Engineers Comments Regarding Surface Water Drainage

Application Reference:	BN/128/24/RES	**Reviewer Reference:**	ADC/SB
Planning Officer:	Simon Davis	**Date of Review:**	11/11/2024
Site Name:	Eastmere Stables Eastergate Lane Eastergate PO20 3SJ		
Application Description:	Approval of reserved matters (other than access) following the grant of BN/99/22/OUT (APP/C3810W/22/3312864) for 9 No. dwellings. This application is in CIL zone 3 and is CIL liable as new dwellings.		
Assessment Number:	1 of 1		

Policy and Guidance Information

Arun District Council Surface Water Drainage Guidance - https://www.arun.gov.uk/surfacewater

Land Drainage Consent – https://www.westsussex.gov.uk/fire-emergencies-and-crime/dealing-with-extreme-weather/flooding/flood-risk-management/ordinary-watercourse-land-drainage-consent/
and
https://www.arun.gov.uk/land-drainage-consent/

Arun District Council surface water pre-commencement conditions -
https://www.arun.gov.uk/planning-pre-commencement-conditions

The SuDs Manual [C753] by CIRIA

Sustainable drainage systems: non-statutory technical standards'
https://assets.publishing.service.gov.uk/media/5a815646ed915d74e6231b43/sustainable-drainage-technical-standards.pdf

Response	**Objection**

Critical Items for Surface Water Drainage Design Conditions

The failure to adequately address the following items will result in an objection to a surface water drainage design.

If any of these items are inadequately addressed by the submission, then their correction may result in a redesign of the surface water drainage scheme. A redesign is likely to have site wide implications such as the potential for storage structures to increase in volume or plan area.

Items are further elaborated upon in the attached comment tracker where necessary.

Further comments which are unlikely to impact the design methodology will be provided in the comment tracker, these relate to the detailed design. Unless clearly stated, it is considered that these additional comments are unlikely to result in a redesign of the system. These can be addressed following a second consultation to prevent unnecessary refusals.

Critical Item	Reason	Status
Winter groundwater monitoring data.	Adequate winter groundwater monitoring data must be supplied to evidence that infiltration designs have sufficient freeboard from the	**Insufficient**

	base of structures and the peak groundwater level. The same data is necessary to ensure that the potential for buoyancy has been adequately considered in attenuation designs.	
Winter infiltration testing data.	Adequate winter infiltration testing must be supplied to justify the proposed discharge method and design infiltration rates. Infiltration tests must be completed strictly in accordance with BRE DG 365, CIRIA R156 or a similar approved method. Testing depths must account for peak groundwater levels and correspond with the location and depth of proposed infiltration features. Designs must be based upon the slowest infiltration rate evidenced closest to a proposed infiltration feature. Average design rates will not be accepted. The results of incomplete tests should not be extrapolated to obtain design values for infiltration rates.	**Insufficient**
The hierarchy for sustainable drainage.	The proposed discharge method must accord with the SuDS hierarchy as given below. Evidence must be supplied to justify the proposed discharge method. 1. Rainwater reuse where possible. 2. Complete discharge into the ground (infiltration). 3. Hybrid infiltration and restricted discharge to an appropriate water body or surface water sewer. 4. Restricted discharge to an appropriate water body. 5. Restricted discharge to a surface water sewer. 6. Restricted discharge to a combined sewer. A water body may be defined as a river, watercourse, ditch, culverted watercourse, reservoir, wetland or the sea. **Engineers cannot support any proposed connection of surface water to the foul sewer.**	**Compliant – but unproven**

Calculations	Calculations for pre-development run off rates must be based upon the positively drained area only. Proposed discharge rates must not increase flood risk on site or elsewhere. Discharge rates must be restricted to QBAR or 2 l/s/ha, depending on whichever is higher.	**Not applicable to current design.**
	Designs must be based on the most recently available rainfall data at the time of conditions being applied. **FSR rainfall data will not be accepted.** FEH rainfall data is based upon more recent records and continues to be updated.	**Insufficient**
	Designs must use the correct climate change allowances at the time of determination of the outline or full planning application. CV values for all events must be set to 1. This includes summer, winter, design, and simulation events. The correct allowance for urban creep must be applied. Additional storage must be set to zero unless it can be evidenced where this is provided. Infiltration half-drain times must be less than 24 hours. Infiltration design rates must be applied to the sides of soakaways, or to the base of infiltration blankets. Design rates must not be applied to both the base and sides of infiltration structures. A surcharged outfall must be modelled.	**Insufficient**
Natural catchments design.	The submission must define the natural drainage characteristics within, and hydraulically linked to, the site and demonstrate that the drainage proposals will integrate with and not compromise the function of the natural and existing drainage systems. The condition, performance (including capacity where appropriate) and ownership of any existing site surface water drainage infrastructure must be accurately reported.	**Compliant**

	Appropriate easements to watercourses and other services must be shown on all plans. Where there are areas of flood risk from any source on the site, it must be shown how a sustainable surface water drainage design can be accommodated on the site without conflicting with those areas of flood risk. Designs must replicate the natural drainage catchments of the site. All surface water drainage designs must therefore drain via gravity to corresponding points of discharge. **The use of pumps for surface water drainage is not sustainable and will not be supported**. .	
Plans	Plan areas, depths and levels of drainage infrastructure must accurately correspond with the supporting calculations.	**Redesign required.**
Water quality benefits.	An assessment of water quality is necessary to evidence that the proposed design provides adequate treatment of surface water.	**Compliant**
Biodiversity and amenity benefits.	The surface water drainage design must provide biodiversity and amenity benefits.	**Insufficient**
Trees and planting	There should be no conflict between surface water drainage infrastructure and existing or proposed trees or planting. The design must consider the potential growth of proposed trees and adequate mitigation must be provided to protect drainage infrastructure where conflict **cannot** be avoided.	**Compliant**
Not applicable	No critical design items have been identified as missing or insufficient. **[DELETE ROW AS REQUIRED]**	

Additional comments to the planning officer
The NPPF states that when determining any planning application, local planning authorities should ensure that flood risk is not increased elsewhere (paragraph 173 and 180e). The PPG guides local planning authorities to refer to 'Sustainable drainage systems: non-statutory technical standards' and detailed industry guidance like The SuDS Manual [C753] by CIRIA to guide decisions about the design, maintenance, and operation of sustainable drainage systems for non-major development. This consultation has been primarily informed by The SuDS Manual.

The following documents have been assessed to inform this consultation:

- Flood Risk Assessment and Drainage Strategy dated 17/09/2024 (in two parts on the planning portal) – henceforth referred to as the FRA.
- West Sussex County Council [WSCC] Surface Water Drainage Proforma (completed) dated 11/09/2024.
- Groundwater monitoring and percolation testing correspondence dated 05/12/2023.
- Percolation Testing Results dated 02/02/2022.
- Topographical Survey EX01 dated March 2022
- Ecological Impact Assessment LLD2426-ECO-REP-001-01 dated 26/05/2023.
- Tree Protection Plan 1844-SYM-XX-ZZ-DR-A-0300-P01
- Site Landscape Proposals 1353-1 dated 07/10/2024

Ground Investigations

Further information is required regarding the ground investigations that have been completed on the site. Four sets of infiltration tests have been completed, however 3 of these were too deep. Only one trial pit, TP4 was set at a depth which allows for 1m of unsaturated ground (freeboard) between the base of the infiltration feature and the peak groundwater levels. The slowest infiltration rate evidenced in this pit was 3.069×10^{-5}m/s or 0.1105m/h.

The head of water in the tests in TP4 is not consistent, 180mm in test 1, 330mm in test 2, 385mm in test 3, the design is based on the formation of the permeable paving being 700mm below ground level with a maximum head of 600mm.

The closest groundwater monitoring point to TP4 was GWP#4. The maximum recorded groundwater level at this point was 1.765m bgl. However, another monitoring point, GWP#3 evidenced groundwater levels at 1.429mbgl.

It is not clear exactly what the proposed drainage strategy is. Drawing 2406066-0500 Rev P01 shows all surface water, including what falls on the roofs of the proposed dwelling as being drained via the permeable paved driveway. This corresponds with the supporting calculations in appendix L

However, the body of the FRA refers to concrete ring soakaways to drain roof water, these are also shown in drawing 2203002-0500-01 Rev B in appendix I and the supporting calculations in appendix J. The proposed ring soakaways that drain surface water from some of the roofs are all proposed at depths that would either penetrate groundwater levels or not allow for 1m freeboard as described above. This strategy would be unacceptable.

The FRA includes an email from the ground investigator. This explains that GWP#3 was installed in 'made-up' ground consisting of brick pieces, general debris in clay soil. They state that the results evidenced in this groundwater monitoring point were not consistent with the others and likely to be runoff from the adjacent area, pooling at the base of the installation pit and not draining away quickly. They also note that the dates when peak levels were recorded in this borehole were not consistent with the dates when groundwater levels peaked in the other monitoring points.

The comments regarding potential surface water ingress to the borehole GWP#3 are not consistent with the infiltration rates evidenced at TP3 – the closest trial pit. The slowest infiltration rate at this point is 1.28×10^{-5}m/s in a pit that was 2m deep. The results indicate that the water level dropped by approximately 2mm/minute in a previously saturated trial pit (if the rate was linear). Therefore, if

surface water had entered the monitoring point you would expect the water levels to drop following ingress if groundwater was not present.

The full record of observations is illegible due to the scan quality. This document needs to be resubmitted for assessment. The above referenced email also refers to groundwater monitoring that was undertaken in the winter of 2021-2022. It is requested that the observations from that winter are supplied to support the submission.

No further evidence of the strata recorded on site has been submitted. It is important to understand what strata is present on the site as this can influence infiltration potential or necessitate further assessment.

The ground investigations and their interpretation are critical to the viability of the proposed development and layout. The SuDS Manual stipulates that any infiltration design must allow for 1m of unsaturated ground (freeboard) between the base of the infiltration feature and the peak groundwater level. If this freeboard is not achievable in parts of the site, then the proposed surface water drainage design will not be implementable.

This may result in a larger plan area required for infiltrating permeable paving and soakaways, or in the case that infiltration is not viable, an alternative disposal location to be evidenced.

The design will need to be altered to account for the recorded groundwater levels. Further winter infiltration testing at the proposed location, depth and head of water for the infiltration design will be required.

Design and Calculations

The calculations have not been analysed in detail as the design is likely to need modification because of the issues highlighted above. The two sets of supporting calculations are not compliant. The rainfall data is not the most recent FEH 2022 data that is available. The inputs also vary between the design and simulation settings which causes unnecessary complication and could lead to misinterpretation. The designer is advised to refer to our full surface water design checklist before submitting further supporting calculations.

If an infiltration design is possible then we are supportive of the strategy as it accords with the sustainable drainage hierarchy as described above. However, if an alternative disposal location is needed then there are no watercourses, surface water or combined sewers in the vicinity of the site. Further evidence of the confirmed disposal location must be provided prior to any positive determination due to the risk that any permission may not be implementable if a fully compliant infiltration scheme is not possible.

The FRA needs to make further reference to the site's location within a groundwater source protection zone and any restrictions that there may be to infiltration in this area.

The FRA does not evidence how the design provides biodiversity or amenity benefits. These are two of the four pillars of sustainable drainage design. Biodiversity and amenity benefits are often achieved through the provision of open storage or conveyance features. There are no open features in this design and it unclear where they may be accommodated within the proposed layout. It is noted that the Ecological Impact Assessment refers to the creation of a wildlife/SuDS pond. This is not shown on the drainage design or within the proposed layout. The designer is asked to

present an assessment to evidence where biodiversity and amenity benefits can and will be provided.

The proposed landscaping does not show any conflicts with surface water drainage that could not be mitigated for in the design. However, caution is suggested regarding approval of the landscaping until a compliant surface water drainage design is submitted.

Overcoming our objection

If the planning officer is minded to allow the applicant additional time to submit further documents to support this application, then the following evidence may overcome our objection. Please do not submit further documents without prior discussion with the planning officer as to whether it will be possible for these to be assessed or influence their determination.

1. Provide further supporting information regarding ground investigations. Including but not limited to:

- Winter groundwater monitoring data from 2022-2023 in a legible format.
- Winter groundwater monitoring data from 2021-2022 that is referred to in the accompanying email.
- Further winter infiltration testing at the proposed location depth and head of water to correspond with the design.
- Evidence of the strata in the boreholes and trial pits.
- Confirmation of the depth of groundwater monitoring boreholes.

2. Evidence that a sustainable surface water drainage design can be accommodated within the proposed site layout. This will require a drainage statement, supporting calculations and a preliminary drainage layout as a minimum.

3. If a full infiltration design is not possible then permission in principle to connect surface water from the site to an alternative disposal location. Please note, evidence of permission to connect surface water to the Southern Water public foul sewer will not be acceptable.

4. FRA revised to remove conflicting design information and calculations.

A reduced site-specific version of our full surface water drainage design checklist is provided below. This has been edited to remove elements that are not applicable to this site, either due to the scale of the proposal or the method of disposal. The checklist is provided to assist the applicant and designer in preparing a revised design to meet our requirements. It is applicable to Eastmere Stables only.

A comment is provided beneath each heading of the edited checklist. Where further information is required, these comments are copied into the attached comment tracker. This tracker can be requested in .docx format by emailing land.drainage@arun.gov.uk. It is advised that a designer provides responses to our comments to aid assessment of their updated submission.

The full unedited surface water design checklist is available on our website at https://www.arun.gov.uk/surfacewater/. **If the design is amended following receipt of our**

consultation the designer may need to refer to the full checklist to ensure that the revised design meets our requirements.

Eastmere Stables Designer Checklist

Ground Investigation Results

Comment: Further information required prior to determination of scale of development and layout. Items required prior to determination have a highlighted checkbox as shown: ☐

Groundwater monitoring
☒ Plan showing location of monitoring points provided.
☐ Depths of holes detailed.
☒ Dates of observations and depth to groundwater recorded **– clearer data required.**
☐ Evidence of the strata within borehole or monitoring pits provided.

Requested to aid speed of assessment
☐ Plan showing the peak groundwater levels at each monitoring point in mAOD.
☐ Peak groundwater levels recorded in metres below ground level and mAOD.

Infiltration testing
☐ Completed strictly in accordance with BRE DG 365, CIRIA R156 or a similar approved method.
☒ Plan showing location of trial pits provided.
☒ Pit dimensions provided.
☒ Depths of testing provided.
☒ Dates, times and readings of each test recorded.
☒ Calculations for the infiltration rate for each test provided.
☐ Evidence of the strata within trial pits provided.
☐ Test locations, and depths correspond with the expected location and depths of proposed infiltration features.

Requested to aid speed of assessment
☐ Depths of testing provided in m below ground level and mAOD.

Other
As appropriate, dependent upon specific site conditions
☐ Geotechnical advice relating to the siting of infiltration features and risk of dissolution. (Usually where chalk strata is evidenced.)
☐ Geotechnical advice where infiltration is proposed into made ground (to be generally avoided).
☐ Geotechnical advice relating to infiltration capacity, and risk of settlement or instability where careful use of ground raising is proposed.

Surface Water Drainage Statement

Comment: Items required prior to determination have a highlighted checkbox as shown: ☐

Disposal method (Select as appropriate)
☒ Rainwater reuse is proposed where possible.
☒ Infiltration is proposed and maximised wherever possible.

Disposal method justification
☐ Infiltration has been adequately investigated, in winter, at appropriate and varying depths where appropriate, above peak recorded winter groundwater levels at the given location.

☐ Public and private downstream highway drainage networks are investigated (location, mapping, network, flow direction, ownership/responsibility, depth, capacity, and condition).
☐ Any relevant permissions or legal agreements from asset or landowners that are needed are identified and evidence of consents provided.

Requested to aid speed of assessment
☐ Any previous relevant correspondence or pre-application advice from the Local Planning Authority [LPA] or the Lead Local Flood Authority [LLFA] regarding the surface water drainage design is included with the statement.

Existing Site
Essential
☐ It is clear what the natural drainage characteristics of the site and hydraulically linked areas are.
☐ Natural flow paths are identified on a plan (where applicable).
☒ Environmentally sensitive receiving water bodies are identified – for example groundwater source protection zones.
☒ Existing and future flood risk from any source is detailed.

It is suggested that the above is achieved with the following, which may be combined where appropriate:
☒ An existing topographical plan.
☒ Flood maps (fluvial, tidal, pluvial, groundwater, sewer, and reservoir) are supplied (or Flood Risk Assessment referred to).
☐ Full details of any known flooding on the site.

Proposed Design
Essential
☐ Statement confirming the proposed design criteria including fixed design calculation inputs for the SuDS system. Examples include:

- Climate change allowances,
- Urban creep allowance,
- CV values,
- Rainfall data,
- MADD factor or additional storage.

☐ Natural catchments are followed.
☒ The design is gravity based with no use of pumps.
☐ Relevant restrictions relating to discharging to an environmentally sensitive receiving water body – for example a groundwater source protection zone - are investigated, reported and adhered to.
☐ If the surface water drainage is designed to flood in the 1% Annual Exceedance Probability [AEP] + Climate Change Allowance [CCA] event, then the flood volume is contained safely on site without flooding any part of a building or utility plant susceptible to water or affecting safe access or egress.

☐ The design provides and evidences interception drainage and is able to capture and retain on site the first 5mm of the majority of all rainfall events.
☐ Water quality and treatment is adequately assessed – with an assessment appropriate for the scale and proposed use of the site.
☐ Adequate freeboard is provided between the top water level of any open storage features and the top of the bank.
☒ There are no clashes with other infrastructure.
☐ Self-cleansing velocities are achieved where pipes are proposed.

☐ 1m freeboard is provided between peak groundwater levels and the base of any infiltration feature.

☐ Amenity benefits are provided by the drainage system (assessed by others).
☐ Biodiversity benefits are provided by the drainage system (assessed by others).
☐ Landscaping has been designed to ensure ease of maintenance of drainage assets.
☐ The justification and criteria for tree root avoidance and mitigation measures is clear, referencing adopting body standards where applicable.
☐ Biodiversity and ecological enhancements do not impede the functionality, maintenance or capacity of the drainage system.

☐ It is confirmed what elements of the SuDS will be private.
☐ It is confirmed what the adoption arrangements for SuDS components will be.
☐ A construction method statement for the SuDS system, appropriate to the scale of the development, is submitted.
☐ A maintenance plan for the SuDS system, appropriate to the scale of the development, is submitted. [Please refer to our SuDS Maintenance Checklist where this is stipulated by condition.]
☐ Any potential health and safety issues relating to SuDS implementation and management have been considered and managed.

Preferred
☐ Ground raising is avoided where possible.
☐ The drainage system is considered by and contributes to the biodiversity net gain statement (assessed by others).

Impermeable Area/Catchment Plan

Comment: See preferred format below.

Essential
☒ An impermeable area plan is provided showing all positively drained areas including open surface water storage plan areas.

Preferred
☐ Impermeable areas are shown in m^2 on the impermeable areas plan(s).
☐ Demarcated impermeable areas correspond with the distribution of those areas in the supporting calculations.

Surface Water Drainage Calculations

Comment: Items required prior to determination have a highlighted checkbox as shown: ☐
Submitted calculations have not been analysed in detail as the design needs to change. Please note points on calculation inputs.

General
☐ The most recently applicable, or previously agreed FEH rainfall data is used.
☐ CV values for all events are set to 1. This includes summer, winter, design, and simulation events.
☒ The correct climate change allowances, appropriate for the full lifetime of the development, have been applied to all calculations.
☒ A 10% allowance for urban creep is applied to all residential roof areas.

☒ 100% Annual Exceedance Probability [AEP] + Climate Change Allowance [CCA] (1 in 1 year) event calculations provided.
☐ 10% AEP + CCA (1 in 10 year) event calculations provided showing that the incoming pipe to any infiltration feature is above this level.
☒ 3.33% AEP + CCA (1 in 30 year) event calculations provided showing that the full surface water volume is contained within the designed system without flooding.
☒ 1% AEP + CCA (1 in 100 year) event calculations provided showing that the full surface water volume is contained safely on site, without flooding any part of a building or utility plant susceptible to water or affecting safe access or egress.

Infiltration
☒ Half drain times do not exceed 24 hours for the 10% AEP + CCA and 1% AEP + CCA events.
☒ The most precautionary design infiltration rate is used.
☐ Design infiltration rates are applied to the sides of soakaways only.
☒ Design infiltration rates are applied to the base of permeable paving, infiltration blankets or basins only.
☐ Where the design infiltration rate is applied to the base an appropriate factor of safety is applied.

Requested to aid assessment
☐ FEH22 point descriptors for the site are provided.

Drainage Plans and Specifications

Comment: Items required prior to determination have a highlighted checkbox as shown: ☐

Essential
Plans are provided showing:
☒ The proposed design within the proposed site layout.
☒ Existing and proposed levels.
☐ Long and cross sections for the proposed drainage system including final finished floor levels.
☒ Exceedance flow management routes.

These plans must be of sufficient detail that a reviewer can be confident that the design can be constructed without flood risk being increased on site or elsewhere.

Specifications are required for all materials used in the design. We suggest that this is best achieved and illustrated with site specific construction detail drawings. The combination of construction details, with plans and sections, ensure that the proposed standard of construction will facilitate adoption and maintenance by an appropriate body and have structural integrity.

The following checklist is designed to demonstrate the level of detail required:

Easements
☒ Infiltration features (aside from permeable paving that does not take any extra impermeable catchment such as a roof) are shown at least 5m from buildings or structures.
☐ Existing trees and their root protection zones are shown on any drainage layout.
☐ Proposed trees and appropriate easements are shown on any drainage layout.

Detail
☐ It can be clearly determined what a pipe's diameter, pipe materials, gradients, flow directions and invert levels are from the plans.

☐ It can be clearly determined what an inspection chamber or manhole's cover level, invert level, cover loading grade and sump depth (where applicable) are from the plans.
☐ All infiltration or attenuation features (including permeable paving) are clearly labelled with their dimensions, invert/base levels and cover levels.
☐ Measures to protect drainage from tree root damage are clearly shown on any drainage layout.
☐ Any areas of necessary ground raising are clearly justified and demarked on a plan, with depths and levels.
☐ If the 1% AEP + CCA event floods, then the extent and depth of the flooding is shown on a site plan. This plan includes proposed external ground levels and finished floor levels of buildings.
☒ Potential flow routes off site are shown. The plan also includes proposed external ground levels, finished floor levels of buildings and designed slopes on all impermeable surfaces such as highways or car parks.
☐ Cross sections and long sections of all open features are provided.
☐ Construction detail drawings are site specific.
☐ Construction detail drawings are provided for all components including but not limited to:

- ☐ Infiltration structures
- ☐ Attenuation structures
- ☐ Manholes/inspection chambers
- ☐ Catchpits/silt traps
- ☐ Flow control devices
- ☐ Permeable paving
- ☐ Headwalls
- ☐ Channel drains
- ☐ Gullies
- ☐ Pipe bed and surround
- ☐ Pipe to pipe connections
- ☐ Filter strips or drains
- ☐ Swales
- ☐ Bio-retention systems
- ☐ Ponds and wetlands
- ☐ Tree pits and measures to protect drainage from root incursion
- ☐ Water treatment features
- ☐ Green roofs
- ☐ Measures to protect drainage from tree roots.
- ☐ Water butts or alternative methods of water reuse – also to be shown on plans.

<u>The following items are requested to aid assessment or confidence in construction:</u>

☐ Where features have a non-uniform plan area, a plan showing the coordinates of the perimeter is provided.
☐ All drainage infrastructure is labelled to correspond with the supporting calculations.

Other
☐ Open feature planting specification is provided (to be assessed by others).

This checklist is designed to aid an applicant with their submission. The list is not exhaustive, and our engineers may request additional information to enable them to review a proposal to their satisfaction.

The checklist may also request information that an applicant does not feel is relevant to their submission. In this case the applicant can provide an explanation as to why they have omitted certain information in their drainage statement. However, the appraising engineer reserves the right to request this information if they believe it is necessary for their review.