

Appendix A11.3

Road Drainage Network
Water Quality Assessment



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1. Introduction

- 1.1.1. This report is a technical appendix to the A9 Dualling Tomatin to Moy – DMRB Stage 3 Environmental Statement, Chapter 11: Road Drainage and the Water Environment.
- 1.1.2. This document details the methods and results of the water quality assessments carried out for each mainline road drainage network, as summarised in Chapter 11.
- 1.1.3. The assessments have taken into consideration the embedded sustainable drainage systems (SuDS) incorporated within the DMRB Stage 3 drainage design.

1.2. Aims and Objectives

- 1.2.1. This document provides details of the assessment methods and results of the following water quality assessments carried out for each mainline road drainage network:
 - DMRB HD 45/09 Method A assessment of pollution impacts from routine runoff on surface waters
 - DMRB HD 45/09 Method D assessment of pollution impacts from operational accidental spillage
 - Assessment of the short term, acute impacts of road salt, utilising a method developed by Jacobs for use on all projects within the A9 Dualling programme

2. Assessment Methods

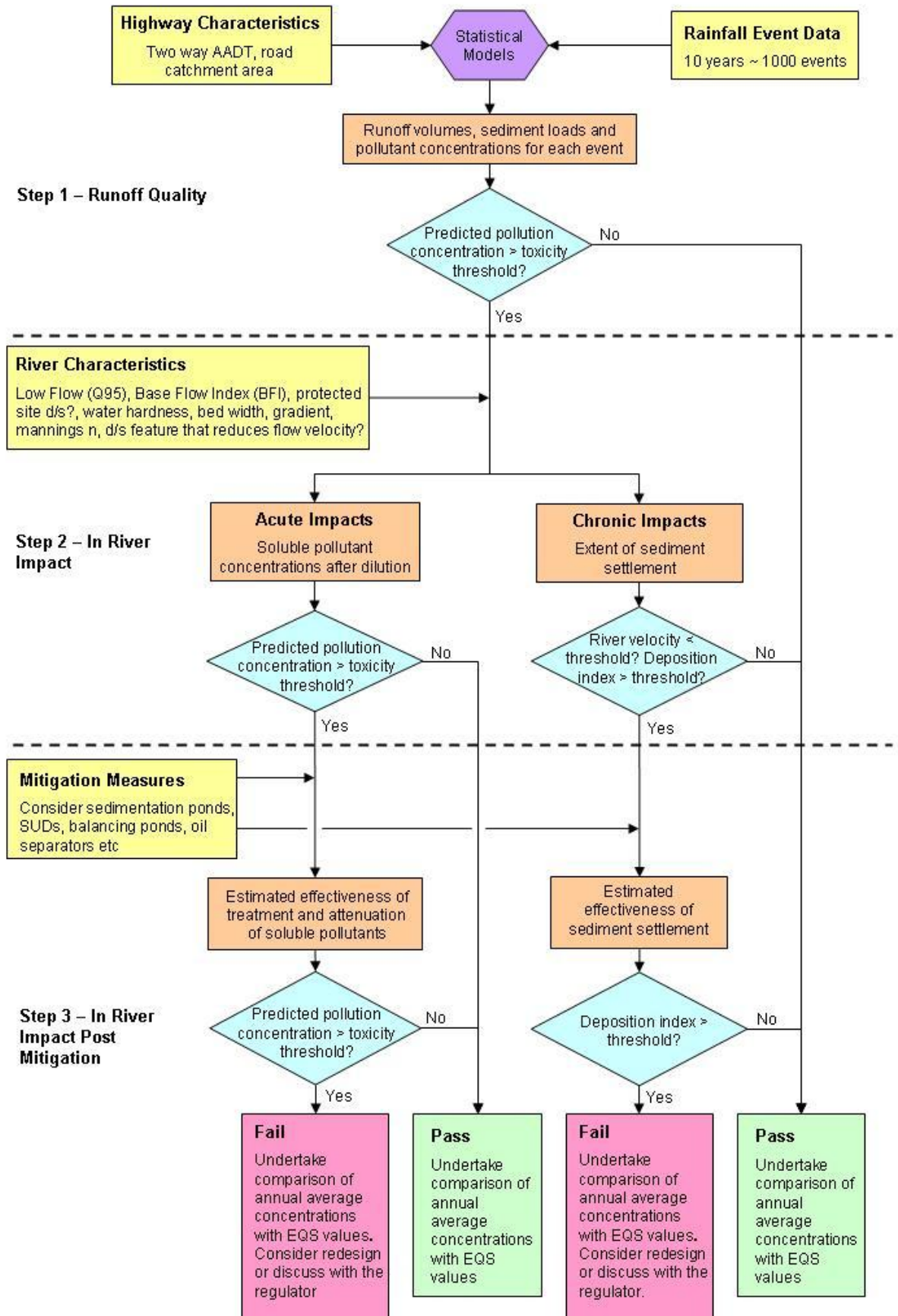
2.1. Method A Routine Runoff Assessment

- 2.1.1. DMRB HD 45/09 Method A assessment of pollution impacts from routine runoff on surface waters, comprises two separate elements:
 - HAWRAT Assessment: the Highways Agency Water Risk Assessment Tool (HAWRAT) is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road runoff. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants, respectively.
 - EQS Assessment: Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.
- 2.1.2. Both assessments require a variety of data about the proposed scheme and the receiving watercourses, this includes: the permeable and impermeable areas of each drainage network, traffic volumes associated with each drainage network, the Q_{95} flow (flow exceeded 95% of the time) for each receiving watercourse at the point of the road discharge, watercourse baseflow index (a measure of the proportion of flow in the watercourse derived from groundwater) and watercourse dimensions such as bed width, side slopes and gradient at the point of discharge.

HAWRAT Assessment

- 2.1.3. HAWRAT is a tiered consequential system which involves up to three assessment stages:
- Step 1 uses statistical models to determine pollutant concentrations in raw road runoff prior to any treatment or dilution in the receiving watercourse.
 - Step 2 assesses in-river pollutant concentrations after dilution and dispersion but without active mitigation.
 - Step 3 considers the in-river pollutant concentrations with active mitigation. For an individual outfall to pass the HAWRAT assessment, it must pass both soluble pollutant and sediment pollutant impacts.
- 2.1.4. Figure 2.1 below displays the HAWRAT process and stages of assessment.
- 2.1.5. For soluble pollutants HAWRAT calculates the in-river concentration 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 or not there are sensitive sites such as SSSIs located downstream of the proposed discharge location (i.e. for less sensitive locations it is considered acceptable for the 24hr 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 metals part of the HAWRAT assessment.
- 2.1.6. For the 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. HAWRAT estimates the river velocity under low flow conditions and assumes that sediment arriving in the river when the velocity is less than 0.1 m/s accumulates. A basic estimation of velocity is calculated iteratively using the cross sectional area of the river channel and the flow volume at low flow conditions. The extent of deposition is evaluated by calculating the deposition index. To pass the sediment assessment within HAWRAT the discharge under assessment must pass both stages.
- 2.1.7. Where failures occur mitigation measures in the form of Sustainable Drainage Systems (SuDS) can be considered. The pollutant removal efficiency (expressed as a percentage reduction in pollutant concentrations) of the SuDS treatment train can be applied to the calculations and the assessments re-run.
- 2.1.8. The SuDS design and assessment process is iterative, and in most cases the drainage design is modified until each network passes all elements of the HAWRAT and EQS assessments.

Figure 2.1: HAWRAT Assessment Process



2.1.9. The treatment efficiency values applied in the assessment are based on those documented in DMRB HD 33/16 Design of Highway Drainage Systems, and summarised in Table A2.1 below.

Table A2.1: Indicative Treatment Efficiencies of Drainage systems

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

2.1.10. Generally, where a two or three stage treatment train is proposed the treatment efficiency of the secondary and tertiary stages is half of that quoted in Table A2.1. This takes into account the reduced performance of the secondary and tertiary stages due to the already reduced pollutant concentrations. However, if the primary stage does not provide any reduction of a particular pollutant, then for the next stage of the treatment train the full treatment efficiency quoted above is used for that particular pollutant. For example, in the case of a two stage treatment train consisting of filter drains followed by a wet/retention pond, the overall treatment efficiencies for sediment, copper and zinc would be as shown in Table A2.2.

Table A2.2: Example of Treatment Train Calculation

Treatment Train	Suspended Solids (% removal)	Soluble Copper (% removal)	Soluble Zinc (% removal)
Primary Treatment - Filter Drains	60	0	45
Secondary Treatment - Wet / Retention Pond	30	40	15
Overall Treatment	72	40	53

EQS Assessment

2.1.11. The HAWRAT program also calculates the annual average concentration of soluble copper and zinc, and these can be compared with the published EQS thresholds to determine pass or failure of the EQS assessment.

2.1.12. The EQS thresholds for copper and zinc are:

- Copper – an annual average of 1µg/l bioavailable copper

- Zinc – an annual average of 10.9 µg/l bioavailable zinc + Ambient Background Concentration (ABC) (µg/l) dissolved zinc

2.1.13. HAWRAT calculates the total annual average concentration of dissolved copper and dissolved zinc, not the bioavailable fraction. Comparing these calculated values with the bioavailable EQSs results in a conservative assessment of the routine runoff impacts, which generally provides a degree of comfort in the Method A assessment. However in exceptional circumstances this approach can be overly conservative leading to very onerous mitigation requirements.

Limitations

2.1.14. With regards to the routine runoff assessment, use of HAWRAT presents several limitations.

2.1.15. Firstly, a rainfall site must be selected from an embedded list of 21 sites across the UK, with only three located in Scotland. The closest and most geographically similar rainfall site is Ardtalnaig (near Aberfeldy). The annual average rainfall at Ardtalnaig is reported as being 1402mm while the annual average rainfall within the study area is approximately 1053mm. There is therefore potential for overestimation of flows within the receiving watercourses and from the road drainage networks.

2.1.16. Additionally, HAWRAT 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 volumes of traffic estimated for the Proposed Scheme (16,000-18,000 AADT) are at the lower end of the lowest traffic band it is likely that there is overestimation of the pollutant concentrations in the road runoff.

2.1.17. Finally, the required treatment percentages returned by HAWRAT are very precise, however the guidance on the treatment efficiency of SuDS provided in HD 33/16 can only be used as broad indicator of performance. With the above in mind a degree of pragmatism is required when designing and assessing the road drainage system; the treatment train should be sufficient to reasonably treat runoff.

2.2. Method D Accidental Spillage Assessment

2.2.1. The DMRB HD 45/09 Method D Accidental 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.
- The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

2.2.2. The probability of a serious spillage occurring is dependent on a variety of factors; 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', 'cross road' or 'roundabout' and the length of each road type within the catchment.

2.2.3. The probability of a serious spillage subsequently causing a serious pollution incident is dependent on the 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.

- 2.2.4. Typically an annual probability of 1% (i.e. a 1 in 100 chance of a serious pollution incident occurring in any one year) is considered by DMRB as an acceptable risk. However, where a road drainage outfall discharges within 1km of a sensitive receptor, (such as a nationally designated conservation site), 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).

2.3. Road Salt Assessment

- 2.3.1. The DMRB does not provide a method for assessing the potential impacts of salt on the water environment, yet this is an area that has been identified as a concern by Scottish Natural Heritage (SNH). In the absence of a published method for assessing salt impacts a common methodology has been developed by Jacobs, which is to be applied to all projects within the A9 Dualling programme.
- 2.3.2. Research has not identified an applicable methodology for the assessment of salt impacts from other reference sources, or specifically the concentration of chloride ions on the water environment. It is known that chloride and the presence of salt ions (as measured by conductivity) have a negative impact on freshwater pearl mussels and fish species in the water environment. There is literature available on the application of salt for safety purposes and for the management of salt application to reduce environmental impacts (UK Roads Liaison Group, 2013ⁱ).
- 2.3.3. The application of salt on road infrastructure is a winter activity (typically October to April) intended to prevent icing and avoid excessive build-up of snow and to promote the melting of snow. It is a widespread and existing practice that is unlikely to change significantly as a direct result of the A9 dualling programme, however the dualling of the A9 will create a larger surface area to which salt is applied and new drainage systems will alter the current pathways for salt to enter the water environment.
- 2.3.4. In the absence of an existing method for assessing salt concentrations in road runoff and at the point of dilution, a simple and conservative risk-based model has been developed that follows the principles of the approach taken by the HAWRAT routine runoff method. The method uses UK Roads Liaison Group (2013) guidance on the maximum application rate of road salt, combined with information of the ratio of road salt to brine in pre-wetted salt application; enabling an estimation of the mass (kg) of salt applied per square metre of road and subsequently per section of road draining to each discharge outlet.
- 2.3.5. The mass of road salt (kg) is then adjusted to estimate the mass (kg) of specific NaCl applied, given a 23% concentration of salt within the brine and a 90% concentration of salt within the rock salt. A number of conservative assumptions have then been made; that the entire mass of NaCl is dissolved in the first 5mm of subsequent rainfall / snow melt and that the entirety of this solution will be discharged from the drainage outlet. This concentrated 'first flush' solution has been assumed to be discharged at the greenfield runoff rate, as per the design standard for the proposed road drainage networks. The result is an estimated concentration of NaCl in road runoff in kg/m³, which can be converted to milligrams per litre (mg/l).
- 2.3.6. The second stage of the assessment considers the dilution available within the receiving watercourse, due to the anticipated winter conditions at the time of application, this is calculated based on the estimated mean flow in each watercourse. No allowance for background watercourse salt concentrations is currently included in the assessment. The subsequent concentration of Cl⁻ in the receiving watercourse is calculated from the outflow concentrations of NaCl (atomic weight of 58.44g/mol) based on the ratio of

relative atomic weights of Na (atomic weight of 22.98g/mol) and Cl⁻ (atomic weight of 35.45g/mol) of 39:61.

- 2.3.7. There is no UK short-term EQS for Cl⁻ that can be used to assess the impact of the estimated outflow concentrations. For the purposes of this assessment, resultant Cl⁻ concentrations have been compared against the Canadian Council of Ministers of the Environment (2011)ⁱⁱ short-term exposure guideline value of 640mg/l. The Canadian guidance is based on chloride toxicity tests which included a mussel species with similar biology / ecology to the freshwater pearl mussel native to the UK. Freshwater mussels are noted in the Canadian guidance document as being the most sensitive taxonomic group to chloride.
- 2.3.8. Generic input parameters used within the salt assessments are provided in Table A2.3 below.

Table A2.3: Generic Salt Assessment Input Parameters

Parameter	Value Used	Source
Max application of salt per m ²	40g/m ²	UK Roads Liaison Group (2013)
Rainfall depth	5mm	Value adopted relates to the first flush rainfall depths used in the 'The SuDS Manual' (CIRIA, 2015).
Ratio of dry salt to brine	70:30	UK Roads Liaison Group (2013)
Runoff coefficient	1	As used in HAWRAT
Canadian Water Quality Guideline for short-term exposure to Chloride	640mgCl ⁻ /l	Canadian Council of Ministers to the Environment (2011)

- 2.3.9. It should be noted that the results of the salt assessment have not been included within the overall impact assessment for the proposed scheme, due to there being no defined UK short-term EQS for Cl⁻, an absence of any methodology for assessing the impacts of salt within the DMRB guidance and lack of published data on SuDS treatment efficiency of Cl⁻.

3. Results

3.1. Method A Routine Runoff Assessment

- 3.1.1. The Proposed Scheme involves a total of 14 surface water discharges associated with mainline drainage. The location of these discharge outfalls and their associated hydrological catchment used in the assessment are presented on Figure A11.3.1.
- 3.1.2. One cumulative assessment has been carried out for outfalls 4A and 4B, as required for outfalls located within 1km of each other, on the same watercourse reach.
- 3.1.3. The results for each drainage network are summarised in Table A3.1. Highways Agency Water Risk Assessment Tool (HAWRAT) datasheets are provided in Annex A.1.

Table A3.1: Summary of Method A Routine Runoff Assessment Results

Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
										Value (mg/l)	Pass / Fail	Value (mg/l)	Pass / Fail
E-A	Grassed Channel & Geocellular Storage Tank	50	50	80	Pass	Pass	Pass	0.04	7	0.02	Pass	0.05	Pass
1-A	Filter Drains, Ditches & Wet/Retention Pond	45	57	76	Pass	Pass	Pass	0.04	11	0.00	Pass	0.00	Pass
2-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.32	-	0.04	Pass	0.10	Pass
3-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.38	-	0.11	Pass	0.26	Pass
4-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.37	-	0.02	Pass	0.05	Pass
4-B	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.29	-	0.03	Pass	0.07	Pass
Cumulative 4A & 4B	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	n/a	n/a	0.05	Pass	0.11	Pass



Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
										Value (ng/l)	Pass / Fail	Value (ng/l)	Pass / Fail
5-A	Filter Drains & 2 Wet/Retention Pond	52	60	80	Pass	Pass	Pass	0.10	-	0.62	Pass	1.56	Pass
6-A	Filter Drains, & 2 Wet/Retention Ponds	52	60	80	Pass	Fail	Pass	0.12	-	1.27	Fail	3.34	Pass
7-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.35	-	0.25	Pass	0.60	Pass
8-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.40	-	0.08	Pass	0.19	Pass
9-A	Filter Drains & Wetland	30	59	72	Pass	Pass	Pass	0.15	-	0.47	Pass	0.83	Pass
X-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.45	-	0.10	Pass	0.25	Pass
Y-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.20	-	0.22	Pass	0.53	Pass
Z-A	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.10	-	0.28	Pass	0.67	Pass

- 3.1.4. As can be seen above all networks, with a single exception, pass all aspects of the routine runoff assessment.
- 3.1.5. Network 6A discharges into Funtack Burn Tributary 6, a very small stream/drain with reasonably good water quality, low flows and therefore limited dilution capacity, and low biodiversity value. Downstream of the proposed outfall this channel flows steeply downhill through conifer plantation, before being culverted under the HML and B9154. The culvert discharges on the opposite side of the B9154 into peatland, approximately 80m downstream of the outfall.
- 3.1.6. Network 6A fails discrete elements of the routine runoff assessment, namely the HAWRAT assessment for short-term acute impacts from soluble zinc and the EQS assessment for the long-term chronic impacts from soluble copper.
- 3.1.7. The preliminary results of the assessments indicated that to mitigate these impacts a 63% percent reduction of copper and a 62% reduction of zinc was required. However it should be noted that due to the relatively low traffic volumes predicted for the dualled A9, the assessment may be overestimating the pollutant loading in the runoff and therefore the treatment requirements. Three stages of treatment are proposed on this network: filter drains, followed by two retention ponds in series. In total this treatment train is expected to provide 52% and 60% reductions in copper and zinc respectively. This is a shortfall of 11% for copper and just 2% for zinc. It is unlikely that adding any further treatment stages will improve the results significantly.
- 3.1.8. Interrogation of the detailed results for the HAWRAT assessment on soluble zinc shows that with the proposed treatment train there will be on average 2.2 exceedances per year of the zinc 24 hour threshold. To put this into context the HAWRAT assessment methodology deems an average of 2 exceedances per year as acceptable.
- 3.1.9. In relation to the EQS failure for copper, the annual average soluble copper concentration downstream of the outfall (with the proposed treatment train) has been predicted to be 1.27µg/l. This is the total concentration of copper, not the bioavailable fraction. The assessment has compared this value with the published EQS of 1µg/l bioavailable copper. It is possible that the bioavailable portion of the estimated downstream concentration is less than the EQS bioavailable limit.
- 3.1.10. It is likely that the residual levels of soluble copper and zinc will have a small impact on the water quality of the Funtack Burn Tributary 6, however the proposed treatment train will minimise this impact. Furthermore it is likely that the existing A9 is currently discharging untreated runoff into the channel. In providing the proposed three levels of treatment it is possible that the water quality of the stream may actually improve.
- 3.1.11. One network (Network E-A, associated with Tomatin South Junction) involves widening of the existing A9 mainline and will subsequently convey mainline drainage for the area surrounding this junction development. The area is highly constrained with very limited space between the existing A9 carriageway and the HML railway. The mainline area to be widened as part of the junction development will therefore be drained via a geocellular storage tank and grassed channel before being conveyed via the existing road drainage ditch (Allt Cosach Trib 1). In addition to this flow, mainline drainage associated with the existing A9 dual carriageway, just south of the section to be widened, will be intercepted and diverted to the ditch also. This will then flow west to converge with the Allt Cosach. Due to the engineered nature of the existing drainage ditch and its limited natural catchment, it has not been possible, nor was it considered appropriate, to assess this outfall at the point of discharge to the drainage ditch. The assessment has therefore been carried out at the point at which the drainage ditch meets the natural watercourse Allt Cosach, approximately 240m downstream.

3.2. Method D Accidental Spillage Assessment

- 3.2.1. The DMRB Method D Accidental Spillage Assessment results are presented in full in Annex A, Section A.2, and are summarised in Table A3.2 below.
- 3.2.2. All mainline networks pass accidental spillage assessments to the higher standard of at least a 1 in 200 year return period (where sensitive receptors are identified within 1km downstream). The minimum return period has been calculated as 1 in 2,885 years (1A). These calculations have been carried out assuming no mitigation is in place. If the SuDs proposed for the treatment of routine runoff are taken into account the accidental spillage risks will fall further.

Table A3.2: Summary Method D Accidental Spillage Assessment Results

Mainline Drainage Network ID	Return Period Probability 1 in 'X' (Years)	Pass / Fail
E-A	4,596	Pass
1-A	2,685	Pass
2-A	10,750	Pass
3-A	6,351	Pass
4-A	11,956	Pass
4-B	9,966	Pass
Cumulative 4A & 4B	5,435	Pass
5-A	3,123	Pass
6-A	10,521	Pass
7-A	8,208	Pass
8-A	5,066	Pass
9-A	3,744	Pass
X-A	7,777	Pass
Y-A	16,787	Pass
Z-A	8,100	Pass

3.3. Road Salt Assessment

- 3.3.1. Using the method and generic parameters set out in Section 2.3 the concentration of Chloride ion in the theoretical raw road runoff has been estimated to be 3411mg/l. The in-river concentrations at each of the mainline road drainage outfalls is presented in Table A3.3 below.

Table A3.3: Road Salt Assessment Results

Mainline Drainage Network ID	Imperm. Area (Ha)	Greenfield Runoff Rate (l/s)	Receiving watercourse	Mean Flow (l/s)	In-river Cl ⁻ Conc. (mg/l)	Pass / Fail
E-A	0.574	1.1	Allt Cosach	22	169	Pass
1-A	2.934	5.9	River Findhorn	10,000	2	Pass

Mainline Drainage Network ID	Imperm. Area (Ha)	Greenfield Runoff Rate (l/s)	Receiving watercourse	Mean Flow (l/s)	In-river Cl ⁻ Conc. (mg/l)	Pass / Fail
2-A	1.484	3.0	Allt na Frithe	137	72	Pass
3-A	2.342	4.7	Allt Dubhag	59	251	Pass
4A & 4B	2.709	5.4	Dalmagarry Burn	199	90	Pass
5-A	2.918	5.8	Funtack Burn Trib 3	8	1,439	Fail
6-A	1.823	3.6	Funtack Burn Trib 6	2	2,203	Fail
7-A	1.248	2.5	Caochan na h-Eaglais	18	415	Pass
8-A	1.697	3.4	Allt Loinne Moire	74	150	Pass
9-A	4.084	8.2	Allt Creag Bheithin Trib 1	22	924	Fail
X-A	1.895	3.8	Allt Creag Bheithin (lower reach)	61	200	Pass
Y-A	3.096	6.2	Allt Creag Bheithin (upper reach)	22	749	Fail
Z-A	0.514	1	Midlairs Burn Trib 2	4	697	Fail

3.3.2. As can be seen above several of the outfalls located on the smallest drains and watercourses fail the road salt assessment. This is unsurprising given that, for these watercourses, a large proportion of the watercourse flow is attributed to the road drainage discharge itself. In these instances it is likely that there will be a short term impact on the watercourse due to road salt. For the theoretical calculations reported above the road salt will discharge over a period of 7 hours, however it should be noted that this is assuming a single gritter run/application of road salt. Any additional gritter runs during the winter weather event would prolong the period of salt discharge.

3.3.3. With regard to the watercourses where failures are anticipated, these are generally very small heavily modified drains with little or no biodiversity interest. Furthermore, each discharges into a larger watercourse a short distance downstream of the outfalls, where the salt content is diluted to levels below the acute impact threshold used in this assessment. Therefore it is unlikely there will be any significant impact on the aquatic ecology of the study area.

5. References

ⁱ Roads Liaison Group (2013). Well-maintained Highways: Code of Practice for Highway Maintenance Management.

ⁱⁱ Canadian Council of Ministers of the Environment (2011). Canadian Water quality Guidelines for the Protection of Aquatic Life – Chloride.

Annex A. Calculation Datasheets

A.1. Method A Routine Runoff Assessment Datasheets

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.04	0.11	Pass	Pass	Pass
Step 3	0.02	0.05			
Sediment deposition for this site is judged as:					
Accumulating?	Yes	0.04	Low flow Vel m/s		
Extensive?	No	2	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	282370	Northing	826277	
OS grid reference of outfall structure (m)	Easting	282597	Northing	826260	
Outfall number	E-A	List of outfalls in cumulative assessment			
Receiving watercourse	Alt Cosach				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	14/02/2018		Version of assessment		2
Notes	Tier 1 Assessment				
Step 1 Runoff Quality					
AADT	>10,000 and <50,000	Climatic region	Colder Wet	Rainfall site	Ardalnaig (SAAR 1343.9m.m)
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.005	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)			
Impermeable road area drained (ha)	0.2104	Permeable area draining to outfall (ha)	0		
Base Flow Index (BFI)	0.217	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 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)	1	Manning's n	0.07	Side slope (m/m)
• Tier 2	Bed width (m)	3			Long slope (m/m)
				0.5	0.0001
Step 3 Mitigation					
Brief description		Estimated effectiveness			
		Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (Vs)	Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Grassed channel	50	Unlimited	80	
<div style="text-align: right;"> Predict Impact Show Detailed Results Exit Tool </div>					



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.04	0.11	Pass	Pass	Pass
Step 3	0.02	0.05			
Location Details		Road number: A9 T-M		HA Area / DBFO number:	
Assessment type		Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)		Easting: 282370		Northing: 826277	
OS grid reference of outfall structure (m)		Easting: 282597		Northing: 826260	
Outfall number		E-A		List of outfalls in cumulative assessment	
Receiving watercourse		Alt Cosach		Assessor and affiliation: AMJV	
EA receiving water Detailed River Network ID		Date of assessment: 14/02/2018		Version of assessment: 2	
Notes		Tier 1 Assessment			
Step 1 Runoff Quality		AADT: >10,000 and <50,000		Climatic region: Colder Wet	
Step 2 River Impacts		Annual 95%ile river flow (m³/s): 0.005		Impermeable road area drained (ha): 0.2104	
For dissolved zinc only		Water hardness: Low = <50mg CaCO3/l		Base Flow Index (BFI): 0.217	
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): 1	
Step 3 Mitigation		Brief description		Estimated effectiveness	
Existing measures		0		0	
Proposed measures		Grassed channel: 50		Settlement of sediments (%): 80	

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.00	0.01	Pass	Pass	Pass
Step 3	0.00	0.01			
Location Details		Road number: A9 T-M		HA Area / DBFO number:	
Assessment type		Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)		Easting: 279878		Northing: 830069	
OS grid reference of outfall structure (m)		Easting:		Northing:	
Outfall number		I-A		List of outfalls in cumulative assessment	
Receiving watercourse		River Findhorn		Assessor and affiliation: AMJV	
EA receiving water Detailed River Network ID		Date of assessment: 14/02/2018		Version of assessment: 2	
Notes					
Step 1 Runoff Quality		AADT: >10,000 and <50,000		Climatic region: Colder Wet	
Step 2 River Impacts		Annual 95%ile river flow (m³/s): 1.705		Impermeable road area drained (ha): 5.54736	
For dissolved zinc only		Water hardness: Low = <50mg CaCO3/l		Base Flow Index (BFI): 0.406	
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): 33	
Step 3 Mitigation		Brief description		Estimated effectiveness	
Existing measures		0		0	
Proposed measures		Filter Drains, Wet Retention Pond & Ditches: 45		Settlement of sediments (%): 76	

Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	0.00	0.01	Pass	Pass	Accumulating? Yes 0.04 Low flow Vel m/s
Step 3	0.00	0.00	Pass	Pass	Extensive? No 3 Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279878	Northing	830069	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	1-A	List of outfalls in cumulative assessment			
Receiving watercourse	River Findhorn				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	14/02/2018		Version of assessment	2	
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Ardtalnaig (SAAR 1343.9m)
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	1.705	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)			
Impermeable road area drained (ha)	5.54736	Permeable area draining to outfall (ha)	5.24164		
Base Flow Index (BFI)	0.406	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 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)		33			
Tier 2 Bed width (m)		3	Manning's n	0.07	Side slope (m/m)
				0.5	Long slope (m/m)
					0.0001
Step 3 Mitigation					
Brief description		Estimated effectiveness			
		Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains, Wet/Retention Pond & Ditches	57	Unlimited	76	

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	0.07	0.22	Pass	Pass	Accumulating? No 0.32 Low flow Vel m/s
Step 3	0.04	0.13	Pass	Pass	Extensive? No - Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279722	Northing	830060	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	2-A	List of outfalls in cumulative assessment			
Receiving watercourse	Allt na Frìthe				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	06/02/2018		Version of assessment	2	
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					
Annual 95%ile river flow (m³/s)	0.0228	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)			
Impermeable road area drained (ha)	1.69012	Permeable area draining to outfall (ha)	1.25888		
Base Flow Index (BFI)	0.47	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 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)		5			
Tier 2 Bed width (m)		8.351	Manning's n	0.035	Side slope (m/m)
				0.690403	Long slope (m/m)
					0.044886
Step 3 Mitigation					
Brief description		Estimated effectiveness			
		Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains & Wet/Retention Ponds	40	Unlimited	72	



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	0.07	0.22	Pass	Pass	Accumulating? No 0.32 Low flow Vel m/s
Step 3	0.03	0.10	Pass	Pass	Extensive? No - Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279722	Northing	830060	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	2-A	List of outfalls in cumulative assessment			
Receiving watercourse	Allt na Fithie				
EA receiving water Detailed River Network ID				Assessor and affiliation	AMJV
Date of assessment	06/02/2018		Version of assessment	2	
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
				Rainfall site	Ardtaraig (SAAR 1343.9mm)
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0228		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.69012		Permeable area draining to outfall (ha)	1.25888	
Base Flow Index (BFI)	0.47		Is the discharge in or within 1 km upstream of a protected site for conservation? No D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l D				
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D					
Tier 1 Estimated river width (m)		5			
Tier 2 Bed width (m)		8.351		Manning's n	0.035
				Side slope (m/m)	0.690403
				Long slope (m/m)	0.044886
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0 D	Unlimited D	0 D
Proposed measures	Filter Drains & Wet/Retention Ponds		53	Unlimited D	72
Predict Impact Show Detailed Results Exit Tool					

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	0.18	0.55	Pass	Pass	Accumulating? No 0.38 Low flow Vel m/s
Step 3	0.11	0.33	Pass	Pass	Extensive? No - Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279328	Northing	830451	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	3-A	List of outfalls in cumulative assessment			
Receiving watercourse	Allt Dubhag				
EA receiving water Detailed River Network ID				Assessor and affiliation	AMJV
Date of assessment	06/02/2018		Version of assessment	2	
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
				Rainfall site	Ardtaraig (SAAR 1343.9mm)
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0104		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	2.18994		Permeable area draining to outfall (ha)	1.53806	
Base Flow Index (BFI)	0.38		Is the discharge in or within 1 km upstream of a protected site for conservation? No D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l D				
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes					
Tier 1 Estimated river width (m)		5			
Tier 2 Bed width (m)		2		Manning's n	0.04
				Side slope (m/m)	1.072
				Long slope (m/m)	0.042285
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0 D	Unlimited D	0 D
Proposed measures	Filter Drains & Wet/Retention Ponds		40	Unlimited D	72
Predict Impact Show Detailed Results Exit Tool					



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.18	0.55	Pass	Pass	
Step 3	0.08	0.26			
Location Details		Road number: A9 T-M		HA Area / DBFO number:	
Assessment type		Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)		Easting: 279328		Northing: 830451	
OS grid reference of outfall structure (m)		Easting:		Northing:	
Outfall number		3-A		List of outfalls in cumulative assessment:	
Receiving watercourse		Allt Dubhag		Assessor and affiliation: AMJV	
EA receiving water Detailed River Network ID:		Date of assessment: 06/02/2018		Version of assessment: 2	
Notes:					
Step 1 Runoff Quality		AADT: >10,000 and <50,000		Climatic region: Colder Wet	
Step 2 River Impacts		Annual 95%ile river flow (m³/s): 0.0104		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
		Impermeable road area drained (ha): 2.16994		Permeable area draining to outfall (ha): 1.53806	
		Base Flow Index (BFI): 0.38		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 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): 5		Manning's n: 0.04	
		Tier 2 Bed width (m): 2		Side slope (m/m): 1.072	
				Long slope (m/m): 0.042285	
Step 3 Mitigation		Brief description		Estimated effectiveness	
				Treatment for solubles (%)	
				Attenuation for solubles - restricted discharge rate (l/s)	
				Settlement of sediments (%)	
Existing measures				0	
Proposed measures		Filter Drains & Wet/Retention Ponds		53	
				Unlimited	
				72	
				Unlimited	

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.03	0.10	Pass	Pass	
Step 3	0.02	0.06			
Location Details		Road number: A9 T-M		HA Area / DBFO number:	
Assessment type		Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)		Easting: 279329		Northing: 831977	
OS grid reference of outfall structure (m)		Easting:		Northing:	
Outfall number		4-A		List of outfalls in cumulative assessment:	
Receiving watercourse		Dalmagarry Burn		Assessor and affiliation: AMJV	
EA receiving water Detailed River Network ID:		Date of assessment: 06/02/2018		Version of assessment: 2	
Notes:					
Step 1 Runoff Quality		AADT: >10,000 and <50,000		Climatic region: Colder Wet	
Step 2 River Impacts		Annual 95%ile river flow (m³/s): 0.038		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
		Impermeable road area drained (ha): 1.38985		Permeable area draining to outfall (ha): 1.00015	
		Base Flow Index (BFI): 0.34		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 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): 5		Manning's n: 0.035	
		Tier 2 Bed width (m): 2.5		Side slope (m/m): 1.089077	
				Long slope (m/m): 0.007047	
Step 3 Mitigation		Brief description		Estimated effectiveness	
				Treatment for solubles (%)	
				Attenuation for solubles - restricted discharge rate (l/s)	
				Settlement of sediments (%)	
Existing measures				0	
Proposed measures		Filter Drains & Wet/Retention Ponds		40	
				Unlimited	
				72	
				Unlimited	

Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Zinc	
	Copper	Zinc	Copper	Zinc	
Step 2	0.03	0.10	Pass	Pass	
Step 3	0.02	0.05			
Sediment - Chronic Impact					
Sediment deposition for this site is judged as:					
Accumulating?	No	0.37	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279329	Northing	831977	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	4-A		List of outfalls in cumulative assessment		
Receiving watercourse	Dalmagarry Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.038		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.38985		Permeable area draining to outfall (ha) 1.00015		
Base Flow Index (BFI)	0.34		Is the discharge in or within 1 km upstream of a protected site for conservation? No <input type="checkbox"/> D <input type="checkbox"/>		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l		D <input type="checkbox"/>		
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 <input type="checkbox"/> D <input type="checkbox"/>					
Tier 1	Estimated river width (m)		5		
Tier 2	Bed width (m)		Manning's n	0.035	Side slope (m/m)
	2.5			1.089077	Long slope (m/m)
					0.007047
Step 3 Mitigation					
Brief description		Estimated effectiveness			
		Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains & Wet/Retention Ponds	53	Unlimited	72	
<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>					

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Zinc	
	Copper	Zinc	Copper	Zinc	
Step 2	0.05	0.14	Pass	Pass	
Step 3	0.03	0.09			
Sediment - Chronic Impact					
Sediment deposition for this site is judged as:					
Accumulating?	No	0.29	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279081	Northing	832070	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	4-B		List of outfalls in cumulative assessment		
Receiving watercourse	Dalmagarry Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.038		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.97928		Permeable area draining to outfall (ha) 1.08472		
Base Flow Index (BFI)	0.34		Is the discharge in or within 1 km upstream of a protected site for conservation? No <input type="checkbox"/> D <input type="checkbox"/>		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l		D <input type="checkbox"/>		
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 <input type="checkbox"/> D <input type="checkbox"/>					
Tier 1	Estimated river width (m)		5		
Tier 2	Bed width (m)		Manning's n	0.035	Side slope (m/m)
	4			1	Long slope (m/m)
					0.005637
Step 3 Mitigation					
Brief description		Estimated effectiveness			
		Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains & Wet/Retention Ponds	40	Unlimited	72	
<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>					

Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.05	0.14	Pass	Pass	Pass
Step 3	0.02	0.07			
Sediment deposition for this site is judged as: Accumulating? <input type="checkbox"/> No <input type="checkbox"/> 0.29 Low flow Vel m/s Extensive? <input type="checkbox"/> No <input type="checkbox"/> - Deposition Index					
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	279081		Northing	832070
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	4-B		List of outfalls in cumulative assessment		
Receiving watercourse	Dalmagarry Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
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					
Annual 95%ile river flow (m³/s)	0.038		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.97929		Permeable area draining to outfall (ha) 1.08472		
Base Flow Index (BFI)	0.34		Is the discharge in or within 1 km upstream of a protected site for conservation? <input type="checkbox"/> No <input type="checkbox"/> D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l <input type="checkbox"/> D				
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? <input type="checkbox"/> No <input type="checkbox"/> D					
Tier 1	Estimated river width (m)		5		
Tier 2	Bed width (m)		Manning's n	Side slope (m/m)	Long slope (m/m)
	4		0.035	1	0.005637
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains & Wet/Retention Ponds		53	Unlimited	72
Predict Impact Show Detailed Results Exit Tool					

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.08	0.24	Pass	Pass	
Step 3	0.05	0.14			
Sediment deposition for this site is judged as: Accumulating? <input type="checkbox"/> <input type="checkbox"/> Low flow Vel m/s Extensive? <input type="checkbox"/> <input type="checkbox"/> Deposition Index					
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Cumulative assessment excluding sediments (outfalls between 100m and 1km apart)				
OS grid reference of assessment point (m)	Easting	279329		Northing	831977
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	Cum 4-A & 4-B		List of outfalls in cumulative assessment		
Receiving watercourse	Dalmagarry Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
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					
Annual 95%ile river flow (m³/s)	0.038		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	3.36913		Permeable area draining to outfall (ha) 2.08487		
Base Flow Index (BFI)	0.34		Is the discharge in or within 1 km upstream of a protected site for conservation? <input type="checkbox"/> No <input type="checkbox"/> D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l <input type="checkbox"/> D				
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? <input type="checkbox"/> No <input type="checkbox"/> D					
Tier 1	Estimated river width (m)		5		
Tier 2	Bed width (m)		Manning's n	Side slope (m/m)	Long slope (m/m)
	3		0.07	0.5	0.0001
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains & Wet/Retention Ponds		40	Unlimited	0
Predict Impact Show Detailed Results Exit Tool					

Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.08	0.24	Pass	Pass	
Step 3	0.04	0.11			
Sediment deposition for this site is judged as: Accumulating? <input type="checkbox"/> Extensive? <input type="checkbox"/> Low flow Vel m/s <input type="checkbox"/> Deposition Index <input type="checkbox"/>					
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Cumulative assessment excluding sediments (outfalls between 100m and 1km apart)				
OS grid reference of assessment point (m)	Easting 278329		Northing		831977
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Cum 4-A & 4-B		List of outfalls in cumulative assessment		
Receiving watercourse	Dalmagarry Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
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 Annual 95%ile river flow (m³/s) 0.038 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)					
Impermeable road area drained (ha)		3.36913	Permeable area draining to outfall (ha) 2.08487		
Base Flow Index (BFI)		0.34	Is the discharge in or within 1 km upstream of a protected site for conservation? No <input type="checkbox"/> D <input type="checkbox"/>		
For dissolved zinc only Water hardness Low = <50mg CaCO3/l <input type="checkbox"/> D <input type="checkbox"/>					
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 <input type="checkbox"/> D <input type="checkbox"/>					
Tier 1 Estimated river width (m)		5			
Tier 2 Bed width (m)		3	Manning's n	0.07 <input type="checkbox"/> D <input type="checkbox"/>	Side slope (m/m) 0.5 Long slope (m/m) 0.0001
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0 <input type="checkbox"/> D <input type="checkbox"/>	Unlimited <input type="checkbox"/> D <input type="checkbox"/>	0 <input type="checkbox"/> D <input type="checkbox"/>
Proposed measures Filter Drains & Wet/Retention Ponds			53 <input type="checkbox"/>	Unlimited <input type="checkbox"/> D <input type="checkbox"/>	0 <input type="checkbox"/>
			<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>		

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	1.29	3.91	Pass	Pass	Pass
Step 3	0.62	1.87			
Sediment deposition for this site is judged as: Accumulating? <input type="checkbox"/> No <input checked="" type="checkbox"/> 0.10 Low flow Vel m/s <input type="checkbox"/> Deposition Index <input type="checkbox"/> Extensive? <input type="checkbox"/> No <input checked="" type="checkbox"/> -					
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting 278469		Northing		832619
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	5-A		List of outfalls in cumulative assessment		
Receiving watercourse	Funtack Burn Trib 3				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	15/02/2018		Version of assessment		2
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 Annual 95%ile river flow (m³/s) 0.0010248 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)					
Impermeable road area drained (ha)		3.28986	Permeable area draining to outfall (ha) 1.21914		
Base Flow Index (BFI)		0.18	Is the discharge in or within 1 km upstream of a protected site for conservation? No <input type="checkbox"/> D <input type="checkbox"/>		
For dissolved zinc only Water hardness Low = <50mg CaCO3/l <input type="checkbox"/> D <input type="checkbox"/>					
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 <input type="checkbox"/> D <input type="checkbox"/>					
Tier 1 Estimated river width (m)		5			
Tier 2 Bed width (m)		0.9	Manning's n	0.05 <input type="checkbox"/>	Side slope (m/m) 0.627517 Long slope (m/m) 0.005934
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0 <input type="checkbox"/> D <input type="checkbox"/>	Unlimited <input type="checkbox"/> D <input type="checkbox"/>	0 <input type="checkbox"/> D <input type="checkbox"/>
Proposed measures Filter Drains & 2 x Wet/Retention Ponds			52 <input type="checkbox"/>	Unlimited <input type="checkbox"/> D <input type="checkbox"/>	80 <input type="checkbox"/>
			<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>		



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	1.29	3.91	Pass	Pass	Accumulating? No 0.10 Low flow Vel m/s
Step 3	0.51	1.56	Pass	Pass	Extensive? No - Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	278469	Northing	832619	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	5-A		List of outfalls in cumulative assessment		
Receiving watercourse	Funtack Burn Trib 3				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	15/02/2018		Version of assessment	2	
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder/Wet	
			Rainfall site	Ardtalnaig (SAAR 1343.9m)	
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0010246		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	3.26986		Permeable area draining to outfall (ha)	1.21914	
Base Flow Index (BFI)	0.18		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 sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No					
<input type="checkbox"/> Tier 1 Estimated river width (m) 5 <input checked="" type="checkbox"/> Tier 2 Bed width (m) 0.9 Manning's n 0.05 Side slope (m/m) 0.627517 Long slope (m/m) 0.005934					
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (Vs)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains & 2x Wet/Retention Ponds		60	Unlimited	80

Predict Impact

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Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	2.64	8.36	Pass	River Fails Toxicity Test Try more mitigation	Alert, D/S Structure.
Step 3	1.27	4.01	Pass	River Fails Toxicity Test Try more mitigation	Alert, D/S Structure.
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	277715	Northing	833476	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	6-A		List of outfalls in cumulative assessment		
Receiving watercourse	Funtack Burn Trib 6				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	05/02/2018		Version of assessment	2	
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder/Wet	
			Rainfall site	Ardtalnaig (SAAR 1343.9m)	
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0001307		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.57157		Permeable area draining to outfall (ha)	0.74043	
Base Flow Index (BFI)	0.3		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 sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Yes					
<input type="checkbox"/> Tier 1 Estimated river width (m) 5 <input checked="" type="checkbox"/> Tier 2 Bed width (m) 1.176 Manning's n 0.035 Side slope (m/m) 0.547611 Long slope (m/m) 0.1					
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (Vs)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains and 2x Wet/Retention Ponds		52	Unlimited	80

Predict Impact

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Soluble Zinc Results

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	2.64	8.36 ug/l	Pass	River Fails Toxicity Test. Try more mitigation	Accumulating? No 0.12 Low flow Vel m/s
Step 3	1.06	3.34 ug/l			Extensive? No - Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting 277715		Northing		833476
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	6-A		List of outfalls in cumulative assessment		
Receiving watercourse	Furtask Burn Trib 6				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	05/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
			Rainfall site	Ardalnaig (SAAR 1343.9mm)	
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0001307		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.57157		Permeable area draining to outfall (ha)		0.74043
Base Flow Index (BFI)	0.3		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 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) 5				
Tier 2	Bed width (m) 1.176		Manning's n	0.035	Side slope (m/m) 0.547611 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	Unlimited	0
Proposed measures	Filter Drains and 2 x Wet/Retention Ponds		60	Unlimited	80
			Predict Impact Show Detailed Results Exit Tool		

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2	0.42	1.28 ug/l	Pass	Pass	Accumulating? No 0.35 Low flow Vel m/s
Step 3	0.25	0.77 ug/l			Extensive? No - Deposition Index
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting 277050		Northing		833887
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	7-A		List of outfalls in cumulative assessment		
Receiving watercourse	Caochan na h-Eaglais				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
			Rainfall site	Ardalnaig (SAAR 1343.9mm)	
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.00233		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.41462		Permeable area draining to outfall (ha)		0.68338
Base Flow Index (BFI)	0.28		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 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) 5				
Tier 2	Bed width (m) 1		Manning's n	0.035	Side slope (m/m) 0.307826 Long slope (m/m) 0.069533
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains & Wet/Retention Ponds		40	Unlimited	72
			Predict Impact Show Detailed Results Exit Tool		



Soluble Zinc Results

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact Copper		Zinc	Sediment - Chronic Impact
Step 2	Copper 0.42 ug/l	Zinc 1.28 ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	Copper 0.20 ug/l	Zinc 0.60 ug/l	Pass	Pass	Alert. D/S Structure.
Sediment deposition for this site is judged as:		Accumulating? No		0.35 Low flow Vel m/s	
Extensive? No				Deposition Index	
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	277050		Northing	833887
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	7-A		List of outfalls in cumulative assessment		
Receiving watercourse	Caochan na h-Eaglais				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.00233		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.41462		Permeable area draining to outfall (ha) 0.68338		
Base Flow Index (BFI)	0.28		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 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)		5			
Tier 2 Bed width (m)		1		Manning's n	0.035
				Side slope (m/m)	0.307826
				Long slope (m/m)	0.069533
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains & Wet/Retention Ponds		53	Unlimited	72
Predict Impact Show Detailed Results Exit Tool					

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact Copper		Zinc	Sediment - Chronic Impact
Step 2	Copper 0.13 ug/l	Zinc 0.39 ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	Copper 0.08 ug/l	Zinc 0.24 ug/l	Pass	Pass	Alert. D/S Structure.
Sediment deposition for this site is judged as:		Accumulating? No		0.40 Low flow Vel m/s	
Extensive? No				Deposition Index	
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	276297		Northing	834251
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	8-A		List of outfalls in cumulative assessment		
Receiving watercourse	Alltna Loinne Moire				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0124		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.70578		Permeable area draining to outfall (ha) 0.97922		
Base Flow Index (BFI)	0.5		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 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)		5			
Tier 2 Bed width (m)		1.7		Manning's n	0.04
				Side slope (m/m)	1.705
				Long slope (m/m)	0.032147
Step 3 Mitigation					
Brief description			Estimated effectiveness		
			Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures			0	Unlimited	0
Proposed measures	Filter Drains & Wet/Retention Ponds		40	Unlimited	72
Predict Impact Show Detailed Results Exit Tool					



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Zinc	
	Copper	Zinc			
Step 2	0.13	0.39	ug/l	Pass	Pass
Step 3	0.06	0.19	ug/l		
Sediment - Chronic Impact					
Alert. D/S Structure.					
Sediment deposition for this site is judged as:					
Accumulating?	No	0.40	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	278297		Northing	834251
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	β-A		List of outfalls in cumulative assessment		
Receiving watercourse	Allt na Loinne Moire				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	06/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	≥10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.0124		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	1.70578		Permeable area draining to outfall (ha)	0.97922	
Base Flow Index (BFI)	0.5		Is the discharge in or within 1 km upstream of a protected site for conservation?		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l				
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?					
Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>					
Tier 1 Estimated river width (m) 5					
Tier 2 Bed width (m) 1.7 Manning's n 0.04 Side slope (m/m) 1.705 Long slope (m/m) 0.032147					
Step 3 Mitigation					
Brief description		Treatment for solubles (%)		Estimated effectiveness	
				Attenuation for solubles - restricted discharge rate (l/s)	
				Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains & Wet/Retention Ponds	53	Unlimited	72	
<div style="text-align: right;"> Predict Impact Show Detailed Results Exit Tool </div>					

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Zinc	
	Copper	Zinc			
Step 2	0.67	2.02	ug/l	Pass	Pass
Step 3	0.47	1.42	ug/l		
Sediment - Chronic Impact					
Pass					
Sediment deposition for this site is judged as:					
Accumulating?	No	0.15	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	275568		Northing	834710
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	β-A		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Creag Bheithin Trib 1				
EA receiving water Detailed River Network ID			Assessor and affiliation		AMJV
Date of assessment	05/02/2018		Version of assessment		2
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m³/s)	0.00393		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	4.03948		Permeable area draining to outfall (ha)	1.26752	
Base Flow Index (BFI)	0.43		Is the discharge in or within 1 km upstream of a protected site for conservation?		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l				
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?					
No <input checked="" type="checkbox"/> Yes <input type="checkbox"/>					
Tier 1 Estimated river width (m) 5					
Tier 2 Bed width (m) 6.5 Manning's n 0.04 Side slope (m/m) 0.837 Long slope (m/m) 0.032064					
Step 3 Mitigation					
Brief description		Treatment for solubles (%)		Estimated effectiveness	
				Attenuation for solubles - restricted discharge rate (l/s)	
				Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains and Wetlands	30	Unlimited	72	
<div style="text-align: right;"> Predict Impact Show Detailed Results Exit Tool </div>					



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.67	2.02	Pass	Pass	Pass
Step 3	0.27	0.83			
Location Details		Road number		HA 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		List of outfalls in cumulative assessment			
Receiving watercourse		EA receiving water Detailed River Network ID		Assessor and affiliation	
Date of assessment		Version of assessment		2	
Notes					
Step 1 Runoff Quality		AADT		Rainfall site	
Step 2 River Impacts		Annual 95%ile river flow (m³/s)		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)		Permeable area draining to outfall (ha)			
Base Flow Index (BFI)		Is the discharge in or within 1 km upstream of a protected site for conservation?		No	
For dissolved zinc only		Water hardness			
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)		Manning's n		Side slope (m/m)	
Tier 2 Bed width (m)				Long slope (m/m)	
Step 3 Mitigation		Brief description		Estimated effectiveness	
Existing measures		Treatment for solubles (%)		Attenuation for solubles - restricted discharge rate (l/s)	
Proposed measures		Settlement of sediments (%)			
Filter Drains and Wetlands		59		72	

Predict Impact

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Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.17	0.53	Pass	Pass	Pass
Step 3	0.10	0.32			
Location Details		Road number		HA 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		List of outfalls in cumulative assessment			
Receiving watercourse		EA receiving water Detailed River Network ID		Assessor and affiliation	
Date of assessment		Version of assessment		2	
Notes					
Step 1 Runoff Quality		AADT		Rainfall site	
Step 2 River Impacts		Annual 95%ile river flow (m³/s)		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)		Permeable area draining to outfall (ha)			
Base Flow Index (BFI)		Is the discharge in or within 1 km upstream of a protected site for conservation?		No	
For dissolved zinc only		Water hardness			
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)		Manning's n		Side slope (m/m)	
Tier 2 Bed width (m)				Long slope (m/m)	
Step 3 Mitigation		Brief description		Estimated effectiveness	
Existing measures		Treatment for solubles (%)		Attenuation for solubles - restricted discharge rate (l/s)	
Proposed measures		Settlement of sediments (%)			
Filter Drains & Wet/Retention Ponds		40		72	

Predict Impact

Show Detailed Results

Exit Tool

Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.17	0.53	Pass	Pass	Pass
Step 3	0.08	0.25			
Location Details Road number: A9 T-M HA Area / DBFO number: Assessment type: Non-cumulative assessment (single outfall) OS grid reference of assessment point (m): Easting 274897 Northing 834784 OS grid reference of outfall structure (m): Easting Northing Outfall number: X-A List of outfalls in cumulative assessment: Receiving watercourse: Allt Creag Bheithin EA receiving water Detailed River Network ID: Assessor and affiliation: AMJV Date of assessment: 06/02/2018 Version of assessment: 2 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 Annual 95%ile river flow (m³/s): 0.011 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only) Impermeable road area drained (ha): 2.21901 Permeable area draining to outfall (ha): 1.87499 Base Flow Index (BFI): 0.4 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 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): 5 Tier 2 Bed width (m): 0.7 Manning's n: 0.04 Side slope (m/m): 1.207529 Long slope (m/m): 0.019781					
Step 3 Mitigation Brief description: Filter Drains & Wet/Retention Ponds				Estimated effectiveness Treatment for solubles (%): 53 Attenuation for solubles - restricted discharge rate (1/s): Unlimited Settlement of sediments (%): 72	
Existing measures				0 Unlimited 0	
Proposed measures				53 Unlimited 72	
				Predict Impact Show Detailed Results Exit Tool	

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.37	1.13	Pass	Pass	Pass
Step 3	0.22	0.68			
Location Details Road number: A9 T-M HA Area / DBFO number: Assessment type: Non-cumulative assessment (single outfall) OS grid reference of assessment point (m): Easting 273942 Northing 834608 OS grid reference of outfall structure (m): Easting Northing Outfall number: Y-A List of outfalls in cumulative assessment: Receiving watercourse: Allt Creag Bheithin EA receiving water Detailed River Network ID: Assessor and affiliation: AMJV Date of assessment: 06/02/2018 Version of assessment: 2 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 Annual 95%ile river flow (m³/s): 0.00414 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only) Impermeable road area drained (ha): 2.20284 Permeable area draining to outfall (ha): 2.04216 Base Flow Index (BFI): 0.34 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 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): 5 Tier 2 Bed width (m): 0.6 Manning's n: 0.05 Side slope (m/m): 2.6135 Long slope (m/m): 0.005985					
Step 3 Mitigation Brief description: Filter Drains & Wet/Retention Ponds				Estimated effectiveness Treatment for solubles (%): 40 Attenuation for solubles - restricted discharge rate (1/s): Unlimited Settlement of sediments (%): 72	
Existing measures				0 Unlimited 0	
Proposed measures				40 Unlimited 72	
				Predict Impact Show Detailed Results Exit Tool	



Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.37	1.13	Pass	Pass	Pass
Step 3	0.18	0.53			
Sediment deposition for this site is judged as:					
Accumulating?	No	0.20	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	273842	Northing	834608	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Y-A	List of outfalls in cumulative assessment			
Receiving watercourse	Alt Creag Bheithin				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	06/02/2018		Version of assessment	2	
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					
Annual 95%ile river flow (m³/s)	0.00414		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	2.20284		Permeable area draining to outfall (ha)	2.04216	
Base Flow Index (BFI)	0.34		Is the discharge in or within 1 km upstream of a protected site for conservation? <input type="checkbox"/> No <input type="checkbox"/> D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l		<input type="checkbox"/> D		
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? <input type="checkbox"/> No <input type="checkbox"/> D					
Tier 1	Estimated river width (m)	5	Manning's n	0.05	
Tier 2	Bed width (m)	0.6	Side slope (m/m)	2.6135	Long slope (m/m) 0.005985
Step 3 Mitigation					
	Brief description	Treatment for solubles (%)		Estimated effectiveness	
		Attenuation for solubles - restricted discharge rate (l/s)		Settlement of sediments (%)	
Existing measures		0	<input type="checkbox"/> D	Unlimited	<input type="checkbox"/> D
Proposed measures	Filter Drains & Wet/Retention Ponds	53	<input type="checkbox"/>	Unlimited	<input type="checkbox"/> D
<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>					

Soluble Copper and Sediment Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Sediment - Chronic Impact	
	Copper	Zinc	Copper	Zinc	
Step 2	0.47	1.42	Pass	Pass	Pass
Step 3	0.28	0.85			
Sediment deposition for this site is judged as:					
Accumulating?	No	0.10	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	272627	Northing	835042	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Z-A	List of outfalls in cumulative assessment			
Receiving watercourse	Midlaigs Burn Trib 2				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	06/02/2018		Version of assessment	2	
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					
Annual 95%ile river flow (m³/s)	0.00064		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	0.51375		Permeable area draining to outfall (ha)	0.70925	
Base Flow Index (BFI)	0.206		Is the discharge in or within 1 km upstream of a protected site for conservation? <input type="checkbox"/> No <input type="checkbox"/> D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO3/l		<input type="checkbox"/> D		
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? <input type="checkbox"/> No <input type="checkbox"/> D					
Tier 1	Estimated river width (m)	5	Manning's n	0.035	
Tier 2	Bed width (m)	2	Side slope (m/m)	0.472553	Long slope (m/m) 0.014107
Step 3 Mitigation					
	Brief description	Treatment for solubles (%)		Estimated effectiveness	
		Attenuation for solubles - restricted discharge rate (l/s)		Settlement of sediments (%)	
Existing measures		0	<input type="checkbox"/> D	Unlimited	<input type="checkbox"/> D
Proposed measures	Filter Drains & Wet/Retention Ponds	40	<input type="checkbox"/>	Unlimited	<input type="checkbox"/> D
<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>					

Soluble Zinc Result

HIGHWAYS AGENCY		Highways Agency Water Risk Assessment		version 1.0 November 2009	
Annual Average Concentration		Soluble - Acute Impact		Zinc	
	Copper	Zinc	Pass	Pass	Pass
Step 2	0.47	1.42	ug/l		
Step 3	0.22	0.67	ug/l		
Sediment - Chronic Impact					
Sediment deposition for this site is judged as:					
Accumulating?	No	0.10	Low flow Vel m/s		
Extensive?	No	-	Deposition Index		
Location Details					
Road number	A9 T-M		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	272627	Northing	835042	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Z-A	List of outfalls in cumulative assessment			
Receiving watercourse	Midlairs Burn Trib 2				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	06/02/2018		Version of assessment	2	
Notes					
Step 1 Runoff Quality					
AADT	>10,000 and <50,000		Climatic region	Colder Wet	
Rainfall site	Ardalnaig (SAAR 1343.9mm)				
Step 2 River Impacts					
Annual 95%ile river flow (m ³ /s)	0.0064		(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)		
Impermeable road area drained (ha)	0.51375		Permeable area draining to outfall (ha)	0.70925	
Base Flow Index (BFI)	0.206		Is the discharge in or within 1 km upstream of a protected site for conservation? <input type="checkbox"/> No <input type="checkbox"/> D		
For dissolved zinc only					
Water hardness	Low = <50mg CaCO ₃ /l		<input type="checkbox"/> D		
For sediment impact only					
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? <input type="checkbox"/> No <input type="checkbox"/> D					
Tier 1	Estimated river width (m)		5		
Tier 2	Bed width (m)		2		
Manning's n	0.035		Side slope (m/m)	0.472553	
Long slope (m/m)	0.014107				
Step 3 Mitigation					
Brief description		Estimated effectiveness			
		Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (1/s)	Settlement of sediments (%)	
Existing measures		0	Unlimited	0	
Proposed measures	Filter Drains & Wet/Retention Ponds	53	Unlimited	72	
<input type="button" value="Predict Impact"/> <input type="button" value="Show Detailed Results"/> <input type="button" value="Exit Tool"/>					

A.2. Method D Accidental Spillage Assessment Datasheet

A9 Accidental Spillage Calculations													
Formula: $Rt \times SS \times (AADT \times 365 \times 10^{-9}) \times (\%HG\ V / 100)$													
Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24-2way	%HG V	p ¹	p ²	p ³	Outfall Risk	Overall Prob.	Designated Area?	Annual Probability 1 in x
E-A	0.3863	Rural	Slip Road	0.83	17,907	11.4	0.00023890396075983	0.75	0.00017917797056987	0.00017917797056987	0.000179178	No	4536
	0.237	Rural	No Junction	0.29	17,907	11.4	0.00005121142885710	0.75	0.00003840857164283	0.00003840857164283	0.000038409	No	
1-A	1.15	Rural	No Junction	0.29	17,906	11.4	0.00024840039811000	0.75	0.00018636029858250	0.00018636029858250	0.000186360	No	2685
	0.4012	Rural	Slip Road	0.83	17,906	11.4	0.00024810488350536	0.75	0.00018607866262902	0.00018607866262902	0.000186079	No	
2-A	0.574	Rural	No Junction	0.29	17,907	11.4	0.00012403105554420	0.75	0.00009302329165815	0.00009302329165815	0.000093023	No	10750
3-A	0.9716	Rural	No Junction	0.29	17,907	11.4	0.00020994525011628	0.75	0.00015745893758721	0.00015745893758721	0.000157459	No	6351
4-A	0.5161	Rural	No Junction	0.29	17,907	11.4	0.00011151990900063	0.75	0.00008363993175047	0.00008363993175047	0.000083640	No	11956
4-B	0.6191	Rural	No Junction	0.29	17,908	11.4	0.00013378382338332	0.75	0.00010033786753749	0.00010033786753749	0.000100338	No	9366
5-A	1.036	Rural	No Junction	0.29	17,908	12.3	0.00024154764905040	0.75	0.00018116073678780	0.00018116073678780	0.000181161	No	
	0.3024	Rural	Slip Road	0.83	17,746	11.4	0.00018533526877152	0.75	0.00013900145157864	0.00013900145157864	0.000139001	No	3123
6-A	0.5916	Rural	No Junction	0.29	17,752	11.4	0.00012672758776608	0.75	0.00009504569082456	0.00009504569082456	0.000095046	No	10521
7-A	0.7582	Rural	No Junction	0.29	17,754	11.4	0.000162433540003932	0.75	0.00012182515502949	0.00012182515502949	0.000121825	No	8208
8-A	0.3709	Rural	No Junction	0.29	17,754	11.4	0.00007946003693034	0.75	0.00005959502769776	0.00005959502769776	0.000059595	No	5066
	0.2996	Rural	Slip Road	0.83	17,603	11.5	0.00018373728519790	0.75	0.00013780296389843	0.00013780296389843	0.000137803	No	
9-A	1.666	Rural	No Junction	0.29	17,716	11.4	0.00035615281586640	0.75	0.00026711461189980	0.00026711461189980	0.000267115	No	3744
X-A	0.8021	Rural	No Junction	0.29	17,714	11.4	0.00017145133471986	0.75	0.00012858850103990	0.00012858850103990	0.000128589	No	7777
Y-A	0.3716	Rural	No Junction	0.29	17,713	11.4	0.00007942615548852	0.75	0.00005956961661639	0.00005956961661639	0.000059570	No	16787
Z-A	0.2691	Rural	Slip Road	0.83	17,712	11.4	0.00016460857325448	0.75	0.00012345642994086	0.00012345642994086	0.000123456	No	8100