West Winch Housing Access Road

Environmental Statement Chapter 11: Water Environment Appendix 11.2: Drainage Network Water Quality Assessment

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Glossary of Abbreviations and Defined Terms

The definition of key terms used in this report are provided below. These definitions have been developed by reference to the definitions used in EU and UK legislation and guidance relevant to the water environment as well as professional judgement based on knowledge and experience of similar schemes in the context of the Proposed Scheme.

Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic flow
BFI	Base Flow Index
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standards
FEH	Flood Estimation Handbook
HA DDMS	National Highway's Drainage Data Management System
HEWRAT	Highways England Water Risk Assessment Tool
HGV	Heavy Goods Vehicle
LiDAR	Light Detection and Ranging
NCC	Norfolk County Council
WFD	Water Framework Directive

Glossary

Term	Definition
Annual Average Daily Traffic flow	The average number of vehicles passing a point in the road network each day over a full year.
Attenuation Basin	Areas of storage that provide flow control through attenuation of stormwater runoff. They also facilitate some settling of particulate pollutants.

Term	Definition
Base Flow Index	A measure of the proportion of the river flow that derives from the baseflow (contains groundwater flow and flow from other delayed sources).
Environmental Impact Assessment	A procedure that must be followed for certain types of projects before they can be given 'development consent'. The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects.
Environmental Quality Standards	Published parameters in the Water Framework Directive for polluting substances. If these standards are exceeded, they could result in adverse effects to ecosystems.
Filter Drain	A linear drain consisting of a trench filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage.
Highways England Water Risk Assessment Tool	A Microsoft Excel application which has been developed to assess the acute and chronic pollution impacts to the receiving watercourses and groundwater.
National Highway's Drainage Data Management System	Provides technical information about the location and condition of drainage infrastructure on National Highway's network.
Outfall	A point of discharge into a watercourse.
Principal Aquifer	Have the potential to provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands.
Proposed Scheme	The proposed West Winch Housing Access Road scheme.
Q95 flow	The flow in cubic metres per second which was equalled or exceeded for 95% of the flow record. The Q95 flow is a commonly used low flow parameter particularly relevant in the assessment of river water quality consent conditions.

Term	Definition
Sediment Forebay	An area designed to slow surface water runoff and facilitate the gravity separation of suspended solids.
Superficial Deposits	The youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 2.6 million years from the present.
Surface Water Drainage Strategy	Demonstrates how surface water will be managed within a scheme so it does not increase flood risk elsewhere, how the scheme is compliant with the relevant legislation and manages risks to water quality.

1 Introduction

1.1 Purpose of the assessment

1.1.1 WSP UK Limited (hereafter referred to as 'WSP') has been commissioned by Norfolk County Council (NCC 'the Applicant') to undertake an Environmental Impact Assessment (EIA) for the Proposed Scheme. To support **Chapter 11: Water Environment** of the Environmental Statement, impacts to water quality need to be assessed. This document summarises the methodology and results of the water quality assessment carried out to fulfil the simple assessment methodology defined within the Design Manual for Roads and Bridges (DMRB) (LA 113) (**Ref. 1.1**).

1.1.2 The Proposed Scheme would increase the impermeable road surface area and alter the current traffic flow regime through the creation of the new access road. These changes have the potential to impact the volume and quality of surface water runoff. The purpose of the assessment is to assess the potential impacts associated with the chemical quality of the receiving waterbodies and to assess the impact of the proposed mitigation measures within the surface water drainage strategy.

1.1.3 The assessment focusses on the potential risks associated with the operational phase of the Proposed Scheme and does not consider any potential risks during the construction phase. The potential impacts to the chemical quality of surface water features during the construction phase are assessed within **Chapter 11: Water Environment** of the Environmental Statement.

1.2 Project Overview

1.2.1 The Proposed Scheme would allow for access and egress to the proposed housing developments within land immediately to the east of West Winch village. The Proposed Scheme is located between the A47 (northern extent) and the A10 (southern extent), crossing a number of agricultural land parcels

and will provide a link between the A47, to the north, and A10, to the south and comprises the following elements:

- 3.5km of new single lane access road;
- A new roundabout junction between the new access road and the A47 trunk road;
- A new roundabout junction between the new access road and the A10 at the southern end of the Proposed Scheme; and
- Dualling of the A47 to the north of the existing highway alignment between the new access road and the A10 / A47 Hardwick Interchange junction.

1.2.2 A summary of the proposed drainage strategy is provided in **Section 2** of this report.

1.3 Study Area

1.3.1 The spatial scope of this assessment encompasses surface water features that are proposed to receive surface water runoff from the new outfalls as part of the surface water drainage strategy and surface water features approximately 1km downstream from the proposed outfalls.

1.4 Methodology

1.4.1 This simple assessment of impacts to water quality is defined by the methodology set out in the DMRB LA 113 (**Ref. 1.1**). Impacts to surface water receptors have been considered in this assessment, with consideration given to effects of routine runoff and risk of a potentially polluting spillage event.

1.4.2 The Highways England Water Risk Assessment Tool (HEWRAT) has been used to determine the potential effect of routine runoff on receiving watercourses. This is the simple assessment method provided in the DMRB which considers several factors including impermeable road area, and low flows and dimensions of the receiving watercourse. The HEWRAT has been

used to assess all new outfalls as part of the Proposed Scheme. The HEWRAT assesses the likely quality of scheme-generated surface water runoff against the Environmental Quality Standards (EQS) given in the Water Framework Directive (WFD) and stated in the Environment Agency's guidance for surface water pollution risk assessments (**Ref. 1.2**) as well as determining chronic impacts from sedimentation and acute impacts from copper and zinc solubles. The results of this assessment are summarised in **Section 3**.

1.4.3 Impacts of routine road runoff on the quality of the underlying groundwater quality has been assessed in accordance with the assessment method set out in Appendix C of LA113 (DMRB) (**Ref. 1.1**) as the Q95 flow for Basin 1, Basin 2, Basin 3, Basin 6 and Basin 7 is less than 0.001m³/s. This method uses a risk assessment matrix and is based on the 'source-pathway-receptor' pollutant linkage principle. Parameters are assessed as low, medium or high risk and assigned a risk factor. These risk factors are then weighted according to the guidance and totalled to provide the total risk score which indicates if further assessment or mitigation is required. The results of this assessment are summarised in **Section 4**.

1.4.4 The risk of a potentially polluting spillage event is calculated using equations and factors provided in Appendix D of LA113 (DMRB) (**Ref. 1.1**). This method calculates the probability of a spillage event with an associated risk of a serious pollution incident occurring. This firstly calculates the probability of a spillage occurring with the potential to pollute, and secondly calculates the probability of the pollutant reaching and impacting a receiving watercourse or groundwater body. The results of this assessment are summarised in **Section 5**.

2 Proposed drainage strategy

2.1.1 It is proposed to install a new surface water drainage system to ensure that the Proposed Scheme does not increase flood risk to the scheme and to

people and places elsewhere and provides appropriate treatment. For a detailed description of the proposed surface water drainage strategy refer to **Appendix 11.1: Flood Risk Assessment**.

2.1.2 As part of the Proposed Scheme there are seven outfalls discharging into existing watercourses.

2.1.3 **Table 2.1** below provides an overview of the proposed attenuation and treatment measures for each proposed outfall.

2.1.4 **Figure 2-1** below shows the location of the basins and outfalls.

Figure 2-1 – Overview of proposed surface water drainage system

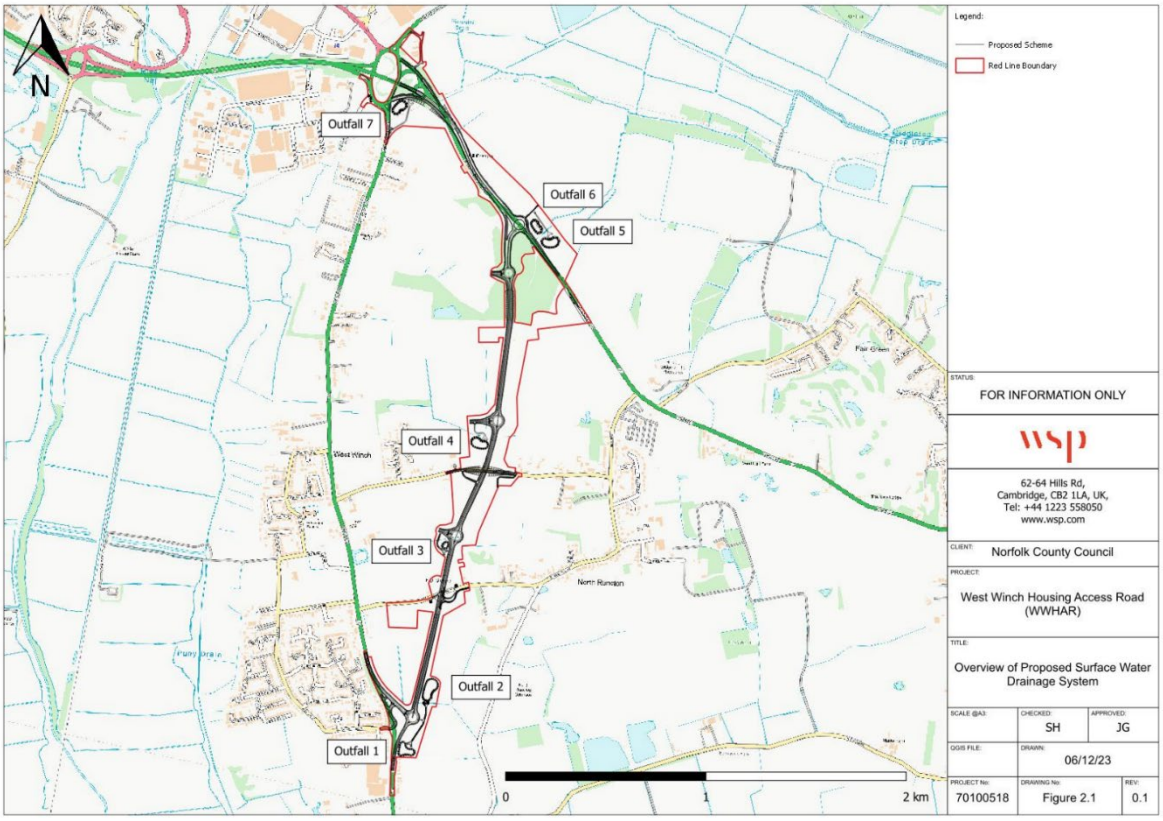

Table 2-1 - Overview of proposed surface water drainage system

Ref	Proposed attenuation and treatment	Discharge location
Outfall 1	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.
Outfall 2	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.
Outfall 3	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.
Outfall 4	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.
Outfall 5	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.
Outfall 6	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.
Outfall 7	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay.	Outfall to an unnamed field drain.

3 Impact of routine runoff on surface water quality

3.1 Methodology and Data

3.1.1 This assessment reviews the effect of pollution from routine runoff on receiving watercourses. This assessment uses the Highways England Water Risk Assessment Tool (HEWRAT) which is described in more detail in Appendix A of LA113 (DMRB) (**Ref. 1.1**). The inputs to this tool are:

- Details about the receiving watercourse
    - Annual Q95 river flow;
    - Base Flow Index (BFI);
    - River width;
    - Bed width;
    - Manning's n;
    - Channel side slope;
    - Channel bed slope;
    - Presence of downstream structures or sensitive areas;
    - Ambient background copper concentration;
    - Water hardness;
    - Details about the Proposed Scheme / current arrangement;
    - Annual Average Daily Traffic flow (AADT);
    - Impermeable area;
    - Permeable area;
    - Existing mitigation; and
    - Proposed mitigation.

3.1.2 Annual Q95 flow is derived from HR Wallingford's LowFlows2 software (**Ref. 1.3**). The software uses a catchment boundary to determine the low flow data. Catchment boundaries have been derived from a watershed analysis based on available LiDAR data Service UK. The LowFlows2 software also provides a value for BFI for each catchment.

3.1.3 Ambient background copper concentration has been set to the default value of zero for the HEWRAT assessments. The HEWRAT assessment therefore assesses the added risk to receiving waterbodies as a result of the Proposed Scheme.

3.1.4 The highest water hardness has been applied for the assessment. This is considered a conservative but appropriate approach to the assessment in terms of water hardness.

3.1.5 The channel width was taken from LiDAR data.

3.1.6 AADT was extracted from the traffic model for both the baseline arrangement and the Proposed Scheme. This data was based on the design year traffic flows expected in 2042.

3.1.7 Impermeable and permeable area, discharge rates and mitigation measures, were taken from **Appendix 11.1: Flood Risk Assessment**.

3.1.8 All input parameters used in this assessment are presented in **Sub Appendix A: Routine Runoff on Surface Water Quality Data**.

3.1.9 A check for existing outfalls to be included within a cumulative assessment was also undertaken on National Highway's Drainage Data Management System (HA DDMS) (**Ref. 1.5**). There are three existing outfalls recorded located along the A47 within 1km of the outfalls assessed as part of the Proposed Scheme. There is no information available regarding the existing outfalls on the HA DDMS that can be used within the assessment and therefore have not been included within the cumulative assessment.

Outfalls

3.1.10 The outfalls in **Table 3.1** have been assessed quantitatively using HEWRAT. A cumulative assessment of outfalls is deemed to be required for outfalls 5 and 6 as the outfalls are located within 100m for the assessment of impacts associated with sediment related pollutants and within 1km for the assessment of impacts associated with soluble pollutants. The other outfalls are not located within

Table 3-1 – Outfalls assessed with the HEWRAT

Outfall Reference	Individual outfall assessment	Cumulative assessment
Outfall 1	Yes	No
Outfall 2	Yes	No
Outfall 3	Yes	No
Outfall 4	Yes	No
Outfall 5	Yes	Yes
Outfall 6	Yes	Yes
Outfall 7	Yes	No

3.2 Mitigation Measures

3.2.1 The following mitigation measures are proposed for the drainage design and are included in **Appendix 11.1: Flood Risk Assessment**:

- Filter drains;
- Attenuation basins; and
- Separate sediment forebays.

3.2.2 Each of these features have treatment efficiencies as stated in Table 8.3.2N1 of CG501 (DMRB) (**Ref. 1.6**) which have been applied in the HEWRAT. For

any treatment features located downstream of another, a 50% reduction in efficiency has been applied as per guidance in CIRIA C609 (**Ref. 1.7**).

3.3 Results

3.3.1 The HEWRAT has two stages of assessment: Tier 1 and Tier 2. Tier 1 is a high level assessment based on river width. If the Tier 1 assessment fails, then Tier 2 is carried out using more channel dimensions. Two assessments are also undertaken for each Tier: Step 2 considers 'in-river' impacts without mitigation, and Step 3 considers 'in-river' impacts with mitigation. The mitigation discussed above is incorporated into the assessment to represent expected reductions in potential impact to water quality from copper, zinc and suspended solids. If the assessment passes Tier 1, the subsequent Tier 2 assessment has not been completed.

Table 3.2 summarises the results for each individual outfall assessed and **Table 3.3** summarises the cumulative assessment for outfalls 5 and 6. In accordance with DMRB, this considers acute impacts from soluble copper and zinc; chronic impacts from sedimentation; and comparison against the EQS limits for copper and zinc. A full summary of the results and input parameters are presented in **Sub Appendix A: Routine Runoff on Surface Water Quality Data**

Table 3-2 – Results from the HEWRAT assessing effects of routine runoff to receiving watercourses

Outfall and receiving watercourse	Step	Soluble Pollutants Acute impact assessment of copper	Soluble Pollutants Acute impact assessment of zinc	Sediments Chronic impact assessment of sediment	EQS Assessment Annual average concertation of copper (µg/l) due to road runoff	EQS Assessment Annual average concertation of zinc (µg/l) due to road runoff
Outfall 1	Tier 1 Step 2	Fail	Pass	Pass	3.47 µg/l Fail	7.67 µg/l Pass
Outfall 1	Tier 1 Step 3	Pass	Pass	Pass	0.85 µg/l Pass	1.93 µg/l Pass
Outfall 2	Tier 1 Step 2	Fail	Pass	Pass	2.65 µg/l Fail	5.94 µg/l Pass
Outfall 2	Tier 1 Step 3	Pass	Pass	Pass	0.93 µg/l Pass	2.12 µg/l Pass
Outfall 3	Tier 1 Step 2	Fail	Pass	Pass	1.81 µg/l Fail	4.13 µg/l Pass
Outfall 3	Tier 1 Step 3	Pass	Pass	Pass	0.64 µg/l Pass	1.48 µg/l Pass

Outfall and receiving watercourse	Step	Soluble Pollutants Acute impact assessment of copper	Soluble Pollutants Acute impact assessment of zinc	Sediments Chronic impact assessment of sediment	EQS Assessment Annual average concertation of copper (µg/l) due to road runoff	EQS Assessment Annual average concertation of zinc (µg/l) due to road runoff
Outfall 4	Tier 1 Step 2	Pass	Pass	Pass	0.63 µg/l Pass	1.53 µg/l Pass
Outfall 4	Tier 1 Step 3	Pass	Pass	Pass	0.22 µg/l Pass	0.56 µg/l Pass
Outfall 5	Tier 1 Step 2	Pass	Pass	Pass	0.73 µg/l Pass	1.76 µg/l Pass
Outfall 5	Tier 1 Step 3	Pass	Pass	Pass	0.26 µg/l Pass	0.64 µg/l Pass
Outfall 6	Tier 1 Step 2	Pass	Pass	Pass	0.93 µg/l Pass	2.21 µg/l Pass
Outfall 6	Tier 1 Step 3	Pass	Pass	Pass	0.34 µg/l Pass	0.84 µg/l Pass

Outfall and receiving watercourse	**Step**	**Soluble Pollutants Acute impact assessment of copper**	**Soluble Pollutants Acute impact assessment of zinc**	**Sediments Chronic impact assessment of sediment**	**EQS Assessment Annual average concertation of copper (µg/l) due to road runoff**	**EQS Assessment Annual average concertation of zinc (µg/l) due to road runoff**
Outfall 7	Tier 1 Step 2	Fail	Pass	Pass	2.77 µg/l Fail	6.18 µg/l Pass
Outfall 7	Tier 1 Step 3	Pass	Pass	Pass	0.97 µg/l Pass	2.20 µg/l Pass

Table 3-3 – Results from the HEWRAT assessing the cumulative effects of routine runoff to receiving watercourses

Outfall and receiving watercourse	Step	Soluble Pollutants Acute impact assessment of copper	Soluble Pollutants Acute impact assessment of zinc	Sediments Chronic impact assessment of sediment	EQS Assessment Annual average concertation of copper (µg/l) due to road runoff	EQS Assessment Annual average concertation of zinc (µg/l) due to road runoff
Outfalls 5 and 6	Tier 1 Step 2	Fail	Pass	Pass	1.26 µg/l Fail	2.93 µg/l Pass
Outfalls 5 and 6	Tier 1 Step 3	Pass	Pass	Pass	0.44 µg/l Pass	1.06 µg/l Pass

3.3.2 All of the outfalls passed the chronic impact assessment of sediment-bound pollutants for Step 2 prior to the inclusion of proposed mitigation (treatment) measures. This indicates that the proposed mitigation measures go beyond the minimum standards required to pass the HEWRAT Method A assessment for this parameter.

3.3.3 Prior to the inclusion of mitigation measures, the outfalls from basins 1, 2, 3, 7 and the cumulative assessment of outfalls 5 and 6 failed the assessment of acute impacts of soluble pollutants (zinc and copper) and long term impacts to the receiving water environment against the EQS threshold values set out under the WFD. Re-assessing the outfalls with the inclusion of proposed mitigation has demonstrated the outfalls pass the HEWRAT assessment.

3.3.4 As Tier 1 has been passed for all assessed parameters, Tier 2 has not been undertaken.

3.4 Further Mitigation

3.4.1 No further mitigation is required to manage the risk of routine runoff on surface water quality based on the findings of the assessment presented above.

4 Impact of routine runoff on groundwater quality

4.1 Methodology and data

4.1.1 As the Q95 flow for outfalls 1, 2, 3 and 7 is less than 1l/s, in accordance with LA 113 (DMRB) (**Ref. 1.1**) an assessment on groundwater quality has been undertaken.

4.1.2 Appendix C of LA 113 (DMRB) (**Ref. 1.1**) sets out a matrix that has been designed to assess the potential overall risk to groundwater and highlight any sites at high risk, where additional measures may be required. The risk assessment matrix uses the Source-Pathway-Receptor (S-P-R) protocol developed for use in risk assessment procedures for contaminated land evaluation.

4.1.3 In the context of road drainage, the source is the road runoff with any pollutants it contains. The pathways are the processes which may modify the pollutants during transmission through the discharge system and unsaturated zone. The receptor is groundwater. The parameters used in the risk assessment matrix are shown in **Table 4.1**.

Table 4-1 – Pathway and source descriptions

S-P-R	Parameter	Weighting Factor	Low Risk (Score 1)	Medium Risk (Score 2)	High Risk (Score 3)
Source	Traffic Flow	10	≤50,000 AADT	<50,000 AADT to <100,000 AADT	≥100,000 AADT
Source	Annual Average Rainfall	10	≤740 mm	>740 mm to <1060 mm	≥1060 mm
Source	Drainage Area Ratio (See Note 1)	10	≤50	>50 to <150	≥150
Pathway	Infiltration Method	15	'Continuous' shallow linear (e.g. unlined ditch, swale, grassed channel)	'Region' shallow infiltration systems (e.g. infiltration basin)	'Point' systems (e.g. chamber soakaways, deep shafts
Pathway	Unsaturated Zone	20	Depth to water table ≥15m or unproductive strata	Depth to water table <15m and >5m	Depth to water table ≤5m
Pathway	Flow Type (See Note 2)	20	Dominantly intergranular flow	Mixed fracture and intergranular flow	Flow dominated by fractures / fissures

S-P-R	Parameter	Weighting Factor	Low Risk (Score 1)	Medium Risk (Score 2)	High Risk (Score 3)
Pathway	Unsaturated Zone Clay Content	5	≥15% clay minerals	<15% to > 1% clay minerals	≤1% clay minerals
Pathway	Organic Carbon	5	≥15% soil organic matter	<15% to >1% soil organic matter	≤1% soil organic matter
Pathway	Unsaturated Zone Soil pH	5	pH ≥8	pH<8 to >5	pH≤5

Note 1: Determined as drainage area of road/active surface area of infiltration device, where the active surface area is that part of the device through which the majority of downward discharge will occur.

Note 2: The flow type incorporates flow type and effective grain size

4.1.4 Traffic flow data was extracted from the traffic model for both the baseline arrangement and the Proposed Scheme. This data was based on the design year traffic flows expected in 2042.

4.1.5 Annual average rainfall was taken from the nearest Met Office station at Holbeach (**Ref. 1.8**) located to the north-east of West Winch.

4.1.6 Drainage areas were taken from the surface water drainage strategy in **Appendix 11.1: Flood Risk Assessment**.

4.1.7 Ground and soil data was collected from geological mapping and results from the ground investigations works undertaken to support **Appendix D of the Flood Risk Assessment: Ground Conditions Appraisal**.

4.1.8 Each parameter used in the assessment of potential overall risk to groundwater is considered and assigned a risk category. The corresponding category risk score (Low Risk – 1, Medium Risk – 2, High Risk – 3) is

multiplied by the weighting factor for each parameter and then summed. The overall risk of impact to groundwater receptors is determined as:

- Overall risk score <150 – Low Risk of impact;
- Overall risk score 150 – 250 – Medium Risk of impact; and
- Overall risk score of >250 – High Risk of impact.

4.1.9 The risk score does not take mitigation into account (i.e. upstream treatment provided by the drainage system). Instead, the risk score identifies which parameters are associated with the greatest risk to best determine what actions can be taken, how to best mitigate the risk and the need for further assessment.

4.2 Results

4.2.1 A summary of the overall risk from routine runoff associated with each network is summarised in **Table 4.2** below based on the criteria and weightings detailed above. The risk score associated with each parameter is included in brackets. A more detailed summary of the results is presented in **Sub Appendix B: Routine Runoff on Groundwater Quality Data**.

Table 4-2 – Results of LA 113 assessment for routine runoff to groundwater

Parameter	Weighting Factor	Score: Outfall 1	Score: Outfall 2	Score: Outfall 3	Score: Outfall 7
Traffic Flow	10	10 (low)	10 (low)	10 (low)	10 (low)
Annual Average Rainfall	10	10 (low)	10 (low)	10 (low)	10 (low)
Drainage Area Ratio	10	10 (low)	20 (medium)	10 (low)	20 (medium)
Infiltration Method	15	15 (low)	15 (low)	15 (low)	15 (low)
Unsaturated Zone	20	60 (high)	60 (high)	60 (high)	60 (high)
Flow Type	20	40 (medium)	40 (medium)	40 (medium)	40 (medium)
Unsaturated Zone Clay Content	5	15 (high)	15 (high)	15 (high)	15 (high)

Parameter	**Weighting Factor**	**Score: Outfall 1**	**Score: Outfall 2**	**Score: Outfall 3**	**Score: Outfall 7**
Organic Carbon	5	15 (high)	15 (high)	15 (high)	15 (high)
Unsaturated Zone Soil pH	5	15 (high)	15 (high)	15 (high)	15 (high)
Overall Risk Score	N/A	190 (Medium Risk)	200 (Medium Risk)	190 (Medium Risk)	200 (Medium Risk)

4.2.2 All of the outfalls have resulted in a Medium Risk score. LA 113 (DMRB) (**Ref. 1.1**) indicates that further assessment is required in order to understand the potential impacts of the Proposed Scheme.

4.2.3 Review of the assessment results indicates that the shallow depth to groundwater in the superficial deposits underlying the receiving watercourses and the underlying soil properties has a significant effect on the overall risk score. Undertaking more detailed quantitative analysis of the Proposed Scheme was not considered likely to change the findings of this assessment and instead a qualitative review of the Proposed Scheme and sensitivity of receiving waters has been undertaken, taking the following information into account:

- Proposed treatment measures; and
- Sensitivity of underlying groundwater resources and downstream surface waters.

Proposed treatment measures and existing drainage regime

4.2.4 As discussed above, the overall risk score does not take proposed treatment into account.

4.2.5 Surface water runoff from the Proposed Scheme will pass through two treatment trains (filter drains and a separate sediment forebay upstream of the lined attenuation basin) which will provide robust treatment of runoff.

Sensitivity of underlying groundwater resources

4.2.6 The Proposed Scheme is not located within a Source Protection Zone. The sandstone bedrocks to the east are classified as Principal Aquifers. These are defined as layers of rock or drift deposits that have high intergranular and/or fracture permeability, meaning they usually provide a high level of water storage and transmission. They may support water supply and/or river base flow on a strategic scale.

4.2.7 The superficial Raised Beach deposits, Tottenhill Gravel Member and Lowestoft Formation (clay and gravel) are Secondary A aquifers, which are

comprised of permeable layers that can support local water supplies and may form an important source of base flow to rivers.

4.2.8 Outfalls 1 and 7 are located over Kimmeridge Clay which is not classified as a Principal Aquifer. Outfalls 2 and 3 are located over Roxham and Runcton Member sand and Mintlyn sands respectively. Both of these are classified as Principal Aquifers.

4.2.9 With regards to pollution risk this is considered low to negligible considering:

- Treatment train within the drainage system; and
- Infiltration through low to medium permeability porous superficial deposits beneath the receiving watercourses provides a filter effect and capacity for natural attenuation of pollutants;

4.2.10 Therefore the risks of pollution of the Chalk aquifer is considered to be Low. During detailed design of the Proposed Scheme there is the potential for additional mitigation measures to be incorporated into the design.

4.3 Further Mitigation

4.3.1 No further mitigation is deemed to be required to manage the risk of routine runoff on groundwater quality (or indirect risks to surface water quality) based on the findings of the assessment presented above.

5 Impacts of increased spillage risk on surface water bodies and groundwater receptors

5.1 Methodology and data

5.1.1 This assessment reviews the probability of a spillage event occurring and the potential for this event to pollute receiving watercourses and groundwater resources. The calculation is based on a formula provided in Appendix D of LA113 (DMRB) (**Ref. 1.1**). The inputs to this calculation are:

- Road grade (motorway, urban trunk road, rural trunk road);

- Road type and junction type (roundabout, slip road, side road, crossroads, road with no junction);
- Road length of each junction type;
- Road location (rural or urban);
- AADT for each road type; and
- Percentage of heavy goods vehicles (%HGV) use for each road type.

5.1.2 The road location considers the proximity to urban areas that are likely to support emergency response services. The data was sourced from a review of OS mapping.

5.1.3 AADT and %HGV data was extracted from the traffic model for both the baseline arrangement and the Proposed Scheme. This data was based on the design year traffic flows expected in 2042.

5.1.4 Road grade, type and length was derived from review of Proposed Scheme design information including the Surface Water Drainage Strategy in **Appendix 11.1: Flood Risk Assessment** and consultation with the drainage designers.

5.1.5 The calculation was carried out for each proposed outfall. Where more than one outfall discharges into a reach, the annual probabilities for each section of road are added to get the combined risk. All input parameters are presented in **Sub Appendix C: Spillage Risk Assessment Data**.

5.1.6 In accordance with LA113 (DMRB) (**Ref. 1.1**), the risk of a serious pollution incident is deemed acceptable if the annual probability is less than 1%. Where the spillage could affect sensitive areas, the risk of a serious pollutant incident is deemed acceptable if the annual probability is less than 0.5%. The River Nar is designated as a SSSI due to the transition from chalk to fenland river. The extent which is designated is upstream of where the Middleton Drain and the Country Drain discharges into the River Nar, and therefore is not hydraulically connected to the Proposed Scheme. The Setchey SSSI is

located adjacent to the River Nar approximately 1.8km to the south of the Site. The Setchey SSSI is located upstream from where the Proposed Scheme is hydraulically connected to the River Nar and so is not hydraulically connected to the Proposed Scheme.

5.2 Mitigation Measures

5.2.1 The following mitigation measures are proposed for the drainage design:

- Filter drains; and
- Attenuation basins with separate sediment forebays.

5.2.2 Each of these features have a spillage risk reducing factor as stated in Table 8.3.2N1 of CG501 (DMRB) (**Ref. 1.6**).

5.3 Results

5.3.1 A summary of the results of the spillage risk assessment for the new outfalls and infiltration basins are presented in **Table 5.1** and the results are shown in **Sub Appendix C: Spillage Risk Assessment Data**.

5.3.2 From **Table 5.1** it can be seen that the proposed drainage and included mitigation for all outfalls has an acceptable risk of spillage.

Table 5-1 – Spillage risk assessment results for proposed new outfalls

Outfall Reference	Description	Mitigation	Proposed Scheme spillage risk
Outfall 1	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.03%
Outfall 2	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.01%
Outfall 3	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.02%
Outfall 4	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.04%

Outfall Reference	Description	Mitigation	Proposed Scheme spillage risk
Outfall 5	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.03%
Outfall 6	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.03%
Outfall 7	Outfall to unnamed field drain	Surface water runoff is collected by filter drains. A lined attenuation basin with a separate sediment forebay. Pollution control value for spillage control.	0.03%

5.3.3 A cumulative assessment of outfalls 5 and 6 was also undertaken to assess the cumulative impacts to the unnamed field drain as both outfalls discharge into the same watercourse. All of the spillage risks for outfalls 5 and 6 were added together to total 0.05%. This is below the 0.5% acceptable threshold for sensitive sites.

5.4 Further Mitigation

5.4.1 No further mitigation is required to manage the risk of a polluting spillage event to an acceptable level.

6 Conclusion

6.1.1 The introduction of a new highway and changes to existing highway junctions can impact water quality of nearby surface water and groundwater bodies which receive highway drainage. This assessment determines if the proposed surface water drainage system serving the Proposed Scheme is likely to cause a significant adverse effect to receiving waterbodies and groundwater receptors. This assessment has considered the impact to water quality from changes to routine runoff and from changes to the risk of a spillage event with potential to pollute waterbodies.

6.1.2 The assessment of routine runoff to surface water features was conducted using HEWRAT. This assessment determined that the proposed system is acceptable for the receiving waterbodies.

6.1.3 The assessment of routine runoff to groundwater resources was conducted using the method outlined in Appendix C of LA 113 (DMRB) (**Ref. 1.1**) and concluded Medium Risk from all outfalls. With consideration given to proposed treatment measures and the sensitivity of groundwater resources, the risk to underlying groundwater resources is not considered to be significant.

6.1.4 The assessment of spillage risk was conducted using the calculations provided in Appendix D of LA 113 (DMRB) (**Ref. 1.1**) and covered the entire length of the Proposed Scheme and adjoining junctions. This assessment determined that the proposed system is acceptable for all receiving surface water bodies.

6.1.5 The inclusion of the embedded mitigation would reduce potential impact to receiving water bodies to an acceptable level according to HEWRAT and LA 113 (**Ref. 1.1**).

6.1.6 The design will be updated at the detailed design stage which may include updates to the surface water drainage strategy. The assessment of routine

runoff to surface water features, routine runoff to groundwater resources and spillage risk will be updated in line with changes in the design.

7 References

Reference 1.1: Design Manual for Roads and Bridges (2020). 'LA 113 Road Drainage and the Water Environment, Revision 1'. Available at: LA 113 Road drainage and the water environment

Reference 1.2: Environment Agency (2016). 'Surface Water Pollution Risk Assessment for your Environmental Permit'. Available at: Surface water pollution risk assessment for your environmental permit

Reference 1.3: Wallingford HydroSolutions (2023). 'LowFlows 2'. Available at: LowFlows 2

Reference 1.4: UK Centre for Ecology & Hydrology (2023). 'Flood Estimation Handbook Web Service'. Available at: Flood Estimation Handbook Web Service

Reference 1.5: National Highways (2023). 'Highways Agency Drainage Data Management System'. Available at: Highways England Drainage Data Management System

Reference 1.6: Design Manual for Roads and Bridges (2022). 'CG 501 - Design of highway drainage systems, Revision 2.1'. Available at: Design of highway drainage systems

Reference 1.7: Wilson, S., Bray R., Cooper, P., (2004). 'Sustainable Drainage Systems, Hydraulic, structural and water quality advice CIRIA C609'.

Reference 1.8: Met Office (2023). 'UK Climate Averages'. Available at: Holbeach Climate Station