A303 Amesbury to Berwick Down

TR010025

6.3 Environmental Statement Appendices

Appendix 11.3 Road Drainage Strategy

Volume 6

APFP Regulation 5(2)(a)

Planning Act 2008

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

October 2018

Table of Contents

1 Introduction

1.1 Purpose of this appendix

1.1.1 A drainage strategy and preliminary drainage design have been developed in conjunction to support the application for the Development Consent Order (DCO) for the scheme.

1.1.2 The purpose of the strategy is to outline the methodology proposed to mitigate significant impacts upon the water environment from the new highway.

1.1.3 This appendix will describe the various drainage concepts identified for each area. The concepts include proposed embedded mitigation measures which have been developed through close coordination with the groundwater, flood risk and water quality disciplines to provide an integrated approach.

1.1.4 The Outline Environmental Management Plan (OEMP) includes details of measures to protect the environment during construction of the scheme.

1.2 Background

1.2.1 The existing A303 is predominantly drained by gullies which discharge directly to either filter drains or road side ditches which infiltrate the runoff to ground.

1.2.2 The existing highway and Scheme traverse two watercourses, the River Till and the River Avon. At these locations the highway runoff is discharged directly to either road side ditches or the watercourses without any modern standards of treatment to mitigate pollution.

1.2.3 Consultation with the Environment Agency (EA) and Wiltshire Council (WC) has also informed the strategy and the choice of features included within the preliminary design.

2 Drainage Strategy Overview

2.1 Preliminary Design

2.1.1 The preliminary design has been undertaken to develop a conceptual or indicative design to demonstrate the viability of the scheme in respect of surface water management, treatment of runoff and managing flows from catchments external to the highway.

2.1.2 The significant drainage features are shown on the Environmental Masterplan, including the locations of the Drainage Treatment Areas (DTA).

2.2 Technical Standards

2.2.1 The preliminary design to support the development of the Drainage Strategy has been undertaken in accordance with the following requirements and advice documents:

- Design Manual for Roads and Bridges (DMRB). Volume 4, Section 2 HD 33/16 Surface and Sub-surface Drainage Systems for Highways
- Design Manual for Roads and Bridges. Volume 4, Section 2, HA 39/98 Edge of Pavement Details
- Design Manual for Roads and Bridges. Volume 4, Section 2 HA 103/06 Vegetative Treatment Systems for Highway Runoff
- Design Manual for Roads and Bridges Volume 2, Section 2,Part 7, HA 107/04 Design of Outfall and Culvert Details
- Design Manual for Roads and Bridges. Volume 4, Section 2 HA 106/04 Drainage of Runoff from Natural Catchments
- Design Manual for Roads and Bridges Volume 2, Section 2, Part 9 BD 78/99
- Unpublished version of the Design Manual for Roads and Bridges Volume 11, Section 3, Part 10 HD45
- The SuDs Manual 2015, CIRIA C753
- Environment Agency Fluvial Design Guide, Chapter 8.

2.2.2 The reasons for using an amended version of HD 45 are outlined in Annex 1 to Appendix 11.1 Water Quality Risk Assessments.

2.3 Catchments

2.3.1 The Scheme comprises three distinct drainage sections, the roads west of the tunnel, the tunnel and the roads east of the tunnel (Figure 2.1). Each of the three sections uses different sustainable drainage features to treat and attenuate the highway water runoff prior to discharge. The drainage proposals for the three areas are described in sections 3 to 5.

2.3.2 The three sections have been broken down into their constituent catchments. The preliminary design drainage catchments are shown in Figure 2.2. The method of discharge for each of these catchments is identified in addition to the catchment area.

2.3.3 Independent highway and land drainage systems are proposed for the scheme in accordance with the guidance in HD 49/16 Highway Drainage Design Principal Requirements.

Figure 2.1: Scheme Drainage Sections

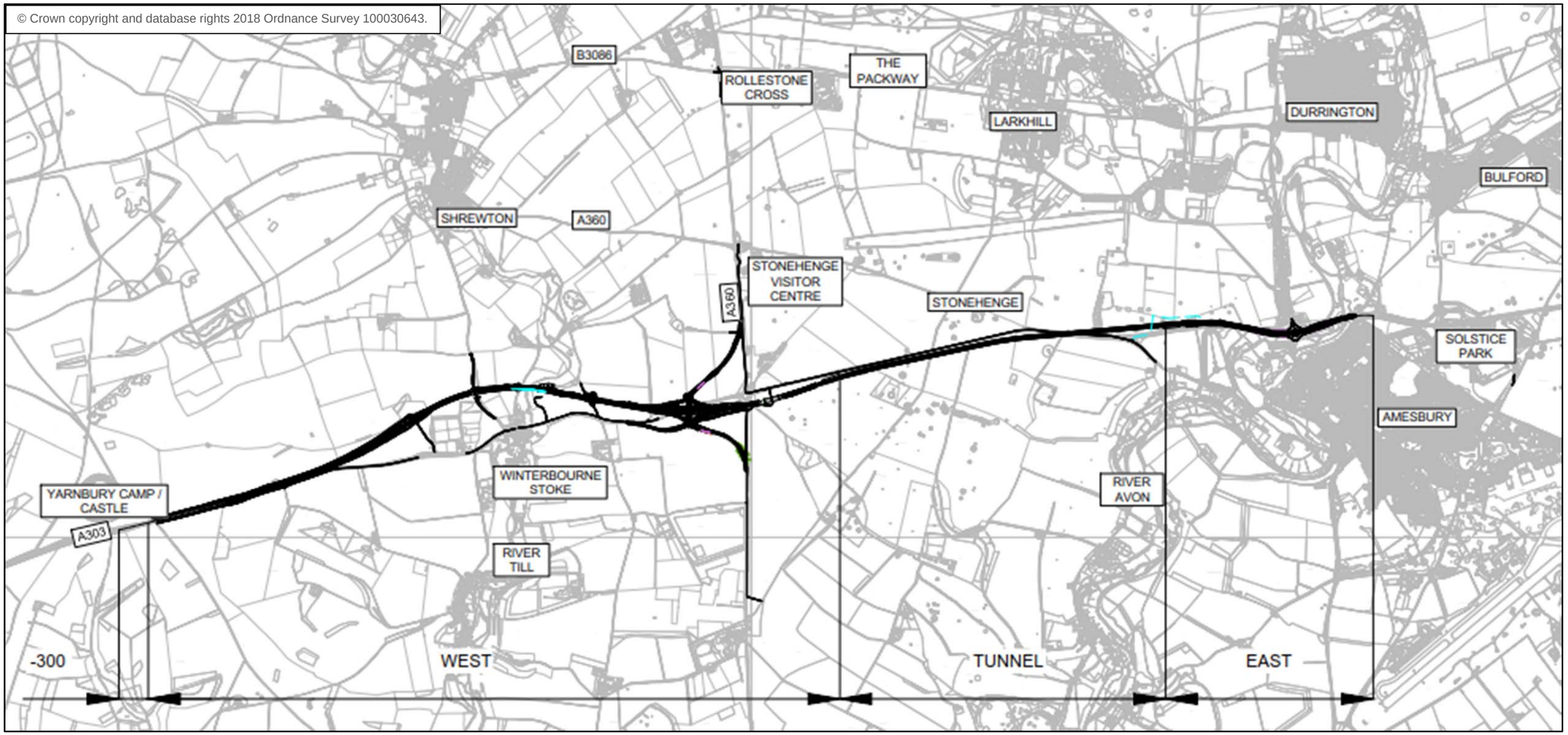
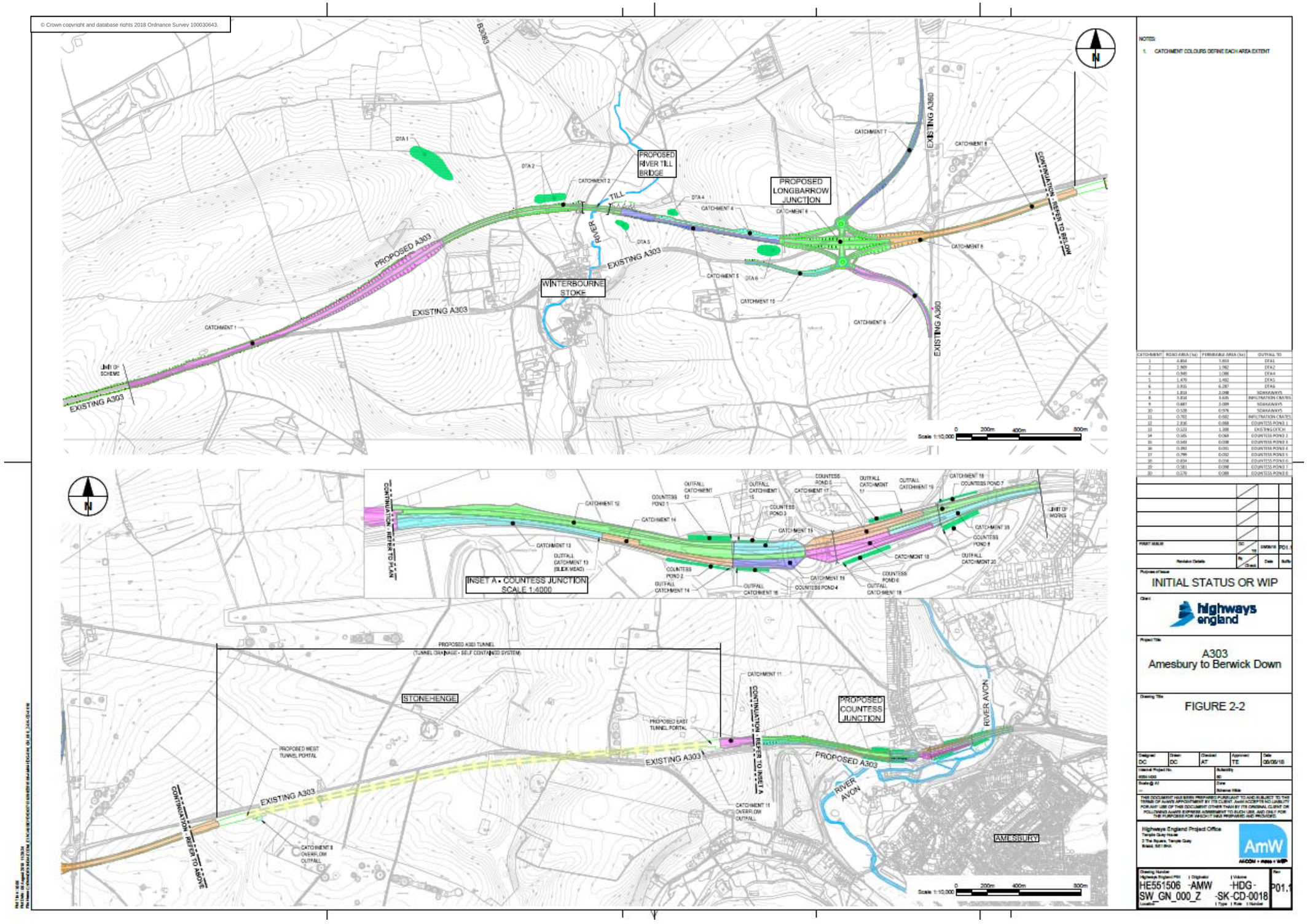


Figure 2.2: Preliminary Design Drainage Catchments



2.4 Hydrology and Geology

2.4.1 Site investigations to determine groundwater levels along the route have identified that discharge of drainage water by infiltration to ground is possible throughout the section west of the tunnel at all of the infiltration locations. Two areas at risk of flooding from groundwater have been identified in the vicinity of the tunnel portals and Parsonage Down during extreme groundwater events.

2.4.2 Groundwater levels within the chalk aquifer fluctuate seasonally. There is also large variance between the minimum and maximum recorded levels. Hydraulic modelling has been undertaken to provide guidance on the anticipated levels to be encountered. Further information can be found the Groundwater Risk Assessment, Appendix 11.4.

2.4.3 A number of historical soakaway tests have been undertaken and their results recorded in the Preliminary Geotechnical Report (P1A-GEO-GEN-R002C). These were used to determine the infiltration rate of the ground at the outfall locations. When calculating attenuation storage the lowest infiltration rate corresponding to the soakaway test closest to the area has been used with an additional factor of safety of 20 applied within the calculations.

2.4.4 The preliminary design invert levels for infiltration systems have been specified at a minimum of 1m above the maximum recorded groundwater level in that locality, in line with best practice guidance (Ref. 11.3.1). The preliminary design invert levels for the basins and the associated maximum recorded groundwater level in that locality are shown in Table 2.1.

2.4.5 Hydraulic modelling undertaken as part of the Flood Risk Assessment (FRA) Appendix 11.5 identified two locations where the scheme proposals would generate impacts in terms of flood depth. Mitigation measures at Parsonage Down and the existing agricultural underpass adjacent to the eastern portal have been included within the assessment and are outlined in sections 3 and 5 of this appendix.

Table 2.1: Preliminary Design Infiltration Basin Invert and Maximum Recorded Groundwater Levels

Drainage Treatment Area	Invert Level (m)	Maximum Recorded Groundwater Level (m)
1	86.0	80.0
2	78.0	74.3
4	75.0	73.1
5	86.0	73.5
6	90.0	75.5

3 West of Tunnel Drainage Strategy

3.1 Route Summary

3.1.1 The proposed route of the new A303 carriageway west of the tunnel is off-line of the existing highway and includes a new dual carriageway, grade separated junction at Longbarrow and viaduct over the River Till.

3.1.2 The route features cuttings and embankments including proposed landscaping areas. From the boundary of the World Heritage Site (WHS) to the entrance to the western tunnel portal the carriageway would be bound to either side by a retained cutting.

3.1.3 Local road improvements would also be included with realignment of the A360 to link with the new grade separated Longbarrow junction.

3.2 Drainage Strategy

Runoff collection and conveyance

3.2.1 Runoff from the carriageway would be collected in road edge channels or gullies which outfall to carrier pipe systems. The use of carrier pipes would ensure that spillages are contained within the drainage system and do not infiltrate to ground close to source. Subsurface drainage would be provided by narrow filter drains throughout all sections of the scheme where necessary. The runoff would be conveyed via the carrier pipes to infiltration basins for treatment.

Attenuation and pollution control

3.2.2 Five DTAs are proposed within the preliminary design for this area, as shown in Figure 2.2. The runoff from catchment 1 would outfall to the infiltration basin (DTA1) located within the landscaped Parsonage Down area. All runoff from catchment 2 would be conveyed to the basin (DTA2) located west of the river and to the north of the proposed highway. The runoff from catchments 4 and 5 would be conveyed to the two basins (DTA4 & DTA5) located east of the River Till. Catchment 6 would drain to the basin (DTA6) located between the new junction and the existing highway.

3.2.3 The infiltration basins would be grassed and designed with shallow slopes to integrate sympathetically into the landscape. They would include impermeable areas to capture a portion of the runoff and aid biodiversity enhancement. A proprietary treatment system would be provided in the base area within the basin to absorb contaminates before the runoff is discharged via infiltration to ground. A conceptual design of the infiltration basins is shown in Figure 3.1.

3.2.4 As infiltration is proposed, there would be no outfalls to surface watercourses from these basins. Preliminary sizing of the basins has been undertaken to contain the 1 in 100 year rainfall event, including a 30% allowance for climate change and 300mm freeboard. In addition, to take into account the risk of an extreme rainfall event larger than the design standard, exceedance routes from the basins have been identified to ensure any potential risk of damage or disruption to property or infrastructure or livestock caused from flow from the basins would be minimised.

3.2.5 Penstocks would be provided in the chambers immediately upstream of the basins to provide spillage control.

3.2.6 Catchment 8 would be an infiltration system, positioned underneath the central reserve, used to discharge the runoff. The infiltration system has been positioned in this location to ensure sufficient clearance from the retaining structures. The road edge channels will discharge directly to the crate system which will be lined with a proprietary treatment system to filter the runoff prior to infiltration. The conceptual drainage cross section through the retained cut is shown in Figure 3.1.

3.2.7 The groundwater modelling indicates that there is a risk of high groundwater impeding infiltration close to the portal entrance during extreme events. A combined surface water/ groundwater system is therefore proposed which would capture and control the groundwater during these events.

3.2.8 These waters would then be captured in a sump located away from the portal (final position to be determined during detailed design) and pumped into an infiltration tank located close to existing ground level to the east of the western portal. This would discharge flows from the system when extreme groundwater levels prevent infiltration to ground at the base of the cutting. The infiltration tank would be positioned away from the retaining wall anchors to minimise risk to the structure from the use of infiltration.

Land Drainage

3.2.9 Ditches would be located at the top of cuttings or at the toe of embankments to capture surface flows from natural catchments adjacent to the highway.

3.2.10 At Parsonage Down a groundwater management system which would include filter drains is proposed to control the water seepages identified during the groundwater assessment. These occur within the proposed landscaping area where the excavated material would be deposited. The groundwater would be conveyed to the River Till in ditches or pipes.

3.2.11 The landscaping proposals in this area would replicate the natural surface flow channels of the valley conveying surface runoff to the low point adjacent to the underpass for the B3083. Here, a bund would be constructed to retain the surface flood flows with a pipe system discharging the runoff to the River Till to the north of the new highway.

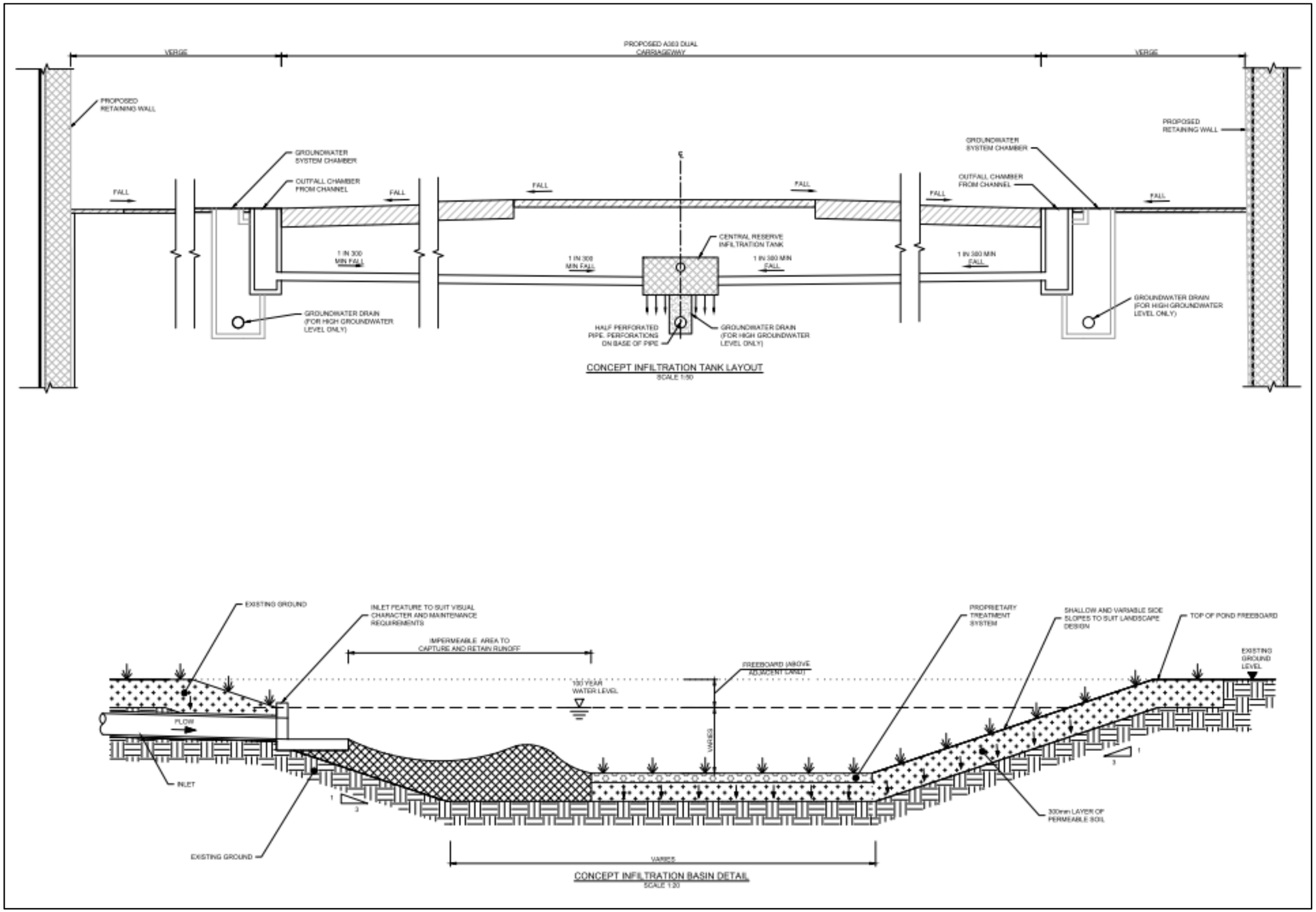
3.2.12 This solution for discharging the surface flood flows forms part of the embedded mitigation described in the FRA, Appendix 11.5 of the Environmental Statement.

3.2.13 Land drainage outfalls at the River Till would be required as part of the scheme and designed in accordance with best practice (Ref 11.3.2).

Local Roads

3.2.14 The new sections of the A360, B3083 and Rollestone Cross would utilise a filter drain system with on-line soakaways to intercept and infiltrate runoff from the carriageway at or close to source. This replicates the existing drainage regime for these routes, with enhancements in terms of water quality through the specification of engineered infiltration systems.

Figure 3.1: Drainage Conceptual Details



4 Tunnel Drainage Strategy

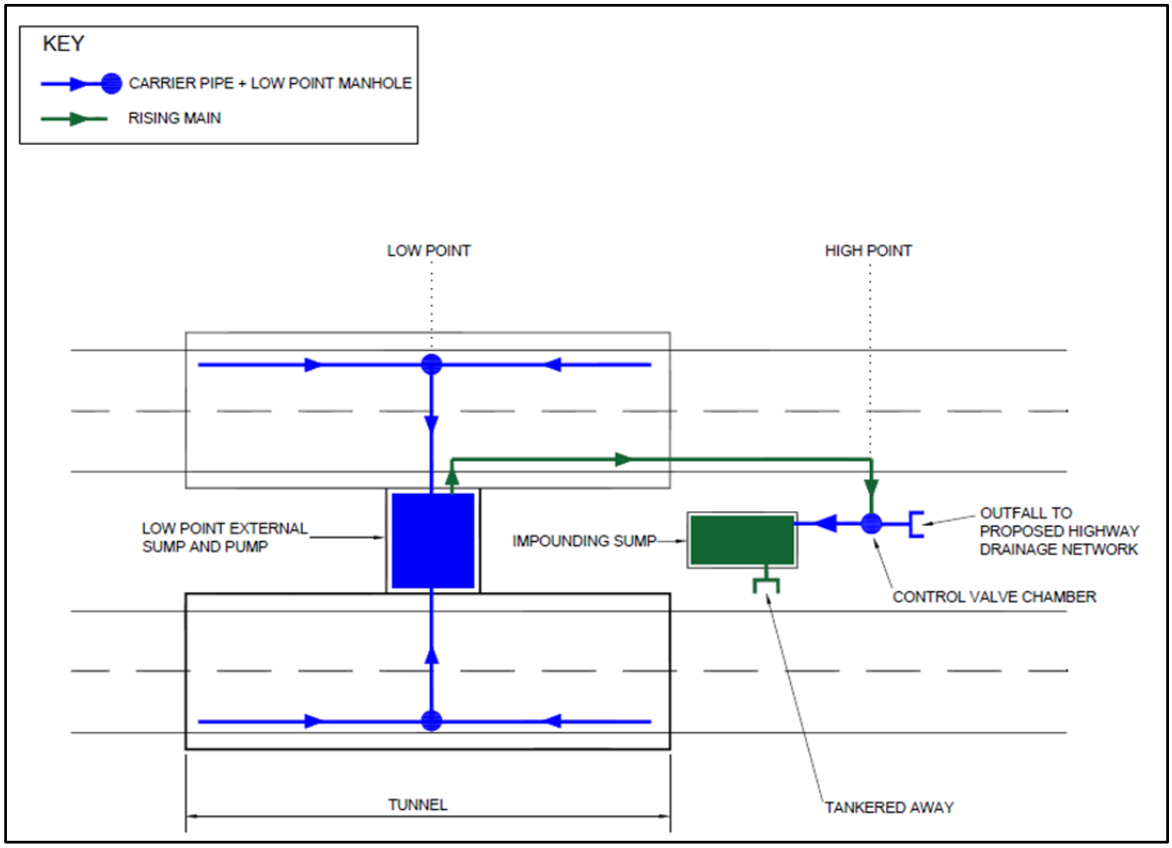
4.1 Drainage Strategy

4.1.1 The tunnel drainage system would be independent of the other drainage networks included within the scheme. The preliminary design solution includes edge of carriageway collection options, carrier drains, a low-point sump and pump, rising main, a control valve, an impounding sump and an outfall to the surface water drainage network.

Tunnel Drainage Schematic

4.1.2 The schematic (Figure 4.1) shows the proposal for the discharge from the tunnel drainage system. The tunnel drainage would be pumped to the alignment high point east of the tunnel where a gravity system would then convey the flow to either the impounding sump or the proposed highway network depending on water quality. A control valve would be placed in the high point chamber to allow an operator to open/close the valve to divert the flows to the correct system.

Figure 4.1: Tunnel Drainage Schematic



4.1.3 Ground water seepage would discharge to the highway network where it would be conveyed in an open ditch to the existing culverts at Countess Roundabout. Contaminated water such as the water from cleaning activities or during a spillage/fire would be stored in the impounding sump. The water would be taken from site by tanker to an appropriate waste disposal facility.

Surface water at approach to tunnel portals

4.1.4 The highway drainage network at the approach to both portals would be terminated at the portal entrances to minimise the volume of runoff entering the tunnel.

In-tunnel surface water and impounding sump

4.1.5 Any liquid falling on the carriageway including firefighting water would drain towards the kerb where it would be intercepted. The surface runoff would be discharged via a fire trap into a carrier pipe beneath the carriageway. The carrier pipes would then convey the runoff to the low point sump. These pipes would also intercept any infiltration water that may leak through the tunnel lining, particularly when the ground water level rises above the level of the tunnel in the winter months,

5 East of Tunnel Drainage Strategy

5.1 Route Summary

5.1.1 The final section of the scheme includes a small length of new highway on the approach to the eastern portal, a new fly-over at Countess Roundabout and on-line improvements to the existing highway.

5.1.2 The carriageway would enter a retained cutting after exiting the tunnel portal.

5.2 Drainage Strategy

Runoff collection and conveyance

5.2.1 The preliminary design proposals include road edge channels along the new highway, new combined kerb drains along the slip roads and fly-over and retention of the existing drainage system around the circulatory carriageway at Countess Roundabout.

5.2.2 The surface water channels would outfall into carrier pipe systems which convey the flows to the outfalls. The combined kerb drains for the fly-over would also drain to a carrier system before outfalling.

Attenuation and Pollution Control

5.2.3 The proposals include eight new Drainage Treatment Areas in the form of linear ponds located within the highway boundary adjacent to the slip roads at Countess Roundabout. These ponds would replace the existing unlined ditches to which the runoff from the carriageway currently outfalls. The ponds would be lined, planted with reeds and contain permanent water to provide treatment prior to discharge and enhance biodiversity opportunities. The runoff would be attenuated to achieve a minimum 20% betterment of the existing discharge rates as requested by with Wiltshire Council during consultation. All ponds would outfall to the existing highway ditches which ultimately discharge the runoff to the River Avon. The ponds would be designed to ensure no ingress from flood waters in the 1 in 100 year plus climate change event from the adjacent River Avon catchment. Conceptual sections showing the linear ponds and the modelled flood levels are in Figure 5.1.

5.2.4 An infiltration crate system similar to that on the western portal approach would be used to drain the carriageway in catchment 11. The maximum anticipated groundwater levels in this locality are a minimum of 2m below the invert level of the proposed infiltration system and therefore pumped mitigation measures similar to that at the western portal are unlikely to be required. However, to ensure resilience of the drainage proposals at this preliminary stage of the design process, indicative locations for the apparatus have been included within the preliminary design.

5.2.5 Particular attention has been given to the catchment adjacent to Blick Mead due to the sensitivities surrounding hydrology in this area. The preliminary proposals include the re-use of the existing highway ditch in this locality, with a contributing area of similar size when compared to existing, thus maintaining similar flows in the proposed and current situations. The comparison of the existing catchment runoff rate and preliminary design catchment area is shown in Figure 5.2. The

ditch would be lined with a filtration treatment system to treat the runoff which infiltrates through the base of the ditch. Further information on the anticipated impact to this area from the scheme are contained within Appendix 11.4, Annex 3 Blick Mead Tiered Assessment.

5.2.6 Penstocks would be provided in the chambers immediately upstream of the ponds to provide additional spillage containment.

Land Drainage

5.2.7 A ditch system would be located beyond the limit of the linear ponds on the northern side of the scheme to intercept and convey overland runoff. These ditches would outfall to the existing culverts, maintaining the existing flow regime.

5.2.8 At the location of the existing agricultural underpass the proposed highway is at grade with the adjacent land. The land falls in a valley towards this point and a flood flow route has been identified.

5.2.9 The runoff would be intercepted by a ditch located at the highway boundary. The ditch would then outfall into a carrier pipe system to convey the flow westwards along the base of the highway cutting before discharging into the ditch which ultimately outfalls into the existing culvert to the west of Countess Roundabout.

Figure 5.1: Countess Roundabout Concept Drainage Cross Section

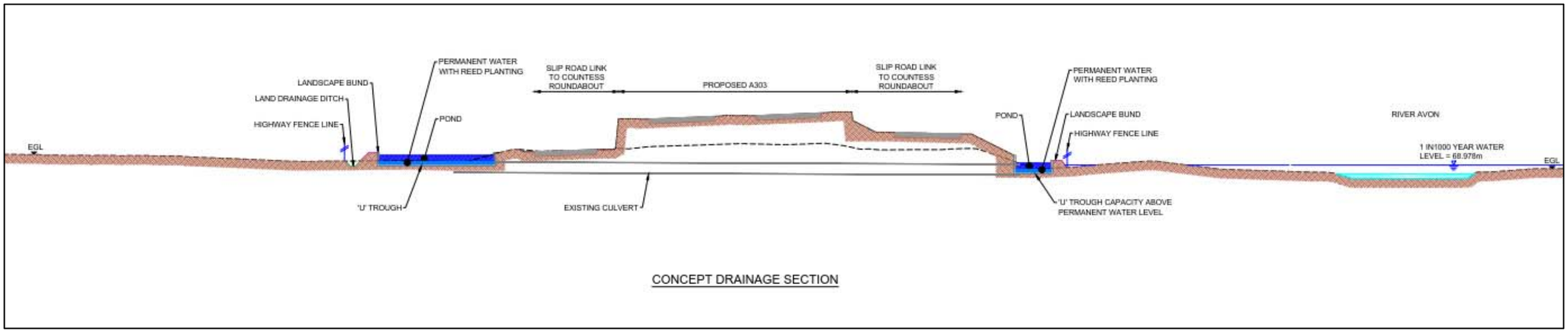
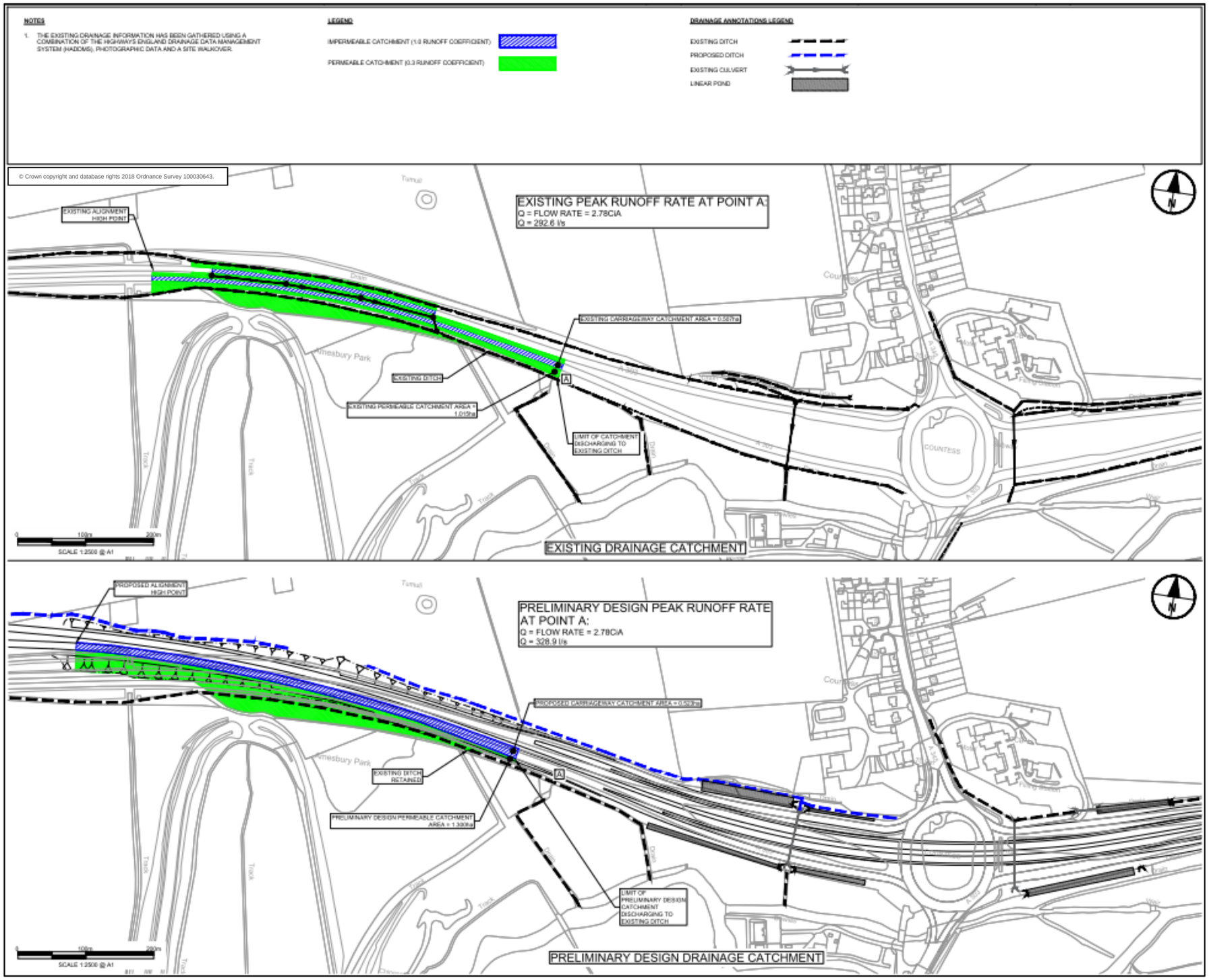


Figure 5.2: Blick Mead Drainage Catchment Comparison



6 Water Quality

6.1 HD45 Assessment

6.1.1 Water quality assessments, which included the road drainage preliminary design proposals, have been undertaken in accordance with an amended version of DMRB HD45. The results of the assessment are included in Appendix 11.1.

6.1.2 They assessed the effects (included spillage and routine road drainage runoff) on both surface water and groundwater quality. For water quality in the River Avon there is likely to be a moderately beneficial residual effect as a result of the introduction of SuDS features, which is considered a likely significant effect. All other surface water quality impacts have been assessed as negligible and there are no other reported likely significant effects.

6.1.3 For the drainage systems which infiltrate to ground a slight improvement in the spillage risk is estimated, but this is not enough to reach the 50% improvement threshold for a minor benefit.

7 Hydraulic Modelling

7.1 Preliminary Modelling

7.1.1 Preliminary hydraulic modelling has been undertaken to demonstrate the validity of the design proposals.

8 Maintenance

8.1.1 Maintenance of any conventional pipe network or SuDS System would be required. For a conventional pipe network, access for maintenance and inspection would be provided with pipework laid to achieve self-cleansing velocities. Figure 8.1 shows the maintenance activities for typical SuDS components as advised in HA 103/06 Vegetated Drainage Systems for Highway Runoff.

Figure 8.1: Table of Inspection and Maintenance Requirements for Vegetative Systems (Extract from HA 103/06)

	Swale	Infiltration Basin	SF Wetland	SSF Wetland	Balancing Pond/ Sedimentation Pond
INSPECTIONS: • Inflow/outfalls • Integrity/erosion • Debris/rubbish	Quarterly or after each major storm	Quarterly	Quarterly or after each major storm	Monthly or after each major storm	Monthly
• Build-up of sediment or invasive weeds	Annually	Twice annually	Annually	Annually	Annually
• Vegetation cover/ vigour	Monthly or after each major storm	Annually	Annually	Annually	Annually
• Check for protected species/breeding birds	Specialist advice to be sought, as described in paragraph 6.2				
ROUTINE WORKS: • Clearance of rubbish/debris	Monthly or after each major storm	Quarterly	Quarterly	Monthly or after each major storm	Quarterly
• Cutting vegetation	Monthly or after each major storm	Annual	10 year cycle and remove	1-5 year cycle and remove	5-10 year cycle and remove
• Removal of plant litter	N/A	N/A	N/A	5-10 year cycle if required	N/A
• Removal of sediment	To be determined annually	To be determined annually	To be determined annually	To be determined annually	To be determined annually

Abbreviations List

OEMP	Outline Environment Management Plan
DCO	Development Consent Order
DMRB	Design Manual for Roads and Bridges
DTA	Drainage Treatment Area
EA	Environment Agency
FRA	Flood Risk Assessment
WHS	World Heritage Site

References

Ref 11.3.1 The SuDS Manual, CIRIA Report C753, Woods Ballard, B, Udale-Clarke, H, Illman, S, Scott, T, Ashley, R, Kellagher, R 2015 ISBN: 978-0-86017-760-9

Ref 11.3.2 Environment Agency Fluvial Design Guide, Chapter 8. http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter8.aspx?pagenum=5

If you need help accessing this or any other Highways England information, please call **0300 123 5000** and we will help you.

This document is also available on our website at **www.gov.uk/highways**

If you have any enquiries about this document email **info@a303stonehenge.co.uk** or call **0300 123 5000***.

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.
These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363