Job Number: 210925

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Flood Risk Assessment

Property:

29 Ulysses Road
Camden
NW6 1ED

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Revision	Date	Comment
-	22.11.2021	First Issue
1	05.01.23	Revised for Campbell Reith comments and new Architectural plans

Contents

Executive Summary

This flood risk assessment for the basement development at 29 Ulysses Road has explored the potential sources of flooding and compared existing and proposed conditions. The assessment has included a detailed study of the site and the surrounding area. The assessment concludes that the proposals will not increase the risk of flooding to nearby properties. There is a low risk of flooding to the property. This can be suitably mitigated by adopting appropriate design and construction methods.

1. Introduction

It is proposed to lower the existing basement at 29 Ulysses Road. This report comprises a FRA (flood risk assessment) to support the planning application.

The objective of the FRA is to establish:

- Whether the basement is likely to be affected by current or future flooding from any source
- Whether the basement will increase flood risk elsewhere
- Whether mitigation measures to deal with these effects and risks are feasible and appropriate

This flood risk assessment includes proposed design measures to reduce any risks associated with flooding and mitigate the impacts for the operation of the building and its occupants.

Planning Context

The Environment Agency has not identified any areas in Camden that are at high risk of flooding from rivers and seas. However, the property is situated in a CDA (Critical Drainage Area). This includes areas that are identified as being subject to localised flooding from surface water. This is caused during times of heavy rainfall, when the local combined sewer system may have insufficient capacity to meet the increase in volume and rate of flow.

All applications for a basement extension within flood risk areas identified in the Camden Flood Risk Management Strategy will be expected to include a Flood Risk Assessment.

This report is based on information from a desk study, a site visit and relevant parts of the following documents:

- LB Camden, Strategic Flood Risk Assessment (July 2014)
- LB Camden, Planning Guidance (CPG) – Water and Flooding (March 2019);
- LB Camden, Planning Guidance (CPG) – Basements (January 2021);

The scope of the FRA should be proportionate to the scale, nature and location of the development. This proposal described in this assessment is for a single dwelling. The level of analytical detail is limited accordingly.

2. Existing Site Conditions & Proposed Development

Existing property is a mid-terraced property with external masonry walls and timber floors, consisting of a main building and a rear addition. The structure comprises three storeys -a cellar, ground floor and first floor. The internal walls are made of masonry and timber.

The floor level of the rear addition is lower than the existing front ground floor. The cellar is under the hallway and the stairs. The front ground floor is made of timber and is supported on masonry piers, the rear wall, the front wall and the spine wall.

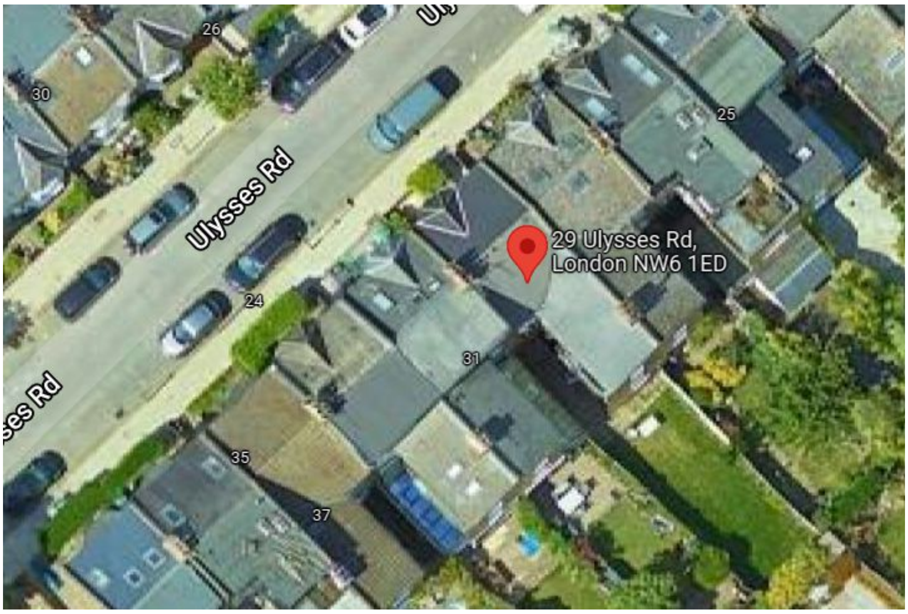

Figure 1: Plan view of site and the surrounding properties

The Strategic Flood Risk Assessment (SFRA 2014) for the London Borough of Camden has identified three CDAs (Critical Drainage Areas) within the borough. These are areas where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) may cause flooding. The property is situated in one of these, as shown below.

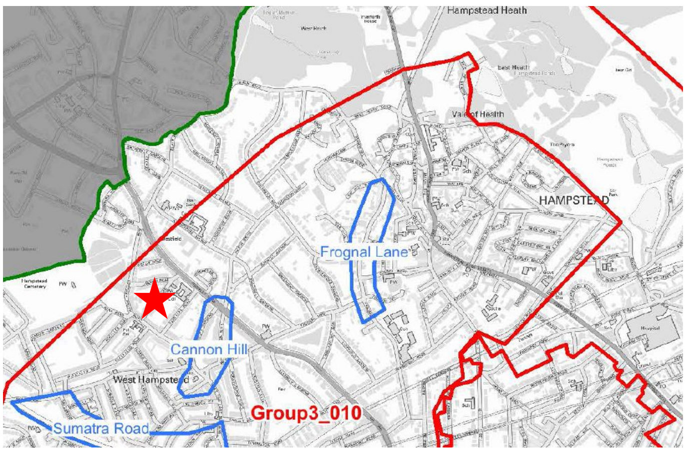

*Figure 2: Extract from Camden CDA map (site indicated with *)*

Given the higher level of flood risk in this area, a flood risk assessment is required in accordance with Camden Council's CPG – Water and Flooding.

The proposal is to lower the existing basement below the footprint of the main building at the front along with a rear extension above ground level. There will be a minor increase in external hard surfaced areas due to the front light well. At the rear, the proposed green roof will compensate the increased hardstanding.

3. Flood Hazards and Mitigation Measures

The potential hazards related to flooding are as follows:

Tidal and Fluvial Flooding

Given that the site is approximately 74m AOD and lies in Flood Risk Zone 1 (defined by the Environment Agency as having low risk of flooding from rivers and seas), the risk of flooding from fluvial and tidal sources is not significant.

Surface Water and Pluvial Flooding

The site is identified as a low risk from the UK Government Flood risk website (extract below).

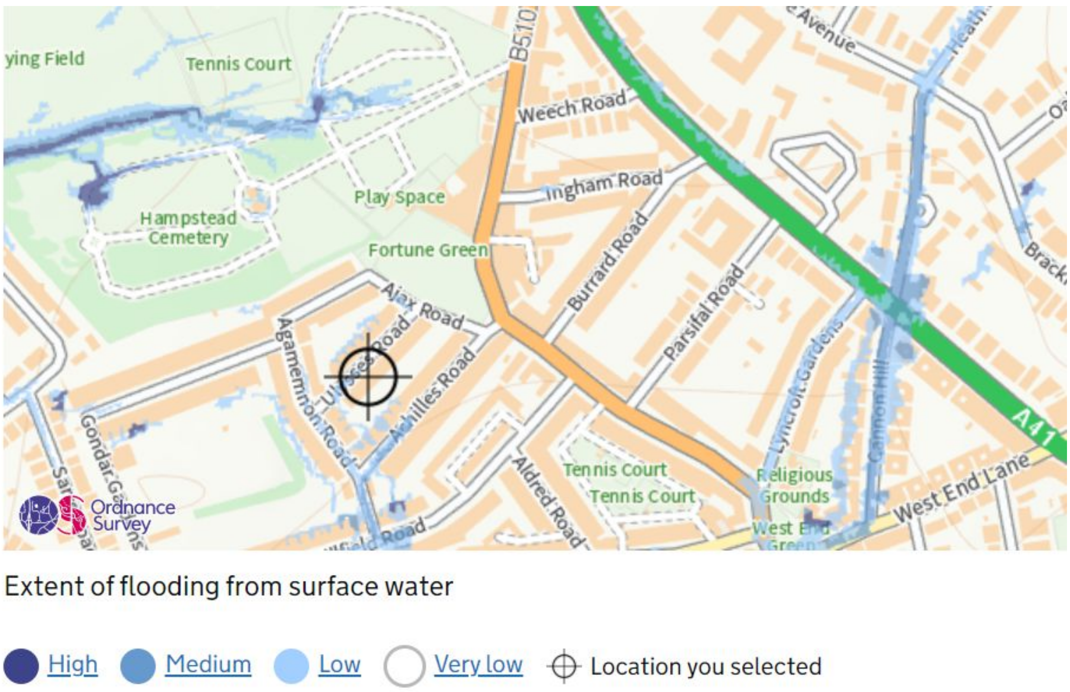

Figure 3: Extract from Environment Agency map showing surface water flood risk areas

From inspection of LiDAR mapping, the area around the site appears to be relatively flat.

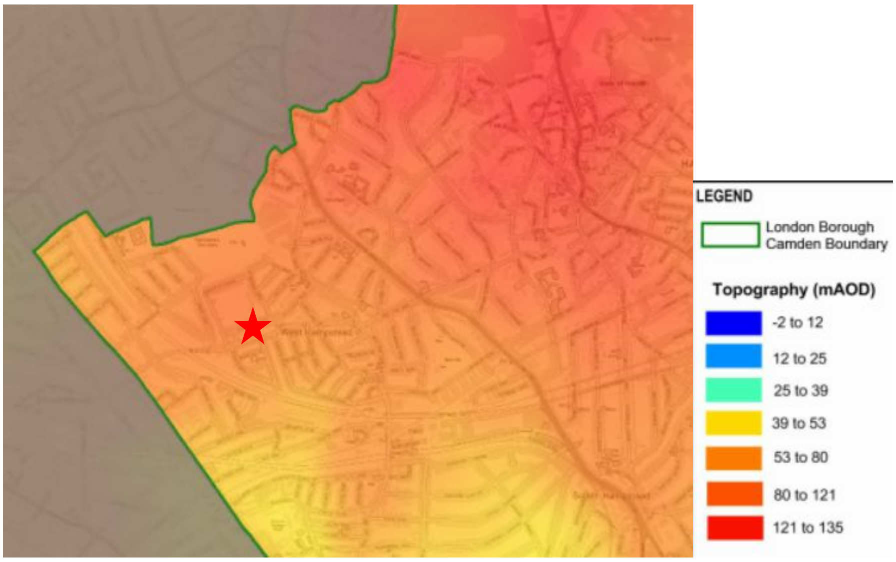

*Figure 4: Extract from Lidar map showing surface topography (site indicated with *)*

From inspection of contours on OS maps, the surrounding area has a gentle slope downwards from north-west to south-east.

*Figure 5: Extract from Lidar map showing surface topography (site indicated with *)*

Any surface water accumulating on the road will flow towards the property. However, given that the Environment Agency has identified the area as being at low risk of flooding from surface water, the risk of surface water entering the property is considered low. This risk is reduced even further by the presence of an uninterrupted kerb by the road in front of the property.

Figure 6: View of the foot path and kerb

The road is drained by gullies. A Thames Water Asset Location search has confirmed the presence of a public sewer below the road. A high level of maintenance is therefore expected, which would keep the risk of surface water flooding at low levels.

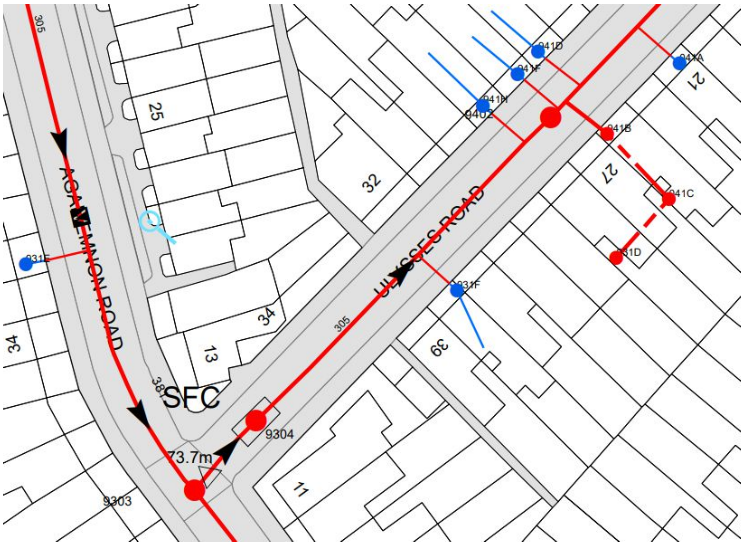

Figure 7: Extract from Thames Water sewer map

The new basement will not involve a significant removal of permeable surfaces except the front light well. The presence of a new basement will therefore not increase the risk of flooding to the ground floor of the property or to any other properties in the surrounding area and beyond.

Groundwater Flooding

Initial and repeat groundwater readings show that groundwater is not present above the formation level of the basement. The basement is highly unlikely to increase the risk of groundwater flooding.

Site specific borehole records (MGC-21-47, October 2021) show that the new basement will be founded on and be surrounded by London Clay Formation. This has a relatively low level of permeability. The new structure will have a negligible impact on the conveyance of groundwater.

The increase in risk of flooding from groundwater to the property and the surrounding area, is therefore negligible.

Infrastructure Flooding

There are no reservoirs close to the site. There are incoming water mains for properties in the area and sewers serving the same properties. Given that these are the property of Thames Water, these assets are assumed to have a high level of maintenance thus the risk of flooding from these is considered very low.

There is always a risk that the incoming water mains may break, causing significant flood risk to the occupants of the basement. This risk is inherent with all basement structures. Mitigation measures are proposed in the following section.

Mitigation Measures

The Environment Agency requires that for new extensions, the ground floor should be at least 300mm above the general ground level. This is out of context with the Ground Floor as it is an existing structure and not a new extension. It is pertinent to note that, given that the front yard is higher than the road level, and the threshold of the front door is at a raised level from this, the level of the Ground Floor is already approximately 200mm higher than the street level.

During times of high rainfall there will be an increased risk of surface water flooding from the impermeable surfaces of the street and pavement in front of the property. As described previously, the likelihood of surface floodwater reaching the front of the property is low. The kerb provides passive defences in front of the property.

There is a low risk of incoming water mains bursting resulting in localised flooding. This would occur at the front of the property and the passive defences stated above would mitigate the risk of flooding into the basement. At detailed design stage, the design team may wish to consider an upstand wall around the external perimeter of the front light-well. This will form an additional passive defence from surface water flooding.

To mitigate the risks associated with flooding from groundwater, Croft would recommend that suitable waterproofing measures be proposed in conjunction with the structural design. A common and anticipated detailed design stage approach is to use internal dimpled membranes (Delta, Sika or similar). These will be integral to the waterproofing of the basement.

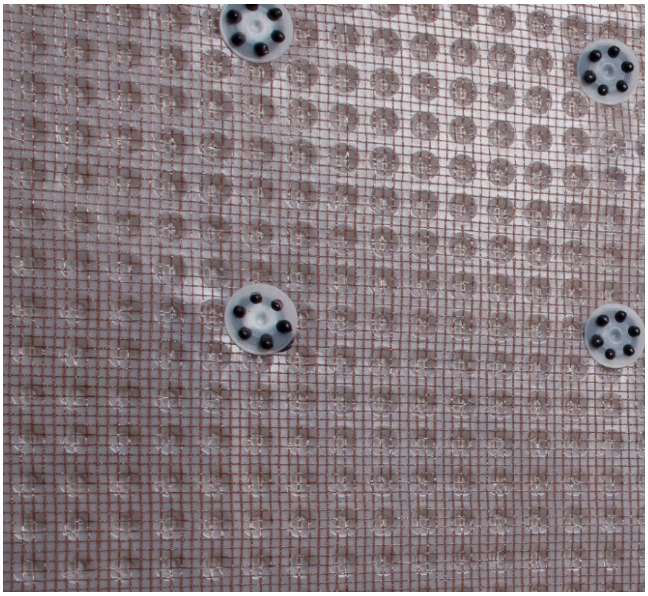

Figure 6: Example of dimpled membrane used for waterproofing basements

Any water from this will enter a drainage channel below the slab. This will be pumped and discharged into the exiting sewer system.

It is recommended that a waterproofing specialist is employed to ensure all the water proofing requirements are met. The waterproofing specialist must name their structural water-proofer. The structural water-proofer must inspect the structural details and confirm that he is happy with the robustness.

Due to the segmental construction nature of the basement, it is not possible to waterproof the joints. All waterproofing must be made by the waterproofing specialist. He should review the structural engineer's design stage details and advise if water bars and stops are necessary.

The waterproofing designer must not assume that the structure is watertight. To help reduce water flow through the joints in the segmental pins, the following measures should be applied:

- All faces should be cleaned of all debris and detritus
- Faces between pins should be needle hammered to improve key for bonding
- All pipe work and other penetrations should have puddle flanges or hydrophilic strips

The design of the services could include the following:

- A pumping system should be installed for the proposed basement. There is a likelihood that this may fail and allow excess water to accumulate. If this were to occur, the build-up of water would be gradual and noticeable before it becomes a significant life-threatening hazard.

- The pumping system should be a dual mechanism to maintain operation in the event of a failure. This should include a battery backup and a suitable alarm system for warning purposes.

Figure 7: Example of sump pump used commonly used for basement drainage

- Non-return valve to avoid the risk of backflow

- Install all electrical wiring at high level

SUDS Considerations

The extension at the rear will replace the existing extension and patio area. The proposed green roof will compensate the new hardstanding that is created by the new rear extension. Beyond the patio, there is plentiful soft landscaping in the rear garden, which allows and will continue to allow rainwater to discharge into the ground. This mechanism will be maintained: there are no proposals to change the landscaping in the rear garden.

The additional hard landscaping is provided by the front light well only. This amounts to an additional 5.6m^2. This equates to an approximate 6% of hardstanding areas over the whole site. From the calculations attached in appendix A, it can be seen that this will increase the run-off from the site for a 1 in 100 year storm event from by approximately 50%, including an allowance of 40% increase in peak rainfall to account for the impacts of climate change over the lifetime of the development.

We would recommend that front pathway, which is currently fully impermeable at present, is replaced with a permeable surface. This gives an area of 4.03m^2.

The hardstanding can be constructed using a permeable surface, with an impermeable lined sub-base of 100mm. Surface water landing on this part of the site will infiltrate through the permeable surfacing, where it will be stored within the sub-base until it is discharged into the soil over time. The sub-base will comprise a Type 3 granular sub-base with a porosity of 20%. This means that the proposed development run-off rates will be constrained to the existing greenfield run-off rates for a 1 in 100-year storm event, including rainwater harvesting would also provide additional benefit.

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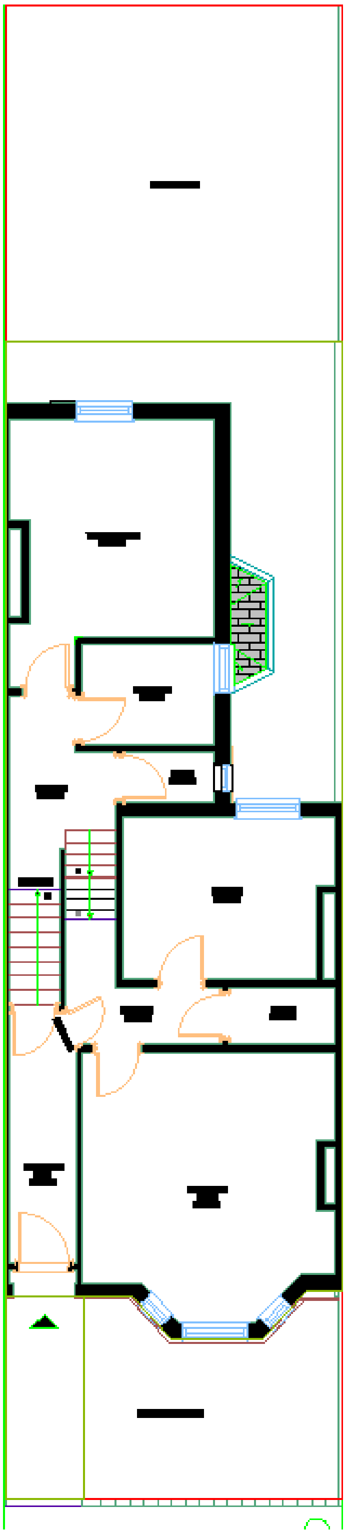
Appendix A: SuDS Calculations

EXISTING SITE PLAN



EXISTING AND PROPOSED IMPERMEABLE AREA

Existing site area: 129.3 sqm

Ground and cellar: 83.9 sqm
Front entrance area: 4.03 sqm
Total Existing impermeable area: 87.93 sqm

68 % impermeable area

Rear addition: 9.4 sqm
Front entrance area: 4.03 sqm
Light well: 5.60 sqm
Green roof: -10.01 sqm
Total Proposed impermeable area: 92.92 sqm
Ground and cellar: 83.9 sqm

71 % impermeable area

If the front entrance area is made permeable,
Rear addition: 9.4 sqm
Front entrance area: -4.03 sqm
Light well: 5.60 sqm
Green roof: -10.01 sqm
Total Proposed impermeable area: 92.92 sqm
Ground and cellar: 83.9 sqm

68.7 % impermeable area

RAINFALL AS EXISTING

Greenfield run-off rates 1/100yr, 6 hour event

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	London	
Storm duration	D = **6** hr	
Return period	Period = **100** yr	
Ratio 60 min to 2 day rainfall of 5 yr return period		r = **0.440**
5-year return period rainfall of 60 minutes duration		M5_60min = **20.0** mm
Increase of rainfall intensity due to global warming		$p_{climate}$ = **0** %

Factor Z1 (Wallingford procedure) $Z1 = \mathbf{1.53}$

Rainfall for 6hr storm with 5 year return period $M5\_6hr_i = Z1 \times M5\_60min = \mathbf{30.6}$ mm

Factor Z2 (Wallingford procedure) $Z2 = \mathbf{1.97}$

Rainfall for 6hr storm with 100 year return period $M100\_6hr = Z2 \times M5\_6hr_i = \mathbf{60.1}$ mm

Design rainfall intensity $I_{max} = M100\_6hr / D = \mathbf{10.0}$ mm/hr

Maximum surface water runoff

Catchment area $A_{catch} = \mathbf{129}$ m^2

Percentage of area that is impermeable $p = \mathbf{68}$ %

Maximum surface water runoff $Q_{max} = A_{catch} \times p \times I_{max} = \mathbf{0.2}$ l/s

RAINFALL INCREASE DUE TO PROPOSED DEVELOPMENT

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area London

Storm duration $D = \mathbf{6}$ hr

Return period Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period $r = \mathbf{0.440}$

5-year return period rainfall of 60 minutes duration $M5\_60min = \mathbf{20.0}$ mm

Increase of rainfall intensity due to global warming $p_{climate} = \mathbf{40}$ %

Factor Z1 (Wallingford procedure) $Z1 = \mathbf{1.53}$

Rainfall for 6hr storm with 5 year return period $M5\_6hr_i = Z1 \times M5\_60min \times (1 + p_{climate}) = \mathbf{42.8}$ mm

Factor Z2 (Wallingford procedure) $Z2 = \mathbf{1.87}$

Rainfall for 6hr storm with 100 year return period $M100\_6hr = Z2 \times M5\_6hr_i = \mathbf{80.0}$ mm

Design rainfall intensity $I_{max} = M100\_6hr / D = \mathbf{13.3}$ mm/hr

Maximum surface water runoff

Catchment area $A_{catch} = \mathbf{129}$ m^2

Percentage of area that is impermeable $p = \mathbf{71}$ %

Maximum surface water runoff $Q_{max} = A_{catch} \times p \times I_{max} = \mathbf{0.3}$ l/s

INFILTRATION FRONT ENTRANCE AREA

PLANE INFILTRATION SYSTEM DESIGN

In accordance with CIRIA C753 SUDS

Tedds calculation version 2.0.04

Design rainfall intensity

Location of catchment area London

Impermeable area drained to the system $A = \mathbf{4.0}$ m^2

Return period Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period $r = \mathbf{0.440}$

5-year return period rainfall of 60 minutes duration M5_60min = **20.0** mm

Increase of rainfall intensity due to global warming $p_{climate} = \mathbf{40}$ %

Infiltration pavement details

Base area of pavement $A_b = \mathbf{4.0}$ m^2

Porosity $n = \mathbf{0.2}$

Drainage ratio $R = A / A_b = \mathbf{1.0}$

Soil infiltration rate $f = \mathbf{44.0 \times 10^{-6}}$ m/s

Table equations

Rainfall intensity $i = M100 / D$

Minimum depth required (Eq. 25.1) $H = D / n \times (R \times i - f)$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Intensity, i (mm/hr)	Depth (mm)
5	0.39	10.8	1.92	20.8	249.87	38
10	0.54	15.0	1.99	29.9	179.44	18
15	0.65	18.1	2.01	36.5	145.93	0
30	0.82	22.9	2.02	46.2	92.31	0
60	1.00	28.0	1.99	55.6	55.61	0
120	1.19	33.4	1.94	64.9	32.46	0
240	1.39	39.0	1.90	74.0	18.51	0
360	1.53	42.8	1.87	80.0	13.33	0
600	1.70	47.6	1.83	87.1	8.71	0
1440	2.07	58.1	1.76	101.9	4.25	0

Min depth of pavement req'd $H_{max} = \mathbf{38}$ mm

Time to empty blanket to half volume - Eq.25.6(1) $t_{s50} = n \times H_{max} / (2 \times f)$ = 1min 27s

PASS - Infiltration system discharge time less than or equal to 24 hours