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A5 WTC
Western Transport Corridor

A5 Western Transport Corridor (A5 WTC)

Appendix TNI – Theme Report:

Drainage Design

16 July 2016

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1. A positive road drainage system incorporating features of Sustainable Drainage Systems (SuDS) was incorporated into the design at the earliest stages in the development of the A5 WTC Dual Carriageway Scheme. Design proposals for all culverts, outfalls and watercourse diversions based on the detailed discussions to date with Rivers Agency will be submitted for approval in accordance with Schedule 6 of the Drainage Order (Northern Ireland) 1973, at a later stage in the project.

Surface and Sub-surface Drainage of the Dual Carriageway

2. Surface drainage for the dual carriageway would be provided by means of a Surface Water Channel (SWC) in accordance with recommendations in the Design Manual for Roads and Bridges (DMRB). The surface drainage channel is adjacent to the carriageway edge (or median as appropriate), and at the same longitudinal gradient as the carriageway, to intercept surface run-off as sheet flow from the carriageway with channelling to a SWC Outlet and discharge to a carrier drain.

3. Carrier drains will transfer flows generated from specific Dual Carriageway drainage catchments to attenuation and retention ponds as appropriate. The incorporation of ponds controls (slows down) the rate of flow and provides water treatment to restrict pollution discharge to the receiving watercourses.

4. Attenuation ponds have been designed in accordance with The SuDS Manual (2015) (CIRIA C753) to accept all flows generated by a particular road catchment, with a controlled discharge to a suitable receiving watercourse based on detailed discussions with Rivers Agency and assessment of the Greenfield Run Off (GFRO) – the equivalent flow that would have been generated prior to the construction of the dual carriageway.

5. Replacement of permeable agricultural land which provides infiltration of rain water and overland flow towards an adjacent watercourse, with an impermeable road surface that channels run-off flows to a receiving watercourse can pose an increased risk to flooding of the receiving watercourse as the surface run-off would be transferred to the watercourse in a shorter time period than the existing scenario.

   The incorporation of ponds is specifically proposed to avoid this increased risk by ensuring controlled discharge rates and maintaining GFRO to the receiving watercourses where appropriate. GFRO is not applied at larger watercourses, for example the Foyle, based on discussion with Rivers Agency; the ponds in these circumstances being primarily for water quality treatment purposes.

6. Ponds have been designed to provide 1:4 side slopes and are graded back into the existing topography with a 1:3 batter. A 3m access track with a 1:40 crossfall (towards the pond) surrounds all ponds for maintenance purposes.

7. Discharge to an adjacent suitable watercourse is via appropriate outfall structures designed in accordance with DMRB HA 107/04 – "Culvert and Outfall Details". At locations where the proposed drainage infrastructure discharges below the water level in the receiving watercourse, particularly where there is a tidal influence, an approved non-return valve will be incorporated to eliminate the potential for backup of flows. The design proposals ensure sufficient hydraulic head in the drainage infrastructure is provided to discharge flows to receiving watercourses during periods of high water levels.

8. It is proposed that sub-surface drainage would be provided by means of Narrow Filter Drains and Fin Drains in accordance with the recommendations in DMRB, Volume 4, Part 2, "HA33/06 Surface and Sub-Surface Drainage systems for Highways." The sub-surface drainage provides a longitudinal drain at the low side of the pavement that drains the pavement layers and prevents ingress of water from adjacent verge areas into the pavement layers.

Pre-Earthworks Drainage (PED)

9. PED would be provided by means of interceptor ditches and/or filter drains at the top of cutting slopes and at the toe of embankment slopes to intercept sheet flows from adjacent natural catchments in advance of the embankment/cutting slope construction in accordance with the recommendations in DMRB Volume 4, Part 2, *"HA 106/04 – Drainage of Run-off from Natural Catchments*". PED would also intercept existing field drainage networks where the Proposed Scheme severs these networks. PED would be sized to accept flows from the contributing natural catchment and installed at a longitudinal gradient to discharge to a suitable receiving watercourse via an outfall structure. The use of PED to intercept flows from embankment slopes would prevent flooding of adjacent lands.

10. It would be necessary to provide drainage pipe work (Cross Drains) to transfer flows from one side of the carriageway to the other due to topographical constraints, to avoid ponding/localised flooding due to trapped sags and to provide a suitable outfall to receiving watercourses.

Culvert and Watercourse Diversions

11. It is proposed that culverts would be constructed to maintain the conveyance of existing watercourses at road crossings. The hydraulic design of culverts has been completed with reference to the design methodology outlined in CIRIA R168 Culvert Design Guide – Conceptual Design and DMRB, Volume 4, Section 2, Part 7 HA 107/04 Design of Outfall and Culvert Details.

12. Culverts have been designed to convey 1% Annual Event Probability (Q100) flows at each crossing. Flow rates for watercourses have been calculated using either Poots & Cochrane or Flood Estimation Handbook (FEH), dependent on catchment size and characteristics. A freeboard of 600mm has been allowed, which includes an allowance for climate change. Appropriate

embedment depths have been incorporated to account for environmental requirements. The proposed culverts have been discussed in detail with Rivers Agency, NIEA, DCAL and Loughs Agency.

13. It is proposed that watercourse diversions would be provided to rationalise the quantity of culverts and to traverse the new road perpendicularly where practicable, thereby minimising culvert length. Watercourse diversions have been designed in consideration of the existing channel dimensions and gradients to provide a diversion of similar hydraulic characteristics where practicable, and in consideration of the topography in the environs of the proposal to minimise land take.