

# Appendix A10.3

## Road Drainage

### Water Quality Calculations

Transport Scotland

August 2016





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## Glossary and Abbreviations

| Terminology                                | Abbreviation | Description  |
|--|--------------|--|
| Accidental spillage                        | -            | An incident on the road network, such as a road traffic accident, which results in non-routine potential pollutants being spilled on the road, entering the road drainage network and being discharged to the receiving surface or groundwater body, potentially leading to an acute pollution event   |
| Annual average daily traffic               | AADT         | Daily volume of vehicle traffic, based on annual traffic volumes to incorporate variations across the year   |
| 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.  |
| Drainage network                           | -            | Specific road drainage catchments, including permeable (e.g. grassed verges and central reservations), and impermeable (e.g. surfaced carriageway) 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   |
| Groundwater Discharge                      |              | Drainage network that discharges via outfall to a groundwater body   |
| 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                             | -            | Rainfall which collects on the road surface and is transferred via the drainage network to an outfall. This may be contaminated with pollutants such as sediment and soluble metals, which collect on the road surface as part of normal use and operation of the road, resulting in chronic pollution of the receiving surface or groundwater body  |
| 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 effects on receiving water body, examples include filter drains, swales, retention/detention ponds, surface flow wetlands and infiltration basins  |

## 1. Introduction

1.1.1. This report provides a technical appendix to the A9 Dualling Dalraddy to Slochd – DMRB Stage 2 Scheme Assessment Report, Chapter 9: Geology, Soils and Groundwater and Chapter 10: Road Drainage and the Water Environment.

### 1.2. Aims and Objectives

1.2.1. This document provides the calculations and results of water quality assessments for the operational phase of the Proposed Scheme, discussed in both Chapter 9 and Chapter 10.

1.2.2. This document provides an assessment of:

- Pollution during road operation due to contaminants within routine road runoff. A broad range of potential pollutants, such as hydrocarbons i.e. fuel and lubricants, fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road surface during rainfall events, polluting the receiving surface water bodies and groundwater aquifers.
- Pollution during road operation due to accidental spillage. On all roads there is a risk that accidents or vehicle fires may lead to an acute pollution incident. Where commercial vehicles are involved, potential pollutants that may be spilled could range from hazardous chemicals to milk, alcoholic beverages, organic sludge and detergents. Spilled materials may drain from the road surface, polluting the receiving surface water bodies and groundwater aquifers.

## 2. Assessment Approach and Methodology

2.1.1. Preliminary drainage network data is detailed in Chapter 5: Engineering Assessment.

2.1.2. For the mainline a single drainage design was provided, common to all Proposed Mainline Alignment Options. The outfall locations for the networks are common to all the Mainline Alignment Options. The road drainage network area draining to several of these outfalls varies between the options, however the differences are small and have no material effect on the assessment results, which are identical across all three Mainline Alignment Options.

2.1.3. For the junctions, as with the mainline, a single drainage design has been provided for each junction location. At each junction the location of outfalls are common to all the Proposed Junction Options, there are however significant differences in the complexity of junction layouts and the drainage network areas draining to each outfall. To overcome this the junction option deemed to have the greatest complexity and drainage area has been selected for drainage design and water quality assessment. In the case of the Aviemore South junction this is Junction Option A18, for the Granish junction Junction Option C34 has been assessed, and for the Black Mount junction Junction Option D51 has been assessed. This follows a precautionary principal and allows for a conservative assessment in that the other junction options, which are of a lower drainage area or less complex layout, can be assumed to perform better in relation to potential water quality impacts.

2.1.4. The drainage design for each mainline and junction network includes at least two levels of treatment, in the form of sustainable drainage systems (SuDS), as standard. A third

stage of treatment has been provided where preliminary water quality assessments indicated a requirement. The treatment stages typically consist of filter drains and wet/retention or dry/detention ponds, with swales proposed as a third level of treatment where required.

- 2.1.5. The water quality assessments within this report have taken this treatment into account as the proposed SuDS are an intrinsic part of the proposed road design, and are not considered to be additional mitigation.
- 2.1.6. No design work has been carried out to date on side roads or accommodation tracks, and therefore these are not assessed at DMRB Stage 2.

## 2.2. Groundwater Assessments

- 2.2.1. Chapter 9 summarises the procedures for the assessment of pollution impacts from routine runoff on groundwater, known as Method C, as provided in The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10, HD 45/09 – Road Drainage and the Water Environment.
- 2.2.2. The Method C assessments considers the drainage discharge scale, potential inherent pathways and the vulnerability of the receiving aquifer. The method applies various factors of scale, (low medium or high) to site specific conditions, resulting in an overall score and category of risk. Details of the parameters for which each groundwater discharge is assessed against are outlined in Chapter 9: Geology, Soils and Groundwater.
- 2.2.3. Six mainline drainage networks and a single junction network at Black Mount are intended to discharge to groundwater and have been assessed against Method C.

## 2.3. Surface Water Assessments

- 2.3.1. Chapter 10 summarises the procedures for the assessment of pollution impacts from routine runoff on surface water, known as Method A, as provided in The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10, HD 45/09 – Road Drainage and the Water Environment.
- 2.3.2. The Method A assessments can be split into two categories; Tier 1 and Tier 2. Tier 1 can be defined as a simple assessment in which an estimated or known river width is used to estimate sediment impacts upon the receiving watercourse. Tier 2 is a more detailed assessment which requires detailed survey data for the receiving watercourse. Assessments at DMRB Stage 2 have been conducted as Tier 1 simple assessments, with Tier 2 assessment to be conducted, where applicable, at Stage 3 as more design and watercourse data becomes available.
- 2.3.3. A total of 32 individual drainage discharges, associated with both the mainline and junctions, are intended to discharge to surface water and have been assessed against Method A.

## 2.4. Accidental Spillage Assessment

- 2.4.1. DMRB document HD 45/09 also specifies procedures for the assessment of pollution impacts on both surface and ground waters from accidental spillage, known as Method D. A summary of this methodology is provided in Chapter 10: Road Drainage and the Water Environment.

- 2.4.2. A total of 39 drainage discharges have been assessed against Method D and include both surface water and groundwater discharges.

## 2.5. Cumulative Assessment

- 2.5.1. Cumulative assessment of proposed road discharges in close proximity to each other has not been undertaken at DMRB Stage 2. All drainage networks and treatment measures shall be refined and re-assessed following the selection of the Preferred Route and additional data collation, with the final design reported at DMRB Stage 3. This will include cumulative assessments of outfalls as outlined in DMRB document HD 45/09.

## 3. Results

- 3.1.1. The Proposed Scheme options involve a total of 39 preliminary drainage networks of which 32 are intended to discharge to surface water and seven to discharge to groundwater.
- 3.1.2. Sensitive receptors have been identified as part of the Stage 2 assessment. Of the proposed surface water discharges 11 either discharge directly into or are within 1km upstream of a sensitive receptor. In context for this assessment, sensitive receptors are considered as internationally or nationally designated sites specifically protected and recognised for hydrological or ecological purposes (e.g. Special Areas of Conservation (SACs) or Sites of Special Scientific Interest (SSSIs)).
- 3.1.3. The results for each individual drainage network are summarised in Table 3.1.
- 3.1.4. Highways Agency Water Risk Assessment Tool (HAWRAT) datasheets are provided in Annex A of this report, which includes details on the baseline conditions of the receiving watercourse, proposed mitigation and summary results. Annex A also contains accidental spillage parameters and results for all drainage networks within the Proposed Scheme.

**Table 3.1 Summary of Individual HAWRAT, EQS and Accidental Spillage Results for Drainage Networks**

| Drainage Network ID | Mitigation                         | Receiving Waterbody             | HAWRAT Acute Impact Assessment |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|---------------------|------------------------------------|---------------------------------|--------------------------------|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                     |                                    |                                 | Soluble Copper                 | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             | Pass / Fail         | Return Period 1 in "x" (years) |
|                     |                                    |                                 |                                |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail |                     |                                |
| 1 B                 | Filter Drains & Wet/Retention Pond | Allt na Fhearna                 | Pass                           | Pass         | Pass                             | 0.04                            | 2                | 0.01         | Pass                          | 0.01         | Pass        | Pass                | 11405                          |
| 1 C                 | Filter Drains & Wet/Retention Pond | Allt Chrioichaidh               | Pass                           | Pass         | Pass                             | 0.01                            | 19               | 0.08         | Pass                          | 0.15         | Pass        | Pass                | 8930                           |
| 1 E                 | Filter Drains & Wet/Retention Pond | Caochan Ruadh                   | Pass                           | Pass         | Pass                             | 0.08                            | 6                | 0.08         | Pass                          | 0.25         | Pass        | Pass                | 16308                          |
| 1 F                 | Filter Drains & Wet/Retention Pond | Unnamed Tributary of Loch Alvie | Pass                           | Pass         | Pass                             | 0.01                            | 11               | 0.08         | Pass                          | 0.16         | Pass        | Pass                | 27943                          |

| Drainage Network ID               | Mitigation  | Receiving Waterbody      | HAWRAT Acute Impact Assessment                                     |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|-----------------------------------|---|--------------------------|--|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                                   |   |                          | Soluble Copper   | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                                   |   |                          |  |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 2 A (Mainline & Junction Opt A18) | Filter Drains & Wet/Retention on Pond & Grass Surface Channels / Swales | Allt na Criche (Lynwilg) | Pass   | Pass         | Pass                             | 0.02                            | 5                | 0.04         | Pass                          | 0.08         | Pass        | Pass                | 608                            |
| 3A B1                             | Filter Drains & Wet/Retention on Pond                                   | Allt na Criche (Lynwilg) | Pass   | Pass         | Pass                             | 0.02                            | 14               | 0.04         | Pass                          | 0.09         | Pass        | Pass                | 6512                           |
| 3A C                              | Filter Drains & Infiltration Basin                                      | Groundwater              | <b>Method C Calculation of Medium Risk (Groundwater Discharge)</b> |              |                                  |                                 |                  |              |                               |              |             | Pass                | 11775                          |
| 3B B                              | Filter Drains & Wet/Retention on Pond & Grass Surface Channels / Swales | Loch Puladdern           | Pass   | Pass         | Pass                             | 0.03                            | 40               | 0.55         | Pass                          | 1.09         | Pass        | Pass                | 3442                           |

| Drainage Network ID | Mitigation                         | Receiving Waterbody                        | HAWRAT Acute Impact Assessment                                     |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|---------------------|------------------------------------|--|--|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                     |                                    |  | Soluble Copper   | Soluble Zinc | Sediment                         | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                     |                                    |  |  |              |                                  | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 4 A                 | Filter Drains & Wet/Retention Pond | Aviemore Burn                              | Pass   | Pass         | Pass                             | 0.04                            | 10               | 0.05         | Pass                          | 0.11         | Pass        | Pass                | 7047                           |
| 5 A                 | Filter Drains & Wet/Retention Pond | Unnamed Drain/Watercourse                  | Pass   | Pass         | Pass                             | 0.03                            | 38               | 0.35         | Pass                          | 0.69         | Pass        | Pass                | 19218                          |
| 5 B                 | Filter Drains & Dry/Detention Pond | Allt na Criche (Granish) North Bifurcation | Pass   | Pass         | Pass                             | 0.06                            | 19               | 0.6          | Pass                          | 1.01         | Pass        | Pass                | 19460                          |
| 5 C                 | Filter Drains & Infiltration Basin | Groundwater                                | <b>Method C Calculation of Medium Risk (Groundwater Discharge)</b> |              |                                  |                                 |                  |              |                               |              |             | Pass                | 10789                          |
| 5 D                 | Filter Drains & Wet/Retention Pond | Allt na Criche                             | Pass   | Pass         | Pass                             | 0.02                            | 12               | 0.07         | Pass                          | 0.13         | Pass        | Pass                | 14977                          |



| Drainage Network ID      | Mitigation                         | Receiving Waterbody              | HAWRAT Acute Impact Assessment                                     |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|--------------------------|------------------------------------|----------------------------------|--|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                          |                                    |                                  | Soluble Copper   | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                          |                                    |                                  |  |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 5 E                      | Filter Drains & Wet/Retention Pond | Unnamed Drain/Watercourse        | Pass   | Pass         | Pass                             | 0.03                            | 18               | 0.21         | Pass                          | 0.4          | Pass        | Pass                | 33564                          |
| 5 F                      | Filter Drains & Wet/Retention Pond | Unnamed Drain/Watercourse        | Pass   | Pass         | Pass                             | 0.03                            | 48               | 0.44         | Pass                          | 0.85         | Pass        | Pass                | 14668                          |
| 5 G                      | Filter Drains & Wet/Retention Pond | Unnamed tributary of Avie Lochan | Pass   | Pass         | Pass                             | 0.03                            | 26               | 0.27         | Pass                          | 0.52         | Pass        | Pass                | 102444                         |
| Granish Junction Opt C34 | Filter Drains & Wet/Retention Pond | Allt na Criche (Granish)         | Pass   | Pass         | Pass                             | 0.02                            | 23               | 0.12         | Pass                          | 0.23         | Pass        | Pass                | 616                            |
| 6A A                     | Filter Drains & Infiltration Basin | Groundwater                      | <b>Method C Calculation of Medium Risk (Groundwater Discharge)</b> |              |                                  |                                 |                  |              |                               |              |             | Pass                | 17722                          |



| Drainage Network ID | Mitigation                          | Receiving Waterbody | HAWRAT Acute Impact Assessment                              |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|---------------------|-------------------------------------|---------------------|---|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                     |                                     |                     | Soluble Copper  | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             | Pass / Fail         | Return Period 1 in "x" (years) |
|                     |                                     |                     |   |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail |                     |                                |
| 6A C                | Filter Drains & Infiltration Basin  | Groundwater         | Method C Calculation of Medium Risk (Groundwater Discharge) |              |                                  |                                 |                  |              |                               |              |             | Pass                | 17023                          |
| 6A E                | Filter Drains & Infiltration Basin  | Groundwater         | Method C Calculation of Medium Risk (Groundwater Discharge) |              |                                  |                                 |                  |              |                               |              |             | Pass                | 74135                          |
| 6B A                | Filter Drains & Infiltration Basin  | Groundwater         | Method C Calculation of Medium Risk (Groundwater Discharge) |              |                                  |                                 |                  |              |                               |              |             | Pass                | 14104                          |
| 6B B                | Filter Drains & Wet/Retenti on Pond | Allt Cnapach        | Pass  | Pass         | Pass                             | 0.02                            | 48               | 0.27         | Pass                          | 0.52         | Pass        | Pass                | 5478                           |
| 7 A                 | Filter Drains & Wet/Retenti on Pond | Feith Mhor          | Pass  | Pass         | Pass                             | 0.03                            | 46               | 0.23         | Pass                          | 0.45         | Pass        | Pass                | 6017                           |

| Drainage Network ID | Mitigation                         | Receiving Waterbody       | HAWRAT Acute Impact Assessment |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|---------------------|------------------------------------|---------------------------|--------------------------------|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                     |                                    |                           | Soluble Copper                 | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                     |                                    |                           |                                |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 7 B                 | Filter Drains & Wet/Retention Pond | Tributary of Feith Mhor   | Pass                           | Pass         | Pass                             | 0.05                            | 75               | 0.75         | Pass                          | 1.45         | Pass        | Pass                | 3014                           |
| 8 A                 | Filter Drains & Dry/Detention Pond | River Dulnain             | Pass                           | Pass         | Pass                             | 0.06                            | 1                | 0            | Pass                          | Pass         | 0           | Pass                | 10326                          |
| 8 C                 | Filter Drains & Dry/Detention Pond | Allt nan Ceatharnach      | Pass                           | Pass         | Pass                             | 0.03                            | 3                | 0.01         | Pass                          | 0.02         | Pass        | Pass                | 27125                          |
| 8 D                 | Filter Drains & Dry/Detention Pond | Allt nan Ceatharnach      | Pass                           | Pass         | Pass                             | 0.03                            | 11               | 0.04         | Pass                          | 0.08         | Pass        | Pass                | 7429                           |
| 9 A                 | Filter Drains & Wet/Retention Pond | Unnamed Drain/Watercourse | Pass                           | Pass         | Pass                             | 0.03                            | 64               | 0.56         | Pass                          | 1.08         | Pass        | Pass                | 8785                           |

| Drainage Network ID                 | Mitigation  | Receiving Waterbody         | HAWRAT Acute Impact Assessment                                     |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|-------------------------------------|---|-----------------------------|--|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                                     |   |                             | Soluble Copper   | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                                     |   |                             |  |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 9 B (Black Mount Junction Opt D54)  | Filter Drains & Wet/Retenti on Pond & Grass Surface Channels / Swales | Unnamed Drain/Water course  | Pass   | Pass         | Pass                             | 0.03                            | 41               | 0.59         | Pass                          | 1.16         | Pass        | Pass                | 749                            |
| 9 B2 (Black Mount Junction Opt D54) | Filter Drains & Infiltration Basin                                    | Groundwater                 | <b>Method C Calculation of Medium Risk (Groundwater Discharge)</b> |              |                                  |                                 |                  |              |                               |              |             | Pass                | 42409                          |
| 9 B3 (Black Mount Junction Opt D54) | Filter Drains & Wet/Retenti on Pond                                   | Bogbain Burn                | Pass   | Pass         | Pass                             | 0.05                            | 4                | 0.03         | Pass                          | 0.06         | Pass        | Pass                | 3295                           |
| 9 D                                 | Filter Drains & Wet/Retenti on Pond                                   | Unnamed Drain/ Water course | Pass   | Pass         | Pass                             | 0.06                            | 54               | 0.79         | Pass                          | 1.52         | Pass        | Pass                | 6601                           |

| Drainage Network ID | Mitigation   | Receiving Waterbody       | HAWRAT Acute Impact Assessment |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|---------------------|--|---------------------------|--------------------------------|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                     |  |                           | Soluble Copper                 | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                     |  |                           |                                |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 10 A                | Filter Drains & Dry/Detention Pond                                   | Bogbain Burn              | Pass                           | Pass         | Pass                             | 0.03                            | 28               | 0.43         | Pass                          | 0.71         | Pass        | Pass                | 95101                          |
| 10 B                | Filter Drains & Wet/Retention Pond                                   | Allt Slochd Mhuic         | Pass                           | Pass         | Pass                             | 0.05                            | 27               | 0.2          | Pass                          | 0.39         | Pass        | Pass                | 12384                          |
| 10 C                | Filter Drains & Wet/Retention Pond                                   | Allt Slochd Mhuic         | Pass                           | Pass         | Pass                             | 0.03                            | 16               | 0.22         | Pass                          | 0.42         | Pass        | Pass                | 7105                           |
| 11 C                | Filter Drains & Wet/Retention Pond & Grass Surface Channels / Swales | Allt Slochd Mhuic         | Pass                           | Pass         | Pass                             | 0.02                            | 7                | 0.11         | Pass                          | 0.22         | Pass        | Pass                | 25017                          |
| 11D                 | Filter Drains & Wet/Retention Pond                                   | Unnamed Drain/Watercourse | Pass                           | Pass         | Pass                             | 0.03                            | 11               | 0.27         | Pass                          | 0.52         | Pass        | Pass                | 8780                           |



| Drainage Network ID | Mitigation                         | Receiving Waterbody | HAWRAT Acute Impact Assessment |              | HAWRAT Chronic Impact Assessment | EQS Assessment                  |                  |              |                               |              |             | Accidental Spillage |                                |
|---------------------|------------------------------------|---------------------|--------------------------------|--------------|----------------------------------|---------------------------------|------------------|--------------|-------------------------------|--------------|-------------|---------------------|--------------------------------|
|                     |                                    |                     | Soluble Copper                 | Soluble Zinc |                                  | Annual Average Dissolved Copper |                  |              | Annual Average Dissolved Zinc |              |             |                     |                                |
|                     |                                    |                     |                                |              | Sediment                         | Low Flow Vel. (m/s)             | Deposition Index | Value (µg/l) | Pass / Fail                   | Value (µg/l) | Pass / Fail | Pass / Fail         | Return Period 1 in "x" (years) |
| 11 J                | Filter Drains & Dry/Detention Pond | Allt Sloch Mhuic    | Pass                           | Pass         | Pass                             | 0.02                            | 37               | 0.39         | Pass                          | 0.65         | Pass        | Pass                | 15703                          |
| 11 K                | Filter Drains & Wet/Retention Pond | Allt Cosach         | Pass                           | Pass         | Pass                             | 0.01                            | 50               | 0.42         | Pass                          | 0.80         | Pass        | Pass                | 11309                          |

## 4. Conclusion

- 4.1.1. There are a total of 39 preliminary road drainage network options. After applying the planned mitigation, all 32 networks discharging to surface waters meet acceptable HAWRAT and EQS standards for routine runoff impacts. All seven drainage networks which discharge to groundwater are considered to be of a medium risk and therefore deemed acceptable for routine runoff impacts.
- 4.1.2. Accidental spillage calculations and assessments were conducted for each mainline and junction drainage network. All networks pass the higher standard of at least a 1 in 200 year return period (to be applied where sensitive receptors are identified within 1km downstream). The minimum return period has been calculated as 1 in 608 years return period.
- 4.1.3. All drainage networks and treatment measures shall be refined and assessed following the selection of the Preferred Route and additional data collation during DMRB Stage 3. DMRB Stage 3 Assessments will also involve cumulative assessment of confirmed discharge outfall locations. Stage 3 will also include individual assessments of specific side roads and accommodation tracks against guidance detailed within CIRIA's The SuDS Manual<sup>ii</sup>.



# Annex A. Calculations

## A.1. HAWRAT Datasheets

**HIGHWAYS AGENCY** Highways Agency Water Risk Assessment Tool version 1.0 November 2009

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

**Location Details**

|  |  |   |                          |         |
|--|--|---|--------------------------|---------|
| Road number                                    | A9   |   | HA Area / DBFO number    |         |
| Assessment type                                | Non-cumulative assessment (single outfall) |   |                          |         |
| OS grid reference of assessment point (m)      | Easting                                    | 285672                                    | Northing                 | 809351  |
| OS grid reference of outfall structure (m)     | Easting                                    | 285672                                    | Northing                 | 809351  |
| Outfall number                                 | DS1B                                       | List of outfalls in cumulative assessment |                          |         |
| Receiving watercourse                          | Allt an Fheama                             |   |                          |         |
| E.A. receiving water Detailed River Network ID |  |   | Assessor and affiliation | LN AMJV |
| Date of assessment                             | 16/05/2016                                 | Version of assessment                     |                          | 1       |
| Notes  |  |   |                          |         |

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

**Step 2 River Impacts** Annual 95%ile river flow (m<sup>3</sup>/s) 0.1 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impervious road area drained (ha) 1.147 Permeable area draining to outfall (ha) 0  
 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 CaCO<sub>3</sub>/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) 8.5  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** Highways Agency Water Risk Assessment Tool version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |      | Zinc   |      | Sediment - Chronic Impact |   |
|------------------------------|--------|------------------------|------|--------|------|---------------------------|---|
| Step 2                       | Step 3 | Copper                 | Zinc | Copper | Zinc | Alert, Protected Area     | Sediment deposition for this site is judged as: |
| 0.13                         | 0.38   | Pass                   | Pass | Pass   | Pass | Alert, Protected Area     | Accumulating? Yes 0.01<br>Extensive? No 19      |
| 0.05                         | 0.15   |                        |      |        |      |                           | Low flow Vel m/s<br>Deposition Index            |

**Location Details**

|  |  |   |                          |         |
|--|--|---|--------------------------|---------|
| Road number                                    | A9   |   | HA Area / DBFO number    |         |
| Assessment type                                | Non-cumulative assessment (single outfall) |   |                          |         |
| OS grid reference of assessment point (m)      | Easting                                    | 285804                                    | Northing                 | 809524  |
| OS grid reference of outfall structure (m)     | Easting                                    | 285804                                    | Northing                 | 809524  |
| Outfall number                                 | DS1C                                       | List of outfalls in cumulative assessment |                          |         |
| Receiving watercourse                          | Allt Chrìochaidh                           |   |                          |         |
| E.A. receiving water Detailed River Network ID |  |   | Assessor and affiliation | LN AMJV |
| Date of assessment                             | 16/05/2016                                 | Version of assessment                     |                          | 1       |
| Notes  |  |   |                          |         |

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

**Step 2 River Impacts** Annual 95%ile river flow (m<sup>3</sup>/s) 0.017 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impervious road area drained (ha) 2.302 Permeable area draining to outfall (ha) 0  
 Base Flow Index (BFI) 0.45 Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

For dissolved zinc only Water hardness Low = <50mg CaCO<sub>3</sub>/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) 4  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**



**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |   |
|------------------------------|--------|------------------------|--------|------|---|---|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |   |
| Step 2                       | 0.13   | 0.41                   | Pass   | Pass | Alert, Protected Area & D/S Structure.          | Accumulating? Yes 0.08 Low flow Vel m/s |
| Step 3                       | 0.05   | 0.16                   |        |      |   | Extensive? No 6 Deposition Index        |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 286678 Northing 809973  
 OS grid reference of outfall structure (m): Easting 286678 Northing 809973  
 Outfall number: DS1E List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Caochan Ruadh  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 16/05/2016 Version of assessment: 1  
 Notes: \_\_\_\_\_

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

**Step 2 River Impacts** Annual 95%ile river flow (m³/s): 0.009 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 1.28 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.52 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): 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 (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 82                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |   |
|------------------------------|--------|------------------------|--------|------|---|---|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |   |
| Step 2                       | 0.13   | 0.42                   | Pass   | Pass | Alert, Protected Area & D/S Structure.          | Accumulating? Yes 0.01 Low flow Vel m/s |
| Step 3                       | 0.05   | 0.16                   |        |      |   | Extensive? No 11 Deposition Index       |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 286876 Northing 810115  
 OS grid reference of outfall structure (m): Easting 286876 Northing 810115  
 Outfall number: DS1F List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Unnamed Tributary of Loch Alvie  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 16/05/2016 Version of assessment: 1  
 Notes: \_\_\_\_\_

**Step 1 Runoff Quality** AADT: >10,000 and <50,000 Climatic region: Colder Wet Rainfall site: Ardtnaig (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): 0.553 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.66 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): 2  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 82                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**



**HIGHWAYS AGENCY** Highways Agency Water Risk Assessment Tool version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |      | Zinc   |      | Sediment - Chronic Impact             |                  |                  |
|------------------------------|--------|------------------------|------|--------|------|---------------------------------------|------------------|------------------|
| Step 2                       | Step 3 | Copper                 | Zinc | Copper | Zinc | Alert, Protected Area & D/S Structure | Accumulating?    | Extensive?       |
| 0.14                         | 0.03   | 0.44                   | 0.08 | Pass   | Pass | Alert, Protected Area & D/S Structure | Yes 0.02         | No 5             |
| 0.03                         | 0.03   | 0.08                   | 0.08 |        |      |                                       | Low flow Vel m/s | Deposition Index |

**Location Details**

Road number: A9 HA Area / DBFO number: [ ]

Assessment type: Cumulative assessment including sediments (outfalls within 100m)

OS grid reference of assessment point (m): Easting 288345 Northing 810627

OS grid reference of outfall structure (m): Easting 288345 Northing 810627

Outfall number: DS 2A (A18 Junction) List of outfalls in cumulative assessment: [ ]

Receiving watercourse: Allt na Criche (Lynwilo)

EA receiving water Detailed River Network ID: [ ] Assessor and affiliation: LN AMJV

Date of assessment: 27/07/2016 Version of assessment: 2

Notes: [ ]

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

**Step 2 River Impacts** Annual 95%ile river flow (m<sup>3</sup>/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 5.708 Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.41 Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 4.5

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 (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds & Swales (Cu 70%, Zn 81%, Sed 97%) | 81                         | Unlimited  | 97                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

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| Annual Average Concentration |        | Soluble - Acute Impact |      | Zinc   |      | Sediment - Chronic Impact             |                  |                  |
|------------------------------|--------|------------------------|------|--------|------|---------------------------------------|------------------|------------------|
| Step 2                       | Step 3 | Copper                 | Zinc | Copper | Zinc | Alert, Protected Area & D/S Structure | Accumulating?    | Extensive?       |
| 0.07                         | 0.03   | 0.23                   | 0.09 | Pass   | Pass | Alert, Protected Area & D/S Structure | Yes 0.02         | No 14            |
| 0.03                         | 0.03   | 0.09                   | 0.09 |        |      |                                       | Low flow Vel m/s | Deposition Index |

**Location Details**

Road number: A9 HA Area / DBFO number: [ ]

Assessment type: Non-cumulative assessment (single outfall)

OS grid reference of assessment point (m): Easting 288360 Northing 810624

OS grid reference of outfall structure (m): Easting 288360 Northing 810624

Outfall number: DS 3A B1 List of outfalls in cumulative assessment: [ ]

Receiving watercourse: Allt na Criche (Lynwilo)

EA receiving water Detailed River Network ID: [ ] Assessor and affiliation: LN AMJV

Date of assessment: 22/06/2016 Version of assessment: 2

Notes: [ ]

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

**Step 2 River Impacts** Annual 95%ile river flow (m<sup>3</sup>/s): 0.035 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.774 Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.41 Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 4.5

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 (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**



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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |               |          |                  |
|------------------------------|--------|------------------------|--------|------|---|---------------|----------|------------------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |               |          |                  |
| Step 2                       | 1.84   | 5.74                   | Pass   | Pass | Alert, Protected Area & D/S Structure.          | Accumulating? | Yes 0.03 | Low flow Vel m/s |
| Step 3                       | 0.35   | 1.09                   |        |      |   | Extensive?    | No 40    | Deposition Index |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_

Assessment type: Non-cumulative assessment (single outfall)

OS grid reference of assessment point (m): Easting 289112 Northing 812105

OS grid reference of outfall structure (m): Easting 289112 Northing 812105

Outfall number: DS 3B B List of outfalls in cumulative assessment: \_\_\_\_\_

Receiving watercourse: Loch Puladdern

EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV

Date of assessment: 17/06/2016 Version of assessment: 1

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

Impermeable road area drained (ha): 4.253 Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.699 Is the discharge in or within 1 km upstream of a protected site for conservation? Yes

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.5 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001

Tier 2 Bed width (m): 3

**Step 3 Mitigation**

| Brief description   | Estimated effectiveness    |                             |
|---|----------------------------|-----------------------------|
|   | Treatment for solubles (%) | Settlement of sediments (%) |
| Existing measures   | 0                          | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds & Swales (Cu 70%, Zn 81%, Sed 97%) | 81                         | 97                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |               |          |                  |
|------------------------------|--------|------------------------|--------|------|---|---------------|----------|------------------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |               |          |                  |
| Step 2                       | 0.09   | 0.28                   | Pass   | Pass | Alert, D/S Structure.                           | Accumulating? | Yes 0.04 | Low flow Vel m/s |
| Step 3                       | 0.03   | 0.11                   |        |      |   | Extensive?    | No 10    | Deposition Index |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_

Assessment type: Non-cumulative assessment (single outfall)

OS grid reference of assessment point (m): Easting 289376 Northing 813856

OS grid reference of outfall structure (m): Easting 289376 Northing 813856

Outfall number: DS4A List of outfalls in cumulative assessment: \_\_\_\_\_

Receiving watercourse: Aviemore Burn

EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV

Date of assessment: 16/06/2016 Version of assessment: 1

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<sup>3</sup>/s): 0.023 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.404 Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.33 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 2.5 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001

Tier 2 Bed width (m): 3

**Step 3 Mitigation**

| Brief description  | Estimated effectiveness    |                             |
|--|----------------------------|-----------------------------|
|  | Treatment for solubles (%) | Settlement of sediments (%) |
| Existing measures  | 0                          | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62                         | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**





**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.58   | 1.80                   | Pass   | Pass | Accumulating?                                   | Yes | 0.03 |
| Step 3                       | 0.22   | 0.69                   |        |      | Extensive?                                      | No  | 38   |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 289698 Northing 814684  
 OS grid reference of outfall structure (m): Easting 289698 Northing 814684  
 Outfall number: DS5A List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Unnamed Watercourse  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 0.763 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.699 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.5 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001  
 Tier 2 Bed width (m): 3

**Step 3 Mitigation**

| Brief description  | Estimated effectiveness    |  |                             |
|--|----------------------------|--|-----------------------------|
|  | Treatment for solubles (%) | Attenuation for solubles - restricted discharge rate (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.60   | 1.84                   | Pass   | Pass | Accumulating?                                   | Yes | 0.06 |
| Step 3                       | 0.33   | 1.01                   |        |      | Extensive?                                      | No  | 19   |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 289863 Northing 815012  
 OS grid reference of outfall structure (m): Easting 289863 Northing 815012  
 Outfall number: DS5B List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: All na Criche (North Bifucation)  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 0.763 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.699 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.3 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001  
 Tier 2 Bed width (m): 3

**Step 3 Mitigation**

| Brief description   | Estimated effectiveness    |  |                             |
|---|----------------------------|--|-----------------------------|
|   | Treatment for solubles (%) | Attenuation for solubles - restricted discharge rate (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Dry/Detention Ponds (Cu 0%, Zn 45%, Sed 80%) | 45                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**





**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.11   | 0.33                   | Pass   | Pass | Accumulating?                                   | Yes | 0.02 |
| Step 3                       | 0.04   | 0.13                   | Pass   | Pass | Extensive?                                      | No  | 12   |

**Location Details**

Road number: A9 HA Area / DBFO number: [ ]  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 290143 Northing 815663  
 OS grid reference of outfall structure (m): Easting 290143 Northing 815663  
 Outfall number: DS5D List of outfalls in cumulative assessment: [ ]  
 Receiving watercourse: All na Crìche (Granish)  
 EA receiving water Detailed River Network ID: [ ] Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 1.015 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.349 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): 2  
 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 (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.34   | 1.05                   | Pass   | Pass | Accumulating?                                   | Yes | 0.03 |
| Step 3                       | 0.13   | 0.40                   | Pass   | Pass | Extensive?                                      | No  | 18   |

**Location Details**

Road number: A9 HA Area / DBFO number: [ ]  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 290157 Northing 816074  
 OS grid reference of outfall structure (m): Easting 290157 Northing 816074  
 Outfall number: DS5E List of outfalls in cumulative assessment: [ ]  
 Receiving watercourse: Unnamed Watercourse  
 EA receiving water Detailed River Network ID: [ ] Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 0.437 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.404 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): 0.5  
 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 & Dry/Detention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**







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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.20   | 0.60                   | Pass   | Pass | Accumulating?                                   | Yes | 0.02 |
| Step 3                       | 0.07   | 0.23                   | Pass   | Pass | Extensive?                                      | No  | 23   |

**Location Details**

Road number: A9 HA Area / DBFO number: [ ]  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 290143 Northing 815663  
 OS grid reference of outfall structure (m): Easting 290490 Northing 815490  
 Outfall number: DS JUNCTION C34 List of outfalls in cumulative assessment: [ ]  
 Receiving watercourse: Allt na Criche (Granish) \*See Note  
 EA receiving water Detailed River Network ID: [ ] Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 Notes: Outfall to Side Road Network. Assessment Point taken at existing A9 Crossing Location with Allt na Criche (Granish)

**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<sup>3</sup>/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 1.929 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.349 Is the discharge in or within 1 km upstream of a protected site for conservation? No  
 For dissolved zinc only Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 2  
 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 (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |               |     |      |
|------------------------------|--------|------------------------|--------|------|---|---------------|-----|------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |               |     |      |
| Step 2                       | 0.45   | 1.37                   | Pass   | Pass | Alert: D/S Structure.                           | Accumulating? | Yes | 0.02 |
| Step 3                       | 0.17   | 0.52                   | Pass   | Pass | Extensive?                                      | No            | 48  |      |

**Location Details**

Road number: A9 HA Area / DBFO number: [ ]  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 290993 Northing 818533  
 OS grid reference of outfall structure (m): Easting 290993 Northing 818533  
 Outfall number: 6BB List of outfalls in cumulative assessment: [ ]  
 Receiving watercourse: Allt Cnapach  
 EA receiving water Detailed River Network ID: [ ] Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.004 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 2.593 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.34 Is the discharge in or within 1 km upstream of a protected site for conservation? No  
 For dissolved zinc only Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 1.5  
 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 (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**





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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |               |                           |
|------------------------------|--------|------------------------|--------|------|---|---------------|---------------------------|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |               |                           |
| Step 2                       | 0.39   | 1.18                   | Pass   | Pass | Alert. D/S Structure.                           | Accumulating? | Yes 0.03 Low flow Vel m/s |
| Step 3                       | 0.15   | 0.45                   |        |      |   | Extensive?    | No 46 Deposition Index    |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 290826 Northing 820822  
 OS grid reference of outfall structure (m): Easting 290826 Northing 820822  
 Outfall number: 7A List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Feith Mhor  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.007 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 3.551 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.41 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 CaCO<sub>3</sub>/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  No   
 Tier 1 Estimated river width (m): 1.5  
 Tier 2 Bed width (m): 3 Manning's n: 0.07  D 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 (1/s) | Settlement of sediments (%)  |
| Existing measures  | 0 <input type="checkbox"/> D | Unlimited <input type="checkbox"/> D                       | 0 <input type="checkbox"/> D |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62 <input type="checkbox"/>  | Unlimited <input type="checkbox"/> D                       | 84 <input type="checkbox"/>  |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |               |                           |
|------------------------------|--------|------------------------|--------|------|---|---------------|---------------------------|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |               |                           |
| Step 2                       | 1.25   | 3.82                   | Pass   | Pass | Alert. D/S Structure.                           | Accumulating? | Yes 0.05 Low flow Vel m/s |
| Step 3                       | 0.47   | 1.45                   |        |      |   | Extensive?    | No 75 Deposition Index    |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 290815 Northing 820894  
 OS grid reference of outfall structure (m): Easting 290815 Northing 820894  
 Outfall number: 7B List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Tributary of Feith Mhor  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 16/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 4.729 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.48 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 CaCO<sub>3</sub>/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  No   
 Tier 1 Estimated river width (m): 0.5  
 Tier 2 Bed width (m): 3 Manning's n: 0.07  D 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 (1/s) | Settlement of sediments (%)  |
| Existing measures  | 0 <input type="checkbox"/> D | Unlimited <input type="checkbox"/> D                       | 0 <input type="checkbox"/> D |
| Proposed measures: Filter Drains & Wet/Retention Ponds (Cu 40%, Zn 62%, Sed 84%) | 62 <input type="checkbox"/>  | Unlimited <input type="checkbox"/> D                       | 84 <input type="checkbox"/>  |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**



| HIGHWAYS AGENCY  |   | Highways Agency Water Risk Assessment Tool version 1.0 November 2009                  |                          |  |  |
|--|---|---|--------------------------|--|--|
| Annual Average Concentration   |   | Soluble - Acute Impact  |                          | Zinc   | Sediment - Chronic Impact              |
|  | Copper  | Zinc  | Copper                   | Zinc   |  |
| Step 2   | 0.00  | 0.01  | Pass                     | Pass   | Alert, Protected Area & D/S Structure. |
| Step 3   | 0.00  | 0.00  |                          |  |  |
| Sediment deposition for this site is judged as:  |   |   |                          |  |  |
| Accumulating?  |   | Yes   | 0.06                     | Low flow Vel m/s   |  |
| Extensive?   |   | No  | 1                        | Deposition Index   |  |
| <b>Location Details</b>  |   |   |                          |  |  |
| Road number  | A9  |   | HA Area / DBFO number    |  |  |
| Assessment type  | Non-cumulative assessment (single outfall)                  |   |                          |  |  |
| OS grid reference of assessment point (m)  | Easting   | 289609  | Northing                 | 822506   |  |
| OS grid reference of outfall structure (m)   | Easting   | 289609  | Northing                 | 822506   |  |
| Outfall number   | 8A  | List of outfalls in cumulative assessment   |                          |  |  |
| Receiving watercourse  | River Dulhain   |   |                          |  |  |
| EA receiving water Detailed River Network ID   |   |   | Assessor and affiliation | LN AMJV  |  |
| Date of assessment   | 16/06/2016  | Version of assessment   |                          | 1  |  |
| Notes  |   |   |                          |  |  |
| <b>Step 1 Runoff Quality</b>   |   |   |                          |  |  |
| AADT   | >10,000 and <50,000   | Climatic region   | Colder Wet               | Rainfall site  | Ardtalnaig (SAAR 1343.9mm)             |
| <b>Step 2 River Impacts</b>  |   |   |                          |  |  |
| Annual 95%ile river flow (m <sup>3</sup> /s)   | 0.884   | (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)     |                          |  |  |
| Impermeable road area drained (ha)   | 1.829   | Permeable area draining to outfall (ha)   |                          | 0  |  |
| Base Flow Index (BFI)  | 0.44  | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes |                          |  |  |
| <b>For dissolved zinc only</b>   |   |   |                          |  |  |
| Water hardness   | Low = <50mg CaCO <sub>3</sub> /l                            | D   |                          |  |  |
| <b>For sediment impact only</b>  |   |   |                          |  |  |
| 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)   |   | 3   | Manning's n              | 0.07   | D                                      |
|  |   |   | Side slope (m/m)         | 0.5  | Long slope (m/m)                       |
|  |   |   | 0.0001                   |  |  |
| <b>Step 3 Mitigation</b>   |   |   |                          |  |  |
| Brief description  |   | Treatment for solubles (%)  |                          | Estimated effectiveness                                    |  |
|  |   |   |                          | Attenuation for solubles - restricted discharge rate (l/s) |  |
|  |   |   |                          | Settlement of sediments (%)                                |  |
| Existing measures  |   | 0   | Unlimited                | 0  | D                                      |
| Proposed measures  | Filter Drains & Dry/Detention Pond (Cu 0%, Zn 45%, Sed 80%) | 45  | Unlimited                | 80   | D                                      |
| <div style="text-align: right;"> <a href="#">Predict Impact</a><br/> <a href="#">Show Detailed Results</a><br/> <a href="#">Exit Tool</a> </div> |   |   |                          |  |  |

| HIGHWAYS AGENCY  |   | Highways Agency Water Risk Assessment Tool version 1.0 November 2009                  |                          |  |                            |
|--|---|---|--------------------------|--|----------------------------|
| Annual Average Concentration   |   | Soluble - Acute Impact  |                          | Zinc   | Sediment - Chronic Impact  |
|  | Copper  | Zinc  | Copper                   | Zinc   |                            |
| Step 2   | 0.01  | 0.04  | Pass                     | Pass   | Alert, Protected Area.     |
| Step 3   | 0.01  | 0.02  |                          |  |                            |
| Sediment deposition for this site is judged as:  |   |   |                          |  |                            |
| Accumulating?  |   | Yes   | 0.03                     | Low flow Vel m/s   |                            |
| Extensive?   |   | No  | 3                        | Deposition Index   |                            |
| <b>Location Details</b>  |   |   |                          |  |                            |
| Road number  | A9  |   | HA Area / DBFO number    |  |                            |
| Assessment type  | Non-cumulative assessment (single outfall)                  |   |                          |  |                            |
| OS grid reference of assessment point (m)  | Easting   | 289152  | Northing                 | 822981   |                            |
| OS grid reference of outfall structure (m)   | Easting   | 289152  | Northing                 | 822981   |                            |
| Outfall number   | 8C  | List of outfalls in cumulative assessment   |                          |  |                            |
| Receiving watercourse  | Allt nan Ceatharnach  |   |                          |  |                            |
| EA receiving water Detailed River Network ID   |   |   | Assessor and affiliation | LN AMJV  |                            |
| Date of assessment   | 16/06/2016  | Version of assessment   |                          | 1  |                            |
| Notes  |   |   |                          |  |                            |
| <b>Step 1 Runoff Quality</b>   |   |   |                          |  |                            |
| AADT   | >10,000 and <50,000   | Climatic region   | Colder Wet               | Rainfall site  | Ardtalnaig (SAAR 1343.9mm) |
| <b>Step 2 River Impacts</b>  |   |   |                          |  |                            |
| Annual 95%ile river flow (m <sup>3</sup> /s)   | 0.044   | (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)     |                          |  |                            |
| Impermeable road area drained (ha)   | 0.63  | Permeable area draining to outfall (ha)   |                          | 0  |                            |
| Base Flow Index (BFI)  | 0.28  | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes |                          |  |                            |
| <b>For dissolved zinc only</b>   |   |   |                          |  |                            |
| Water hardness   | Low = <50mg CaCO <sub>3</sub> /l                            | D   |                          |  |                            |
| <b>For sediment impact only</b>  |   |   |                          |  |                            |
| 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)   |   | 3   | Manning's n              | 0.07   | D                          |
|  |   |   | Side slope (m/m)         | 0.5  | Long slope (m/m)           |
|  |   |   | 0.0001                   |  |                            |
| <b>Step 3 Mitigation</b>   |   |   |                          |  |                            |
| Brief description  |   | Treatment for solubles (%)  |                          | Estimated effectiveness                                    |                            |
|  |   |   |                          | Attenuation for solubles - restricted discharge rate (l/s) |                            |
|  |   |   |                          | Settlement of sediments (%)                                |                            |
| Existing measures  |   | 0   | Unlimited                | 0  | D                          |
| Proposed measures  | Filter Drains & Dry/Detention Pond (Cu 0%, Zn 45%, Sed 80%) | 45  | Unlimited                | 80   | D                          |
| <div style="text-align: right;"> <a href="#">Predict Impact</a><br/> <a href="#">Show Detailed Results</a><br/> <a href="#">Exit Tool</a> </div> |   |   |                          |  |                            |





| HIGHWAYS AGENCY   |  | Highways Agency Water Risk Assessment Tool version 1.0 November 2009                  |                       |                             |                            |                       |                              |                  |
|---|--|---|-----------------------|-----------------------------|----------------------------|-----------------------|------------------------------|------------------|
| Annual Average Concentration  |  | Soluble - Acute Impact  |                       | Zinc                        | Sediment - Chronic Impact  |                       |                              |                  |
|   | Copper                                     | Zinc  | Copper                | Zinc                        |                            |                       |                              |                  |
| Step 2  | 0.04                                       | 0.14  | Pass                  | Pass                        | Alert. Protected Area.     |                       |                              |                  |
| Step 3  | 0.02                                       | 0.08  |                       |                             |                            |                       |                              |                  |
| Sediment deposition for this site is judged as:   |  |   |                       |                             |                            |                       |                              |                  |
| Accumulating?   |  | Yes   | 0.03                  | Low flow Vel m/s            |                            |                       |                              |                  |
| Extensive?  |  | No  | 11                    | Deposition Index            |                            |                       |                              |                  |
| <b>Location Details</b>   |  |   |                       |                             |                            |                       |                              |                  |
| Road number   | A9   |   | HA Area / DBFO number |                             |                            |                       |                              |                  |
| Assessment type   | Non-cumulative assessment (single outfall) |   |                       |                             |                            |                       |                              |                  |
| OS grid reference of assessment point (m)   | Easting                                    | 289126  | Northing              | 823007                      |                            |                       |                              |                  |
| OS grid reference of outfall structure (m)  | Easting                                    | 289126  | Northing              | 823007                      |                            |                       |                              |                  |
| Outfall number  | 8D   | List of outfalls in cumulative assessment   |                       |                             |                            |                       |                              |                  |
| Receiving watercourse   | Allt nan Ceatharnach                       |   |                       |                             |                            |                       |                              |                  |
| EA receiving water Detailed River Network ID  |  |   |                       | Assessor and affiliation    | LN AMJV                    |                       |                              |                  |
| Date of assessment  | 24/06/2016                                 | Version of assessment   |                       | 1                           |                            |                       |                              |                  |
| Notes   |  |   |                       |                             |                            |                       |                              |                  |
| <b>Step 1 Runoff Quality</b>  |  |   |                       |                             |                            |                       |                              |                  |
| AADT  | >10,000 and <50,000                        | Climatic region   | Colder Wet            | Rainfall site               | Ardtalnaig (SAAR 1343.9mm) |                       |                              |                  |
| <b>Step 2 River Impacts</b>   |  |   |                       |                             |                            |                       |                              |                  |
| Annual 95%ile river flow (m <sup>3</sup> /s)  | 0.044                                      | (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)     |                       |                             |                            |                       |                              |                  |
| Impermeable road area drained (ha)  | 2.195                                      | Permeable area draining to outfall (ha)   |                       | 0                           |                            |                       |                              |                  |
| Base Flow Index (BFI)   | 0.28                                       | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes |                       |                             |                            |                       |                              |                  |
| <b>For dissolved zinc only</b>  |  |   |                       |                             |                            |                       |                              |                  |
| Water hardness  | Low = <50mg CaCO <sub>3</sub> /l           | D   |                       |                             |                            |                       |                              |                  |
| <b>For sediment impact only</b>   |  |   |                       |                             |                            |                       |                              |                  |
| Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No                                    |  |   |                       |                             |                            |                       |                              |                  |
| Tier 1 Estimated river width (m)  |  | 5   | Manning's n           |                             |                            |                       |                              |                  |
| Tier 2 Bed width (m)  |  | 3   | 0.07                  | Side slope (m/m)            | 0.5                        |                       |                              |                  |
|   |  |   |                       | Long slope (m/m)            | 0.0001                     |                       |                              |                  |
| <b>Step 3 Mitigation</b>  |  |   |                       |                             |                            |                       |                              |                  |
| Brief description   |  | Treatment for solubles (%)  |                       | Settlement of sediments (%) |                            |                       |                              |                  |
| Existing measures   |  | 0   |                       | 0                           |                            |                       |                              |                  |
| Proposed measures   |  | 45  |                       | 80                          |                            |                       |                              |                  |
|   |  | Filter Drains & Dry/Retention Pond (Cu 0%, Zn 45%, Sed 80%)                           |                       |                             |                            |                       |                              |                  |
| <table border="0"> <tr> <td><b>Predict Impact</b></td> </tr> <tr> <td><b>Show Detailed Results</b></td> </tr> <tr> <td><b>Exit Tool</b></td> </tr> </table> |  |   |                       |                             |                            | <b>Predict Impact</b> | <b>Show Detailed Results</b> | <b>Exit Tool</b> |
| <b>Predict Impact</b>   |  |   |                       |                             |                            |                       |                              |                  |
| <b>Show Detailed Results</b>  |  |   |                       |                             |                            |                       |                              |                  |
| <b>Exit Tool</b>  |  |   |                       |                             |                            |                       |                              |                  |

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|---|--|---|-----------------------|-----------------------------|----------------------------|-----------------------|------------------------------|------------------|
| Annual Average Concentration  |  | Soluble - Acute Impact  |                       | Zinc                        | Sediment - Chronic Impact  |                       |                              |                  |
|   | Copper                                     | Zinc  | Copper                | Zinc                        |                            |                       |                              |                  |
| Step 2  | 0.93                                       | 2.83  | Pass                  | Pass                        | Alert. Protected Area.     |                       |                              |                  |
| Step 3  | 0.36                                       | 1.08  |                       |                             |                            |                       |                              |                  |
| Sediment deposition for this site is judged as:   |  |   |                       |                             |                            |                       |                              |                  |
| Accumulating?   |  | Yes   | 0.03                  | Low flow Vel m/s            |                            |                       |                              |                  |
| Extensive?  |  | No  | 64                    | Deposition Index            |                            |                       |                              |                  |
| <b>Location Details</b>   |  |   |                       |                             |                            |                       |                              |                  |
| Road number   | A9   |   | HA Area / DBFO number |                             |                            |                       |                              |                  |
| Assessment type   | Non-cumulative assessment (single outfall) |   |                       |                             |                            |                       |                              |                  |
| OS grid reference of assessment point (m)   | Easting                                    | 288557  | Northing              | 823906                      |                            |                       |                              |                  |
| OS grid reference of outfall structure (m)  | Easting                                    | 288557  | Northing              | 823906                      |                            |                       |                              |                  |
| Outfall number  | 9A   | List of outfalls in cumulative assessment   |                       |                             |                            |                       |                              |                  |
| Receiving watercourse   | Unnamed Watercourse                        |   |                       |                             |                            |                       |                              |                  |
| EA receiving water Detailed River Network ID  |  |   |                       | Assessor and affiliation    | LN AMJV                    |                       |                              |                  |
| Date of assessment  | 24/06/2016                                 | Version of assessment   |                       | 1                           |                            |                       |                              |                  |
| Notes   |  |   |                       |                             |                            |                       |                              |                  |
| <b>Step 1 Runoff Quality</b>  |  |   |                       |                             |                            |                       |                              |                  |
| AADT  | >10,000 and <50,000                        | Climatic region   | Colder Wet            | Rainfall site               | Ardtalnaig (SAAR 1343.9mm) |                       |                              |                  |
| <b>Step 2 River Impacts</b>   |  |   |                       |                             |                            |                       |                              |                  |
| Annual 95%ile river flow (m <sup>3</sup> /s)  | 0.001                                      | (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)     |                       |                             |                            |                       |                              |                  |
| Impermeable road area drained (ha)  | 1.715                                      | Permeable area draining to outfall (ha)   |                       | 0                           |                            |                       |                              |                  |
| Base Flow Index (BFI)   | 0.3  | Is the discharge in or within 1 km upstream of a protected site for conservation? Yes |                       |                             |                            |                       |                              |                  |
| <b>For dissolved zinc only</b>  |  |   |                       |                             |                            |                       |                              |                  |
| Water hardness  | Low = <50mg CaCO <sub>3</sub> /l           | D   |                       |                             |                            |                       |                              |                  |
| <b>For sediment impact only</b>   |  |   |                       |                             |                            |                       |                              |                  |
| 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)  |  | 0.5   | Manning's n           |                             |                            |                       |                              |                  |
| Tier 2 Bed width (m)  |  | 3   | 0.07                  | Side slope (m/m)            | 0.5                        |                       |                              |                  |
|   |  |   |                       | Long slope (m/m)            | 0.0001                     |                       |                              |                  |
| <b>Step 3 Mitigation</b>  |  |   |                       |                             |                            |                       |                              |                  |
| Brief description   |  | Treatment for solubles (%)  |                       | Settlement of sediments (%) |                            |                       |                              |                  |
| Existing measures   |  | 0   |                       | 0                           |                            |                       |                              |                  |
| Proposed measures   |  | 62  |                       | 84                          |                            |                       |                              |                  |
|   |  | Filter Drains & Wet/Retention Pond (Cu 40%, Zn 62%, Sed 84%)                          |                       |                             |                            |                       |                              |                  |
| <table border="0"> <tr> <td><b>Predict Impact</b></td> </tr> <tr> <td><b>Show Detailed Results</b></td> </tr> <tr> <td><b>Exit Tool</b></td> </tr> </table> |  |   |                       |                             |                            | <b>Predict Impact</b> | <b>Show Detailed Results</b> | <b>Exit Tool</b> |
| <b>Predict Impact</b>   |  |   |                       |                             |                            |                       |                              |                  |
| <b>Show Detailed Results</b>  |  |   |                       |                             |                            |                       |                              |                  |
| <b>Exit Tool</b>  |  |   |                       |                             |                            |                       |                              |                  |



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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 1.49   | 4.55                   | Pass   | Pass | Accumulating?                                   | Yes | 0.03 |
| Step 3                       | 0.28   | 0.87                   | Pass   | Pass | Extensive?                                      | No  | 25   |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 288557 Northing 823906  
 OS grid reference of outfall structure (m): Easting 288557 Northing 823906  
 Outfall number: 9B List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Unnamed Watercourse  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 24/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 3.549 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.3 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.5  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Pond & Swale (Cu 70%, Zn 81%, Sed 84%) | 81                         | Unlimited  | 97                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper | Zinc | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.05   | 0.17                   | Pass   | Pass | Accumulating?                                   | Yes | 0.05 |
| Step 3                       | 0.02   | 0.06                   | Pass   | Pass | Extensive?                                      | No  | 4    |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 287855 Northing 824213  
 OS grid reference of outfall structure (m): Easting 287855 Northing 824213  
 Outfall number: 9B3 List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Boqbain Burn  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 27/07/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.016 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 0.982 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.27 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 1.75  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Pond (Cu 40%, Zn 62%, Sed 84%) | 82                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**



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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc |      | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper | Zinc |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 1.32   | 4.01                   | Pass   | Pass | Pass | Accumulating?                                   | Yes | 0.06 |
| Step 3                       | 0.50   | 1.52                   |        |      |      | Extensive?                                      | No  | 54   |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 286349 Northing 824831  
 OS grid reference of outfall structure (m): Easting 286349 Northing 824831  
 Outfall number: 9D List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Unnamed Watercourse  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 24/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 2.894 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.3 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.3  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures   | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Pond (Cu 40%, Zn 62%, Sed 84%) | 62                         | Unlimited  | 84                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc |      | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper | Zinc |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.43   | 1.29                   | Pass   | Pass | Pass | Accumulating?                                   | Yes | 0.03 |
| Step 3                       | 0.23   | 0.71                   |        |      |      | Extensive?                                      | No  | 28   |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 285340 Northing 823987  
 OS grid reference of outfall structure (m): Easting 285340 Northing 823987  
 Outfall number: 10A List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Bogbain Burn  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 21/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 0.603 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.29 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.5  
 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 (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Dry/Detention Pond (Cu 0%, Zn 45%, Sed 80%) | 45                         | Unlimited  | 80                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**





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|--|--|--|--|--|---------------------------|
| Annual Average Concentration   |  | Soluble - Acute Impact   |  | Zinc   | Sediment - Chronic Impact |
|  | Copper   | Zinc   | Copper   | Zinc   |                           |
| Step 2   | 0.33   | 1.01   | Pass   | Pass   | Pass                      |
| Step 3   | 0.13   | 0.39   |  |  |                           |
| Sediment deposition for this site is judged as:  |  |  |  |  |                           |
| Accumulating?  | Yes  | 0.05   | Low flow Vel m/s   |  |                           |
| Extensive?   | No   | 27   | Deposition Index   |  |                           |
| <b>Location Details</b>  |  |  |  |  |                           |
| Road number  | A9   |  | HA Area / DBFO number  |  |                           |
| Assessment type  | Non-cumulative assessment (single outfall)                   |  |  |  |                           |
| OS grid reference of assessment point (m)  | Easting  | 284357   | Northing   | 824187   |                           |
| OS grid reference of outfall structure (m)   | Easting  | 284357   | Northing   | 824187   |                           |
| Outfall number   | 10B  |  | List of outfalls in cumulative assessment  |  |                           |
| Receiving watercourse  | Allt Slochd Mhuic  |  |  |  |                           |
| EA receiving water Detailed River Network ID   |  |  |  | Assessor and affiliation                                   |                           |
| Date of assessment   | 21/06/2016   |  | Version of assessment  |  | 1                         |
| Notes  |  |  |  |  |                           |
| <b>Step 1 Runoff Quality</b>   |  |  |  |  |                           |
| AADT   | >10,000 and <50,000  |  | Climatic region  | Colder Wet   |                           |
|  |  |  | Rainfall site  | Ardtalnaig (SAAR 1343.9mm)                                 |                           |
| <b>Step 2 River Impacts</b>  |  |  |  |  |                           |
| Annual 95%ile river flow (m <sup>3</sup> /s)   | 0.012  |  | (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)    |  |                           |
| Impermeable road area drained (ha)   | 5.378  |  | Permeable area draining to outfall (ha) 0  |  |                           |
| Base Flow Index (BFI)  | 0.25   |  | Is the discharge in or within 1 km upstream of a protected site for conservation? No |  |                           |
| <b>For dissolved zinc only</b>   |  |  |  |  |                           |
| Water hardness   | Low = <50mg CaCO <sub>3</sub> /l                             |  |  |  |                           |
| <b>For sediment impact only</b>  |  |  |  |  |                           |
| 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)   |  | 1.5  |  |  |                           |
| Tier 2 Bed width (m)   |  | 3  |  | Manning's n  | 0.07                      |
|  |  |  |  | Side slope (m/m)   | 0.5                       |
|  |  |  |  | Long slope (m/m)   | 0.0001                    |
| <b>Step 3 Mitigation</b>   |  |  |  |  |                           |
| Brief description  |  | Treatment for solubles (%)   |  | Estimated effectiveness                                    |                           |
|  |  |  |  | Attenuation for solubles - restricted discharge rate (1/s) |                           |
|  |  |  |  | Settlement of sediments (%)                                |                           |
| Existing measures  |  |  | 0  |  | Unlimited                 |
| Proposed measures  | Filter Drains & Wet/Retention Pond (Cu 40%, Zn 62%, Sed 84%) |  | 62   |  | Unlimited                 |
|  |  |  |  | 0  |                           |
|  |  |  |  | 84   |                           |
| <b>Predict Impact</b>  |  |  |  |  |                           |
| <b>Show Detailed Results</b>   |  |  |  |  |                           |
| <b>Exit Tool</b>   |  |  |  |  |                           |

| HIGHWAYS AGENCY  |   | Highways Agency Water Risk Assessment Tool version 1.0 November 2009 |  |  |                           |
|--|---|--|--|--|---------------------------|
| Annual Average Concentration   |   | Soluble - Acute Impact   |  | Zinc   | Sediment - Chronic Impact |
|  | Copper  | Zinc   | Copper   | Zinc   |                           |
| Step 2   | 0.73  | 2.19   | Pass   | Pass   | Pass                      |
| Step 3   | 0.14  | 0.42   |  |  |                           |
| Sediment deposition for this site is judged as:  |   |  |  |  |                           |
| Accumulating?  | Yes   | 0.03   | Low flow Vel m/s   |  |                           |
| Extensive?   | No  | 16   | Deposition Index   |  |                           |
| <b>Location Details</b>  |   |  |  |  |                           |
| Road number  | A9  |  | HA Area / DBFO number  |  |                           |
| Assessment type  | Non-cumulative assessment (single outfall)                            |  |  |  |                           |
| OS grid reference of assessment point (m)  | Easting   | 284210   | Northing   | 824529   |                           |
| OS grid reference of outfall structure (m)   | Easting   | 284210   | Northing   | 824529   |                           |
| Outfall number   | 10C   |  | List of outfalls in cumulative assessment  |  |                           |
| Receiving watercourse  | Allt Slochd Mhuic   |  |  |  |                           |
| EA receiving water Detailed River Network ID   |   |  |  | Assessor and affiliation                                   |                           |
| Date of assessment   | 21/06/2016  |  | Version of assessment  |  | 1                         |
| Notes  |   |  |  |  |                           |
| <b>Step 1 Runoff Quality</b>   |   |  |  |  |                           |
| AADT   | >10,000 and <50,000   |  | Climatic region  | Colder Wet   |                           |
|  |   |  | Rainfall site  | Ardtalnaig (SAAR 1343.9mm)                                 |                           |
| <b>Step 2 River Impacts</b>  |   |  |  |  |                           |
| Annual 95%ile river flow (m <sup>3</sup> /s)   | 0.006   |  | (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)    |  |                           |
| Impermeable road area drained (ha)   | 7.915   |  | Permeable area draining to outfall (ha) 0  |  |                           |
| Base Flow Index (BFI)  | 0.22  |  | Is the discharge in or within 1 km upstream of a protected site for conservation? No |  |                           |
| <b>For dissolved zinc only</b>   |   |  |  |  |                           |
| Water hardness   | Low = <50mg CaCO <sub>3</sub> /l                                      |  |  |  |                           |
| <b>For sediment impact only</b>  |   |  |  |  |                           |
| 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)   |   | 1.5  |  |  |                           |
| Tier 2 Bed width (m)   |   | 3  |  | Manning's n  | 0.07                      |
|  |   |  |  | Side slope (m/m)   | 0.5                       |
|  |   |  |  | Long slope (m/m)   | 0.0001                    |
| <b>Step 3 Mitigation</b>   |   |  |  |  |                           |
| Brief description  |   | Treatment for solubles (%)   |  | Estimated effectiveness                                    |                           |
|  |   |  |  | Attenuation for solubles - restricted discharge rate (1/s) |                           |
|  |   |  |  | Settlement of sediments (%)                                |                           |
| Existing measures  |   |  | 0  |  | Unlimited                 |
| Proposed measures  | Filter Drains & Wet/Retention Pond & Swales (Cu 70%, Zn 81%, Sed 97%) |  | 81   |  | Unlimited                 |
|  |   |  |  | 0  |                           |
|  |   |  |  | 97   |                           |
| <b>Predict Impact</b>  |   |  |  |  |                           |
| <b>Show Detailed Results</b>   |   |  |  |  |                           |
| <b>Exit Tool</b>   |   |  |  |  |                           |





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| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.38   | 1.14                   | Pass   | Pass | Accumulating?                                   | Yes | 0.02 |
| Step 3                       | 0.07   | 0.22                   | Pass   | Pass | Extensive?                                      | No  | 7    |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_

Assessment type: Non-cumulative assessment (single outfall)

OS grid reference of assessment point (m): Easting 284079 Northing 824790

OS grid reference of outfall structure (m): Easting 284079 Northing 824790

Outfall number: 11C List of outfalls in cumulative assessment: \_\_\_\_\_

Receiving watercourse: Allt Slochd Mhuic

EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV

Date of assessment: 21/06/2016 Version of assessment: 1

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

Impermeable road area drained (ha): 2.826 Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.22 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 1.5 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001

Tier 2 Bed width (m): 3

**Step 3 Mitigation**

| Brief description  | Estimated effectiveness    |  |                             |
|--|----------------------------|--|-----------------------------|
|  | Treatment for solubles (%) | Attenuation for solubles - restricted discharge rate (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Pond & Swales (Cu 70%, Zn 81%, Sed 97%) | 81                         | Unlimited  | 97                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        | Soluble - Acute Impact |        | Zinc | Sediment - Chronic Impact                       |     |      |
|------------------------------|--------|------------------------|--------|------|---|-----|------|
|                              | Copper | Zinc                   | Copper |      | Sediment deposition for this site is judged as: |     |      |
| Step 2                       | 0.91   | 2.74                   | Pass   | Pass | Accumulating?                                   | Yes | 0.03 |
| Step 3                       | 0.17   | 0.52                   | Pass   | Pass | Extensive?                                      | No  | 11   |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_

Assessment type: Non-cumulative assessment (single outfall)

OS grid reference of assessment point (m): Easting 283972 Northing 825054

OS grid reference of outfall structure (m): Easting 283972 Northing 825054

Outfall number: 11D List of outfalls in cumulative assessment: \_\_\_\_\_

Receiving watercourse: Unnamed Watercourse

EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV

Date of assessment: 21/06/2016 Version of assessment: 1

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

Impermeable road area drained (ha): 1.804 Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.22 Is the discharge in or within 1 km upstream of a protected site for conservation? No

**For dissolved zinc only** Water hardness: Low = <50mg CaCO<sub>3</sub>/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): 0.5 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001

Tier 2 Bed width (m): 3

**Step 3 Mitigation**

| Brief description  | Estimated effectiveness    |  |                             |
|--|----------------------------|--|-----------------------------|
|  | Treatment for solubles (%) | Attenuation for solubles - restricted discharge rate (1/s) | Settlement of sediments (%) |
| Existing measures  | 0                          | Unlimited  | 0                           |
| Proposed measures: Filter Drains & Wet/Retention Pond & Swales (Cu 70%, Zn 81%, Sed 97%) | 81                         | Unlimited  | 97                          |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**





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| Annual Average Concentration |        |      | Soluble - Acute Impact |      | Sediment - Chronic Impact                       |   |
|------------------------------|--------|------|------------------------|------|---|---|
|                              | Copper | Zinc | Copper                 | Zinc | Sediment deposition for this site is judged as: |   |
| Step 2                       | 0.39   | 1.18 | Pass                   | Pass | Pass  | Accumulating? Yes 0.02 Low flow Vel m/s |
| Step 3                       | 0.22   | 0.65 | Pass                   | Pass | Pass  | Extensive? No 37 Deposition Index       |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 283470 Northing 825663  
 OS grid reference of outfall structure (m): Easting 283470 Northing 825663  
 Outfall number: 11J List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Allt Slochd Mhuic  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 21/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.002 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 1.184 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.21 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 CaCO<sub>3</sub>/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): 1  
 Tier 2 Bed width (m): 3 Manning's n: 0.07  D Side slope (m/m): 0.5 Long slope (m/m): 0.001

**Step 3 Mitigation**

| Brief description  | Treatment for solubles (%)   | Estimated effectiveness                                    |                              |
|--|------------------------------|--|------------------------------|
|  |                              | Attenuation for solubles - restricted discharge rate (l/s) | Settlement of sediments (%)  |
| Existing measures  | 0 <input type="checkbox"/> D | Unlimited <input type="checkbox"/> D                       | 0 <input type="checkbox"/> D |
| Proposed measures: Filter Drains & Dry/Retention Pond (Cu 0%, Zn 45%, Sed 80%) | 45 <input type="checkbox"/>  | Unlimited <input type="checkbox"/> D                       | 80 <input type="checkbox"/>  |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

**HIGHWAYS AGENCY** **Highways Agency Water Risk Assessment Tool** version 1.0 November 2009

| Annual Average Concentration |        |      | Soluble - Acute Impact |      | Sediment - Chronic Impact                       |   |
|------------------------------|--------|------|------------------------|------|---|---|
|                              | Copper | Zinc | Copper                 | Zinc | Sediment deposition for this site is judged as: |   |
| Step 2                       | 0.70   | 2.10 | Pass                   | Pass | Pass  | Accumulating? Yes 0.01 Low flow Vel m/s |
| Step 3                       | 0.27   | 0.80 | Pass                   | Pass | Pass  | Extensive? No 50 Deposition Index       |

**Location Details**

Road number: A9 HA Area / DBFO number: \_\_\_\_\_  
 Assessment type: Non-cumulative assessment (single outfall)  
 OS grid reference of assessment point (m): Easting 282598 Northing 826257  
 OS grid reference of outfall structure (m): Easting 282598 Northing 826257  
 Outfall number: 11K List of outfalls in cumulative assessment: \_\_\_\_\_  
 Receiving watercourse: Tributary of Allt Corsach  
 EA receiving water Detailed River Network ID: \_\_\_\_\_ Assessor and affiliation: LN AMJV  
 Date of assessment: 21/06/2016 Version of assessment: 1  
 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<sup>3</sup>/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)  
 Impermeable road area drained (ha): 1.248 Permeable area draining to outfall (ha): 0  
 Base Flow Index (BFI): 0.22 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 CaCO<sub>3</sub>/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): 1  
 Tier 2 Bed width (m): 3 Manning's n: 0.07  D Side slope (m/m): 0.5 Long slope (m/m): 0.001

**Step 3 Mitigation**

| Brief description   | Treatment for solubles (%)   | Estimated effectiveness                                    |                              |
|---|------------------------------|--|------------------------------|
|   |                              | Attenuation for solubles - restricted discharge rate (l/s) | Settlement of sediments (%)  |
| Existing measures   | 0 <input type="checkbox"/> D | Unlimited <input type="checkbox"/> D                       | 0 <input type="checkbox"/> D |
| Proposed measures: Filter Drains & Wet/Retention Pond (Cu 40%, Zn 62%, Sed 84%) | 62 <input type="checkbox"/>  | Unlimited <input type="checkbox"/> D                       | 84 <input type="checkbox"/>  |

**Predict Impact**  
**Show Detailed Results**  
**Exit Tool**

## A.2. Accidental Spillage Calculation Criteria

| Drainage Network ID           | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sub>pol</sub> | p <sub>inc</sub> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|-------------------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| 1 B                           | 0.5677           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 8.8E-05          | 8.8E-05             | Yes             | Pass      | 11405                             |
| 1 C                           | 0.725            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00011          | 0.00011             | Yes             | Pass      | 8930                              |
| 1 E                           | 0.397            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 6.1E-05          | 6.1E-05             | Yes             | Pass      | 16308                             |
| 1 F                           | 0.2317           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 3.6E-05          | 3.6E-05             | Yes             | Pass      | 27943                             |
| 2 A (Mainline & Junction A18) | 0.9954           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.0002           | 0.0016              | Yes             | Pass      | 608                               |
|                               | 0.5375           | Slip Road   | 0.83                         | 16213       | 12   | 0.75             | 0.0002           |                     |                 |           |                                   |
|                               | 1.352            | Slip Road   | 0.83                         | 16213       | 12   | 0.75             | 0.0006           |                     |                 |           |                                   |
|                               | 1.108            | Side Road   | 0.93                         | 16213       | 12   | 0.75             | 0.0005           |                     |                 |           |                                   |
|                               | 0.6967           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.0001           |                     |                 |           |                                   |



| Drainage Network ID | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sup>pol</sup> | p <sup>inc</sup> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|---------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| 3A B1               | 0.9943           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00015          | 0.00015             | Yes             | Pass      | 6512                              |
| 3A C                | 0.8248           | No Junction | 0.29                         | 16213       | 12   | 0.5              | 8.5E-05          | 8.5E-05             | No              | Pass      | 11775                             |
| 3B B                | 1.881            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00029          | 0.00029             | Yes             | Pass      | 3442                              |
| 4 A                 | 0.9187           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00014          | 0.00014             | No              | Pass      | 7047                              |
| 5 A                 | 0.1779           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 3E-05            | 0.000097764         | No              | Pass      | 10229                             |
|                     | 0.159            | Slip Road   | 0.83                         | 16213       | 12   | 0.75             | 7E-05            |                     |                 |           |                                   |
| 5 B                 | 0.2927           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 5.1E-05          | 0.000062891         | No              | Pass      | 15901                             |
|                     | 0.04             | Slip Road   | 0.83                         | 16213       | 12   | 0.75             | 1.8E-05          |                     |                 |           |                                   |



| Drainage Network ID      | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sup>pol</sup> | p <sup>inc</sup> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|--------------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| 5 C                      | 0.3477           | No Junction | 0.29                         | 16213       | 12   | 0.5              | 3.37429E-05      | 0.000092684         | No              | Pass      | 10789                             |
|                          | 0.2              | Slip Road   | 0.83                         | 16213       | 12   | 0.5              | 5.89407E-05      |                     |                 |           |                                   |
| 5 D                      | 0.4323           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 6.7E-05          | 6.7E-05             | No              | Pass      | 14977                             |
| 5 E                      | 0.1929           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 3E-05            | 3E-05               | No              | Pass      | 33564                             |
| 5 F                      | 0.4414           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 6.8E-05          | 6.8E-05             | No              | Pass      | 14668                             |
| 5 G                      | 0.0632           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 9.8E-06          | 9.8E-06             | No              | Pass      | 102444                            |
| Granish Junction Opt C34 | 1.292            | Slip Road   | 0.83                         | 16213       | 12   | 0.75             | 0.0006           | 0.001623050         | No              | Pass      | 616                               |
|                          | 0.2195           | Side Road   | 0.93                         | 16213       | 12   | 0.75             | 0.0001           |                     |                 |           |                                   |
|                          | 0.5675           | Roundabout  | 3.09                         | 16213       | 12   | 0.75             | 9.2E-6           |                     |                 |           |                                   |
|                          | 0.05985          | No Junction | 0.29                         | 16213       | 12   | 0.75             | 9.24402E-06      |                     |                 |           |                                   |



| Drainage Network ID | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sup>pol</sup> | p <sup>inc</sup> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|---------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| 6A A                | 0.548            | No Junction | 0.29                         | 16213       | 12   | 0.5              | 5.6E-05          | 5.6E-05             | No              | Pass      | 17722                             |
| 6A C                | 0.5705           | No Junction | 0.29                         | 16213       | 12   | 0.5              | 5.9E-05          | 5.9E-05             | No              | Pass      | 17023                             |
| 6A E                | 0.131            | No Junction | 0.29                         | 16213       | 12   | 0.5              | 1.3E-05          | 1.3E-05             | No              | Pass      | 74135                             |
| 6B A                | 0.8196           | No Junction | 0.29                         | 16213       | 12   | 0.5              | 8.4E-05          | 8.4E-05             | No              | Pass      | 11849                             |
| 6B B                | 1.182            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00018          | 0.00018             | No              | Pass      | 5478                              |
| 7 A                 | 1.076            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00017          | 0.00017             | No              | Pass      | 6017                              |
| 7 B                 | 2.148            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00033          | 0.00033             | No              | Pass      | 3014                              |
| 8 A                 | 0.627            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 9.7E-05          | 9.7E-05             | Yes             | Pass      | 10326                             |



| Drainage Network ID | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sup>pol</sup> | p <sup>inc</sup> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|---------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| 8 C                 | 0.2302           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 3.6E-05          | 3.6E-05             | Yes             | Pass      | 28125                             |
| 8 D                 | 0.8715           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00013          | 0.00013             | Yes             | Pass      | 7429                              |
| 9 A                 | 0.737            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00011          | 0.00011             | Yes             | Pass      | 8785                              |
| 9 B                 | 0.338            | Side Road   | 0.93                         | 16213       | 12   | 0.75             | 0.000167417      | 0.0012              | No              | Pass      | 866                               |
|                     | 0.61             | No Junction | 0.29                         | 16213       | 12   | 0.75             | 9.42164E-05      |                     |                 |           |                                   |
|                     | 1.61             | Slip Road   | 0.83                         | 16213       | 12   | 0.75             | 0.000711709      |                     |                 |           |                                   |
|                     | 1.178            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.000181946      |                     |                 |           |                                   |
| 9 B2                | 0.229            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 2.4E-05          | 2.4E-05             | No              | Pass      | 42409                             |



| Drainage Network ID | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sup>pol</sup> | p <sup>inc</sup> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|---------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| <b>9 B3</b>         | 0.807            | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00012          | 0.0003              | No              | Pass      | 3295                              |
|                     | 0.361            | Side Road   | 0.93                         | 16213       | 12   | 0.75             | 0.00017          |                     |                 |           |                                   |
| <b>9 D</b>          | 0.9808           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00015          | 0.00015             | No              | Pass      | 6601                              |
| <b>10 A</b>         | 0.06808          | No Junction | 0.29                         | 16213       | 12   | 0.75             | 1.1E-05          | 1.1E-05             | No              | Pass      | 95101                             |
| <b>10 B</b>         | 0.5228           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 8.1E-05          | 8.1E-05             | No              | Pass      | 12384                             |
| <b>10 C</b>         | 0.9113           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00014          | 0.00014             | No              | Pass      | 7105                              |
| <b>11 C</b>         | 0.2588           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 4E-05            | 4E-05               | No              | Pass      | 25017                             |
| <b>11D</b>          | 0.7374           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 0.00011          | 0.00011             | No              | Pass      | 8780                              |



| Drainage Network ID | Road Length (Km) | Type        | Spillage Accident Rates (SS) | AADT24-2WAY | %HGV | p <sup>pol</sup> | p <sup>inc</sup> | Overall Probability | Designated Area | Pass/Fail | Annual Probability (1 in x years) |
|---------------------|------------------|-------------|------------------------------|-------------|------|------------------|------------------|---------------------|-----------------|-----------|-----------------------------------|
| 11 J                | 0.4123           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 6.4E-05          | 6.4E-05             | No              | Pass      | 15703                             |
| 11 K                | 0.5725           | No Junction | 0.29                         | 16213       | 12   | 0.75             | 8.8E-05          | 8.8E-05             | No              | Pass      | 11309                             |

## 5. References

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- <sup>i</sup> The Highways Agency, Scottish Executive, Welsh Assembly Government and The Department Regional Development Northern Ireland (2009). Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10, Road Drainage and the Water Environment.
- <sup>ii</sup> CIRIA 2015. The SuDS Manual (C753). London: CIRIA