A46 Newark Bypass

TR010065/APP/6.3

6.3 Environmental Statement
Appendix 13.4 Drainage Strategy Report

APFP Regulation 5(2)(a)

Planning Act 2008

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

Volume 6

April 2024

Infrastructure Planning

Planning Act 2008

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

A46 Newark Bypass

Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT

APPENDIX 13.4 DRAINAGE STRATEGY REPORT

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010065
Application Document Reference	TR010065/APP/6.3
Author:	A46 Newark Bypass Project Team, National Highways

Version	Date	Status of Version
Rev 1	April 2024	DCO Application

Table of Contents

1 Introduction

1.1 Overview

1.1.1 This Drainage Strategy and the preliminary drainage design drawings have been developed to support the application for Development Consent for the A46 Newark Bypass Scheme (the Scheme).

1.1.2 The Applicant has developed the Drainage Strategy in support of the Development Consent Order (DCO) application for the A46 Newark Bypass Scheme (hereafter referred to as the 'Scheme') in accordance with the requirements of the National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) and the National Planning Policy Framework (Department for Levelling Up, Housing and Communities, 2023).The Drainage Strategy for the Scheme has been developed in consultation with the stakeholders listed in Table 1 below.

Table 1: Stakeholders consulted through the development of the Drainage Strategy

Stakeholder	Requirement
Environment Agency (EA)	Under the Flood and Water Management Act 2010, the EA has direct responsibility for the mitigation and remediation of flood damages for main rivers. As such, given that a number of outfalls on the proposed Scheme would discharge to main rivers, the EA has been consulted from the perspective of flood mitigation.
Nottinghamshire County Council (NCC)	NCC is the Lead Local Flood Authority (LLFA), responsible for the management of local flooding from surface water, groundwater and ordinary watercourses. Consultation was required to inform the proposed outfall discharge rates and the drainage design criteria to mitigate flood risk.
National Highways (the Operations Directorate (OD) and	National Highways would be responsible for maintaining the A46 highway drainage assets, while NCC would be responsible

the Highways Safety, Engineering & Standards (SES))	for maintaining the local side road highway drainage assets. National Highways were consulted to inform the drainage design in general and to address Construction (Design and Management) Regulations 2015 requirements (i.e. health, safety and welfare) for the Scheme as part of the highway drainage design.

1.1.3 The public were consulted through Statutory Consultation which included questionnaires and letter drops. Local landowners were also consulted as part of the Statutory Consultation..

1.1.4 The principal objective of the proposed Drainage Strategy is to ensure that the highway drainage infrastructure would mitigate the potential for surface water flood risk to the Scheme and to the surrounding area during the construction and operational stages of the Scheme.

1.1.5 The Drainage Strategy also mitigates the risk of pollution by assessing the pollution potential of highway run-off and proposing suitable treatment. This is achieved through the use of the Highways England Water Risk Assessment Tool (HEWRAT). Further information on this assessment can be reviewed in **Appendix 13.3 of the Environmental Statement Appendices (TR010065/APP/6.3)**

1.1.6 A substantial portion of the Scheme is located within the River Trent's floodplain. Details of the floodplain extent can be found in the Flood Risk Assessment, which forms **Appendix 13.2 of the Environmental Statement Appendices (TR010065/APP/6.3**). The design of highway drainage infrastructure and attenuation features has taken into account fluvial flooding and joint fluvial and pluvial events regarding water quality, volume control and maintenance.

1.1.7 The Drainage Strategy makes use of a number of devices to drain the Scheme, these are summarised in Table 2 below.

Table 2: Proposed drainage devices for the Scheme

Role	Device
Run-off capture	Concrete 'V' profile surface water channels (SWC) Gullies (open topped drain with slatted steel cover at road level) Kerb Drains Slot Drains (limited locations within central reserve)

Conveyance	Swale Buried pipe
Attenuation	Attenuation Basins Below Ground Storage
Treatment	Catchpits, Swales, Forebays, Wetlands

1.2 Purpose of the report

1.2.1 A road Drainage Strategy and preliminary design have been developed to support the application for Development Consent for the Scheme. The purpose of this report is to outline the existing drainage regime, summarise the drainage philosophy agreed with stakeholders, and present the proposed drainage design that would be developed during detailed design. The structure of the report is as follows;

- Section 1 – Introduction
- Sections 2 – A description of the Scheme
- Section 3 – Scheme constraints
- Section 4 – Existing drainage
- Section 5 – The proposed drainage design strategy
- Section 6 – The drainage strategy per catchment
- Section 7 – Design aspects common across all catchments, as well as specific information on attenuation and pollution control.

1.2.2 The following key aspects have been assessed as part of the Drainage Strategy:

- Design Criteria
- Existing catchments
- Proposed catchments to be drained
- Surface water run-off conveyance systems
- Attenuation storage and flow controls
- Pollution control measures
- Operations and maintenance considerations

1.3 Design parameters agreed

1.3.1 The following parameters agreed with National Highways drainage SES, the EA and the LLFA are summarised below:

- Climate Change - National Highways guidance for the Scheme (provided via their SES team) is that the climate change rainfall intensities are to be increased by 20% to allow for climate change. However, the requirement

of the LLFA is 25% within the locality of the Scheme, therefore 25% has been adopted by the Applicant.

- Attenuation – Detention basins would hold the 1 in 30 years (plus 25% climate change) pluvial storm event volumes. A 40% climate change allowance was used for a sensitivity check of the design.
- Discharge Rates – The attenuation features would have an outfall restricted to the 1 in 30 years greenfield run-off rate for the 1 in 30 years storm event, to ensure the run-off is managed and that flows and volumes are no greater than the existing or a minimum of 5 litres per second (minimum flow required to minimise the risk of blockage from debris). Where a storm event exceeds the 1:30 intensity, water would overtop the attenuation area via a spillway to the receiving watercourse, or the floodplain compensation areas (FCA) at Farndon East and Farndon West.
- Drainage conveyance and attenuation features would be raised within the flood plain in order to separate them from a 1:2 fluvial flood event.
- This Drainage Strategy report should be read in conjunction with the documents listed in Table 3 below.

Table 3: Additional documents associated with the Drainage Strategy

Document Title	Document reference
HEWRAT Report	Appendix 13.3 of the Environmental Statement Appendices (TR010065/APP/6.3)
Flood Risk Assessment	Appendix 13.2 of the Environmental Statement Appendices (TR010065/APP/6.3)

2 The Scheme

2.1 Scheme context

2.1.1 In March 2020, the Department for Transport's (DfT) Road Investment Strategy 2 included a commitment for National Highways to improve the A46 'Trans-Midlands Trade Corridor' between the M5 and the Humber Ports, to create a continuous dual carriageway from Lincoln to Warwick.

2.1.2 The A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the south-west and the Humber Ports in the northeast. The improvements to the A46 corridor are detailed within the DfT's Road Investment Strategy 2 as a mechanism for underpinning the wider economic transformation of the country. RIS2 makes a commitment to create a continuous dual carriageway from Lincoln to Warwick.

2.1.3 The stretch of A46 between the Farndon roundabout to the west of Newark-on-Trent, and the A1, to the east of Newark-on-Trent, is the last remaining stretch of single carriageway between the M1 and A1 and consequently queuing traffic is a regular occurrence, often impacting journey time reliability.

2.1.4 The preferred route announcement (PRA) for the Scheme was made in February 2022. The option presented at PRA has been developed to form the preliminary design of the Scheme. This preliminary design forms the application for DCO. The preliminary design determines the route, location, general layout, components etc. of the Scheme and is the basis on which the more detailed designs are progressed.

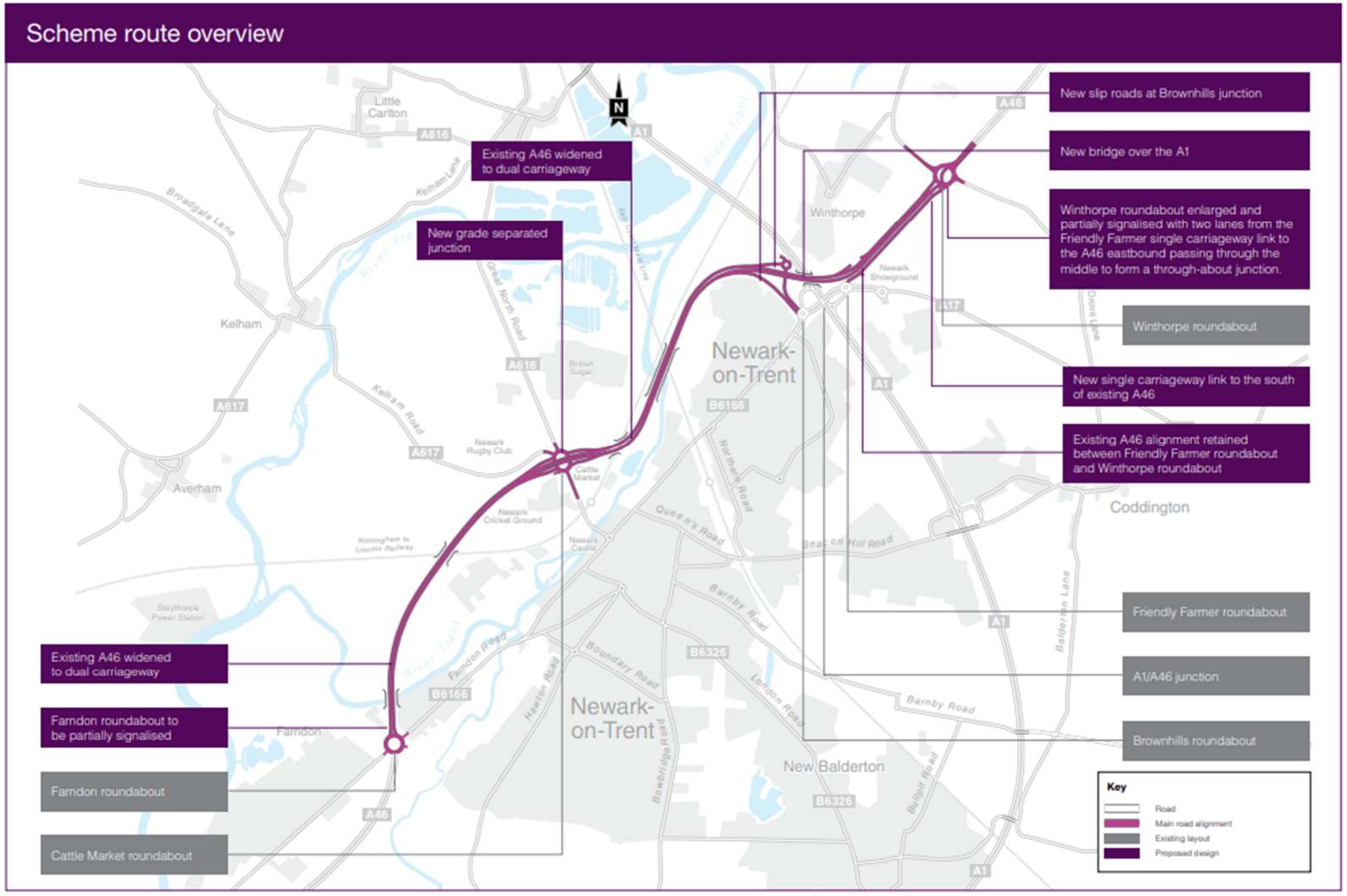
2.1.5 Further details on the need for the Scheme are contained within the **Case for the Scheme (TR010065/APP/7.1).**

2.2 Scheme location

2.2.1 The Scheme would provide a dual carriageway on the A46 between Farndon and Winthorpe in Nottinghamshire. The Farndon roundabout is located at the southern extent of the Scheme where the B6166 Farndon Road joins the A46.

2.2.2 The Winthorpe roundabout is located at the northern extent where the A1133 joins the A46. Along its route, it crosses the A617 and the B6326, at the Cattle Market junction, and the A1 between the Friendly Farmer and Brownhills roundabouts. Figure 1 below shows the location of the Scheme. Further details can also be found on the **Location Plan (TR010065/APP/2.1)** which shows the Scheme in its wider geographical context.

Figure 1: Scheme location



2.2.3 The Scheme would be situated within the county boundary of NCC and within the administrative boundary of Newark and Sherwood District Council.

2.2.4 The Scheme crosses the River Trent twice, the Nottingham to Lincoln railway line twice, and the East Coast Main Line once.

2.2.5 The existing A46, currently a single carriageway, is elevated on embankments due to the low-lying floodplain of the River Trent. This floodplain is located to the west of the A46 for the majority of the affected length, along with a section at the southern end on the eastern side of the A46. Several roundabouts form key junctions along the route, linking local A roads. Road infrastructure is softened by roadside vegetation in places and the River Trent is a strong natural influence within an otherwise built-up landscape. To the north of the A46, farmland dominates, interspersed with small-scale settlements. To the south of the A46, the town of Newark-on-Trent forms a notable urban settlement.

2.3 Scheme aims and objectives

2.3.1 The aim of the proposed Scheme is to increase capacity and reduce traffic congestion on the A46 around Newark-on-Trent. This would directly contribute to the UK, regional and local Government's transport and economic growth plans by improving connectivity from Lincolnshire to the national motorway network, and improving route standard consistency for the A46, providing a consistent high standard dual carriageway between the Midlands and Lincoln.

2.3.2 Scheme-specific objectives have been used to develop the proposed Scheme design which are set out below:

Safety	Improving safety through Scheme design to reduce collisions for all users of the A46 Scheme.
Congestion	Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads.
Connectivity	Accommodate economic growth in Newark-on-Trent and the wider area by improving its strategic and local connectivity.
Environment	Deliver better environmental outcomes by achieving a net gain in biodiversity and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe roundabouts.

Customer	Build an inclusive Scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected.

2.4 Scheme description

2.4.1 The section of the A46 that is to be upgraded is approximately 6.5 kilometres in length. The Scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway is proposed between the western and eastern sides of the A1 before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout. The widening works include earthwork widening along the existing embankments, and new structures where the route crosses the railway lines, River Trent, the A1 and local roads.

2.4.2 For information on the river and ordinary watercourse crossings please refer to **Appendix 13.2 Flood Risk Assessment of the Environmental Statement (TR010065/APP/6.3).**

2.4.3 The Scheme consists of the following principal elements:

- Widening of the existing A46 to a dual carriageway for a distance of 6.5 kilometres to provide two traffic lanes in both directions.
- Partial signalisation of Farndon roundabout at the southern extents of the Scheme.
- A new grade separated junction at Cattle Market junction with the A46 elevated to pass over the roundabout. A larger roundabout beneath the A46 to provide increased capacity.
- A new off-line section to bypass the existing Brownhills roundabout and Friendly Farmer roundabout.
- A new grade separated northbound exit slip to a new roundabout providing local access, with a two-way link road on the southern arm to connect with the existing Brownhills roundabout.
- A two-way parallel link road from Friendly Farmer to Winthorpe roundabout to the southern side of the existing dual carriageway.
- A new bridge structure across the existing A1, located to the north of the existing bridge.
- An upgraded roundabout with partial signal controls at Winthorpe roundabout.
- Improvements to walker, cyclist and horse-rider (WCH) facilities through safer, enhanced routes.
- Three areas have been identified for floodplain compensation which are being referred to as the Kelham and Averham FCA, Farndon West FCA and Farndon East FCA. In addition, the Farndon East FCA would also be used as a borrow pit to support the creation of embankments required for the Scheme.
- Drainage features including attenuation basins.

- Environmental mitigation including landscape planting.
- Associated accommodation works and maintenance access tracks.

2.4.4 Details of how the Scheme meets the objectives of the Scheme can be found in the **Case for the Scheme (TR010065/APP/7.1)**.

3 Scheme constraints

3.1 Topography

3.1.1 The majority of the Scheme sits within the floodplain of the River Trent. The Scheme widens the existing embankments where the road level sits above the flood plains maximum water level. This widening reduces the flood plain area and compensation storage for the displaced flood water.

3.1.2 North of Farndon, the existing A46 is on an embankment as it crosses the River Trent, with the road being raised approximately 5m above the floodplain. As the A46 crosses over the Nottingham – Lincoln railway line, it raises up to approximately 8 metres above the floodplain, before dropping to around 5m above the floodplain as it crosses the Old Trent Dyke south-west of Cattle Market roundabout.

3.1.3 Northeast of Cattle Market roundabout, the road is raised to approximately 8 metres above the floodplain as the road crosses the River Trent for a second time. South-west of Brownhills, the Scheme crosses a lower elevation section of the River Trent floodplain. The ground in this area generally slopes up in a northwest to south-east direction, with land to the south-east of the A46 being around 2-3 m higher than land to the northwest.

3.1.4 Beyond the Friendly Farmer roundabout, the northeast extent of the Scheme area sits outside of the River Trent floodplain, at approximately 19 metres above ordnance datum (AOD).

3.1.5 The existing River Trent floodplain from the south at Farndon roundabout to the Brownhills roundabout varies in elevation from approximately 12 metres AOD to 8 metres AOD. The floodplain is crossed by multiple Network Rail and local road crossings with each linear feature typically raised above existing ground elevations to reduce risk of flooding. These existing infrastructure features are likely to have an impact on the conveyance capacity of the floodplain during times of a fluvial flood event.

3.1.6 For further details of the floodplain extents, refer to Chapter 13 **Appendix 13.2 Flood Risk Assessment of the Environmental Statement (TR010065/APP/6.3)**.

3.2 Geology

3.2.1 Whilst the geology of the underlying strata is not a constraint to the Scheme, it does affect the options available to manage drainage run-off regarding the potential for infiltration.

3.2.2 This section describes the geology for the scheme specifically in regard to drainage, groundwater and the infiltration potential of the underlying geology and has been based upon the information contained within Chapter 9 (Geology and Soils) of this Environment Statement **(TR010065/APP/6.1)** and the Ground Investigation Report contained in Appendix 9.2 (Contaminated Land Risk Assessment) (CLRA) of the ES Appendices **(TR010065/APP/6.3)**.

3.2.3 For approximately 4 km the existing A46 is elevated on an embankment due to the low-lying alluvial floodplain of the nearby River Trent.

3.2.4 The Scheme is underlain by various mudstone strata along its length. These include the Edwalton Member, Gunthorpe Member and the Mercia Mudstone Group. These bedrocks are overlain by superficial deposits of Alluvium and the Baldertone Sand and Gravel member to the north. Groundwater is likely to be high within the indicated flood zones.

3.2.5 The Drainage Strategy has been conservatively designed with an assumed seasonal peak at ground level. This would be optimised during detailed design once the baseline groundwater monitoring has been completed (January 2024). If the groundwater level is below ground level (0 AOD), then the basins can potentially be lowered.

3.2.6 Infiltration may be possible within the Baldertone Sand and Gravel member as the strata may be more permeable and these areas are located away from the indicated flood zone.

3.3 Hydrology

3.3.1 The local hydrology is dominated by the River Trent, which the A46 crosses twice along this length of the highway.

3.3.2 The proposed highway widening works encroach on a large part of the River Trent's flood zone 3 fluvial floodplain. Floodplain compensation works are therefore required. The Flood Risk Assessment which forms **Appendix 13.2 of the Environmental Statement Appendices (TR010065/APP/6.3)** outlines details of the floodplain compensation volume requirements and how these are addressed as part of the Scheme. At Farndon East and Farndon West FCAs the surface water is stored within these during extreme rainfall events to prevent the existing Old Trent Dyke from flooding during a 1:100 year (+climate change) further downstream when the water from basins further north of this area discharge into the dyke.

3.3.3 Several watercourses cross the existing A46, such as the Old Trent Dyke, which crosses the A46 twice between Farndon roundabout and Cattle Market junction.

4 Existing drainage

4.1 Existing drainage infrastructure

Summary

4.1.1 Surface water run-off generated within the existing highway area currently flows as follows:

- over-the-edge into a ditch at the toe of the embankment (in some places this run-off flows into a filter drain rather than a ditch). Some of the ditches observed on-site were concrete lined.
- is captured by road gullies and kerb drains, and conveyed via a piped network to a ditch located at the toe of the embankment.
- is captured by a filter drain located on the verge and discharged to the drainage network.

4.1.2 The existing highway catchment system generally consists of gullies and kerb drains along the highway and edge of the embankment. The catchment systems convey run-off to a piped system which discharges to concrete-lined ditches and culverts alongside and under the A46. Surface water run-off outfalls into the River Trent directly or is channeled into existing dykes and ditches which ultimately discharge to the River Trent.

4.1.3 Run-off does not appear to be treated but some ditches seem to have a penstock chamber which may have originally restricted discharge.

4.2 Assessment of existing drainage systems

4.2.1 The existing drainage system would, where possible, be retained and reused as the existing carriageway becomes the new southbound element of the Scheme.

4.2.2 National Highways utilise the Highways Agency Drainage Management System (HADDMS) to record the location and condition of the drainage assets. These records do not show any instances of flooding on the carriageway during rainfall events, which indicates that the system is fully functional. During a site visit a number of ditches were observed to be overgrown and some requiring maintenance. Vegetation clearance and cleaning would be undertaken as part of the works by National Highways prior to the Scheme becoming operational.

4.3 Existing drainage catchment descriptions

4.3.1 The following section outlines the existing drainage regime on a catchment basis using the existing drainage network and describes the run-off conveyance route. Details of catchments are shown on the drainage engineering plans, Sheet 1 to 6 (drawing numbers HE551478-SKAG-HDG-CONWI_CONW-DR-CD-26301 to 26306).

4.3.2 The drainage engineering plans have been developed to show the existing and proposed catchment areas. Where the existing carriageway is retained, the same catchment has been preserved and each area is colour coded and referenced within the key for the plan.

Catchment 1

4.3.3 Catchment 1 drains via the existing gullies located along the western kerbline and run-off is conveyed down to the drainage ditch at the toe of the embankment, prior to discharging, uncontrolled, into the River Trent.

Catchment 3

4.3.4 Catchment 3 drains via the existing gullies located along the western kerbline. The gullies are shown to be connected with a longitudinal conveyance pipe, however no lateral connection to the toe-ditch is indicated. It is assumed the run-off is conveyed down to the toe ditch which conveys it west, under the embankment, and into the Old Trent Dyke via the existing outfall pipe.

Catchment 5

4.3.5 Catchment 5, southbound, drains via the existing gullies located along the outer kerbline. It is assumed (not indicated on HADDMS) that run-off is conveyed down to the drainage ditch at the toe of the embankment, prior to discharging uncontrolled to the Old Trent dyke.

Catchment 7

4.3.6 Catchment 7, southbound, drains via the existing gullies located along the outer kerbline. It is assumed (not indicated on HADDMS) that run-off is conveyed down to the drainage ditch, at the toe of the embankment, prior to discharging uncontrolled to the Old Trent Dyke.

Catchment 9

4.3.7 Catchment 9, southbound, drains via the existing gullies located along the outer kerbline. It is assumed (not indicated on HADDMS) that run-off is conveyed down to the drainage ditch, at the toe of the embankment, prior to discharging uncontrolled to the Old Trent dyke.

Catchment 14

4.3.8 Catchment 14 forms both the southbound and northbound embankments and drains via overland flow. It is assumed that run-off is conveyed down the embankments to the drainage ditches, at the toe of the embankments, prior to discharging uncontrolled via an outfall to the River Trent.

Catchment 15

4.3.9 Catchment 15, southbound, drains via the existing gullies located along the outer eastern kerbline, run-off is conveyed down to the drainage ditch at the toe of the embankment. This is then conveyed via a culvert under the A46. Finally, this is conveyed into a detention basin prior to discharging uncontrolled via an outfall to a tributary of the River Trent.

Catchment 17

4.3.10 Catchment 17, southbound embankment, drains via overland flow. Run-off is conveyed down to the drainage ditch at the toe of the embankment. This is then conveyed via a priority culvert of moderate status under the A46, into a culvert of low status into a detention basin prior to discharging uncontrolled via an outfall to a tributary of the River Trent.

Catchment 19

4.3.11 Catchment 19, southbound, drains via the existing gullies located along the outer kerbline which are piped to the adjacent ditch. Run-off is then conveyed down to the drainage ditch at the toe of the embankment, prior to it discharging uncontrolled to the Slough Dyke.

Catchment 23

4.3.12 Catchment 23, southbound, drains via the existing gullies located along the eastern kerbline. Run-off is conveyed down to the drainage ditch at the toe of the embankment, this then discharges to a culvert of undetermined status, under the existing A46, prior to discharging uncontrolled to the Fleet.

5 Design strategy

5.1.1 This section discusses the Drainage Strategy for the Scheme, covering the principles and constraints along with the proposed catchments.

5.1.2 The Drainage Plans within the Engineering Plans and Sections **(TR010065/APP/2.6)** present a preliminary drainage layout for the Scheme. The strategy includes a standard percentage run-off (SPR) of 100% assuming no filtration into the ground below for the embankment and hard surfaces (such as the highway) which would be refined as the strategy develops.

5.1.3 The approach is to utilise Nature-based Solutions (NbS) and Sustainable Drainage Systems (SuDS) to maximise water treatment opportunities and environmental co-benefits such as biodiversity net-gain. These features would be connected within a blue-green corridor that would span most of the Scheme, this corridor integrates drainage features with landscape planting and screening rather than creating separate features that would require more land for the Scheme.

5.1.4 The design ethos seeks to improve the ease of inspection and maintenance of drainage assets over conventional piped solutions. This would be achieved through the implementation of swales, detention basins, ponds, forebays or settlement forebays. As these assets would lie within the flood plain these elements would be protected against the 1 in 2 year fluvial flood, as set out in the Flood Risk Assessment which forms **Appendix 13.2 of the Environmental Statement Appendices (TR010065/APP/6.3).**

5.2 Flood resilience

5.2.1 One of the key constraints of the project is flooding and the interaction this would have with the drainage on the Scheme. Much of the Scheme is located within flood zones 2 and 3. For details of flood zones see Figure 42 of the Flood Risk Assessment which forms **Appendix 13.2 of the Environmental Statement Appendices (TR010065/APP/6.3)**.

5.2.2 As such, attenuation and conveyance features located at the toe of the embankment would need to be raised so that the drainage system, specifically the pollution control measures, can continue to function during most high reoccurrence events - this has been quantified to the 1 in 2 year fluvial event (plus climate change allowance) and agreed with the consultees. Protecting the features for a less frequent event would have displaced more flood water and require the Scheme to utilise more land for flood compensation.

5.2.3 A climate change allowance of 25% has been used for this Scheme based on the peak rainfall intensity allowances, set out in Table 5-4 of the Flood Risk Assessment which forms **Appendix 13.2 of the**

Environmental Statement Appendices (TR010065/APP/6.3). A 40% climate change allowance has been used for a sensitivity check of the design.

5.2.4 The flood scenarios that would interact with the drainage within the flood plain that have been considered in the design of the drainage system are:

- A fluvial flood event that would inundate the SuDS features in the floodplain. In such events pollutants within the highway run-off water would be diluted to acceptable levels within the flood water. See the HEWRAT Appendix 13.3 of the Environmental Statement Appendices **(TR010065/APP/6.3)**.

- A fluvial flood event that would surcharge outfalls 1-9 inclusive coinciding with a pluvial (storm) event with run-off flowing into the SuDS features.

5.3 Overview of proposed Drainage Strategy

5.3.1 NbS (The Nature-based Solutions Initiative is an interdisciplinary programme of research, education and policy advice based in the Department of Biology at the University of Oxford. Its mission is to enhance understanding of the potential of nature-based solutions to address multiple global challenges whilst supporting the health of ecosystems and respecting the rights of Indigenous Peoples and local communities) and SuDS are the primary principles implemented in draining, treating and attenuating the extended catchment of the Scheme.

5.3.2 Above-ground SuDS have been integrated with environmental and landscaping features to produce additional benefits where practical. A blue-green corridor has been utilised to tie attenuation features and landscaping into a holistic design.

5.3.3 The following sections describe the conveyance routes for surface water run-off generated on the carriageway.

Highway drainage capture and conveyance

5.3.4 Surface water run-off from the carriageway surface would be collected by a V-shaped SWC in most instances, located along the nearside edge of the carriageway, or within the central reserve, depending on the crossfall or camber of the highway. The SWC would be sized to avoid carriageway flooding beyond the highway boundary during a 1 in 100 year storm event and would be designed to minimise the number of outfalls, therefore, reducing the number of piped runs down the embankment.

5.3.5 The outfall from highway to swale entails draining run-off from the SWC into a catchpit which then discharges flows down the embankment via a conventional piped system. The piped system

would outfall onto an engineered spillway to dissipate flow energy and reduce velocities. This would promote settlement of suspended pollutants in the swales forebay.

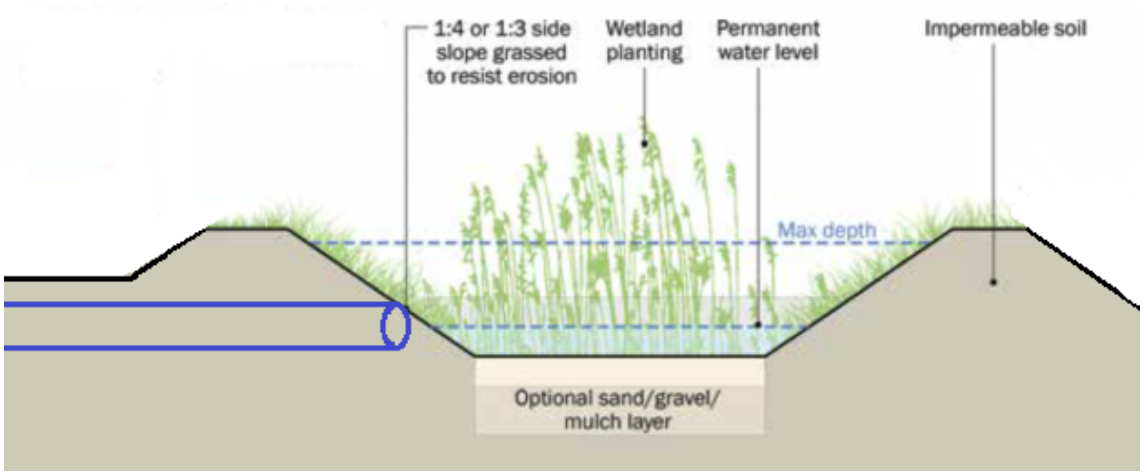
Primary conveyance swale to attenuation feature

5.3.6 The primary conveyance swale would span the length of the scheme, at the toe of embankment, on the widened side of the highway. The swale would receive run-off from the highway surface via a piped connection. Spillways and forebays would be integrated into the swale at each outfall to dissipate flow energy and to intercept pollutants.

5.3.7 The configuration and the design considerations of these primary conveyance swales have been presented in Figure 2 below. The primary conveyance swales would act as a conveyance feature, a treatment device and also the primary interception device.

5.3.8 To improve the treatment potential of the swale a permanent shallow water level would be maintained. Check dams would be included along the swales length to maintain this water level as well as to provide additional treatment and interception of pollutants.

Figure 2: Cross-section of a typical wet swale (Figure 17.3 from CIRIA SuDS Manual 2015)



5.3.9 Planting in forebays, basins and swales would slow down flows and improve pollution treatment capabilities.

5.3.10 Penstocks would be installed at the outfall of the primary conveyance swales to prevent spills from flowing into the downstream basins and out into the receiving watercourse.

5.3.11 In the event of an oil spill, emergency services would be deployed to close the penstocks and contain and eliminate the spill.

Attenuation features and exceedance management

5.3.12 Within the floodplain, for each catchment, an attenuation feature made-up of several detention basins would attenuate the 1 in 30 year (plus a 25% allowance for climate change) volume. Any storms above

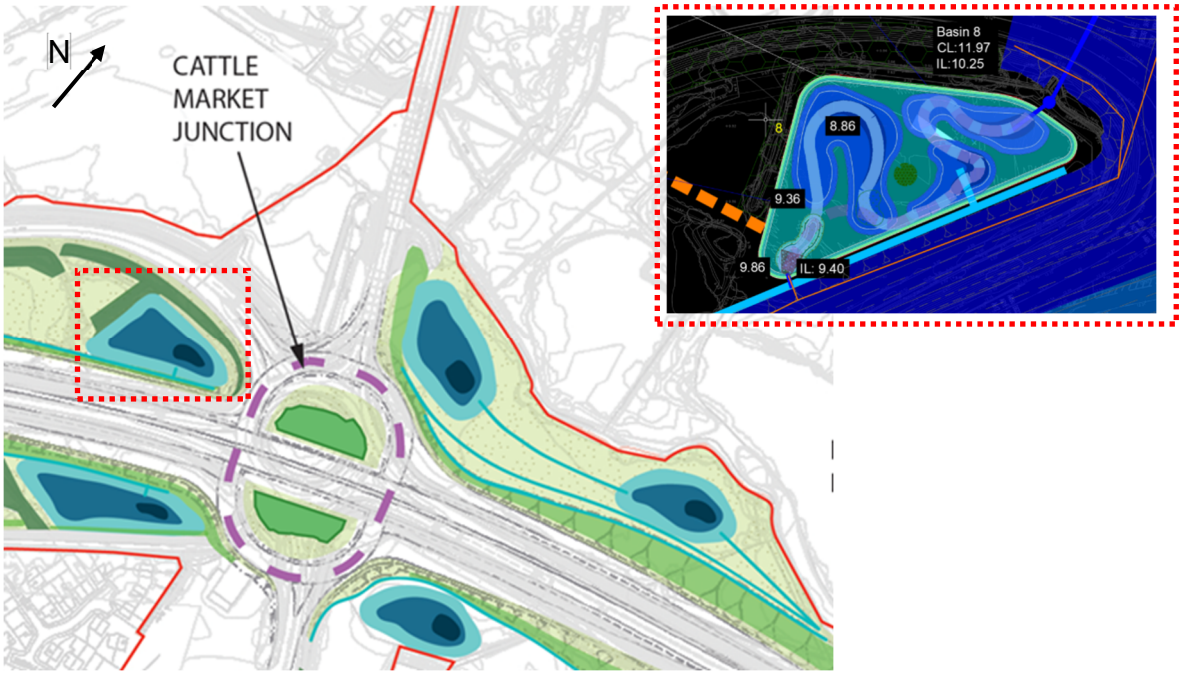
the 1 in 30 year (plus 25% climate change) storm event would be managed via overland flow routes, within the landscape, allowing exceedance to flow to its natural receptor. An initial assessment has been carried out for each area to ensure the additional run-off does not impact third parties and cause flooding that currently does not occur. A full assessment would be undertaken during detailed design.

5.3.13 Outside the floodplain the attenuation areas would be designed to store run-off for all storm events up to and including the 1 in 100 year storm event, with a 25% allowance for climate change.

5.3.14 The dry weather channel and permanent wetted areas (ponds) proposed within the attenuation area would be formed out of an impermeable layer to prevent the ingress of pollutants.

5.3.15 Details of detention basin design levels can be found in Appendix A.

Figure 3: Example of a preliminary detention basin design



6 Proposed catchment strategy

6.1 Overview of proposed catchment strategy

6.1.1 This section describes in detail the Drainage Strategy for each outfall and should be cross-referenced with The Drainage Plans within the Engineering Plans and Sections **(TR010065/APP/2.6)**. Details of catchments are shown on the Drainage Engineering Plans, Sheet 1 to 6 (drawing numbers HE551478-SKAG-HDG-CONWI_CONW-DR-CD-26301 to 26306).

6.2 Outfall O1 catchment

6.2.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH00 and CH230, the A46 north of Farndon Roundabout.

6.2.2 Catchments C1 and C2 make up the outfall O1 catchment area. The total catchment area is 0.5ha (Sheet 1 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.2.3 The existing outfall on the western side of the A46 would be reused (outfall 1).

6.3 Outfall O2 catchment

6.3.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH230 and CH1100, the northbound lane of the A46 between the River Trent and the Old Trent Dyke.

6.3.2 Catchment C4 makes up the Outfall O2 catchment area. The total catchment area is 1.7ha (Sheet 2 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.3.3 The surface water run-off from this catchment is then conveyed via the carrier drainage system to the primary treatment swale S1 at the toe of the embankment, towards the south of the catchment, and primary treatment swale S2 towards the north of the catchment.

6.3.4 S1 and S2 act as the primary treatment stage for the highway run-off and feature regularly spaced check dams throughout. The swales are raised above the 1 in 2 year fluvial flood event and flow into basin B1.

6.3.5 Basin B1 discharges to Outfall O2 via an existing pipe to the Old Trent Dyke.

6.4 Outfall O3 catchment

6.4.1 This catchment includes the area of existing A46 carriageway and embankment between approximate chainages CH230 and CH1100, the southbound lane of the A46 between the River Trent and the Old Trent Dyke.

6.4.2 Due to physical constraints (topography and existing trees) within Catchment C1 it was not possible to attenuate the flows to outfall for the new impermeable area. Attenuation has therefore been provided for equivalent existing highway catchment, catchment C3 at a limited discharge rate.

6.4.3 Catchment C3 makes up the Outfall O3 catchment area. The total catchment area is 2ha (Sheet 2 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.4.4 The surface water run-off from this catchment is conveyed in the existing carrier drainage system to basin B2 via a new connecting pipe.

6.4.5 Basin B2 discharges to Outfall O3 via a new outfall to the Old Trent Dyke.

6.5 Outfall O4 catchment

6.5.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH1100 and CH1490, the A46 between the Old Trent Dyke and the Nottingham to Lincoln Railway line crossing.

6.5.2 Catchment C6 makes up the Outfall O4 catchment area. The total catchment area is 1.8ha (Sheet 2 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.5.3 Swale S4 only drains the embankment surface and drains directly into Old Trent Dyke.

6.5.4 Swale S3 outfalls to basin B3 which discharges to Outfall O4 via a new outfall to the Old Trent Dyke.

6.6 Outfall O5 catchment

6.6.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH1490 and CH1800, the A46 between the Nottingham to Lincoln Railway line crossing and Old Trent Dyke.

6.6.2 Catchment C8 makes up the Outfall O5 catchment area. The total catchment area is 0.6ha (Sheet 3 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.6.3 The surface water run-off from this catchment is conveyed via the carrier drainage system to the primary treatment swale S5 at the toe of the embankment, towards the south of the catchment, and primary treatment swale S6, towards the north of the catchment. It then discharges into basin B4 which discharges to Outfall O5 via a new outfall to the Old Trent Dyke.

6.7 Outfall O6 catchment

6.7.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH1800 and CH2200, the A46 between the Old Trent Dyke and Kelham Road.

6.7.2 Catchment C10 makes up the Outfall O6 catchment area. The total catchment area is 0.8ha (Sheet 3 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.7.3 S7 and S8 outfall to basin which discharges to Outfall O6 via a new outfall to the Old Trent Dyke.

6.8 Outfall O7 catchment

6.8.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH2200 and CH2640, the A46 between Kelham Road and the centre of Cattle Market Roundabout.

6.8.2 Catchments C11 and C12 make up the Outfall O7 catchment area. The total catchment area is 3.4ha (Sheet 3 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.8.3 The surface water run-off from this catchment is conveyed via swale S9, at the toe of the embankment, towards the south-east of the catchment, primary treatment swale S10 towards the south-west of the catchment. It is then conveyed via filter drain F1 towards the northeast of the catchment, primary treatment swale S11 towards the northwest of the catchment, and retention basin P1 in the centre of Cattle Market Roundabout.

6.8.4 S9 and F1 outfall to B6 which connects to swale S12 north of the catchment via an extended existing culvert under Cattle Market roundabout.

6.8.5 S10 and S11 outfall to B7 which connects to an existing ditch via a piped connection and connects to swale S12.

6.8.6 This catchment also features a retention basin - P1, which discharges to the existing culvert under Cattle Market Roundabout and discharges to swale S12.

6.8.7 Basin B6 and B7 connect to swale S12 which then discharges to Outfall O7 via a new outfall to a tributary of the River Trent.

6.9 Outfall O8 catchment

6.9.1 This catchment includes the area of realigned A46 carriageway and embankment between approximate chainages CH2640 and CH3660, the A46 between the centre of Cattle Market Roundabout and the Nether Lock Viaduct - not including the highway embankment north of the Nottingham to Lincoln Railway crossing.

6.9.2 Catchment C13 makes up the Outfall O8 catchment area. The total catchment area is 4.7ha (Sheet 3 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.9.3 The surface water run-off from this catchment is then conveyed via filter drain F1 and swales S13 and S14 to basin B8.

6.9.4 Basin B8 discharges to outfall O8 via a new outfall to a tributary of the River Trent, F3 outfalls to an existing watercourse.

6.10 Outfall O9 catchment

6.10.1 This catchment includes the area of embankment of the realigned A46 carriageway between approximate chainages CH3050 and CH3660, between the Nottingham to Lincoln Railway crossing and Nether Lock Viaduct.

6.10.2 Catchment C14 makes up the Outfall O9 catchment area. The total catchment area is 2.5ha (Sheet 4 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.10.3 The surface water run-off from this catchment is then conveyed via swale S15 at the toe of the embankment to basin B9 which discharges to outfall O9 via a new outfall to the River Trent.

6.11 Outfall O9A catchment

6.11.1 This catchment includes the area of the realigned A46 carriageway between approximate chainages CH3660 and CH3810, the A46 Nether Lock viaduct.

6.11.2 The areas of the existing bridge deck of catchment C15 and C16 make up the O9A catchment area. The total catchment area is 0.4ha

(Sheet 4 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.11.3 The surface water run-off outfalls to a culvert under the A46 Nether Lock Viaduct and discharges to an existing outfall to the River Trent via an existing culvert.

6.12 Outfall O10 catchment

6.12.1 This catchment includes the area of the realigned A46 carriageway between approximate chainages CH3660 and CH4630, the A46 between Windmill Viaduct and the new A1 slip road.

6.12.2 Catchments C15 and C16 make up the Outfall O10 catchment area. The total catchment area is 1.4ha (Sheet 4 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.12.3 The surface water run-off from this catchment is then conveyed via the carrier drainage system to basin B10 which connects to swale S16, then discharges to outfall O10 via a new outfall to a tributary of the River Trent.

6.13 Outfall O11 catchment

6.13.1 This catchment includes the area of the realigned A46 carriageway and embankment between approximate chainages CH4630 and CH5260, the new A1 slip road from the A46.

6.13.2 Catchment C21 makes up the Outfall O11 catchment area. The total catchment area is 2ha (Sheet 5 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.13.3 The surface water run-off from this catchment is then conveyed via swales S17, S18, S19 and S20.

6.13.4 S17, S18 and S20 discharge into swale S19 before discharging unattenuated to the Slough Dyke via the new outfall O11. Additional attenuation has been provided within basin B12 to compensate for this.

6.14 Outfall O12 catchment

6.14.1 This catchment includes the area of the realigned A46 carriageway and embankment between approximate chainages CH4630 and CH5310, the A46 between the start of the new A1 slip road and the A1 flyover.

6.14.2 Catchments C19 and C20 make up the Outfall O12 catchment area. The total catchment area is 4ha (Sheet 5 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.14.3 The surface water run-off is conveyed via swale S21, S22, S23 and an existing ditch at the toe of the embankment towards the west of the catchment and swales S24, S25 and S26 at the toe of the embankment towards the south and east of the catchment.

6.14.4 S21, S22 and S23 discharge to the basin B11 and S24, S25 and S26 discharge to the basin B12.

6.14.5 Basin B11 drains to Basin B12 which then discharges to outfall O12 via a new outfall to the Slough Dyke.

6.15 Outfall O13 catchment

6.15.1 This catchment only includes the eastern embankment of the realigned A46 carriageway between approximate chainages CH5310 and CH5620, the A46 between A1 flyover and the Fleet.

6.15.2 The embankment of Catchment C22 makes up the Outfall O13 catchment area. The total catchment area is 0.3ha (Sheet 5 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.15.3 Swale S29 discharges to outfall O13 via a new outfall to the National Highway drain.

6.16 Outfall O14 catchment

6.16.1 This catchment includes the area of the realigned A46 carriageway between approximate chainages CH5310 and CH5620, the A46 between A1 flyover and the Fleet.

6.16.2 Catchment C22 makes up the Outfall O14 catchment area. The total catchment area is 1.2ha (Sheet 5 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.16.3 The surface water run-off from this catchment is then conveyed via swales S27 and S28 at the toe of the embankment.

6.16.4 S27 discharges to the basin B13 and S26 discharges to the basin B13 which discharges to outfall O14 via a new outfall to the Fleet.

6.17 Outfall O15 catchment

6.17.1 This catchment includes the area of the realigned A46 carriageway between approximate chainages CH5620 and CH6630, the A46 between the Fleet and Winthorpe roundabout.

6.17.2 Catchments C23, C24 and C28 make up the Outfall O15 catchment area. The total catchment area is 3.2ha (Sheet 5 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.17.3 The surface water run-off from this catchment outfalls to a culvert under the A46 which discharges to an existing outfall to the Fleet via an existing culvert.

6.17.4 Due to physical constraints (topography and existing trees) within these catchments it was not possible to attenuate the flows to outfall for the new impermeable area. Attenuation has therefore been provided for equivalent existing highway catchment within O16 which outfalls to the same watercourse at a limited discharge rate.

6.18 Outfall O16 catchment

6.18.1 This catchment includes the area of the existing A46 carriageway between approximate chainages CH5620 and CH6630 and the A46 between the Fleet and Winthorpe Roundabout.

6.18.2 Catchment C25 makes up the Outfall O16 catchment area. The total catchment area is 1.3ha (Sheet 5 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.18.3 The surface water run-off from this catchment is then conveyed via filter drains F4 and F5 at the toe of the embankment, where they discharge to basin B14 which discharges to outfall O16 via a new outfall to the Fleet.

6.19 Outfall O17 catchment

6.19.1 This catchment includes the area of the realigned A46 carriageway between approximate chainages CH6630 and CH6865, Winthorpe roundabout.

6.19.2 Catchments C26, C27 and C29 make up the Outfall O17 catchment area. The total catchment area is 1.7ha (Sheet 6 of the Drainage Plans within the Engineering Plans and Sections (TR010065/APP/2.6)).

6.19.3 The surface water run-off from catchment C29 is conveyed via swales S30 where it crosses beneath the road and enters swales S33-S35, outfalling via O17. Catchment C27 and C26 are conveyed via swales S31 and S32 to Basin B15.

6.19.4 Swales S33, S34, S35 collect run-off from the embankment, conveying it to O17.

6.19.5 This catchment also features a retention basin - P2, which discharges to swale S30.

6.19.6 Basin B15 discharges to outfall O17A via an existing ditch.

7 Surface Water Collection and Outfalls

7.1 Surface water channels

7.1.1 Concrete SWCs are to be used for the capture of highway run-off from the proposed carriageways.

7.2 Gully design and combined kerb drainage units

7.2.1 Gully grating Type R shall be used in the design.

7.2.2 A permitted flow width of 1.0 metre shall be adopted on the mainline where there is a full hard strip (1 metre width). On other roads, a reduced flow width of either 0.75 m or 0.5 m shall be applicable depending on the cross-section and use of that particular road.

7.2.3 Where calculations show that gully spacing would be less than 5 metres, the design of the drainage collection system shall be undertaken based on combined kerb drainage units with no surcharge in the 1 year event, and a surcharge of the adjacent carriageway up to the maximum flow widths stated above in the 5 year event (inclusive of climate change).

7.2.4 In locations where amphibians have been identified, road gullies shall be specified with either amphibian ladders or the kerb type at the rear of the gully changed to a wildlife kerb [redacted]) or equivalent.

7.3 Central reserve

7.3.1 Where the road surface falls towards the central reserve, a SWC would be provided in the central reserve (to one side of the barrier) to collect and convey flows. The channel would discharge into a gully pot where it would be piped to a primary conveyance swale at the toe of the embankment.

7.3.2 Short lengths of slot drain would be required where there is insufficient clearance to the safety barrier to install a channel.

7.4 Outfalls

7.4.1 The level of any outfall to a watercourse shall be provided at a minimum freeboard of 150 mm above the water level recorded in the topographic survey or hydraulic modelling results for a 5% annual exceedance probability event.

7.4.2 Where an outfall is to a ditch which may not have a water level recorded by the topographic survey, a minimum level of 300 millimetres above the invert of the ditch shall be adopted for the outfall level.

7.4.3 Where outfalls are positioned in areas of known floodplain they shall be fitted with hinged flaps unless the level of the flood is not going to risk syphoning back along the outfall to flood an upstream area.

7.5 Land drainage

7.5.1 There is a complex network of formal drainage in land drains and informal drainage on route to the River Trent.

7.5.2 Ditches would be utilised to intercept overland flows falling towards the embankment and would convey them to a nearby watercourse. Ditches would only be located where the land falls towards the embankment. Where the land falls away from the embankment, land drainage would not be required.

7.6 Application of attenuation storage requirements and third-party impact assessment

7.6.1 Two assessments were carried out to measure the impact of not attenuating storm events larger than the 1 in 30 years plus a 25% climate change allowance. The first assessment looks at the impact of the exceedance that would not be formally stored within the detention basins during a storm event. The second assessment looks at the exceedance volume if the storm event occurs at the same time as a fluvial flood event.

Exceedance Management – Assessment 1

7.6.2 Where a storm exceeds 1 in 30 year pluvial storm event, run-off would overtop via a designed spillway and flow to the receiving watercourse via the natural topography of the land.

7.6.3 To demonstrate what happens to run-off that overtop the basins, an exceedance management plan was produced using the topographical survey levels to determine overland flow paths from the designated basin spillway to the receiving watercourse. The plan was required to ensure there is no risk of flooding to site users or landowners/property owners nearby when a basin overtops into the surrounding landscape.

7.6.4 Exceedance flow paths for all storm events above the 1 in 30 years (+25% climate change) for all basins within the floodplain can be seen in Appendix B.

7.6.5 The freeboard would store some additional run-off before overtopping and spilling via a designated spillway towards the receiving watercourse.

Mitigation

7.6.6 When the River Trent is not in flood two approaches would be implemented to manage the discharge:

1. The Farndon East and Farndon West FCAs would be utilised as attenuation to offset, by displacement, the exceedance volume for events above the 1 in 30-year storm (+25% climate change) up to the 1 in 100 years (+25% climate change) where detention basins 1, 2 and 3 would discharge via spillways into these.
2. The existing Old Trent Dyke would discharge flows in excess of 200mm within it into the Farndon East and Farndon West FCAs. This provides capacity within the dyke for basins 4 to 8 inclusive to spill over and utilise the additional capacity and convey the discharge to the River Trent at Nether Lock without flooding adjacent land.

Exceedance Management – Assessment 2

7.6.7 The Flood Risk Assessment which forms **Appendix 13.2** of the Environmental Statement Appendices **(TR010065/APP/6.3)** provides details upon the Scheme impact for flood risk. The assessment provided modelled fluvial flood levels which the volume impact assessment used measure the impact exceedance flows would have on fluvial flood events.

7.6.8 Due to the enormity of the flood plain, the pluvial rainfall event had a negligible impact on the level of the water within the flood plain and the volume impact assessment included within appendix B concluded that the exceedance volume run-off raises the flood water levels by less than 1mm.

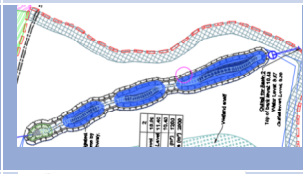
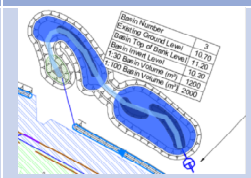
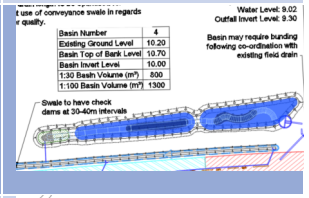
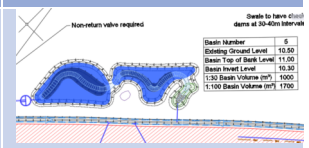
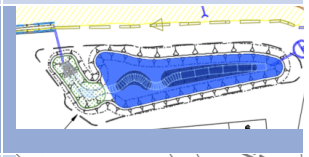
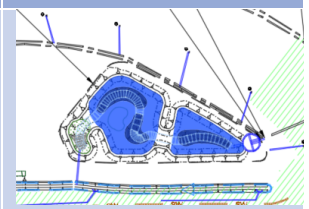
7.7 Spill events

7.7.1 The system has been designed to withstand typical spill events on the carriageway and the annual probability of a spill has been calculated to less than 1%.

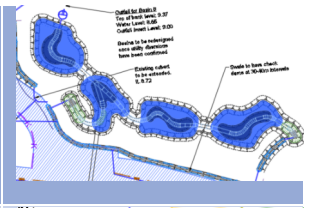
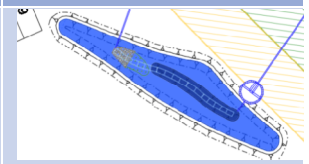
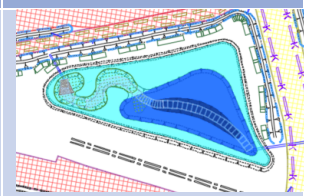
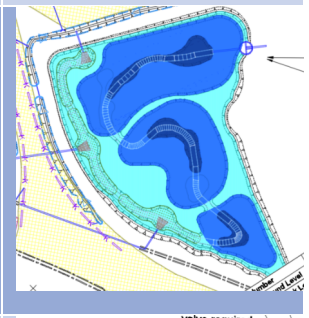
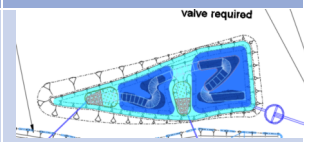
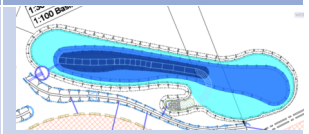
7.7.2 A typical ‘common’ spill entails a conservative estimate of two compartments of the tank rupturing and spilling a combined volume of 6000 litres (2 x 3000 litres). This volume would be captured and contained within the primary conveyance swale which runs along the length of the scheme’s northern embankment edge (on the widened side of the A46). This forms the primary interception stage with the forebay and first basin within the attenuation feature forming the second stage.

7.7.3 The use of non-mechanical methods of pollution control such as check dams have been specified for ‘common’ spill events, and the use of mechanical penstock chambers, for ‘catastrophic’ higher severity spills located upstream of the detention basins.

Appendix A - details of attenuation design

Basin	Levels (m AoD)				Effective storage of basin m^3	Approximate controlled discharge rate (l/s)[1]	Image
	Outfall Invert Level	Basin Invert Level	1:30	Top of Basin (with 200mm freeboard)			
1	9.90	10.80	11.30	11.50	1,500 *(2,500)*	5.0	
2	9.90	10.40	11.10	11.40	1,200 *(2,000)*	5.6	
3	10.00	10.20	10.90	11.20	1,200 *(2,000)*	5.0	
4	9.30	10.00	10.50	10.70	800 *(1,300)*	5.0	
5	9.30	10.30	10.80	11.00	1,000 *(1,700)*	5.0	
6	9.07	9.60	10.10	10.30	700 *(1,100)*	5.0	
7	9.50	9.80	10.30	10.50	700 *(1,200)*	5.0	

[1] Assumed to be single staged discharge. All discharge characteristics are subject to interactions with the River Trent flood flow model. Discharge rates are subject to physical practicalities in terms of maintenance and operation.

8	9.00	9.50	10.20	10.60	2,900 *(4,700)*	13.0	
9	9.00	9.50	10.00	10.20	500 *(800)*	7.1	
10	8.09	11.50	12.20	12.50	1,500 *(2,500)*	5.0	
11	9.50	10.40	10.90	11.10	500 (*900*)	5.0	
12	9.50	9.90	10.60	10.90	3,700 *(6,000)*	7.7	
13	13.50	15.00	15.70	16.00	500 (*900*)	5.0	
14	12.55	17.20	17.90	18.50	2,100 *(3,400)*	5.0	
15	18.56	18.90	19.40	19.60	1,900 *(3,100)*	5.0	
Effective storage = Storage volume of the basin not including permanent wet volume and freeboard							

Appendix B – Volume Impact Assessment

13.4 A46 Newark Bypass

TR010065/APP/6.3

6.3 Environmental Statement
Appendix 13.4 Drainage Strategy Report
Appendix B Volume Impact Assessment

APFP Regulation 5(2)(a)

Planning Act 2008

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

Volume 6

March 2024

Infrastructure Planning

Planning Act 2008

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

A46 Newark Bypass

Development Consent Order 202[x]

VOLUME IMPACT ASSESSMENT

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010065
Application Document Reference	TR010065/APP/6.3
Author:	A46 Newark Bypass Project Team, National Highways

Version	Date	Status of Version
Rev 1	March 2024	DCO Application

Contents

1 Introduction

1.1 Overview

1.1.1 The A46 Newark Bypass Scheme (hereafter referred to as the 'Scheme') passes through the floodplain of the River Trent, a hydrologically active environment, with evidence of the floodplain being inundated at least once a year. Attenuation basins to accommodate surplus rainfall are proposed within the floodplain, as a means of preventing flooding. Details of these features are set out in Appendix 13.4 (Drainage Strategy Report) of the Environmental Statement Appendices **(TR010065/APP/6.3).**

1.1.2 This volume impact assessment has been developed to support both the Flood Risk Assessment and the Drainage Strategy, which form Appendices 13.2 and 13.4 of the Environmental Statement Appendices **(TR010065/APP/6.3**) respectively, for the application for Development Consent for the Scheme in accordance with the requirements of the National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) and the National Planning Policy Framework (Department for Levelling Up, Housing and Communities, 2023).

1.2 Purpose of the report

1.2.1 The purpose of this report is to demonstrate that a relaxation in the lead local flood authority's (LLFA) requirement for drainage attenuation of the 1 in 100 year event plus climate change allowance is appropriate due to the floodplain conditions adjacent to the Scheme. In this context, attenuation is the control of storm water runoff from the road to replicate the equivalent flow from a greenfield. The climate change allowance is an uplift on the estimated storm water flows from the Scheme's drainage system. This report has been prepared in consultation with the LLFA (Nottinghamshire County Council (NCC)) as discussed in paragraph 1.3.2.

1.3 Correspondence

1.3.1 Drainage and Flood Management Steering Group meetings have been held regularly (at least every two months) to ensure key stakeholders, including the Environment Agency (EA), NCC as the LLFA, the River Trent and Lindsey Marsh Internal Drainage Board (LMDB) and the Canals and Rivers Trust (CRT) are kept updated.

1.3.2 During the 6th steering group meeting, held on the 30 November 2022 (meeting minutes ref: HE551478-SKAG-HDG-CONWI_CONW-MI-CD-

00014 in Appendix A), in discussion between the LLFA and the Applicant, it was proposed to only attenuate surface water flows up to the 1 in 30 year storm event plus a climate change allowance (+ 40%). During the meeting, NCC agreed that such a principle could be explored, and any proposals would need to be qualified with a volume impact assessment (this report). Confirmation that this principle could be explored was provided in writing by NCC on the 22 March 2023 (see record of meetings in Appendix A).

1.3.3 On the 20 July 2023 during further detailed correspondence with the EA, it was proposed that the Farndon East borrow pit area would be utilised as attenuation to offset, by displacement, the exceedance volume for events above the 1 in 30-year storm (+ climate change) up to the 1 in 100 year (+ 40% climate change allowance) which cannot be managed in the borrow pits or their landscaped area. This volume would approximately be 4,000 m^3 – 12,000 m^3.

1.3.4 This borrow pit wetland area would drain via the proposed de-culverted land drain, with flow control, across the A46 and into the Old Trent Dyke via an existing retained drain. All the above proposed is located within the DCO Order Limit.

1.4 Principles of approach

1.4.1 The alternative application in storage requirements has been proposed because a considerable part of the land surrounding the Scheme is located within Flood Zones 2 and 3 and has been designated as agricultural land. The reasons for allowing this change have been listed below:

- During a pluvial event above the 1 in 30 year pluvial storm event, exceedance would flow into the surrounding land. As the land is expected to flood regularly from fluvial events, it has only been utilised for agricultural purposes. It is therefore reasonable to allow the exceedance volume to flow into this land before draining into the receiving watercourse.
- If a storm event above the 1 in 30 year (+ 40% climate change allowance) occurs at the same time as a fluvial flood event the additional volume would lead to a negligible increase in fluvial flood levels.
- Residential and commercial areas are located above and outside of the floodplain and existing flood defences are also in place.
- As the highway is raised on an embankment there is no risk of the highway being flooded during this event.
- Any additional volume discharged into the receiving watercourses would have a minimal impact downstream.

1.4.2 Current Design Manual for Roads and Bridges (DMRB) guidance requires all surface water run-off generated on the highway during a 1 in 100 year storm event (+ climate change %), to be attenuated before

it is discharged. It is proposed that this is stepped down, and surface water attenuated for the 1 in 30 year storm event (+ 40% climate change allowance), with the additional run-off generated during larger storm events managed within the surrounding floodplain.

1.4.3 A key difference between the pluvial and fluvial flood events is that pluvial events have a much smaller catchment area and volumetric flow rate and would therefore drain quicker than a fluvial event, which has a catchment area and volumetric flow rate several magnitudes larger.

1.5 Management of Exceedance Flows

1.5.1 In the event of a basin overtopping (for storm events above the 1 in 30 + 40% climate change for basins within the floodplain and above the 1 in 100 year event (+ 40% climate change allowance) outside the floodplain, exceedance would either flow directly into the nearest watercourse or be controlled with the surrounding land before discharging to the receiving watercourse.

1.5.2 Where exceedance run-off is managed within the topography, the run-off would discharge via the land drain. Where exceedance flows to the nearest watercourse a spillway would be engineered into the bund to control the flow direction to the receiving watercourse. By dispersing the water over a large flow path and reducing the flow's energy we can mitigate rutting and potentially reduce its flow rate into the receiving watercourse.

1.5.3 Drawing reference: HE551478-SKAG-HDG-CONWI_CONW-DR-CD-00010 illustrates the flow routes exceedance flows would take when basins overtop. As this document assesses the overtopping of basins designed to store the 1 in 30 year storm event (+ 40% climate change allowance) it also covers the management of exceedance flows for larger storm event's up to and including the 1 in 100 year storm events (+ 40% climate change allowance).

2 The scheme

2.1 Scheme context

2.1.1 In March 2020, the Department for Transport's (DfT) Road Investment Strategy 2 included a commitment for National Highways to improve the A46 'Trans-Midlands Trade Corridor' between the M5 and the Humber Ports, to create a continuous dual carriageway from Lincoln to Warwick.

2.1.2 The A46 forms part of the strategic Trans-Midlands Trade Corridor between the M5 in the south-west and the Humber Ports in the northeast. The improvements to the A46 corridor are detailed within the DfT's Road Investment Strategy 2 as a mechanism for underpinning the wider economic transformation of the country. RIS2 makes a commitment to create a continuous dual carriageway from Lincoln to Warwick.

2.1.3 The stretch of A46 between the Farndon roundabout to the west of Newark-on-Trent, and the A1, to the east of Newark-on-Trent, is the last remaining stretch of single carriageway between the M1 and A1 and consequently queuing traffic is a regular occurrence, often impacting journey time reliability.

2.1.4 The preferred route announcement (PRA) for the Scheme was made in February 2022. The option presented at PRA has been developed to form the preliminary design of the Scheme. This preliminary design forms the application for DCO. The preliminary design determines the route, location, general layout, components etc. of the Scheme and is the basis on which the more detailed designs are progressed.

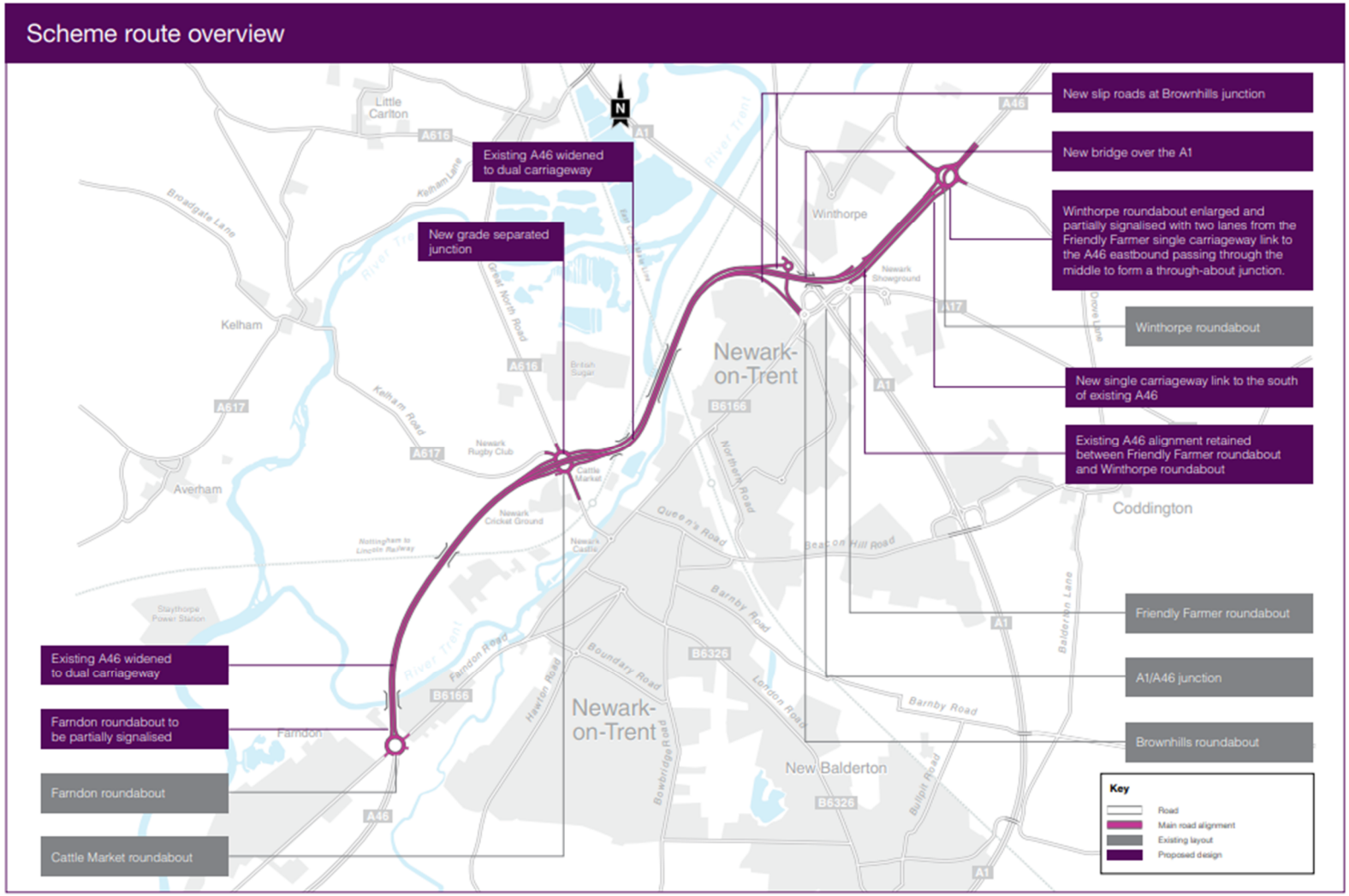
2.1.5 Further details on the need for the Scheme are contained within the Case for the Scheme **(TR010065/APP/7.1).**

2.2 Scheme location

2.2.1 The Scheme would provide a dual carriageway on the A46 between Farndon and Winthorpe in Nottinghamshire. The Farndon roundabout is located at the southern extent of the Scheme where the B6166 Farndon Road joins the A46.

2.2.2 The Winthorpe roundabout is located at the northern extent where the A1133 joins the A46. Along its route, it crosses the A617 and the B6326, at the Cattle Market junction, and the A1 between the Friendly Farmer and Brownhills roundabouts. Figure 1 below shows the location of the Scheme. Further details can also be found on the Location Plan **(TR010065/APP/2.1)** which shows the Scheme in its wider geographical context.

Figure 2-1: Scheme location



2.2.3 The Scheme would be situated within the county boundary of NCC and within the administrative boundary of Newark and Sherwood District Council.

2.2.4 The Scheme crosses the River Trent twice, the Nottingham to Lincoln railway line twice, and the East Coast Main Line once.

2.2.5 The existing A46, currently a single carriageway, is elevated on embankments due to the low-lying floodplain of the River Trent. This floodplain is located to the west of the A46 for the majority of the affected length, along with a section at the southern end on the eastern side of the A46. Several roundabouts form key junctions along the route, linking local A roads. Road infrastructure is softened by roadside vegetation in places and the River Trent is a strong natural influence within an otherwise built-up landscape. To the north of the A46, farmland dominates, interspersed with small-scale settlements. To the south of the A46, the town of Newark-on-Trent forms a notable urban settlement.

2.3 Scheme aims and objectives

2.3.1 Scheme-specific objectives have been used to develop the proposed Scheme design which are set out below:

Safety	Improving safety through Scheme design to reduce collisions for all users of the A46 Scheme.
Congestion	Improve journey time and journey time reliability along the A46 and its junctions between Farndon and Winthorpe, including all approaches and A1 slip roads.
Connectivity	Accommodate economic growth in Newark-on-Trent and the wider area by improving its strategic and local connectivity.
Environment	Deliver better environmental outcomes by achieving a net gain in biodiversity and improve noise levels at Noise Important Areas along the A46 between Farndon and Winthorpe roundabouts.
Customer	Build an inclusive Scheme which improves facilities for cyclists, walkers and other vulnerable users where existing routes are affected.

2.4 Scheme description

2.4.1 The section of the A46 that is to be upgraded is approximately 6.5 kilometres in length. The Scheme comprises on-line widening for the majority of its length between Farndon roundabout and the A1. A new section of offline dual carriageway is proposed between the western and eastern sides of the A1 before the new dual carriageway ties into the existing A46 to the west of Winthorpe roundabout. The widening works include earthwork widening along the existing embankments, and new structures where the route crosses the railway lines, River Trent, the A1 and local roads.

2.4.2 For information on the river and ordinary watercourse crossings please refer to Appendix 13.2 Flood Risk Assessment of the Environmental Statement **(TR010065/APP/6.3).**

2.4.3 The Scheme consists of the following principal elements:

- Widening of the existing A46 to a dual carriageway for a distance of 6.5 kilometres to provide two traffic lanes in both directions.
- Partial signalisation of Farndon roundabout at the southern extents of the Scheme.
- A new grade separated junction at Cattle Market junction with the A46 elevated to pass over the roundabout. A larger roundabout beneath the A46 to provide increased capacity.
- A new off-line section to bypass the existing Brownhills roundabout and Friendly Farmer roundabout.
- A new grade separated northbound exit slip to a new roundabout providing local access, with a two-way link road on the southern arm to connect with the existing Brownhills roundabout.
- A two-way parallel link road from Friendly Farmer to Winthorpe roundabout to the southern side of the existing dual carriageway.
- A new bridge structure across the existing A1, located to the north of the existing bridge.
- An upgraded roundabout with partial signal controls at Winthorpe roundabout.
- Improvements to walker, cyclist and horse-rider (WCH) facilities through safer, enhanced routes.
- Three areas have been identified for floodplain compensation which are being referred to as the Kelham and Averham floodplain compensation areas (FCA), Farndon West FCA and Farndon East FCA. In addition, the Farndon East and Farndon West FCA would also be used as a borrow pit to support the creation of embankments required for the Scheme.
- Drainage features including attenuation basins.
- Environmental mitigation including landscape planting.
- Associated accommodation works and maintenance access tracks.

2.4.4 Details of how the Scheme meets the objectives of the Scheme can be found in the Case for the Scheme **(TR010065/APP/7.1)**.

3 Assessment methodology

3.1 Overview

3.1.1 An assessment was required to demonstrate that the unattenuated exceedance run-off from extreme events, above the 1 in 30 year storm event (+ climate change %), would have a negligible material impact on nearby properties and land during the following events.

3.1.2 To fully account for the risk this may pose, the impact of the attenuation change was compared to both the 1 in 100 year pluvial storm event as well as combined pluvial and fluvial events. This would therefore account for the impact during a storm event as well as the rare occasion that a storm event occurs at the same time as the river flooding.

3.1.3 Pluvial flooding (also referred to as surface water flooding) occurs when the volume of rainfall exceeds the capacity of the drainage systems or the ground in which to absorb it. This excess water typically flows overland, ponding in natural or man-made low-lying areas.

3.1.4 Fluvial flooding (also referred to as watercourse flooding) occurs when the water level in a river, lake or stream rises and overflows onto the neighbouring land during times of excess rainfall.

3.2 Pluvial assessment

1 in 100 year pluvial event (only)

3.2.1 In this assessment the overtopped exceedance is assessed against the surrounding topography to determine overland flow routes. Spillways and flow routes are indicated on drawing ref HE551478-SKAG-HDG-CONWI_CONW-DR-CD-00010.

3.3 Pluvial - fluvial combined event assessment

Joint 1 in 100 year pluvial event and various fluvial flood event

- This includes the combined 1 in 100 year pluvial event and the following fluvial events;
  - 1 in 2 year fluvial flood event
  - 1 in 30 year fluvial flood event
  - 1 in 100 year fluvial flood event

3.3.1 All the above events make an allowance for climate change, 40% for storm events and 39% for fluvial events.

3.3.2 For these assessments a table of calculations has been provided demonstrating the affect the additional volume would have on flood event.

3.3.3 It should be noted that the probability of peak fluvial flood levels and a pluvial flood levels coinciding is extremely low. Therefore, this impact assessment considers an extreme event scenario.

4 Pluvial event assessment

4.1 Topographic review

4.1.1 The topography of the land surrounding the attenuation basins has been assessed and overland flow paths determined. A suitable spillway location has been set for each basin, shown in Appendix B. No land outside of the DCO Order Limit would be crossed to get to the watercourse.

4.1.2 Where the surrounding topography directs water back to the basin exceedance would flow into the land drain around the perimeter of the basin and to its respective receiving watercourse. No land outside of the DCO Order Limit would be crossed to get to the watercourse.

4.2 Overflow volume and flow rate calculations

4.2.1 An approximation of the exceedance volumes for each attenuation basin located within the floodplain would be calculated. This would be done using the most up-to-date drainage schematics and catchment areas.

4.2.2 The total discharge volumes for the 1 in 100 year event (+ 40% climate change allowance) would be subtracted from the 1 in 30 year event (+ 40% climate change allowance) to provide the unattenuated volume of run-off that would overtop the basin and flow to the receiving watercourse via an overland flow-path that would stay within the boundary limits.

4.2.3 The volume run-off calculator from the Micro Drainage Source Control module was used to determine the storage volume which have been included in table 1 below.

Table 1: Storage volumed calculated on Micro Drainage

Basin	Area (sqm)	Area (ha)	QBAR	Q30 (+40%)	Q100 (+40%)	Exceedance Volume (cubic m)	Outflow Rate (l/s)
1	15311.00	1.53	4.29	1184	1932	748	35.5
2	9880.00	0.99	2.77	765	1250	485	36
3	16200.00	1.62	4.54	1238	2021	783	38.3
4	8050.00	0.81	2.25	621	1013	392	21
5	5975.00	0.60	1.67	464	757	293	16

6	14925.00	1.49	4.18	1162	1895	733	36.8
7	15500.00	1.55	4.34	1202	1960	758	37.3
8	30100.00	3.01	8.43	2323	3791	1468	65
9	5303.00	0.53	1.48	410	669	259	14.5

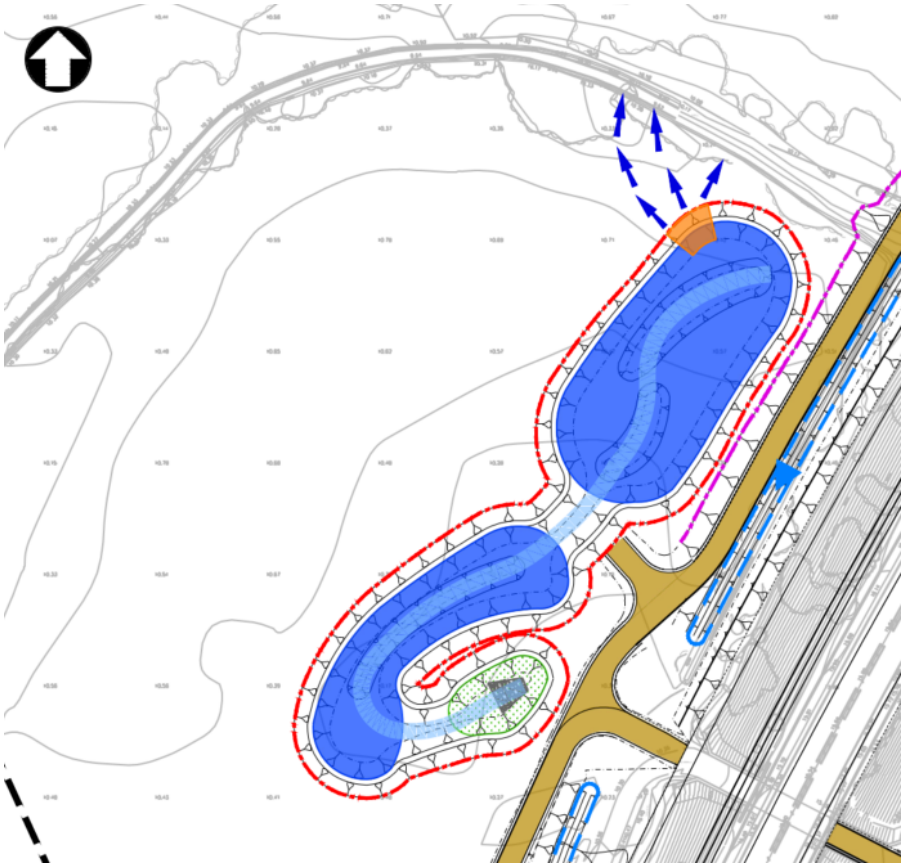
4.3 Flow paths and informal storage areas

4.3.1 When a basin overtops, the controlled exceedance would flow via an erosion-protected flow path, engineered to flow naturally via the existing topography into the closest part of the receiving watercourse.

4.3.2 Overland flow paths for each basin within the floodplain have been provided on drawings in Appendix B of this document HE551478-SKAG-HDG-CONWI_CONW-DR-CD-00010 and HE551478-SKAG-HDG-CONWI_CONW-DR-CD-00020.

4.3.3 These plans include exceedance management routes for the basins outside the floodplain in the event of basins overtopping due consecutive storm events or failure due to lack of maintenance. The drawing has been included in Appendix B for review.

Figure 4-1: Example overland flow plan showing spillway in orange and flow path in blue



5 Combined pluvial - fluvial event assessment

5.1 Reviewing impact on flood levels for combined events

5.1.1 The calculated unattenuated discharge volumes are added to their respective flood zones to determine a worst-case level increase.

5.1.2 The flood zone boundaries are then reviewed wherever the flood zone extends over or near third-party land.

5.2 Topographic review

5.2.1 Physical barriers such as the railways and the A46 itself impact flood levels and the flow of water. For the combined assessment the floodplain would be divided into zones based on the physical barriers as well as flow structures present across the Scheme within the floodplain.

5.2.2 The Scheme has been divided into the below sections based on the physical barriers, which affect the floodplain, such as the railways. Figure 3-1 presents the flood zones as well as approximate flood levels.

Figure 5-1: Flood Zones and respective 1 in 100 year modelled flood levels

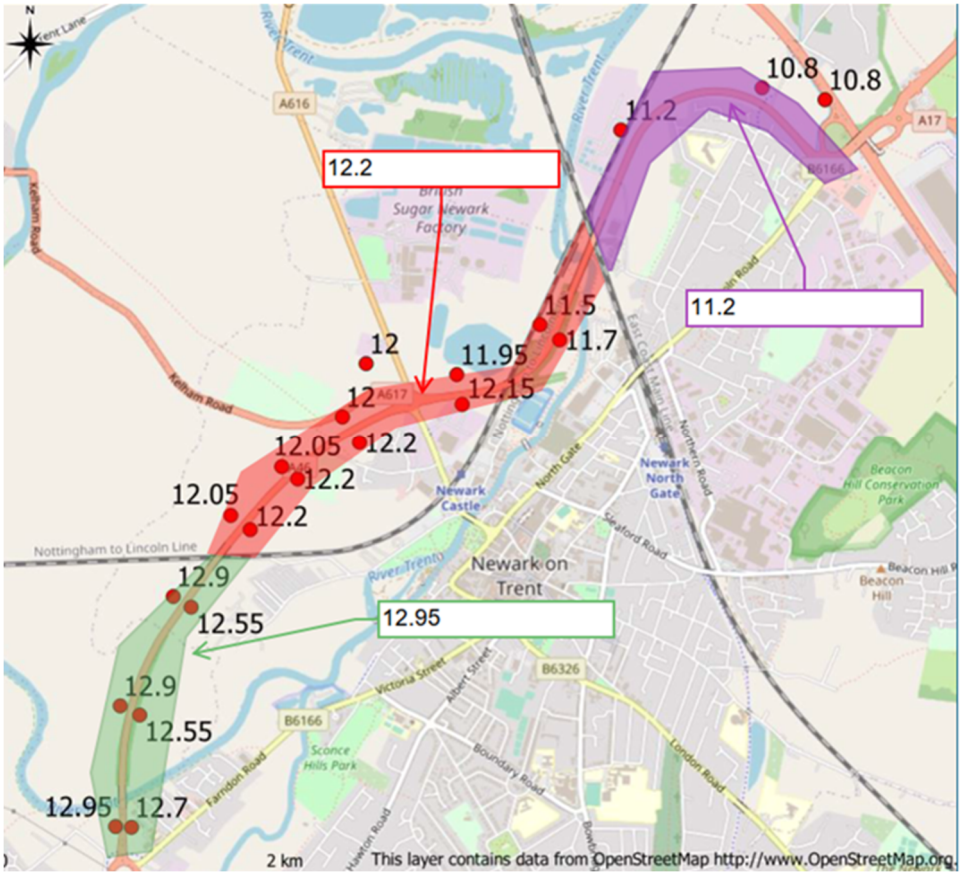


Figure 5-2: Green flood zone

Figure 5-3: Red flood zone

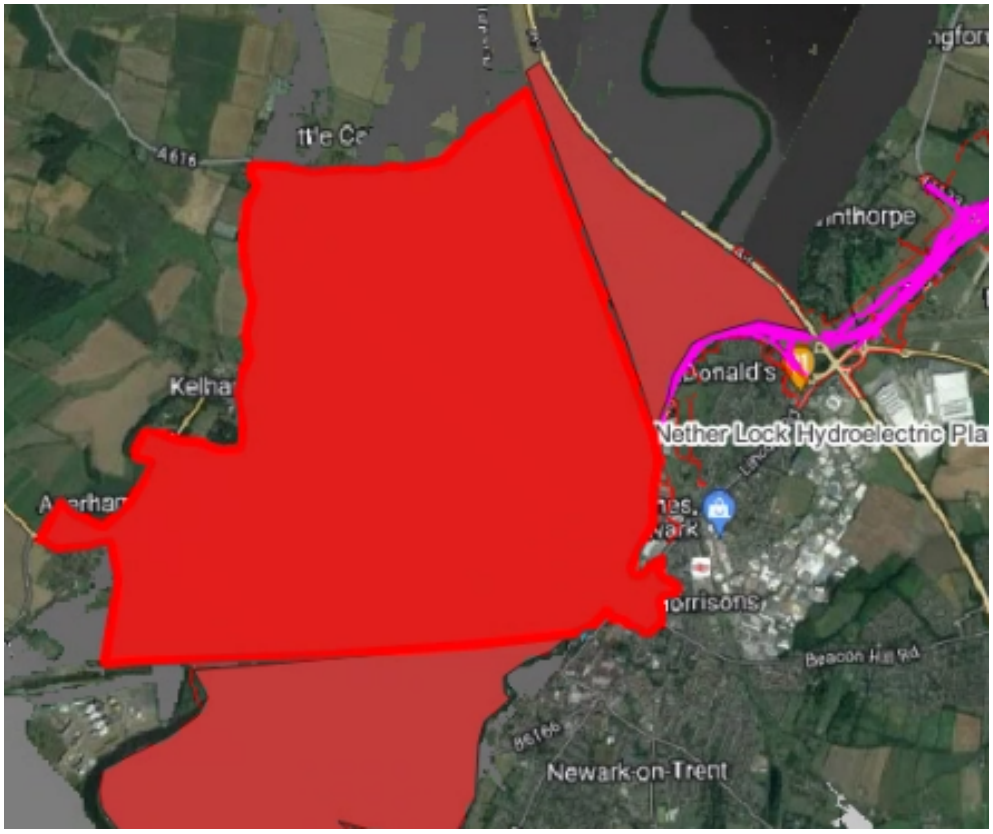


Figure 5-4: Purple flood zone

5.3 Combined event volume calculations

5.3.1 The following table outlines the calculations made for the impact assessment and the resulting impact on fluvial flood levels for the 1 in 100 year storm event. Table 2 below has been colour coded to match the indicated flood zones in Figure 1.

Table 2: Impact assessment calculations

Basin	Total Volume - 1 in 100 year (+40% climate change) (m3)	Total Volume - 1 in 30 year (+20% climate change) (m3)	Unattenuated Volume (m3)	Total Volume in Zone (m3)	Safety Factor +20% (m3)	Available Floodplain Area (m2)	Additional Flood Depth(m)	Existing Flood Levels (m)	Impacted Flood Levels (m)
1	4447	3033	1414						
2	2546	1734	812						
3	1627	1112	515	2741	3290	3169079	0.001	12.90	12.90
4	1258	860	399						
5	1548	1058	490						
6	3529	2414	1114						
7	3436	2351	1085						
8	7393	5061	2332						
9	1835	1254	581	6001	7201	9251390	0.001	12.20	12.20
11	2685	1835	850						
12	5584	3821	1763	2613	2115	1191819	0.002	11.20	11.20

6 Conclusion

6.1 Mitigation

6.1.1 It has been proposed that the Farndon East borrow pit area would be utilised as attenuation in pluvial only events to offset the exceedance volume for events above the 1 in 30 year storm (+ 40% climate change allowance) up to the 1 in 100 year (+ 40% climate change allowance) which cannot be managed in the wetland basins or the landscaped area.

6.1.2 This area would outfall via a flow control device limited to the 1 in 100 year discharge rate into a de-culverted land drain which would flow north-west through the A46 into the Old Trent Dyke. This volume displacement would counteract the additional volume discharged.

6.1.3 Additionally, further displacement has been included in design to ensure that all attenuation basins would discharge at QBAR (mean annual flood) greenfield run-off rates rather than like-for-like greenfield run-off rates. Storm events above the QBAR event (including the 1 in 30 and 1 in 100 year events) would therefore discharge at a rate that is much lower than natural greenfield run-off rates for the equivalent event.

6.1.4 The results of the impact assessments have been discussed below using the same colour zones from Figures 5-2 to 5-4 and Table 2.

6.2 Pluvial event assessment

6.2.1 The pluvial event assessment found that, with the provision of a spillway and an overland flow path there is an extremely low risk to both residential and commercial areas if only up to the 1 in 30 year storm event (+ 40% climate change allowance) is attenuated. Appendix B provides evidence of exceedance routes for attenuation basins within the floodplain.

6.2.2 The exceedance volume from storm events above the 1 in 30 year storm event (+ 40% climate change allowance) would be offset by the provision of additional storage within the Farndon East borrow pit area. This volume would be available for use when the river is not in flood i.e. no fluvial flooding.

6.3 Combined fluvial and pluvial event assessment

Green zone

6.3.1 Critical areas within the green flood zone (as shown in figure 5-2) include the Tolney Lane Road residential area. As the area is already within flood zone 3 and partially within flood zone 2, based on the topography of the area the indicated 1 millimetre increase in flood levels would have a negligible impact on the existing flood risk. There would also be minimal impact on properties at Mill Gate Road in comparison to the existing flood risk.

6.3.2 Based on this, the change of attenuation requirements from the 1 in 100 year (+ 40% climate change allowance) to the 1 in 30 year (+ 40% climate change allowance) would have no material impact within the green zone (as shown in figure 5-2).

Red zone

6.3.3 Within the red areas (as shown in figure 5-3) the flood plain extends up to North Gate Road. As the resulting flood level increase is only 1 millimetre there would be a negligible increase in flood levels.

6.3.4 Based on this, the change of attenuation requirements from the 1 in 100 year (+ 40 climate change allowance) to the 1 in 30 year (+ 40 climate change allowance) would have no material impact within the green zone (as shown in figure 5-2).

Purple zone

6.3.5 The topography within the area around Basins 11 and 12 indicates an increase in flood plain levels of 2 millimetres. This increase shall be negligible over the existing flood risk in this area.

6.3.6 Based on this, the change of attenuation requirements from the 1 in 100 year (+ 40% climate change allowance) to the 1 in 30 year (+ 40% climate change allowance) would have no material impact within the purple zone (as shown in figure 5-4).

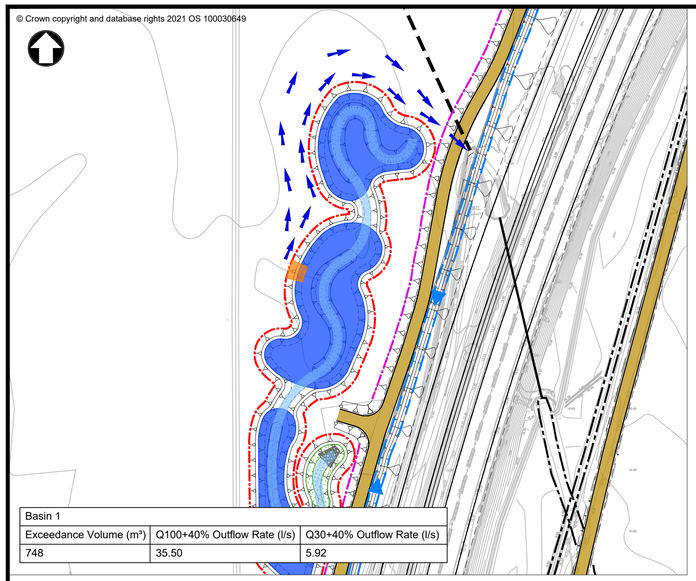
6.4 Pollution dilution

6.4.1 Surface water run-off generated on the highway's surface would be conveyed to the conveyance swales, which will treat the run-off and remove pollutants. In the event of a fluvial flood event that inundated the swales in the floodplain, pollutants within the highway run-off water would be diluted to acceptable levels within the flood water. See the Highways England Water Risk Assessment Tool (HEWRAT) at Appendix 13.3 of the Environmental Statement **(TR010065/APP/6.3).**

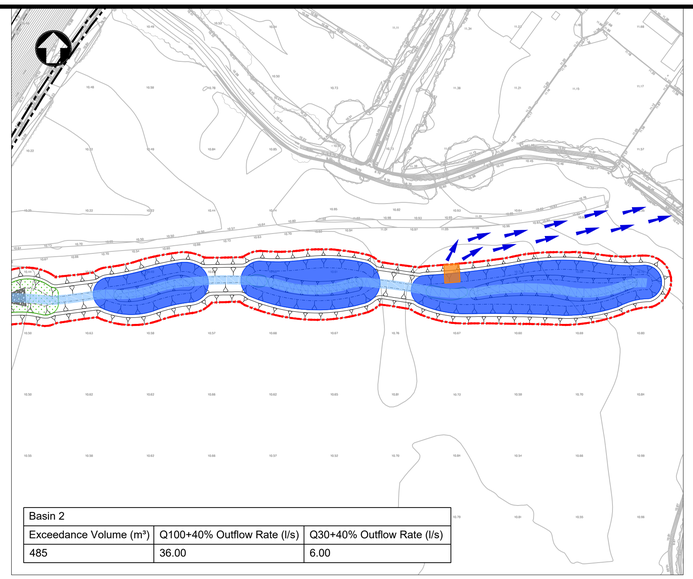
A. Record of meetings

Meeting	Date	Key discussions and decisions made
A46 Newark Bypass Drainage and Flood Management Steering Group meeting number 6	30/11/2022	Proposal to only attenuate surface water flows up to the 1 in 30 year storm event plus a climate change allowance (+ 40%). NCC agreed that such a principle could be explored, and any proposals would need to be qualified with a volume impact assessment (this report). Further confirmation that this principle could be explored was provided in writing by NCC on the 22 March 2023.
Email exchange between the Applicant and NCC	22/03/2023	The principle of relaxing the 1 in 100 year attenuation requirements down to the 1 in 30 year (+40% climate change allowance) for the drainage strategy previously. NCC responded to confirm that they would consider the relaxation subject to the proposals having no significant detrimental impacts on the surrounding area.
Email exchange between the Applicant and NCC	03/04/2023	Request from the Applicant for NCC's standard planning requirements with a response from NCC that set-out the surface water drainage conditions.
Email exchange between the Applicant and the EA	05/07/2023	Discussions around the EA's comments that surface water exceedance flow routing and volumes had not been presented or assessed for comment as part of the consultation process. The applicant has now fully engaged the EA and proposed an expanded surface water attenuation system which attenuates surface water flows up to the 1 in 100 year + 40% climate change allowance.

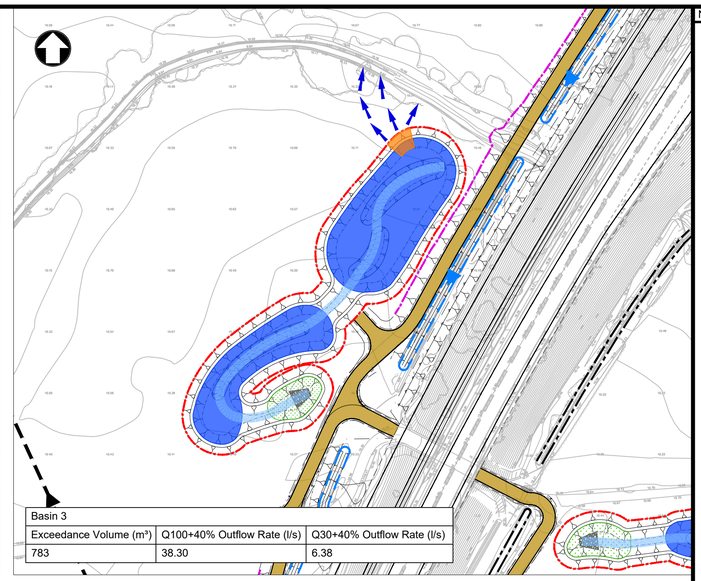
B. Volume impact assessment plans



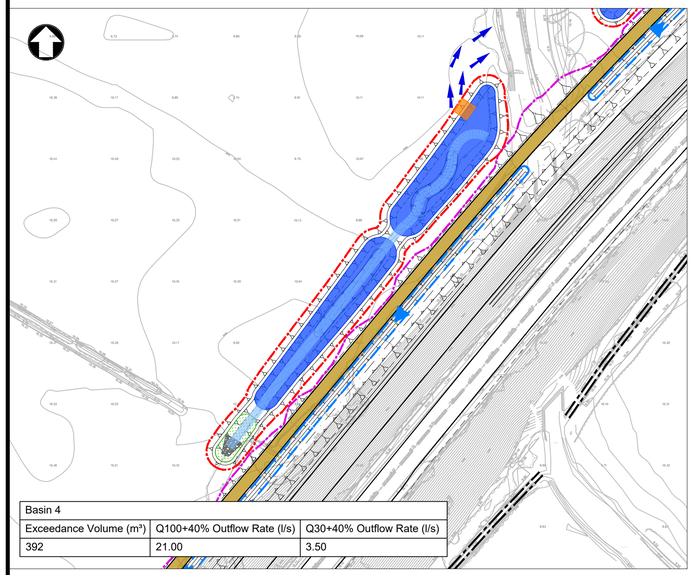
Basin 1		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
748	35.50	5.92



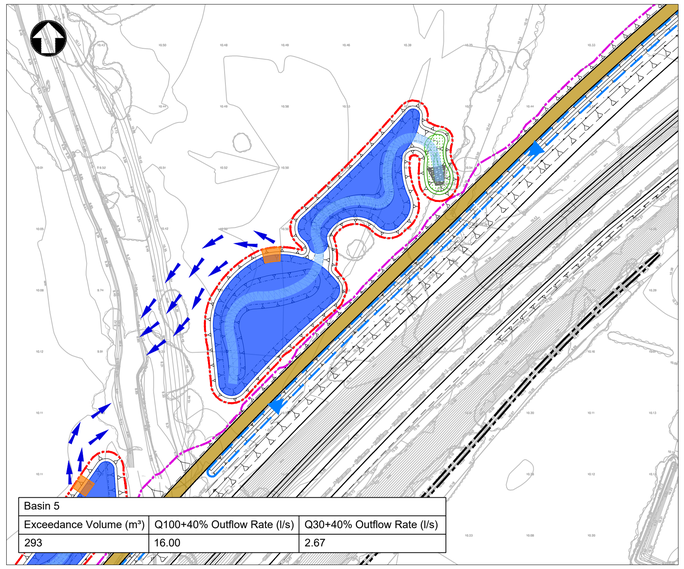
Basin 2		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
485	36.00	6.00



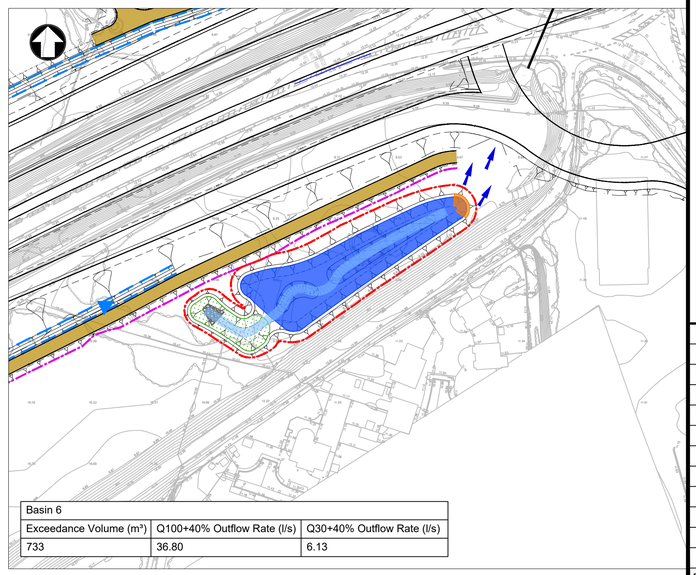
Basin 3		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
783	38.30	6.38



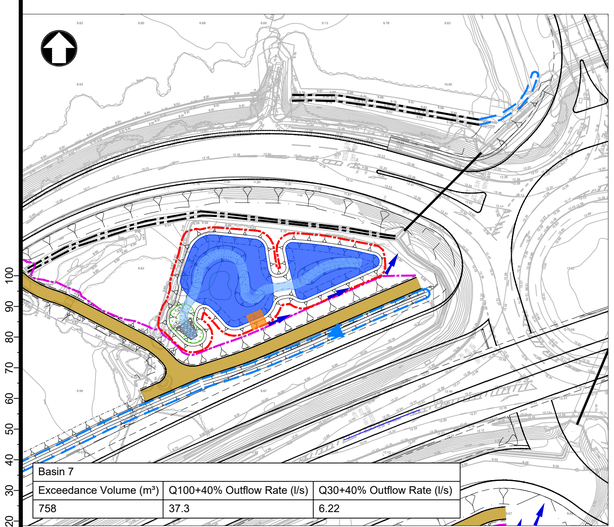
Basin 4		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
392	21.00	3.50



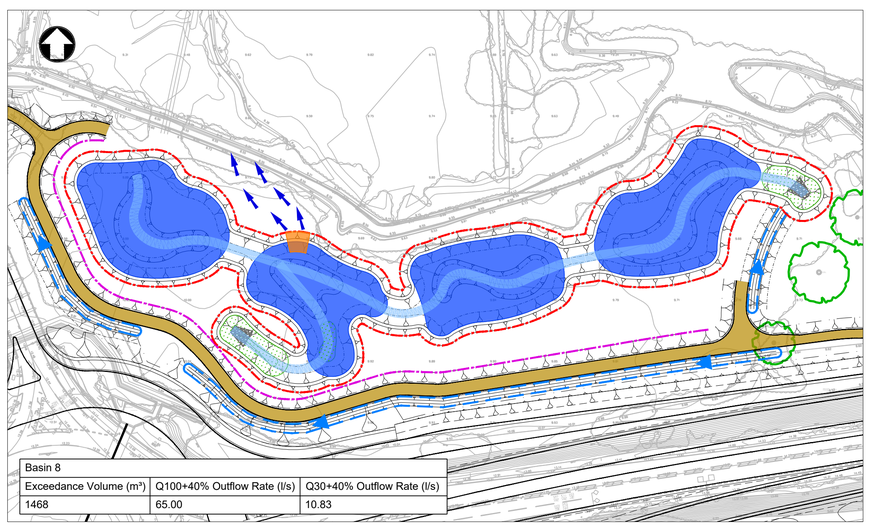
Basin 5		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
293	16.00	2.67



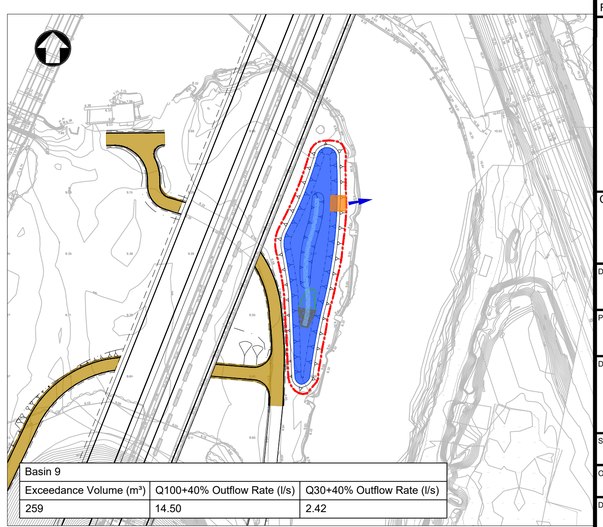
Basin 6		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
733	36.80	6.13



Basin 7		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
758	37.3	6.22



Basin 8		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
1468	65.00	10.83



Basin 9		
Exceedance Volume (m³)	Q100+40% Outflow Rate (l/s)	Q30+40% Outflow Rate (l/s)
259	14.50	2.42

Notes

Key

- Main basin
- Pond
- Basin forebay
- Flow paths
- Rockblanket
- Proposed swale/ditch
- Existing swale/ditch to remain
- Access and Maintenance Track (includes cutoff drain)
- Land drain for basin
- Toe drain for maintenance track
- 5m wide spillway for basin
- Spill route to outfall/watercourse

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
P01	06/07/23	First Issue	RB	GT	---

SKANSKA
1 Hercules Way
Leavesden
Watford
WD25 7GS
Tel : +44 (0)19 2377 6666
www.skanska.co.uk

MOTT MACDONALD
Mountbatten House
Grosvenor Square
Southampton
SO15 2JU
Tel : +44 (0)23 8062 8800
www.mottmac.com

Client: national highways

Drawing Status: Suitable for Information
Status: S2

Project Title: A46 Newark Bypass

Drawing Title: A46 Newark Bypass
Volume Impact Assessment Plan

Scale	Designed	Drawn	Checked	Approved
1:1000	I. Tayab	R.Barwell	G.Tregillis	---
Original Size	**Date**	**Date**	**Date**	**Date**
A1	06/07/23	06/07/23	06/07/23	---

Drawing Number: HE551478 - SKAG - HDG - CONWI_CONW - DR - CD - 00010
(HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No.: HE551478

Revision: P01

1:1000 0 50m 100m

C:\pwworkdir\bs1192\ronan.barwell@mottmac.com\dms76148\HE551478-SKAG-HDG-CONWI_CONW-DR-CD-00010.dwg Jul 6, 2023 - 3:09PM

Notes

Key

- Main basin
- Pond
- Basin forebay
- Flow paths
- Rockblanket
- Proposed swale/ditch
- Existing swale/ditch to remain
- Access and Maintenance Track (includes cutoff drain)
- Land drain for basin
- Toe drain for maintenance track
- 5m wide spillway for basin
- Spill route to outfall/watercourse

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
P01	14/09/23	First Issue	RB	GT	---

SKANSKA

1 Hercules Way
Leavesden
Watford
WD25 7GS

Tel : +44 (0)19 2377 6666 [redacted]

MOTT MACDONALD

Mountbatten House
Grosvenor Square
Southampton
SO15 2JU

Tel : +44 (0)23 8062 8800 [redacted]

Client: national highways

Drawing Status: Suitable for Information

Status: S2

Project Title: A46 Newark Bypass

Drawing Title: A46 Newark Bypass
Volume Impact Assessment Plan
Basins Outside of Floodplain

Scale	Designed	Drawn	Checked	Approved
1:1000	I. Tayab	R.Barwell	G.Tregillis	---
Original Size	**Date**	**Date**	**Date**	**Date**
A1	14/09/23	14/09/23	14/09/23	---

Drawing Number: HE PIN | Originator | Volume
HE551478 - SKAG - HDG -
CONWI_CONW - DR - CD - 00020
Location

Project Ref. No.: HE551478

Revision: P01

1:1000 0 50m 100m

Appendix C – Drainage standards and guidance documents

Title	Reference
Design Manual of Roads and Bridges	
GG 101 Introduction to the Design Manual for Roads and Bridges	DMRB
CG 501 Version 02- Design of highway drainage systems	DMRB
CG 502 Version 0 - The certification of drainage design	DMRB
CD521 Version 01- Hydraulic design of road edge surface water channels (SWC) and outlets	DMRB
CD 522 Version 0 - Drainage of run-off from natural catchments	DMRB
CD 524 Version 0 – Edge of pavement details	DMRB
CD 525 Version 01 – Design of combined surface and sub-surface drains and management of stone scatter	DMRB
CD 526 Version 03 - Spacing of road gullies	DMRB
CD 528 Version 0 Vortex separators for use with road drainage systems	DMRB
CD 529 – Version 01 Design of outfall and culvert details	DMRB
CD 532 – Version 0 Vegetated drainage systems for highway run-off	DMRB
CD 533 – Version 01 - Determination of pipe and bedding combinations for drainage works	DMRB
CD 534 – Version 0 - Chamber tops and gully tops for road drainage and services	DMRB
CD 535 Volume 4 Section 2 CD 535 Drainage. Design. Drainage asset data and risk management	DMRB
LA 113 – Version 1 - Road Drainage and the Water Environment.	DMRB
Local Highway Authority Standards	
Drainage Part 5.2 Nottinghamshire Highway Design Guide	Nottinghamshire County Council
Other standards or guidance	
SuDS Manual 2nd Edition (2015 v5), C753	CIRIA
A Design and Construction Guide for Developers (Sewers for Adoption 8th edition) for design of pumping stations	Sewerage Sector Guidance, Water UK

Guide to road Design, Part 5A: Drainage – Road Surface, Networks, Basins and Subsurface	Austroads
Urban Wetland Design Guide – Designing wetlands to improve water quality	Enfield Council, ZSL, Environment Agency