A9 DUALLING
PERTH TO INVERNESS

Appendix 11.4

Surface Water Environment

Water Quality Calculations

Transport Scotland

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TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

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Glossary and Abbreviations

Terminology	Abbreviation	Description
Accidental spillage	-	Contaminated road runoff directly resulting from spillages due to vehicle accident, leading to an acute pollution incident and impact on the receiving surface or groundwater body
Ambient Background Concentration	ABC	Site-specific or soil type-specific ambient background concentrations of trace metals in soils - needed for risk assessment
Annual Average Daily (24 hour) Traffic	AADT24	Daily volume of vehicle traffic, based on annual traffic volumes to incorporate variations across the year
Base Flow Index	BFI	A measure of the ratio of long-term base-flow to total stream flow representing the slow continuous contribution of groundwater to river flow
Design Manual for Roads and Bridges	DMRB	A series of 15 volumes that provide standards, advice notes and other documents relating to the design, assessment and operation of trunk roads, including motorways in the United Kingdom, and, with some amendments, the Republic of Ireland
Drainage network	-	Specific catchments, including permeable and impermeable surfaces, collecting precipitation to be transferred from The Proposed Scheme to a local receiving water body via either surface water or groundwater discharge
Environmental Quality Standards	EQS	Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined by the Water Framework Directive. The assessment of EQS considers long-term risks over the period of one year by comparing discharge concentrations of pollutants against EQS level
Five percentile flow	Q95	The flow in cubic metres per second which was equalled or exceeded for 95% of the flow record
Highways Agency Water Risk Assessment Tool	HAWRAT	Standard approach specified in Design Manual for Roads and Bridges document HD 45/09. A Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road runoff. Assesses acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants (with dissolved copper and dissolved zinc used as indicators)
Mainline	-	Main carriageway of The Proposed Scheme; A9 dual carriageway between Dalraddy and Slochd
Outfall	-	Discharge location for drainage network
Routine runoff	-	Potentially contaminated road runoff from routine operation, including sediment and soluble metals
Side roads	-	New/upgraded side roads and accommodation tracks required to link with the mainline of The Proposed Scheme

Terminology	Abbreviation	Description
Site of Special Scientific Interest	SSSI	A formal conservation designation for an area which is of particular interest because of its fauna, flora or geological or physiological features; in other words, these areas have extremely high conservation value
Sodium chloride	NaCl	An ionic compound with the chemical formula NaCl, representing a 1:1 ratio of sodium and chloride ions.
Surface water discharge	-	Drainage network that discharges via outfall to surface water body
Sustainable Drainage Systems	SuDS	Techniques used to manage flow attenuation and water quality treatment of runoff to minimise adverse effect on receiving water body, examples include filter drains, swales, retention/detention ponds, surface flow wetlands and infiltration basins
Water Framework Directive	WFD	The purpose of the Water Framework Directive is to establish a framework for the protection of inland surface waters, estuaries, coastal waters and groundwater

1. Introduction

1.1 Overview

1.1.1 This report is a technical appendix to the A9 Dualling Dalraddy to Slochd – 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 Design Manual for Roads and Bridges (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; and
- Assessment of the short term, acute impacts of road salt, utilising a method developed 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 is an assessment of pollution impacts from routine runoff on surface waters, comprising 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; and
- EQS Assessment: Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the Water Framework Directive (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, including: 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 Base Flow Index (BFI) (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.

2.1.3 It should be noted that Method C assessments are included within Chapter 10: Geology, Soils and Groundwater.

HAWRAT Assessment

2.1.4 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.

2.1.5 Figure 2.1 displays the HAWRAT process and stages of assessment.

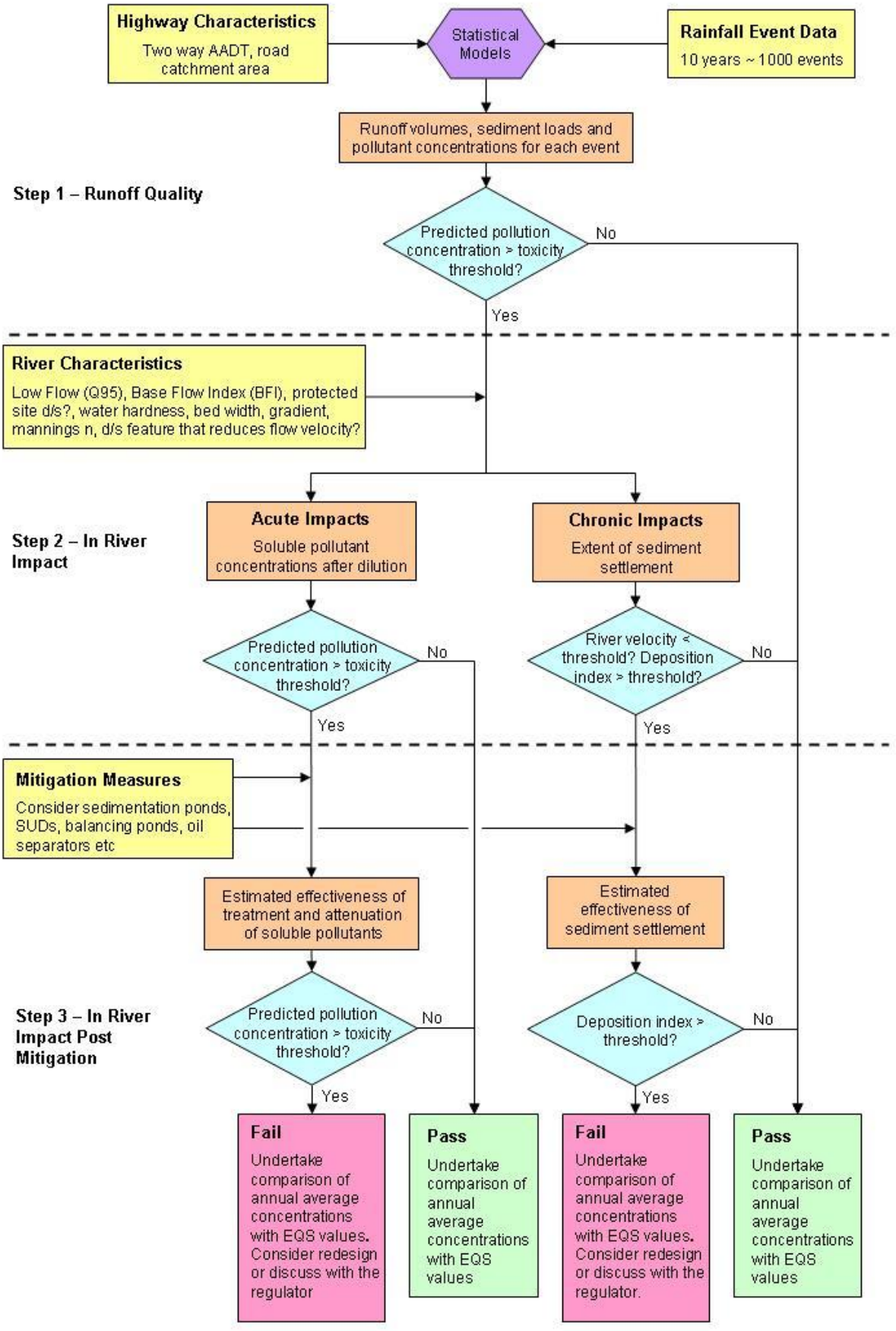
2.1.6 For soluble pollutants the HAWRAT calculates the in-river concentration of soluble copper and zinc for approximately 1000 stochastically generated rainfall events. For each rainfall event the calculated soluble copper and zinc concentrations are compared with in-built thresholds, and the number of exceedances across the 1000 rainfall events calculated. This is then compared with in-built exceedance thresholds. These vary depending on if sensitive sites such as any Site of Special Scientific Interest (SSSI) are 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.

2.1.7 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.

2.1.8 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.

2.1.9 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



2.1.10 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 2.1.

Table 2.1: 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

2.1.11 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 2.1. 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 2.2. Please note: this is a conservative approach and assumes the treatment efficiency has a level of error, e.g. in reality it is unlikely that any pollutant will be removed to zero concentration.

Table 2.2: 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

2.1.12 The HAWRAT 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.

2.1.13 The EQS thresholds for copper and zinc are:

- Copper – an annual average of 1 µg/l bioavailable copper
- Zinc – an annual average of 10.9 µg/l bioavailable zinc + Ambient Background Concentration (ABC) (µg/l) dissolved zinc

2.1.14 The HAWRAT calculates the total annual average concentration of dissolved copper and dissolved zinc, not the bioavailable fraction. Comparing these calculated values with the bioavailable EQS-+ 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.

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; and
- The probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident.

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 (NaCl) on the surface water environment. In the absence of an existing method for assessing salt concentrations in runoff and at the point of dilution, a simple and conservative risk-based model has been developed for use on projects within the A9 Dualling Programme that generally follows the approach taken by the HAWRAT method.

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, 2013[i]).

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. The method assumes that the road salt applied is essentially NaCl rather than any alternative chloride based salt compounds or other additives.

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/m^3, 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 58.44 g/mol) based on the ratio of relative atomic weights of Na (atomic weight of 22.98 g/mol) and Cl^- (atomic weight of 35.45 g/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 640 mg/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 2.3 below.

Table 2.3: Generic Salt Assessment Input Parameters

Parameter	Value Used	Source
Max application of salt per m^2	40 g/m^2	UK Roads Liaison Group (2013)
Rainfall depth	5 mm	Value adopted relates to the first flush rainfall depths used in the 'The SuDS Manual' (CIRIA, 2015).

Parameter	Value Used	Source
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	640 $mgCl^-/l$	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^-.

Limitations

- With regards to the routine runoff assessment, use of HAWRAT presents several limitations:
  - 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 1402 mm while the annual average rainfall within the study area is approximately 977 mm. There is therefore potential for overestimation of flows within the receiving watercourses and from the road drainage networks, but this is considered the best available alternative and a conservative approach in terms of impact.
  - HAWRAT uses two-way Annual Average Daily (24 hour) Traffic (AADT24) 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. Again this is a conservative approach 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 and it is likely that there is overestimation of the pollutant concentrations in the road runoff.
  - The required treatment percentages returned by HAWRAT are very precise, which is a conservative approach, 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.
  - A runoff coefficient of 1 is potentially very conservative even for paved road as this assumes that 100% of rainfall (above 5mm events) turns into runoff.

3. Results

3.1 Method A Routine Runoff Assessment

3.1.1 The Proposed Scheme involves a total of 26 surface water discharges associated with mainline drainage.

3.1.2 Four cumulative assessments have been carried out for outfalls: S4 and S5; S7 and S7A; N4 and N5; and N7, N8, N9, N10 and N11, 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 3.1. Highways Agency Water Risk Assessment Tool (HAWRAT) datasheets are provided in Annex A.1.

Table 3.1: Summary of Method A Routine Runoff Assessment Results

Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
										Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Value (µg/l)	Pass / Fail	Value (µg/l)	Pass / Fail
S1	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	0.086	4	0.01	Pass	0.02	Pass
S2	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	0.017	-	0.07	Pass	0.17	Pass
S3	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	0.004	-	0.13	Pass	0.32	Pass
S4	Filter Drains & Wet/Retention Ponds	55	65	83	Pass	Pass	Pass	0.035	-	0.04	Pass	0.10	Pass
S5	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	0.035	-	0.04	Pass	0.10	Pass
S4/S5	Wet/Retention Ponds &	40	53	72	Pass	Pass	Pass	0.035	-	0.09	Pass	0.22	Pass
S7	Filter Drains & Wet/Retention Ponds	55	65	83	Pass	Pass	-	0.002	54	0.44	Pass	1.05	Pass

Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
										Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Value (µg/l)	Pass / Fail	Value (µg/l)	Pass / Fail
S7A	Filter Drains & Dry/Detention Ponds	0	45	70	Pass	Pass	-	0.002	-	0.26	Pass	0.44	Pass
S7/S7A	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	-	0.002	207	0.61	Pass	1.46	Pass
S8	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	0.002	-	0.29	Pass	0.68	Pass
S9	Filter Drains & Wet/Retention Ponds	40	53	72	Pass	Pass	Pass	0.003	-	0.10	Pass	0.25	Pass
C1	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.001	-	0.24	Pass	0.58	Pass
C3	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.003	-	0.18	Pass	0.44	Pass
C5B	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.003	-	0.12	Pass	0.28	Pass

Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
										Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Value (µg/l)	Pass / Fail	Value (µg/l)	Pass / Fail
C11	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.004	-	0.24	Pass	0.58	Pass
C12	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.007	-	0.14	Pass	0.33	Pass
C13	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.002	21	0.22	Pass	0.53	Pass
C14	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.002	-	0.56	Pass	1.35	Pass
N1	Filter Drains & Wet/Retention Pond	0	45	70	Pass	Pass	Pass	0.889	1	0.00	Pass	0.00	Pass
N2	Filter Drains & Wet/Retention Pond	0	45	70	Pass	Pass	Pass	0.045	-	0.06	Pass	0.10	Pass
N4	Filter Drains & Wet/Retention Pond	0	45	70	Pass	Pass	Pass	0.017	-	0.06	Pass	0.11	Pass

Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
										Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Value (µg/l)	Pass / Fail	Value (µg/l)	Pass / Fail
N5	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.016	-	0.15	Pass	0.36	Pass
N4/N5	Dry/Detention Ponds &	0	45	70	Pass	Pass	-	0.017	-	0.29	Pass	0.48	Pass
N7	Filter Drains & Wet/Retention Pond	0	45	70	Pass	Pass	Pass	0.012	-	0.07	Pass	0.12	Pass
N8	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.005	-	0.14	Pass	0.33	Pass
N9	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.004	-	0.07	Pass	0.17	Pass
N10	Filter Drains & Wet/Retention Pond	40	53	72	Pass	Pass	Pass	0.004	-	0.08	Pass	0.19	Pass
N11	Swales/Grassed Channels & Filter Drains	50	50	80	Pass	Pass	Pass	0.003	-	0.18	Pass	0.53	Pass
N12	Filter Drains & Swales/Grassed Channels	50	59	76	Pass	Pass	Pass	0.04	31	0.04	Pass	0.11	Pass

Mainline Drainage Network ID	Proposed SuDS Treatment Train	Treatment Efficiencies (% removal)			HAWRAT Assessment					EQS Assessment			
										Annual Average Dissolved Copper		Annual Average Dissolved Zinc	
		Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc	Sediment	Low Flow Vel. (m/s)	Deposition Index	Value (µg/l)	Pass / Fail	Value (µg/l)	Pass / Fail
N7/N8/N9/N10/N11	Dry/Detention Ponds &	0	45	70	Pass	Pass	-	0.012	-	0.31	Pass	0.52	Pass
N12	Filter Drains & Swales/Grassed Channels	50	59	76	Pass	Pass	Pass	0.005	8	0.04	Pass	0.11	Pass

3.1.4 Each impact is assessed using the methods outlined in Section 11.2. The potential impacts are assessed with embedded design mitigation, but without additional environmental mitigation and therefore a precautionary approach has been adopted.

3.1.5 Silt and sediment laden site runoff generated during construction activities, such as soil stripping and earthworks can have a detrimental impact if allowed to enter watercourses untreated. Fine sediments can increase water turbidity and smother stream beds, affecting water quality and causing harm to fish, aquatic invertebrates and plants by interfering with feeding, respiration and spawning. The effects of sediment release can extend considerable distances 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 3.2 below.

3.2.2 All mainline drainage 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 1 km downstream). The minimum return period for a single drainage network has been calculated as 1 in 1,720 years (S4). 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 3.2: Summary Method D Accidental Spillage Assessment Results

Mainline Drainage Network ID	Return Period Probability 1 in 'X' (Years)	Pass / Fail
S1	13,238	Pass
S2	5,642	Pass
S3	12,707	Pass
S4	1,690	Pass
S5	4,583	Pass
S4/S5	1,234	Pass
S7	3,191	Pass
S7A	15,005	Pass
S7/S7A	2,631	Pass
S8	7,667	Pass
S9	16,155	Pass
C1	10,369	Pass
C3	12,505	Pass
C5B	17,570	Pass
C11	6,527	Pass
C12	3,875	Pass
C13	15,056	Pass
C14	4,293	Pass
N1	9,413	Pass

Mainline Drainage Network ID	Return Period Probability 1 in 'X' (Years)	Pass / Fail
N2	5,626	Pass
N4	2,147	Pass
N5	2,327	Pass
N4/N5	1,116	Pass
N7	11,207	Pass
N8	4,737	Pass
N9	24,267	Pass
N10	18,340	Pass
N11	7,975	Pass
N7/N8/N9/N10/N11	1,917	Pass
N12	21,789	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 ions in the theoretical raw road runoff has been estimated to be 3411 mg/l. The in-river concentrations at each of the mainline road drainage outfalls is presented in Table 3.3. The assessment fails if the in river Cl concentrations is calculated as over 640 mg/l.

Table 3.3: 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
S1	0.926	1.9	Allt an Fhearna	471	13	Pass
S2	2.176	4.4	Allt Chriochaidh	67	208	Pass
S3	0.946	1.9	Ballinluig Burn	18	324	Pass
S4	3.715	7.4	Allt-na-Criche (Lynwilg)	137	175	Pass
S5	2.492	5.0	Allt-na-Criche (Lynwilg)	137	120	Pass
S7	4.668	9.3	Loch Puladdern	12	1493	Fail

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
S7A	0.685	1.4	Loch Puladdern	12	350	Pass
S8	1.365	2.7	Easter Aviemore Burn	7	957	Fail
S9	0.647	1.3	AnCG bifurcation south	34	125	Pass
C1	0.548	1.1	AnCG bifurcation north	37	98	Pass
C3	1.255	2.5	Allt na Criche (Granish)	53	154	Pass
C5B	0.814	1.6	Avie Lochan Burn South	21	245	Pass
C11	2.326	4.7	Allt Cnapach	19	671	Fail
C12	1.978	4.0	Feith Mhor	37	329	Pass
C13	0.938	1.9	Feith Mhor Trib 2	8	648	Fail
C14	3.416	6.8	Feith Mhor Drain 7	11	1307	Fail
N1	1.479	3.0	River Dulnain	4770	2	Pass
N2	2.879	5.8	Allt nan Ceatharnach	343	56	Pass
N4	1.262	2.5	Bogbain Burn	131	64	Pass
N5	5.29	10.6	Bogbain Burn	122	272	Pass
N7	1.031	2.1	Allt Slochd Mhuic	74	92	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
N8	1.7	3.4	Allt Slochd Mhuic	44	245	Pass
N9	0.595	1.2	Allt Slochd Mhuic	37	106	Pass
N10	0.707	1.4	Allt Slochd Mhuic	35	132	Pass
N11	1.576	3.2	Allt Slochd Mhuic	27	357	Pass
N12	0.545	1.1	Allt Cosach	22	161	Pass

3.3.2 As can be seen in Table 3.3, five of the outfalls discharging to the following waterbodies Loch Puladdern, Easter Aviemore Burn, Allt Cnapach, Feith Mhor Trib 2 and Feith Mhor Drain 7 fail the road salt assessment. This is unsurprising given that, for four of 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 small heavily modified drains with little or no biodiversity interest, with the exception of Loch Puladdern which is within the Craigellachie National Nature Reserve and SSSI. 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.

[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

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Soluble - Acute Impact	Copper	Zinc
Annual Average Concentration		
Step 2	0.01	0.03 ug/l
Step 3	0.01	0.02 ug/l
	Pass	Pass

Sediment - Chronic Impact

Alert. Protected Area.

Sediment deposition for this site is judged as:
Accumulating? Yes 0.04 Low flow Vel m/s
Extensive? No 4 Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 285357	Northing	809186
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	S1	List of outfalls in cumulative assessment	
Receiving watercourse	Allt an Fhearna		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	02/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality — AADT: >10,000 and <50,000 — Climatic region: Colder Wet — Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.086 — (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 0.926 — Permeable area draining to outfall (ha): 1.228
Base Flow Index (BFI): 0.369 — Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6
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 Ponds	40	Unlimited	72

Predict Impact | Show Detailed Results | Exit Tool

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Soluble - Acute Impact	Copper	Zinc
Annual Average Concentration		
Step 2	0.12	0.36 ug/l
Step 3	0.07	0.22 ug/l
	Pass	Pass

Sediment - Chronic Impact

Alert. Protected Area.

Sediment deposition for this site is judged as:
Accumulating? No 0.43 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 285720	Northing	809495
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	S2	List of outfalls in cumulative assessment	
Receiving watercourse	Allt Chriochaidh		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	02/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality — AADT: >10,000 and <50,000 — Climatic region: Colder Wet — Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.017 — (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 2.176 — Permeable area draining to outfall (ha): 3.55
Base Flow Index (BFI): 0.451 — Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6
Tier 2 — Bed width (m): 2.25 — Manning's n: 0.04 — Side slope (m/m): 0.98857 — Long slope (m/m): 0.041402

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

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Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc		Copper	Zinc
Step 2	0.21	0.67	ug/l	Pass	Pass
Step 3	0.13	0.40	ug/l		

Sediment - Chronic Impact

Alert. Protected Area.

Sediment deposition for this site is judged as:

Accumulating?	No	0.53	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 286883		Northing	810073
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	S3	List of outfalls in cumulative assessment		
Receiving watercourse	Ballinluig Burn			
EA receiving water Detailed River Network ID		Assessor and affiliation		AMJV
Date of assessment	02/07/2018	Version of assessment		4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.946 | Permeable area draining to outfall (ha): 0.938

Base Flow Index (BFI): 0.658 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6

Tier 2 Bed width (m): 0.17 | Manning's n: 0.035 | Side slope (m/m): 1.26969 | Long slope (m/m): 0.029467

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

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Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc		Copper	Zinc
Step 2	0.10	0.30	ug/l	Pass	Pass
Step 3	0.04	0.13	ug/l		

Sediment - Chronic Impact

Alert. Protected Area & D/S Structure.

Sediment deposition for this site is judged as:

Accumulating?	No	0.49	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 288338		Northing	810636
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	S4	List of outfalls in cumulative assessment		
Receiving watercourse	Allt-na-Criche(Lynwilg)			
EA receiving water Detailed River Network ID		Assessor and affiliation		AMJV
Date of assessment	02/07/2018	Version of assessment		4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.715 | Permeable area draining to outfall (ha): 4.478

Base Flow Index (BFI): 0.411 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6

Tier 2 Bed width (m): 2.68 | Manning's n: 0.04 | Side slope (m/m): 0.411708 | Long slope (m/m): 0.029392

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 & Swales/Grassed Channels	55	Unlimited	83

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

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Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc		Copper	Zinc
Step 2	0.07	0.20	ug/l	Pass	Pass
Step 3	-	-	ug/l		

Sediment - Chronic Impact

Alert. Protected Area & D/S Structure.

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 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 288351		Northing	810631
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	S5	List of outfalls in cumulative assessment		
Receiving watercourse	Allt-na-Criche(Lynwilg)			
EA receiving water Detailed River Network ID		Assessor and affiliation		AMJV
Date of assessment	02/07/2018	Version of assessment		4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.492 | Permeable area draining to outfall (ha): 1.489

Base Flow Index (BFI): 0.411 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6

Tier 2 Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379935 | Long slope (m/m): 0.031568

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		0	Unlimited	0

Predict Impact | Show Detailed Results | Exit Tool

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Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc		Copper	Zinc
Step 2	0.26	0.80	ug/l	Pass	Pass
Step 3	-	-	ug/l		

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 289101		Northing	812069
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	S7A	List of outfalls in cumulative assessment		
Receiving watercourse	Loch Pulladern			
EA receiving water Detailed River Network ID		Assessor and affiliation		AMJV
Date of assessment	03/07/2018	Version of assessment		4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.685 | Permeable area draining to outfall (ha): 0.406

Base Flow Index (BFI): 0.252 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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 & Dry/Detention Ponds	0	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc
Step 2	0.99	2.99	ug/l	Pass	Pass
Step 3	0.44	1.35	ug/l		

Location Details

Road number	A9 D-S		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	289080	Northing	812185
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	S7		List of outfalls in cumulative assessment	
Receiving watercourse	Loch Pulladern			
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV
Date of assessment	03/07/2018		Version of assessment	4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 3.945 | Permeable area draining to outfall (ha): 2.531
Base Flow Index (BFI): 0.252 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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 & Swales/Grassed Channels	55	Unlimited	83

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.48	1.46	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.29	0.87	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.26 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	289403	Northing	814149
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	S8		List of outfalls in cumulative assessment	
Receiving watercourse	Easter Aviemore Burn			
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV
Date of assessment	03/07/2018		Version of assessment	4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 1.365 | Permeable area draining to outfall (ha): 1.015
Base Flow Index (BFI): 0.403 | 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): 1.22 | Manning's n: 0.035 | Side slope (m/m): 1.164 | Long slope (m/m): 0.04263

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

HIGHWAYS AGENCY

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.17	0.53	ug/l	Pass	Pass	Pass
Step 3	0.10	0.32	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.22	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289746	Northing	814646	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S9		List of outfalls in cumulative assessment		
Receiving watercourse	Southern bifurcation Allt na Criche (Granish)				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.647 | Permeable area draining to outfall (ha): 0.502

Base Flow Index (BFI): 0.321 | 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): 1.67 | Manning's n: 0.048 | Side slope (m/m): 0.31232 | Long slope (m/m): 0.03826

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

HIGHWAYS AGENCY

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.41	1.24	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.24	0.74	ug/l			

Sediment deposition for this site is judged as:

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

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289906	Northing	814997	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	C1		List of outfalls in cumulative assessment		
Receiving watercourse	Northern bifurcation Allt na Criche (Granish)				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.548 | Permeable area draining to outfall (ha): 0.247

Base Flow Index (BFI): 0.383 | 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): 0.77 | Manning's n: 0.045 | Side slope (m/m): 6.7 | Long slope (m/m): 0.05807

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.31	0.93	ug/l	Pass	Pass	Pass
Step 3	0.18	0.56	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.21 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 290152		Northing	815669
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	C3	List of outfalls in cumulative assessment		
Receiving watercourse	Allt na Criche (Granish)			
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV	
Date of assessment	03/07/2018	Version of assessment	4	
Notes				

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 1.255 Permeable area draining to outfall (ha) 1.173
Base Flow Index (BFI) 0.344 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) 0.89 Manning's n 0.045 Side slope (m/m) 2.08387 Long slope (m/m) 0.0124041

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.20	0.59	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.12	0.36	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.27 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 290260		Northing	816360
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	C5B	List of outfalls in cumulative assessment		
Receiving watercourse	Avie Lochan Burn South			
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV	
Date of assessment	05/07/2018	Version of assessment	4	
Notes				

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 0.814 Permeable area draining to outfall (ha) 1.16
Base Flow Index (BFI) 0.247 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) 2 Manning's n 0.04 Side slope (m/m) 0.5162118 Long slope (m/m) 0.063385

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

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Annual Average Concentration	Copper	Zinc	
Step 2	0.40	1.22	ug/l
Step 3	0.24	0.73	ug/l

Soluble - Acute Impact: Copper: Pass; Zinc: Pass

Sediment - Chronic Impact: Pass

Sediment deposition for this site is judged as:

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

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 291142		Northing	818469
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	C11	List of outfalls in cumulative assessment		
Receiving watercourse	Allt Cnapach			
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV	
Date of assessment	03/07/2018	Version of assessment	4	
Notes				

Step 1 Runoff Quality — AADT: >10,000 and <50,000; Climatic region: Colder Wet; Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.326 — Permeable area draining to outfall (ha): 1.535

Base Flow Index (BFI): 0.341 — 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): 2.1 — Manning's n: 0.045 — Side slope (m/m): 0.42951 — Long slope (m/m): 0.019693

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

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Annual Average Concentration	Copper	Zinc	
Step 2	0.23	0.70	ug/l
Step 3	0.14	0.42	ug/l

Soluble - Acute Impact: Copper: Pass; Zinc: Pass

Sediment - Chronic Impact: Alert. D/S Structure.

Sediment deposition for this site is judged as:

Accumulating?	No	0.30	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 290827		Northing	820800
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	C12	List of outfalls in cumulative assessment		
Receiving watercourse	Feith Mhor			
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV	
Date of assessment	03/07/2018	Version of assessment	4	
Notes				

Step 1 Runoff Quality — AADT: >10,000 and <50,000; Climatic region: Colder Wet; Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.007 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.978 — Permeable area draining to outfall (ha): 2.283

Base Flow Index (BFI): 0.407 — 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): 0.18 — Manning's n: 0.04 — Side slope (m/m): 1.22195 — Long slope (m/m): 0.005051

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

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Soluble - Acute Impact	Annual Average Concentration			Sediment - Chronic Impact
	Copper	Zinc		
Step 2	0.36	1.12	ug/l	Alert. D/S Structure.
Step 3	0.22	0.67	ug/l	
Pass		Pass		

Sediment deposition for this site is judged as:
Accumulating? Yes 0.08 Low flow Vel m/s
Extensive? No 21 Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	290661	Northing	820868	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	C13	List of outfalls in cumulative assessment			
Receiving watercourse	Feith Mhor Trib 2				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	05/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 0.938 Permeable area draining to outfall (ha) 0.933
Base Flow Index (BFI) 0.477 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) 1.5 Manning's n 0.04 Side slope (m/m) 0.5147679 Long slope (m/m) 0.001295

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
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Soluble - Acute Impact	Annual Average Concentration			Sediment - Chronic Impact
	Copper	Zinc		
Step 2	0.94	2.87	ug/l	Pass
Step 3	0.56	1.72	ug/l	
Pass		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 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	290591	Northing	821255	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	C14	List of outfalls in cumulative assessment			
Receiving watercourse	Feith Mhor Drain 7				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 3.416 Permeable area draining to outfall (ha) 3.954
Base Flow Index (BFI) 0.534 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) 0.85 Manning's n 0.07 Side slope (m/m) 4.088 Long slope (m/m) 0.01851

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact	Sediment deposition for this site is judged as:		
Step 2	0.00	0.01	ug/l	Pass	Pass	Alert. Protected Area & D/S Structure.	Accumulating?	Yes	0.06 Low flow Vel m/s
Step 3	-	-	ug/l				Extensive?	No	1 Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number			
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289623	Northing	822513	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N1	List of outfalls in cumulative assessment			
Receiving watercourse	River Dulnain				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.889 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 1.479 | Permeable area draining to outfall (ha): 0.662
Base Flow Index (BFI): 0.436 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 18
Tier 2 Bed width (m): 0.85 | Manning's n: 0.07 | Side slope (m/m): 4.088 | Long slope (m/m): 0.01851

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 & Dry/Detention Ponds	0	Unlimited	70

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact	Sediment deposition for this site is judged as:		
Step 2	0.06	0.17	ug/l	Pass	Pass	Alert. Protected Area.	Accumulating?	No	0.35 Low flow Vel m/s
Step 3	-	-	ug/l				Extensive?	No	- Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number			
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289165	Northing	822798	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N2	List of outfalls in cumulative assessment			
Receiving watercourse	Allt nan Ceatharnach				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.045 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 2.879 | Permeable area draining to outfall (ha): 4.426
Base Flow Index (BFI): 0.278 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 18
Tier 2 Bed width (m): 4.56 | Manning's n: 0.045 | Side slope (m/m): 1.09615 | Long slope (m/m): 0.015136

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 & Dry/Detention Ponds	0	Unlimited	70

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.06	0.20	ug/l	Pass	Pass	Pass
Step 3	-	-	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.32	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	288290	Northing	824099	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N4		List of outfalls in cumulative assessment		
Receiving watercourse	Bogbain Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.017 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 1.262 | Permeable area draining to outfall (ha): 1.791
Base Flow Index (BFI): 0.283 | 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): 18
Tier 2 — Bed width (m): 1.61 | Manning's n: 0.045 | Side slope (m/m): 2.049387 | Long slope (m/m): 0.011224

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 & Dry/Detention Ponds	0	Unlimited	70

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.25	0.77	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.15	0.46	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.30	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	287839	Northing	824195	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N5		List of outfalls in cumulative assessment		
Receiving watercourse	Bogbain Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.016 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 5.29 | Permeable area draining to outfall (ha): 3.445
Base Flow Index (BFI): 0.282 | 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): 18
Tier 2 — Bed width (m): 2.2 | Manning's n: 0.045 | Side slope (m/m): 0.857272 | Long slope (m/m): 0.014026

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.07	0.21	ug/l	Pass	Pass	Pass
Step 3	-	-	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.24 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 284364	Northing	824103
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	N7	List of outfalls in cumulative assessment	
Receiving watercourse	Allt Slochd Mhuic		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	03/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality AADT: >10,000 and <50,000 Climatic region: Colder Wet Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.012 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 1.031 Permeable area draining to outfall (ha): 1.462
Base Flow Index (BFI): 0.249 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): 18
Tier 2 Bed width (m): 0.14 Manning's n: 0.04 Side slope (m/m): 1.864197 Long slope (m/m): 0.001915

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 & Dry/Detention Ponds	0	Unlimited	70

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.24	0.71	ug/l	Pass	Pass	Pass
Step 3	0.14	0.43	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.26 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 284212	Northing	824528
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	N8	List of outfalls in cumulative assessment	
Receiving watercourse	Allt Slochd Mhuic		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	04/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality AADT: >10,000 and <50,000 Climatic region: Colder Wet Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

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): 1.7 Permeable area draining to outfall (ha): 3.03
Base Flow Index (BFI): 0.215 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): 1.59 Manning's n: 0.04 Side slope (m/m): 0.965714 Long slope (m/m): 0.019824

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.12	0.36	ug/l	Pass	Pass	Pass
Step 3	0.07	0.21	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.23 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	284069	Northing	824795	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N9		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 0.595 | Permeable area draining to outfall (ha): 0.154
Base Flow Index (BFI): 0.209 | 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): 18
Tier 2 Bed width (m): 1.24 | Manning's n: 0.04 | Side slope (m/m): 1.8230769 | Long slope (m/m): 0.013652

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.14	0.41	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.08	0.25	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.22 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	283999	Northing	825014	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N10		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 0.707 | Permeable area draining to outfall (ha): 0.305
Base Flow Index (BFI): 0.207 | 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): 18
Tier 2 Bed width (m): 1.45 | Manning's n: 0.04 | Side slope (m/m): 10 | Long slope (m/m): 0.014401

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact			
Step 2	0.35	1.06	ug/l	Pass	Pass	Alert. D/S Structure.	Sediment deposition for this site is judged as: Accumulating?	No	0.24 Low flow Vel m/s
Step 3	0.18	0.53	ug/l				Extensive?	No	- Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	283725	Northing	825397	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N11	List of outfalls in cumulative assessment			
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.576 | Permeable area draining to outfall (ha): 0.639

Base Flow Index (BFI): 0.205 | 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): 18

Tier 2 Bed width (m): 1.83 | Manning's n: 0.04 | Side slope (m/m): 0.4937313 | Long slope (m/m): 0.038734

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	Swales/Grassed Channels	50	Unlimited	80

Predict Impact | Show Detailed Results | Exit Tool

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact			
Step 2	0.09	0.27	ug/l	Pass	Pass	Pass	Sediment deposition for this site is judged as: Accumulating?	Yes	0.04 Low flow Vel m/s
Step 3	0.04	0.13	ug/l				Extensive?	No	8 Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	282723	Northing	826218	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N12	List of outfalls in cumulative assessment			
Receiving watercourse	Allt Cosach				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.545 | Permeable area draining to outfall (ha): 0.397

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

Tier 2 Bed width (m): 1.83 | Manning's n: 0.04 | Side slope (m/m): 0.4937313 | Long slope (m/m): 0.038734

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 & Swales/Grassed Channels	50	Unlimited	76

Predict Impact | Show Detailed Results | Exit Tool

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc
Step 2	0.15	0.47	ug/l	Pass	Pass
Step 3	0.09	0.28	ug/l		

Sediment - Chronic Impact

Alert. Protected Area & D/S Structure.

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 D-S		HA Area / DBFO number		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting	288351	Northing	810631	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S4/S5	List of outfalls in cumulative assessment	S4		S5
Receiving watercourse	Allt-na-Criche (Lynwilg)				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes	S5 is downstream outfall location.				

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): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 6.207 | Permeable area draining to outfall (ha): 5.967

Base Flow Index (BFI): 0.411 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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

Tier 1 Estimated river width (m): 1

Tier 2 Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc
Step 2	1.02	3.11	ug/l	Pass	River Fails Toxicity Test. Try more mitigation
Step 3	0.61	1.87	ug/l		

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting	289102	Northing	812069	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S7/S7A	List of outfalls in cumulative assessment	S7		S7A
Receiving watercourse	Loch Pulladern				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 4.196 | Permeable area draining to outfall (ha): 2.9

Base Flow Index (BFI): 0.252 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.29	0.87	ug/l	Pass	Pass	Pass
Step 3	-	-	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.14	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number			
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting 288290		Northing	824099	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N4/N5	List of outfalls in cumulative assessment	N4		N5
Receiving watercourse	Bogbain Burn				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.017 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 6.552 | Permeable area draining to outfall (ha): 5.236

Base Flow Index (BFI): 0.282 | 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

Tier 2 — Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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 & Dry/Detention Ponds	0	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.31	0.94	ug/l	Pass	Pass	Pass
Step 3	0.17	0.52	ug/l			

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 D-S	HA Area / DBFO number			
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting 284364		Northing	824103	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N7/N8/N9/N10/N11	List of outfalls in cumulative assessment	N7		N8
Receiving watercourse	Allt Slochd Mhuic		N9	N10	N11
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.012 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 5.609 | Permeable area draining to outfall (ha): 5.59

Base Flow Index (BFI): 0.249 | 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

Tier 2 — Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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 & Dry/Detention Ponds	45	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

Soluble Zinc

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Soluble - Acute Impact	Annual Average Concentration			Soluble - Acute Impact		Sediment - Chronic Impact			
	Copper	Zinc		Copper	Zinc				
Step 2	0.01	0.03	ug/l	Pass	Pass	Alert. Protected Area.	Sediment deposition for this site is judged as: Accumulating?	Yes	0.04 Low flow Vel m/s
Step 3	0.00	0.02	ug/l				Extensive?	No	4 Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 285357	Northing	809186
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	S1	List of outfalls in cumulative assessment	
Receiving watercourse	Allt an Fhearna		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	02/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.086 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 0.926 | Permeable area draining to outfall (ha): 1.228
Base Flow Index (BFI): 0.369 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6
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 Ponds	53	Unlimited	72

Predict Impact | Show Detailed Results | Exit Tool

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Soluble - Acute Impact	Annual Average Concentration			Soluble - Acute Impact		Sediment - Chronic Impact			
	Copper	Zinc		Copper	Zinc				
Step 2	0.12	0.36	ug/l	Pass	Pass	Alert. Protected Area.	Sediment deposition for this site is judged as: Accumulating?	No	0.43 Low flow Vel m/s
Step 3	0.05	0.17	ug/l				Extensive?	No	- Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 285720	Northing	809495
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	S2	List of outfalls in cumulative assessment	
Receiving watercourse	Allt Chriochaidh		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	02/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.017 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 2.176 | Permeable area draining to outfall (ha): 3.55
Base Flow Index (BFI): 0.451 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6
Tier 2 Bed width (m): 2.25 | Manning's n: 0.04 | Side slope (m/m): 0.98857 | Long slope (m/m): 0.041402

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

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Soluble - Acute Impact	Annual Average Concentration			Copper	Zinc
	Copper	Zinc			
Step 2	0.21	0.67	ug/l	Pass	Pass
Step 3	0.10	0.32	ug/l		

Sediment - Chronic Impact

Alert. Protected Area.

Sediment deposition for this site is judged as:

Accumulating?	No	0.53	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 286883	Northing	810073
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	S3	List of outfalls in cumulative assessment	
Receiving watercourse	Ballinluig Burn		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	02/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.946 | Permeable area draining to outfall (ha): 0.938

Base Flow Index (BFI): 0.658 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6

Tier 2 Bed width (m): 0.17 | Manning's n: 0.035 | Side slope (m/m): 1.26969 | Long slope (m/m): 0.029467

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

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Soluble - Acute Impact	Annual Average Concentration			Copper	Zinc
	Copper	Zinc			
Step 2	0.10	0.30	ug/l	Pass	Pass
Step 3	0.03	0.10	ug/l		

Sediment - Chronic Impact

Alert. Protected Area & D/S Structure.

Sediment deposition for this site is judged as:

Accumulating?	No	0.49	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 288338	Northing	810636
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	S4	List of outfalls in cumulative assessment	
Receiving watercourse	Allt-na-Criche(Lynwilg)		
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV
Date of assessment	02/07/2018	Version of assessment	4
Notes			

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.715 | Permeable area draining to outfall (ha): 4.478

Base Flow Index (BFI): 0.411 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6

Tier 2 Bed width (m): 2.68 | Manning's n: 0.04 | Side slope (m/m): 0.411708 | Long slope (m/m): 0.029392

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 & Swales/Grassed Channels	65	Unlimited	83

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc
Step 2	0.07	0.20	ug/l	Pass	Pass
Step 3	0.04	0.12	ug/l		

Sediment - Chronic Impact: Alert. Protected Area & D/S Structure.

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 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	288351	Northing	810631	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S5		List of outfalls in cumulative assessment		
Receiving watercourse	Allt-na-Criche(Lynwilg)				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	02/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.492 | Permeable area draining to outfall (ha): 1.489

Base Flow Index (BFI): 0.411 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 6

Tier 2 Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379935 | Long slope (m/m): 0.031568

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc
Step 2	0.26	0.80	ug/l	Pass	Pass
Step 3	0.14	0.44	ug/l		

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289101	Northing	812069	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S7A		List of outfalls in cumulative assessment		
Receiving watercourse	Loch Pulladern				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.685 | Permeable area draining to outfall (ha): 0.406

Base Flow Index (BFI): 0.252 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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 & Dry/Detention Ponds	45	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc
Step 2	0.99	2.99	ug/l	Pass	Pass
Step 3	0.35	1.05	ug/l		

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289080	Northing	812185	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S7		List of outfalls in cumulative assessment		
Receiving watercourse	Loch Pulladern				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.945 | Permeable area draining to outfall (ha): 2.531

Base Flow Index (BFI): 0.252 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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 & Swales/Grassed Channels	65	Unlimited	83

Predict Impact | Show Detailed Results | Exit Tool

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc
Step 2	0.48	1.46	ug/l	Pass	Pass
Step 3	0.22	0.68	ug/l		

Sediment - Chronic Impact: Alert. D/S Structure.

Sediment deposition for this site is judged as:

Accumulating?	No	0.26	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289403	Northing	814149	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S8		List of outfalls in cumulative assessment		
Receiving watercourse	Easter Aviemore Burn				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.365 | Permeable area draining to outfall (ha): 1.015

Base Flow Index (BFI): 0.403 | 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): 1.22 | Manning's n: 0.035 | Side slope (m/m): 1.164 | Long slope (m/m): 0.04263

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

HIGHWAYS AGENCY

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.17	0.53	ug/l	Pass	Pass	Pass
Step 3	0.08	0.25	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.22 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289746	Northing	814646	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S9		List of outfalls in cumulative assessment		
Receiving watercourse	Southern bifurcation Allt na Criche (Granish)				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 0.647 Permeable area draining to outfall (ha) 0.502
Base Flow Index (BFI) 0.321 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) 1.67 Manning's n 0.048 Side slope (m/m) 0.31232 Long slope (m/m) 0.03826

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.41	1.24	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.19	0.58	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.23 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289906	Northing	814997	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	C1		List of outfalls in cumulative assessment		
Receiving watercourse	Northern bifurcation Allt na Criche (Granish)				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 0.548 Permeable area draining to outfall (ha) 0.247
Base Flow Index (BFI) 0.383 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) 0.77 Manning's n 0.045 Side slope (m/m) 6.7 Long slope (m/m) 0.05807

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.31	0.93	ug/l	Pass	Pass	Pass
Step 3	0.14	0.44	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.21 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	290152		Northing	815669
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	C3		List of outfalls in cumulative assessment		
Receiving watercourse	Allt na Criche (Granish)				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 Climatic region: Colder Wet Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 1.255 Permeable area draining to outfall (ha) 1.173
Base Flow Index (BFI) 0.344 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) 0.89 Manning's n 0.045 Side slope (m/m) 2.08387 Long slope (m/m) 0.0124041

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
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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.20	0.59	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.09	0.28	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.27 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	290260		Northing	816360
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	C5B		List of outfalls in cumulative assessment		
Receiving watercourse	Avie Lochan Burn South				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	05/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 Climatic region: Colder Wet Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 0.814 Permeable area draining to outfall (ha) 1.16
Base Flow Index (BFI) 0.247 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) 0.5162118 Long slope (m/m) 0.063385

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.40	1.22	ug/l	Pass	Pass	Pass
Step 3	0.19	0.58	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.19 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	291142	Northing	818469	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	C11		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Cnapach				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s) 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 2.326 Permeable area draining to outfall (ha) 1.535
Base Flow Index (BFI) 0.341 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) 2.1 Manning's n 0.045 Side slope (m/m) 0.42951 Long slope (m/m) 0.019693

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

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.23	0.70	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.11	0.33	ug/l			

Sediment deposition for this site is judged as:
Accumulating? No 0.30 Low flow Vel m/s
Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	290827	Northing	820800	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	C12		List of outfalls in cumulative assessment		
Receiving watercourse	Feith Mhor				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s) 0.007 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha) 1.978 Permeable area draining to outfall (ha) 2.283
Base Flow Index (BFI) 0.407 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) 0.18 Manning's n 0.04 Side slope (m/m) 1.22195 Long slope (m/m) 0.005051

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

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Soluble - Acute Impact			Sediment - Chronic Impact			
Annual Average Concentration	Copper	Zinc	Copper	Zinc		
Step 2	0.36	1.12 ug/l	Pass	Pass	Alert. D/S Structure.	Sediment deposition for this site is judged as:
Step 3	0.17	0.53 ug/l				Accumulating? Yes 0.08 Low flow Vel m/s
						Extensive? No 21 Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	290661	Northing	820868
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	C13	List of outfalls in cumulative assessment		
Receiving watercourse	Feith Mhor Trib 2			
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV	
Date of assessment	05/07/2018	Version of assessment	4	
Notes				

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) 0.938 Permeable area draining to outfall (ha) 0.933

Base Flow Index (BFI) 0.477 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) 1.5 Manning's n 0.04 Side slope (m/m) 0.5147679 Long slope (m/m) 0.001295

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

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Soluble - Acute Impact			Sediment - Chronic Impact			
Annual Average Concentration	Copper	Zinc	Copper	Zinc		
Step 2	0.94	2.87 ug/l	Pass	Pass	Pass	Sediment deposition for this site is judged as:
Step 3	0.44	1.35 ug/l				Accumulating? No 0.15 Low flow Vel m/s
						Extensive? No - Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	290591	Northing	821255
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	C14	List of outfalls in cumulative assessment		
Receiving watercourse	Feith Mhor Drain 7			
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV	
Date of assessment	03/07/2018	Version of assessment	4	
Notes				

Step 1 Runoff Quality AADT >10,000 and <50,000 Climatic region Colder Wet Rainfall site Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) 3.416 Permeable area draining to outfall (ha) 3.954

Base Flow Index (BFI) 0.534 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) 0.85 Manning's n 0.07 Side slope (m/m) 4.088 Long slope (m/m) 0.01851

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

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Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.00	0.01	ug/l
Step 3	0.00	0.00	ug/l

Copper: Pass — Zinc: Pass

Sediment - Chronic Impact

Alert. Protected Area & D/S Structure.

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.06	Low flow Vel m/s
Extensive?	No	1	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289623	Northing	822513	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N1		List of outfalls in cumulative assessment		
Receiving watercourse	River Dulnain				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 — Climatic region: Colder Wet — Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.889 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.479 — Permeable area draining to outfall (ha): 0.662

Base Flow Index (BFI): 0.436 — Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 18

Tier 2 — Bed width (m): 0.85 — Manning's n: 0.07 — Side slope (m/m): 4.088 — Long slope (m/m): 0.01851

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 & Dry/Detention Ponds	45	Unlimited	70

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Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.06	0.17	ug/l
Step 3	0.03	0.10	ug/l

Copper: Pass — Zinc: Pass

Sediment - Chronic Impact

Alert. Protected Area.

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 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	289165	Northing	822798	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N2		List of outfalls in cumulative assessment		
Receiving watercourse	Allt nan Ceatharnach				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 — Climatic region: Colder Wet — Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.045 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.879 — Permeable area draining to outfall (ha): 4.426

Base Flow Index (BFI): 0.278 — Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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): 18

Tier 2 — Bed width (m): 4.56 — Manning's n: 0.045 — Side slope (m/m): 1.09615 — Long slope (m/m): 0.015136

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 & Dry/Detention Ponds	45	Unlimited	70

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Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.06	0.20	ug/l	Pass	Pass	Pass
Step 3	0.04	0.11	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.32	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	288290	Northing	824099
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	N4		List of outfalls in cumulative assessment	
Receiving watercourse	Bogbain Burn			
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV
Date of assessment	03/07/2018		Version of assessment	4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.017 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 1.262 | Permeable area draining to outfall (ha): 1.791
Base Flow Index (BFI): 0.283 | 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): 18
Tier 2 Bed width (m): 1.61 | Manning's n: 0.045 | Side slope (m/m): 2.049387 | Long slope (m/m): 0.011224

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 & Dry/Detention Ponds	45	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.25	0.77	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.12	0.36	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.30	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting	287839	Northing	824195
OS grid reference of outfall structure (m)	Easting		Northing	
Outfall number	N5		List of outfalls in cumulative assessment	
Receiving watercourse	Bogbain Burn			
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV
Date of assessment	03/07/2018		Version of assessment	4
Notes				

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.016 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
Impermeable road area drained (ha): 5.29 | Permeable area draining to outfall (ha): 3.445
Base Flow Index (BFI): 0.282 | 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): 18
Tier 2 Bed width (m): 2.2 | Manning's n: 0.045 | Side slope (m/m): 0.857272 | Long slope (m/m): 0.014026

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.07	0.21	ug/l	Pass	Pass	Pass
Step 3	0.04	0.12	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.24	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	284364	Northing	824103	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N7		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.012 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.031 | Permeable area draining to outfall (ha): 1.462

Base Flow Index (BFI): 0.249 | 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): 18

Tier 2 Bed width (m): 0.14 | Manning's n: 0.04 | Side slope (m/m): 1.864197 | Long slope (m/m): 0.001915

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 & Dry/Detention Ponds	45	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.24	0.71	ug/l	Pass	Pass	Pass
Step 3	0.11	0.33	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.26	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	284212	Northing	824528	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N8		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	04/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.7 | Permeable area draining to outfall (ha): 3.03

Base Flow Index (BFI): 0.215 | 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): 1.59 | Manning's n: 0.04 | Side slope (m/m): 0.965714 | Long slope (m/m): 0.019824

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.12	0.36	ug/l	Pass	Pass	Pass
Step 3	0.06	0.17	ug/l			

Sediment deposition for this site is judged as:

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

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	284069	Northing	824795	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N9		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.595 | Permeable area draining to outfall (ha): 0.154

Base Flow Index (BFI): 0.209 | 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): 18

Tier 2 — Bed width (m): 1.24 | Manning's n: 0.04 | Side slope (m/m): 1.8230769 | Long slope (m/m): 0.013652

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.14	0.41	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.06	0.19	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.22	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	283999	Northing	825014	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N10		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.707 | Permeable area draining to outfall (ha): 0.305

Base Flow Index (BFI): 0.207 | 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): 18

Tier 2 — Bed width (m): 1.45 | Manning's n: 0.04 | Side slope (m/m): 10 | Long slope (m/m): 0.014401

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.35	1.06	ug/l	Pass	Pass	Alert. D/S Structure.
Step 3	0.18	0.53	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.24	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	283725	Northing	825397	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N11		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Slochd Mhuic				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.003 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.576 | Permeable area draining to outfall (ha): 0.639

Base Flow Index (BFI): 0.205 | 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): 18

Tier 2 Bed width (m): 1.83 | Manning's n: 0.04 | Side slope (m/m): 0.4937313 | Long slope (m/m): 0.038734

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	Swales/Grassed Channels	50	Unlimited	80

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact Copper	Soluble - Acute Impact Zinc	Sediment - Chronic Impact
Step 2	0.09	0.27	ug/l	Pass	Pass	Pass
Step 3	0.04	0.11	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.04	Low flow Vel m/s
Extensive?	No	8	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	282723	Northing	826218	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N12		List of outfalls in cumulative assessment		
Receiving watercourse	Allt Cosach				
EA receiving water Detailed River Network ID			Assessor and affiliation	AMJV	
Date of assessment	03/07/2018		Version of assessment	4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.545 | Permeable area draining to outfall (ha): 0.397

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

Tier 2 Bed width (m): 1.83 | Manning's n: 0.04 | Side slope (m/m): 0.4937313 | Long slope (m/m): 0.038734

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 & Swales/Grassed Channels	59	Unlimited	76

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.15	0.47	ug/l	Pass	Pass	Alert. Protected Area & D/S Structure.
Step 3	0.07	0.22	ug/l			

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 D-S		HA Area / DBFO number		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting	288351	Northing	810631	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S4/S5	List of outfalls in cumulative assessment	S4		S5
Receiving watercourse	Allt-na-Criche (Lynwilg)				
EA receiving water Detailed River Network ID		Assessor and affiliation		AMJV	
Date of assessment	03/07/2018	Version of assessment		4	
Notes	S5 is downstream outfall location.				

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 (m^3/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 6.207 | Permeable area draining to outfall (ha): 5.967

Base Flow Index (BFI): 0.411 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

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

Tier 1 — Estimated river width (m): 1

Tier 2 — Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	1.02	3.11	ug/l	Pass	Pass	Fail. Try Tier 2 for Velocity
Step 3	0.48	1.46	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.02	Low flow Vel m/s
Extensive?	Yes	207	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting	289102	Northing	812069	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	S7/S7A	List of outfalls in cumulative assessment	S7		S7A
Receiving watercourse	Loch Pulladern				
EA receiving water Detailed River Network ID		Assessor and affiliation		AMJV	
Date of assessment	03/07/2018	Version of assessment		4	
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 4.196 | Permeable area draining to outfall (ha): 2.9

Base Flow Index (BFI): 0.252 | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

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

For 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

Tier 2 — Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.29	0.87	ug/l	Pass	Pass	Pass
Step 3	0.16	0.48	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	No	0.14	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A9 D-S		HA Area / DBFO number		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting	288290	Northing	824099	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N4/N5	List of outfalls in cumulative assessment	N4		N5
Receiving watercourse	Bogbain Burn				
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.017 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 6.552 | Permeable area draining to outfall (ha): 5.236

Base Flow Index (BFI): 0.282 | 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

Tier 2 Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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 & Dry/Detention Ponds	45	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.31	0.94	ug/l	Pass	Pass	Pass
Step 3	0.17	0.52	ug/l			

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 D-S		HA Area / DBFO number		
Assessment type	Cumulative assessment including sediments (outfalls within 100m)				
OS grid reference of assessment point (m)	Easting	284364	Northing	824103	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	N7/N8/N9/N10/N11	List of outfalls in cumulative assessment	N7		N8
Receiving watercourse	Allt Slochd Mhuic		N9	N10	N11
EA receiving water Detailed River Network ID		Assessor and affiliation	AMJV		
Date of assessment	03/07/2018	Version of assessment	4		
Notes					

Step 1 Runoff Quality AADT: >10,000 and <50,000 | Climatic region: Colder Wet | Rainfall site: Ardtalnaig (SAAR 1343.9mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.012 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 5.609 | Permeable area draining to outfall (ha): 5.59

Base Flow Index (BFI): 0.249 | 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

Tier 2 Bed width (m): 6.11 | Manning's n: 0.04 | Side slope (m/m): 0.9379993 | Long slope (m/m): 0.031568

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 & Dry/Detention Ponds	45	Unlimited	70

Predict Impact | Show Detailed Results | Exit Tool

A.2 Method D Accidental Spillage Assessment Datasheet

A9 Accidental Spillage Calculations																		
Formula																		
RL x SS x (AADT x 365 x 10^{-8}) x (%HGV /100)																		
Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24-2way	%HGV	p^{vpl}	p^{pol}	p^{inc}	Outfall Risk	Overall Prob.	Designated Area <1km	Annual Probability 1 in x	RANK	Annual Probability 1 in x		Cumulatives	
																	Overall Prob.	Annual Probability 1 in x
C1	0.02457	Rural	No Junction	0.29	10955.92	15.1	4.30251E-06	0.75	3.22688E-06	0.00000322688198071	0.000003227	No	309897	48	10369			
C1	0.18197	Rural	Slip Road	0.83	10955.81	15.1	9.11994E-05	0.75	6.83996E-05	0.00006839958307874	0.000068400	No	14620	33				
C1	0.13656	Rural	No Junction	0.29	13623.27	16.8	3.3083E-05	0.75	2.48123E-05	0.00002481225749913	0.000024812	No	40303	47				
C11	1.16545	Rural	No Junction	0.29	10965.56	15.1	0.000204264	0.75	0.000153198	0.00015319815492287	0.000153198	No	6527	14	6527			
C12	0.37308	Rural	No Junction	0.29	10966.11	15.1	6.53917E-05	0.75	4.90437E-05	0.00004904374651207	0.000049044	No	20390	40	3875			
C12	0.2049	Rural	Side Road	0.93	10966.24	15.1	0.000115173	0.75	8.63801E-05	0.00008638010516168	0.000086380	No	11577	26				
C12	0.22156	Rural	No Junction	0.29	10966.81	15.1	3.88364E-05	0.75	2.91273E-05	0.00002912733487549	0.000029127	No	34332	46				
C12	0.22176	Rural	Side Road	0.93	10967.62	15.1	0.000124666	0.75	9.34996E-05	0.00009349957385318	0.000093500	No	10695	24				
C13	0.50522	Rural	No Junction	0.29	10966.83	15.1	8.85583E-05	0.75	6.64188E-05	0.00006641875321632	0.000066419	No	15056	35	15056			
C14	1.77114	Rural	No Junction	0.29	10971.94	15.1	0.000310602	0.75	0.000232951	0.00023295143412708	0.000232951	No	4293	8	4293			
C15	0.59162	Rural	Slip Road	0.83	8500.86	13.3	0.000202641	0.75	0.000151981	0.00015198109603739	0.000151981	No	6580	15	475			
C15	0.28044	Rural	Roundabout	3.09	9815.53	12.5	0.000388074	1.75	0.00067913	0.00067913031789851	0.000679130	No	1472	1				
C15	0.10002	Rural	Roundabout	3.09	7819.98	8.3	7.32187E-05	2.75	0.000201351	0.00020135138563616	0.000201351	No	4966	10				
C15	0.10008	Rural	Roundabout	3.09	9815.53	12.5	0.000138491	3.75	0.000519342	0.00051934227501133	0.000519342	No	1926	2				
C15	0.18649	Rural	Side Road	0.93	7819.86	8.3	4.10874E-05	4.75	0.000195165	0.00019516504760660	0.000195165	No	5124	11				
C15	0.14897	Rural	Side Road	0.93	9814.81	12.5	6.20393E-05	5.75	0.000356726	0.00035672568879581	0.000356726	No	2803	5				
C2	0.36205	Rural	No Junction	0.29	10955.92	15.1	6.33994E-05	0.75	4.75496E-05	0.00004754955722894	0.000047550	No	21031	41	21031			
C3	0.60887	Rural	No Junction	0.29	10956.24	15.1	0.000106624	0.75	7.99678E-05	0.00007996780699906	0.000079968	No	12505	28	12505			
C5B	0.433331	Rural	No Junction	0.29	10956.95	15.1	7.58887E-05	0.75	5.69165E-05	0.00005691654272897	0.000056917	No	17570	38	17570		0.000895539	1116.65
C7	0.62822	Rural	No Junction	0.29	10959.77	15.1	0.000110048	0.75	8.25358E-05	0.00008253578224327	0.000082536	No	12116	27	12116			
C8	0.53669	Rural	No Junction	0.29	10961.21	15.1	9.40264E-05	0.75	7.05198E-05	0.00007051980042601	0.000070520	No	14180	32	14180			
C9A	0.84707	Rural	No Junction	0.29	10962.05	15	0.000147432	0.75	0.000110574	0.00011057436764516	0.000110574	No	9044	20	9044			
N1	0.80757	Rural	No Junction	0.29	10973.83	15.1	0.000141647	0.75	0.000106235	0.00010623496479524	0.000106235	Yes	9413	21	9413			
N10	0.34902	Rural	No Junction	0.29	17261.63	11.4	7.26989E-05	0.75	5.45242E-05	0.00005452417394300	0.000054524	No	18340	39	18340			
N11	0.80257	Rural	No Junction	0.29	17262.85	11.4	0.000167183	0.75	0.000125387	0.00012538696655969	0.000125387	No	7975	19	7975			
N12	0.29373	Rural	No Junction	0.29	17264.49	11.4	6.11924E-05	0.75	4.58943E-05	0.00004589433020395	0.000045894	No	21789	43	21789			
N2	1.35522	Rural	No Junction	0.29	10978.13	15.05	0.000237009	0.75	0.000177757	0.00017775703483573	0.000177757	Yes	5626	12	5626			
N4	0.93835	Rural	Slip Road	0.83	17249.15	11.4	0.000558996	0.75	0.000419247	0.00041924667674603	0.000419247	No	2385	4	2147			
N4	0.04461	Rural	Slip Road	0.83	17249.15	11.4	2.65752E-05	1.75	4.65065E-05	0.00004650651311610	0.000046507	No	21502	42				
N5	2.75156	Rural	No Junction	0.29	17259	11.4	0.000573047	0.75	0.000429785	0.00042978533566746	0.000429785	No	2327	3	2327			
N7	0.57125	Rural	No Junction	0.29	17259.4	11.4	0.000118973	0.75	8.92296E-05	0.00008922958726314	0.000089230	No	11207	25	11207			
N8	0.23572	Rural	No Junction	0.29	17259.76	11.4	4.90938E-05	0.75	3.68204E-05	0.00003682037115852	0.000036820	No	27159	45	4737			
N8	0.4712	Rural	No Junction	0.29	17260.24	11.4	9.81404E-05	0.75	7.36053E-05	0.00007360530032579	0.000073605	No	13586	31			0.000521467	1917.67
N8	0.20101	Rural	Side Road	0.93	17259.76	11.4	0.000134256	0.75	0.000100692	0.00010069185547602	0.000100692	No	9931	23				
N9	0.2638	Rural	No Junction	0.29	17260.59	11.4	5.49447E-05	0.75	4.12086E-05	0.00004120855679524	0.000041209	No	24267	44	24267			
S1	0.40233	Rural	No Junction	0.29	15160.96	15.6	0.000100722	0.75	7.55415E-05	0.00007554154158080	0.000075542	Yes	13238	30	13238			
S10	1.01018	Rural	Side Road	0.93	3314.26	6.7	7.6144E-05	0.75	5.7108E-05	0.00005710803543781	0.000057108	No	17511	37	17511			
S2	0.94393	Rural	No Junction	0.29	15160.91	15.6	0.000236309	0.75	0.000177232	0.00017723185489870	0.000177232	Yes	5642	13	5642			
S3	0.4192	Rural	No Junction	0.29	15158.25	15.6	0.000104927	0.75	7.8695E-05	0.00007869498619788	0.000078695	Yes	12707	29	12707			
S4	0.01681	Rural	Side Road	0.93	1199.85	8.4	5.75108E-07	0.75	4.31331E-07	0.00000043133135704	0.000000431	Yes	2318403	49	1690			
S4	0.71139	Rural	No Junction	0.29	13628.47	16.8	0.000172407	0.75	0.000129305	0.00012930528206973	0.000129305	Yes	7734	17				
S4	0.68624	Rural	No Junction	0.29	15159.14	15.6	0.000171777	0.75	0.000128833	0.00012883305842861	0.000128833	Yes	7762	18			0.000809819	1234.84
S4	0.61979	Rural	Slip Road	0.83	15159.76	15.6	0.000444051	0.75	0.000333038	0.00033303793824858	0.000333038	Yes	3003	6				
S5	1.20053	Rural	No Junction	0.29	13628.33	16.8	0.000290948	0.75	0.000218211	0.00021821121412362	0.000218211	Yes	4583	9	4583			
S6	0.5555	Rural	No Junction	0.29	13627.97	16.8	0.000134622	0.75	0.000100966	0.00010096634607063	0.000100966	No	9904	22	9904			
S7	1.72426	Rural	No Junction	0.29	13626.95	16.8	0.000417832	0.75	0.000313374	0.00031337390055144	0.000313374	Yes	3191	7	3191		0.000380018	2631.45
S7A	0.36667	Rural	No Junction	0.29	13627.85	16.8	8.88593E-05	0.75	6.66445E-05	0.00006664447187283	0.000066644	Yes	15005	34	15005			
S8	0.71773	Rural	No Junction	0.29	13625.42	16.8	0.000173905	0.75	0.000130428	0.00013042847159182	0.000130428	No	7667	16	7667			
S9	0.34068	Rural	No Junction	0.29	13623.51	16.8	8.25346E-05	0.75	6.19009E-05	0.00006190091389349	0.000061901	No	16155	36	16155			