

SECTION 6 SUSTAINABLE DRAINAGE STRATEGY

- 6.1. The general requirement set out by the NSSDS 2011 and NSTSSD 2015 technical documents is that 'the development must not increase the risk of flooding elsewhere.' In practical terms, this means that the proposed development runoff rate must provide a betterment or be equal to the calculated greenfield rate.

EXISTING SURFACE WATER RUNOFF RATE

- 6.2. Calculating the surface water runoff from a brownfield site is not an exact science. It's based on several assumptions and can be estimated using the following methods.

Modified Rational Method

- 6.3. The Modified Rational Method can be used to calculate the existing runoff rate from a site. It requires the existing impermeable area, an approximate time of concentration and a couple of variables from the Wallingford Procedure.
- 6.4. An existing impermeable area plan i.e., the areas benefiting from positive drainage has been included within **Appendix D**.



Figure 6.1 Existing Site Review

	m ²	ha
Site Boundary	9400	0.9400
Impermeable Area	6885	0.6885
Percentage	0.73	

Table 6.1 Existing Site Analysis

Return Period (Years)	1	2	5	30	100
Rainfall Intensity (mm/h)	42	54	70	99	122

Table 6.2 Return Period Rainfall Intensity

Volume Wallingford Variables	Value
M5-60 minute rainfall depth	19mm
Ratio of M5-60 to M5-2 day rainfalls	0.28
Average Annual Rainfall (SAAR)	858mm
Winter Rain Acceptance Potential (SOIL)	Soil Type 4 (0.45)
Urban Catchment Wetness Index (UCWI)	90
Time of Concentration (mins)	5

Table 6.3 Wallingford Procedure Volume 3 Variables

6.5. The peak flow rate as calculated by the Modified Rational Method is as follows:

$$Q_{\text{Brownfield}} (\text{I/s}) = 2.78 \times C_v \times C_r \times R_i \times \text{Area}$$

Where;

$$PIMP = \text{Percentage of impermeable area} = 100 \%$$

$$P_r = 0.829 PIMP + 25 \text{ SOIL} + 0.078 \text{ UCWI} - 20.7 = 80.47$$

$$C_v = \text{Volumetric runoff coefficient} = \frac{P_r}{PIMP} = 0.805$$

$$C_r = \text{Routing coefficient (Urban Areas)} = 1.3$$

$$R_i = \text{Rainfall Intensity 1 Year} = 42$$

$$\text{Area} = \text{Impermeable Area} = 0.6885$$

$$Q_{\text{Brownfield}} (\text{I/s}) = 2.78 \times 0.805 \times 1.3 \times 42 \times 0.6885 = 84$$

Return Period (Years)	1	2	5	30	100
Peak Runoff Rate (I/s)	84	108	140	198	244

Table 6.4 Existing Peak Runoff Rates

Colebrook Formula

- 6.6. The GPR survey has identified two outfall pipes that connect to United Utilities Sewers. Using the GPR data provided we have been able to calculate the capacity of the existing pipes.

	Pipe One	Pipe Two
Pipe Size (m)	0.300	0.225
Upstream Invert (m)	27.480	28.810
Downstream Invert (m)	26.540	25.720
Lateral Distance (m)	18.000	8.250
Approximate Grade*	1 in 100* (1 in 20)	1 in 100* (1 in 3)
Capacity (Ks 1.5)	116 l/s	54 l/s

Table 6.5 Existing Pipe Capacity

**The existing pipe gradients are deemed excessive and suggest that there is a backdrop at the United Utilities manhole. A 1 in 100 gradient has been deemed more suitable/will better reflect the current arrangement.*

Allowable Runoff Rate

- 6.7. The flow rates in **Table 6.4** indicate the peak runoff that could be generated in each return period. However, it is unlikely that the underground network was designed to serve the more extreme events.
- 6.8. The capacity of the outfall pipes shown in **Table 6.5** suggests the underground network could have been designed for a 5-year return period. The flow rate from the PDS will therefore be restricted to this flow rate with the required betterment (**Figure 3.1**).

5 Year Peak Runoff Rate (l/s)	140 l/s
Required Betterment	50% Minimum
Proposed Peak Runoff (l/s)	70 l/s

Table 6.6 Proposed Peak Runoff Rates

PROPOSED RUNOFF DESTINATION

Surface Water Hierarchy

- 6.9. Paragraph 080 of the Flood Risk and Coastal Change Guidance within the Planning Practice Guidance sets out the following hierarchy of surface water runoff destinations:
- Discharge into the ground (infiltration),
 - Discharge to a surface waterbody,