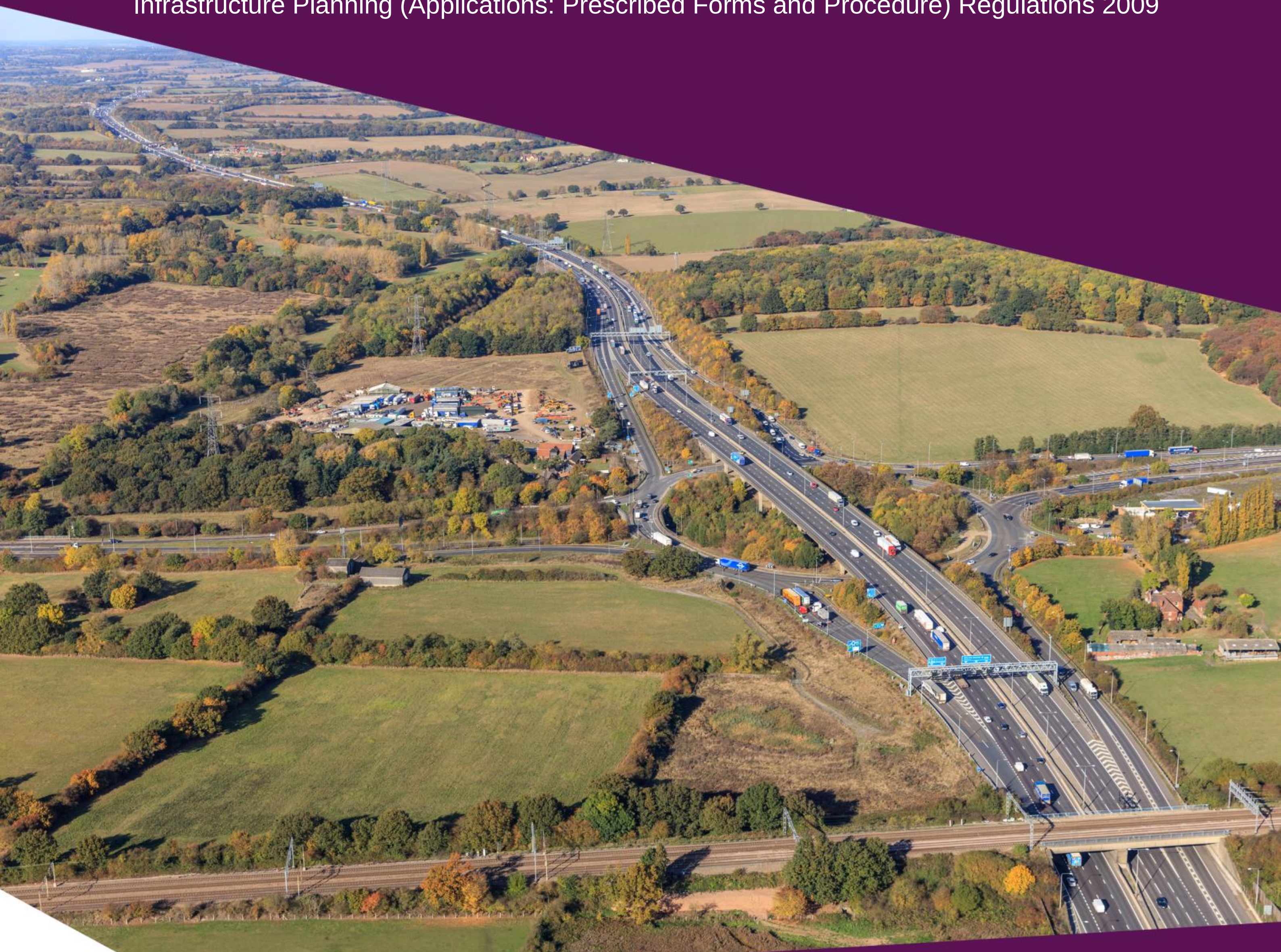
M25 junction 28 improvement scheme
TR010029
6.8 Drainage strategy report

APFP Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



Volume 6
May 2020

Infrastructure Planning

Planning Act 2008

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

M25 junction 28 scheme

Development Consent Order 202[x]

6.8 DRAINAGE STRATEGY REPORT

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference:	TR010029
Application Document Reference:	TR010029/APP/6.8
Author:	M25 junction 28 improvement scheme project team, Highways England

Version	Date	Status of Version
1	May 2020	Application issue

Table of contents

1 Introduction

1.1 Scope of this technical note

1.1.1 This report provides a summary of the overall Drainage Design Input Statement for the RIS schemes, and specifically to the M25 junction 28 improvement scheme (referred to as the "Scheme"), outlining a comprehensive and systematic approach for road drainage design aspects to contribute to the requirements of the Stage 3[1] assessment. This report does not encompass land drainage aspects including inter alia, culvert proposals, watercourse alterations, geomorphology, floodplain storage matters, or associated flood risk relating to land drainage proposals. Notwithstanding, close collaboration will be undertaken with the land drainage team to provide appropriate solutions, contribute to risk mitigation, and rigorously challenge imposed constraints and opportunities of all elements of the design solution. Proposed road drainage designs and estimates have been carried out to current best practice guidance and based on the available information for the existing situation.

[1] Project control framework (PCF) is a joint Department for Transport and Highways Agency approach to managing major projects. Stage 3 relates in this case to the Pre-Application (DCO) / Preliminary Design phase of the Scheme.

2 Existing situation and upgrade

2.1 Roads and drainage

2.1.1 The existing M25 junction 28, located on the intersection between the A12 and the M25 orbital motorway, near Brentwood, is a combination of dual and single carriageway sections on 3 levels.

2.1.2 The proposed loop road diverges from the M25 anti-clockwise carriageway to the north of the existing Brook Street viaduct, which carries the mainline over the junction 28 roundabout. The loop road is in the form of a compound curve comprising circular elements joined by clothoid transitions. The curve immediately after the diverge is a short element which has the smallest radius in the loop and is critical in reducing the northern and western extents of the highway footprint. The second curve runs for most of the length of the loop road and merges with the A12 eastbound carriageway just to the west of the West Poplars Bridge.

2.1.3 The loop road falls from its highest level at the M25 anti-clockwise diverge to its lowest point at the A12 eastbound merge. The alignment follows the ground profile as closely as possible within the other Scheme constraints. The junction 28 to M25 anti-clockwise slip road is realigned to the west of its current location and lowered to pass under the loop road. The A12 eastbound diverge to junction 28 is realigned to the north of its existing location and raised to pass over the loop road.

2.1.4 The three proposed sections comprising the M25 on-slip, the loop road and the A12 off-slip form the largest part of the Scheme and existing drainage is only used at the transition from the loop road onto the A12. The transition from the loop road onto the existing A12 introduces additional new paved catchment area, for which the additional runoff needs to be discharged into the existing drainage on the A12. This additional discharge is conveyed along the existing drainage pipework along the A12 and eventually discharged into the existing outfall to the south of the Putwell Bridge (which carries the A12 west of the junction over Weald Brook). The existing discharge rate at this outfall must be maintained and therefore all additional discharge from new paved area from the loop must be attenuated. This is further discussed in the section on attenuation below. Information on the existing drainage is limited. A visual inspection from site visits and Google Maps indicate that the surface water collection system consists of kerbs and gullies. The as-built drawings downloaded from the HADDMS data base provide information on the outfall on the A12 and the associated pipe network. This data will have to be verified by drainage survey and updated during the detailed design as the topographical survey data becomes available for the drainage.

2.2 Environment and flooding

2.2.1 One Water Framework Directive (WFD, 2000/60/EC) surface waterbody has been identified within the study area. This is the Ingrebourne River (GB106037028130), and currently crosses Junction 28, running parallel and north of the A12. It flows south at Putwell Bridge to join the Weald Brook, which is designated as a Main River. The Weald Brook lies to the west of the M25 and runs parallel to the motorway.

2.2.2 Flood zones 2 and 3 are within the study area adjacent to both the A12 and the M25. These flood zones are associated with both the Ingrebourne River and Weald Brook watercourses. The construction of the Scheme will require mitigation measures to minimise the impact on the flood risk due to encroachment into Flood Zone 3.

2.3 Aquifers and groundwater (source protection zones)

2.3.1 The Scheme area is underlain by superficial aquifers, including alluvium associated with the Ingrebourne River and Weald Brook watercourses. There is no groundwater source protection zone (SPZ) in the area.

3 PCF Stage 3 road drainage design strategy

3.1 Road drainage design strategy

3.1.1 The drainage design for the proposed dual carriageway sections on the M25 on-slip, the loop road and the A12 off-slip consists of new gravity drainage networks, which convey flows to suitable outfalls.

3.1.2 The road drainage design has been developed to sufficient detail to contribute to the preparation of the Project Control Framework (PCF) Stage 3 Assessment. One of the products in the PCF Stage 2 is the Scheme Assessment Report[2]. The stages of the Scheme Assessment Report are detailed in TD 37/93 of the Design Manual for Roads and Bridges (DMRB).

3.1.3 Existing carrier pipe drainage is only re-used at the transition from the loop road onto the existing A12 or potentially where the proposed M25 on-slip joins the existing M25 (CH 500 to CH 800). For the remainder of the drainage the following strategy applies:

- The pipe carrier systems comprise a full, new installation. The outfalls for the pipe carrier systems are located closest to the low points in the proposed vertical alignment of the main catchment areas.

3.1.4 Drainage scheme specific risks are recorded in a separate Drainage tab in the Scheme risk register.

3.2 Constraints

3.2.1 The following key constraints/issues have been addressed in the design:

- The outfall water course, the Weald Brook, is located between the following two utilities, which introduces a major constraint to the Scheme, since all drainage network outfall ditches pass over either one of these utilities to their final discharge points:
  - A British Pipeline Agency fuel pipeline along the eastern embankment of the Weald Brook.
  - A high-pressure gas pipeline along the western embankment of the Weald Brook, which will be relocated to the western side of the loop road.
- The presence of flood zone 3 on either side of the Weald Brook imposes the following constraints on the Scheme:
  - The pond footprints have been designed to be located outside flood zone 3.
  - The outfall arrangements, whether ditches or pipes, have been designed to prevent the backup of flood zone 3 into the drainage networks.
- The Scheme layout creates a proposed drainage network on two levels as a result of the M25 on-slip in cutting together with the overpassing loop road. Drainage on the overpassing loop road is discharged to a pond at a lower level.

[2] https://highwaysengland.citizenspace.com/he/m25-junction-28/results/m25-j28-scheme-assessment-report.pdf

- The land drainage culvert diversion at Alder Wood Bridge is associated with deep chambers where it passes underneath the M25 on-slip road.
- The M25 on-slip is passing underneath Alder Wood Bridge, which carries the loop road. At the location underneath Alder Wood Bridge, retaining walls are supporting both sides of the road, coinciding with the low point in the vertical alignment. Consideration has been given to discharge the carrier pipes at the low point through the reinforced concrete retaining wall however this has been discounted at the stage for reasons of buildability. As a consequence, carrier pipes have been designed to fall in the opposite direction to the longitudinal gradient of the carriageway around the northern edge of the retaining wall. This has resulted in deeper pipes than for a normal design.
- The location of the Maylands Golf Club to the west of the junction affects the land take in some locations. This is because some golf holes are near to the proposed road, which affects the corridor for the pre-earthworks ditches. The objective here is to minimise the impact on the normal functioning of the golf course. This is described in further detail in the section on Earthworks Drainage. Based on the current available data, it is assumed that the golf course drainage is not affected by the Scheme.

3.3 Allowable discharge

3.3.1 Control of allowable discharge is required to contribute to the flood management objectives of neutral or better effect on the overall flood risk.

3.3.2 Attenuation is provided to ensure that the proposed discharge rates are not greater than the limiting discharge rates.

3.3.3 For the new highway catchments of the M25 on-slip, the loop road and the A12 off-slip, peak outflows will be controlled to a maximum of the 1 in 100-year greenfield runoff rates.

3.3.4 The layouts of the highway catchments and outfalls are indicated in Appendix A.

3.3.5 The corresponding catchment data, including actual and attenuated flows, is provided in Appendix B.

Minimum limit of discharge rate

3.3.6 A practical minimum limit on the discharge rate from a flow attenuation device is a compromise between attenuating to a satisfactory low flow rate while keeping the risk of blockage to an acceptable level. The Sustainable Drainage Systems (SuDS) Manual acknowledges that the minimum size flow control is typically between 75mm to 150mm. The sizing of the flow control device complies with this requirement from the SuDS manual with an absolute minimum diameter of 75mm of the flow control aperture to prevent blockage.

3.3.7 In the hierarchy of drainage options infiltration into the ground is preferable to discharge to a surface water body. There is no infiltration characteristics or water table level information for the ground available at this stage of the preliminary design and it will therefore be a risk to propose soakaways. Furthermore, historic boreholes show presence of London clay across the site, with no evidence of significant areas of granular material. Therefore, relying on infiltration would constitute an even higher risk. This option can be explored during the detailed design when reliable infiltration characteristics and water table level information becomes available. It is considered unlikely that this solution will work.

3.4 Pipe and chamber networks

3.4.1 For the purposes of feasibility assessment for PCF Stage 3, outline conveyance pipework is generally developed in accordance with HD 33/16, Design of Highway Drainage Systems, section 2.7. At the end of October 2019, CG501 was published and HD33/16 withdrawn. Considering that the drainage design was completed in August 2019, it was agreed with the Highways England specialists that HD33/16 can be used for the preliminary design. The new design standard CG501 shall be implemented in the next design stages. Pipes are designed for the 1 in 1-year return period without surcharge and the 1 in 5-year return period with no surface flooding. It is important to note that the new DMRB guidance would not have altered the conclusions of this report.

Hydraulic design parameters

3.4.2 For this Scheme, the Flood Studies Report (FSR) rainfall data is used. Inflow hyetograph rainfall intensities used to calculate the design storms includes a 20% increase as an allowance for the effects of climate change. There may be a requirement for a higher percentage value for climate change to comply with recent sustainability objectives. However, a 20% climate change allowance has been used in the design, with a sensitivity test undertaken with a 40% allowance to ensure the maximum flood level is contained within the freeboard area of the pond.

3.5 Surface water collection system

3.5.1 At this stage of the preliminary design the surface water collection system design is indicative. It is however important to identify areas that require special attention, because it determines the chamber layout of the main carrier pipe system. The type of surface water collection system selected is determined by the verge width and is in accordance with the *Hierarchy of Preferred Drainage Inlet Measures* flow chart in section 3.1.3 of the drainage design input statement. The following areas require special consideration:

- The large cuttings on the M25 on-slip section require filter drains and to reduce the pipework in the cross section, the filter and carrier drains have been amalgamated in combined filter carrier drains.
- The transition area between the M25 on-slip and the existing M25 is on a shallow gradient of 0.89% between chainages 550 and 650. Gullies are not viable, because of the impractical close spacing. The existing surface water collection system on the M25 in this area consists of slot drains. Slot drains and surface water channels are constructed by slip forming and, from a buildability point of view, these two types of surface water collection systems would not be economically viable for roads lengths of less than a kilometre. For this section, it is considered that it would be easier for the contractor to install combined drainage kerb units (CDKU’s), which could be procured commercially.

3.5.2 The over bridges within the site extents are drained by suitable bridge deck units where required. No surface water collection system outfall arrangements are allowed on bridge decks and at this stage it has been sought to eliminate such a scenario by careful alignment design. It is an environmental objective to reduce the amount of silt discharging into the Weald Brook. Gullies, will add to the silt-trapping capacity of the catchpits and the pond and are therefore considered to be an effective surface water collection solution for the rest of the Scheme.

3.6 Attenuation

3.6.1 The Scheme consists of new sections of carriageway on the M25 on slip, the loop road and the A12 off-slip. To achieve the limiting discharge greenfield rates at the outfalls requires the design of attenuation structures. Where there are no space constraints within the verge, attenuation ponds are the preferred option since they also provide for the water quality treatment objectives indicated in the HAWRAT assessment (further details are provided in the Road Drainage and Water Environment Chapter (Chapter 8), application reference TR010029/APP/6.1 and Appendix 8.1 in the Environmental Statement application reference TR010029/APP/6.3). It also satisfies the silt removal objective highlighted by the environmental design. All ponds are designed as dry detention ponds, unless otherwise stated. Ponds have therefore been proposed in the following locations:

- Between the eastern side of the proposed loop road and the western side of the Weald Brook (Pond 1 – Catchment 1).
- On the Southern side of the proposed loop road where it passes over the M25 on-slip and the eastern side of the Weald Brook (Pond 2 - Catchment 2).
- On the northern side of the A12 off-slip and to the west of the proposed loop road, where it is joining the A12 (Pond 3 – Catchment 3).

3.6.2 The attenuation design is summarised in Appendix B.

3.6.3 The option of locating Pond 2 on the northern side of the proposed loop road has been explored, on the assumption that a pond in this location would be preferable to the landowner. On further investigation it was decided that a pond located on the southern side of the loop road was a more viable option for the following reasons:

- Presence of woodland and veteran trees at the top of the loop road has constrained possibilities to find alternative locations for this pond to the north whereas the current location has minimum environmental impact.
- To convey carrier pipes to a pond on the northern side from the M25 on-slip, which is in cutting on that side, deep manholes would be required increasing cost and maintenance issues.
- A pond on the northern side, would be located on the opposite or high side of the super elevation and would require a crossing of the carriageway from the surface water collection system.

3.6.4 At the following locations space restrictions or unavailability of land make the introduction of an attenuation pond unviable:

- Adjacent to the proposed section of M25 on-slip between chainages 0 and 100, an existing electrical substation needs to be retained.

- The transition area between the M25 on-slip and the existing M25 (chainages 550 and 650) is adjacent to an existing bund occupying the space within the verge. This bund needs to be retained because it fulfils a pre-earthworks drainage function adjacent to the Maylands Golf course, from which further land take would have a disproportionate impact to the benefits achieved.
- The section of the A12 off-slip from the high point on the bridge over the Weald Brook to the connection with the roundabout section (chainages 450 to 759) – this section of road is confined by retaining walls on both sides.
- The section of the loop road (chainages 1260 to 1448) that is transitioning into the existing A12. For this section of road, the surface runoff discharges into the existing drainage on the A12.

3.6.5 At the above locations, attenuation is in the form of larger diameter pipes, which discharge through flow controls into the existing drainage pipes. The maximum diameter for the attenuation pipe is 900 mm.

3.7 Earthworks drainage

3.7.1 It is generally necessary to provide pre-earthworks cut-off drains, located at the top of cuttings or at the toe of embankments, to intercept runoff flowing towards the road from adjoining land. This is anticipated to be by means of a ditch where space permits and where insufficient space is available filter drains are used. For this preliminary outline design the following corridors have been allowed for in the design:

- Minimum 13 m for cut off/ toe ditches (4 m maintenance strip to boundary, 7 m for 1 m deep 1 in 3 side sloped ditch, 2 m to earthworks interface slope).
- Minimum 6.675 m for pre-earthworks filter drains (4 m maintenance strip to boundary, 0.675 m for filter drain trench, 2 m to earthworks interface slope).

3.7.2 Further design development on the Scheme, and particularly the location of the Maylands Golf Club as mentioned in the section on “Constraints”, indicated that the above-mentioned 13 m corridor width could not be achieved in the following locations:

- Golf hole 5 is located adjacent to the M25 on-slip at chainage 1050, where the proposed on-slip joins the M25 anti-clockwise Orbital Motorway. A study of the land drainage flow directions and the topography indicated that an existing bund would serve the same purpose as a pre-earthworks ditch, and the latter could therefore be eliminated. The topographical survey indicates that an existing pipe underneath the bund conveys pre-earthworks drainage from the upstream to the downstream side of the bund. This will have to be confirmed by drainage surveys.
- The pre-earthworks ditch corridor would have encroached on the area of Golf hole 2, located adjacent to chainage 700, on the western side of the proposed loop road section. Further investigation indicated that this corridor at chainage 700 could be eliminated by diverting this pre-earthworks ditch through a culvert underneath the loop road to the other side, where it can discharge into pond 1.

3.7.3 Pre-earthworks drainage is generally kept separate from the road drainage network unless there is a specific benefit in connecting them. Depending on the catchment and ground characteristics and topography, a suitable flow assessment method has been selected from DMRB HA 106/04 Drainage of Runoff from Natural Catchments, Section 5, or CIRIA C753 SuDS Manual.

3.8 Interaction with existing drainage

3.8.1 This aspect relates to the re-use, replacement and connection into existing drainage. The Scheme consists of new sections of carriageway on the M25 on slip, the loop road and the A12 off-slip and only the section of the loop road (chainages 1260 to 1448), that is transitioning into the existing A12, uses a connection into the existing A12 drainage.

3.8.2 Where the M25 on-slip is joining the existing M25 between chainages 500 and 800 there is a 60% estimated overlap with the existing drainage. At this stage there is no survey information available for this existing drainage and it is therefore not clear if any of this could be reused. Since the verge, which accommodates the drainage, is relocated to the western side, there is less likelihood of re-using any of the existing drainage. For this stage of the preliminary design it was assumed that all drainage in this transition area was full depth new replacement design.

3.8.3 On the western side of the proposed loop road, near hole 2 on the Maylands golf course, a ditch inside the golf course boundary, is affected by the loop road alignment and is therefore diverted over a short length as part of this Scheme.

3.9 Surface water treatment

3.9.1 Section 3.1.3 of the Drainage Design Input Statement requires that the Highways Agency Water Risk Assessment Tool (HAWRAT) (DMRB Section 3 Part 10, HD 45/09 ‘Road Drainage and the Water Environment’ Section 5), shall be used to assess the impacts of road drainage on receiving surface watercourses where it has potential to affect the water quality. An assessment of the potential impacts of routine runoff on surface waters is required to determine whether there is an environmental risk and if pollution mitigation measures are needed.

3.9.2 The Scheme comprises of the following nine drainage catchments:

- Two existing drainage catchments (catchments 5b and catchment 7) remain unchanged.
- Six drainage catchments, with existing road overlaps. These catchments are being extended as a result of the Scheme.
- The Scheme will introduce the construction of a new highway drainage catchment (catchment 1) to accommodate the new loop road.

3.9.3 Of the nine drainage catchments, five will be outfalling to Weald Brook and four to the river Ingrebourne River. Catchment 7 is the only catchment thought to have existing mitigation in place in the form of a highway drainage ditch.

3.9.4 HAWRAT tests were undertaken at Stage 3 (preliminary design). Methods A and D were used on the nine surface water drainage catchments.

3.9.5 A combination of dry attenuation ponds, ditches and filter drains are the proposed mitigation for surface water quality mitigation. Sediment catch-pits are proposed for sediment mitigation.

3.9.6 With mitigation in the form of dry ponds (catchments 1 + 2 + 3) and ditches (catchments 6a + 6b + 6c) prior discharge to Weald Brook all outfalls discharging to this receptor meet and pass all water quality thresholds, including RST's, EQS and sediment. No risk to Weald Brook has been identified from the Scheme with mitigation in place. This is assessed as negligible impact with neutral significance.

3.9.7 With mitigation in the form of filter drains (catchment 5a) and an existing ditch (catchment 7) prior discharge to the Ingrebourne River all outfalls, with the exception of catchment 5b meet and pass all water quality thresholds, including RST's, EQS and sediment.

3.9.8 Existing catchment 5b fails the sediment test only. This has been identified as an existing failure. A minor adverse impact with a slight significance of effect on the Ingrebourne River has been identified from catchment 5b owing to the existing sediment failure. This is not deemed significant in EIA terms.

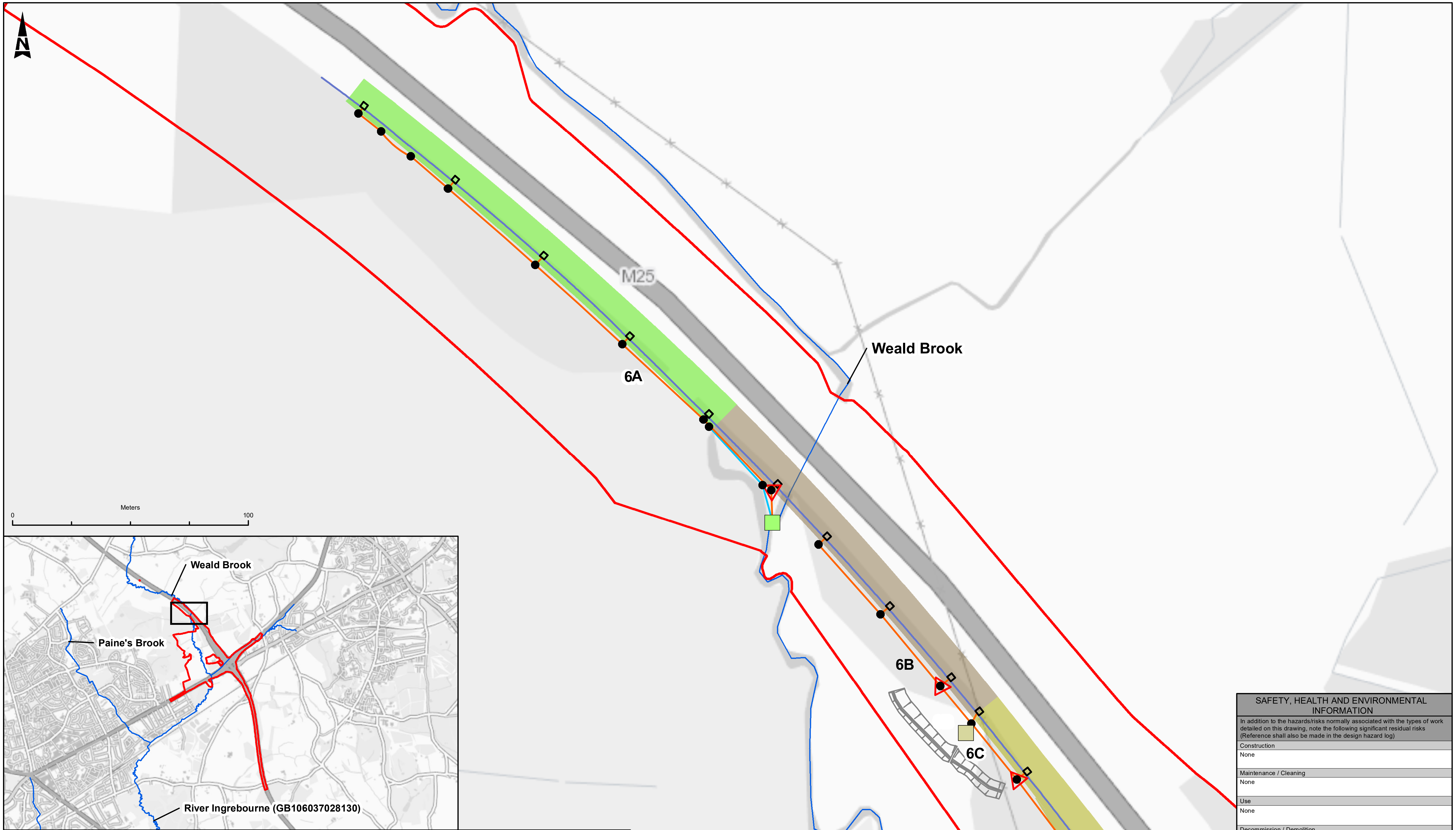
3.9.9 The cumulative/collective water quality assessments for all outfalls discharging into Weald Brook (and within 100 m for sediment or 1 km for solubles) with the proposed mitigation in the form of dry ponds and ditches, demonstrate compliance and passes in all water quality tests. As no risk has been identified to Weald Brook from the Scheme with mitigation in place, this is assessed as negligible impact with neutral significance.

3.9.10 The cumulative/collective water quality assessments for all outfalls discharging into Ingrebourne River (and within 100 m for sediment or 1km for solubles) with the proposed mitigation in the form of filter drains (catchment 5a), demonstrates a failure in sediment only. A minor adverse impact with a slight significance of effect on the Ingrebourne River is predicted. This is not deemed significant in EIA terms

3.9.11 In terms of spillage risk, there is a low risk of spillage (less than 1 in 100 years) from the Scheme with mitigation for the Weald Brook and the Ingrebourne River.

Appendices

Appendix A. Proposed drainage design



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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Construction
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Maintenance / Cleaning
None

Use
None

Decommission / Demolition
None

LEGEND

- DCO Boundary
- River Watercourses
- Proposed Ditches and Ponds

Proposed Drainage

- Proposed Carrier Drain
- Proposed Filter Drain
- Proposed Combined Drainage Kerb Unit
- Proposed Bridge Deck Drainage Unit
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- Channel Drain
- Proposed Catchpit
- Proposed Headwall
- Proposed Flow Control Catchpit
- Combined Drainage Kerb Unit Outlet Chamber
- Concrete Manhole

Catchments and Outfalls

- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5A
- Catchment 5B
- Catchment 6A
- Catchment 6B
- Catchment 6C
- Catchment 7

Description						
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Status: A1

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Project Title: M25 Junction 28

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FIGURE 8.2
PROPOSED DRAINAGE
CATCHMENTS 6A & 6B
SHEET 1 OF 7

Drawing Number (Project | Originator | Volume | Location | Type | Role | Number):
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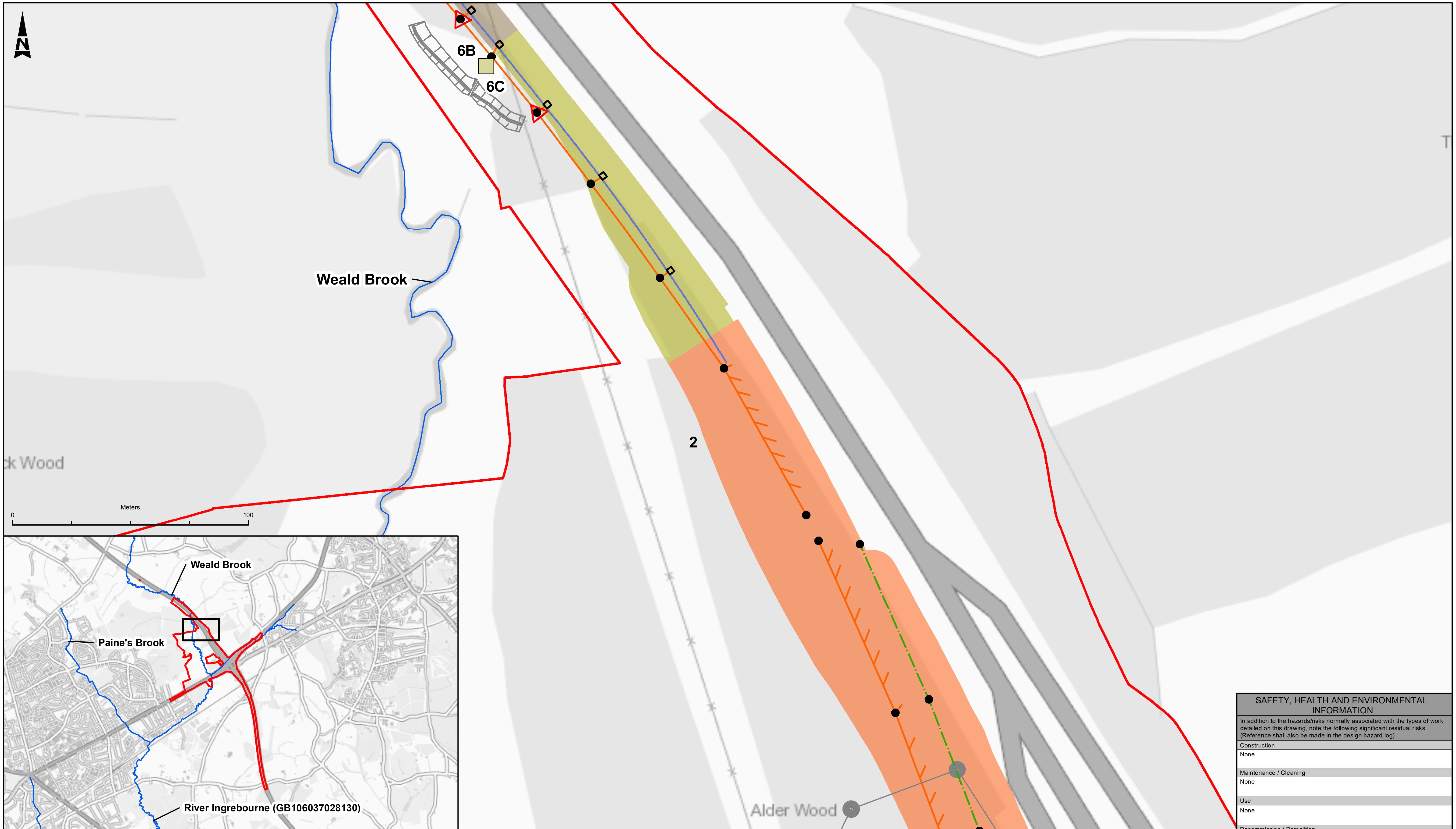

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- Catchment 6B
- Catchment 6C
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Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

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Description						
Description: PUBLISHED						
A1	C01	SD	KG	EM	PG	15/05/20

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Project Title: M25 Junction 28

Drawing Title:

FIGURE 8.2
PROPOSED DRAINAGE
CATCHMENTS 2 & 6C
SHEET 2 OF 7

Drawing Number:

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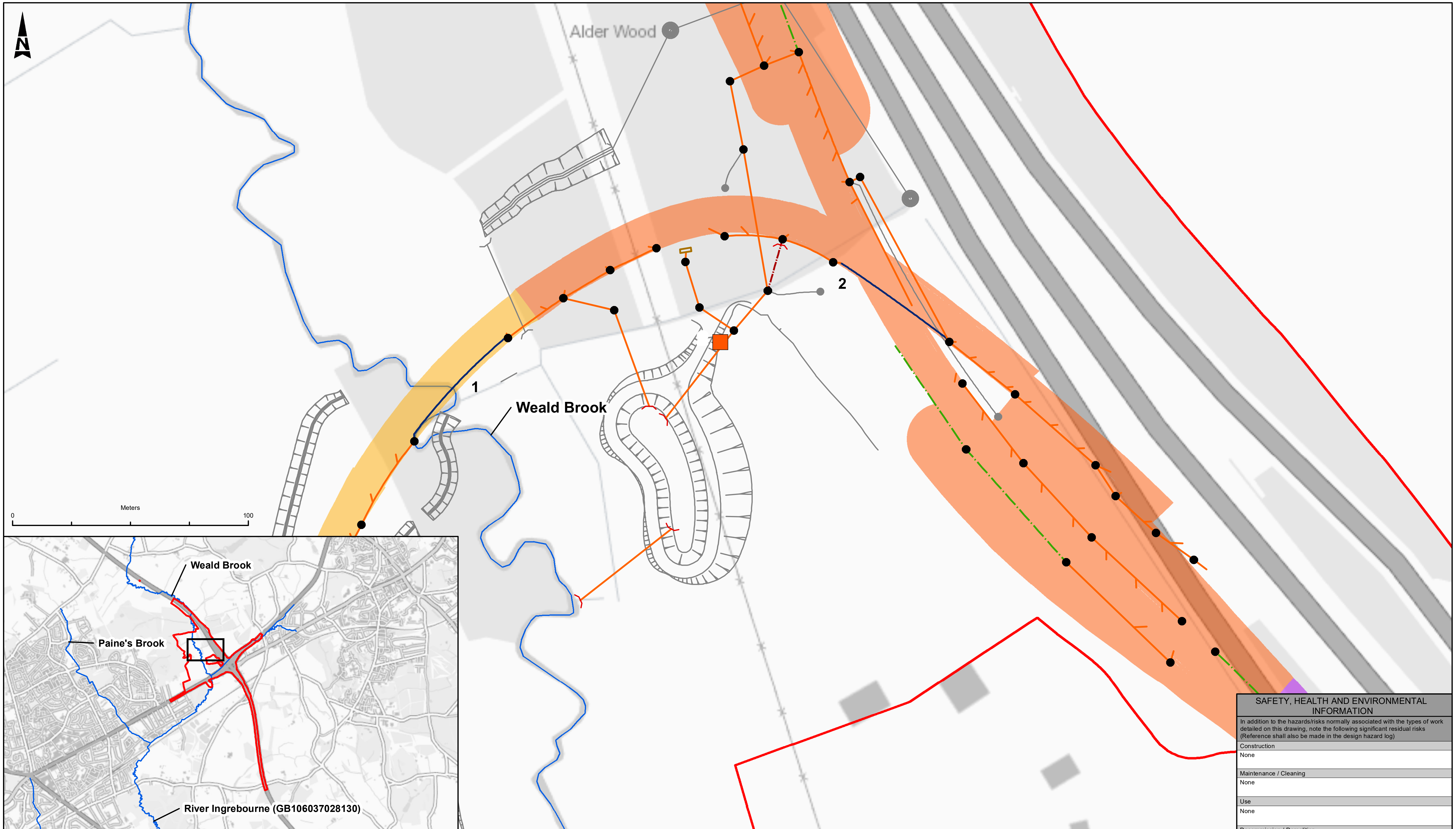

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FIGURE 8.2
PROPOSED DRAINAGE
CATCHMENTS 1 & 2
SHEET 3 OF 7

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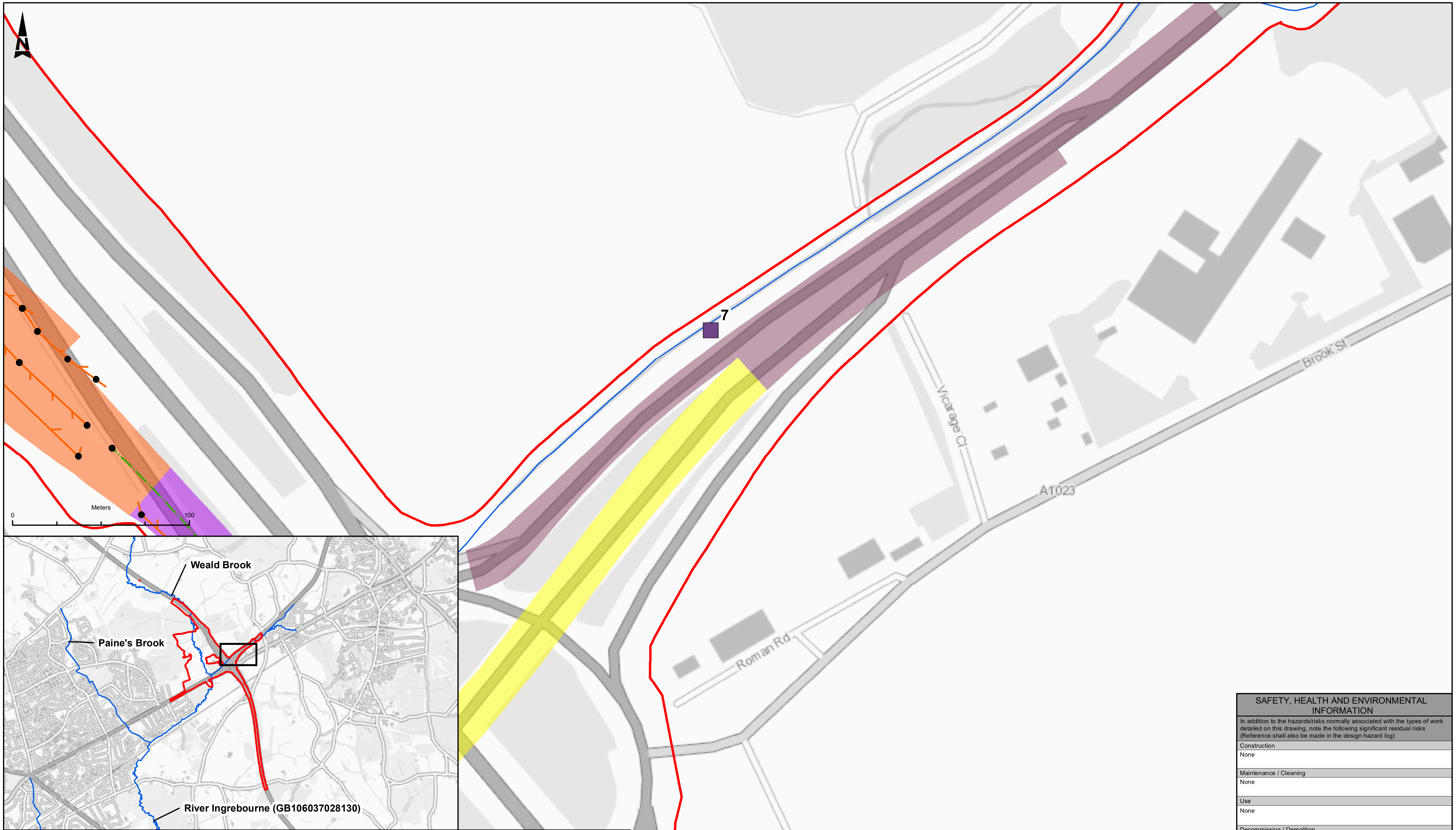

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

Construction
None

Maintenance / Cleaning
None

Use
None

Decommission / Demolition
None

LEGEND

- DCO Boundary
- River Watercourses
- Proposed Ditches and Ponds

Proposed Drainage

- Proposed Carrier Drain
- Proposed Filter Drain
- Proposed Combined Drainage Kerb Unit
- Proposed Bridge Deck Drainage Unit
- Rock Filled Cascade Channel
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- Proposed Linear Drainage Channel
- Channel Drain
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- Proposed Headwall
- Proposed Flow Control Catchpit
- Combined Drainage Kerb Unit Outlet Chamber
- Concrete Manhole

Catchments and Outfalls

- Catchment 1
- Catchment 2
- Catchment 3
- Catchment 4
- Catchment 5A
- Catchment 5B
- Catchment 6A
- Catchment 6B
- Catchment 6C
- Catchment 7

Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
Description						
Description						
Description						
Description: PUBLISHED						
A1	C01	SD	KG	EM	PG	15/05/20

Drawing Suitability: **PUBLISHED**
Status: **A1**

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Project Title: M25 Junction 28

Drawing Title:
FIGURE 8.2 PROPOSED DRAINAGE CATCHMENT 7 SHEET 4 OF 7

Drawing Number (Project | Originator | Volume / Location | Type | Role | Number):
HE551519 - ATK - EWE
XX - GS - GI - 000005

Original Size	Scale	Project Ref. No.	Sheet	Rev
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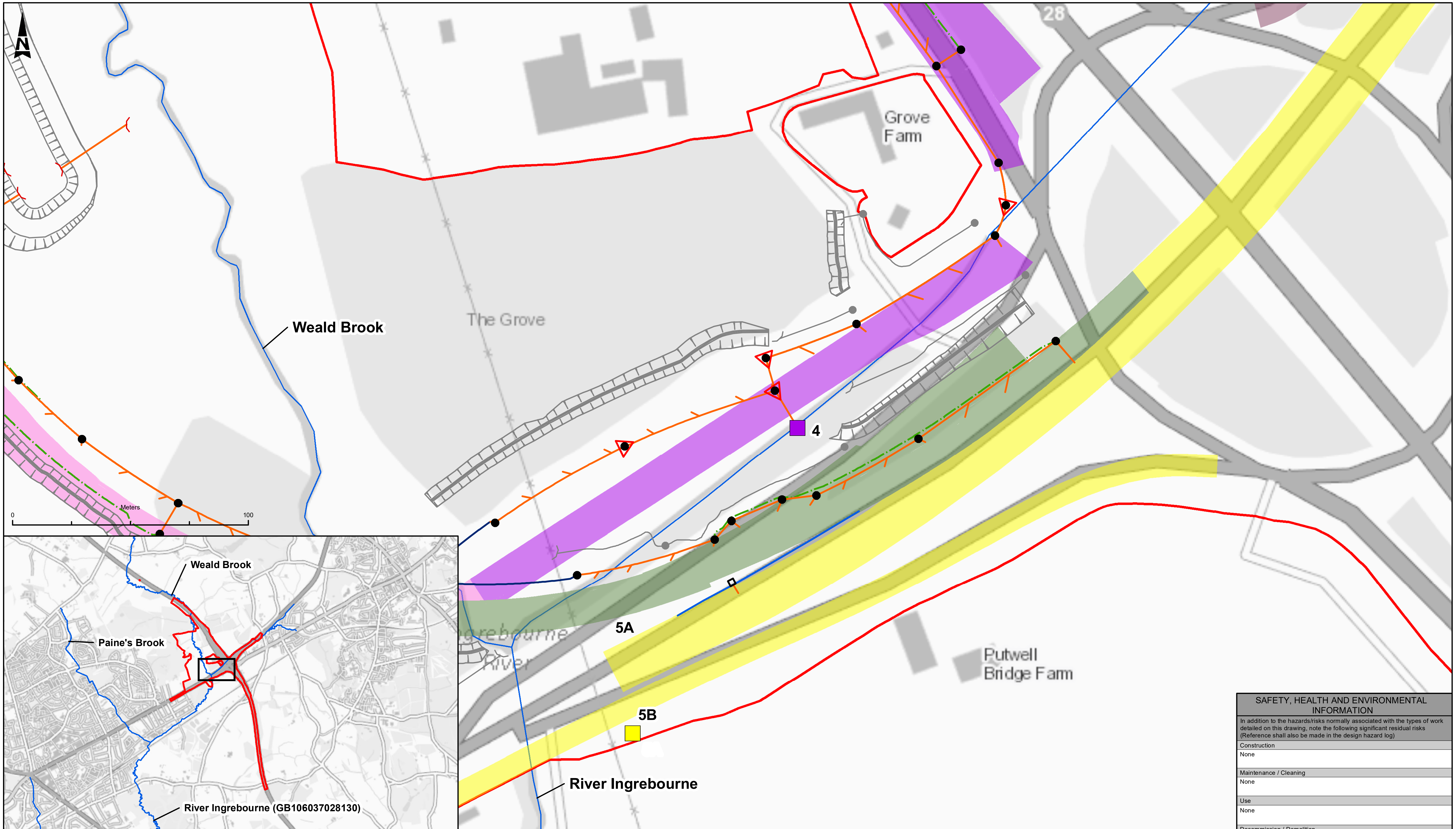

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None

Maintenance / Cleaning
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Use
None

Decommission / Demolition
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- Catchment 4
- Catchment 5A
- Catchment 5B
- Catchment 6A
- Catchment 6B
- Catchment 6C
- Catchment 7

Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
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Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description: PUBLISHED						
Status: A1	Revision: C01	Drawn: SD	Checked: KG	Reviewed: EM	Authorised: PG	Issue Date: 15/05/20

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Project Title: M25 Junction 28

Drawing Title: FIGURE 8.2 PROPOSED DRAINAGE CATCHMENTS 4, 5A & 5B SHEET 5 OF 7

Drawing Number (Project | Originator | Volume | Location | Type | Role | Number): HE551519 - ATK - EWE XX - GS - GI - 000006

Original Size	Scale	Project Ref. No:	Sheet:	Rev:
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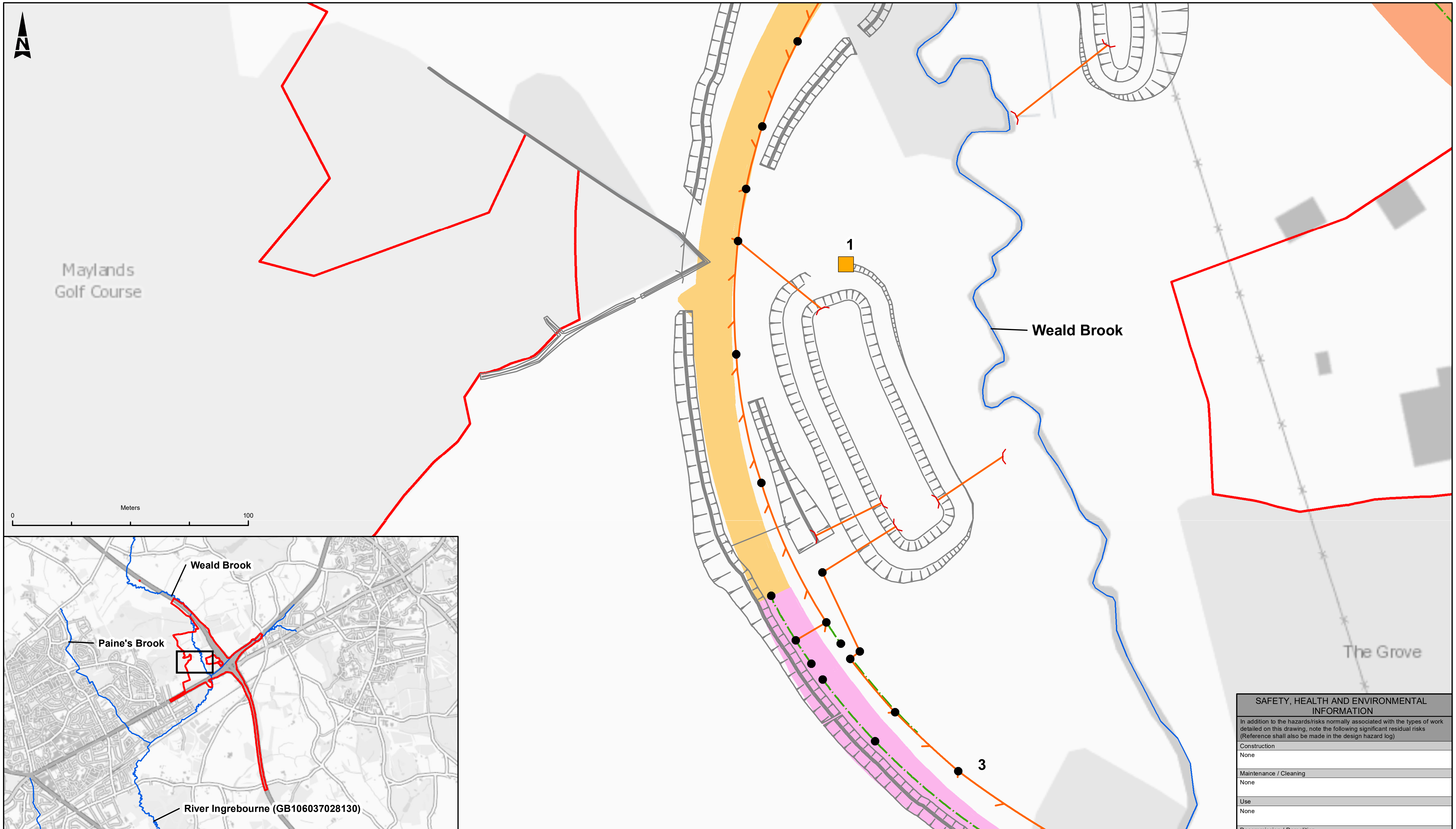

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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Construction
None

Maintenance / Cleaning
None

Use
None

Decommission / Demolition
None

LEGEND

- DCO Boundary
- River Watercourses
- Proposed Ditches and Ponds

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- Catchment 3
- Catchment 4
- Catchment 5A
- Catchment 5B
- Catchment 6A
- Catchment 6B
- Catchment 6C
- Catchment 7

Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
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Description						
Description: PUBLISHED						
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Drawing Title:
FIGURE 8.2
PROPOSED DRAINAGE
CATCHMENTS 1 & 3
SHEET 6 OF 7

Drawing Number (Project | Originator | Volume / Location | Type | Role | Number):
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XX - GS - GI - 000007

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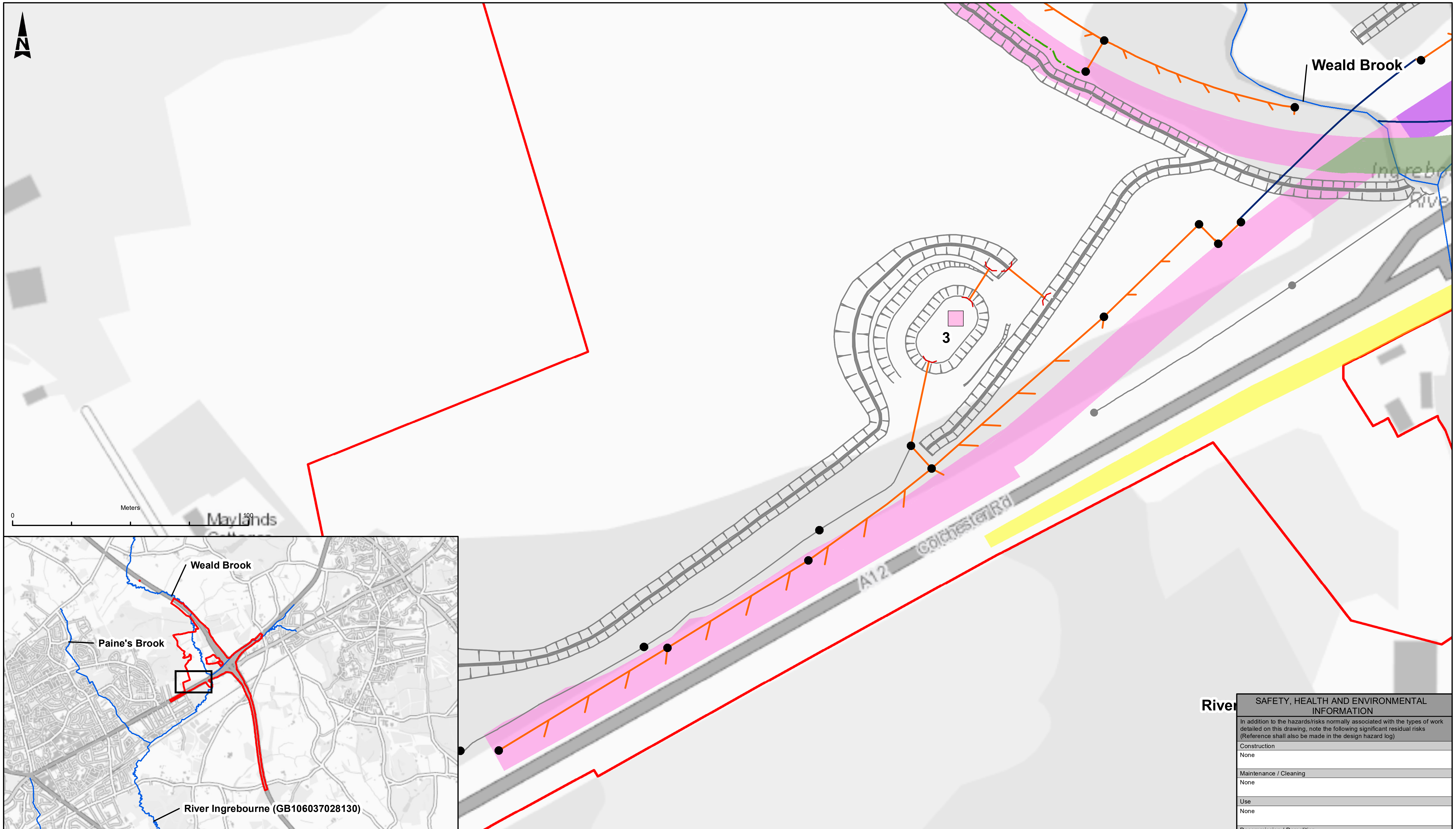

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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Construction
None

Maintenance / Cleaning
None

Use
None

Decommission / Demolition
None

LEGEND

- DCO Boundary
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- Catchment 5B
- Catchment 6A
- Catchment 6B
- Catchment 6C
- Catchment 7

Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
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Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description PUBLISHED						
Status A1	Revision C01	Drawn SD	Checked KG	Reviewed EM	Authorised PG	Issue Date 15/05/20

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Drawing Title:
FIGURE 8.2
PROPOSED DRAINAGE CATCHMENT 3
SHEET 7 OF 7

Drawing Number (Project | Originator | Volume / Location | Type | Role | Number):
HE551519 - ATK - EWE
XX - GS - GI - 000008

Original Size:	Scale	Project Ref. No:	Sheet:	Rev:
A3	1:1,500	---	7 OF 7	C01

Appendix B. Attenuation detail

		As per preliminary design															
										Before Attenuation			After Attenuation				
Catchment Ref	Pond/ Outfall	Total Impermeable Area (ha)	Total Permeable Area (Ha)	Q (1 yr) in l/s by Greenfield method	Q (5 yr) in l/s by Greenfield method	Q (100 yr) in l/s by Greenfield method	Q (1 yr) in l/s by Brownfield method	Q (5 yr) in l/s by Brownfield method	Q (100 yr) in l/s by Brownfield method	Q (1 yrs) in l/s from MD model	Q (5 yrs) in l/s from MD model	Q (100 yrs) in l/s from MD model	Q (1 yrs) in l/s from MD model	Q (5 yrs) in l/s from MD model	Q (100 yrs) in l/s from MD model	Attenuation Volume (Cum)	Receiving water feature
Catchment 1	POND 1 AND THEN OUTFALL TO EXISTING WATER COURSE VIA DITCH	1.321	9.417	33.4	50.4	125.6				181	189	210	25.0	44.4	87.3	3154.0	WEALD BROOK
Catchment 2	POND 2 AND THEN OUTFALL TO EXISTING WATER COURSE VIA DITCH	1.580	2.590	13.0	19.6	48.8				211.2	248.1	264.3	10.8	19.8	35.1	1674.0	WEALD BROOK
Catchment 3	POND 3 AND THEN OUTFALL TO EXISTING WATER COURSE VIA DITCH	0.826	0.574	4.4	6.6	16.5				79.8	81.9	87.8	4.4	6.5	11.0	776.0	WEALD BROOK
Catchment 4	PROPOSED OUTFALL OF- 4 (ON REALIGNED WATERCOURSE)	0.457	0.356				26.3	41.3	83.2	100.5	163.8	362.4	25.5	30.7	44.6	184.1	RIVER INGREBOURNE
Catchment 5A	TO EXISTING OUTFALL 10 NEAR PUTWEL BRIDGE	0.375	0.15				19.3	30.3	60.9	73.8	120.8	201.9	29.5	37.3	47.3	84.7	RIVER INGREBOURNE
Catchment 5B	TO EXISTING OUTFALL 10 NEAR PUTWEL BRIDGE	NA	NA				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	RIVER INGREBOURNE
Catchment 6A	OUTFALL TO PROPOSED DITCH AND THEN TO EXISTING WATER COURSE	0.523	0.133				80.8	127.2	252.9	81.1	120.7	254.1	71.5	105.5	147.3	9.5	WEALD BROOK
Catchment 6B	OUTFALL TO PROPOSED DITCH AND THEN TO EXISTING WATER COURSE	1.004	0.41				144.7	227.8	453.1	216.1	341.2	671	175	276.2	338.4	19.6	WEALD BROOK
Catchment 6C	OUTFALL TO PROPOSED DITCH AND THEN TO EXISTING WATER COURSE																WEALD BROOK
Existing Catchment 7 (Existing catchmnet 7 remains unchanged in the existing and the proposed).	EXISTING DITCH NEAR EXISTING OUTFALL-6 (EXISTING DITCH)									NA	NA	NA	NA	NA	NA	NA	RIVER INGREBOURNE

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