Memorandum

To:	Patrick Bonfield	**At:**	Webb Architects
From:	Daniel Watson	**At:**	SLR London
Date:	29th April 2016	**Ref:**	401.05595.00001
Subject:	66 FITZJOHN'S AVENUE BIA - RESPONSE TO AUDIT QUERY 2A		

Audit Query 2a: Further assessment of attenuation requirements for water infiltration to ground to ensure current regime is maintained Audit Para 4.21: *'Development increases the impermeable surface area. An assessment was undertaken in accordance with CIRIA Suds Manual C697 and concluded that there is no material impact from the increased surface area. However, it did state that attenuation could be provided if needed to ensure the existing condition is maintained and detailed drainage design could also include grassed filter strips. Further analyses and design are required to further develop this.'*

SLR Response: There are two drainage receptors for the proposed development. These are:

1) The sewer beneath Fitzjohn's Avenue - Query 2a does not relate to this system. Discharge rates to this feature would be mirrored by the original proposals which only positively drain the roof (unchanged in area) to the sewer. Revised proposals include a green sedum roof on the roof of the building which will significantly reduce total runoff volumes and will also help to slow flows and reduce peak rates of runoff during larger storms.
2) Ground to the south of the basement - Query 2a relates to this system and further possible requirements for attenuation and filter strips are discussed below.

Currently the area where the basement footprint would extend outside the above ground footprint is covered by cobbles and flowerbeds. Such surfaces are permeable and so rainfall falling on this area will currently infiltrate through into the clayey gravel made ground that was observed to be present in BH01 down to a depth of 1m below ground level. Significant deeper infiltration is however likely to be limited by the underlying sandy clay and as such excess flows are currently likely to migrate laterally downslope to the south within the upper layer passing into, and beneath, the adjacent garden which is slightly sunken compared to onsite ground levels. This is the baseline situation and the drainage proposals developed are aimed at maintaining this regime.

Post-development, runoff from the area of hardstanding (and skylights), to the west of the building, would be directed towards the lawn. These flows, and rainfall falling directly on the lawn, would (less any losses resulting from evaporation) infiltrate down towards the underlying basement. Prior to reaching the impermeable roof of the basement, flows would drain due south within a shallow sub base drainage layer to be installed above the basement. The presence of a grassed filter strip at the southern extent of the basement (see Figure 1) and very shallow gradient sloping down to the south along the roof of the basement would help ensure that this water drains southwards and does not pond above the basement. The precise approach will be confirmed at the detailed design stage.

Upon reaching the edge of the basement these flows would passively infiltrate to the ground (i.e. mimicking the existing pre-development regime in that portion of the site). It should be noted that this passive infiltration is distinct and separate from the French drain and sump system proposed to the west of the building to control any exceptional groundwater levels.

The passive infiltration would occur to the south of the basement where it would not impact upon the neighbours' sunken patios (located to the west). The suggestion that attenuation storage might be provided relates to the possible need to store excess water during severe storms prior to it either infiltrating into the deeper sandy clay (at a slow rate) or progressing laterally downslope within the shallower more permeable layer. The requirement for such attenuation storage and its sizing would be dependent upon infiltration rates. Further review and, if necessary, detail design of any necessary features would be carried out after the planning application is granted, when infiltration testing is recommended to confirm potential infiltration rates.

In concept, based on the additional footprint of 89.5m^2 due to the proposed basement, the design storm considered in the drainage impact assessment (half hour, 1 in 100 annual probability event) would result in a maximum uplift in runoff of 1.84 l/s[1]. Over the duration of this event (half an hour) this would equate to a total volume of storm water of 3.3 m^3 (1.82 x 30 x 60 / 1000). Following the same methodology the 1 in 100 annual probability six hour storm, which is also often considered with respect to drainage design, would generate an estimated total storm volume of 5.6 m^3. In reality, for these events, the total amount of water that would need to be managed would be somewhat less as a proportion of these flows would infiltrate during the storm event.

Based on a permeable area (lawn and paths) of 41.1m^2, a soil / gravel depth between the ground and the top of the basement of 0.3 m, and an indicative soil / gravel void ratio of 0.3, the total volume of storage available within the soil beneath the lawn is estimated to be 3.7 m^3. It is acknowledged that a proportion of this void may not be free draining; however provided that the sub base layers beneath the lawn are formed by sandy free draining soils the large majority of this volume could reasonably be expected to be available to store and regulate storm flows. The volume of available storage is therefore less than the volume of runoff generated by the 1 in 100 annual probability six hour storm duration event indicating that additional attenuation storage will be required unless infiltration testing demonstrates that flow will readily infiltrate at the southern edge of the basement.

If following infiltration testing the shallow geology is found to have a low permeability, further storage may need to be created to avoid the potential for uncontrolled runoff away from the site to the south. How this is provided would be determined through detailed design, but conceptually could involve;

- construction of the hardstanding area above the north of the basement with permeable material (i.e. open structure brocks or similar) set above gravel. Assuming a hardstanding formation depth of 0.2 m (probably thicker than necessary) the gravel bed would be at least 0.1 m thick. Rainwater falling on the hardstanding would percolate through and would be slowed and stored within the void spaces prior to discharging to the south. Based on a hardstanding area of 48.4m^2, a 0.2m deep layer of gravel and a void ratio of 0.3, this would provide 1.5m^3 of additional storage to hold and attenuate flows prior to discharge.

1 This includes a 20% uplift in rainfall depth to allow for potential increases in storm severity associated with climate change. This value is slightly different to that quoted in the BIA due to updates to the development design which have changed the area being considered.

- a grassed filter drain constructed parallel to the southern edge of the western part of the basement. This would provide additional storage required to hold and attenuate flows and would also assist in recharge of groundwater via infiltration. Conceptually, a 0.5m wide, 5m long trench that extends from the surface down to 0.5m below the top of the basement could be created (i.e. 0.9m overall depth). If this was filled with coarse gravel it would provide an additional 0.7m^3 of storage.

The total possible additional available storage, in combination with the storage inherently provided within and beneath the lawn area, would be 5.9m^3. This should be sufficient to manage projected volumes of runoff from a major rainfall event (5.6m^3 for 1% annual probability 6 hour storm).

A high level overflow from the filter drain to the storm water sewer system beneath Fitzjohn's Avenue could also be included to ensure that uncontrolled surface runoff in this area is prevented during exceedance events (i.e. very extreme in excess of design standard). The system could be designed such that this overflow would not be required under design condition (1 in 100 annual probability event). If under very severe conditions (or other system failure) it was required, this would however not constitute an increase in runoff to the storm water sewer network as the small additional flows from the new contributing areas would be more than offset by reductions in total storm volumes and peak rates of discharge from the main roof area resulting from the incorporation of the green sedum roof.

Figure 1: Sketch plan of site

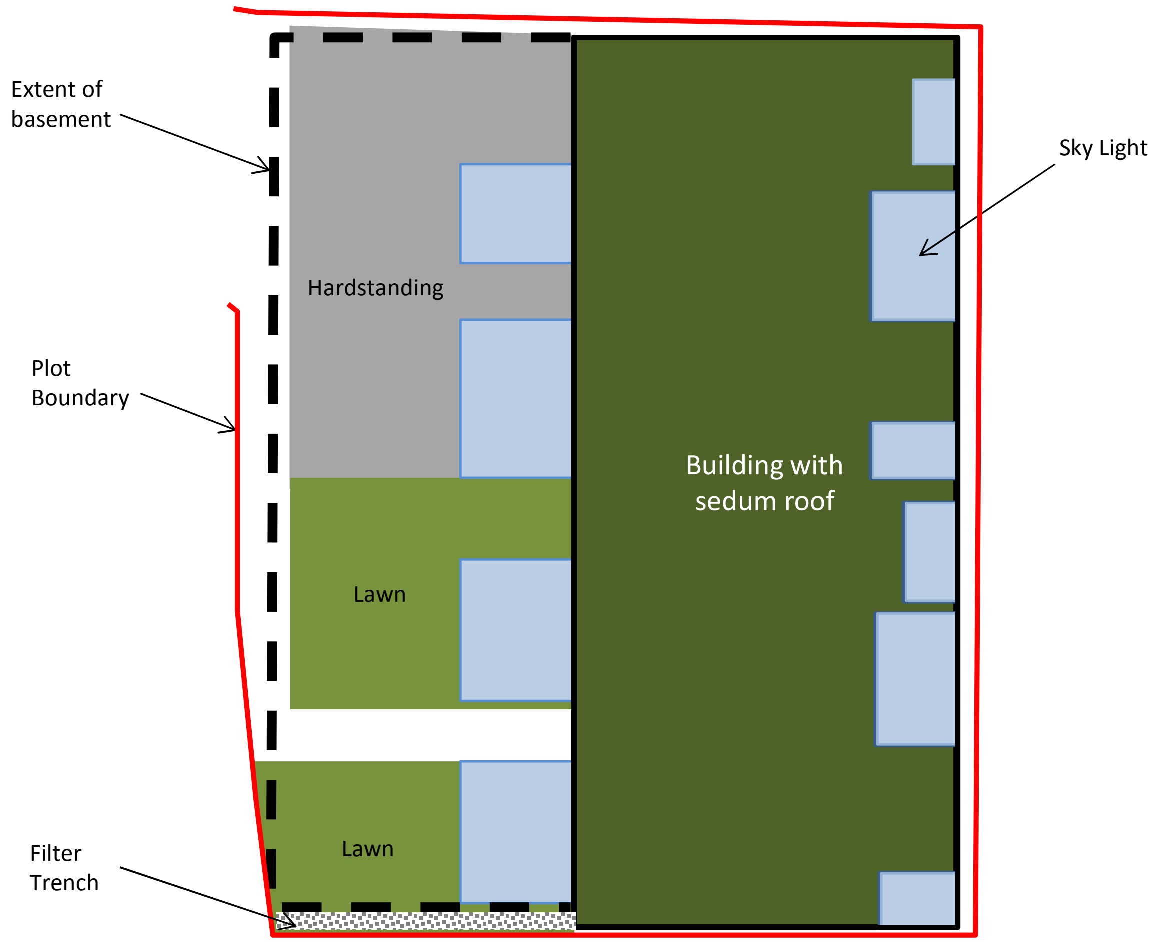

Figure 2: Conceptual drawing of water movements (blue dashed lines) in section