Pell Frischmann

Suite 4.2-1, 4th Floor, The Poynt, Wollaton Street - NOTTINGHAM NG1 5FW

Telephone: +44(0)115 784 8960
Email: pfnottingham@pellfrischmann.com
www.pellfrischmann.com

Our ref: 104878-PEF-ZZ-XX-CD-RP-000600
Planning ref: 2022/0528/P

This note is in response to the initial LLFA response provided by Camden Council, dated 8th March 2022, in relation to the planning application for a site at The O2 Centre, Finchley Road.

The response requests more information on the following:

1. The applicant has not sufficiently demonstrated compliance with the drainage hierarchy set out in the London Plan, Policy SI 13. The applicant proposes to use a combination of brown roofs, blue roofs, a swale, permeable pavement, and attenuation crates. Rainwater harvesting has not been justifiably discounted.
2. The proposed discharge rate does not achieve the required greenfield runoff rate and does not prove that it is not possible to achieve greenfield run off rates.
3. The drainage layouts provided do not include the outfalls and levels of all the drainage features proposed. Details of the green and blue roofs should be submitted, showing the 150mm substrate.
4. The application does not comply with Defra's Non-Statutory Technical Standards for Sustainable Drainage.
5. No maintenance plan has been submitted.
6. Consent for the proposed discharge point connection has not been provided and this is required.

The response outlines additional information that is needed to address the six points, which have been summarised in table format below. The table provides information, responses, and links to the submitted information (where applicable) in response to these requests.

<table>
<tr><th>Camden Council – Requested Information</th><th>Pell Frischmann - Response</th></tr>
<tr><td>The applicant has not sufficiently demonstrated compliance with the drainage hierarchy set out in the London Plan, Policy SI 13. The applicant proposes to use a combination of brown roofs, blue roofs, a swale, permeable pavement, and attenuation crates. Rainwater harvesting has not been justifiably discounted.</td><td>Policy SI 13 of the London Plan outlines measures to be taken to manage surface water flooding as part of new development. Part A of SI13 outlines the process for the LLFA to identify areas of particular surface water management issues and plans to reduce this risk. The Camden Surface Water Management Plan does this and identifies the site to be within a Critical Drainage Area (Group3_010) but outside a Local Flood Risk Zone. Issues in this area may already be partly resolved by the Sumatra Road Storage Scheme implemented by Thames Water. The proposed development will also contribute to surface water management in this area by a reduction in the rate and volume of water discharging from the site (discussed further below).

Part B of SI13 then outlines a surface water management hierarchy as follows:
1. Rainwater use as a resource
2. Rainwater infiltration to ground at or close to source
3. Rainwater attenuation in green infrastructure features for gradual release
4. Rainwater discharge direct to a watercourse
5. Controlled rainwater discharge to a surface water sewer or drain
6. Controlled rainwater discharge to a combined sewer
The proposed development’s approach to the hierarchy provides the following in response:
1. The density of the development is such that the rainwater yield across the site does not meet with the demand for non-potable water within the development (see below).
2. Infiltration is not possible due to the underlying geology comprising London Clay and other low permeability geology
3. There is some provision of green infrastructure, including green and brown roofs, swales and permeable paving, to be supplemented by additional SuDS including cellular storage tanks below-ground
4. There are no watercourses within, or close to the site to afford a point of connection.
5. There are no surface water sewers within or near to the site to afford a point of connection.
6. Controlled discharge is proposed to a combined sewer, similar to the current arrangement, but at a much reduced rate.</td></tr>
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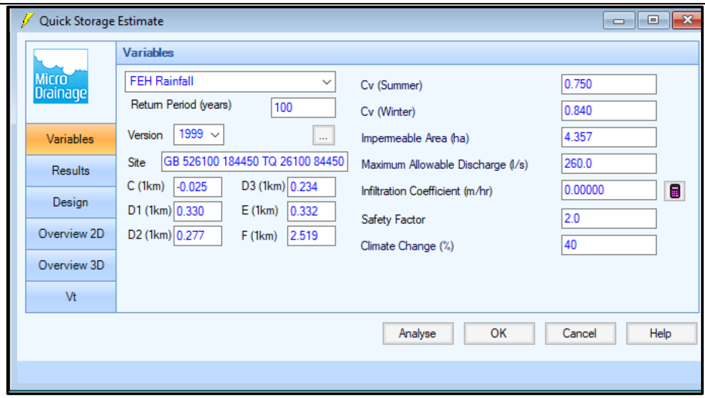
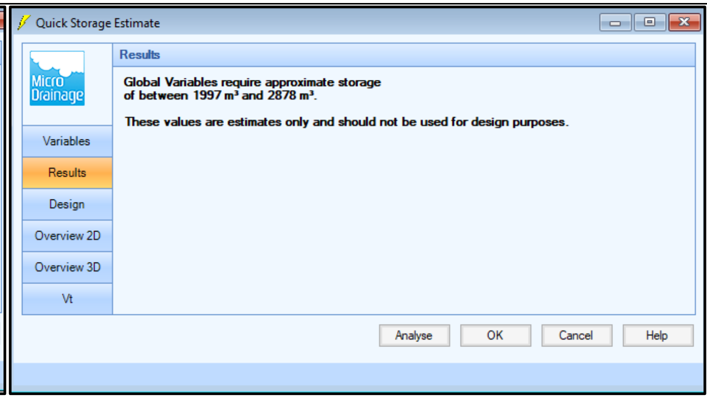
Justifies why rainwater harvesting is not proposed for the development.	Due to the high-rise nature of the development, the supply:demand ratio is disproportionately weighted to demand over supply. Calculating rainwater harvesting systems comprises the following steps (as set out in BS EN 16941-1:2018) **Step 1 – Calculate supply (yield)** Use average rainfall intensity and roof area to calculate potential rainwater supply to be calculated site-wide: $$Y_R = A \times h \times e \times \eta$$ *Where:* *Y_R = rainwater yield (l)* *A = Collection area (m^2)* *h = total annual rainfall (mm)* *e = surface yield coefficient [0.5 for green roofs]* *η = hydraulic treatment efficiency coefficient [0.9]* Therefore: $$Y_R = 24{,}016 \times 653 \times 0.5 \times 0.9$$ **Y_R = 7,057,101 l/yr or 19,334 l /day (19.334m^3)** **Step 2 – Calculate demand** As an approximation, the total housing mix (1190 units x 2.4 occupancy rate = 2,856 people) averages 286 people per block. BS EN 16941-1:2018 suggests an average daily non-potable water use per person of 50l/day when sizing rainwater harvesting tanks. This would generate a demand of 142,800l/day across the site, which far outweighs the yield. The potential yield as calculated above would only provide ~6.7l/person/day, assuming a regular supply of rainwater was available which is unlikely to be the case. At the early project phases, the inclusion of blue roofs was considered but ultimately ruled out due to the use of roofs for other plant, green and brown roofs. Discussion with providers of blue roof systems also demonstrated a preference to drain water from the blue roof quickly, rather than storing it within the roof as part of a rainwater harvesting system. Therefore, any storage required to support a rainwater harvesting system would be required in below-ground storage in external areas. To then supply this within the development would require significant pumping infrastructure to serve the building, with additional non-potable water supply infrastructure that renders the solution not viable in this case. The embedded carbon and additional energy demand within such a solution also reduces its overall sustainability.

Provide justification and evidence that the proposed runoff is the greatest possible reduction.	The existing brownfield site has an existing, established surface water connection to the public sewer. This was confirmed through on-site drainage survey, with modelling completed of the existing network to understand the existing rate in greater detail. The proposed strategy is based on a 50% reduction in the 1 in 1 year storm runoff rate, providing significant improvements in both frequent storms and more extreme events. The flow reduction increases as the storm events become more severe. The proposed flow rate for the 100 year +40% event provides a reduction of 81% compared to existing. The existing site model recorded a potential flood volume of 1,632m^3 during the same storm event. The proposed reduction in flow rate and addition of a variety of attenuation features ensures no flooding occurs during the 100 year +40% event. The volume of runoff generated by the existing site is also high due to the prominence of impermeable surfacing (covering 5.14ha of the 5.72ha site), and the proposed development will reduce the impermeable area to 4.36ha thereby also reducing the volume of surface water discharging from the site and providing further benefit. This means for the 100year, 6-hour storm, the volume of runoff generated decreases from 4,137m^3 to 3,662m^3. This reduction in impermeable surface also accords with the principle of Part C of Policy SI13 of the London Plan that seeks to resist increased development of impermeable surfacing. The existing site has no surface water SuDS features and is based on a traditional piped system with no restriction in flows or attenuation other than the capacity of the piped system. The difference in reduction of impermeable area and inclusion of various SuDS elements can be seen when comparing drawings 100006 and 100008 attached for reference. The site has several physical constraints that limit the space available for attenuation beyond the proposed building foundations. This includes the railway infrastructure to both the north and south boundaries, and existing buried utilities, including a substantial Thames Water (TW) strategic foul sewer running north-south and another foul sewer from the west. The foul sewer will be subject to a S185 agreement with TW to ensure the sewer is no longer under buildings as per the existing site. The diversion further restricts space, particularly around N4 & N5 where the diversion requires a run from the west and east to avoid buildings. The proposed discharge rate strikes a suitable balance between substantial reductions in the existing rate, and provision of well-considered and sustainable attenuation within the proposed layout.

Shows the outfalls and levels of all the drainage features proposed.	Indicative drainage levels have been provided for the attenuation units and outfalls to N3, N4 & N5 on dwg 4602-001-PEF-ZZZ-100-DR-C-000002. The full detailed design is awaiting the survey results for the existing public sewers. This is due back shortly and the levels and positions can be plotted accurately. The design levels of the sewer diversion will dictate the levels of the proposed SW and FW sewers. We are also undertaking a co-ordination process for drainage, utilities, and landscape to suit the sewer diversion route. We would welcome suitably worded condition to reserve detailed drainage design to reserved matters stage.
Shows the details of the green and blue roofs, showing the 150mm substrate.	No blue roofs are proposed, only green / brown roofs. The inclusion of blue roofs was explored in great detail to incorporate into the podium areas during early design consultation. This included engaging with blue roof suppliers for design to produce calculations and blue roof build up. The main objective for considering blue roofs for the podium areas was to provide recycled surface water for landscape irrigation. Blue roofs are designed as a sealed system and therefore offered no opportunity for irrigation unless it was discharged to ground level and pumped back up to podium level. As blue roofs hold water at an un-natural level, the design is based on emptying the storage within a 24-hour period to minimise load time on the structure. Therefore, blue roofs were discounted based on offering no sustainable benefit to the podium level. The storage system would be a sealed buried system hidden in the podium deck. The storage of water above ground in a blue roof system only adds unnecessary load to the structure, risk of leakage and prolonged maintenance in a public area. Therefore, the sustainable, amenity and biodiversity benefits provided by green/brown outweighed the storage only benefit of blue roofs. The exact type and system for the green / brown roofs are yet to be determined. Once confirmed, a section through the roof area can be produced showing the build-up. It is expected that the details of the green/brown roofs will be conditioned.
Includes the storage volume required in order to discharge the site at 260l/s. This is needed to ensure that the volume provided is greater or equal to the volume required.	The volume of attenuation required for the entire site has been calculated based on QSE MicroDrainage calculations using FEH rainfall data as per the included images below. The maximum allowable flow rate has then been distributed on a pro rata basis to the proposed phases based on impermeable area. This is to ensure that each development phase could be brought forward independently, with the volume of attenuation required to deliver each parcel. The Proposed Drainage Strategy Report (report ref: 104878-PEF-ZZ-ZZ-RP-Z-100017) prepared by Pell Frischmann and submitted as part of the application provides a breakdown of the discharge rate and corresponding storage volume for each phase. The volume required is then accommodated within the cellular storage for each phase as shown on Pell Frischmann drawing 104878-PEF-ZZ-ZZ-DR-D-100008, and in total equates to 2,435m^3.

	 
Shows the storage volumes provided by the brown and green roofs, the swale and the permeable pavement.	There are ongoing workshops with architect and landscape architect to allocate sufficient space to have a variety of above ground SuDS to complement the overarching drainage strategy and landscaping proposals. The approx. breakdown of storage volumes per SuDS feature (site-wide) are as follows: Brown and Green roofs = 200m^3 (tbc on type of roof build up and exact area) Swales = 90m^3 Permeable Paving = 60m^3 Cellular Storage = 2,435m^3 All volumes to be confirmed and should only be used as a guide at this stage. The SuDS Strategy has been worked up such that each sub-catchment has a variety of features, where spatial constraints allow. All phases currently comprise an element of brown and green roof, to provide source control and rainwater treatment at source from those buildings where this is present. Where possible, the permeable paving has also been considered, to drain non-adopted roads, paving and landscaped that is not likely to be heavily trafficked. Phase 1B and 2A also currently comprise open swale features where the landscaping proposals provide more open space, ensuring a balance is met between drainage requirements and need for open and accessible public open space.
Demonstrates that the site will not flood as a result of the 1 in 30-year rainfall event. That there will	The overall storage volume of 2,345m^3 based on restricted flow of 260l/s ensures no flooding occurs up to and including the 100 year +40% climate change standard. All storage will be allocated within the attenuation units and upstream pipework.

be no flooding of buildings as a result of events up to and including the 1 in 100-year rainfall event, and on-site flow as a result of the 1 in 100 year event with climate change consideration must be suitably managed.	
A drainage strategy with the maintenance tasks and frequencies for each drainage component.	Maintenance options are identified as part of the submitted ‘Proposed Drainage Strategy Report’, Section 3.6. The CIRIA SuDS Manual provides best practice guidance on maintenance of SuDS and other drainage components, which should be followed. A full maintenance plan should be provided as part of any S104 application for the adoption of the drainage system, and it is recommended suitable conditions are put forward to ensure this is captured at detailed design.
Shows that Thames Water has given consent to the proposed connection to the combined sewer and has sufficient capacity.	Consultation is ongoing with Thames Water regarding the point of connection, however in our pre-development enquiry Thames Water advised they would consider the surface water connection once the LLFA had been consulted in respect of the strategy adhering to the discharge hierarchy. The proposed strategy offers a betterment of existing flows and volume discharging to the same sewer network. This will also provide betterment both upstream and downstream network capacity. Furthermore, the team has consulted TW early in the process to define the sewer diversions and providing better access to their assets once the development is complete.