A2 Bean and Ebbsfleet Junction Improvements

Environmental Statement

Volume 2 – Appendix H.2 Drainage Strategy

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Volume 2 - Appendix H.2 Drainage Strategy

1. Introduction

1.1.1 Appendix H.2 is intended to provide a summary of the overall Drainage Design Strategy for the RIP schemes as it relates to the A2BE project, outlining a comprehensive and systematic approach for road drainage design aspects of the above scheme to contribute to the requirements of the Preliminary Design Stage Assessment. This appendix 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 will be carried out to current best practice guidance and based on the available information for the existing situation.

2. Existing Situation and Upgrade

2.1 Roads and Drainage

2.1.1 The existing A2 Bean and Ebbsfleet junctions are two grade-separated junctions on the A2 trunk road, separated by approximately 2km. The Bean Junction connects the A296 and B255, which provide access to the Bluewater shopping centre, to the A2. The junction was rebuilt in 1999 as part of the Bluewater development. The Ebbsfleet junction connects the A2 to the A2260 and B259 Southfleet Road. It was constructed in 2005 to serve the Ebbsfleet International rail station and the proposed surrounding Ebbsfleet Valley and Eastern Quarry developments.

2.1.2 The existing road network has 15 number drainage catchments within the Scheme limits.

2.1.3 Catchments 1 and 2 discharges to Attenuation/Infiltration Ponds, catchment 5 and 6 discharge into River Ebbsfleet. All other catchments are discharging to Ground via Soakaways, infiltration ditch as per Technical Appraisal Report.

2.1.4 Catchment 6 is believed to discharge towards the River Ebbsfleet although this needs to be confirmed by further survey.

2.1.5 Information on the existing drainage is limited. A Desktop study was carried out indicating that the surface water collection system consisted of kerbs and gullies. Since the upgrade consists mainly of carriageway widening, new gullies will have to be placed against the new relocated kerbs. As-built drawings and Highways Agency Drainage Data Management System (HADDMS) data have been evaluated but did not provide comprehensive information on the underground pipe conveyance system. No data on the drainage outfalls could be located.

- HADDMS - The HADDMS data has been retrieved for this scheme. The gap analysis of the data returned shows that it is incomplete. The use of the data is limited and will need to be proved by drainage and topographic surveys.

- Existing drainage information for A2BE has been assessed from Stage-1 Highways England and Stage-2 Halcrow Hyder Joint Venture (HHJV) data and compiled at the following location (HA543917-HHJV-HDG-XXXX-M2-D-0001.dwg) . The Existing Drainage from Stage 2 comprises of Surface and sub-surface water collection systems such as Carrier and Filter Drain pipe networks, Kerb and Gully Drainage, Pre-Earthwork Drainage, Soakaways, ponds and other attenuation systems.
- The information on existing outfalls and any nearby watercourses is unavailable/ unknown from HADDMS and As-builts. There is no information available in the Scheme Assessment Report (SAR) / Technical Appraisal Report (TAR) report from the Stage 1/ 2.

2.1.6 Preliminary design will have to be reviewed during the Detailed design as it was not possible to carry a full Drainage survey in this stage. For drainage survey requirements and extent plans showing available HADDMS data refer to the Drainage Survey Specification (HE552512-ATK-HDG-XX-SP-CD-000001).During Detailed design stage it is recommended to carry out a CCTV survey of the proposed network to be retained.

2.2 Environment and Flooding

2.2.1 The presence of ancient woodlands constrains the extent of drainage work. There will be no new drainage proposed within the protected area. Environmental Constraints are shown in Volume 3 Figure 1.2.

2.2.2 The environment map for planning indicates that most of the Scheme and wider study area is in Flood Zone 1. There is a narrow area of Flood Zone 3 along the upstream reach of the River Ebbsfleet, which intersects with the Scheme approximately 500m east of the A2 Ebbsfleet Junction. No parts of the Scheme or wider study area are within the medium (Flood Zone 2) or high (Flood Zone 3) flood risk zones associated with the River Thames.

2.2.3 Accidents data shows accidents happened due to aquaplaning near Bean South Roundabout on the A2 westbound off-slip, the current water collection system seems to be appropriate. Further investigation will be carried during detail design.

2.3 Aquifers and Groundwater (Source Protection Zones)

2.3.1 The Source Protection Zones (SPZ) show the risk of contamination from activities that might cause pollution in the area; the closer the activity the greater the risk. A2BE Site limits fall within SPZ (HE543917-ATK-EAC-XX-M2-LL-000012). A 2km overview of the scheme area shows that the majority of the Scheme to be within the Outer Zone (Zone 2) with one section of the A296 Roman Road, Ebbsfleet Junction and the A2260 at Ebbsfleet Junction being within the Inner Zone (Zone 1) and a small portion of the A2 being within the Total Catchment (Zone 3).

2.3.2 Discharge from Highway surface should normally be outside SPZ1 and ideally outside SPZ2. A risk assessment is required to demonstrate that pollution of groundwater will not occur if there is an existing or unavoidable need to discharge in SPZ1.

3. PCF Stage 3 Road Drainage Design Strategy

3.1 Road Drainage Design Strategy

3.1.1 The drainage design for the upgraded and new carriageway sections will consist of gravity drainage networks, which will convey flows to suitable outfalls.

3.1.2 The road drainage design has been developed to sufficient detail to contribute to the Preliminary Design Stage assessment. One of the items in the Preliminary Design Stage is the Scheme Assessment report. The stages of the Scheme Assessment report are detailed in TD37/93 of the Design Manual for Roads and Bridges (DMRB).

3.1.3 It was the original intention to re-use as much as possible of the existing drainage. The modelling of the existing drainage relied on the availability of surveys. During the initial stages of the preliminary design it became clear that it was impossible to secure the necessary road space bookings to progress the surveys within the required timeframe for the preliminary design. However, to proceed with the preliminary design the design team based the preliminary design on the baseline data and fundament below:

- Existing Topographic Survey (from Aerial survey / Lidar)
- Existing stage 2 drainage information available
- Proposed Highway 3D models
- The outfalls for the pipe carrier systems would be closest to the low points of the catchment areas created by the proposed vertical alignment
- Where the low points of the highway do not correlate with known outfalls, a soakaway will be proposed. At these locations a permeability test will be scheduled to confirm suitability.

3.1.4 With the limited survey information available to inform the drainage design the surface water outfalls are based on the following strategy:

- In general, the strategy uses the existing outfalls where identifiable from HADDMS and As-Built, and close to the proposed low points on the highway (according to the highway design).
- Where the low points of the highway do not correlate with known outfalls, a soakaway has been proposed. At these locations infiltration test which is being undertaken as part of the ground investigation (GI) will be required. Suitable assumptions have been added in the assumptions register due to insufficient information received before Design Fix (DF3).

3.2 Constraints

3.2.1 Some key constraints identified on the plan may include:

- Existing drainage pipes located under areas of new carriageway widening
- Existing chamber covers located in areas of new carriageway widening
- Most of the existing drainage details are unknown. It is assumed that retained existing drainage is fit for use.
- Works within existing confined spaces (Catch pits and Soakaways)

- Pond and Soakaways have been sized using assumed infiltration rates from previous tests, the infiltration rate to be confirmed after infiltration test have been carried out.
- All ditches are assumed to be lined.
- Suitable Pollution control to be confirmed.
- There is space constraint for Bean Pond (Pond No- P-A2BE-002 located east of Bean North roundabout) due to extension of Highway and proposed retaining wall. Existing Pond to be decommissioned and replaced with proposed Bean pond. If required part of the catchment draining to Bean Pond (located east of Bean North roundabout) can be diverted into Pond located west of Bean north roundabout in later design stage. Earthworks at Ebbsfleet are limited due to Archaeological constraints near East side of Ebbsfleet South East Roundabout.

3.2.2 Other relevant constraints shall be identified and included on the drawings as they become known.

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 The proposed widened carriageway follows the corridor of the existing A2 and will therefore consist of a combination of the existing junction (brownfield) and adjacent thin strip of undeveloped land (greenfield).

3.3.3 Peak outflows from these increased widened catchments will be controlled to match existing highway peak runoff rates for 1 in 1, 1 in 5 and 1 in 100-year return periods. The increase in new impermeable area for these catchments shall be controlled to equivalent greenfield runoff rates.

Minimum Limit of Discharge Rate

3.3.4 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 will comply with this requirement from the SUDS manual with an absolute minimum diameter of 75mm of the flow control aperture to prevent blockage.

3.4 Pipe and Chamber Networks

3.4.1 For the purposes of feasibility assessment for the Preliminary Design Stage, outline conveyance pipework will generally be developed in accordance with HD33/16 'Surface and Subsurface Drainage Systems for Highways', section 6. Pipes shall be designed to 1year Return Period without surcharge and 5 year Return Period with no surface flooding. Review of design return periods may be carried out on critical sections of carriageway during the Preliminary Design Stage assessment. Due to lack of existing drainage survey and information, preliminary design assumes that at locations where there is an increase of impermeable area, the pipe carrier systems would be full depth new replacement design. Where new drainage connects into existing drainage, attenuation shall

be in the form of a larger diameter pipe which discharges through an orifice flow control into the existing drainage pipe. The maximum diameter for the attenuation pipe shall be 900mm.

Hydraulic Design Parameters

3.4.2 For this project the Flood Estimation Handbook (FEH 2013) rainfall data will be used instead of Flood Studies Report (FSR) rainfall data, which was compiled during the period 1941 to 1970. Inflow hyetograph rainfall intensities used to calculate the design storms shall include increase as an allowance for the effects of climate change. There may be a requirement for higher percentage value for climate change to comply with recent sustainability objectives. However, a decision was taken at Drainage Management level for all the RIP schemes to use climate change allowance in the design and then to add the additional percentage requirement as a risk in the project risk register. Percentage Runoff estimates have been used in the calculations of contributing areas as per HA37.

3.5 Surface Water Collection System

3.5.1 There are areas where the existing Surface water collection system needs to be re- designed due to the increase in the effective catchment areas and changes in edge of carriageway due to widening. All mainline drainage where effected will be replaced. All slip roads will have Kerb and Gully or CDKU/LDC arrangement and will be covered in detail design. It is assumed that retained existing drainage is fit for use. Full extents of retained existing drainage is shown on Retained existing drainage layout (HE543917-ATK-HDG-XX-M2-CD-000009).

Drainage on Over Bridges and Under Bridges

3.5.2 The overbridges within the site extents will be drained by suitable Bridge deck units on the deck where required and the approaches to the bridge by a kerb and gully arrangement. Under bridge areas would drain with suitable linear drainage system that fits within available verge width.

3.6 Attenuation

3.6.1 The DIS requires 100% betterment to the proposed ponds to cover the unknown issues at the Preliminary Design Stage. However, where space constraints are an issue, a reduction of the required betterment to the ponds can be proposed adding online storage.

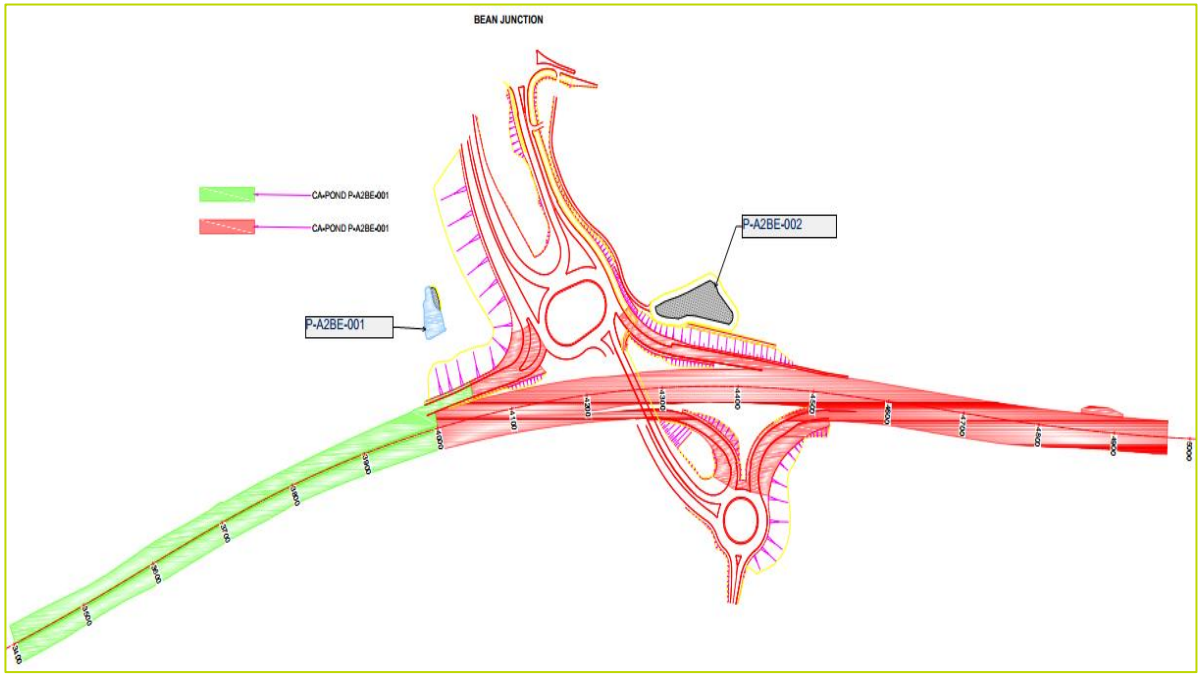
3.6.2 The attenuation ponds on this scheme will be designed according to the SUDS Manual CIRIA C753. In accordance with good practice and CDM designer duties, early consideration was given in consultation with Highways to accessibility to this SUDS pond for inspection and maintenance. Online attenuation will be in the form of larger diameter pipes with orifice flow controls where discharge points are into existing pipe networks. Pond and Soakaways have been sized using assumed infiltration rates from previous tests, the infiltration rate to be confirmed after infiltration test have been carried out.

3.6.3 There is space constraint at Bean pond (Pond No- P-A2BE-002 located east of Bean North roundabout) due to the extension of Highway and proposed retaining wall. Existing Pond to be decommissioned and replaced with proposed Bean pond (Pond No- P-A2BE-002 located east of Bean North roundabout) If required

part of the catchment draining to Bean pond (located east of Bean North roundabout) can be diverted into Pond (Pond No- P-A2BE-001) located west of Bean north roundabout in later design stage.

3.6.4 A summary of pond volumes considered are given on the Catchment calculation spreadsheet (HE543917-ATK-HDG-XX_ML_PO_Z-CA-CD-000001). Refer to Section 4 for catchment area details for both the ponds. Schematic Diagram of Catchment area of both Ponds is as shown below.

Figure 3.1: Catchment area for ponds



3.7 Earthworks Drainage

3.7.1 It will generally be 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 will be used. For this preliminary outline design the following corridors shall be allowed for in the design:

3.7.2 Minimum 13m for cut off/ toe ditches (4m maintenance strip to boundary, 7m for 1m deep 1 in 3 side slope, 2m to earthworks interface slope). However, a width of 13m is not feasible all around the length of the site considered.

3.7.3 Pre-earthworks drainage shall generally be 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 shall be selected from DMRB HA106/04 'Drainage of Runoff from Natural Catchments' Section 5 or CIRIA C697 'SUDS Manual' Table 4.2.

3.7.4 The Highways team indicated that a 4m offset for maintenance access cannot be achieved in all areas thereby resulting in less width/ no width for maintenance track for the ditches/ pre- earthwork drainage.

3.7.5 All cut-off/toe ditches are assumed to be lined as per GI requirement. Due to Space constraint, few filter drains also have been proposed at toe of highway

Embankment where no surrounding catchment area is flowing towards Highway embankment.

3.7.6 Ditches are not allowed near east side of Ebbsfleet Junction due to Archaeological constraint.

3.8 Soakaways

3.8.1 Soakaways will be designed to collect and store storm water run-off from impermeable areas and to allow its efficient infiltration to the ground. The effective functioning of soakaways depends on soakaway shape, size and the soil's infiltration properties. Soakaways are designed to HA118/06, HA103/06 and the methodology described in BRE Digest 365 and CIRIA Report 156.

3.8.2 The infiltration rate and asset status of existing Soakaways are unknown. New Soakaways have been sized until further site investigation are made based on assumptions. This principle is per approval from Environmental Agency (EA).

3.8.3 The following are the assumptions considered in the design:

- Percentage run-off is taken as 100% from the drained area, i.e. no reduction is made to the design runoff volume discharged to the soakaway for losses due to surface wetting or the filling of puddles during the storm;
- No allowance is made for the time taken for run-off to discharge to the soakaway: the required storage volume is calculated based on instantaneous discharge to the soakaway
- The outflow from the soakaway is under-estimated; higher infiltration rates occur at greater depths of storage in practice than are adopted in design, and because the outflow is calculated based on the rainfall duration rather than the run-off duration. The latter may be considerably longer, depending on the length of drains.

3.9 Interaction with Existing Drainage

3.9.1 This aspect relates to the re-use, replacement and connection into existing drainage. Since this project relates to the upgrade of an existing junction it is very important to understand the interaction with the existing drainage. The lack of drainage surveys during the Preliminary Design Stage is explained in the above Section 2. It was therefore not possible to investigate the interaction with the existing drainage during the preliminary design. It is assumed that retained existing drainage is fit for use. It is however realised that when the drainage surveys become available, the interaction with the existing drainage will have to be evaluated. This may lead to substantial redesign of the preliminary design.

3.10 Stormwater Treatment for the junction improvements

3.10.1 Highways Agency Water Risk Assessment Tool (HAWRAT) (DMRB Section 3 Part 10, HD45/09 '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.

3.10.2 HAWART assessment was carried out and can be found in the Environmental Statement

3.10.3 The existing pollution mitigation tanks near Bean pond will be removed and Suitable Pollution control to be relocated close to new Pond location.

4. Catchment area for ponds

Table 4.1: Catchment area for ponds

Catchment Ref	Outfall to Pond	Existing Impervious area (ha), from Technical Assessment Report	Revised catchment area (Ha)	
			Impermeable Area (ha)	Permeable Area (ha)
1	P-A2BE-001	3.122	3.536	0.498
2	P-A2BE-002	4.788	4.285	1.696

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