A66 Northern Trans-Pennine Project
TR010062

3.4 Environmental Statement Appendix 14.3 Water Quality Assessment

APFP Regulations 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 3

June 2022

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A66 Northern Trans-Pennine Project Development Consent Order 202x

3.4 ENVIRONMENTAL STATEMENT APPENDIX 14.3 WATER QUALITY ASSESSMENT

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010062
Application Document Reference	3.4
Author:	A66 Northern Trans-Pennine Project Team, National Highways

Version	Date	Status of Version
Rev 1	13/06/22	DCO Application

CONTENTS

14.3 Water quality assessment

14.3.1 Purpose of this assessment

14.3.1.1 This document summarises the assessment of potential impacts to surface water and groundwater quality as a result of the Project's proposed operational drainage. These assessments have been undertaken in accordance with *Design Manual for Roads and Bridges (DMRB) LA 113 Road Drainage and the Water Environment (DMRB LA 113)* (Highways England, 2020)[1].

14.3.1.2 Details of the drainage strategy and outfalls are within ES Appendix 14.2: Flood Risk Assessment and Outline Drainage Strategy (Application Document 3.4). Locations of outfalls are also shown on ES Figure 14.1: Surface Water Features (Application Document 3.3).

14.3.2 Assessment of pollution impacts from routine runoff on surface water

Introduction

14.3.2.1 The assessment of potential effects from routine runoff on surface water quality has been undertaken using the Highways England Water Risk Assessment Tool (HEWRAT), as detailed in *DMRB LA 113*.

14.3.2.2 The Environment Agency has approved the method of assessment used by HEWRAT and has agreed that the outputs from the tool can be used to undertake an assessment of the potential impacts on surface water quality.

Methodology

14.3.2.3 HEWRAT adopts the following tiered approach:

- Step 1: Runoff quality. This predicts concentrations of pollutants in untreated and undiluted highway runoff prior to any treatment and dilution in a water body
- Step 2: In-river impacts. This predicts acute (runoff specific thresholds (RST)) and chronic (Environmental Quality Standards (EQS)) concentrations of pollutants after mixing within the receiving water body. At this stage, the ability of the receiving watercourse to disperse sediments is considered and, if sediment is predicted to accumulate, the potential extent of sediment coverage (i.e., the deposition index (DI)) is also considered.
  Step 2 incorporates two 'tiers' of assessment for sediment accumulation, based on different levels of input parameters. If one or more risks are defined as unacceptable at Tier 1, i.e., 'fail', then a more detailed Tier 2 assessment is undertaken, requiring values for further parameters relating to the physical dimensions of the receiving watercourse.

[1] Highways England (2020) Design Manual for Roads and Bridges LA 113 Road drainage and the water environment

- Step 3: In-river impacts with mitigation. Steps 1 and 2 assume that the road drainage system incorporates no mitigation measures to reduce the risk of pollution. Step 3 includes mitigation in the form of Sustainable Drainage Systems (SuDS), taking into account the risk reduction associated with any existing measures or any proposed new measures.

Cumulative assessment within HEWRAT

14.3.2.4 The cumulative impacts of the Project were calculated following *DMRB LA 113*. The combined effect of two outfalls discharging into the same watercourse within the same reach (distance between two outfalls into the same watercourse) are assessed by combining the contributing impermeable areas of the affected drainage basins.

14.3.2.5 For solutes, cumulative effects have been considered where proposed outfalls are within 1km of each other (stream length) and discharge into the same watercourse. For sediment, cumulative impacts have been considered where proposed outfalls are less than 100m apart.

Environmental quality assessments within HEWRAT

14.3.2.6 A long-term impact assessment of surface water runoff from the highway has been undertaken by comparing the annual average concentrations of copper and zinc predicted in the HEWRAT results with the Environmental Quality Standards (EQS) stated in the Water Framework Directive (WFD) (Standards and Classifications) Directions 2015. The WFD EQS standards stipulate 1µg/l for copper and 10.91µg/l for zinc (plus ambient background concentration) in freshwater.

14.3.2.7 The study area for the HEWRAT assessment encompasses all the watercourses that would receive road runoff from the project.

Input parameters

14.3.2.8 The parameters, methods of derivation and sources of information used in the assessment are listed in Table 1: Inputs used for the surface water quality assessment.

Table 1: Inputs used for the surface water quality assessment

Parameter	Information Source(s)
Two-way annual average daily traffic flow (AADT)	Figures taken from the Department for Transport (DfT) Road Accidents and Safety Statistics dataset (2019 - observed), using the STATS19 reporting system. Design year (2044) values were calculated in 3.07 Transport Assessment (see for details) and applied to the HEWRAT assessment process. The two-way Annual Average Daily Traffic (AADT) flow for the A66 mainline ranges from 27,000-47,000 (design year 2044). This falls within the 10,000-50,000 AADT range of the HEWRAT assessment.
Climatic conditions	Selected within HEWRAT. The scheme is within the ‘cold and wet’ region and with a standard average annual rainfall of 900mm (Penrith).

Parameter	Information Source(s)
Q95 (the water flow exceeded 95% of the time) of the receiving watercourse.	Catchment descriptors obtained from the Flood Estimation Handbook (FEH) web service and Q95 subsequently derived using the FEH LowFlows tool, the standard method for estimating Q95 in the absence of monitoring data. The estimated values were further sense-checked during site walkover observations.
Base flow index (BFI)	Obtained from the FEH web service and/or the National River Flow Archive for each catchment. This is a measure of the proportion of the flow in the watercourse that derives from groundwater.
Drainage areas	Impermeable area (e.g. highway) and permeable area (e.g. cutting/slope drainage) to each outfall has been calculated from the design models of the scheme.
Water hardness	Water hardness has been estimated using the Drinking Water Inspectorate Map for England and Wales. All watercourses have been deemed to have a medium water hardness, i.e., 50-200 $CaCO^3$ mg/l.
Ambient background concentration (µg/l) (dissolved copper)	Ambient background concentrations defaulted to 0 due to an absence of monitoring data. It is anticipated that this data will be acquired and applied to the detailed design screening round for HEWRAT.
Physical attributes of the receiving watercourse	Watercourse dimensions have been estimated based on the site walkovers.

14.3.2.9 Ambient background copper concentrations were not applied at this stage due to an absence of monitoring data for receiving watercourses within close proximity to the proposed outfalls. This data will be acquired and applied to the detail design screening round for HEWRAT. This commitment is recorded in Register of Environmental Actions and Commitments (REAC) within the EMP (Application Document 2.7)

14.3.2.10 Table 2: Input data for HEWRAT assessments lists the receiving watercourse, Q_{95} and drainage areas for each outfall on the new sections of highway for the Project and side roads.

Table 2: Input data for HEWRAT assessments

Outfall	Receiving watercourse	Q_{95} (m^3/s)	Impermeable area (ha)	Permeable area (ha)	Base flow index (BFI)
M6 Junction 40 to Kemplay Bank					
0101	Drain leading to River Eamont	0.056	0.81	0.12	0.39
0201	Drain leading to River Eamont	0.056	5.00	1.30	0.39
0202	Thacka Beck	0.007	1.40	0.21	0.39
Penrith to Temple Sowerby					
0301 0302	Light Water	0.017	3.73	1.656	0.5

Outfall	Receiving watercourse	Q_{95} (m^3/s)	Impermeable area (ha)	Permeable area (ha)	Base flow index (BFI)
0303	Tributary of River Eamont 3.3	0.02	1.74	0.57	0.39
0304	Tributary of River Eamont 3.5	0.003	1.20	1.13	0.39
0305 0306	Unnamed drain leading to tributary of River Eamont 3.6	0.003	1.371	1.157	0.37
0307	Swine Gill	0.012	3.82	1.17	0.37
Temple Sowerby to Appleby					
0401	Tributary of River Eden 4.0	0.001	1.04	0.90	0.37
0402	Tributary of Birk Sike 4.1	0.001	1.42	1.70	0.37
0403	Tributary of Birk Sike 4.2	0.001	1.36	1.92	0.37
0404	Tributary of Birk Sike 4.2	0.007	3.46	10.80	0.37
0405	Tributary of Birk Sike 4.2	0.001	0.90	1.84	0.37
0406	Tributary of Birk Sike 4.3	0.001	0.70	0.64	0.37
0407	Drainage ditch leading to Trout Beck	0.221	0.39	0.28	0.37
0408	Drainage ditch leading to Trout Beck	0.001	0.33	0.24	0.37
0409	Drainage ditch leading to Trout Beck	0.001	1.84	4.03	0.37
0410	Tributary of Trout Beck 4.6	0.221	5.40	4.46	0.37
0411	Trout Beck	0.227	0.94	2.39	0.37
0412	Tributary of Trout Beck 4.3	0.005	0.48	1.10	0.37
0413	Drainage ditch leading to Tributary of	0.001	1.50	1.71	0.37

Outfall	Receiving watercourse	Q_{95} (m^3/s)	Impermeable area (ha)	Permeable area (ha)	Base flow index (BFI)
	Trout Beck 4.2				
0414	Tributary of River Eden 4.2	0.221	0.91	2.31	0.37
0415	Tributary of River Eden 4.3	0.001	1.11	2.26	0.37
Appleby to Brough					
0601	Tributary of Mire Sike 6.4	0.001	2.00	1.00	0.5
0602	Tributary of Mire Sike 6.4	0.001	1.10	0.70	0.5
0603	Tributary of Mire Sike	0.001	2.40	1.60	0.5
0604	Tributary of Mire Sike 6.12	0.001	0.51	0.27	0.5
0605	Tributary of Mire Sike 6.12	0.001	1.80	0.85	0.5
0606	Tributary of Mire Sike 6.12	0.001	0.44	0.24	0.5
0607	Tributary of Mire Sike 6.12	0.001	1.63	0.98	0.5
0608	Tributary of Cringle Beck 6.3	0.001	2.10	0.49	0.5
0609	Lowgill Beck	0.019	0.19	0.10	0.37
0610	Crooks Beck	0.01	4.00	0.89	0.3
0611	Crooks Beck	0.01	0.20	0.10	0.3
0612	Lowgill Beck	0.002	0.556	0.21	0.3
0613	Lowgill Beck	0.002	0.31	0.16	0.3
0614	Lowgill Beck	0.002	4.18	0.90	0.3
0615	Lowgill Beck	0.002	0.409	0.11	0.3
0616	Lowgill Beck	0.009	0.212	0.17	0.3
0617	Woodend Sike	0.009	0.12	0.04	0.3
0618	Lowgill Beck	0.009	2.45	0.48	0.3
0619	Yosgill Sike	0.009	0.851	0.36	0.3

Outfall	Receiving watercourse	Q_{95} (m^3/s)	Impermeable area (ha)	Permeable area (ha)	Base flow index (BFI)
0620	Tributary of Lowgill Beck 6.7	0.001	0.688	0.19	0.5
Bowes Bypass					
0701	River Greta	0.113	2.71	1.75	0.22
0702	Tributary of River Greta 7.3	0.001	1.46	2.57	0.22
0703 0704	Tributary of River Greta 7.5	0.002	3.23	1.51	0.22
0705	Tributary of River Greta 7.5	0.0565	0.64	0.30	0.22
0706	Tributary of River Greta 7.6	0.001	2.19	1.16	0.22
0707	Tributary of River Greta 7.6	0.001	0.20	0.00	0.22
Cross Lanes to Rokeby					
0801	Tutta Beck	0.007	0.80	0.504	0.22
0802	Tutta Beck	0.007	0.61	0.22	0.22
0803	Tutta Beck	0.007	3.66	1.55	0.22
0804	Tributary of Tutta Beck	0.001	1.61	0.86	0.22
0805	Tutta Beck	0.007	4.095	2.86	0.22
0806	Tutta Beck	0.007	2.65	1.39	0.22
0807	Tutta Beck	0.007	1.61	0.86	0.22
0808	Tributary of Punders Gill 8.1	0.007	4.10	2.86	0.22
0809	Tutta Beck	0.007	2.65	1.39	0.22
Stephen Bank to Carkin Moor					
0901 0902	Tributary of Cottonmill Beck 9.1 & 9.3	0.021	2.60	2.23	0.22
0903	Tributary of Dalton Beck 9.1	0.003	2.82	-	0.35

Outfall	Receiving watercourse	Q_{95} (m^3/s)	Impermeable area (ha)	Permeable area (ha)	Base flow index (BFI)
0904	Tributary of Dalton Beck 9.2	0.001	1.25	0.70	0.35
0905	Tributary of Dalton Beck 9.3	0.0015	2.50	2.21	0.35
0906	Mains Gill	0.003	2.38	2.30	0.5
0909 0910	Tributary of Holme Beck 9.2	0.002	3.03	0.31	0.37
0911	Tributary of Hartforth Beck 1.1	0.001	0.31	0.21	0.5
0912	Mains Gill	0.003	0.69	3.14	0.5

14.3.2.11 The proposed discharge locations were screened against the location of protected areas (e.g. Sites of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC)). Outfall locations less than 1km upstream of a protected site require more stringent pollutant thresholds to be applied. There are 28 outfalls meeting this criterion:

- One for the M6 Junction 40 to Kemplay Bank scheme.
- Four for the Penrith to Temple Sowerby scheme.
- 11 for the Temple Sowerby to Appleby scheme.
- 12 for the Appleby to Brough scheme.

14.3.2.12 Locations of outfalls are shown on ES Figure 14.1: Surface Water Features (Application Document 3.3).

Results - without mitigation

14.3.2.13 All outfalls failed the step 1 assessment, which screens against AADT, climatic region, and standardised annual average rainfall (SAAR) only. Values for these criteria remain constant across every outfall across the project.

14.3.2.14 All outfalls passed the zinc – EQS soluble pollutant assessment at step 2. All other step 2 results (copper EQS soluble pollutant assessment, copper and zinc acute impact assessment, and sediment assessments) are a mix of passes and fails. Mitigation (treatment) is therefore required within the drainage design to reduce the soluble pollutant load. The detailed results of the Step 2 assessment are shown in Table 3: Summary of routine runoff assessments.

14.3.2.15 All outfalls are initially assessed individually. Where outfalls are situated within 100m and on the same river reach, they are cumulatively assessed for both solutes and sediment. Outfalls situated within 1000m and on the same river reach are also cumulatively assessed for solute (copper and zinc) pollutants. However, sediment assessment is excluded in these cases.

Table 3: Summary of routine runoff assessments

Basin Outfall	Step 2 HEWRAT result				
	Copper - Acute	Copper - EQS	Zinc - Acute	Zinc - EQS	Sediment
M6 Junction 40 to Kemplay Bank					
0101	Fail	Pass	Fail	Pass	Fail
0201	Fail	Fail	Fail	Pass	Fail
0202	Pass	Pass	Pass	Pass	Fail
Penrith to Temple Sowerby					
0301 0302	Pass	Pass	Pass	Pass	Fail
0303	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0304	Pass	Pass	Pass	Pass	Fail
0305 0306	Pass	Pass	Pass	Pass	Pass
0307	Pass	Pass	Pass	Pass	Pass
Temple Sowerby to Appleby					
0401	Pass	Pass	Pass	Pass	Fail
0402	Pass	Pass	Pass	Pass	Fail
0403	Pass	Pass	Pass	Pass	Fail
0404	Pass	Pass	Pass	Pass	Pass
0405	Pass	Pass	Pass	Pass	Pass
S0402 S0403 S0404 S0405	Fail	Fail	Fail	Pass	Not applicable - cumulative
0406	Pass	Pass	Pass	Pass	Fail
0407	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0408	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0409	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0410	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0411	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0412	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0413	Fail	Pass	Fail	Pass	Fail

Basin Outfall	Step 2 HEWRAT result				
	Copper - Acute	Copper - EQS	Zinc - Acute	Zinc - EQS	Sediment
0414	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
0415	Pass	Pass	Pass	Pass	Pass (Alert – protected area)
Appleby to Brough					
0601 0602	Fail	Fail	Fail	Pass	Fail
0603	Fail	Pass	Pass	Pass	Fail
0604	Pass	Pass	Pass	Pass	Fail
0605	Pass	Pass	Pass	Pass	Fail
0606	Pass	Pass	Pass	Pass	Pass
0607	Fail	Fail	Fail	Pass	Fail
0604 0605 0606 0607	Fail	Fail	Fail	Pass	Not applicable - cumulative
0608	Fail	Fail	Fail	Pass	Fail
0609	Fail	Fail	Fail	Pass	Fail
0610 0611	Pass	Pass	Pass	Pass	Fail
0612	Pass	Pass	Pass	Pass	Fail
0613	Pass	Pass	Pass	Pass	Pass
0614	Fail	Fail	Fail	Pass	Fail
0615	Pass	Pass	Pass	Pass	Pass
0612 0613 0614 0615	Fail	Fail	Fail	Pass	Not applicable - cumulative
0616	Pass	Pass	Pass	Pass	Pass
0617	Pass	Pass	Pass	Pass	Pass
0618	Pass	Pass	Pass	Pass	Pass
0619	Pass	Pass	Pass	Pass	Pass
0616 0617 0618 0619	Pass	Pass	Pass	Pass	Not applicable - cumulative
0620	Pass	Pass	Pass	Pass	Fail

Basin Outfall	Step 2 HEWRAT result				
	Copper - Acute	Copper - EQS	Zinc - Acute	Zinc - EQS	Sediment
Bowes Bypass					
0701	Pass	Pass	Pass	Pass	Pass
0702	Pass	Pass	Pass	Pass	Fail
0703 0704	Pass	Pass	Pass	Pass	Fail
0703 0704 0705	Pass	Pass	Pass	Pass	Not applicable - cumulative
0705	Pass	Pass	Pass	Pass	Pass
0706	Fail	Fail	Fail	Pass	Fail
0707	Pass	Pass	Pass	Pass	Pass
Cross Lanes to Rokeby					
0801	Pass	Pass	Pass	Pass	Pass
0802	Pass	Pass	Pass	Pass	Pass
0803	Pass	Pass	Pass	Pass	Pass
0804	Pass	Pass	Pass	Pass	Pass
0805	Pass	Pass	Pass	Pass	Pass
0806	Pass	Pass	Pass	Pass	Pass
0807	Pass	Pass	Pass	Pass	Pass
0808	Pass	Pass	Pass	Pass	Pass
0809	Pass	Pass	Pass	Pass	Pass
0801 0807 0809	Pass	Pass	Pass	Pass	Not applicable - cumulative
Stephen Bank to Carkin Moor					
0901 0902	Pass	Pass	Pass	Pass	Pass
0903	Pass	Pass	Pass	Pass	Fail
0904	Pass	Pass	Pass	Pass	Pass
0905	Fail	Fail	Fail	Pass	Fail
0906	Pass	Pass	Pass	Pass	Fail
0906 0912	Pass	Fail	Pass	Pass	Not applicable - cumulative
0909 0910	Fail	Pass	Pass	Pass	Fail
0911	Pass	Pass	Pass	Pass	Pass
0912	Pass	Pass	Pass	Pass	Pass

Embedded mitigation

14.3.2.16 A sensitivity test was undertaken using the HEWRAT model to identify the percentage mitigation required for each outfall to pass. The level of pollutant removal has been determined from the values listed in *DMRB CG 501 Design of highway drainage systems (CG 501)* (Highways England, 2020)[2] and is shown in Table 4: Indicative treatment efficiencies (from CG501, Table 8.6.4N3)

Table 4: Indicative treatment efficiencies (from CG501, Table 8.6.4N3)

Name of measure	Indicative treatment efficiencies		
	Suspended solids (% removal)	Dissolved copper (% removal)	Dissolved zinc (% removal)
Filter drains	60	0	45
Ditch (vegetated)	25	15	15
Swale/grassed surface water channel	80	50	50
Ponds (drainage basin - wet)	60	40	30
Infiltration basin/soakaway	100	100	100
Sediment trap (catchpit)*	X	X	X
Vortex grit separator	40	0	15

**DMRB CG 501* does not explicitly state a percentage value for sediment removal. CIRIA C609 acknowledges these will have some impact, although does not state a percentage value.

14.3.2.17 Pollution and flow control measures have been developed for the drainage systems to each outfall to ensure that the required treatment levels are met. A summary of these for each outfall are provided in Table 5: Summary of proposed treatment.

Table 5: Summary of proposed treatment

Outfall	Proposed treatment methods	Comment
0101	Pond, ditch (vegetated)	Sufficient pollution removal. (Alert - protected area)
0201	Pond, swale	Sufficient pollution removal. (Alert - protected area)
0202	Pond, ditch (vegetated)	Sufficient pollution removal. (Alert - protected area)
0301 0302	Pond	Sufficient pollution removal. (Alert - protected area)
0303	Pond	Sufficient pollution removal. (Alert - protected area)
0304	Pond, ditch (vegetated)	Sufficient pollution removal.

[2] Highways England (2020) Design Manual for Roads and Bridges CG 501 Design of highway drainage systems

Outfall	Proposed treatment methods	Comment
		(Alert - protected area)
0305 0306	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0307	Pond	Sufficient pollution removal.
0401	Pond, ditch (vegetated)	Sufficient pollution removal.
0402	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0403	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0404	Pond, ditch (vegetated)	Sufficient pollution removal.
0405	Pond, ditch (vegetated)	Sufficient pollution removal.
0406	Pond	Sufficient pollution removal. (Alert - protected area)
0407	Pond	Sufficient pollution removal. (Alert - protected area)
0408	Pond	Sufficient pollution removal.
0409	Pond, ditch (vegetated)	Sufficient pollution removal. (Alert - protected area)
0410	Pond	Sufficient pollution removal. (Alert - protected area)
0411	Pond	Sufficient pollution removal.
0412	Pond	Sufficient pollution removal.
0413	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0414	Pond	Sufficient pollution removal. (Alert - protected area)
0415	Pond, ditch (vegetated)	Sufficient pollution removal.
0601 0602	Pond, ditch (vegetated), vortex grit separator	Sufficient pollution removal.
0603	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0604	Pond, ditch (vegetated)	Sufficient pollution removal. (Alert - protected area)
0605	Pond, ditch (vegetated)	Sufficient pollution removal. (Alert - protected area)
0606	Pond	Sufficient pollution removal.
0607	Pond	Sufficient pollution removal. (Alert - protected area)
0608	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.

Outfall	Proposed treatment methods	Comment
0609	Pond	Sufficient pollution removal.
0610 0611	Pond, ditch (vegetated)	Sufficient pollution removal.
0612	Pond	Sufficient pollution removal. (Alert - protected area)
0613	Pond	Sufficient pollution removal.
0614	Pond, ditch (vegetated)	Sufficient pollution removal. (Alert - protected area)
0615	Pond	Sufficient pollution removal.
0616	Pond	Sufficient pollution removal.
0617	Pond, ditch (vegetated)	Sufficient pollution removal.
0618	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0619	Pond	Sufficient pollution removal.
0620	Pond	Sufficient pollution removal.
0701	Pond	Sufficient pollution removal.
0702	Pond, ditch (vegetated)	Sufficient pollution removal.
0703 0704	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0705	Pond, ditch (vegetated)	Sufficient pollution removal.
0706	Pond, ditch (vegetated)	Sufficient pollution removal.
0707	Ditch (vegetated)	Sufficient pollution removal.
0801	Pond	Sufficient pollution removal.
0802	Pond, ditch (vegetated)	Sufficient pollution removal.
0803	Pond	Sufficient pollution removal.
0804	Pond	Sufficient pollution removal.
0805	Pond, ditch (vegetated)	Sufficient pollution removal.
0806	Pond, ditch (vegetated)	Sufficient pollution removal.
0807	No additional measures required.	Sufficient pollution removal.
0808	No additional measures required.	Sufficient pollution removal.
0809	No additional measures required.	Sufficient pollution removal.
0901 0902	Pond	Sufficient pollution removal.
0903	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0904	Ditch (vegetated)	Sufficient pollution removal.
0905	Vortex grit separator, pond, ditch (vegetated)	Sufficient pollution removal.
0906	Pond	Sufficient pollution removal.

Outfall	Proposed treatment methods	Comment
0909 0910	Vortex grit separator, pond, ditch (vegetated ditch)	Sufficient pollution removal.
0911	Pond, ditch (vegetated)	Sufficient pollution removal.
0912	Pond	Sufficient pollution removal.

Results - with mitigation

14.3.2.18 All networks on the Project include a basin (wet pond) along with at least one other pollution control measure - with the exception of outfalls S07-07, S08-07, S08-08, and S08-09, which drain minor access/slip road catchments, and S09-04 which is a minor realignment of existing A66. Due to local spatial and gradient constraints, basins in these locations were not feasible. However, all outfalls passed HEWRAT screening at step 2 without the need for mitigation, due to the high Q_{95} value of the receiving beck and the small impermeable area draining to these outfalls.

14.3.2.19 Catchments with high '% Treatment Required' and no swale / grassed surface water channel (SWC), require additional pollution control measures to meet the required removal percentage for sediment. Vortex grit separators have been proposed as an additional measure at these locations. With these additional measures, all outfalls pass HEWRAT assessment for solutes and sediment.

14.3.2.20 Further additional treatment is proposed in the form of a sediment forebay within all network drainage basins, as well as catchpits at every outfall, to effectively remove sediment and pollutants. The forebay design would be developed at the detailed design stage.

14.3.2.21 Note also that tier 2 sediment assessment, which accounts for riverbed width, bank slope, and Manning's values, has not been run at this stage. Tier 2 results provide more accurate outputs and negate the need for conservative estimates, which is anticipated to produce more favourable and more accurate HEWRAT screening results. Additional HEWRAT screening will take place during detailed design and will include tier 2 sediment assessments.

14.3.2.22 This surface water quality assessment is based on a precautionary assumption that no infiltration would take place within the drainage systems and at the drainage basins. However, when the ground investigation is complete, there would potentially be opportunities to introduce infiltration techniques and optimise the drainage basin designs. Infiltration would improve the pollutant removal performance of the highway drainage systems.

14.3.2.23 The exact type and configuration of the drainage basins at each location will therefore be determined at detailed design, when the preferred maintenance regime of the adopting bodies would also be confirmed.

14.3.3 Assessment of pollution impacts from routine runoff on groundwater

Introduction

14.3.3.1 An assessment of pollution impacts from routine runoff to groundwater has also been undertaken using HEWRAT, following the guidance in *DMRB LA 113*.

14.3.3.2 This risk assessment procedure is based on the study of the source-pathway-receptor pollutant linkage principal, whereby the:

- Source comprises the road drainage water with any pollutants contained therein, as it enters any unlined ditch, watercourse or soakaway discharge system, that has the potential to transmit water through the ground to groundwater.
- Pathway represents the processes, which may modify the pollutants during transmission through the discharge system and soil and subsoil until the actual 'point of entry' to groundwater (this includes the unsaturated zone).
- Receptor is groundwater.

14.3.3.3 For there to be a risk of impact to the receiving environment, all elements of the source-pathway-receptor model must be present to for there to be a pollutant linkage.

Methodology

14.3.3.4 The drainage solution for the scheme includes drainage basins, all of which discharge to surface watercourses but may also infiltrate to groundwater, pending completion of detailed ground investigations. The drainage basins are situated at various points along the scheme and for the purposes of the assessment, are assumed to act as soakaways as a worst case for groundwater impact.

14.3.3.5 The assessment determines an overall risk score by incorporating the key factors affecting the level of risk posed by the source of pollutants, the persistence and movement of pollutants within the pathway to groundwater and linkages between them. In this way, the matrix provides a means of ranking specific road drainage discharge sites in terms of their potential risks to groundwater.

14.3.3.6 All assessment data is derived from ES Appendix 14.6 Hydrogeological Impact Assessment (Application Document 3.4) and ES Chapter 9: Geology and soils (Application Document 3.2).

Results

14.3.3.7 Table 6: Overall risk scores summarises the results of the groundwater assessment. The risk scores range from 190 to 205, within the 150 to 250 suggested action class range, which indicates there is a medium risk of impact.

Table 6: Overall risk scores

	Weighting factor	Property or parameter	Site data	Risk score	Component score
Source	10	Traffic flow	<=50,000	Low	10
	10	Rainfall depth (annual averages)	>740 to <1060mm	Medium	20
	10	Drainage area ratio	<=50	Low	10
Pathway	15	Infiltration method	Region	Medium	30
	20	Unsaturated Zone	Depth to water table <=5m	High	60
	20	Flow Type	Mixed fracture and intergranular flow	Medium	40
	5	Unsaturated zone clay content	Ranges from <15% to >15% along scheme	Low, Medium	5, 10
	5	Organic carbon	Ranges from <1% to >15% along the scheme	Low, Medium, High	5, 10, 15
	5	Unsaturated zone soil pH	5 to 8	Medium	10
Overall risk score				Medium	Min = 190 Max = 205

Mitigation

14.3.3.8 *DMRB LA 113* states that where a medium risk of impact is indicated, a detailed assessment is required to be undertaken by a competent expert.

14.3.3.9 The detailed assessment would be undertaken at the detailed design stage for those basins that are identified as susceptible to groundwater infiltration. This would be supported by further site-specific tests, such as infiltration rate through the ground. Ground conditions specific to the drainage basin locations would also be ascertained through further ground investigation.

14.3.3.10 The specific groundwater infiltration mitigation measures required in the design of surface water drainage systems and drainage basins would therefore be refined at detailed design. This could include measures to separate carriageway drainage systems from groundwater, the lining of drainage basins, and limitations on the disposal of surface water though infiltration to groundwater.

14.3.3.11 Where required, the detailed assessment would incorporate mitigation measures to reduce any identified risks to a suitable level. Should this be required, appropriate mitigation will be identified and incorporated into the design to ensure a reduced risk to receiving water bodies during operation. Therefore, no significant effect is predicted.