

Ageas Bowl, Hampshire

Flood and Drainage Addendum 2

A Flood Risk Assessment (FRA) for the proposed development of the site at the Ageas Bowl (planning reference number F/22/93194) was provided by Andy Clay Consulting (ACC) in August 2022.

The FRA included drainage design input from Tumu Consulting Ltd and also flood modelling input by Thomas Mackay Ltd.

The LPA are Eastleigh Borough Council (EBC) and the LLFA are Hampshire County Council (HCC). Comment was provided on the FRA in October 2022, requesting the provision of some additional information and clarification of certain points.

A FRA Addendum was then provided in December 2022, which the LPA and LLFA provided comment on in March 2023. In addition, a meeting with the LPA and LLFA was held on 8th March 2023 including some follow up discussion, which raised some other questions and queries.

This FRA Addendum 2 has aimed to capture and address these various points, in an attempt to reach a position of agreement on some or all of them and an agreed way forward.

LPA Comment 1:

"The diverted watercourse (thick dashed line) should be de-culverted as much as possible."

ACC Response 1:

As stated in the FRA and noted in the meeting, the proposed development would replace and re-align the culverted section of the watercourse in the western part of the site. The inclusion of a longer section of open channel was investigated, but unfortunately this was limited due to the depth of the culvert in the ground, the location of the inlet from Telegraph Wood and also the discharge at the outlet end.

With the amendment to the layout, we will of course look to see if the open section of watercourse (and therefore the amount of de-culverting) can be increased. Appendix C of the FRA provided a long-section of the culverted watercourse which further illustrates this – included below as **Figure 1**.

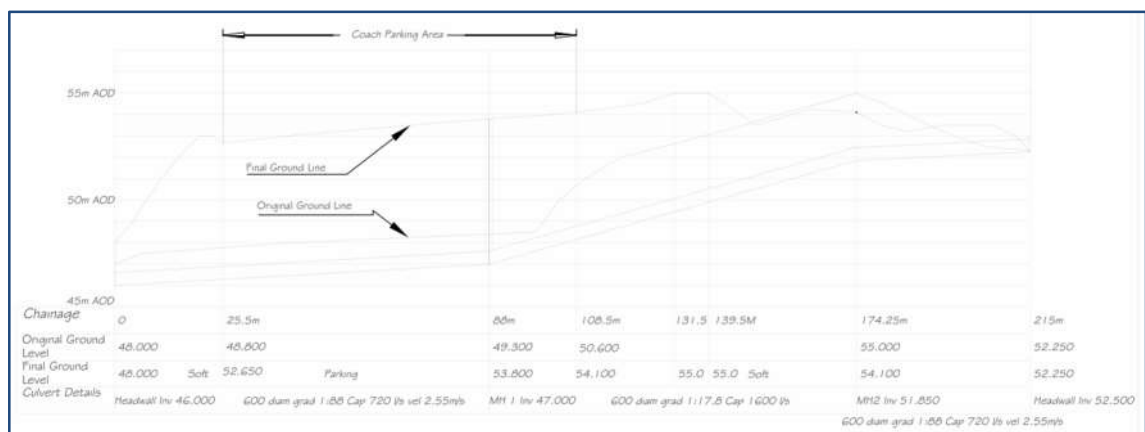


Figure 1 – Long Section of Culvert

LPA Comment 2:

“The area labelled Attenuation Pond should not be an attenuation pond. It is the watercourse, because the culverted Telegraph Brook flows into it when it exits the culvert. It should be profiled as a watercourse, and should be managed as a watercourse, with a low flow, two stage channel and not a trapezoidal channel.”

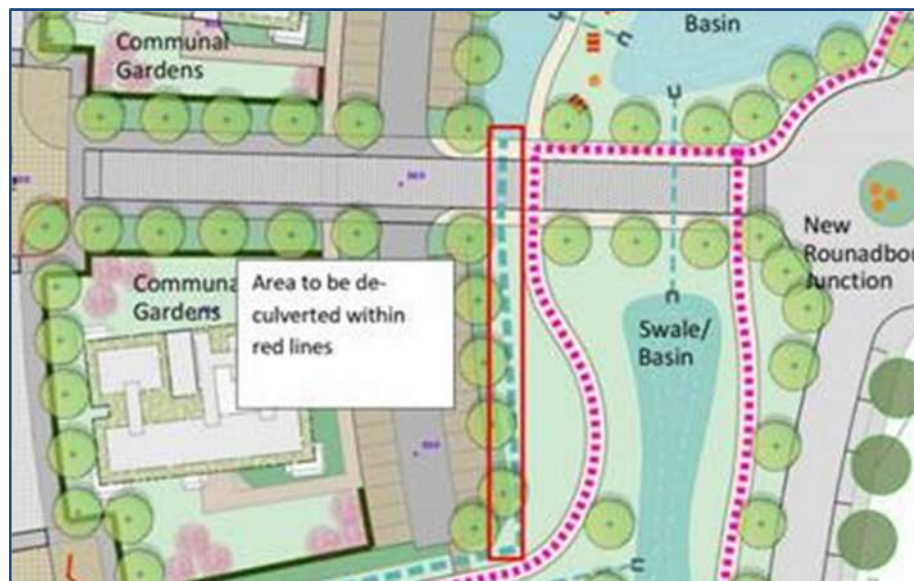
ACC Response 2:

Please find attached the drainage plans that were previously included in the FRA Addendum – but provided in a reduced file format as **Appendix A** including an indication of where surface water runoff is conveyed and also a compressed file format as **Appendix B**. This labels the various part of the drainage strategy, and does not show the watercourse as an attenuation pond (but as a watercourse).

As advised in the FRA and also noted in the meeting, it is the aim to include the watercourse as a two-stage channel. However, the flood model would need to ensure that this channel profile can be achieved in all locations without resulting in an adverse flood risk.

LPA Comment 3:

“The watercourse could be de-culverted south of where it is shown now, back to the right-angle bend. Eliminating the right-angle bend would also reduce the chances of blockages”



ACC Response 3:

We agree that this would be preferable if it can be achieved. However, the current culvert outlet is located where it is due to the challenges with the existing site levels, the fixed inlet point and the fairly fixed outlet point (as above). With the amendment to the layout, we will of course look to see if the open section of watercourse (and therefore the amount of de-culverting) can be increased.

LPA Comment 4:

“Most of area 5 is proposed to be drained by permeable paving, the swale/basin and the basin before discharge into the watercourse. This would provide 3 forms of filtration, of which 2 are naturalised. The

lakes within the golf course must provide another form of naturalised filtration for this water, the final level of treatment before it is discharged off site"

ACC Response 4:

Thank you for clarifying the natural forms of filtration and that the two existing lakes can be included. There are two lakes that are separated by a weir and therefore we consider these to provide two forms of naturalised filtration (and referred to below as Lake A and Lake B), with the water then passing through another lake and a wet woodland area before it leaves the overall site (via a culvert).

We have attached the drainage plans from the previous FRA Addendum, but in a reduced file format as **Appendix A** including an indication of where surface water runoff is conveyed and also a compressed file format as **Appendix B**. These show the drainage catchments for each character area and also the outfall locations. I've summarised below the water quality treatment that is provided for each drainage catchment.

- Character Area 5a (Outfall 2):
1) Permeable Paving; 2) Existing Lake A; then 3) Existing Lake B.
- Character Area 5b (Outfall 3):
1) Permeable Paving; 2) Swale A; 3) Detention Basin A; 4) Existing Lake A; then 5) Existing Lake B.
- Character Area 5c (Outfall 1):
1) Permeable Paving; 2) Biodiverse Channel A; 3) Existing Lake A; then 4) Existing Lake B.
- Character Area 4 (Outfall 5):
1) Permeable Paving; 2) Existing Lake A; then 3) Existing Lake B.
- Character Area 2 and 3 (Outfall 6):
1) Permeable Paving; 2) Existing Lake A; then 3) Existing Lake B.
- Character Area 1a (Overflow / Infiltration):
1) Biodiverse Channel B.
- Character Area 1b (Outfall 4):
1) Permeable Paving; 2) Existing Lake A; then 3) Existing Lake B.

As above, we are suggesting that the old section of watercourse (i.e. upstream of where the new watercourse adjoins) is retained and enhanced as Biodiverse Channel A. There would be an outfall of surface water from Character Area 5c that would help prevent this from drying out and it would benefit water quality. We are also suggesting that the drainage channel along the northern boundary is retained and enhanced also as Biodiverse Channel B. Surface water from Character Area 1a would drain to this.

However, this still leaves Character Area 1a with one form of treatment. The options available are to include a gravel filled filter drain along the edge of the parking area, parallel to the drainage channel. Surface water would naturally drain through this filter drain prior to draining into Biodiverse Channel B.

The SuDS Manual provides advice on gravel filled filter drains, and that they can be designed to provide attractive boundary lines or edging and can be protected with a geotextile or even covered with topsoil and planted with grass. An extract from the SuDS Manual is included below as **Figure 2**.

Given the temporary nature of the car parking across the site, we consider that there is the potential to park on the gravel filled filter drain so long as the surface is protected with an appropriate geotextile.

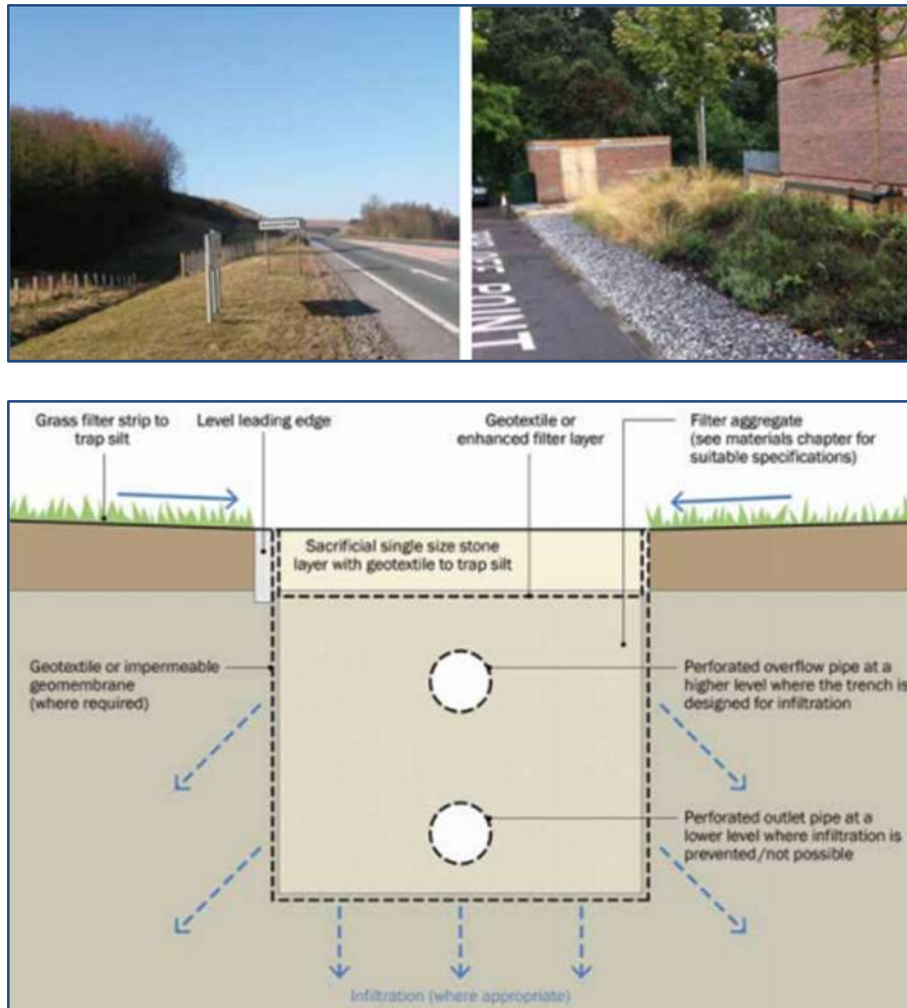


Figure 2 – SuDS Manual Extract on Gravel Filled Filter Drains

An alternative option to consider is to reprofile the existing ground levels across the temporary car park. Essentially to increase ground levels and thereby alter the existing drainage regime, so that instead of this part of the site draining to the north and into Biodiverse Channel B, to instead drain to the south and into the realigned watercourse. This watercourse then passes through Lake A and Lake B.

An initial assessment was completed to consider this, to indicate the required amount of reprofiling, achieved through increasing ground levels. In summary, it is not currently proposed to reprofile ground levels in this way – and therefore the site would continue to drain north into Biodiverse Channel B.

LPA Comment 5:

“It is not clear which areas in this housing section (Area 5) are proposed to be drained by which features and where this runoff will enter the system.”

ACC Response 5:

We have attached the drainage plans from the previous FRA Addendum, but in a reduced file format as **Appendix A** including an indication of where surface water runoff is conveyed and also a compressed file format as **Appendix B**. These show the drainage catchments for each character area and also the outfall locations.

LPA Comment 6:

“Surface water from all of the roads should drain through the permeable paving, the Swale/Basin and the Basin before draining into the main watercourse.”

ACC Response 6:

We have attached the drainage plans from the previous FRA Addendum, but in a reduced file format as **Appendix A** including an indication of where surface water runoff is conveyed and also a compressed file format as **Appendix B**. These show the drainage catchments for each character area and also the outfall locations.

The majority of the hardstanding areas including internal road would pass through permeable paving. It is not possible for all road areas to drain through permeable paving. However, they would drain through other forms of treatment (for example, the two existing lakes which would be enhanced through planting to make them more biodiverse).

LPA Comment 7:

“In this new plan, the old watercourse, labelled existing ditch, will not receive the main flow from Telegraph Brook. We need to know which areas are proposed to drain into to this ditch. The simple index approach needs to apply to any runoff before entering the ditch. This ditch cannot be managed as a swale, as it is shaded by the trees, which should be retained. Some water must enter this ditch so that it does not get starved of water and dry out. There was some discussion about the surface water drainage from the houses in area F and the apartment blocks draining into this ditch but it is not clear how this would work. What level of filtration would this watercourse with trees.”

ACC Response 7:

We have attached the drainage plans from the previous FRA Addendum, but in a reduced file format as **Appendix A** including an indication of where surface water runoff is conveyed and also a compressed file format as **Appendix B**. These show the drainage catchments for each character area and also the outfall locations.

We applied the SuDS Manual approach for assessing the pollution indices and the mitigation indices. For example, the inclusion of permeable pavement with no other forms of treatment is typically sufficient to treat the runoff from residential roofs combined with property driveways and low trafficked roads. However, we are also including a series of other naturalised forms of treatment, including the two existing lakes which would be enhanced through planting to make them more biodiverse.

We are also suggesting that the old section of watercourse (i.e. upstream of where the new watercourse adjoins) is retained and enhanced as Biodiverse Channel A. There would be an outfall of surface water from Character Area 5c that would help prevent this from drying out and it would benefit water quality. We are also suggesting that the drainage channel along the northern boundary is retained and enhanced also as Biodiverse Channel B. Surface water from Character Area 1a would drain to this.

We welcome further discussion with the LPA and LLFA on the creation of these biodiverse channels. We envisage the inclusion of appropriately spaced and sized natural check dams in the channel to help restrict water flow. This is considered acceptable, as the channels are not part of the main watercourse.

The check dams could be formed through the use of mounded gravel and/or through the inclusion of a wooden structure or large woody debris fixed in the channel. This would help to promote a wetter channel bed, supporting the planting of appropriate vegetation and the associated biodiversity benefits.

ACC Additional Information 1 – Two Stage Channels:

The FRA suggests that the realigned watercourse is provided as a two-staged channel. This would provide a low flow channel for conveying the more typical flows from Telegraph Wood, but also an upper profile for containing flood flows. This upper profile could also be planted to provide landscape and biodiversity benefit. However, the flood model would need to ensure that this channel profile can be achieved in all locations without resulting in an adverse flood risk.

ACC Additional Information 2 – Flood Flows / Channel Overtopping:

The flood modelling indicated that there could be some overtopping of the watercourse as it passes through the temporary car park. It went on to suggest that the existing bankside levels would need to be elevated by approximately 0.2m to 0.3m and with an appropriate freeboard to prevent channel overtopping.

As mentioned above, an alternative option for the temporary car park is to reprofile the existing ground levels. There is therefore the potential to incorporate the required elevation of bankside levels into this.

ACC Additional Information 3: Catchment Plans and Figures:

There was a general comment in the meeting that the drainage plans that were sent should be simplified so they are easier to load on the computers available to the LPA and LLFA and understand.

We have attached the drainage plans from the previous FRA Addendum, but in a reduced file format as **Appendix A** including an indication of where surface water runoff is conveyed and also a compressed file format as **Appendix B**. These show the drainage catchments for each character area and also the outfall locations.

ACC Additional Information 4: Flood Modelled Catchment Area:

The LPA and LLFA also asked about the extent of the hydrological catchment that drains to Telegraph Brook. The extract included below as **Figure 3** is from the flood modelling, and shows that the hydrological assessment resulted in the following catchment area for the flood modelled reach.

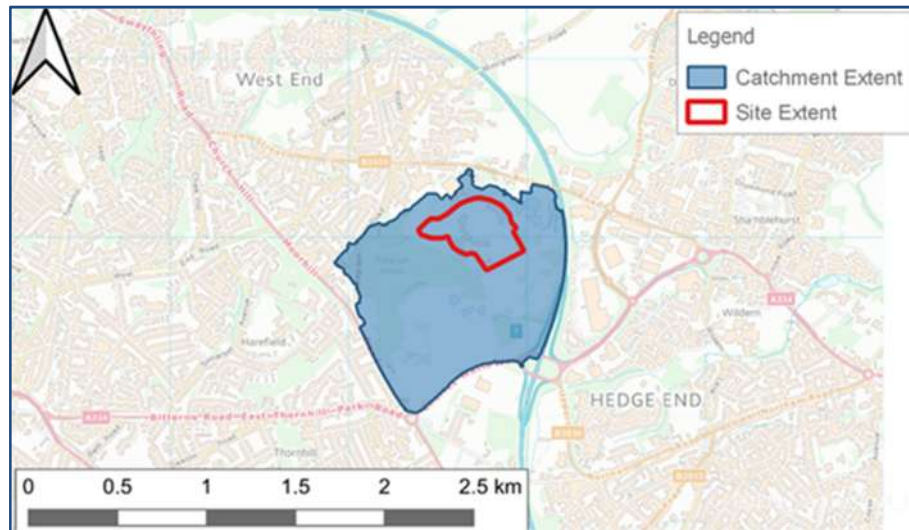


Figure 3 – Flood Modelled Catchment Extent

This shows the whole flood modelled extent (i.e. the hydrological catchment down to the two existing lakes). Whereas the hydrological catchment upstream of the culvert inlet from Telegraph Wood would be less than this, and is indicated by the extent of sub-catchment 1 as illustrated in **Figure 4**.

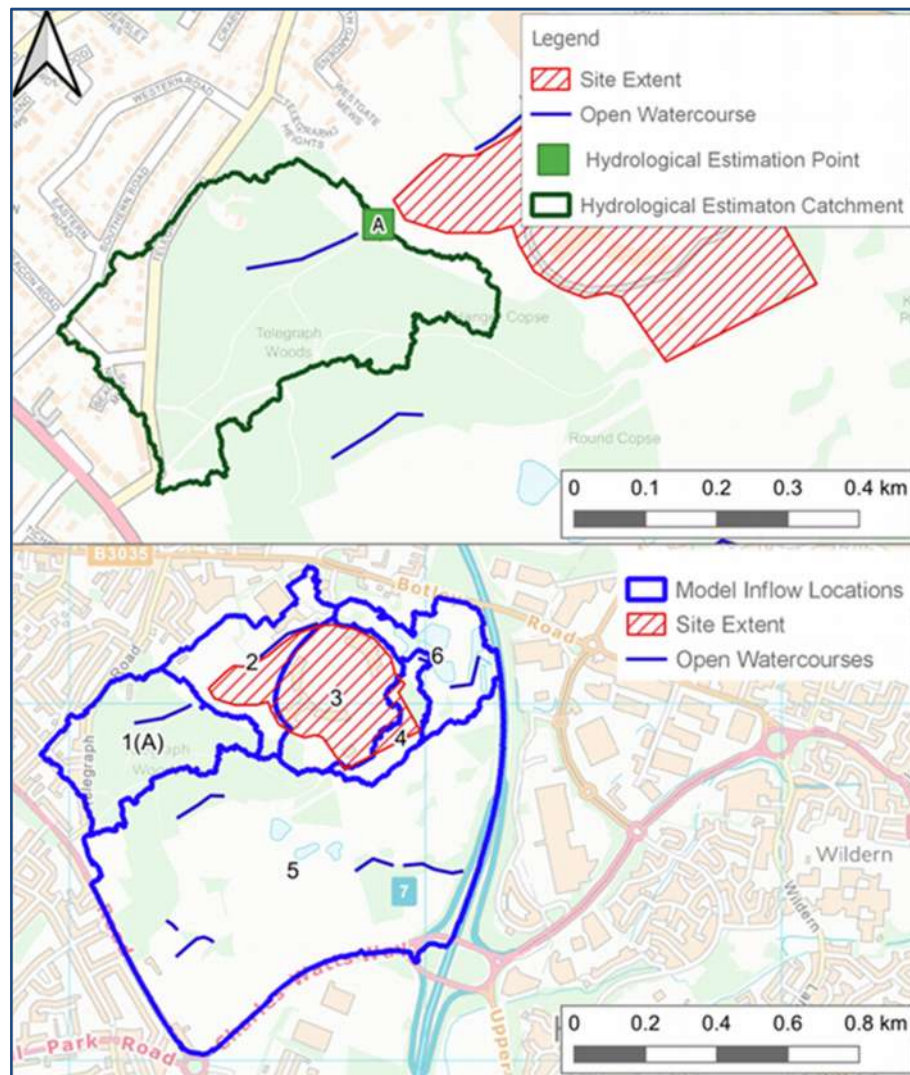


Figure 4 – Flood Modelled Sub-Catchment Extent

ACC Additional Information 5 – Summary of Modelled Flows:

The LPA and LLFA also asked about the flows of water along Telegraph Brook.

The flows (m^3/sec) included below as **Table 1** are taken from the post-development modelled scenario for a series of return periods (20% is the 1 in 5-event and 1% is the 1 in 100-year event etc).

The model node locations are indicated in **Figure 5**, with model node A located at the upstream end and model node E located at the downstream end.

This shows that at model node A there is very little change across events, with this largely a result of the existing culvert throttling the flows from sub-catchment 1. As would be expected, flows accumulate with distance downstream (model nodes D and E) due to the intake of flows from sub-catchments 2 and 6.

In summary, at model node E (upstream of the existing two lakes) then even with the 1 in 100-year event – the flows in the watercourse are $0.37 \text{ m}^3/\text{sec}$. This is not a significant flow for a flood event.

Flow (m³/s)	Model node	Location	20%	10%	5%	1%	1%	0.1%
			AEP	AEP	AEP	AEP	AEP CC	AEP
			2 hour	2 hour	2 hour	2 hour	2 hour	2 hour
			storm	storm	storm	storm	storm	storm
	PR01U_0121	A	0.08	0.08	0.09	0.09	0.09	0.09
	PR01L_0187	D	0.19	0.22	0.24	0.30	0.38	0.43
	PR01L_0023	E	0.23	0.26	0.29	0.37	0.47	0.54

Table 1 – Flood Modelled Sub-Catchment Extent

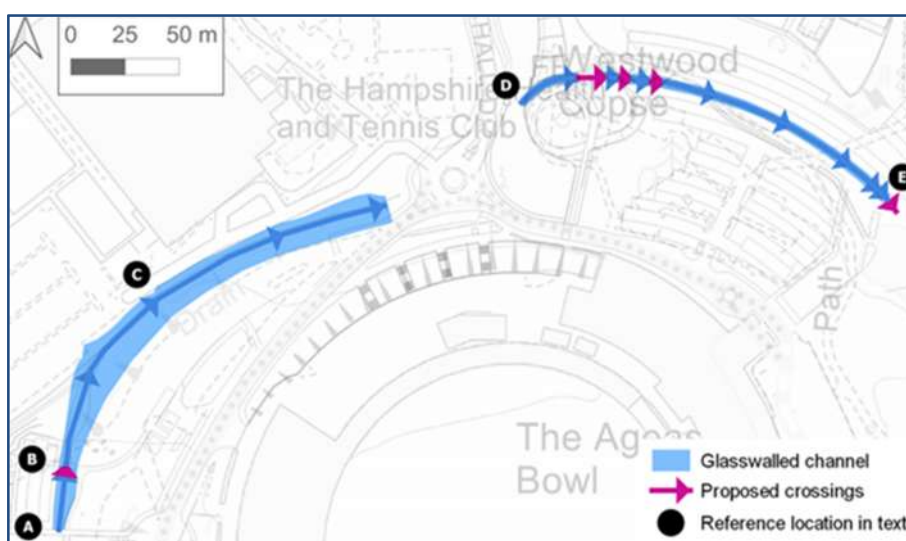


Figure 5 – Flood Modelled Sub-Catchment Extent

ACC Additional Information 6 – Flood Modelled Channel Configurations:

The assumptions that the flood modelling have made to date with the channel shape / geometry in the post-development modelled scenario are as follows (refer to **Figure 5** as above for location):

- Model nodes A to B – modelled as a two-stage trapezoidal channel (with a 0.2m deep low-flow channel);
- Model nodes B to C – modelled as trapezoidal channel;
- Model nodes C to D – the existing watercourse and culvert were modelled; and
- Model nodes D to E – modelled as a 3m wide rectangular channel (i.e. not two-stage).

ACC Summary:

Responses have been provided to points that had been raised by the LPA and LLFA, in an attempt to reach a position of agreement on some or all of them and an agreed way forward.

Some additional information including from the flood modelling has also been provided in response to points raised by the LPA and LLFA in the meeting.

Appendix A

Drainage Catchment Areas (Reduced File Format)

Appendix B

Drainage Catchment Areas (Compressed File Format)