



From: Laura Gibbons <Laura.Gibbons@arun.gov.uk>
Sent: 08 June 2021 12:32
To: Planning.Responses <Planning.Responses@arun.gov.uk>
Cc: Michael Eastham <Michael.Eastham@arun.gov.uk>
Subject: A/84/21/DOC

We have the following further comments on this discharge of conditions application.

Condition 23 SuDS details

We do not recommend discharge of this condition at this time, as a result of the following issues:

- Design lifetimes of some elements still have not been provided. For example the lifetime of the impermeable liner to the attenuation basin and tank must be stated along with requirements to check its condition and for replacement.
- I note that maintenance of proprietary treatment devices is included within the manual. Please confirm where these are proposed.
- We note that trees are referenced within the maintenance manual. As a result we looked for the landscaping proposals, we wish to highlight that there is significant conflict between planting proposals and drainage proposals. Trees must not be proposed within or in close proximity to attenuation features. Please ensure that trees are sufficiently positioned so that their root potential areas are not in conflict with drainage features, especially lined features.
- It is not appropriate to recommend discharge of this condition until the design has been agreed. Currently the design fails to meet policy requirements (full detailed comments below). WSCC policy for the management of surface water is an adopted policy, both by WSCC and ourselves. The policy requirements of this policy, along with national planning policy, and local plan policy must be met.

Condition 25- discharge of flows to watercourse

We note that a flood risk activity permit has been provided for the culverting of the watercourse, it does not appear that a consent is in place for discharging water to the watercourse specifically the headwall construction. Please can the applicant provide further details of the proposed headwall, as per the below comments.

Condition 26- maintenance of watercourse

We wish to see the drainage design further refined prior to commenting in full on this condition. Further discussions regarding who will be maintaining the culvert and flood scheme are required.

Condition 28- surface water drainage strategy

We do not recommend discharge of this condition at this time. Currently the design fails to meet policy requirements (full detailed comments below). WSCC policy for the management of surface water is an adopted policy, both by WSCC

and ourselves. The policy requirements of this policy, along with national planning policy, and local plan policy must be met.

Please see detailed comments below.

Detailed Drainage Comments Key

ADC comments 02/03/21

ABLP response 29/03/21

ADC comments 13/04/21

ABLP response 26/04/21

ADC Comments 18/05/21

ADC Comments 08/06/21

1. Calculation printouts do not include pipeline schedule printouts of upstream and downstream manholes. This combined with layouts not showing pipe numbers makes it very time consuming to review. I therefore have not reviewed the calculations. Please supply further calculation printouts and include pipe numbers on plan. Please see comments below (24 onwards)

All calculations are provided again and amended as per your comments. All pipe numbers have been included on all plans.

~~*2. Please can you provide a dwg of your drainage area plans. As we are working from home and have no access to plotters we cannot do spot checks of impermeable areas without this.*~~

~~*A dwg is included in the submission. Okay, thank you.*~~

3. Please can you provide an update on the additional groundwater monitoring that has been completed. Further details awaited.

The groundwater monitoring has been completed and is being issued to you for approval. However initial investigation have shown the drainage design does not change.

Thank you for providing the flotation calculations. Groundwater monitoring results need to be supplied as part of this application. Groundwater monitoring results show that groundwater was found at 0.07mbgl in borehole 5. The borehole log identifies that this extended down 3m into the gravels. We do not believe there is sufficient justification for not using these results. Worst case readings must be used in flotation calculations. Especially given that monitoring did not commence until February, when most of the area experienced absolute peak in late December or early January. Calculations must also account for lower areas of basin, i.e. liner depth in sediment forebays will be greater and displaced water depth will be greater here.

- ~~4. Grilles should be cranked (45 degrees) and not vertical. Okay, point closed~~
- ~~5. I note that the headwall details include a biodegradable erosion control blanket. What is the design life of this, will it be sufficient? Okay, point closed~~
- ~~6. Please clearly state invert levels of proposed basins on basin plans on the construction detail drawing. Okay, point closed~~
- ~~7. Please clearly state side slopes on basin cross sections. Please also state side slopes on the northern basin plan drawing. Okay, point closed~~
- ~~8. I note that the northern basin is to have some sides where the top of bank level exceeds existing/ proposed surrounding ground level. Please detail the top width of the bund that is being proposed, along with side slopes on the dry side of these embankments. Okay, point closed~~
- ~~9. Layout plans must detail proposed falls of all pipes along with pipe diameter. Okay, thank you.~~
- ~~10. Please confirm groundwater level adjacent to the cellular attenuation tank in the car park, near SN1. Okay, point closed~~
- ~~11. The construction detail of the cellular attenuation tank in the car park appears to have a permeable membrane around the tank and then an impermeable membrane around the sand. Please confirm if it is proposed to allow infiltration or not here. Okay, point closed~~
- ~~12. The small permeable paving area appears to have diffuser blocks located outside of the permeable sub-base. Please confirm where these are intended to connect, show invert levels of the diffuser blocks on plan, and provide a construction detail which clearly shows how they link to the surface water drainage design. Okay, point closed~~
- ~~13. The invert level of the permeable paving construction detail is different to that stated on plan. Okay, point closed~~
- ~~14. The permeable paving construction detail needs to provide further detail on the surface course, and any layers below this. Okay, point closed~~
15. Please detail swale invert levels, top of bank levels, side slopes, and any bed slope on drainage layout plans.

This has been noted and included on the drawings. This still is not included on layout drawings. This has been noted and included on the drawings. Okay, will be reviewed once appropriate calculations are supplied. The construction detail of the southern infiltration swale has an invert level of the filter material that is inconsistent with the layout, please correct.

- ~~16. The construction detail of the cellular soakaway needs to show the permeable liner around the crates, not around the sand to ensure the correct separation of material.~~

~~This has been noted and included on the drawings. This is still incorrectly detailed. This has been noted and included on the drawings. Okay, point closed.~~

17. Invert level and depth of soakaway crates is inconsistent between surface water drainage layouts and construction detail drawings.

This has been noted and included on the drawings. *This is still incorrectly detailed. This has been noted and included on the drawings. Okay, will be reviewed once appropriate calculations are supplied. Cover level of the main western infiltration crate is inconsistent between layout and detail drawing.*

~~18. It appears that incoming pipe invert levels into the soakaway are at the base of the infiltrating structure. Incoming invert levels to infiltrating structures must be set above the 1 in 10 year plus cc event water level. This has been noted and included on the drawings. Please see comments below, it appears that invert levels are set below the 1 in 10 year plus cc level on multiple structures.~~

~~As provided in our emails we state we apply to all design criteria wrt the 1:10 level and freeboard. However, you have queried this and also our calculations. To clarify we have provided two sets of calculations as requested and as per all other schemes and all previous submissions. The first set is the full design for all storms up to the 1:100 year plus climate change. This has been used to set all design criteria in accordance with industry standards including the 1:10 level and the freeboard. The design has then been tested to include Urban Creep in accordance with industry standard and ADC request. This is the second set of calculations. This proves the design still works if, in the future, further impermeable area is added, albeit there is minimal encroachment above the 1:10 level and in to the freeboard. We believe it is these calculations you are commenting on as to above the 1 in 10 and freeboard constraints.~~

~~We have provided one set of calculations including all constraints with urban creep allowance setting the 1:10 level meaning the site is very over-engineered. As per SuDS policy 5, of the West Sussex LLFA Policy for the management of surface water, surface water drainage design must account for changes over the lifetime of the development, and should include urban creep. The calculations provided now have results for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:~~

~~1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.~~

~~1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall.~~

~~Please make it clear on impermeable areas plans and calculations where urban creep is added. The results provided show impermeable areas plans for the northern catchment matching those in the first set of calculations in the previous printout, which according to your above statement did not include urban creep.~~

~~Okay, point closed.~~

~~19. Please detail incoming pipe invert levels on the central swales. This has been noted and included on the drawings, as previously. Please include invert level of swale on plan~~

~~This has been noted and included on the drawings, as previously. Okay, will be reviewed once appropriate calculations are supplied. Okay, point closed.~~

~~20. Catchpits must be provided upstream of all connections into infiltrating structures. Okay, point closed~~

21. *Construction details are required of the proposed headwall to watercourse, channel drains, catchpits, gulleys. This has been noted and included on the drawings. However, we must note our frustration at this request. We understand details of non-standard items are required but details of standard "off the shelf" items such as channel drains, catchpits and gulleys are standard items provided to national standards and as such should not be detailed on drawings. This causes confusion on site and misinformation. Requirement for this information is included within our checklist which we have made reference to previously, we do not understand how this causes confusion on site. Construction detail of headwall to watercourse has not been provided.*

This has been noted and included on the drawings. It is still not clear what the construction detail drawing is for the connection to the watercourse. Is it the same as those into the basin, or different? Please clearly define. The watercourse headwall should be a site specific detail which includes bed and bank levels and proposed invert level. Awaited, does not appear that a revision has been provided.

22. *The hydrobrake construction detail drawings should be site specific and show invert level, cover level, and incoming and outgoing pipe diameters. Hydrobrake unit reference and invert level is different between calculations and detail. Detail shows the hydrobrake set in a weir wall, the hydrobrake invert plus design head gives a level of 13.2mAOD, it is unclear how you are going to achieve 100mm free clearance between the top of weir wall and base of slab when you have a cover level of 13.50mAOD, require a minimum of two courses of engineering bricks and cover slab depth is 250mm. There clearly isn't enough space. Consider removing weir wall. If weir wall is retained we will need to see that the weir level is above the 1 in 100 year plus cc event water level and that it is physically possible to build.*

This has been noted and included on the drawings. The weir wall has been removed with a further manhole downstream for inspection and maintenance. Okay, will be reviewed once appropriate calculations are supplied. Hydrobrake unit reference is not stated on the detail, further detail on the construction detail is required. For example detail on, chamber dimensions, engineering bricks, cover, concrete slab, construction such as rings, surround, benching within manhole, etc. should be provided. Please let us know if you wish to see examples of hydrobrake construction details.

23. ~~*Where connections are being made to pipelines rather than direct to manholes—add note 'all connections to be made using oblique 45 degree junctions'.*~~ Okay, point closed.

24. Northern calculations review comments.

- a. *It is not clear from printouts what the input differences are between the first set of results and second, as no input details have been provided for the second set of results.*
- b. *Maximum basin water level in the 1 in 100 year plus 40% cc event is 13.236, resulting in insufficient freeboard being provided. Please ensure a minimum of 300mm of freeboard is provided.*

With respect to the two sets of calculations as stated we show the main design calculations and then the test for resilience by including Urban Creep, etc. As stated at your request we now include just one set of calculations with all design criteria included.

There is no requirement for 300mm of freeboard just that freeboard is provided. However, we have provided 300mm as requested.

The calculations provided now have results for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:

1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.

1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall. 300mm of freeboard provided above this level.

Further review will be completed of cover levels, invert levels, freeboard, etc. once updated calculations have been supplied.

The calculation results show a maximum water level of 15.217 at MH 6, this will result in water spilling out of the gullies in the 1 in 100 year plus 40% cc event. Please model the cover level as the gully level so that flood volumes can be obtained and a review of whether water will be contained safely on site can be completed.

~~25. Northern swale calculation comments:~~

- ~~a. It is not clear from printouts what the input differences are between the first set of results and second, as no input details have been provided for the second set of results.~~
- ~~b. A low factor of safety has been applied. Infiltration rates are applied to the base and sides, the swale drains an area in excess of 1000m², and a CV of 0.75 is used, therefore a Fos of 6.5 should be applied.~~
- ~~c. Appears that incoming invert level may be below the 1 in 10 year plus cc water level.~~
- ~~d. Layouts are missing detail on pipe diameters, falls and invert levels.~~
- ~~e. Swale invert and cover level not stated on plan.~~

~~With respect to the two sets of calculations as stated we show the main design calculations and then the test for resilience by including Urban Creep, etc. As stated at your request we now include just one set of calculations with all design criteria included.~~

~~As provided in our emails we do not believe a Fos over 2 is required. However, as we use FEH rainfall a factor of safety of 5 has been applied. Where FEH is not applicable, i.e. for 15 or 30 minute storms, we have used FSR with a Cv of 0.75 and a factor of 6.5 is applied in accordance with your Policy.~~

~~There is sufficient storage below the incoming pipe so the 1:10 plus cc is not above the incoming invert level.~~

~~Pipe diameters, falls and invert levels are on all adoptable pipes. We, and all consultants, do not detail private 100mm pipes as they are all 100mm, unless stated otherwise, and laid at a gradient of not less~~

than 1:100 in accordance with Building regs. This is covered by notes on our drawing. However, all pipes have invert levels on them and can be checked for compliance.

Invert and cover levels are provided.

~~The calculations provided now have results for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:~~

~~1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.~~

~~1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall. 300mm of freeboard provided above this level.~~

~~Please make it clear on impermeable areas plans and calculations where urban creep is added.~~

~~Further review will be completed of cover levels, invert levels, freeboard, etc. once updated calculations have been supplied.~~

~~Okay, point closed.~~

~~25. Southern swale calculation comments:~~

~~a. It is not clear from printouts what the input differences are between the first set of results and second, as no input details have been provided for the second set of results.~~

~~b. A low factor of safety has been applied. Infiltration rates are applied to the base and sides, the swale drains an area in excess of 1000m², and a CV of 0.75 is used, therefore a FoS of 6.5 should be applied.~~

~~c. The invert level of the swale is inconsistent between calculations and layouts.~~

~~d. Appears that incoming invert level may be below the 1 in 10 year plus cc water level.~~

~~e. Layouts are missing detail on pipe diameters, falls and invert levels.~~

~~f. Swale invert and cover level not stated on plan.~~

~~With respect to the two sets of calculations as sated we show the main design calculations and then the test for resilience by including Urban Creep, etc. As stated at your request we now include just one set of calculations with all design criteria included.~~

~~As provided in our emails we do not believe a FoS over 2 is required. However, as we use FEH rainfall a factor of safety of 5 has been applied. Where FEH is not applicable, i.e. for 15 or 30 minute storms, we have used FSR with a Cv of 0.75 and a factor of 6.5 is applied in accordance with your Policy.~~

~~All calculations and drawings match.~~

~~There is sufficient storage below the incoming pipe so the 1:10 plus cc is not above the incoming invert level.~~

~~Pipe diameters, falls and invert levels are on all adoptable pipes. We, and all consultants, do not detail private 100mm pipes as they are all 100mm, unless stated otherwise, and laid at a gradient of not less than 1:100 in accordance with Building regs. This is covered by notes on our drawing. However, all pipes have invert levels on them and can be checked for compliance.~~

~~Invert and cover levels are provided.~~

~~The calculations provided now have results for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:~~

~~1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.~~

~~1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall. 300mm of freeboard provided above this level.~~

~~Please make it clear on impermeable areas plans and calculations where urban creep is added.~~

~~Further review will be completed of cover levels, invert levels, freeboard, etc. once updated calculations have been supplied.~~

~~Okay, point closed.~~

27. Western Infiltration Crate calculation comments:

- a. It is not clear from printouts what the input differences are between the first set of results and second, as no input details have been provided for the second set of results.
- b. A low factor of safety has been applied. Infiltration rates are applied to the base and sides, the tank drains an area in excess of 100m², and a CV of 0.75 is used, therefore a FoS of 4 should be applied.
- c. Appears that incoming invert level may be below the 1 in 10 year plus cc water level.
- d. Layouts are missing detail on pipe diameters, falls and invert levels.
- e. Flooding is occurring in the 1 in 100 year plus cc event (on one of the sets of results), the modelled cover level appears to be far in excess of cover levels on the upstream network, flooding will occur sooner than that reported in calculations

With respect to the two sets of calculations as sated we show the main design calculations and then the test for resilience by including Urban Creep, etc. As stated at your request we now include just one set of calculations with all design criteria included.

As provided in our emails we do not believe a FoS over 2 is required. However, as we use FEH rainfall a factor of safety of 3 has been applied. Where FEH is not applicable, i.e. for 15 or 30 minute storms,

we have used FSR with a Cv of 0.75 and a factor of 4 is applied in accordance with your Policy.

There is sufficient storage below the incoming pipe so the 1:10 plus cc is not above the incoming invert level.

Pipe diameters, falls and invert levels are on all adoptable pipes. We, and all consultants, do not detail private 100mm pipes as they are all 100mm, unless stated otherwise, and laid at a gradient of not less than 1:100 in accordance with Building regs. This is covered by notes on our drawing. However, all pipes have invert levels on them and can be checked for compliance.

All calculations and drawings match with any flooding dealt with by overland flow.

The calculations provided now have results for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:

1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.

1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall. 300mm of freeboard provided above this level.

Please make it clear on impermeable areas plans and calculations where urban creep is added.

The "Storm West" calculations appear to be for the cellular soakaway and swale. However, the swale is not included in calcs.

Further review will be completed of cover levels, invert levels, freeboard, etc. once updated calculations have been supplied.

The swale is still not included within calculations. The area of the 2nd layer of crates is modelled as 355m², yet only 195.5m² is modelled on plan. Please ensure consistency.

~~28. Calculations are missing for the western cellular infiltration and swale system. All calculations have been provided~~

~~The calculations for the western infiltration area have now been provided. However, the provided results are for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:~~

~~1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.~~

~~1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall.~~

~~Further review will be completed once updated calculations have been supplied.~~

~~Okay, point closed.~~

29. Southern area calculations comments:

- a. It is not clear from printouts what the input differences are between the first set of results and second, as no input details have been provided for the second set of results.
- b. Flooding at gullies would occur at several nodes on this network. Gully levels are lower than water levels at nearest nodes in several locations where just "flood risk" is specified on calculation results. Please review, and consider modelling gully cover levels in order to establish flooding extents and volumes.
3. Invert levels are not labelled on inlets to southern basin.
- d. A low factor of safety has been applied to the southern network infiltration basin. Infiltration rates are applied to the base and sides, the basin drains an area in excess of 1000m², and a CV of 0.75 is used, therefore a FoS of 6.5 should be applied.
- e. Size of infiltration sub-base is not shown on plan, construction detail drawings implies that the sub-base area is consistent with the base of the basin, however the calculations indicate that the sub-base has a larger area.

With respect to the two sets of calculations as stated we show the main design calculations and then the test for resilience by including Urban Creep, etc. As stated at your request we now include just one set of calculations with all design criteria included.

All gully cover levels have been checked with respect to adjacent nodes and are below the modelled water level so no flooding out of gullies will occur if it does not say flooding in the calculations.

Invert levels of inlets into the southern basin are labelled on drawings.

As provided in our emails we do not believe a FoS over 2 is required. However, as we use FEH rainfall a factor of safety of 5 has been applied. Where FEH is not applicable, i.e. for 15 or 30 minute storms, we have used FSR with a Cv of 0.75 and a factor of 6.5 is applied in accordance with your Policy.

The size of the 1:10 sub-base has been included on the drawings.

The calculations provided now have results for two events, the 1 in 10 year plus 10% climate change event, and the 1 in 100 year plus 40% climate change event. Please design to the following events as per policy requirements:

1 in 10 year plus 40% climate change with urban creep, FEH 2013 rainfall. Incoming inverts to infiltrating structures must be above this level.

1 in 100 year plus 40% climate change with urban creep, FEH 2013 rainfall. 300mm of freeboard provided above this level.

Please make it clear on impermeable areas plans and calculations where urban creep is added. The results provided show impermeable areas plans for the southern catchment matching those in the first set of

calculations in the previous printout, which according to your above statement did not include urban creep.

Further review will be completed of gully levels, invert levels, freeboard, etc. once updated calculations have been supplied.

Some flooding is predicted at nodes 17, 26, 27, 30 and 51. Please detail these flooded volumes on a layout and show where this water will go. Water will also emerge at the gullies near to node 54 in the 1 in 100 year plus cc event, please model node 54 with the cover level of the gullies so that flood volume can be determined and an assessment of whether flood water will be safely contained can be completed.

30. We note that landscaping proposals have been submitted under A/33/21/PL. These show significant conflict between drainage and planting proposals. Please supply plans which show tree root potential areas and drainage. Trees must not be proposed within or in close proximity to attenuation features. Please ensure that trees are sufficiently positioned so that their root potential areas are not in conflict with drainage features, especially lined features. Southern water have a useful planting guide which the applicant may wish to refer to.

Please re-consult us once further information has been supplied.

Kind regards,

Laura Gibbons

Drainage Engineer

Engineering Services

Please note that I work Tuesdays 08:00-16:00 for Arun only.



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