M25 JUNCTION 28 IMPROVEMENTS

Drainage Strategy Report

PCF STAGE 5
SUITABLE FOR REVIEW & COMMENT | S3
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Reviewer List

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1. Scheme introduction

1.1.1. In March 2020, the Department for Transport published its second Road Investment Strategy (RIS2), which covers investment in and management of the strategic road network (SRN) from April 2020 to March 2025. RIS2 sets out government's vision for a safer, more reliable, and greener SRN which uses new technology, supports the country's economy and is an integrated part of the national transport network. Government have allocated £27.4 billion to support this vision. Highways England responded to the RIS with the Highways England Delivery Plan and several schemes have been identified to be constructed within the plan period, including the improvement to M25 junction 28. The M25 junction 28 scheme is a Nationally Significant Infrastructure Project (NSIP). Highways England is therefore required to apply for a Development Consent Order (DCO) for the scheme.

1.1.2. The scheme is located on the M25 at junction 28 between Brentwood and Romford, on the border of London Borough of Havering and Brentwood Borough Council. This junction is one of the major improvement projects planned within the south-east and will provide better access towards Essex and London, as well as connecting Brentwood, Chelmsford, Colchester and Suffolk with London and other key destinations.

1.1.3. The proposed M25 junction 28 improvements scheme comprises:

- the creation of a new two-lane loop road with hard shoulder, for traffic travelling from the M25 anti-clockwise onto the A12 eastbound
- the realignment of the A12 eastbound exit slip road and M25 anticlockwise entry slip road to accommodate the new loop road
- the provision of a bridge (Alder Wood Bridge) over M25 anti-clockwise entry slip road to facilitate the new loop road
- the provision of an overbridge (Maylands Bridge) at the A12 eastbound exit slip road to allow the proposed loop road to join the A12 eastbound carriageway
- diversion of a high-pressure gas main
- diversion and undergrounding of a section of UKPN high voltage overhead line
- other minor utilities diversions
- the creation of three new attenuation ponds and associated drainage facilities
- realignment of the Ingrebourne River and sections of the Weald Brook and an area for ecological compensation to provide mitigation for the impacts of the Scheme on biodiversity resources

- an area for compensation to provide mitigation works for the impacts of the Scheme on Maylands Golf Club.

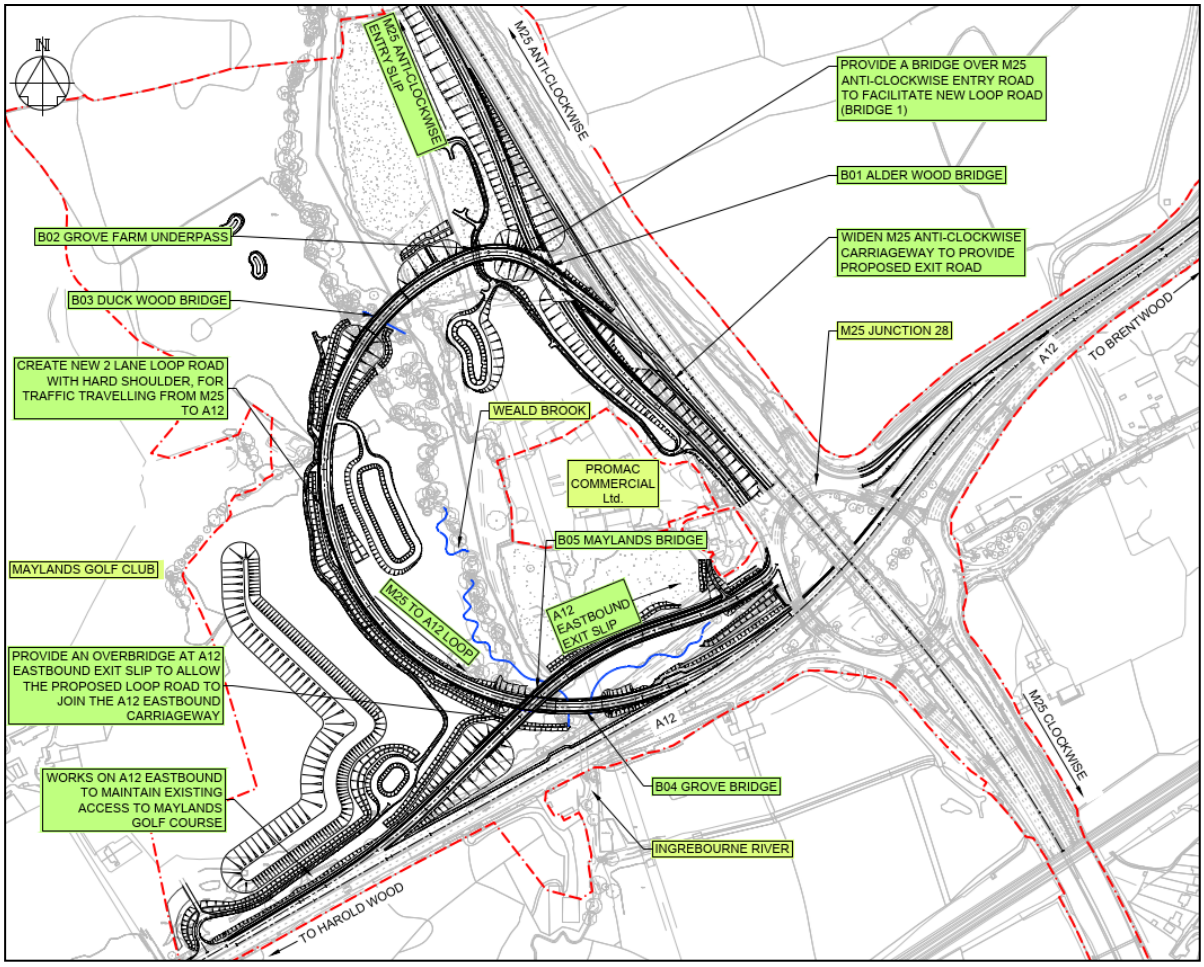
1.1.4. For further background information on the M25 junction 28 improvements scheme, refer to the Highways England Client Scheme Requirements product.

1.2. Scheme Objectives

1.2.1. The M25 junction 28 improvements aims to:

- increase capacity to reduce congestion and delays by providing a new dedicated link from the M25 northbound to A12 eastbound
- reduce the incident rate and resulting disruption by increasing the capacity of the junction and reducing traffic flows on the roundabout
- improve the safety on the roundabout by reducing the traffic flows and redesigning the existing destination signing and road markings
- cater for future traffic demands to enable development and economic growth
- minimise the impact on local air quality and noise by smoothing the traffic flow
- protect access for non-motorised users (pedestrians and cyclists) and improve conditions where possible.

Figure 1 - Scheme plan



1.2.2. Network 501 captures surface water run-off from the Transport for London (TfL) section of the A12 Mainline and the proposed A12 Diverge as well as run off from the golf course bund. The network ultimately discharges to Weald Brook via the attenuation basin and drainage ditch.

1.2.3. Network 502 captures surface water run-off from the Highways England (HE) section of the A12 Mainline and the proposed M25 Loop road. The network ultimately discharges to an existing culvert via existing highway drainage and ultimately the Ingrebourne River.

1.2.4. Network 503 captures surface water run-off from A12 diverge and the proposed M25 slip road. The network ultimately discharges via oversized attenuation pipes to the realigned Ingrebourne River downstream of Grove Farm culvert.

1.2.5. Network 504 captures surface water run-off from the proposed M25 slip road and Loop. The network ultimately discharges via an attenuation basin to the Weald Brook.

1.2.6. Network 505 captures surface water run-off from the proposed Loop road. The network ultimately discharges via an attenuation basin to the realigned Weald Brook.

1.2.7. Network 506 has two outfalls along the M25 one discharging to Weald Brook via the existing petrol interceptor and attenuation tank and the other outfalling to Weald Brook via the culvert extension headwall.

2. Data Sources

2.1.1 The Stage 3 drainage strategy should be read in conjunction with this report to provide additional detail.

2.1.2 The Stage 5 drainage design builds upon the Stage 3 drainage design. The Stage 3 Designer (Atkins) has progressed the DCO alongside the work done during Stage 5 detailed design.

2.1.3 Existing drainage information has been reviewed on HADDMS. The A12 was surveyed during Stage 3. The limited areas of the M25 and sections of the A12 were surveyed during Stage 5 (received May 2021).

3. Field Studies

3.1.1. Existing drainage surveys

Table 3-1: Drainage Survey Summary

Survey Date	Location	Details
10/08/2020	A12	Stage 3 Drainage survey
10/05/2021	M25 and A12	Final Stage 5 survey released to design team

4. Design Options

4.1.1. At Stage 5, the preliminary design from Stage 3 was used as a basis. The vertical and horizontal alignment has been progressed during detailed design so the drainage proposals had to be updated from Stage 3.

4.1.2. The overall strategy is that the proposed discharge rate should not exceed the existing discharge rates for all catchments.

4.1.3. The discharge rates for each of the existing drainage catchments were calculated using greenfield run off rates for areas that are currently greenfield and the Wallingford 'Simple' method for areas that are currently impermeable. The discharge rates for the proposed networks have been taken from the hydraulic models.

4.1.4. The scheme has been designed to the DMRB and so there will not be any surcharging in the 1 in 1 year storm and no flooding during the 1 in 5 year storm. Flooding during the 1 in 100 year storm will be contained within the site boundary.

4.1.5. An allowance of 20% for climate change has been incorporated in the 1 in 1 and 1 in 5 year return period events and an assessment for 40% climate change allowance for the 100 year return period where storage is required.

5. Proposed Design

5.1.1. Overland flows have been calculated by reviewing the contours and determining the catchment. These catchments have assumed that only 10% of the surface water runoff will reach the drainage network. This has been assumed based on the catchment types and the tree coverage which will likely intercept the majority of the flows before entering the drainage ditches.

5.1.2. Attenuation basins have been sized to store the 1 in 100 year storm with a 20% climate change allowance. A 40% climate change allowance has also been run to review the flooding generated and determine the network sensitivity. All of the basins have 300mm of freeboard to ground level. There is then a 1m wide grassed berm and a 5m wide gravel track.

5.2. Network 501

5.2.1. Network 501 allows existing upstream drainage on the A12 to discharge into the proposed network in the verge. The point at which the existing network crosses into the verge is a plated over existing chamber before continuing in the proposed verge. The drainage system is a kerb and gully arrangement before discharging to an attenuation basin. The attenuation basin has a flow control at the outlet discharging to a drainage ditch and ultimately Weald Brook.

5.3. Network 502

5.3.1. The first part of the network runs along the A12. The existing gully connections are used before discharging via an existing headwall outfall. The network draining the loop road and east of A12 culvert will be restricted by a flow control within the proposed drainage network before discharging to existing network and outfall in to Ingrebourne River.

5.4. Network 503

5.4.1. The network covers both the A12 diverge and a section of the M25 slip. The A12 diverge has earth reinforced soil walls on both sides meaning that the outfall is through a deep chamber. There are oversized storage pipes (900mm diameter) attenuating flows and a flow control before discharging downstream of the extended Grove Farm Culvert in to Ingrebourne River.

5.5. Network 504

5.5.1. The network covers both the M25 Loop Road and a section of the M25 slip. The M25 Loop Road has earth reinforced soil walls on the inside meaning that the outfall is through a deep chamber. The network discharges through a cutting

before being attenuated in a basin prior to discharging via a ditch over the BPA pipeline to Weald Brook.

5.6. Network 505

5.6.1. The M25 Loop is built wholly on greenfield and so is restricted to existing greenfield run-off rates. The network discharges to an attenuation basin and outfalls to a section of realigned Weald Brook.

5.7. Network 506

5.7.1. Network 506 is drained by surface water channel along the M25 and accepts existing drainage from the central reserve and to the northern extent of the scheme (M25). Network 506 has two outfall locations to Weald Brook. The southern outfall discharges via an existing petrol interceptor and attenuation tank. The northern outfall discharges to an extended culvert and headwall.

5.8. Discharge Rates

5.8.1. The discharge rates are displayed in the table below and should be used in conjunction with the relevant drainage network drawings: HE551519-SWE-HDG-ZZ-DR-CD-50001 - 50005.

Table 5-1: Discharge rate by Network and Return Period

Network	1 Year Return Period Discharge Rate (l/s)		5 Year Return Period Discharge Rate (l/s)		100 Year Return Period Discharge Rate (l/s)		Comments
	Existing	Proposed	Existing	Proposed	Existing	Proposed	
501	107.69	39.7	163.10	45.5	256.47	235.9	
502A	60.5	< Existing	88.2	< Existing	144.7	< Existing	Existing contributing area reduced in proposed design using same outfall
502B	67.8	62.2	99.0	91.2	162.1	161.2	
503	38.69	38.6	55.5	48.6	95.67	94.5	
504	30.63	26.5	41.97	30	83.85	44.3	
505	4.50	1.5	5.00	3.3	16.90	4.5	
506 (North)	227.85	148.2	358.20	232.5	712.93	428.2	
506 (South)	290.70	204.2	425.40	273	691.90	522.5	

5.9. Attenuation Volumes

The storage volumes required and provided in the drainage design are detailed below:

Table 5-2: Storage Volumes Required for Attenuation

Network	Type	Storage Volume (m3)	Comments
501	Attenuation Basin	1016	
502A	-		No attenuation
502B	Oversized Pipes	26	600mm diameter pipes
503	Oversized Pipes	330	900mm diameter pipes
504	Attenuation Basin	1357	
505	Attenuation Basin	1675	
506 (North)	-		No attenuation required. Existing storage tank retained downstream.
506 (South)	-		No attenuation

5.10. Fencing

5.10.1. Some of the drainage ditches on the scheme are crossed by the deer and otter fencing. In order to create a barrier, short sections of ditch are piped to allow the fencing to cross the drainage ditches.

5.11. Water Quality

5.11.1. No water quality mitigation was required above the proposed drainage network replacement when the HEWRAT assessments were undertaken.

5.11.2. A risk assessment is required to confirm there is sufficient attenuation of potential contamination within groundwater, entering attenuation ponds via forms of leakage mechanisms. It was determined that the groundwater contribution was negligible when compared to the overall discharge volumes. Discharge quality is required to conform to Environmental Quality Standards (EQS).

6. Residual Risks

6.1.1. To reduce the risks of maintaining the attenuation basins, maintenance tracks surrounding the ponds have been designed which will give the maintainer easy access. There is a risk of road users or general public falling into the attenuation basins. This has been eliminated by including a fence around the ponds in the design to prevent access. Public Rescue Equipment (PRE) is also provided at regular intervals around the basins.

6.1.2. Deep drainage chambers (7m+) are required when discharging from the higher carriageway levels to the ground level and where the scheme is in deep cut. These have been highlighted to the maintainers and designed to the DMRB Type 5 Chambers.

6.1.3. The maintainer is expected to close the pollution control valves during emergencies prior to pollutants from spillages entering the attenuation basins. There is still a risk therefore of pollution from the highway entering the watercourses via the surface water runoff if the valve is not operated.

6.1.4. The drainage Designers Risk Assessment is included in Appendix A.

7. Maintenance

7.1.1. Off network access has been provided where possible. Each basin has a maintenance track sufficient for their maintenance requirements.

7.1.2. A pollution control valve is located upstream of each basin outfall and must be operated manually.

7.1.3. The maintenance requirements were discussed and agreed on a call with TFL and Connect Plus Services (CPS). See Appendix B for details of consultation.

7.1.4. Easements and rights of access are required as detailed on the maintenance boundary drawings.

7.1.5. Refer to Maintenance and Repair Statement HE551519-SWE-HSH-ZZ-SG-ZS-50001 for maintenance boundaries drawings and further detail.

7.2. TFL and CPS Maintenance Boundaries Summary

7.2.1. TFL will be responsible for the adoption and maintenance of Network 501 and Network 502. Network 503 will be split between CPS and TFL. TFL will be responsible for the section of the network which is located in the A12 diverge highway.

7.2.2. Network 502 is split between both maintainers. The upstream extent of the M25 Loop road is maintained by CPS and from the nosing where the Loop road meets the A12 TFL take over ownership.

7.2.3. Shared outfalls have been presented and accepted by both TFL and CPS. The split of the network occurs at the boundary lines.

Appendix A. Designers Risk Assessment

Table A-1 : Designers Risk Assessment

Project: M25 J28		**Stage:** Stage 5		**Date:** 01/10/2021	**Issue:** P01	
Ref No	Hazard	Risk(s)	Risk To:	Design Option(s)	Result(s)	Comment(s)
001	Existing drainage	Exposure to contaminated material. Potential exposure to water-borne disease (e.g. Weils Disease)	Construction workers	Do not interact with existing drainage	Risk mitigated.	Option not viable, need to treat existing drainage to be removed, abandoned or re-used.
				Abandoned drainage would need to be either removed or grouted up, drainage to be re-used would require inspection, cleaning and maintenance where required.	Risk outstanding, however its occurrence is expected to be highly unlikely for the majority of the scheme.	To be included in the SHE box on the drawings with any specific known sources of contamination identified separately. Site clearance drawings to highlight known existing drainage.
002	Standing water/flooding by inadequate drainage system	Skidding, aquaplaning from surcharging water into the wheel tracks causing accidents and road closures	Road users.	Design to DMRB utilising an acceptable drainage system	Risk mitigated	None
003	Maintenance access to chambers.	Collision of plant and workforce with road users.	Maintenance workers.	Chambers located in verges away from traffic, therefore minimising future TM requirements.	Reduced risk.	

Project: M25 J28		**Stage:** Stage 5		**Date:** 01/10/2021	**Issue:** P01	
Ref No	Hazard	Risk(s)	Risk To:	Design Option(s)	Result(s)	Comment(s)
004	Contamination within groundwater due to legacy land use	Contamination within groundwater enters attenuation basins via cutting slopes and/or other leakage mechanisms which are then discharged to surface watercourse.	Environment, receiving watercourse downstream of discharge points	Attenuation measures up stream of the watercourse and in accordance with DMRB CD 532 Vegetated drainage systems for highway runoff (formerly HA 103/06)	Risk mitigated	Emergency services to receive locations of all pollution control devices. Maintenance required as per MRS
005	Confined Spaces	Potentially unsafe access for maintenance at flow control chamber	Maintenance workers	Use hydrobrakes which are less prone to blockage (where appropriate) and have a pull handle operated from surface minimising the need to enter chamber.	Risk reduced	
007	Storage	Drowning	Public/ maintenance workers	Attenuation basin Accommodated where land allowed. Dry unless during a rainfall event. Oversized pipe Unsuitable for large storage volumes. Used where required	Risk mitigated	Basins will be gated and fenced. Access track surrounding all the attenuation basins. PRE equipment provided at the largest HE maintained Basins (one life ring at each) to avoid unnecessary provision. Asset is fence, signed and gated. The asset is deemed to be far enough away from residential areas to avoid unnecessary provision.

Project: M25 J28		**Stage:** Stage 5		**Date:** 01/10/2021	**Issue:** P01	
Ref No	Hazard	Risk(s)	Risk To:	Design Option(s)	Result(s)	Comment(s)
008	Discharging flow at outfall above existing rate	Potential to cause flooding	Road users	Throttle – installing a smaller pipe downstream to reduce flow The large diameter pipes where storage is provided were existing therefore excavating and installing a new smaller diameter pipe was deemed inefficient Orifice Plate Restrict flow but has the potential to cause blockages HydroBrake Restricts flow at a rate that is accurate. Less prone to blockage.	Risk mitigated	Hydrobrake preferred as it modelled a discharge rate closer to the existing rate. The chamber will have a pull handle operated from surface minimising the need to enter chamber.
009	Low points/flat spots flooding at slips etc.	Skidding, aquaplaning from surcharging water into the wheel tracks causing accidents and road closures	Road users	Oversizing any drainage required here to ensure that flooding does not occur.	Risk mitigated	Model runs simulated to increase resilience - therefore acceptable.
010	Deep drainage	Excavations to construct	Construction workers	It is efficient to keep drainage as shallow as possible for ease of construction and efficient design		Where deep drainage is located it will be highlighted in the SHE box on the drawings.
THERE ARE NO OTHER KNOWN EXCEPTIONAL RISKS						

Appendix B. Record of Consultation

Havering London Borough Council

10/02/21 - Initial online meeting where drainage design team presented the outline of the scheme and the proposals.

28/04/21 - Stage 3 drainage drawings were shared.

10/05/21 - Drainage contact [redacted] and [redacted] were presented with the drainage strategy in further detail and general arrangement drawings were presented.

Transport for London (TFL)

28/01/21 - Initial online meeting where drainage design team presented the outline of the scheme and the proposals.

19/04/21 – General Maintenance Call drainage strategy and drainage maintenance requirements were agreed.

04/05/21 – Call to discuss Stage 5 drainage strategy and to present shared outfalls and attenuation required.

15/09/21 – Call to provide any updates on the Stage 5 drainage design and address any concerns raised.

Connect Plus Services (CPS)

22/02/21 - Initial introductory online meeting where drainage design team presented the outline of the scheme and the proposals.

10/09/21 – Call to provide any updates on the Stage 5 drainage design and address any concerns raised regarding maintenance.

Environment Agency (EA)

18/02/21 – introductory meeting regarding flood risk and the drainage strategy. Design shared.

17/08/21 - Emails 17th august 2021 and online meeting on 26th August 2021 to discuss further the interaction with the watercourse.