TECHNICAL APPENDIX 6.1: WATER QUALITY CALCULATIONS

8.1.1 Introduction

8.1.1.1 This appendix provides information on the calculations and outputs used to inform the water quality assessment associated with the operational phase of the proposed development, as reported in Chapter 6: Road Drainage and Water Environment in Volume 2. The indicative drainage layout is shown on Figure 6.4 (Drainage Layout) in Volume 4.

8.1.1.2 As part of the water quality assessment, routine runoff and accidental spillage risk to the Swine Burn (proposed to receive operational road drainage) was assessed using the Highways England Water Risk Assessment Tool (HEWRAT), in line with DMRB HD45/09 guidance[1].

8.1.1.3 An overview of the methodologies is provided in Section 8.1.2 of this appendix. Detailed information on methodology and calculations is available in DMRB HD45/09. Input parameters and calculation sheets for the routine runoff and accidental spillage risk assessments are provided in Sections 8.1.3 and 8.1.4 of this appendix, respectively.

8.1.2 Assessment Methodologies

Routine Runoff Assessment (Method A)

8.1.2.1 This Method estimates the magnitude of potential short term and longer-term impacts to water quality associated with discharge of operational road drainage. Calculated concentrations of specific elements are compared against freshwater pollutant thresholds and Environmental Quality Standards (EQS) to assess compliance with the Water Framework Directive (WFD). HEWRAT considers the following:

- Short-term impacts in the form of runoff-specific thresholds (RST), which relate to the intermittent nature of road runoff (i.e. contaminants washed off the road surface in a rainfall event), over a typical exposure period of six hours (RST 6 hour) and for a worst-case scenario of 24 hours (RST 24 hour). Dissolved copper and dissolved zinc are used as indicators of the level of impact as they can result in acute toxic effects to aquatic life in certain concentrations.
- Chronic impacts (i.e. impacts which can persist for weeks or months) associated with sediment-bound pollutants on aquatic ecology. Two standards are used for metal and polycyclic aromatic hydrocarbon (PAH) concentrations within sediment; Threshold Effects Levels (TELs) (i.e. the concentration below which toxic effects are very rare) and Probable Effects Levels (PELs) (i.e. the concentration above which toxic effects are observed on most occasions).
- Longer-term in-river annual average concentrations for soluble pollutants (dissolved copper and dissolved zinc) which includes the contribution from road runoff. These concentrations are compared against published EQS for freshwaters to assess whether there is likely to be a long term impact on ecology.

8.1.2.2 HEWRAT uses a three-step tiered approach to assess the impacts of both soluble and sediment-bound pollutants. A 'Pass' or 'Fail' result is recorded depending on whether the risk is within or exceeds the thresholds indicated above. Where a Fail result is recorded for one or

[1] Highways Agency et al. (2009). Volume 11, Section 3, Part 10: Road Drainage and the Water Environment, HD45/09. Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/hd4509.pdf (Accessed 8 November 2019)

more of the pollutant types, the next step is required based on increasing levels of inputs and assessment.

8.1.2.3 As well as assessing the risk of routine runoff from each drainage outfall in isolation, an in-combination assessment is undertaken where more than one outfall discharges into the same reach of watercourse. This is the 'worst-case' scenario as the combined effects could be more significant. To aggregate the assessments, the total impermeable and permeable carriageway areas to be drained are added together, and the low flow of the watercourse is taken at the outfall location furthest downstream (this is the assessment point of the combined outfall assessment). For drainage outfalls positioned between 100m and 1km apart, the cumulative assessment is for soluble pollutants only, whilst for outfalls positioned closer together (within 100m), the combined assessment includes soluble and sediment pollutants. The two outfalls to the Swine Burn are approximately 100m apart and therefore both soluble and sediment pollutants have been considered in the combined assessment.

Accidental Spillage Risk Assessment (Method D)

8.1.2.4 Along a road there is a risk of vehicular collision that could result in the spillage of fuels, oils or chemicals, particularly if tankers and heavy goods vehicles (HGVs) are involved. A risk assessment of a serious spillage causing a pollution incident was undertaken using the methodology outlined in DMRB HD45/09.

8.1.2.5 The risk is calculated assuming that an accident involving spillage of pollutants onto the carriageway would occur at an assumed frequency (expressed as an annual probability), based on calculated traffic volumes and the type of road/junction. The annual probability of a serious accidental spillage also depends upon the emergency services response time, based on the location (i.e. urban, rural or remote location) and type of receiving water body (surface or groundwater).

8.1.2.6 Where spillage risk is calculated as less than 1% Annual Exceedance Probability (AEP) (less frequent than 1:100 years), the spillage falls within acceptable limits and no mitigation (i.e. sustainable drainage systems, SuDS) is required.

8.1.2.7 Using the same process as for the routine runoff assessment, a combined spillage risk assessment is undertaken where more than one outfall discharges into the same reach of watercourse. To aggregate the assessments, the total length of road drained (split into each road/junction type) is combined for all outfalls and the highest AADT and %HGV values are taken for each road/junction type.

8.1.2.8 Indicative pollution risk reduction factors associated with the SuDS systems proposed prior to each outfall is shown in Table TA6.1.1.

Table TA6.1.1: Indicative Pollutant Risk Reduction Factors (DMRB HD45/09)

SuDS System	Risk Reduction Factor
Filter Drain	0.6 (40%)
Detention Basin	0.5 (50%)
Combined SuDS	0.35 (65%) (40 + (50/2) = 65%)[2]

[2] After the first level of treatment, which will generally remove the majority of pollutant inputs in the 'first flush', subsequent SuDS components are assumed to have half the efficiency quoted. A factor of 0.5 is used to account for the reduced performance of secondary (or more) components associated with already reduced inflow concentrations

8.1.3 Assessment Inputs

8.1.3.1 The routine runoff and accidental spillage risk assessment parameters (and sources) for the two outfalls to the Swine Burn are provided in Table TA6.1.2 and Table TA6.1.3. The cumulative assessment inputs are provided in Table TA6.1.4.

Table TA6.1.2: M9 Junction Eastbound Outfall

Parameter	Value	Source
Receiving Watercourse	Swine Burn	
Assessment (outfall) location	309634, 675880	Scheme drainage design
AADT (vehicles/day) (range)	>10,000 and <50,000	Scheme design year 2037 (Sweco traffic model)
AADT (vehicles/day)	Slip roads: 7,100 Roundabout: 10,800 Side roads: 10,800	
%HGV	Slip roads: 14.5 Roundabout: 14.5 Side roads: 10	
Climatic Region	Colder Dry	HAWRAT Help Manual v1.0 (2009)
Rainfall Site	Edinburgh (SAAR 676.2mm)	
Low flow (Q95) (m^3/s)	0.012	Wallingford HydroSolutions (WHS) software
Baseflow Index (BFI)	0.398	Flood Estimation Handbook (FEH) website catchment descriptors
Impermeable road area drained (ha)	1.412	Scheme drainage design
Permeable area drained (ha)	0	Precautionary approach to assume 'zero'
Length of road drainage to outfall (m)	Slip roads: 641 Roundabout: 138 Side roads: 271	Scheme drainage design
Is the discharge in or within 1km upstream of a protected site for conservation?	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	No	Fishery pond and Humbie Reservoir downstream but not assumed to restrict flow/reduce velocity
Hardness	Low (<50mg $CaCO_3$/l)	No site data, low hardness is worst-case (precautionary)
Estimated river width at Q95 (m)	4	Channel cross-section data
Existing treatment of solubles (%)	0	Assume no existing treatment or attenuation (worst-case)
Existing attenuation (l/s)	Unlimited	
Existing settlement of sediments (%)	0	
Proposed treatment of solubles (%)	65	2 levels of treatment – filter drains and detention basin (indicative
Proposed attenuation (l/s)	6.6	

Table TA6.1.2: M9 Junction Eastbound Outfall		
Parameter	**Value**	**Source**
Proposed settlement of sediments (%)	65	pollution mitigation indices from DMRB HD45/09). Outflow from SuDS restricted to the Greenfield (1 in 2 year) runoff rate.

Table TA6.1.3: M9 Junction Westbound Outfall		
Parameter	**Value**	**Source**
Receiving Watercourse	Swine Burn	
Assessment (outfall) location	309530 675839	Scheme drainage design
AADT (vehicles/day) (range)	>10,000 and <50,000	Scheme design year 2037 (Sweco traffic model)
AADT (vehicles/day)	Slip roads: 7,200 Roundabout: 16,300 Side roads: 18,200	
%HGV	Slip roads: 14.5 Roundabout: 14.5 Side roads: 14.5	
Climatic Region	Colder Dry	HAWRAT Help Manual v1.0 (2009)
Rainfall Site	Edinburgh (SAAR 676.2mm)	
Low flow (Q95) (m^3/s)	0.012	Wallingford HydroSolutions (WHS) software
Baseflow Index (BFI)	0.398	FEH catchment descriptors
Impermeable road area drained (ha)	1.186	Scheme drainage design
Permeable area drained (ha)	0	Precautionary approach to assume 'zero'
Length of road drainage to outfall (m)	Slip roads: 809 Roundabout: 140 Side roads: 140	Scheme drainage design
Is the discharge in or within 1km upstream of a protected site for conservation?	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	No	Fishery pond and Humbie Reservoir downstream but not assumed to restrict flow/reduce velocity
Hardness	Low (<50mg $CaCO_3$/l)	No site data, low hardness is worst-case (precautionary)
Estimated river width at Q95 (m)	4	Cross-section data for flood modelling
Existing treatment of solubles (%)	0	Assume no existing treatment or attenuation (worst-case)
Existing attenuation (l/s)	Unlimited	
Existing settlement of sediments (%)	0	

Table TA6.1.3: M9 Junction Westbound Outfall		
Parameter	**Value**	**Source**
Proposed treatment of solubles (%)	65	2 levels of treatment – filter drains and detention basin (indicative pollution mitigation indices from DMRB HD45/09). Outflow from SuDS restricted to the Greenfield (1 in 2 year) runoff rate.
Proposed attenuation (l/s)	5.5	
Proposed settlement of sediments (%)	65	

Table TA6.1.4: M9 Junction In-Combination Outfall Assessment		
Parameter	**Value**	**Source**
Receiving Watercourse	Swine Burn	
Assessment (outfall) location	309634, 675880	Scheme drainage design
AADT (vehicles/day) (range)	>10,000 and <50,000	Scheme design year 2037 (Sweco traffic model)
AADT (vehicles/day)	Slip roads: 7,200 Roundabout: 16,300 Side roads: 18,200	
%HGV	Slip roads: 14.5 Roundabout: 14.5 Side roads: 14.5	
Climatic Region	Colder Dry	HAWRAT Help Manual v1.0 (2009)
Rainfall Site	Edinburgh (SAAR 676.2mm)	
Low flow (Q95) (m^3/s)	0.012	Wallingford HydroSolutions (WHS) software
Baseflow Index (BFI)	0.398	FEH catchment descriptors
Impermeable road area drained (ha)	(1.186+1.412) = 2.598	Scheme drainage design
Permeable area drained (ha)	0	Precautionary approach to assume 'zero'
Length of road drainage to outfall (m)	Slip roads: 1,450 Roundabout: 278 Side roads: 411	Scheme drainage design
Is the discharge in or within 1km upstream of a protected site for conservation?	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	No	Fishery pond and Humbie Reservoir downstream but not assumed to restrict flow/reduce velocity
Hardness	Low (<50mg $CaCO_3$/l)	No site data, low hardness is worst-case (precautionary)
Estimated river width at Q95 (m)	4	Cross-section data for flood modelling
Existing treatment of solubles (%)	0	Assume no existing treatment or attenuation (worst-case)
Existing attenuation (l/s)	Unlimited	

Table TA6.1.4: M9 Junction In-Combination Outfall Assessment		
Parameter	**Value**	**Source**
Existing settlement of sediments (%)	0	
Proposed treatment of solubles (%)	65	2 levels of treatment – filter drains and detention basin (indicative pollution mitigation indices from DMRB HD45/09). Outflow from SuDS restricted to the Greenfield (1 in 2 year) runoff rate.
Proposed attenuation (l/s)	6.6	
Proposed settlement of sediments (%)	65	

8.1.4 Calculation Sheets (Outputs)

8.1.4.1 The routine runoff output tables and accidental spillage calculation sheets are provided in Table TA6.1.5 to TA6.1.10, and the results are summarised in Chapter 6: Road Drainage and Water Environment in Volume 2.

Table TA6.1.5: Routine Runoff Assessment – M9 Junction Eastbound Outfall

Summary of predictions

Prediction of Impact	Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact: Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Step1										
Step2										
Step3										

DETAILED RESULTS

In Runoff

Step 1

	Copper RST24	Zinc RST24	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
			Toxicity Threshold							
Allowable Exceedances/year	1	1	1	1	1	1	1	1	1	1
No. of exceedances/year	24.90	37.40	46.40	77.20	1.30	39.00	90.70	39.00	17.80	74.30
No. of exceedances/worst year	33	46	52	88	4	42	105	42	24	88
	RST6									
Allowable Exceedances/year	1	1								
No. of exceedances/year	4.60	10.30								
No. of exceedances/worst year	8	18								
	(ug/l)	(ug/l)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Thresholds RST24	21	60	Toxicity 197	315	3.5	16770	875	2355	245	515
Thresholds RST6	42	120								
Event Statistics Mean	15.02	55.76	219	819	1	15606	2700	2591	165	730
90%ile	28.66	112.55	529	1987	1	28184	4876	4679	299	1319
95%ile	37.01	154.77	679	2673	2	35481	6138	5890	376	1661
99%ile	60.95	329.68	975	4718	4	89125	15419	14795	945	4171

In River (no mitigation)

Step 2

	Copper RST24	Zinc RST24
Allowable Exceedances/year	2	2
No. of exceedances/year	0	0.1
No. of exceedances/worst year	0	1
No. of exceedances/summer	0	0.1
No. of exceedances/worst summer	0	1
	RST6	
Allowable Exceedances/year	1	1
No. of exceedances/year	0	0
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.05	0.21
	(ug/l)	(ug/l)
Thresholds RST24	21	60
Thresholds RST6	42	120
Event Statistics Mean	0.22	0.91
90%ile	0.58	1.94
95%ile	1.01	3.49
99%ile	2.79	13.43

Step 2

Velocity 0.01 m/s — Tier 1 is used for the calculation

DI 60.07

% settlement needed 0 %

In River (with mitigation)

Step 3

	Copper RST24	Zinc RST24
Allowable Exceedances/year	2	2
No. of exceedances/year	0.00	0.00
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
	RST6	
Allowable Exceedances/year	1	1
No. of exceedances/year	0.00	0.00
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.02	0.07
	(ug/l)	(ug/l)
Thresholds thresholds RST24	21	60
Thresholds RST6	42	120
Event Statistics Mean	0.08	0.31
90%ile	0.20	0.68
95%ile	0.35	1.22
99%ile	0.93	4.70

DI 21.02

Details of the chosen rainfall site	
SAAR (mm)	676.2
Altitude (m)	57
Easting	3254
Northing	6733
Coastal distance (km)	3.4

Table TA6.1.6: Routine Runoff Assessment – M9 Junction Westbound Outfall

Summary of predictions

Prediction of impact		Soluble - Acute Impact		Sediment - Chronic Impact					
		Copper	Zinc	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
	Step1										
	Step2										
	Step3										

DETAILED RESULTS

In Runoff

Step 1

	Copper	Zinc
RST24		
Allowable Exceedances/year	1	1
No. of exceedances/year	24.90	37.40
No. of exceedances/worst year	33	46
RST6		
Allowable Exceedances/year	1	1
No. of exceedances/year	4.60	10.30
No. of exceedances/worst year	8	18
	(ug/l)	(ug/l)
Thresholds RST24	21	60
Thresholds RST6	42	120
Event Statistics Mean	15.02	55.76
90%ile	28.66	112.55
95%ile	37.01	154.77
99%ile	60.95	329.68

Step 1

	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
					Toxicity Threshold			
Allowable Exceedances/year	1	1	1	1	1	1	1	1
No. of exceedances/year	46.40	77.20	1.30	39.00	90.70	39.00	17.80	74.30
No. of exceedances/worst year	52	88	4	42	105	42	24	88
	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245	515
Mean	219	819	1	15606	2700	2591	165	730
90%ile	529	1987	1	28184	4876	4679	299	1319
95%ile	679	2673	2	35481	6138	5890	376	1661
99%ile	975	4718	4	89125	15419	14795	945	4171

In River (no mitigation)

Step 2

	Copper	Zinc
RST24		
Allowable Exceedances/year	2	2
No. of exceedances/year	0	0
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
RST6		
Allowable Exceedances/year	1	1
No. of exceedances/year	0	0
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.04	0.18
	(ug/l)	(ug/l)
Thresholds RST24	21	60
Thresholds RST6	42	120
Event Statistics Mean	0.19	0.78
90%ile	0.49	1.64
95%ile	0.86	2.98
99%ile	2.40	11.41

Step 2

Velocity 0.01 m/s — Tier 1 is used for the calculation

DI 50.45

% settlement needed 0 %

In River (with mitigation)

Step 3

	Copper	Zinc
RST24		
Allowable Exceedances/year	2	2
No. of exceedances/year	0.00	0.00
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
RST6		
Allowable Exceedances/year	1	1
No. of exceedances/year	0.00	0.00
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.01	0.06
	(ug/l)	(ug/l)
Thresholds hresholds RST24	21	60
Thresholds RST6	42	120
Event Statistics Mean	0.06	0.26
90%ile	0.17	0.57
95%ile	0.30	1.04
99%ile	0.80	3.99

DI 17.66

Details of the chosen rainfall site

SAAR (mm)	676.2
Altitude (m)	57
Easting	3254
Northing	6733
Coastal distance (km)	3.4

Table TA6.1.7: Routine Runoff Assessment – M9 Junction In-Combination Outfall Assessment

Summary of predictions

Prediction of impact	Soluble - Acute Impact		Sediment - Chronic Impact							
	Copper	Zinc	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Step1										
Step2										
Step3										

DETAILED RESULTS

In Runoff

Step 1

	Copper	Zinc	Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
	RST24		Toxicity Threshold							
Allowable Exceedances/year	1	1	1	1	1	1	1	1	1	1
No. of exceedances/year	24.90	37.40	46.40	77.20	1.30	39.00	90.70	39.00	17.80	74.30
No. of exceedances/worst year	33	46	52	88	4	42	105	42	24	88
	RST6									
Allowable Exceedances/year	1	1								
No. of exceedances/year	4.60	10.30								
No. of exceedances/worst year	8	18								
	(ug/l)	(ug/l)	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Thresholds *RST24*	21	60	*Toxicity* 197	315	3.5	16770	875	2355	245	515
Thresholds *RST6*	42	120								
Event Statistics Mean	15.02	55.76	219	819	1	15606	2700	2591	165	730
90%ile	28.66	112.55	529	1987	1	28184	4876	4679	299	1319
95%ile	37.01	154.77	679	2673	2	35481	6138	5890	376	1661
99%ile	60.95	329.68	975	4718	4	89125	15419	14795	945	4171

In River (no mitigation)

Step 2

	Copper	Zinc
	RST24	
Allowable Exceedances/year	2	2
No. of exceedances/year	0	0.1
No. of exceedances/worst year	0	1
No. of exceedances/summer	0	0.1
No. of exceedances/worst summer	0	1
	RST6	
Allowable Exceedances/year	1	1
No. of exceedances/year	0	0
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.09	0.37
	(ug/l)	(ug/l)
Thresholds *RST24*	21	60
Thresholds *RST6*	42	120
Event Statistics Mean	0.37	1.52
90%ile	1.05	3.50
95%ile	1.79	6.01
99%ile	4.21	23.71

Step 2

Velocity 0.01 m/s — Tier 1 is used for the calculation

DI 110.52

% settlement needed 10 %

In River (with mitigation)

Step 3

	Copper	Zinc
	RST24	
Allowable Exceedances/year	2	2
No. of exceedances/year	0.00	0.00
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
	RST6	
Allowable Exceedances/year	1	1
No. of exceedances/year	0.00	0.00
No. of exceedances/worst year	0	0
No. of exceedances/summer	0	0
No. of exceedances/worst summer	0	0
Annual average concentration (ug/l)	0.03	0.13
	(ug/l)	(ug/l)
Thresholds hresholds *RST24*	21	60
Thresholds *RST6*	42	120
Event Statistics Mean	0.13	0.50
90%ile	0.36	1.17
95%ile	0.62	2.05
99%ile	1.41	7.74

DI 38.68

Details of the chosen rainfall site	
SAAR (mm)	676.2
Altitude (m)	57
Easting	3254
Northing	6733
Coastal distance (km)	3.4

Table TA6.1.8: Spillage Risk Assessment – M9 Junction Eastbound Outfall

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

		A (main road)	Additional columns for use if other roads drain to the same outfall: B	C	D	E	F	Totals	Return Period (years)
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse					
D2	Length of road draining to outfall *(m)*	641	271	138					
D3	Road Type *(A-road or Motorway)*	M	A	M					
D4	If A road, is site urban or rural?	Rural	Rural	Rural					
D5	Junction type	Slip road	Side road	Roundabout					
D6	Location	< 1 hour	< 1 hour	< 1 hour					
D7	Traffic flow (AADT two way)	7,100	10,800	10,800					
D8	% HGV	14.5	10	14.5					
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.43	0.93	3.09					
D9	Risk of accidental spillage	0.00010	0.00010	0.00024	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60					
D11	Risk of pollution incident	0.00006	0.00006	0.00015	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**					
D13	Return period without pollution reduction measures	0.00006	0.00006	0.00015	0.00000	0.00000	0.00000	0.0003	3731
D14	Existing measures factor	1	1	1					
D15	Return period with existing pollution reduction measures	0.00006	0.00006	0.00015	0.00000	0.00000	0.00000	0.0003	3731
D16	Proposed measures factor	0.35	0.35	0.35					
D17	Residual with proposed Pollution reduction measures	0.00002	0.00002	0.00005	0.00000	0.00000	0.00000	0.0001	10661

Justification for choice of existing measures factors:

Limited existing treatment on M9 (assume none - precautionary approach)

Justification for choice of proposed measures factors:

Two levels of treatment (filter drains and detention basin)

Table D1

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

Table 7.1

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Table TA6.1.9: Spillage Risk Assessment – M9 Junction Westbound Outfall

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

		A (main road)	Additional columns for use if other roads drain to the same outfall: B	C	D	E	F	Totals	Return Period (years)
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse					
D2	Length of road draining to outfall *(m)*	809	140	140					
D3	Road Type *(A-road or Motorway)*	M	A	M					
D4	If A road, is site urban or rural?	Rural	Rural	Rural					
D5	Junction type	Slip road	Side road	Roundabout					
D6	Location	< 1 hour	< 1 hour	< 1 hour					
D7	Traffic flow (AADT two way)	7,200	18,200	16,300					
D8	% HGV	14.5	14.5	14.5					
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.43	0.93	3.09					
D9	Risk of accidental spillage	0.00013	0.00013	0.00037	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60					
D11	Risk of pollution incident	0.00008	0.00008	0.00022	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**					
D13	Return period without pollution reduction measures	0.00008	0.00008	0.00022	0.00000	0.00000	0.00000	0.0004	2641
D14	Existing measures factor	1	1	1					
D15	Return period with existing pollution reduction measures	0.00008	0.00008	0.00022	0.00000	0.00000	0.00000	0.0004	2641
D16	Proposed measures factor	0.35	0.35	0.35					
D17	Residual with proposed Pollution reduction measures	0.00003	0.00003	0.00008	0.00000	0.00000	0.00000	0.0001	7545

Justification for choice of existing measures factors:

Limited existing treatment on M9 (assume none - precautionary approach)

Justification for choice of proposed measures factors:

Two levels of treatment (filter drains and detention basin)

Table D1

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

Table 7.1

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Table TA6.1.10: Spillage Risk Assessment – M9 Junction In-Combination Outfall Assessment

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

		A (main road)	B	C	D	E	F	Totals	Return Period (years)
			Additional columns for use if other roads drain to the same outfall						
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse					
D2	Length of road draining to outfall *(m)*	1,450	411	278					
D3	Road Type *(A-road or Motorway)*	M	A	M					
D4	If A road, is site urban or rural?	Rural	Rural	Rural					
D5	Junction type	Slip road	Side road	Roundabout					
D6	Location	< 1 hour	< 1 hour	< 1 hour					
D7	Traffic flow (AADT two way)	7,200	18,200	16,300					
D8	% HGV	14.5	14.5	14.5					
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.43	0.93	3.09					
D9	Risk of accidental spillage	0.00024	0.00037	0.00074	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60					
D11	Risk of pollution incident	0.00014	0.00022	0.00044	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**					
D13	Return period without pollution reduction measures	0.00014	0.00022	0.00044	0.00000	0.00000	0.00000	0.0008	1237
D14	Existing measures factor	1	1	1					
D15	Return period with existing pollution reduction measures	0.00014	0.00022	0.00044	0.00000	0.00000	0.00000	0.0008	1237
D16	Proposed measures factor	0.35	0.35	0.35					
D17	Residual with proposed Pollution reduction measures	0.00005	0.00008	0.00016	0.00000	0.00000	0.00000	0.0003	3536

Justification for choice of existing measures factors:

Limited existing treatment on M9 (assume none - precautionary approach)

Justification for choice of proposed measures factors:

Two levels of treatment (filter drains and detention basin)

Table D1

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

Table 7.1

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

The worksheet should be read in conjunction with DMRB 11.3.10.