

Technical Note

Project:	Dunsbury Masterplan	To:	John Malyon
Subject:	Assessment of Impacts of Link Road on the Water Environment	From:	Ian Dalglish
Date:	24 th August	cc:	Jo Farrar, Tom Wood, Tim Fay

Road Drainage assessment for Dunsbury Hill Masterplan.

- 1.1. The Assessment of the preliminary road design for Dunsbury Hill Masterplan and its impacts on the water environment has been considered as part of an Environmental Statement for Dunsbury Hill Masterplan. The purpose of this note is to present key parts of the Environmental Statement specifically relating to the proposed road across the site are. The road will be constructed mainly on greenfield land and will link in to Hulbert Road to the west of the site with a bus gate restricting traffic flow to Woolston Road on the east of the site.
- 1.2. The assessment will be considered using guidance from the Highways Agency's Design Manual for Roads and Bridges and The SUDS Manual (CIRIA C697).
- 1.3. The potential magnitude of impact on the water environment from the road during construction and operation of this project is considered in the sections below. The assessment of potential effects section and the significance of effects is summarised in Table 6.

Construction

- 1.4. During construction of new roads, mobilisation of suspended solids is a key concern. At this site the greatest concern would be mobilisation of suspended solids into Hermitage Stream and the potential for deterioration in water quality and resultant effects on ecological receptors. This could occur during bridging works over the Hermitage stream or during creation of any embankments in close proximity to the stream. Further guidance is available in CIRIA c648 to help direct prevention of sediment mobilisation. Key mitigation should include:
 - Development of a sediment erosion management plan (pre construction)
 - The use of sediment nets between the road and watercourses including Hermitage Stream in particular, Park Lane Stream and on-site drains; and
 - Regular sweeping of surfaces to restrict windblown sediment.
- 1.5. A summary of relevant mitigation measures during construction is included in Table 1 below.

Table 1 Construction Mitigation measures.

Attribute	Mitigation Measure	Magnitude of impact
Park Lane Stream and Hermitage Stream (surface water quality)	Follow C648 and PPG guidance	Negligible Adverse
Groundwater water quality	No discharge to groundwater. Obtain appropriate licence if required.	Negligible Adverse
Fluvial flood risk	Ensure no working or storage of material in floodplain.	Negligible Adverse
Groundwater flood risk	No discharge to groundwater and watching brief.	Negligible Adverse
Pluvial flood risk	Ensure construction of proposed drainage system first to provide	Negligible Adverse

	attenuation	
Existing discharges/abstractions	Ensure adequate bunding of fuel and oil and no unauthorised discharges	Negligible Adverse
Aquatic Ecology	Ensure sediment matting to restrict sediment to stream.	Negligible Adverse

Operation

- 1.6. The DMRB considers a number of different methods for assessing the significance of effect on the water environment. These typically include;
- Method A – routine run-off;
 - Method C – groundwater assessment;
 - Method D – spillage risk assessment; and
 - Method E and F – Hydrological assessment and Hydraulic assessment
- 1.7. Method B is used for detailed water quality assessment and would only be considered if in rare circumstances if Method A is failed.
- 1.8. Method E and F were fulfilled by the production of a flood risk assessment and as part of the Environmental Statement and are summarised here.

Method A – routine run-off assessment

- 1.9. During operation a wide range of potential pollutants could be associated with routine run-off from roads. Dependant on the type and concentration of pollutant there will be a consequent effect on ecology of water body should pollution occur. The key influencing factor on the polluting routine run-off polluting capacity of a road is the Annual Average Daily Traffic flow (AADT). Generally the higher the AADT the greater the risk.
- 1.10. Where possible it is preferred to discharge water from the road to SUDS (or vegetative treatment) systems replicating drainage existing in the natural environment. This will both provide treatment of road discharges and attenuation of road run-off. Before determining the type of drainage the water quality of each catchment of the road will be assessed.
- 1.11. The baseline assessment of the water environment undertaken for the Environmental Statement at Dunsbury has determined underlying clay across the site preventing full infiltration.
- 1.12. Table 2 shows the location of four proposed catchments along the road and the water environment attribute that it will discharge to. It is proposed that the link road discharges to a combination of Hermitage Stream and existing sewer given known constraints of the size of the development area.

Table 2 – Road Catchments and discharge points

Catchment	Discharging to	Approximate chainage (m)
1	Existing sewer on Hulbert road	0
2	New outfall to hermitage stream (receiving eastward drainage)	320
3	New outfall to hermitage stream (receiving westward drainage)	340
4	Existing sewer on Woolston road	1300

- 1.13. Using the Highways Agency Water Risk Assessment Tool (HAWRAT) an assessment of the impact of road run-off on the water attribute receptor has been made. Although it is proposed to discharge two of the catchments to existing sewer the loading of the road run-off to the sewers are still considered. The results of the assessment are shown in Table 3.

Table 3 – Road Catchments HAWRAT assessment

Catchment	Step 1	Short term water quality		Long term water quality		Step 2 – sediment	Step 3 - mitigation
		Step 2 – RST/ Copper	Step 2 – RST/ Zinc	Step 2 – AAC / Copper	Step 2 – AAC / Zinc		
1	Fail	Pass	Pass	Pass	Pass	Pass	-
2	Fail	Pass	Pass	Pass	Pass	Pass	-
3	Fail	Pass	Pass	Pass	Pass	Pass	-
4	Fail	Pass	Pass	Pass	Pass	Fail	Sediment removal required

- 1.14. The results of the assessment showed that for catchments 1-3 without further mitigation all outfalls passed all assessments at Step 2. Catchment four failed the test on sediment accumulation and deposition. Using guidance from Table 3.3 of HA103/06 and applying a 60% removal efficiency of sediment for a swale Catchment 4 passed the HAWRAT assessment. It is considered that during operation there would be a negligible adverse magnitude of impact on the water environment relating to routine run-off water quality.

Method C – Groundwater risk assessment

- 1.15. This method would determine what action should be taken if there may be a risk to groundwater. Following the baseline investigation in the Environmental Statement it had been determined that the geology underlying the site was clay and that there were no primary aquifers. For this reason it is not proposed to drain fully to ground for this scheme and instead to drain to surface waters. The routine run-off assessments have shown that the soluble water quality passes without further mitigation (only sediment is shown to be a failure in catchment 4). Any water that is discharged via SUDS features such as swales, that could potentially provide a pathway to groundwater, would not require any further mitigation, such as lining. No further assessment using the Method C test is required.

Method D – Spillage Risk Assessment

- 1.16. This assessment determines the likelihood that there will be a serious spillage risk that may harm the water environment. When a serious spillage risk has a return period of less than 200 years then further mitigation should be considered. Table 4 shows the results of the Method D for each of the four catchments.
- 1.17. The key factors in determining serious spillage risk are AADT, percentage of Heavy Goods Vehicles (HGV) and type of road. There is a greater risk with higher AADT, higher percentage HGV and where there are side roads, junctions and roundabouts. The highest predicted traffic flows of 24,051 for year 2026 were estimated on the nearby Hulbert Road and will be used conservatively for this assessment. A conservatively high value of 20% was used for the proportion of HGV.

Table 4 – Road catchments serious spillage risk assessment.

Catchment	Total length	Main	Roundabout	Side road	Spillage risk return period
1	200	150	50	-	2976
2	320	320	-	-	9559
3	320	70	50	200	1458
4	600	500	-	100	2825

- 1.18. Table 4 shows that none of the catchments break the threshold of 1 in 200 years for serious spillage risk, therefore no further specific mitigation is required for serious spillage risk. However, as part of the proposal for the new road, two roundabouts and other junctions to side roads have been proposed. These types of location would provide an increased risk of serious spillage (even if it has shown to be above the threshold standard). It is recommended that a storage area is provided that could be operated in the event of an emergency prior to discharge directly to a watercourse or an existing sewer. This may take the form of a swale, sized to provide attenuation, with the additional facility to temporarily block off a section of the swale. It is considered that during operation there will be a negligible magnitude of impact on the surface water and groundwater quality relating to serious spillage risk.

Sustainable Drainage Selection

- 1.19. To aid mitigation of the operational effects of a new road scheme, PPS25, the PUSH SFRA and Havant Borough Council Core Strategy recommend the consideration of SUDS during development.
- 1.20. The SUDS Manual provides a SUDS selection matrix which can be adapted to the drainage of the road and compliments the Design Manual for Roads and Bridges guidance on Vegetative Treatment Systems (HA103/06). This includes consideration of the land use characteristics, site characteristics, catchment characteristics, quantity and quality performance and use. The aim of using this selection matrix is to refine the selection of SUDS options for this site by assessing these considerations.
- 1.21. Table 5.1 of The SUDS Manual suggest low trafficked roads should be considered like a commercial development which only discounts source control such as rainwater harvesting from selection. The underlying soils of the road are clay like the rest of the site which presumes against the use of full infiltration drainage. The proposed slope of the road will be mainly gradual permitting the use of most types of SUDS. The approach to Hulbert Road which is at a slightly increased gradient will be kerbed with gulleys. Space alongside the road is quite constrained in some areas, particularly where the road is raised on embankment adjacent to Hermitage Stream. In these areas SUDS such as wetlands, ponds and swales may be limited and kerb and gully may be one of a few options for drainage. The key catchment characteristic for the road is the Hermitage Stream which has been identified as of medium importance in the Environmental Statement. Using Table 5.6 from The SUDS Manual, for a commercial zone (which it is suggested that the road is considered) and a receiving water of medium sensitivity, it would be appropriate for two levels of treatment.
- 1.22. It is suggested at this site that a combination of gulleys and kerbs are used in areas restricted by space, and swales and wet swales (with some planting) are used alongside the road to provide two levels of treatment in series.
- 1.23. Assuming appropriate SUDS are used on this site as suggested, during operation the magnitude of impact of polluting run-off on surface water quality is negligible adverse.
- 1.24. It is presumed that due to the ground conditions at this site there would be no discharge to ground or even if there were indirect drainage it would be unlikely to permeate the clay

substrate on site. Therefore the magnitude of impact of polluting run-off on ground water quality is considered negligible adverse.

Flooding and attenuation

- 1.25. The risk of flooding either to the road or caused by the road has been assessed.
- 1.26. The link road crosses Hermitage Stream. A cross section of the proposed bridge is shown in drawing 5099849/TP/BR/0001. A combination of increased cross sectional area due to restoration of Hermitage Stream and design of a free spanning bridge above known flood levels confirms that there should be a minor negligible beneficial impact to fluvial flood risk during operation. Further comment on the flood risk related to this bridge crossing can be found in the Flood Risk Assessment.
- 1.27. Prior to construction, detailed sizing should be undertaken for culverting of an on-site drain around chainage 85 of alignment MC002, shown on drawing 5099849/TP/GA/0002, taking into consideration this drain may receive discharge from a number of the proposed development plots. It is in the interests of the developer to ensure this culvert is appropriately designed as the area immediately upstream of the ditch crossing could flood in the event of flow restriction and is part of the development site. It has been assumed for the purposes of this report that there will be no impact from appropriate design of this culvert during operation.
- 1.28. Spot checks on groundwater levels through trial pits have identified that the closest point of water to ground level was 3.15m below ground. There are no known historical records of persistent groundwater flooding. It is assumed that should any high water levels be identified on site during more detailed site investigation prior to construction that it would be likely that this water would be perched and therefore isolated above the generally clayey ground conditions. It is considered groundwater flood risk will produce a negligible magnitude of impact on the scheme.
- 1.29. During operation the increased impermeable area of the road surface will generate increased runoff to be discharged to the water environment. This could create an increased surface water flood risk. In accordance with the DMRB and PPS25 this should be mitigated to ensure no increased flood risk. To mitigate run-off from additional hardstanding Microdrainage quick storage estimator has been used. The discharge from the road has been limited to QBAR and the upper limit of attenuation requirement for a 1 in 100 yr plus 30% (for climate change) has been taken for each catchment. It is proposed the road will have four catchments. These are shown on the illustrative drainage figure. To the west of the scheme the road ties in with Hulbert Road at a proposed roundabout. The roads north and south of this roundabout are known as catchment 1. It is assumed that there will be little change in drainage north and south of the roundabout and that drainage will keep discharging to the existing drainage system. From the proposed Hulbert Road roundabout eastwards there are three other main catchments. Catchment 2 contains two sub catchments 2a and 2b. Catchment 2a will drain the new Hulbert Road roundabout with kerbs and gulleys towards a section of road that will be drained by swale, eventually outfalling at a low point directly to the Hermitage Stream. The swale will provide both pollution removal and attenuation and should provide capacity to store required attenuation volumes as shown in Table 5. Catchment 2b will drain the proposed bridge over Hermitage Stream toward the low point again with a combination of bridge drainage and swale providing pollution removal and attenuation directly to the first outfall to Hermitage Stream. Catchment 3 will discharge westwards via a combination of swales and kerbs and gulleys and discharge directly into the Hermitage Stream at a second outfall just to the north side of the proposed crossing of Hermitage Stream. Catchment 4 will discharge eastward receiving over the edge drainage into a wet swale that will provide attenuation. This will then be discharged at restricted rates to existing sewer at Woolston Road.
- 1.30. All drainage associated with the road and to be maintained by the local authority shall be kept separate from any other site drainage.

- 1.31. Table 5 shows allowable discharge rates and required volumes of storage for a 1 in 100yr event plus 30% storage.

Table 5 – Road Catchments and attenuation requirements to ensure Greenfield discharge

Catchment	QBAR Greenfield Run-off Rate (l/s)	Area to be drained (ha)	Attenuation requirement (m3)	Receptor
1	0.3	0.1	98	Existing sewer
2a	2.1	0.6	394	Hermitage Stream
2b			179	Hermitage Stream
3	1.7	0.5	473	Hermitage Stream
4	2.1	0.6	563	Existing Sewer

- 1.32. During operation following provision of attenuation as required in Table 5 is provided through swales or other methods it is considered the magnitude of impact of increased surface water flooding is negligible adverse.
- 1.33. It is proposed that the maintenance of the drainage be provided in accordance with the best provision found within The SUDS Manual guidance, the Design Manual for Roads and Bridges or local highway authority guidance.

Summary

- 1.34. During operation the discharges from the scheme will be attenuated to prevent any increase in discharge rates. They will also be treated with an appropriate level of treatment. On this basis it is considered that the magnitude of impact of the scheme on discharges would be negligible.
- 1.35. During operation there will be no abstraction required for the road scheme. It is considered there will be a negligible magnitude of impact on abstractions during operation.
- 1.36. In operation, the restored section of the Hermitage Stream will provide betterment to both stream habitat quality and stream ecology. This is due to the replacement of the concrete lined channel (approximately 100m) with a more sinuous and natural soft banked channel length and the provision of greater habitat heterogeneity for the current ecological communities of the stream i.e. macroinvertebrates and bullhead fish populations. It is considered that the magnitude of this effect on both aquatic ecology and stream geomorphology as a result of the restoration will be permanent minor beneficial.
- 1.37. Assuming appropriate SUDS are used and maintained appropriately during operation, the magnitude of impact of polluting run-off and changes in surface water quality on aquatic ecology and geomorphological quality of the Hermitage Stream is assessed as negligible adverse.
- 1.38. Bridge shading effects are also considered during operation as a result of the required road crossing of the Hermitage Stream. The deck height is likely to preclude the development of instream and marginal vegetation due to shading impacts. Despite this any negative effects are considered to be significantly off-set by the provision of the restored channel length.
- 1.39. Table 6 summarises the overall operational impact of the proposed link road during operation concluding 2 slight beneficial effects and no significant adverse effects.

Table 6 Overall operational significance effect of the proposed link road during operation.

Receptor	Value	Magnitude of impact	Significance of effects
Park Lane Stream and Hermitage Stream (surface water quality)	Medium	Negligible adverse	Neutral
Groundwater water quality	Low	Negligible adverse	Neutral
Fisheries/recreational users	Scoped out at baseline assessment		
Fluvial flood risk	Medium	Negligible beneficial	Slight beneficial
Groundwater flood risk	Low	Negligible adverse	Neutral
Pluvial flood risk	Low	Negligible adverse	Neutral
Existing discharges/abstractions	Low	Negligible adverse	Neutral
Aquatic Ecology	Medium	Minor beneficial	Slight beneficial