Appendix L – Drainage Strategy Calculations
Estimation of Urban Realm Peak Flow Rate Runoff

The aim of this calculation is to determine the peak discharge runoff rate of the existing brownfield site for 1:30 and 1:100 year return period events based on The Wallingford Procedure 'Modified Rational Method'.

\[ Q = 2.78 \times C \times I \times A \]

Z1 from Fig A.3b for 15 min duration = 0.65

\[ M5-15 = 0.65 \times 20.7 = 13.455 \text{ mm} \]

Z2 values taken from Table A1 of Volume 4 of Modified Rational Method for 13.455mm rainfall

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Q 1 year</th>
<th>Q 2 year</th>
<th>Q 10 year</th>
<th>Q 20 year</th>
<th>Q 30 year</th>
<th>Q 100 year</th>
<th>Q 100 year + 30% C/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Point Intensity</td>
<td>8.30</td>
<td>10.72</td>
<td>16.62</td>
<td>19.15</td>
<td>20.38</td>
<td>26.51</td>
<td>34.46</td>
</tr>
<tr>
<td>Areal Reduction Factor</td>
<td>33.2069</td>
<td>42.8945</td>
<td>66.4677</td>
<td>76.586</td>
<td>81.5373</td>
<td>106</td>
<td>137.83</td>
</tr>
<tr>
<td>Rainfall (mm/hr)</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
<td>0.94</td>
</tr>
<tr>
<td>Discharge Rates (l/s)</td>
<td>31.21</td>
<td>40.32</td>
<td>62.48</td>
<td>71.99</td>
<td>76.65</td>
<td>99.66</td>
<td>129.56</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storm Event</th>
<th>Q 1 year</th>
<th>Q 2 year</th>
<th>Q 10 year</th>
<th>Q 20 year</th>
<th>Q 30 year</th>
<th>Q 100 year</th>
<th>Q 100 year + 30% C/C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall (mm/hr)</td>
<td>19.19</td>
<td>24.79</td>
<td>38.42</td>
<td>44.27</td>
<td>47.13</td>
<td>61.29</td>
<td>79.67</td>
</tr>
</tbody>
</table>

Existing peak surface water runoff (100 year) = 61.3 l/s

Existing peak surface water runoff (30 year) = 47.1 l/s

Existing peak surface water runoff (20 year) = 44.3 l/s

Existing peak surface water runoff (10 year) = 38.4 l/s

Existing peak surface water runoff (1 year) = 19.2 l/s
### APPLIANCE Discharge Units

<table>
<thead>
<tr>
<th>APPLIANCE</th>
<th>Discharge Units (du/l/s)</th>
<th>Number of appliances</th>
<th>Total of du's (l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet Bowl with flushing box</td>
<td>2</td>
<td>27</td>
<td>54</td>
</tr>
<tr>
<td>Basin</td>
<td>0.5</td>
<td>27</td>
<td>13.5</td>
</tr>
<tr>
<td>Bath</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Shower Tray</td>
<td>0.6</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Kitchen Sink</td>
<td>0.8</td>
<td>7</td>
<td>5.6</td>
</tr>
<tr>
<td>Urinal</td>
<td>0.5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Washing Machine</td>
<td>1.5</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>0.8</td>
<td>6</td>
<td>4.8</td>
</tr>
<tr>
<td>Floor Gully</td>
<td>1.5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Bidet</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Drinking fountain</td>
<td>0.05</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sprinkling tap</td>
<td>0.3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Frequency of use factors (K)

<table>
<thead>
<tr>
<th>Kind</th>
<th>Frequency of use factor (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent use- e.g. domestic/guesthouse/office</td>
<td>0.50</td>
</tr>
<tr>
<td>Frequent use- e.g. Restaurant/Office</td>
<td>0.70</td>
</tr>
<tr>
<td>Congested use- e.g. Public use</td>
<td>1.00</td>
</tr>
<tr>
<td>Special use- e.g. laboratory</td>
<td>1.20</td>
</tr>
</tbody>
</table>

### Enter Frequency of use factor (from above)

0.70

### Designers notes:

1) Wastewater discharge units in accordance with BS EN 12056-2:2000 table 2
**APPLIANCE** | **Discharge Units** | **Number of appliances** | **Total of du's (l/s)**
--- | --- | --- | ---
Toilet Bowl with flushing box | 2 | 58 | 116
Basin | 0.5 | 58 | 29
Bath | 0.8 | 0 | 0
Shower Tray | 0.6 | 6 | 3.6
Kitchen Sink | 0.8 | 7 | 5.6
Urinal | 0.5 | 0 | 0
Washing Machine | 1.5 | 7 | 10.5
Dishwasher | 0.8 | 7 | 5.6
Floor Gully | 1.5 | 6 | 9
Bidet | 0.5 | 0 | 0
Drinking fountain | 0.05 | 0 | 0
Sprinkling tap | 0.3 | 0 | 0

\[(\Sigma Du) \text{ total load (du-l/s) for this location}\] = 179.3

Total waste flow rate based on equation \((l/s) (Q_{ww}) = K(\sqrt{du's})\)

Any pumped waste discharge \((l/s) (Q_p)\)

Any continuous discharge (e.g. condensate etc) \((l/s) (Q_c)\)

Peak design flow rate for stack/location \((Q_{tot}) (l/s)\)

\[9.37\]

\[0.00\]

\[0.00\]

\[9.37\]

**Average flow (l/s)** \[1.56\]

*average flow rates dependant upon fitting usage and building operation hours*

**Frequency of use factors (K)**

- Intermittent use-e.g. domestic/guesthouse/office 0.50
- Frequent use- e.g. Restaurant/Office 0.70
- Congested use- e.g. Public use 1.00
- Special use- e.g. laboratory 1.20

**Enter Frequency of use factor (from above)** 0.70

**Designers notes:**

1) Wastewater discharge units in accordance with BS EN 12056-2:2000 table 2
Quick storage estimate

Site location: LONDON

Site area: 0.221ha

Existing discharge rate: 61.3 L/s

Proposed flow rate: 30.65 L/s

Results:

Volume required = 60 m$^3$
Proposed Drainage Strategy

Attenuation Requirement = 60m³

Porous Paving Attenuation at 500mm (190m²) of which is storage (30%) = 60m³

Orifice Plate or Hydro Brake Control to control discharge below <30.65l/s
ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH
U.N.O.
ALL HEIGHTS ARE IN METRES ABOVE ORDNANCE DATUM
ALL DIMENSIONS ARE IN MILLIMETRES U.N.O.
DO NOT SCALE FROM THIS DRAWING

136-142 BRAMLEY ROAD
LONDON W12

BELOW GROUND DRAINAGE

PRELIMINARY

NEWMARK PROPERTIES

14-48

APR 2015

DRAWN: D S C H R I N T

1:200@A1

PRELIMINARY ISSUE

P01