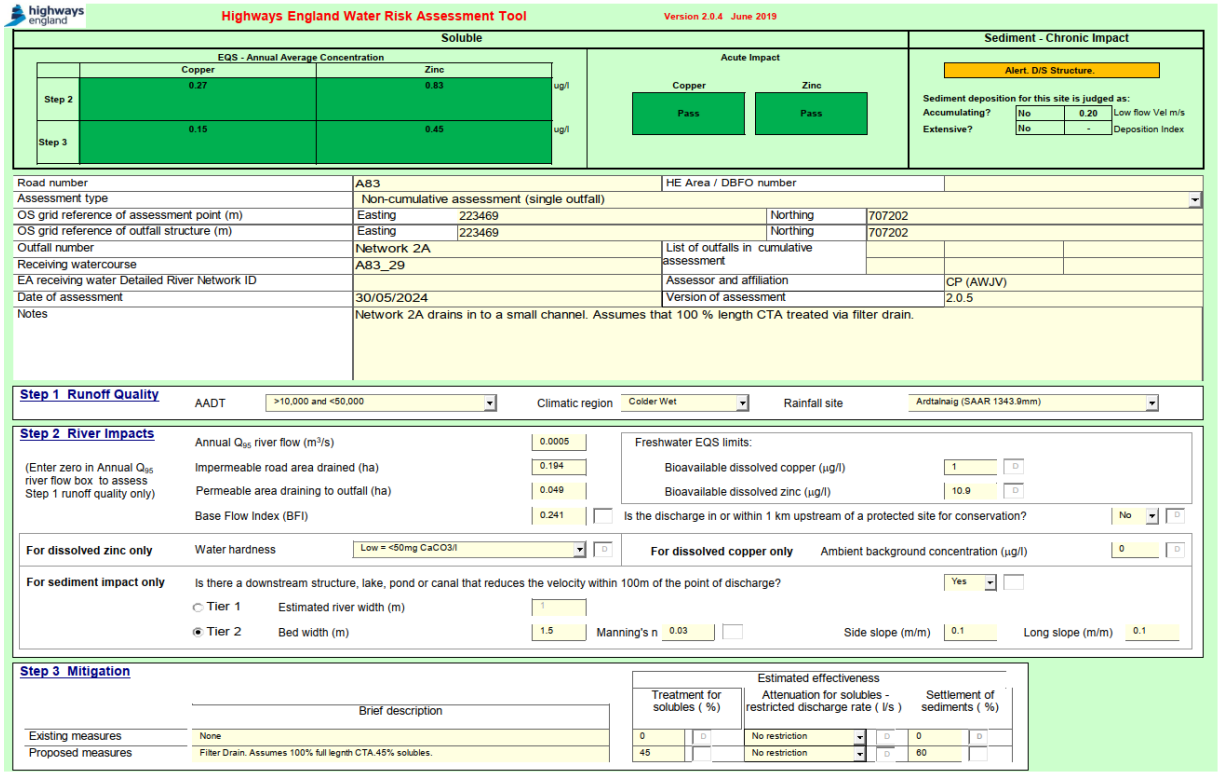
| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 2 | 2 |
| No. of exceedances/year | - | - |
| No. of exceedances/worst year | - | - |
| No. of exceedances/summer | - | - |
| No. of exceedances/worst summer | - | - |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | - | - |
| No. of exceedances/worst year | - | - |
| No. of exceedances/summer | - | - |
| No. of exceedances/worst summer | - | - |
| Annual average concentration (ug/l) | - | - |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 69 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | - | - |
| 90%ile | - | - |
| 95%ile | - | - |
| 99%ile | - | - |

DI -

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1800 |
| Altitude (m) | 200 |
| Easting | 4060 |
| Northing | 6410 |
| Coastal distance (km) | 70 |

## Image 19-5.3 Network 2A HEWRAT Interface Assessment Results



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**Highways England Water Risk Assessment Tool** Version 2.0.4 June 2019

| Soluble | | | | Sediment - Chronic Impact |
|---|---|---|---|---|
| EQS - Annual Average Concentration | | | Acute Impact | Alert. D/S Structure. |
| | Copper | Zinc | Copper / Zinc | Sediment deposition for this site is judged as: |
| Step 2 | 0.27 | 0.83 ug/l | Pass / Pass | Accumulating? No 0.20 Low flow Vel m/s |
| Step 3 | 0.15 | 0.45 ug/l | | Extensive? No - Deposition Index |

| | | | | | |
|---|---|---|---|---|---|
| Road number | A83 | | HE Area / DBFO number | | |
| Assessment type | Non-cumulative assessment (single outfall) | | | | |
| OS grid reference of assessment point (m) | Easting | 223469 | Northing | 707202 | |
| OS grid reference of outfall structure (m) | Easting | 223469 | Northing | 707202 | |
| Outfall number | Network 2A | | List of outfalls in cumulative assessment | | |
| Receiving watercourse | A83_29 | | | | |
| EA receiving water Detailed River Network ID | | | Assessor and affiliation | CP (AWJV) | |
| Date of assessment | 30/05/2024 | | Version of assessment | 2.0.5 | |
| Notes | Network 2A drains in to a small channel. Assumes that 100 % length CTA treated via filter drain. | | | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

**Step 2 River Impacts**

(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

| | | | |
|---|---|---|---|
| Annual $Q_{95}$ river flow ($m^3/s$) | 0.0005 | Freshwater EQS limits: | |
| Impermeable road area drained (ha) | 0.194 | Bioavailable dissolved copper (µg/l) | 1 |
| Permeable area draining to outfall (ha) | 0.049 | Bioavailable dissolved zinc (µg/l) | 10.9 |
| Base Flow Index (BFI) | 0.241 | Is the discharge in or within 1 km upstream of a protected site for conservation? | No |

**For dissolved zinc only** — Water hardness: Low = <50mg CaCO3/l

**For dissolved copper only** — Ambient background concentration (µg/l): 0

**For sediment impact only** — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes

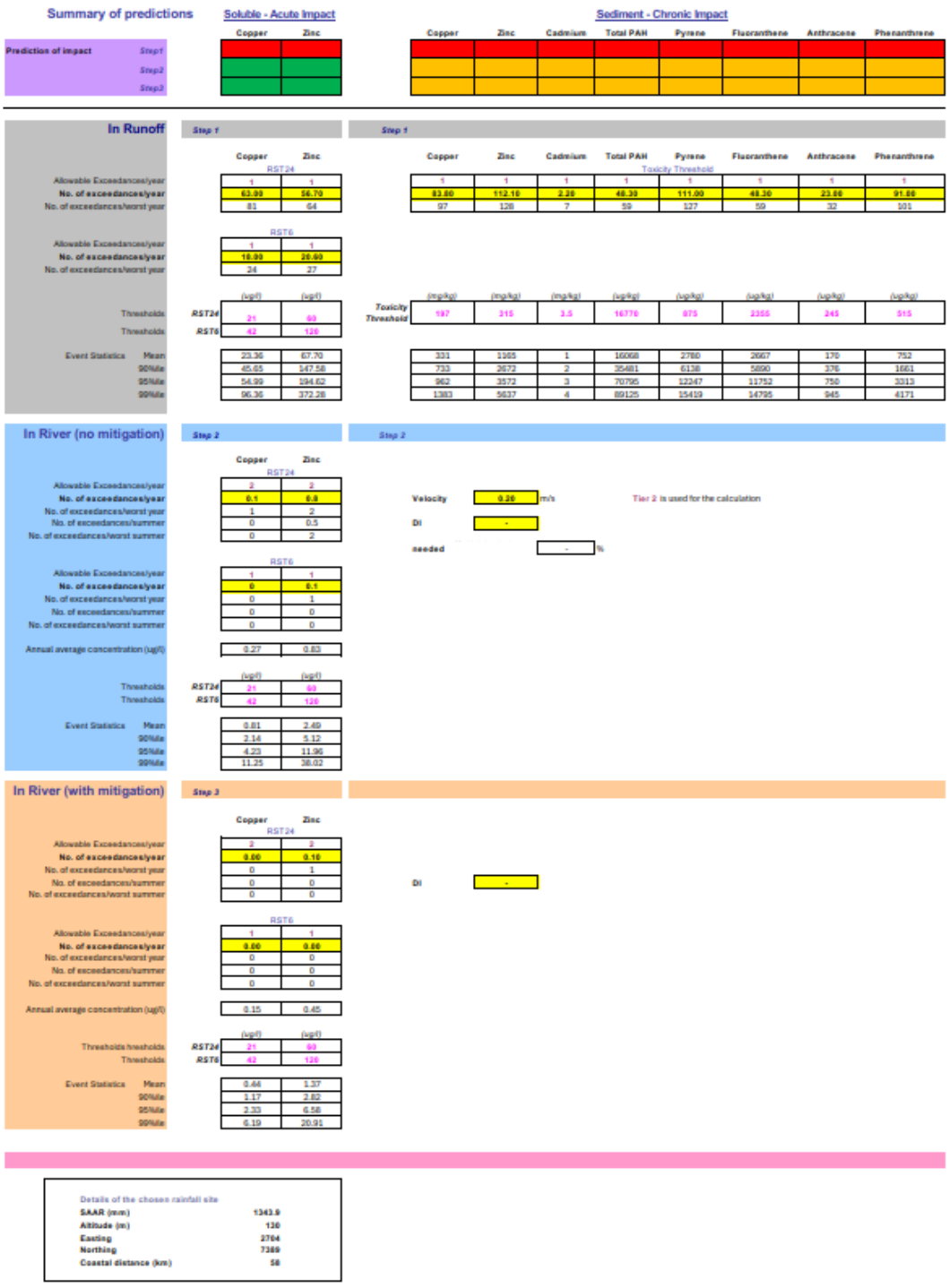
Tier 1 — Estimated river width (m): 1

Tier 2 — Bed width (m): 1.5 | Manning's n: 0.03 | Side slope (m/m): 0.1 | Long slope (m/m): 0.1

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | None | 0 | No restriction | 0 |
| Proposed measures | Filter Drain. Assumes 100% full legnth CTA.45% solubles. | 45 | No restriction | 60 |

## Image 19-5.4 Network 2A HEWRAT Detailed Assessment Results



Summary of predictions

Soluble - Acute Impact

| Prediction of impact | Copper | Zinc |
|---|---|---|
| Step1 | | |
| Step2 | | |
| Step3 | | |

Sediment - Chronic Impact

| Prediction of impact | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**In Runoff**

Step 1

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 63.00 | 56.70 |
| No. of exceedances/worst year | 81 | 64 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 18.00 | 20.00 |
| No. of exceedances/worst year | 24 | 27 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 23.36 | 67.70 |
| 90%ile | 45.65 | 147.58 |
| 95%ile | 54.99 | 194.62 |
| 99%ile | 96.36 | 372.28 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| Toxicity Threshold | | | | | | | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 83.80 | 112.10 | 2.20 | 48.30 | 111.00 | 48.30 | 23.80 | 91.80 |
| | 97 | 128 | 7 | 59 | 127 | 59 | 32 | 101 |
| | (mg/kg) | (mg/kg) | (mg/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) |
| Toxicity Threshold | 197 | 315 | 3.5 | 16770 | 975 | 2355 | 245 | 515 |
| | 331 | 1365 | 1 | 16068 | 2760 | 2667 | 170 | 752 |
| | 733 | 2672 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 962 | 3572 | 3 | 70795 | 12247 | 11752 | 750 | 3313 |
| | 1383 | 5637 | 4 | 89125 | 15419 | 14795 | 945 | 4171 |

**In River (no mitigation)**

Step 2

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 2 | 2 |
| No. of exceedances/year | 0.1 | 0.8 |
| No. of exceedances/worst year | 1 | 2 |
| No. of exceedances/summer | 0 | 0.5 |
| No. of exceedances/worst summer | 0 | 2 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0 | 0.1 |
| No. of exceedances/worst year | 0 | 1 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.27 | 0.83 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 0.81 | 2.49 |
| 90%ile | 2.14 | 5.12 |
| 95%ile | 4.23 | 11.96 |
| 99%ile | 11.25 | 38.02 |

Step 2

Velocity 0.20 m/s Tier 2 is used for the calculation

DI -

needed - %

**In River (with mitigation)**

Step 3

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 2 | 2 |
| No. of exceedances/year | 0.00 | 0.10 |
| No. of exceedances/worst year | 0 | 1 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.00 | 0.00 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.15 | 0.45 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 0.44 | 1.37 |
| 90%ile | 1.17 | 2.82 |
| 95%ile | 2.33 | 6.58 |
| 99%ile | 6.19 | 20.91 |

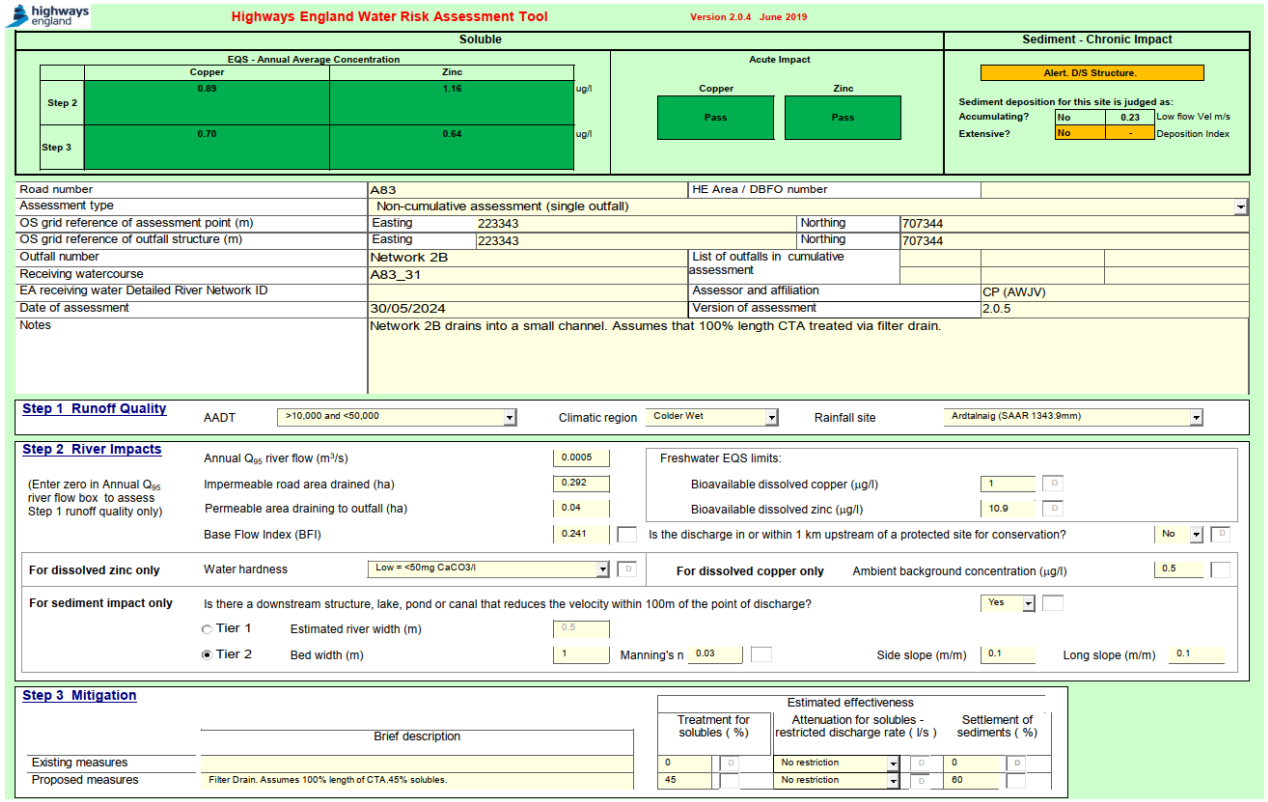
Step 3

DI -

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1343.9 |
| Altitude (m) | 130 |
| Easting | 2704 |
| Northing | 7389 |
| Coastal distance (km) | 58 |

## Image 19-5.5 Network 2B HEWRAT Interface Assessment Results



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**Soluble**

EQS - Annual Average Concentration

| | Copper | Zinc | |
|---|---|---|---|
| Step 2 | 0.89 | 1.16 | ug/l |
| Step 3 | 0.70 | 0.64 | ug/l |

Acute Impact

| Copper | Zinc |
|---|---|
| Pass | Pass |

**Sediment - Chronic Impact**

Alert. D/S Structure.

Sediment deposition for this site is judged as:

| | | | |
|---|---|---|---|
| Accumulating? | No | 0.23 | Low flow Vel m/s |
| Extensive? | No | - | Deposition Index |

| | | | | | |
|---|---|---|---|---|---|
| Road number | A83 | | HE Area / DBFO number | | |
| Assessment type | Non-cumulative assessment (single outfall) | | | | |
| OS grid reference of assessment point (m) | Easting | 223343 | Northing | 707344 | |
| OS grid reference of outfall structure (m) | Easting | 223343 | Northing | 707344 | |
| Outfall number | Network 2B | | List of outfalls in cumulative assessment | | |
| Receiving watercourse | A83_31 | | | | |
| EA receiving water Detailed River Network ID | | | Assessor and affiliation | CP (AWJV) | |
| Date of assessment | 30/05/2024 | | Version of assessment | 2.0.5 | |
| Notes | Network 2B drains into a small channel. Assumes that 100% length CTA treated via filter drain. | | | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

**Step 2 River Impacts**

(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

| | |
|---|---|
| Annual $Q_{95}$ river flow ($m^3/s$) | 0.0005 |
| Impermeable road area drained (ha) | 0.292 |
| Permeable area draining to outfall (ha) | 0.04 |
| Base Flow Index (BFI) | 0.241 |

Freshwater EQS limits:

| | |
|---|---|
| Bioavailable dissolved copper (µg/l) | 1 |
| Bioavailable dissolved zinc (µg/l) | 10.9 |

Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO3/l

**For dissolved copper only** Ambient background concentration (µg/l): 0.5

**For sediment impact only** Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes

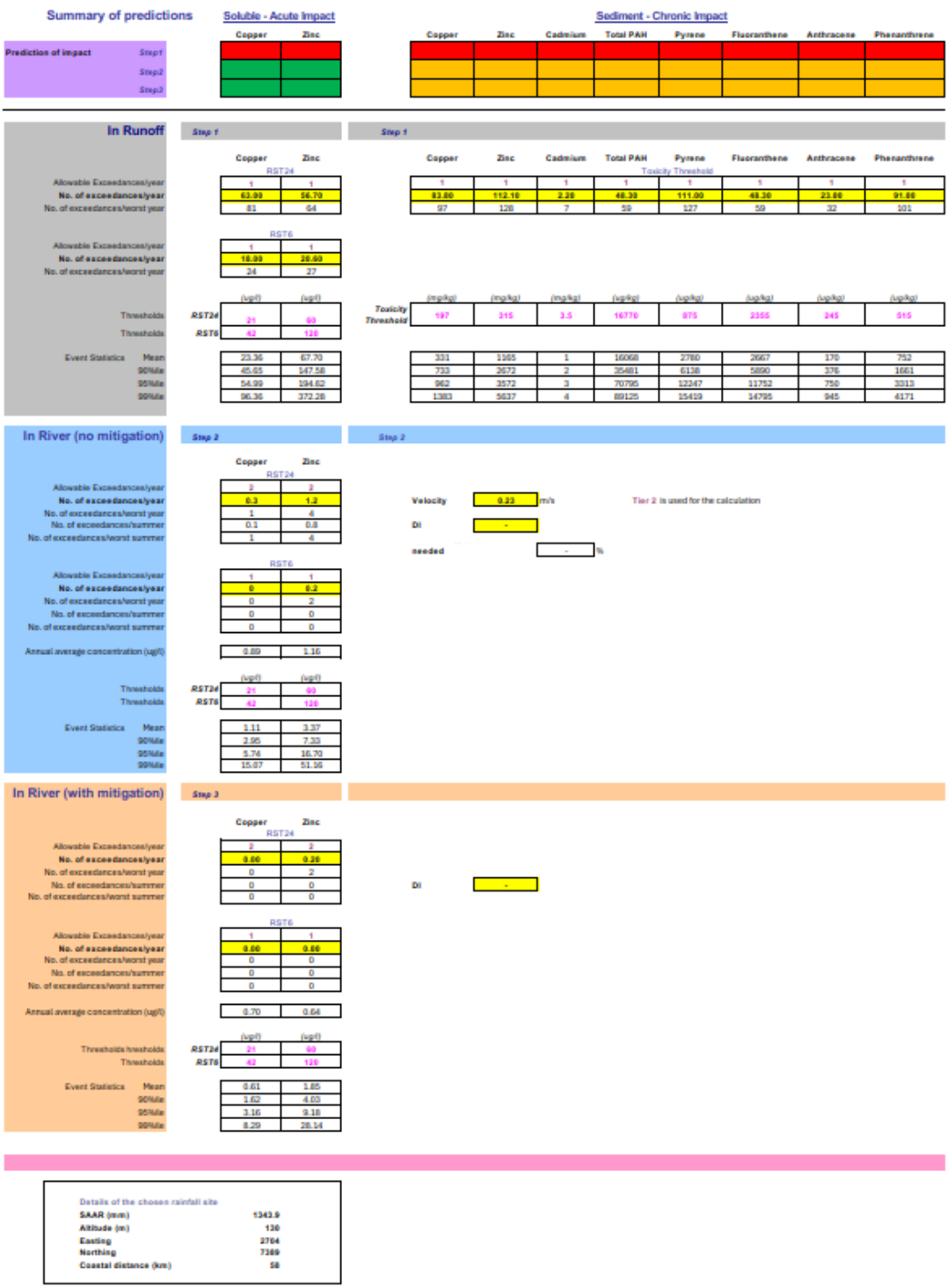
Tier 1 Estimated river width (m): 0.5

Tier 2 Bed width (m): 1 | Manning's n: 0.03 | Side slope (m/m): 0.1 | Long slope (m/m): 0.1

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | | 0 | No restriction | 0 |
| Proposed measures | Filter Drain. Assumes 100% length of CTA.45% solubles. | 45 | No restriction | 60 |

## Image 19-5.6 Network 2B HEWRAT Detailed Assessment Results



Summary of predictions

Soluble - Acute Impact

| Prediction of impact | Copper | Zinc |
|---|---|---|
| Step1 | | |
| Step2 | | |
| Step3 | | |

Sediment - Chronic Impact

| Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

In Runoff

Step 1

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 63.00 | 56.70 |
| No. of exceedances/worst year | 81 | 64 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 18.00 | 20.60 |
| No. of exceedances/worst year | 24 | 27 |
| Thresholds (ug/l) RST24 | 21 | 99 |
| Thresholds (ug/l) RST6 | 42 | 126 |
| Event Statistics Mean | 23.36 | 67.70 |
| 90%ile | 45.65 | 147.58 |
| 95%ile | 54.99 | 194.62 |
| 99%ile | 96.36 | 372.28 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| Toxicity Threshold | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 83.60 | 112.10 | 2.20 | 48.30 | 111.00 | 48.30 | 23.60 | 91.60 |
| | 97 | 128 | 7 | 59 | 127 | 59 | 32 | 101 |
| Toxicity Threshold (mg/kg) | 197 | 315 | 3.5 | 16770 | 975 | 2355 | 345 | 515 |
| | 331 | 1165 | 1 | 16068 | 2780 | 2667 | 170 | 752 |
| | 733 | 2672 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 962 | 3572 | 3 | 70795 | 12247 | 11752 | 750 | 3313 |
| | 1383 | 5637 | 4 | 89125 | 15419 | 14795 | 945 | 4171 |

In River (no mitigation)

Step 2

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 2 | 2 |
| No. of exceedances/year | 0.3 | 1.2 |
| No. of exceedances/worst year | 1 | 4 |
| No. of exceedances/summer | 0.1 | 0.8 |
| No. of exceedances/worst summer | 1 | 4 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0 | 0.2 |
| No. of exceedances/worst year | 0 | 2 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.89 | 1.16 |
| Thresholds (ug/l) RST24 | 21 | 99 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 1.11 | 3.37 |
| 90%ile | 2.95 | 7.33 |
| 95%ile | 5.74 | 16.70 |
| 99%ile | 15.07 | 51.16 |

Step 2

Velocity 0.23 m/s — Tier 2 is used for the calculation

DI -

needed - %

In River (with mitigation)

Step 3

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 2 | 2 |
| No. of exceedances/year | 0.00 | 0.20 |
| No. of exceedances/worst year | 0 | 2 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.00 | 0.00 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.70 | 0.64 |
| Thresholds (ug/l) RST24 | 21 | 99 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 0.61 | 1.85 |
| 90%ile | 1.62 | 4.03 |
| 95%ile | 3.16 | 9.18 |
| 99%ile | 8.29 | 28.14 |

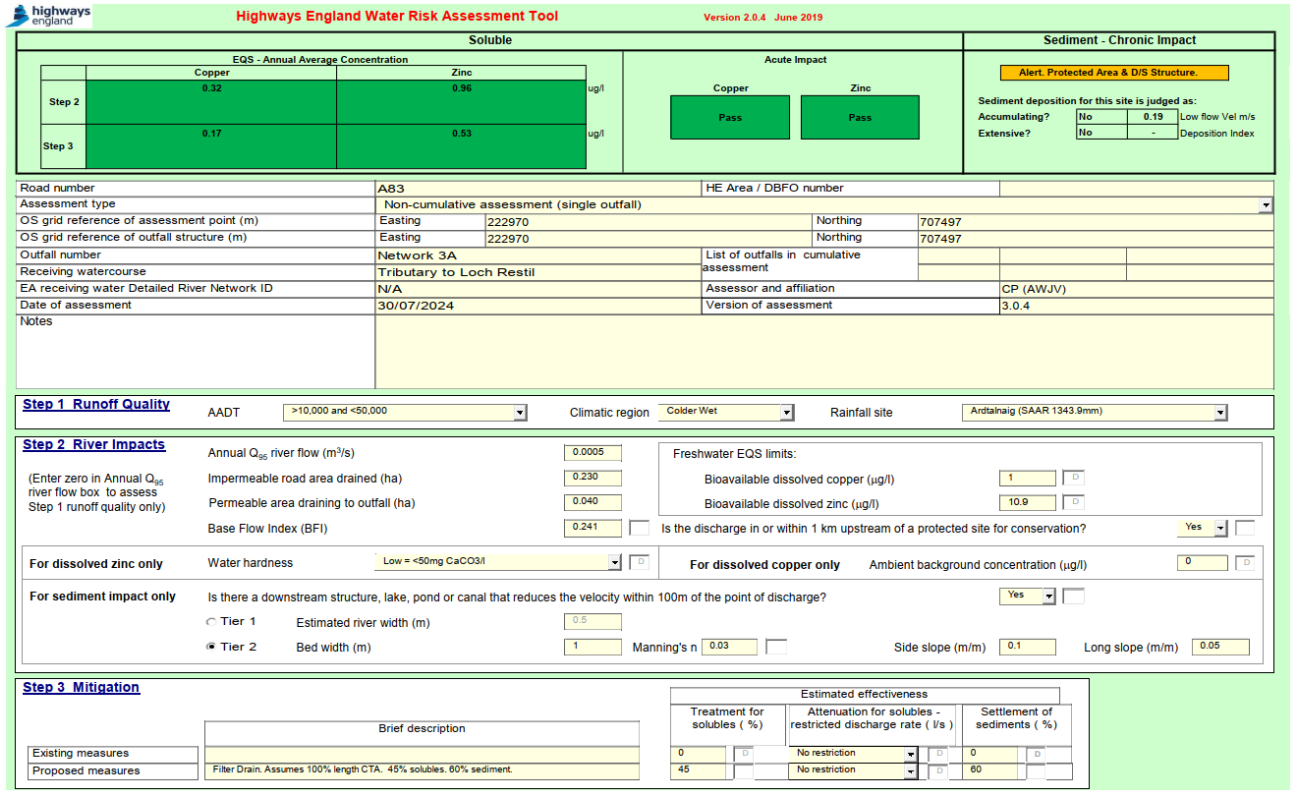
Step 3

DI -

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1343.9 |
| Altitude (m) | 130 |
| Easting | 2704 |
| Northing | 7389 |
| Coastal distance (km) | 58 |

## Image 19-5.7 Network 3A HEWRAT Interface Assessment Results



highways england

**Highways England Water Risk Assessment Tool** Version 2.0.4 June 2019

| Soluble | | | | Sediment - Chronic Impact |
|---|---|---|---|---|
| EQS - Annual Average Concentration | | | Acute Impact | Alert. Protected Area & D/S Structure. |
| | Copper | Zinc | Copper / Zinc | Sediment deposition for this site is judged as: |
| Step 2 | 0.32 | 0.96 ug/l | Pass / Pass | Accumulating? No 0.19 Low flow Vel m/s |
| Step 3 | 0.17 | 0.53 ug/l | | Extensive? No - Deposition Index |

| | | | | |
|---|---|---|---|---|
| Road number | A83 | | HE Area / DBFO number | |
| Assessment type | Non-cumulative assessment (single outfall) | | | |
| OS grid reference of assessment point (m) | Easting | 222970 | Northing | 707497 |
| OS grid reference of outfall structure (m) | Easting | 222970 | Northing | 707497 |
| Outfall number | Network 3A | | List of outfalls in cumulative assessment | |
| Receiving watercourse | Tributary to Loch Restil | | | |
| EA receiving water Detailed River Network ID | N/A | | Assessor and affiliation | CP (AWJV) |
| Date of assessment | 30/07/2024 | | Version of assessment | 3.0.4 |
| Notes | | | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

**Step 2 River Impacts**

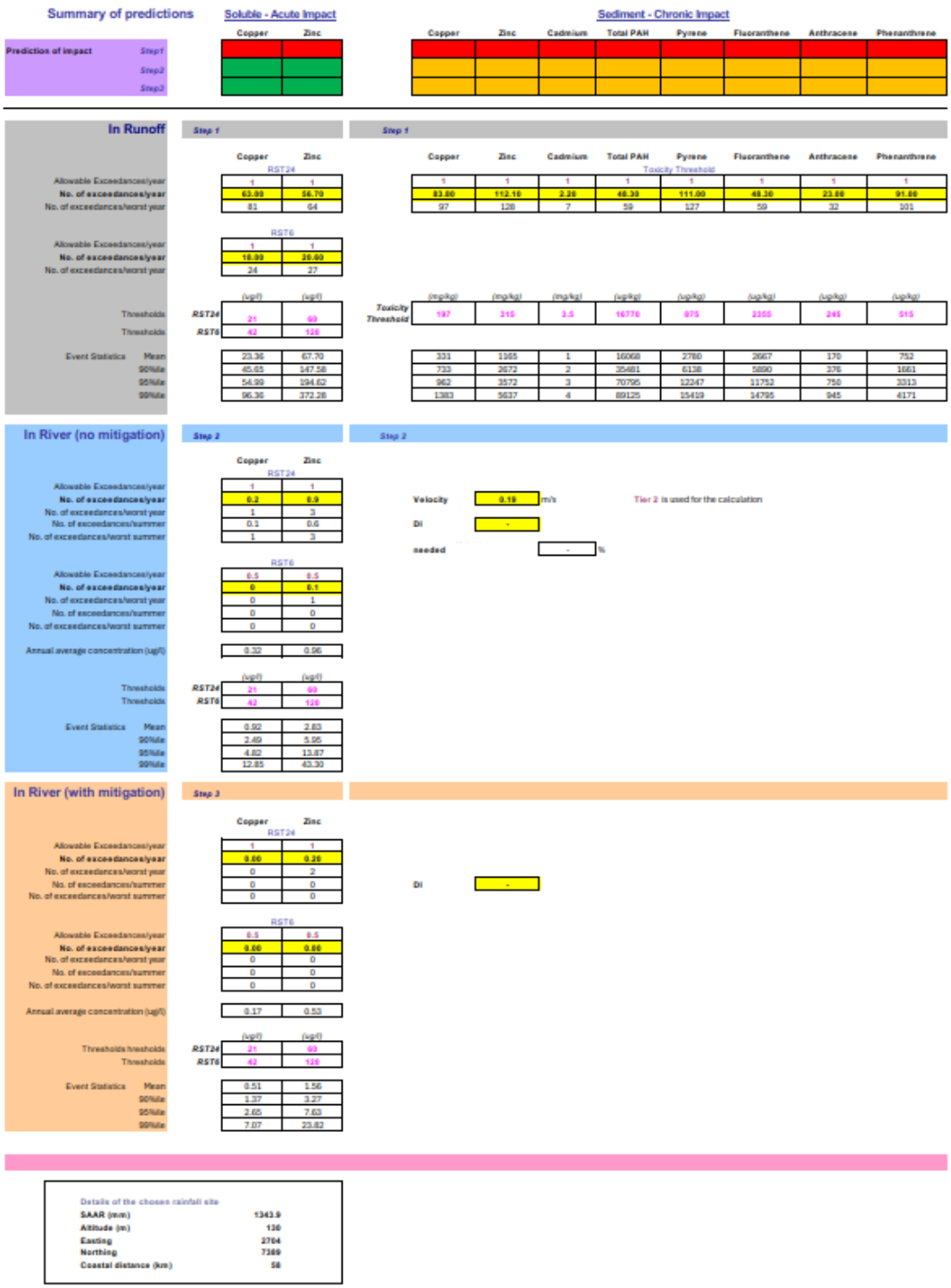
(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

| | | | |
|---|---|---|---|
| Annual $Q_{95}$ river flow ($m^3/s$) | 0.0005 | Freshwater EQS limits: | |
| Impermeable road area drained (ha) | 0.230 | Bioavailable dissolved copper (µg/l) | 1 |
| Permeable area draining to outfall (ha) | 0.040 | Bioavailable dissolved zinc (µg/l) | 10.9 |
| Base Flow Index (BFI) | 0.241 | Is the discharge in or within 1 km upstream of a protected site for conservation? | Yes |
| **For dissolved zinc only** Water hardness | Low = <50mg CaCO3/l | **For dissolved copper only** Ambient background concentration (µg/l) | 0 |
| **For sediment impact only** Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? | | | Yes |
| Tier 1 Estimated river width (m) | 0.5 | | |
| Tier 2 Bed width (m) | 1 | Manning's n 0.03 | Side slope (m/m) 0.1 Long slope (m/m) 0.05 |

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | | 0 | No restriction | 0 |
| Proposed measures | Filter Drain. Assumes 100% length CTA. 45% solubles. 60% sediment. | 45 | No restriction | 60 |

## Image 19-5.8 Network 3A HEWRAT Detailed Assessment Results



Summary of predictions

Soluble - Acute Impact

| Prediction of impact | | Copper | Zinc |
|---|---|---|---|
| | Step1 | | |
| | Step2 | | |
| | Step3 | | |

Sediment - Chronic Impact

| Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

**In Runoff**

Step 1

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 63.00 | 56.70 |
| No. of exceedances/worst year | 81 | 64 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/worst year | 18.00 | 36.00 |
| | 24 | 27 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 93 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 23.36 | 67.70 |
| 90%ile | 45.65 | 147.58 |
| 95%ile | 54.99 | 194.62 |
| 99%ile | 96.36 | 372.28 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| Toxicity Threshold | | | | | | | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 83.88 | 112.16 | 2.26 | 48.39 | 111.00 | 48.39 | 23.66 | 91.66 |
| | 97 | 128 | 7 | 59 | 127 | 59 | 32 | 101 |
| | (mg/kg) | (mg/kg) | (mg/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) |
| Toxicity Threshold | 197 | 315 | 3.5 | 16770 | 875 | 2355 | 245 | 515 |
| | 331 | 1165 | 1 | 16068 | 2780 | 2667 | 170 | 752 |
| | 733 | 2672 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 962 | 3572 | 3 | 70795 | 12247 | 11752 | 750 | 3313 |
| | 1383 | 5637 | 4 | 89125 | 15419 | 14795 | 945 | 4171 |

**In River (no mitigation)**

Step 2

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.2 | 0.9 |
| No. of exceedances/worst year | 1 | 3 |
| No. of exceedances/summer | 0.1 | 0.6 |
| No. of exceedances/worst summer | 1 | 3 |
| RST6 | | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| No. of exceedances/year | 0 | 0.1 |
| No. of exceedances/worst year | 0 | 1 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.32 | 0.96 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 93 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 0.92 | 2.83 |
| 90%ile | 2.49 | 5.95 |
| 95%ile | 4.82 | 13.87 |
| 99%ile | 12.85 | 43.30 |

Step 2

Velocity 0.19 m/s Tier 2 is used for the calculation

DI -

needed - %

**In River (with mitigation)**

Step 3

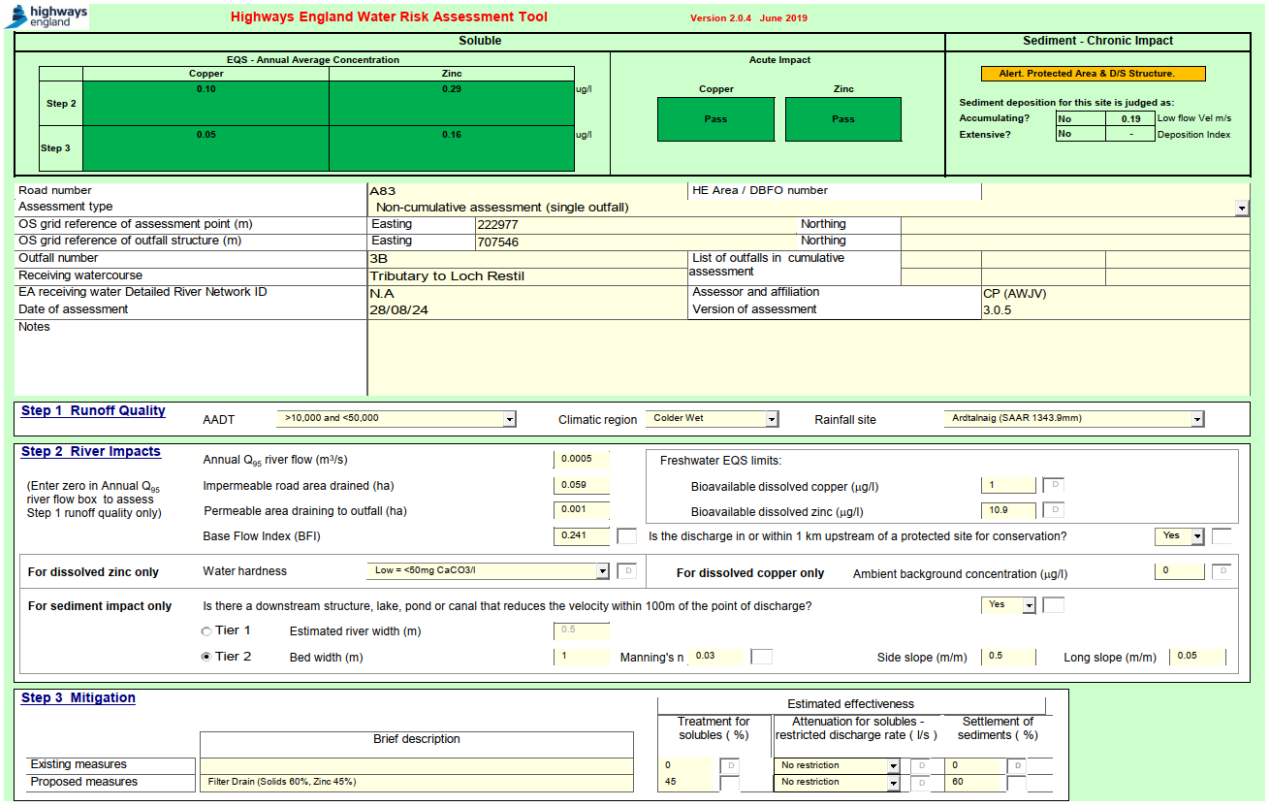
| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.00 | 0.20 |
| No. of exceedances/worst year | 0 | 2 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| RST6 | | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| No. of exceedances/year | 0.00 | 0.00 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.17 | 0.53 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 93 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 0.51 | 1.56 |
| 90%ile | 1.37 | 3.27 |
| 95%ile | 2.65 | 7.63 |
| 99%ile | 7.07 | 23.82 |

DI -

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1343.9 |
| Altitude (m) | 130 |
| Easting | 2704 |
| Northing | 7389 |
| Coastal distance (km) | 58 |

## Image 19-5.9 Network 3B HEWRAT Interface Assessment Results



highways england

**Highways England Water Risk Assessment Tool** Version 2.0.4 June 2019

| Soluble | | | | Sediment - Chronic Impact |
|---|---|---|---|---|
| EQS - Annual Average Concentration | | | Acute Impact | Alert. Protected Area & D/S Structure. |
| | Copper | Zinc | | |
| Step 2 | 0.10 ug/l | 0.29 | Copper: Pass; Zinc: Pass | Sediment deposition for this site is judged as: |
| Step 3 | 0.05 ug/l | 0.16 | | Accumulating? No 0.19 Low flow Vel m/s |
| | | | | Extensive? No - Deposition Index |

| | | | | | |
|---|---|---|---|---|---|
| Road number | A83 | | HE Area / DBFO number | | |
| Assessment type | Non-cumulative assessment (single outfall) | | | | |
| OS grid reference of assessment point (m) | Easting | 222977 | Northing | | |
| OS grid reference of outfall structure (m) | Easting | 707546 | Northing | | |
| Outfall number | 3B | | List of outfalls in cumulative assessment | | |
| Receiving watercourse | Tributary to Loch Restil | | | | |
| EA receiving water Detailed River Network ID | N.A | | Assessor and affiliation | CP (AWJV) | |
| Date of assessment | 28/08/24 | | Version of assessment | 3.0.5 | |
| Notes | | | | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

**Step 2 River Impacts**

(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

- Annual $Q_{95}$ river flow ($m^3/s$): 0.0005
- Impermeable road area drained (ha): 0.059
- Permeable area draining to outfall (ha): 0.001
- Base Flow Index (BFI): 0.241

Freshwater EQS limits:
- Bioavailable dissolved copper (µg/l): 1
- Bioavailable dissolved zinc (µg/l): 10.9

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

**For dissolved zinc only** Water hardness: Low = <50mg CaCO3/l

**For dissolved copper only** Ambient background concentration (µg/l): 0

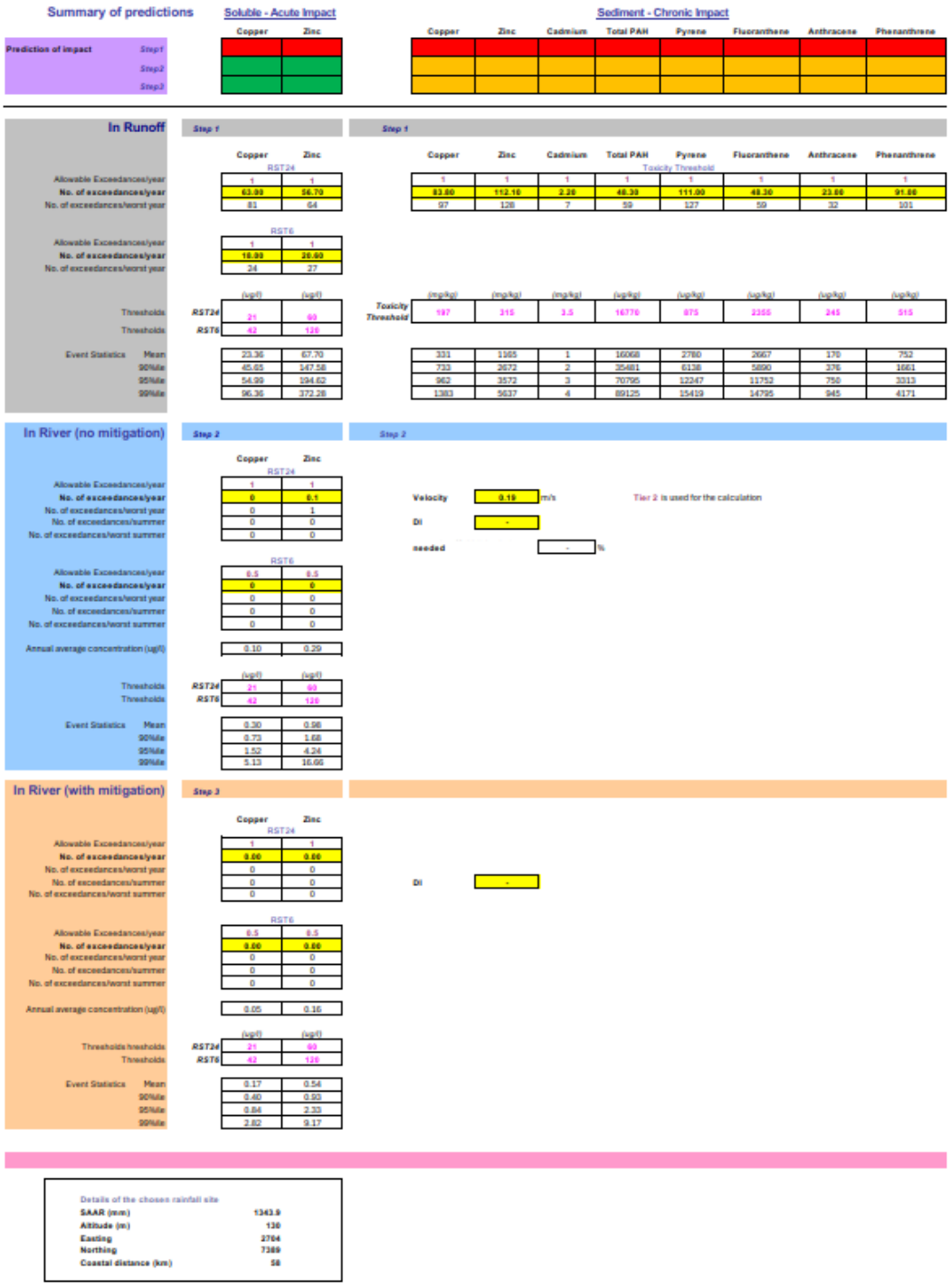
**For sediment impact only** Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes

- Tier 1 Estimated river width (m): 0.5
- Tier 2 Bed width (m): 1 Manning's n: 0.03 Side slope (m/m): 0.5 Long slope (m/m): 0.05

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | | 0 | No restriction | 0 |
| Proposed measures | Filter Drain (Solids 60%, Zinc 45%) | 45 | No restriction | 60 |

## Image 19-5.10 Network 3B HEWRAT Detailed Assessment Results



Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

| Prediction of impact | Copper | Zinc | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|---|---|
| Step1 | | | | | | | | | | |
| Step2 | | | | | | | | | | |
| Step3 | | | | | | | | | | |

**In Runoff**

Step 1

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 63.00 | 56.70 |
| No. of exceedances/worst year | 81 | 64 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 18.00 | 20.60 |
| No. of exceedances/worst year | 24 | 27 |
| Thresholds (ug/l) RST24 | 21 | 60 |
| Thresholds (ug/l) RST6 | 42 | 120 |
| Event Statistics Mean | 23.36 | 67.70 |
| 90%ile | 45.65 | 147.58 |
| 95%ile | 54.99 | 194.62 |
| 99%ile | 96.36 | 372.28 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| Toxicity Threshold | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 83.80 | 112.10 | 2.20 | 46.39 | 111.00 | 46.30 | 23.80 | 91.80 |
| | 97 | 128 | 7 | 59 | 127 | 59 | 32 | 101 |
| Toxicity Threshold (mg/kg) | 197 | 315 | 3.5 | 16770 | 875 | 2355 | 245 | 515 |
| | 331 | 1165 | 1 | 16068 | 2780 | 2667 | 170 | 752 |
| | 733 | 2672 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 962 | 3572 | 3 | 70795 | 12247 | 11752 | 750 | 3313 |
| | 1383 | 5637 | 4 | 89125 | 15419 | 14795 | 945 | 4171 |

**In River (no mitigation)**

Step 2

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0 | 0.1 |
| No. of exceedances/worst year | 0 | 1 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| RST6 | | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| No. of exceedances/year | 0 | 0 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.10 | 0.29 |
| Thresholds (ug/l) RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 0.30 | 0.98 |
| 90%ile | 0.73 | 1.68 |
| 95%ile | 1.52 | 4.24 |
| 99%ile | 5.13 | 16.66 |

Step 2

Velocity 0.19 m/s — Tier 2 is used for the calculation

DI -

needed - %

**In River (with mitigation)**

Step 3

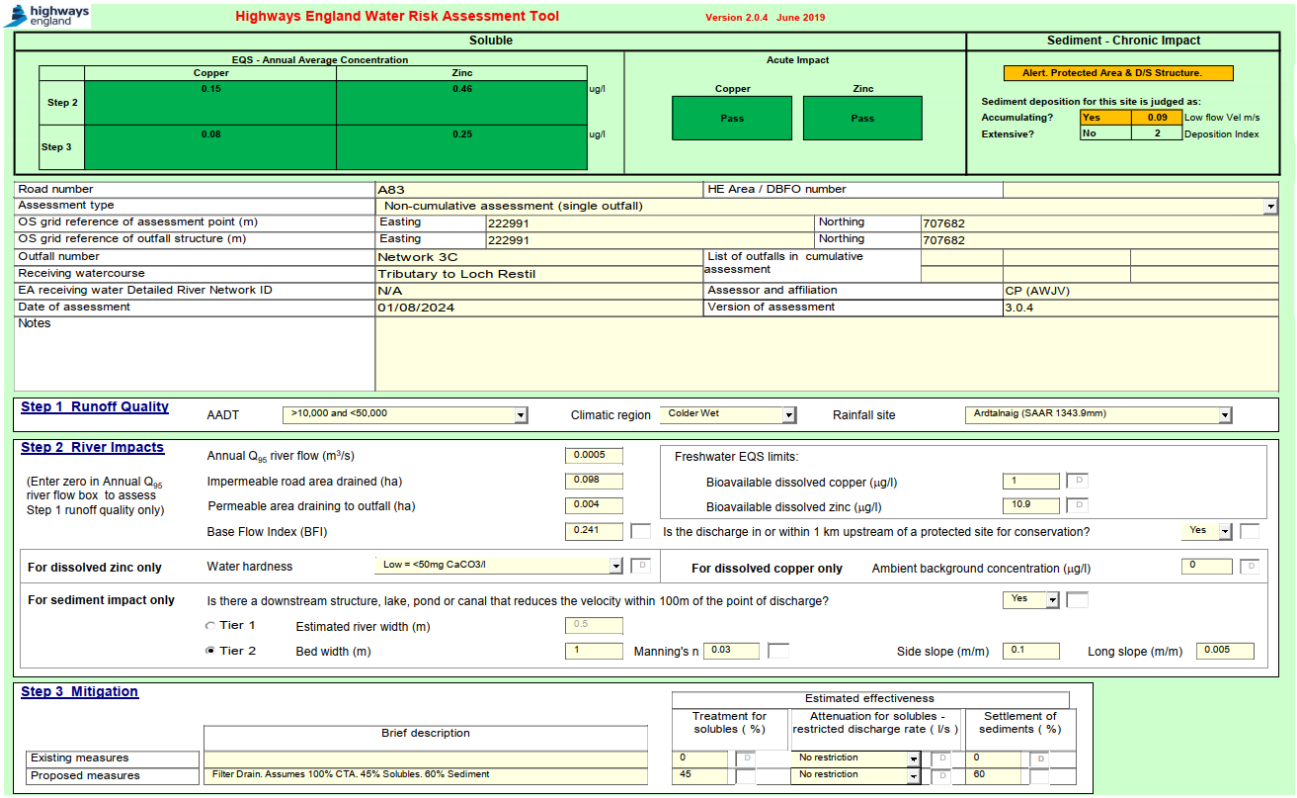
| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.00 | 0.00 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| RST6 | | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| No. of exceedances/year | 0.00 | 0.00 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.05 | 0.16 |
| Thresholds (ug/l) RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 120 |
| Event Statistics Mean | 0.17 | 0.54 |
| 90%ile | 0.40 | 0.93 |
| 95%ile | 0.84 | 2.33 |
| 99%ile | 2.82 | 9.17 |

DI -

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1343.9 |
| Altitude (m) | 130 |
| Easting | 2704 |
| Northing | 7389 |
| Coastal distance (km) | 58 |

## Image 19-5.11 Network 3C HEWRAT Interface Assessment Results



highways england

**Highways England Water Risk Assessment Tool** Version 2.0.4 June 2019

**Soluble**

EQS - Annual Average Concentration

| | Copper | Zinc | |
|---|---|---|---|
| Step 2 | 0.15 | 0.46 | ug/l |
| Step 3 | 0.08 | 0.25 | ug/l |

Acute Impact

| Copper | Zinc |
|---|---|
| Pass | Pass |

**Sediment - Chronic Impact**

Alert. Protected Area & D/S Structure.

Sediment deposition for this site is judged as:

| | | | |
|---|---|---|---|
| Accumulating? | Yes | 0.09 | Low flow Vel m/s |
| Extensive? | No | 2 | Deposition Index |

| | | | | | |
|---|---|---|---|---|---|
| Road number | A83 | | HE Area / DBFO number | | |
| Assessment type | Non-cumulative assessment (single outfall) | | | | |
| OS grid reference of assessment point (m) | Easting | 222991 | Northing | 707682 | |
| OS grid reference of outfall structure (m) | Easting | 222991 | Northing | 707682 | |
| Outfall number | Network 3C | | List of outfalls in cumulative assessment | | |
| Receiving watercourse | Tributary to Loch Restil | | | | |
| EA receiving water Detailed River Network ID | N/A | | Assessor and affiliation | CP (AWJV) | |
| Date of assessment | 01/08/2024 | | Version of assessment | 3.0.4 | |
| Notes | | | | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

**Step 2 River Impacts**

(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

| | |
|---|---|
| Annual $Q_{95}$ river flow ($m^3/s$) | 0.0005 |
| Impermeable road area drained (ha) | 0.098 |
| Permeable area draining to outfall (ha) | 0.004 |
| Base Flow Index (BFI) | 0.241 |

Freshwater EQS limits:

| | |
|---|---|
| Bioavailable dissolved copper (µg/l) | 1 |
| Bioavailable dissolved zinc (µg/l) | 10.9 |

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

**For dissolved zinc only** — Water hardness: Low = <50mg CaCO3/l

**For dissolved copper only** — Ambient background concentration (µg/l): 0

**For sediment impact only** — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes

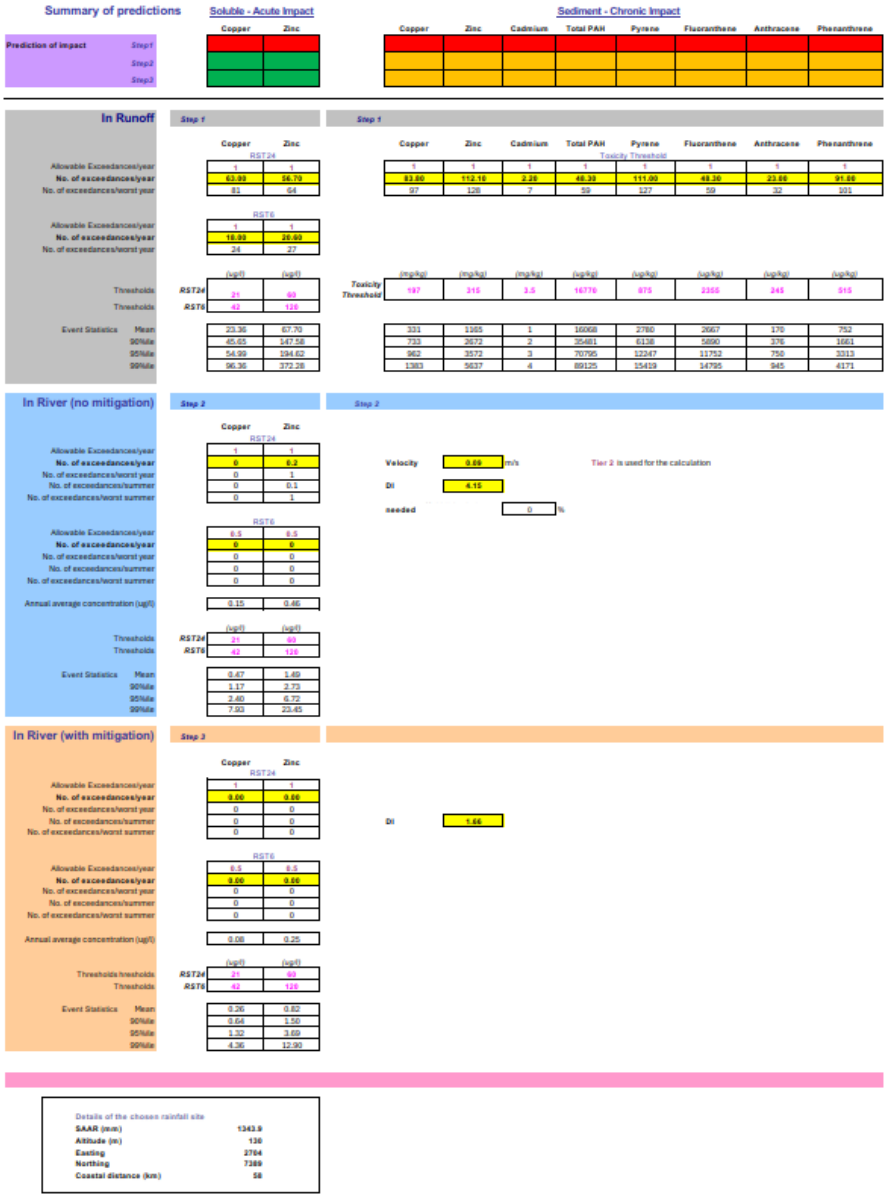
Tier 1 — Estimated river width (m): 0.5

Tier 2 — Bed width (m): 1 | Manning's n: 0.03 | Side slope (m/m): 0.1 | Long slope (m/m): 0.005

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | | 0 | No restriction | 0 |
| Proposed measures | Filter Drain. Assumes 100% CTA. 45% Solubles. 60% Sediment | 45 | No restriction | 60 |

## Image 19-5.12 Network 3C HEWRAT Interface Assessment Results



Summary of predictions

Soluble - Acute Impact

| | Copper | Zinc |
|---|---|---|
| Prediction of impact | Step1 | |
| | Step2 | |
| | Step3 | |

Sediment - Chronic Impact

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**In Runoff**

Step 1

| | Copper | Zinc |
|---|---|---|
| | RST24 | |
| Allowable Exceedances/year | 1 | 1 |
| **No. of exceedances/year** | **63.00** | **56.70** |
| No. of exceedances/worst year | 83 | 64 |
| | RST6 | |
| Allowable Exceedances/year | 1 | 1 |
| **No. of exceedances/year** | **18.00** | **20.60** |
| No. of exceedances/worst year | 24 | 27 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 23.36 | 67.70 |
| 90%ile | 45.65 | 147.58 |
| 95%ile | 54.99 | 194.62 |
| 99%ile | 96.36 | 372.28 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| | | | | Toxicity Threshold | | | | |
| Allowable Exceedances/year | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **No. of exceedances/year** | **93.60** | **112.10** | **2.26** | **46.30** | **111.00** | **48.30** | **23.60** | **91.60** |
| No. of exceedances/worst year | 97 | 128 | 7 | 59 | 127 | 59 | 32 | 101 |
| | (mg/kg) | (mg/kg) | (mg/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) |
| Toxicity Threshold | 197 | 315 | 3.5 | 16770 | 875 | 2355 | 245 | 515 |
| | 331 | 1165 | 1 | 16068 | 2780 | 2667 | 170 | 752 |
| | 733 | 2672 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 962 | 3572 | 3 | 70795 | 12247 | 11752 | 750 | 3313 |
| | 1383 | 5637 | 4 | 89125 | 15419 | 14795 | 945 | 4171 |

**In River (no mitigation)**

Step 2

| | Copper | Zinc |
|---|---|---|
| | RST24 | |
| Allowable Exceedances/year | 1 | 1 |
| **No. of exceedances/year** | **0** | **0.2** |
| No. of exceedances/worst year | 0 | 1 |
| No. of exceedances/summer | 0 | 0.1 |
| No. of exceedances/worst summer | 0 | 1 |
| | RST6 | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| **No. of exceedances/year** | **0** | **0** |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.15 | 0.46 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 0.47 | 1.49 |
| 90%ile | 1.17 | 2.73 |
| 95%ile | 2.40 | 6.72 |
| 99%ile | 7.93 | 23.45 |

Step 2

Velocity 0.69 m/s — Tier 2 is used for the calculation

DI 4.15

needed 0 %

**In River (with mitigation)**

Step 3

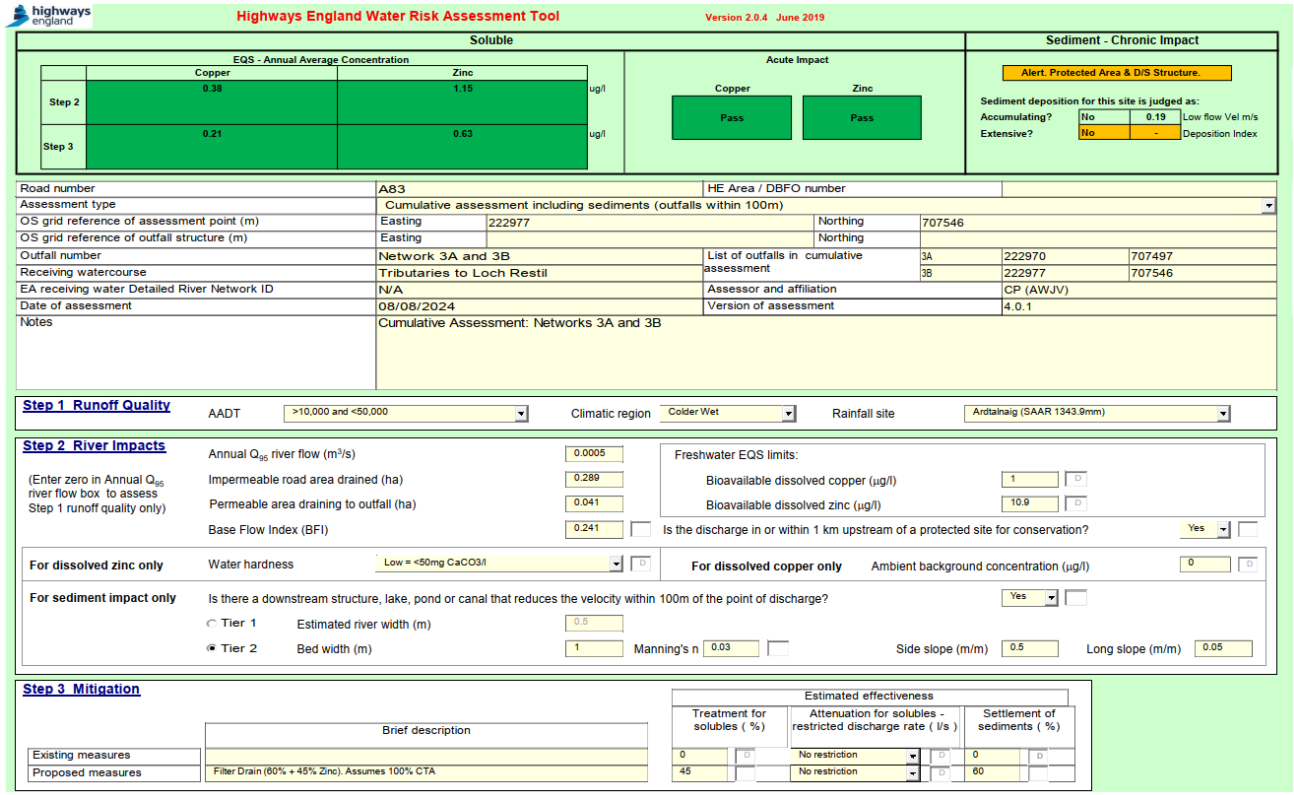
| | Copper | Zinc |
|---|---|---|
| | RST24 | |
| Allowable Exceedances/year | 1 | 1 |
| **No. of exceedances/year** | **0.00** | **0.00** |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| | RST6 | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| **No. of exceedances/year** | **0.00** | **0.00** |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.08 | 0.25 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 60 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 0.26 | 0.82 |
| 90%ile | 0.64 | 1.50 |
| 95%ile | 1.32 | 3.69 |
| 99%ile | 4.36 | 12.90 |

DI 1.66

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1343.9 |
| Altitude (m) | 130 |
| Easting | 2704 |
| Northing | 7389 |
| Coastal distance (km) | 58 |

## Image 19-5.13 Cumulative Networks 3A and 3B HEWRAT Interface Assessment Results



highways england

**Highways England Water Risk Assessment Tool** Version 2.0.4 June 2019

**Soluble**

EQS - Annual Average Concentration

| | Copper | Zinc | |
|---|---|---|---|
| Step 2 | 0.38 | 1.15 | ug/l |
| Step 3 | 0.21 | 0.63 | ug/l |

Acute Impact

| Copper | Zinc |
|---|---|
| Pass | Pass |

**Sediment - Chronic Impact**

Alert. Protected Area & D/S Structure.

Sediment deposition for this site is judged as:

| | | | |
|---|---|---|---|
| Accumulating? | No | 0.19 | Low flow Vel m/s |
| Extensive? | No | - | Deposition Index |

| | | | | | | |
|---|---|---|---|---|---|---|
| Road number | A83 | | HE Area / DBFO number | | | |
| Assessment type | Cumulative assessment including sediments (outfalls within 100m) | | | | | |
| OS grid reference of assessment point (m) | Easting | 222977 | Northing | 707546 | | |
| OS grid reference of outfall structure (m) | Easting | | Northing | | | |
| Outfall number | Network 3A and 3B | | List of outfalls in cumulative assessment | 3A | 222970 | 707497 |
| Receiving watercourse | Tributaries to Loch Restil | | | 3B | 222977 | 707546 |
| EA receiving water Detailed River Network ID | N/A | | Assessor and affiliation | | CP (AWJV) | |
| Date of assessment | 08/08/2024 | | Version of assessment | | 4.0.1 | |
| Notes | Cumulative Assessment: Networks 3A and 3B | | | | | |

**Step 1 Runoff Quality**

AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

**Step 2 River Impacts**

(Enter zero in Annual $Q_{95}$ river flow box to assess Step 1 runoff quality only)

| | |
|---|---|
| Annual $Q_{95}$ river flow ($m^3/s$) | 0.0005 |
| Impermeable road area drained (ha) | 0.289 |
| Permeable area draining to outfall (ha) | 0.041 |
| Base Flow Index (BFI) | 0.241 |

Freshwater EQS limits:

| | |
|---|---|
| Bioavailable dissolved copper (µg/l) | 1 |
| Bioavailable dissolved zinc (µg/l) | 10.9 |

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

**For dissolved zinc only** Water hardness: Low = <50mg CaCO3/l

**For dissolved copper only** Ambient background concentration (µg/l): 0

**For sediment impact only** Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes

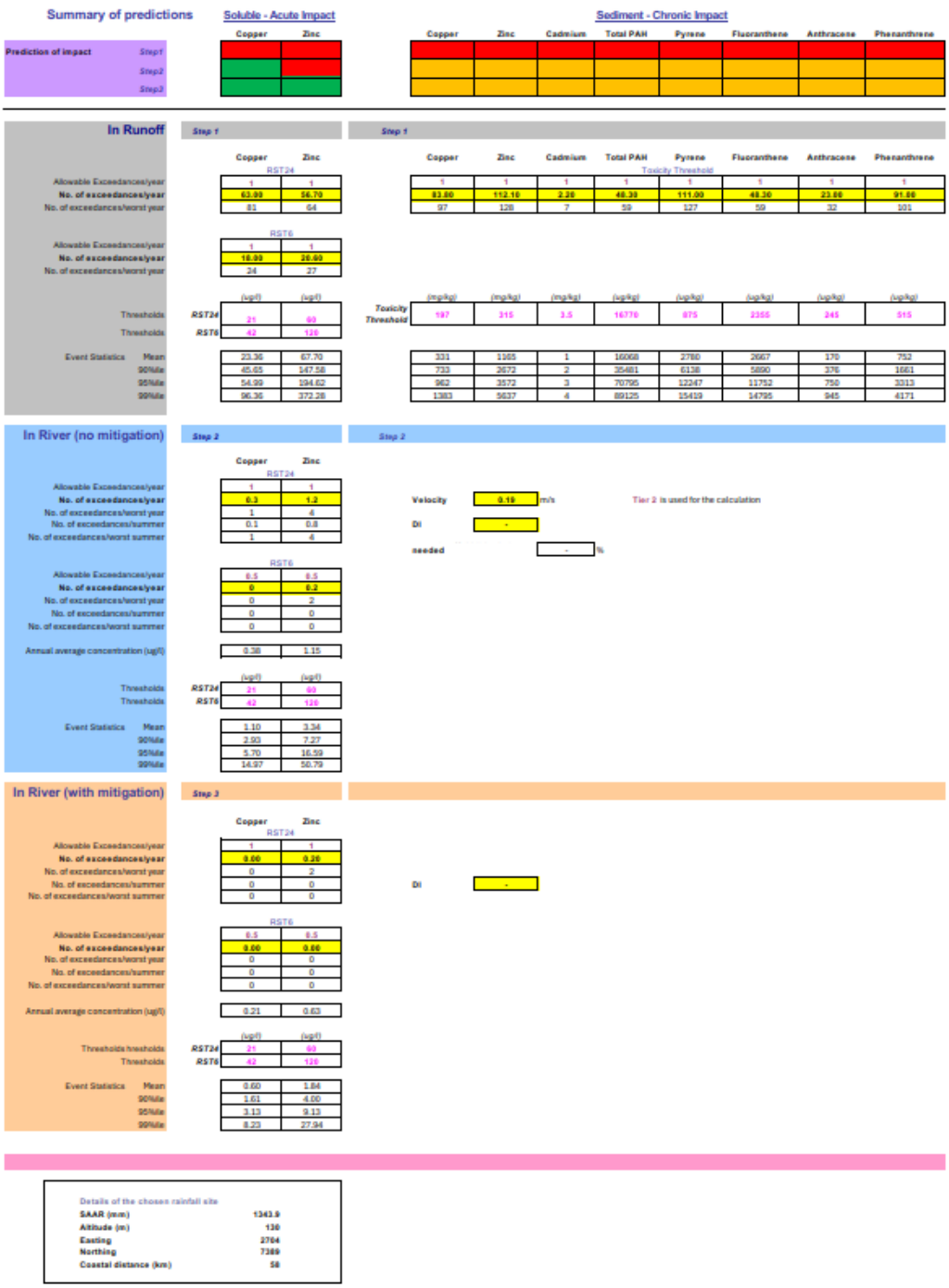
Tier 1 Estimated river width (m): 0.5

Tier 2 Bed width (m): 1 | Manning's n: 0.03 | Side slope (m/m): 0.5 | Long slope (m/m): 0.05

**Step 3 Mitigation**

| | Brief description | Estimated effectiveness: Treatment for solubles ( %) | Attenuation for solubles - restricted discharge rate ( l/s ) | Settlement of sediments ( %) |
|---|---|---|---|---|
| Existing measures | | 0 | No restriction | 0 |
| Proposed measures | Filter Drain (60% + 45% Zinc). Assumes 100% CTA | 45 | No restriction | 60 |

## Image 19-5.14 Cumulative Networks 3A and 3B HEWRAT Detailed Assessment Results



Summary of predictions

Soluble - Acute Impact

| Prediction of impact | Copper | Zinc |
|---|---|---|
| Step1 | | |
| Step2 | | |
| Step3 | | |

Sediment - Chronic Impact

| Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

In Runoff

Step 1

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 63.90 | 56.70 |
| No. of exceedances/worst year | 81 | 64 |
| RST6 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 18.90 | 20.60 |
| No. of exceedances/worst year | 24 | 27 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 63 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 23.36 | 67.70 |
| 90%ile | 45.65 | 147.58 |
| 95%ile | 54.99 | 194.62 |
| 99%ile | 96.36 | 372.28 |

Step 1

| | Copper | Zinc | Cadmium | Total PAH | Pyrene | Fluoranthene | Anthracene | Phenanthrene |
|---|---|---|---|---|---|---|---|---|
| | | | | Toxicity Threshold | | | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | 83.80 | 112.10 | 2.26 | 48.30 | 111.00 | 48.30 | 23.80 | 91.80 |
| | 97 | 128 | 7 | 59 | 127 | 59 | 32 | 101 |
| | (mg/kg) | (mg/kg) | (mg/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) | (ug/kg) |
| Toxicity Threshold | 197 | 315 | 3.5 | 16770 | 675 | 2355 | 245 | 515 |
| | 331 | 1165 | 1 | 16068 | 2780 | 2667 | 170 | 752 |
| | 733 | 2672 | 2 | 35481 | 6138 | 5890 | 376 | 1661 |
| | 962 | 3572 | 3 | 70795 | 12247 | 11752 | 750 | 3313 |
| | 1383 | 5637 | 4 | 89125 | 15419 | 14795 | 945 | 4171 |

In River (no mitigation)

Step 2

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.3 | 1.2 |
| No. of exceedances/worst year | 1 | 4 |
| No. of exceedances/summer | 0.1 | 0.8 |
| No. of exceedances/worst summer | 1 | 4 |
| RST6 | | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| No. of exceedances/year | 0 | 0.2 |
| No. of exceedances/worst year | 0 | 2 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.38 | 1.15 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 63 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 1.10 | 3.34 |
| 90%ile | 2.93 | 7.27 |
| 95%ile | 5.70 | 16.59 |
| 99%ile | 14.97 | 58.79 |

Step 2

Velocity 0.19 m/s Tier 2 is used for the calculation

DI -

needed - %

In River (with mitigation)

Step 3

| | Copper | Zinc |
|---|---|---|
| RST24 | | |
| Allowable Exceedances/year | 1 | 1 |
| No. of exceedances/year | 0.00 | 0.20 |
| No. of exceedances/worst year | 0 | 2 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| RST6 | | |
| Allowable Exceedances/year | 0.5 | 0.5 |
| No. of exceedances/year | 0.00 | 0.00 |
| No. of exceedances/worst year | 0 | 0 |
| No. of exceedances/summer | 0 | 0 |
| No. of exceedances/worst summer | 0 | 0 |
| Annual average concentration (ug/l) | 0.21 | 0.63 |
| | (ug/l) | (ug/l) |
| Thresholds RST24 | 21 | 63 |
| Thresholds RST6 | 42 | 126 |
| Event Statistics Mean | 0.60 | 1.84 |
| 90%ile | 1.61 | 4.00 |
| 95%ile | 3.13 | 9.13 |
| 99%ile | 8.23 | 27.94 |

DI -

Details of the chosen rainfall site

| | |
|---|---|
| SAAR (mm) | 1343.9 |
| Altitude (m) | 130 |
| Easting | 2704 |
| Northing | 7389 |
| Coastal distance (km) | 58 |

## Image 19-5.15 Network 1 HEWRAT Accidental Spillage Risk Assessment Results

highways england

View Parameters | Reset Spillage Risk | Go To Interface

**Assessment of Priority Outfalls**

**Method D - assessment of risk from accidental spillage**

| | | A (main road) | Additional columns for use if other roads drain to the same outfall B | C | D | E | F | Totals | Return Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| D1 | Water body type | Surface watercourse | | | | | | | |
| D2 | Length of road draining to outfall *(m)* | 1,421 | | | | | | | |
| D3 | Road Type *(A-road or Motorway)* | A | | | | | | | |
| D4 | If A road, is site urban or rural? | Rural | | | | | | | |
| D5 | Junction type | No junction | | | | | | | |
| D6 | Location (response time for emergency services) | > 1 hour | | | | | | | |
| D7 | Traffic flow (AADT two way) | 8,948 | | | | | | | |
| D8 | % HGV | 12 | | | | | | | |
| D8 | Spillage factor *(no/$10^9$ HGVkm/year)* | 0.75 | | | | | | | |
| D9 | Risk of accidental spillage | 0.00042 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D10 | Probability factor | 0.75 | | | | | | | |
| D11 | Risk of pollution incident | 0.00031 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D12 | Is risk greater than 0.01? | **No** | | | | | | | |
| D13 | Return period without pollution reduction measures | 0.00031 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0003 | 3192 |
| D14 | Existing measures factor | 1 | | | | | | | |
| D15 | Return period with existing pollution reduction measures | 0.00031 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0003 | 3192 |
| D16 | Proposed measures factor | 1 | | | | | | | |
| D17 | Residual with proposed Pollution reduction measures | 0.00031 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0003 | 3192 |

**Justification for choice of existing measures factors:**

Network 1 - No existing measures

**Justification for choice of proposed measures factors:**

Network 1 - SuDS attenuation basin, no suitable factor provided.

**Spillage Factor**

| Location | Serious Accidental Spillages *(Billion HGV km/ year)* | Motorways | Rural Trunk | Urban Trunk |
|---|---|---|---|---|
| | No junction | 0.36 | 0.29 | 0.31 |
| | Slip road | 0.43 | 0.83 | 0.36 |
| | Roundabout | 3.09 | 3.09 | 5.35 |
| | Cross road | - | 0.88 | 1.46 |
| | Side road | - | 0.93 | 1.81 |
| | Total | 0.37 | 0.45 | 0.85 |

**Indicative Pollution Risk Reduction Factors for Spillages**

| System | Optimum Risk Reduction Factor |
|---|---|
| Filter Drain | 0.6 |
| Grassed Ditch / Swale | 0.6 |
| Pond | 0.5 |
| Wetland | 0.4 |
| Soakaway / Infiltration basin | 0.6 |
| Sediment Trap | 0.6 |
| Unlined Ditch | 0.7 |
| Penstock / valve | 0.4 |
| Notched Weir | 0.6 |
| Oil Separator | 0.5 |

The worksheet should be read in conjunction with DMRB 11.3.10.

HEWRAT v2.0.4Spillage Risk

## Image 19-5.16 Network 2A HEWRAT Accidental Spillage Risk Assessment Results

highways england

View Parameters | Reset Spillage Risk | Go To Interface

**Assessment of Priority Outfalls**

**Method D - assessment of risk from accidental spillage**

| | | A (main road) | Additional columns for use if other roads drain to the same outfall: B | C | D | E | F | Totals | Return Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| D1 | Water body type | Surface watercourse | | | | | | | |
| D2 | Length of road draining to outfall *(m)* | 320 | | | | | | | |
| D3 | Road Type *(A-road or Motorway)* | A | | | | | | | |
| D4 | If A road, is site urban or rural? | Rural | | | | | | | |
| D5 | Junction type | No junction | | | | | | | |
| D6 | Location (response time for emergency services) | > 1 hour | | | | | | | |
| D7 | Traffic flow (AADT two way) | 8,948 | | | | | | | |
| D8 | % HGV | 12 | | | | | | | |
| D8 | Spillage factor *(no/$10^9$ HGVkm/year)* | 0.29 | | | | | | | |
| D9 | Risk of accidental spillage | 0.00004 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D10 | Probability factor | 0.75 | | | | | | | |
| D11 | Risk of pollution incident | 0.00003 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D12 | Is risk greater than 0.01? | No | | | | | | | |
| D13 | Return period without pollution reduction measures | 0.00003 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 36660 |
| D14 | Existing measures factor | 1 | | | | | | | |
| D15 | Return period with existing pollution reduction measures | 0.00003 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 36660 |
| D16 | Proposed measures factor | 0.6 | | | | | | | |
| D17 | Residual with proposed Pollution reduction measures | 0.00002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 61100 |

**Justification for choice of existing measures factors:**

Network 2A - No existing measures

**Justification for choice of proposed measures factors:**

Network 2A - Filter drain only

**Spillage Factor**

| Location | Serious Accidental Spillages *(Billion HGV km/ year)* | Motorways | Rural Trunk | Urban Trunk |
|---|---|---|---|---|
| | No junction | 0.36 | 0.29 | 0.31 |
| | Slip road | 0.43 | 0.83 | 0.36 |
| | Roundabout | 3.09 | 3.09 | 5.35 |
| | Cross road | - | 0.88 | 1.46 |
| | Side road | - | 0.93 | 1.81 |
| | Total | 0.37 | 0.45 | 0.85 |

**Indicative Pollution Risk Reduction Factors for Spillages**

| System | Optimum Risk Reduction Factor |
|---|---|
| Filter Drain | 0.6 |
| Grassed Ditch / Swale | 0.6 |
| Pond | 0.5 |
| Wetland | 0.4 |
| Soakaway / Infiltration basin | 0.6 |
| Sediment Trap | 0.6 |
| Unlined Ditch | 0.7 |
| Penstock / valve | 0.4 |
| Notched Weir | 0.6 |
| Oil Separator | 0.5 |

The worksheet should be read in conjunction with DMRB 11.3.10.

HEWRAT v2.0.4Spillage Risk

## Image 19-5.17 Network 2B HEWRAT Accidental Spillage Risk Assessment Results

highways england

View Parameters | Reset Spillage Risk | Go To Interface

**Assessment of Priority Outfalls**

**Method D - assessment of risk from accidental spillage**

| | | A (main road) | Additional columns for use if other roads drain to the same outfall B | C | D | E | F | | |
|---|---|---|---|---|---|---|---|---|---|
| D1 | Water body type | Surface watercourse | Surface watercourse | | | | | | |
| D2 | Length of road draining to outfall *(m)* | 140 | 50 | | | | | | |
| D3 | Road Type *(A-road or Motorway)* | A | A | | | | | | |
| D4 | If A road, is site urban or rural? | Rural | Rural | | | | | | |
| D5 | Junction type | No junction | Side road | | | | | | |
| D6 | Location (response time for emergency services) | > 1 hour | > 1 hour | | | | | | |
| D7 | Traffic flow (AADT two way) | 8,948 | 8,948 | | | | | | |
| D8 | % HGV | 12 | 12 | | | | | | |
| D8 | Spillage factor *(no/$10^9$ HGVkm/year)* | 0.29 | 0.93 | | | | | | |
| D9 | Risk of accidental spillage | 0.00002 | 0.00002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D10 | Probability factor | 0.75 | 0.75 | | | | | | |
| D11 | Risk of pollution incident | 0.00001 | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D12 | Is risk greater than 0.01? | **No** | **No** | | | | | **Totals** | **Return Period (years)** |
| D13 | Return period without pollution reduction measures | 0.00001 | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 39059 |
| D14 | Existing measures factor | 1 | 1 | | | | | | |
| D15 | Return period with existing pollution reduction measures | 0.00001 | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 39059 |
| D16 | Proposed measures factor | 0.6 | 0.6 | | | | | | |
| D17 | Residual with proposed Pollution reduction measures | 0.00001 | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 65098 |

**Justification for choice of existing measures factors:**

Network 2B - No existing measures

**Justification for choice of proposed measures factors:**

Network 2B - Filter drain only

**Spillage Factor**

| | Serious Accidental Spillages *(Billion HGV km/ year)* | Motorways | Rural Trunk | Urban Trunk |
|---|---|---|---|---|
| Location | No junction | 0.36 | 0.29 | 0.31 |
| | Slip road | 0.43 | 0.83 | 0.36 |
| | Roundabout | 3.09 | 3.09 | 5.35 |
| | Cross road | - | 0.88 | 1.46 |
| | Side road | - | 0.93 | 1.81 |
| | Total | 0.37 | 0.45 | 0.85 |

**Indicative Pollution Risk Reduction Factors for Spillages**

| System | Optimum Risk Reduction Factor |
|---|---|
| Filter Drain | 0.6 |
| Grassed Ditch / Swale | 0.6 |
| Pond | 0.5 |
| Wetland | 0.4 |
| Soakaway / Infiltration basin | 0.6 |
| Sediment Trap | 0.6 |
| Unlined Ditch | 0.7 |
| Penstock / valve | 0.4 |
| Notched Weir | 0.6 |
| Oil Separator | 0.5 |

The worksheet should be read in conjunction with DMRB 11.3.10.

HEWRAT v2.0.4Spillage Risk

## Image 19-5.18 Network 3A HEWRAT Accidental Spillage Risk Assessment Results

highways england

View Parameters | Reset Spillage Risk | Go To Interface

**Assessment of Priority Outfalls**

**Method D - assessment of risk from accidental spillage**

| | | A (main road) | Additional columns for use if other roads drain to the same outfall B | C | D | E | F | | |
|---|---|---|---|---|---|---|---|---|---|
| D1 | Water body type | Surface watercourse | Surface watercourse | | | | | | |
| D2 | Length of road draining to outfall *(m)* | 105 | 55 | | | | | | |
| D3 | Road Type *(A-road or Motorway)* | A | A | | | | | | |
| D4 | If A road, is site urban or rural? | Rural | Rural | | | | | | |
| D5 | Junction type | No junction | Side road | | | | | | |
| D6 | Location (response time for emergency services) | > 1 hour | > 1 hour | | | | | | |
| D7 | Traffic flow (AADT two way) | 8,948 | 8,948 | | | | | | |
| D8 | % HGV | 12 | 12 | | | | | | |
| D8 | Spillage factor *(no/$10^9$ HGVkm/year)* | 0.29 | 0.93 | | | | | | |
| D9 | Risk of accidental spillage | 0.00001 | 0.00002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D10 | Probability factor | 0.75 | 0.75 | | | | | | |
| D11 | Risk of pollution incident | 0.00001 | 0.00002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D12 | Is risk greater than 0.01? | **No** | **No** | | | | | **Totals** | **Return Period (years)** |
| D13 | Return period without pollution reduction measures | 0.00001 | 0.00002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 41692 |
| D14 | Existing measures factor | 1 | 1 | | | | | | |
| D15 | Return period with existing pollution reduction measures | 0.00001 | 0.00002 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 41692 |
| D16 | Proposed measures factor | 0.6 | 0.6 | | | | | | |
| D17 | Residual with proposed Pollution reduction measures | 0.00001 | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 69486 |

**Justification for choice of existing measures factors:**

Network 3A - No existing measures

**Justification for choice of proposed measures factors:**

Network 3A - Filter drain only

**Spillage Factor**

| Location | Serious Accidental Spillages *(Billion HGV km/ year)* | Motorways | Rural Trunk | Urban Trunk |
|---|---|---|---|---|
| | No junction | 0.36 | 0.29 | 0.31 |
| | Slip road | 0.43 | 0.83 | 0.36 |
| | Roundabout | 3.09 | 3.09 | 5.35 |
| | Cross road | - | 0.88 | 1.46 |
| | Side road | - | 0.93 | 1.81 |
| | Total | 0.37 | 0.45 | 0.85 |

**Indicative Pollution Risk Reduction Factors for Spillages**

| System | Optimum Risk Reduction Factor |
|---|---|
| Filter Drain | 0.6 |
| Grassed Ditch / Swale | 0.6 |
| Pond | 0.5 |
| Wetland | 0.4 |
| Soakaway / Infiltration basin | 0.6 |
| Sediment Trap | 0.6 |
| Unlined Ditch | 0.7 |
| Penstock / valve | 0.4 |
| Notched Weir | 0.6 |
| Oil Separator | 0.5 |

The worksheet should be read in conjunction with DMRB 11.3.10.

HEWRAT v2.0.4Spillage Risk

## Image 19-5.19 Network 3B HEWRAT Accidental Spillage Risk Assessment Results

highways england

View Parameters | Reset Spillage Risk | Go To Interface

**Assessment of Priority Outfalls**

**Method D - assessment of risk from accidental spillage**

| | | A (main road) | Additional columns for use if other roads drain to the same outfall: B | C | D | E | F | Totals | Return Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| D1 | Water body type | Surface watercourse | | | | | | | |
| D2 | Length of road draining to outfall *(m)* | 60 | | | | | | | |
| D3 | Road Type *(A-road or Motorway)* | A | | | | | | | |
| D4 | If A road, is site urban or rural? | Rural | | | | | | | |
| D5 | Junction type | No junction | | | | | | | |
| D6 | Location (response time for emergency services) | > 1 hour | | | | | | | |
| D7 | Traffic flow (AADT two way) | 8,948 | | | | | | | |
| D8 | % HGV | 12 | | | | | | | |
| D8 | Spillage factor *(no/$10^9$ HGVkm/year)* | 0.29 | | | | | | | |
| D9 | Risk of accidental spillage | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D10 | Probability factor | 0.75 | | | | | | | |
| D11 | Risk of pollution incident | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D12 | Is risk greater than 0.01? | **No** | | | | | | | |
| D13 | Return period without pollution reduction measures | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 195519 |
| D14 | Existing measures factor | 1 | | | | | | | |
| D15 | Return period with existing pollution reduction measures | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 195519 |
| D16 | Proposed measures factor | 0.6 | | | | | | | |
| D17 | Residual with proposed Pollution reduction measures | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 325865 |

**Justification for choice of existing measures factors:**

Network 3B - No existing measures

**Justification for choice of proposed measures factors:**

Network 3B - Filter drain only

**Spillage Factor**

| Location | Serious Accidental Spillages *(Billion HGV km/ year)* | Motorways | Rural Trunk | Urban Trunk |
|---|---|---|---|---|
| | No junction | 0.36 | 0.29 | 0.31 |
| | Slip road | 0.43 | 0.83 | 0.36 |
| | Roundabout | 3.09 | 3.09 | 5.35 |
| | Cross road | - | 0.88 | 1.46 |
| | Side road | - | 0.93 | 1.81 |
| | Total | 0.37 | 0.45 | 0.85 |

**Indicative Pollution Risk Reduction Factors for Spillages**

| System | Optimum Risk Reduction Factor |
|---|---|
| Filter Drain | 0.6 |
| Grassed Ditch / Swale | 0.6 |
| Pond | 0.5 |
| Wetland | 0.4 |
| Soakaway / Infiltration basin | 0.6 |
| Sediment Trap | 0.6 |
| Unlined Ditch | 0.7 |
| Penstock / valve | 0.4 |
| Notched Weir | 0.6 |
| Oil Separator | 0.5 |

The worksheet should be read in conjunction with DMRB 11.3.10.

HEWRAT v2.0.4Spillage Risk

## Image 19-5. 20 Network 3C HEWRAT Accidental Spillage Risk Assessment Results

highways england

View Parameters | Reset Spillage Risk | Go To Interface

**Assessment of Priority Outfalls**

**Method D - assessment of risk from accidental spillage**

| | | A (main road) | Additional columns for use if other roads drain to the same outfall B | C | D | E | F | Totals | Return Period (years) |
|---|---|---|---|---|---|---|---|---|---|
| D1 | Water body type | Surface watercourse | | | | | | | |
| D2 | Length of road draining to outfall *(m)* | 90 | | | | | | | |
| D3 | Road Type *(A-road or Motorway)* | A | | | | | | | |
| D4 | If A road, is site urban or rural? | Rural | | | | | | | |
| D5 | Junction type | No junction | | | | | | | |
| D6 | Location (response time for emergency services) | > 1 hour | | | | | | | |
| D7 | Traffic flow (AADT two way) | 8,948 | | | | | | | |
| D8 | % HGV | 12 | | | | | | | |
| D8 | Spillage factor *(no/10$^8$ HGVkm/year)* | 0.29 | | | | | | | |
| D9 | Risk of accidental spillage | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D10 | Probability factor | 0.75 | | | | | | | |
| D11 | Risk of pollution incident | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | | |
| D12 | Is risk greater than 0.01? | **No** | | | | | | | |
| D13 | Return period without pollution reduction measures | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 130346 |
| D14 | Existing measures factor | 1 | | | | | | | |
| D15 | Return period with existing pollution reduction measures | 0.00001 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 130346 |
| D16 | Proposed measures factor | 0.6 | | | | | | | |
| D17 | Residual with proposed Pollution reduction measures | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 | 0.0000 | 217244 |

**Justification for choice of existing measures factors:**

Network 3C - No existing measures

**Justification for choice of proposed measures factors:**

Network 3C - Filter drain only

**Spillage Factor**

| Location | Serious Accidental Spillages *(Billion HGV km/ year)* | Motorways | Rural Trunk | Urban Trunk |
|---|---|---|---|---|
| | No junction | 0.36 | 0.29 | 0.31 |
| | Slip road | 0.43 | 0.83 | 0.36 |
| | Roundabout | 3.09 | 3.09 | 5.35 |
| | Cross road | - | 0.88 | 1.46 |
| | Side road | - | 0.93 | 1.81 |
| | Total | 0.37 | 0.45 | 0.85 |

**Indicative Pollution Risk Reduction Factors for Spillages**

| System | Optimum Risk Reduction Factor |
|---|---|
| Filter Drain | 0.6 |
| Grassed Ditch / Swale | 0.6 |
| Pond | 0.5 |
| Wetland | 0.4 |
| Soakaway / Infiltration basin | 0.6 |
| Sediment Trap | 0.6 |
| Unlined Ditch | 0.7 |
| Penstock / valve | 0.4 |
| Notched Weir | 0.6 |
| Oil Separator | 0.5 |

The worksheet should be read in conjunction with DMRB 11.3.10.

HEWRAT v2.0.4Spillage Risk