

3 THE PROPOSED DEVELOPMENT

Drawings of the proposed development are provided in Appendix 1. The proposed development is three storey residential with a commercial retail unit at ground floor on the Uxbridge Road frontage. The Uxbridge Road frontage retains a pitched roof but the remainder of the development comprises flat roofs, terraced balconies and parking as indicated in Figure 3.1 which shows the elevation from Brookside Road.

Figure 3.1 Side elevation of proposed building



and indicates the predominance of flats roofs and terraces. Note some elements overlie others – the access and part of the parking is covered by the building above for example, as is the delivery yard. Table 3.1 shows the areas of surfaces that are exposed to rainfall.

Table 3.1 Exposed Surfaces

Roofs	Area (m2)	%
Flat roofs	338.9	51%
Pitched Front	45.2	7%
Pitched Rear	3.4	1%
2nd floor private terrace	38.9	6%
1st floor private terrace	86.9	13%
Grnd private amenity	16.5	3%
Exposed parking	78.1	12%
Landscaping	52.2	8%
Total	660.0	100%

4 OUTLINE SUDS DESIGN

4.1 Discharge Routes

Potential routes for surface water are presented as a hierarchy in national planning policy guidance⁹ and elsewhere as follows:

1. Harvesting and re-use;
2. into the ground (infiltration);
3. to a surface water body;
4. to a surface water sewer, highway drain, or another drainage system;
5. to a combined sewer.

These options are considered below.

4.1.1 Water Re-use

The London Plan accords a high priority to rainwater capture for re-use, either for non-potable use within buildings or for external amenity use such as gardens and washing. The site has extensive flat roofs and these can be used to capture runoff and potentially store it for re-use.

4.1.2 Infiltration

The underlying geology is not likely to be suitable for infiltration via soakaway but if the Site is not contaminated from the previous use for parking permeable paving may be suitable for the small area of exposed parking to the rear of the development. This is likely to require an engineered sub-base to provide temporary storage of incident rainfall due to the poor infiltration characteristics of the geology.

4.1.3 Surface Water Bodies

The Yeading Brook lies 215 metres to the south east, but the area is heavily urbanised and the creation of a discharge route across third party land is not feasible.

Direct discharge to the watercourse is therefore not feasible.

4.1.4 Surface Water Sewer

The site currently discharges to surface water sewer and this is a feasible route. Attenuation storage will be required to reduce the peak runoff and comply with planning requirements.

4.1.5 Other Drainage Systems

These are the last option in the hierarchy and would not be acceptable if other routes are available.

4.2 Proposed Suds Design

The proposed SuDS drainage system incorporates source control where possible and adopts the above drainage hierarchy to reduce the volume of runoff, improve water quality and provide amenity and habitat.

It is proposed to use the large area of flat roofs and terraces in the proposed design as green roofs to control runoff from roofed areas and provide opportunity for water storage and re-use.

Attenuation will be required to meet the requirement to reduce peak flow to original greenfield conditions and will be provided by storage in the greenroof and terrace areas with residual attenuation within the parking area. More detailed consideration of each element is provided below.

⁹ Flood Risk and Coastal Change, paragraph 80. Reference ID: 7-080-20150323, revised 23/3/15.

4.2.1 Drainage from Hardstanding Areas

As soil infiltration rates are likely to be poor, and the soil may be contaminated, the paving area will be lined to prevent infiltration. Attenuation crates will be installed underneath the parking area to contribute to site attenuation (see section 4.3) and the small area of exposed parking that generates runoff will drain into these.

4.2.2 Drainage from Roof Areas

Green roofs will be installed on the flat roof areas of the new building to provide source control, storage and treatment for runoff as well as providing amenity and habitat benefits. Where feasible, drainage from the remaining pitched roofs along the Uxbridge Road frontage will also be drained onto the flat roof areas. There may be a need to continue to drain some of these south-facing pitched roofs directly to sewer but these are to be minimised.

- All the surfacing within the private and communal amenity areas will be porous, comprising either porous paving/decking or paving/decking with porous jointing. These areas will be raised above the flat roof structure thus providing a reservoir for water storage beneath the green roof. After filtration through the underlying substrate this water will be led to planters and/or collection for irrigation and reuse;
- Planting and trees will be sited in planters with an engineered substrate and filtration system;

Any remaining excess runoff will then ultimately be led to the rainwater downpipes into the attenuation under the paved parking area at ground floor level.

This system will store and filter rainwater, provide opportunities for water reuse and loss through evaporation and transpiration. Runoff will be greatly delayed and reduced in volume, and other SuDS benefits of improved water quality, amenity and habitat will all be attained.

4.2.3 Drainage from Private balconies

These are on intermediate floors and generally too small to provide a green roof. These areas need to be finished in hard surfaces which should be of permeable material underlain by an engineered sub grade to provide slow filtration and substrate contained in a lightweight eggshell laid a waterproof membrane which will lead residual drainage into the attenuation under paving at ground level below.

4.3 Attenuation design

Attenuation should be provided to limit the rate of runoff to the greenfield runoff rates for the Site that are provided in Section 2.3. For the purposes of calculating attenuation requirement this has been assumed at 2 l/s, for the 100 year rainfall event including a 40% climate change increase.

The outlet from the site attenuation system will be controlled by a vortex limited at 2 l/s for all events up to the storage limit for the 100 year + climate change event. This outlet will be to the existing sewer connection subject to the approval of Thames Water.

The runoff produced by the proposed development had been calculated using the modified rational method as before. The proportion of rapid runoff generated by rainfall will vary with the type of surface as shown in Table 4.1. The combined runoff from these surfaces provides the effective runoff area used in the rational method calculations. No allowance for urban creep has been made as the site is fully developed in the proposal.

Table 4.1 Drainage from surface finishes

Surface	Area (m2)	%	Runoff Percent	Effective Drainage Area
Flat roofs	338.9	51%	75%	254.2
Pitched Front	45.2	7%	95%	42.9
Pitched Rear	3.4	1%	95%	3.2
2nd floor private terrace	38.9	6%	80%	31.1
1st floor private terrace	86.9	13%	80%	69.5
Grnd private amenity	16.5	3%	80%	13.2
Exposed parking	78.1	12%	85%	66.4
Landscaping	52.2	8%	0%	0.0
Total	660.0	100%		480.6

The attenuation required has been calculated as the difference in volume between the runoff and the rate at which water can be discharged over the duration of the rainfall event, for a range of rainfall durations.

Table 4.2 shows (in **Red**) the maximum storage required to restrict the outflow from the proposed development is 25.01 m³ of storage.

Table 4.2 Attenuation storage requirements

Storage Required for discharge from effective runoff area of 480 m2				
Duration (hr)	100 year rainfall +40% (mm)	Vol (m3)	Outflow volume at 2 l/s	Storage required (m3)
0.25	39.8	19.1	1.8	17.33
0.5	52.2	25.1	3.6	21.48
0.75	59.5	28.6	5.4	23.18
1	64.8	31.1	7.2	23.93
1.25	69.9	33.5	9.0	24.55
1.5	74.4	35.7	10.8	24.90
1.75	78.4	37.6	12.6	25.01
2	81.9	39.3	14.4	24.91
2.25	85.0	40.8	16.2	24.58
2.5	87.7	42.1	18.0	24.09
2.75	90.1	43.3	19.8	23.47
3	92.4	44.3	21.6	22.75

4.4 Provision of Attenuation

To comply with London Plan policy, rainwater harvesting butts should be established for each proposed development. In terms of attenuation storage within the SuDS scheme, the volume of run-off which could be attenuated by rainwater butts has not been considered as butts could be full at the start of a rainfall event.

Attenuation will be provided across the site as follows:

- A green roof covering a total area of 338 m² (cover area of all green roof spaces) with a green roof mix example of 0.2 m depth and water retention and drainage layer of 0.015m depth would attenuate for 10.99 m³.
- The combined terrace area of 125.8 m² will be porous decking underlain by an engineered sub grade which will provide 1.26 m³ of attenuation
- A 50 m² area of permeable paving (underlain with geo-cellular crates) within the proposed parking area to a depth of 0.3 m, with a 95% void ratio would result in c. 14.25 m³ attenuation.

The total attenuation provided is therefore $10.99 + 1.26 + 14.25 = 26.5 \text{ m}^3$.

Excess storage for exceedance events is provided in the storage freeboard.

4.5 Ownership

Ownership of communal SuDS systems would have to be clearly defined and would have to be held by a property company or housing association which would be responsible for ensuring maintenance of the green roofs, paving and drainage structures.

4.6 Maintenance

Details of SuDS maintenance requirements are provided by the installers and in the CIRIA SuDS manual¹⁰. A brief summary follows.

4.6.1 Permeable paving

Porous hardstanding areas should require minimal maintenance provided they are designed and installed correctly. The general advice is that the maintenance schedule should allow for a bi-annual sweep with re-instatement of any joint refill. The developers should maintain the porous area and a management company contractor could be appointed to undertake this work.

The porous paved areas should only be constructed after general building work has ceased to avoid blockage by sediment, and areas of soil should not be drained onto the paving to prevent sediment being washed onto the surface.

4.6.2 Green Roofs

Extensive green roofs should normally only require twice yearly or annual visits to remove litter and check drains and, in some cases, remove unwanted invasive plants. The most maintenance is responsibility of the green roof provider. Maintenance contractors with specialist training in green roof care should be used.

The specialist contractor should provide a detailed maintenance schedule – further guidance is available from the CIRIA SuDS Manual¹⁰ and from the Green Roof Code¹¹.

¹⁰ The SuDS Manual. CIRIA Report C753, 2015.

¹¹ The Green Roof Code of Best Practice for the UK 2011. Green Roof Organisation, National Federation of Roofing Contractors

4.6.3 Attenuation Crates

Underground attenuation crates, if used, require minimal maintenance if properly installed. A sediment trap is required upstream of the crates, and this should be inspected annually, or to manufacturer's specification, and emptied when required.

4.6.4 Vortex flow control

The outlet restrictor, normally a vortex flow control, should be inspected and maintained according to manufacturer's specification. A typical example of a manufacturer's schedule is below:

Maintenance

The flow control unit requires no routine maintenance. Action is only required in the event of a blockage or suspected blockage.

Inspection

The chamber containing the flow control unit and disc valve should be inspected in line with normal practice. Any debris or silt should be removed. Any visible fixing bolts should be checked. If an internal blockage is suspected the vortex unit can be inspected internally and cleaned out by opening the inspection/access cover on the upstream end. The cover must be replaced and secured before the unit becomes operational

4.6.5 Records

Cleaning and maintenance records shall be kept and made available to the authorities upon request and shall contain remarks on specific events (e.g. repairs, accidents).

APPENDICES

APPENDIX 1 – DEVELOPMENT PLANS