



# Evans & Langford LLP

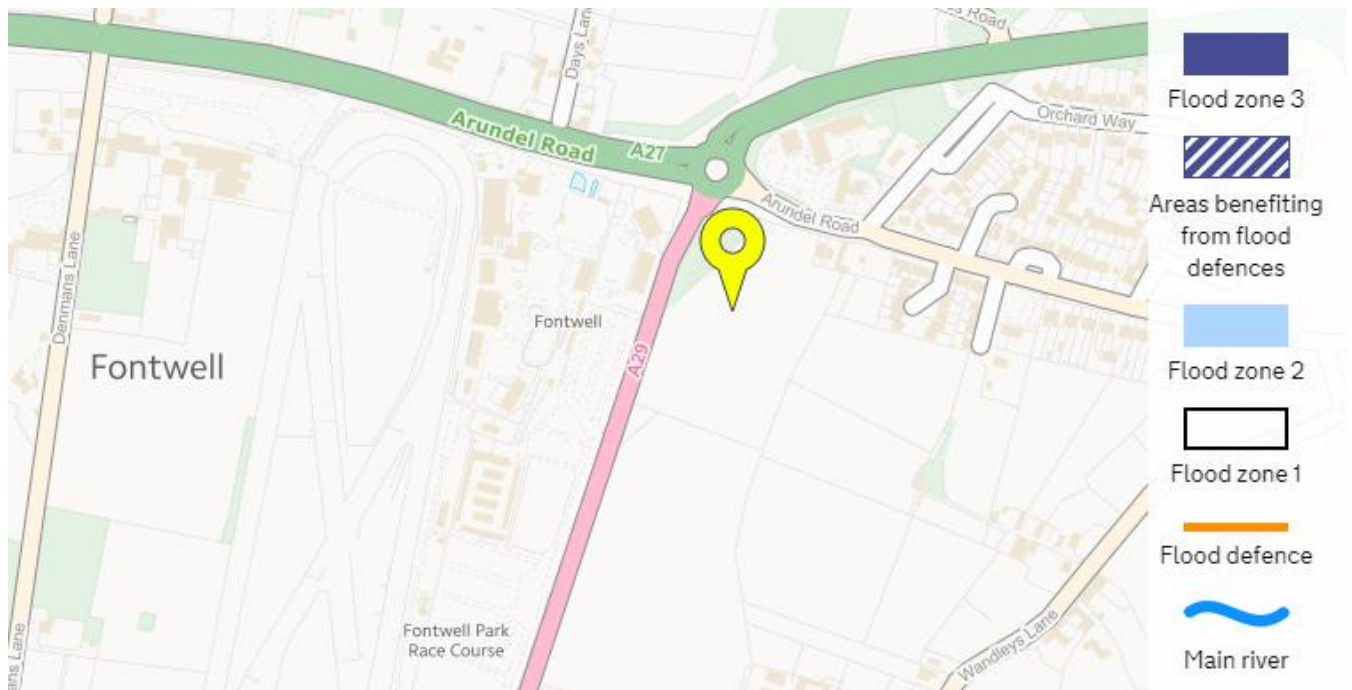
- ◆ Structural & Civil Engineers
- ◆ Land & Building Surveyors
- ◆ Geo-Environmental Engineers
- ◆ Project Managers
- ◆ CDM Consultants
- ◆ Contract Administrators

## Surface Water Drainage Strategy – GTR Fontwell

### Existing Site

The site for the proposed industrial units is located opposite Fontwell Racecourse approximately 6.5km to the north of Bognor Regis town centre. The site is centred on approximate National Grid Reference 495070, 106975. Currently the site is predominantly green open space.

The site is located in Flood Zone 1 (see below), and recommendations for surface water disposal utilising infiltration Suds are viable.



Extract from Flood Map for Planning (Gov.uk)

### Drainage Design

The premise behind the surface water drainage system for GTR Fontwell is that rain falling on to the roof area and hardstandings be collected and channelled via permeable paving and underground pipes to a soakaway which discharges into clean natural gravel.

It is expected that infiltration drainage should be used for surface water, the soil was tested but infiltration rates are still to be finalised. For the purposes of the drainage design, soil infiltration rates appropriate to the soils found on site have been used.



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In general, the system has been designed in accordance with Non Statutory Technical Standards for Sustainable Drainage Systems, The SUDS Manual C753 by CIRIA and Sustainable Drainage Systems C609 also published by CIRIA. The system has been designed in WinDes Microdrainage to ensure that there is no flooding to any part of the site for all storms up to and including a 1 in 100 year storm, with a 40% allowance for climate change.

Figure 23.4 provides a typical design of a pond in plan view and profile. Figure 23.5 shows typical planted pond edge details and Figure 23.6 shows equivalent details for a typical non-planted pond.

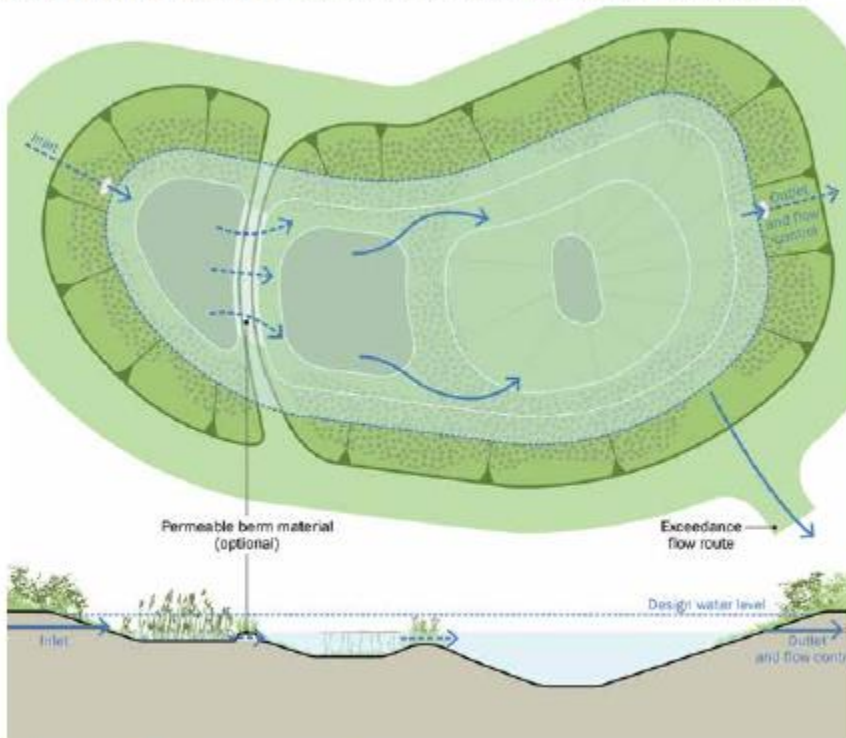
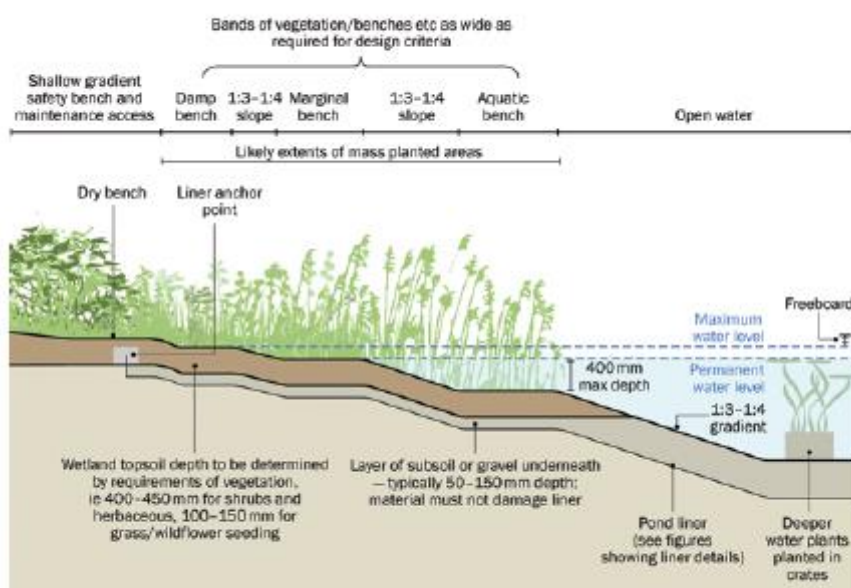


Figure 23.4 Plan view and profile of pond details

CIRIA SuDS Manual 2015



Notes: Width, surfacing and extent etc of safety bench and maintenance access all dependent on site, size of pond, maintenance requirements etc

Figure 23.5 Typical planted pond edge details

The design allows for the carpark to the east of the buildings, as well as that in the north west corner, to be constructed with permeable paving. Roof water will also be routed through the paving sub-base to allow for utilisation of infiltration to the underlying soils. The pavements will be provided with overflow structures (such as weirs) that will ultimately discharge through an attenuation pond which in turn overflows into a below ground soakaway located in the south west corner of the site.

The attenuation pond will be designed to provide additional benefits in the form of water quality, amenity and biodiversity through the planting of appropriate aquatic species. It will likely be designed to have a permanent shallow pond to support aquatic wildlife. The Ciria SuDS Manual C753 contains further details, as shown in the extracts above.

Microdrainage calculations have been completed for the 100 year + 40% climate change event and the resulting size of soakaway obtained was 300m<sup>2</sup> x 0.8m deep. The calculations have been completed with each of the drainage elements cascaded, that is the permeable carparking with overflows into the pond and then soakaway. The half drain time of the carparks are 131 minutes for the top carpark, 283 minutes for the bottom carpark and 1161 minutes for the soakaway.

Catchpits will also be constructed upstream of the soakaways to collect silt and leaves. An oil separator will also be required to remove any pollutants for car parking areas. As with any surface water drainage system, to maintain best performance, regular maintenance and cleaning are required.

Collecting and discharging the surface water as detailed above is considered to be in accordance with the principals of sustainable urban drainage systems.

Revision A  
February 2020

|                                                                   |                                                |                                                                                     |                               |                        |               |
|-------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------|------------------------|---------------|
| Evans & Langford                                                  |                                                | Page 1                                                                              |                               |                        |               |
| 91 King Street<br>Maidstone<br>Kent ME14 1BQ                      | GTR Fontwell<br><br>Indicative Drainage Design |  |                               |                        |               |
| Date 30/01/2020<br>File 15104 Drainage system c...                | Designed by DPM<br>Checked by                  |                                                                                     |                               |                        |               |
| Causeway                                                          | Source Control 2017.1.2                        |                                                                                     |                               |                        |               |
| <u>Cascade Summary of Results for 15104 Soakaway cascade.SRCX</u> |                                                |                                                                                     |                               |                        |               |
| <b>Upstream Structures</b>                                        |                                                | <b>Outflow To Overflow To</b>                                                       |                               |                        |               |
| 15104 Permeable bottom cascade.SRCX                               |                                                | (None)                                                                              |                               |                        |               |
| 15104 Permeable top cascade.SRCX                                  |                                                | (None)                                                                              |                               |                        |               |
| Half Drain Time : 1161 minutes.                                   |                                                |                                                                                     |                               |                        |               |
| <b>Storm Event</b>                                                | <b>Max Level (m)</b>                           | <b>Max Depth (m)</b>                                                                | <b>Max Infiltration (l/s)</b> | <b>Max Volume (m³)</b> | <b>Status</b> |
| 15 min Summer                                                     | 23.661                                         | 0.161                                                                               | 1.3                           | 46.0                   | O K           |
| 30 min Summer                                                     | 23.762                                         | 0.262                                                                               | 1.3                           | 74.8                   | O K           |
| 60 min Summer                                                     | 23.869                                         | 0.369                                                                               | 1.4                           | 105.1                  | O K           |
| 120 min Summer                                                    | 23.969                                         | 0.469                                                                               | 1.4                           | 133.7                  | O K           |
| 180 min Summer                                                    | 24.016                                         | 0.516                                                                               | 1.4                           | 147.2                  | O K           |
| 240 min Summer                                                    | 24.041                                         | 0.541                                                                               | 1.4                           | 154.2                  | O K           |
| 360 min Summer                                                    | 24.065                                         | 0.565                                                                               | 1.4                           | 161.1                  | O K           |
| 480 min Summer                                                    | 24.068                                         | 0.568                                                                               | 1.4                           | 161.9                  | O K           |
| 600 min Summer                                                    | 24.065                                         | 0.565                                                                               | 1.4                           | 160.9                  | O K           |
| 720 min Summer                                                    | 24.059                                         | 0.559                                                                               | 1.4                           | 159.2                  | O K           |
| 960 min Summer                                                    | 24.042                                         | 0.542                                                                               | 1.4                           | 154.3                  | O K           |
| 1440 min Summer                                                   | 24.000                                         | 0.500                                                                               | 1.4                           | 142.4                  | O K           |
| 2160 min Summer                                                   | 23.938                                         | 0.438                                                                               | 1.4                           | 124.8                  | O K           |
| 2880 min Summer                                                   | 23.879                                         | 0.379                                                                               | 1.4                           | 108.1                  | O K           |
| 4320 min Summer                                                   | 23.775                                         | 0.275                                                                               | 1.3                           | 78.3                   | O K           |
| 5760 min Summer                                                   | 23.689                                         | 0.189                                                                               | 1.3                           | 53.9                   | O K           |
| 7200 min Summer                                                   | 23.624                                         | 0.124                                                                               | 1.3                           | 35.4                   | O K           |
| <b>Storm Event</b>                                                | <b>Rain (mm/hr)</b>                            | <b>Flooded Volume (m³)</b>                                                          | <b>Time-Peak (mins)</b>       |                        |               |
| 15 min Summer                                                     | 127.747                                        | 0.0                                                                                 | 33                            |                        |               |
| 30 min Summer                                                     | 86.691                                         | 0.0                                                                                 | 46                            |                        |               |
| 60 min Summer                                                     | 56.129                                         | 0.0                                                                                 | 74                            |                        |               |
| 120 min Summer                                                    | 35.009                                         | 0.0                                                                                 | 132                           |                        |               |
| 180 min Summer                                                    | 26.112                                         | 0.0                                                                                 | 190                           |                        |               |
| 240 min Summer                                                    | 21.070                                         | 0.0                                                                                 | 250                           |                        |               |
| 360 min Summer                                                    | 15.587                                         | 0.0                                                                                 | 366                           |                        |               |
| 480 min Summer                                                    | 12.563                                         | 0.0                                                                                 | 466                           |                        |               |
| 600 min Summer                                                    | 10.618                                         | 0.0                                                                                 | 518                           |                        |               |
| 720 min Summer                                                    | 9.248                                          | 0.0                                                                                 | 580                           |                        |               |
| 960 min Summer                                                    | 7.430                                          | 0.0                                                                                 | 706                           |                        |               |
| 1440 min Summer                                                   | 5.446                                          | 0.0                                                                                 | 986                           |                        |               |
| 2160 min Summer                                                   | 3.982                                          | 0.0                                                                                 | 1392                          |                        |               |
| 2880 min Summer                                                   | 3.185                                          | 0.0                                                                                 | 1792                          |                        |               |
| 4320 min Summer                                                   | 2.319                                          | 0.0                                                                                 | 2556                          |                        |               |
| 5760 min Summer                                                   | 1.852                                          | 0.0                                                                                 | 3288                          |                        |               |
| 7200 min Summer                                                   | 1.556                                          | 0.0                                                                                 | 3960                          |                        |               |
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|                                                                   |                        |                              |                                                |                                       |                                |                                                                                     |
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| 91 King Street<br>Maidstone<br>Kent ME14 1BQ                      |                        |                              | GTR Fontwell<br><br>Indicative Drainage Design |                                       |                                |  |
| Date 30/01/2020<br>File 15104 Drainage system c...                |                        |                              | Designed by DPM<br>Checked by                  |                                       |                                |                                                                                     |
| Causeway                                                          |                        |                              | Source Control 2017.1.2                        |                                       |                                |                                                                                     |
| <u>Cascade Summary of Results for 15104 Soakaway cascade.SRCX</u> |                        |                              |                                                |                                       |                                |                                                                                     |
|                                                                   | <b>Storm<br/>Event</b> | <b>Max<br/>Level<br/>(m)</b> | <b>Max<br/>Depth<br/>(m)</b>                   | <b>Max<br/>Infiltration<br/>(l/s)</b> | <b>Max<br/>Volume<br/>(m³)</b> | <b>Status</b>                                                                       |
|                                                                   | 8640 min Summer        | 23.577                       | 0.077                                          | 1.3                                   | 21.9                           | O K                                                                                 |
|                                                                   | 10080 min Summer       | 23.549                       | 0.049                                          | 1.2                                   | 14.1                           | O K                                                                                 |
|                                                                   | 15 min Winter          | 23.697                       | 0.197                                          | 1.3                                   | 56.2                           | O K                                                                                 |
|                                                                   | 30 min Winter          | 23.811                       | 0.311                                          | 1.3                                   | 88.7                           | O K                                                                                 |
|                                                                   | 60 min Winter          | 23.932                       | 0.432                                          | 1.4                                   | 123.0                          | O K                                                                                 |
|                                                                   | 120 min Winter         | 24.048                       | 0.548                                          | 1.4                                   | 156.1                          | O K                                                                                 |
|                                                                   | 180 min Winter         | 24.105                       | 0.605                                          | 1.4                                   | 172.3                          | O K                                                                                 |
|                                                                   | 240 min Winter         | 24.136                       | 0.636                                          | 1.4                                   | 181.2                          | O K                                                                                 |
|                                                                   | 360 min Winter         | 24.170                       | 0.670                                          | 1.4                                   | 190.9                          | O K                                                                                 |
|                                                                   | 480 min Winter         | 24.181                       | 0.681                                          | 1.4                                   | 194.0                          | O K                                                                                 |
|                                                                   | 600 min Winter         | 24.179                       | 0.679                                          | 1.4                                   | 193.4                          | O K                                                                                 |
|                                                                   | 720 min Winter         | 24.169                       | 0.669                                          | 1.4                                   | 190.7                          | O K                                                                                 |
|                                                                   | 960 min Winter         | 24.147                       | 0.647                                          | 1.4                                   | 184.4                          | O K                                                                                 |
|                                                                   | 1440 min Winter        | 24.089                       | 0.589                                          | 1.4                                   | 167.8                          | O K                                                                                 |
|                                                                   | 2160 min Winter        | 23.994                       | 0.494                                          | 1.4                                   | 140.8                          | O K                                                                                 |
|                                                                   | 2880 min Winter        | 23.903                       | 0.403                                          | 1.4                                   | 115.0                          | O K                                                                                 |
|                                                                   | 4320 min Winter        | 23.744                       | 0.244                                          | 1.3                                   | 69.5                           | O K                                                                                 |
|                                                                   | 5760 min Winter        | 23.624                       | 0.124                                          | 1.3                                   | 35.4                           | O K                                                                                 |
|                                                                   | 7200 min Winter        | 23.554                       | 0.054                                          | 1.3                                   | 15.4                           | O K                                                                                 |
|                                                                   | 8640 min Winter        | 23.536                       | 0.036                                          | 0.9                                   | 10.2                           | O K                                                                                 |
|                                                                   | 10080 min Winter       | 23.522                       | 0.022                                          | 0.6                                   | 6.2                            | O K                                                                                 |
|                                                                   | <b>Storm<br/>Event</b> | <b>Rain<br/>(mm/hr)</b>      | <b>Flooded<br/>Volume<br/>(m³)</b>             | <b>Time-Peak<br/>(mins)</b>           |                                |                                                                                     |
|                                                                   | 8640 min Summer        | 1.350                        | 0.0                                            | 4592                                  |                                |                                                                                     |
|                                                                   | 10080 min Summer       | 1.198                        | 0.0                                            | 5248                                  |                                |                                                                                     |
|                                                                   | 15 min Winter          | 127.747                      | 0.0                                            | 34                                    |                                |                                                                                     |
|                                                                   | 30 min Winter          | 86.691                       | 0.0                                            | 46                                    |                                |                                                                                     |
|                                                                   | 60 min Winter          | 56.129                       | 0.0                                            | 74                                    |                                |                                                                                     |
|                                                                   | 120 min Winter         | 35.009                       | 0.0                                            | 130                                   |                                |                                                                                     |
|                                                                   | 180 min Winter         | 26.112                       | 0.0                                            | 188                                   |                                |                                                                                     |
|                                                                   | 240 min Winter         | 21.070                       | 0.0                                            | 246                                   |                                |                                                                                     |
|                                                                   | 360 min Winter         | 15.587                       | 0.0                                            | 360                                   |                                |                                                                                     |
|                                                                   | 480 min Winter         | 12.563                       | 0.0                                            | 472                                   |                                |                                                                                     |
|                                                                   | 600 min Winter         | 10.618                       | 0.0                                            | 578                                   |                                |                                                                                     |
|                                                                   | 720 min Winter         | 9.248                        | 0.0                                            | 674                                   |                                |                                                                                     |
|                                                                   | 960 min Winter         | 7.430                        | 0.0                                            | 762                                   |                                |                                                                                     |
|                                                                   | 1440 min Winter        | 5.446                        | 0.0                                            | 1066                                  |                                |                                                                                     |
|                                                                   | 2160 min Winter        | 3.982                        | 0.0                                            | 1516                                  |                                |                                                                                     |
|                                                                   | 2880 min Winter        | 3.185                        | 0.0                                            | 1936                                  |                                |                                                                                     |
|                                                                   | 4320 min Winter        | 2.319                        | 0.0                                            | 2692                                  |                                |                                                                                     |
|                                                                   | 5760 min Winter        | 1.852                        | 0.0                                            | 3352                                  |                                |                                                                                     |
|                                                                   | 7200 min Winter        | 1.556                        | 0.0                                            | 3880                                  |                                |                                                                                     |
|                                                                   | 8640 min Winter        | 1.350                        | 0.0                                            | 4584                                  |                                |                                                                                     |
|                                                                   | 10080 min Winter       | 1.198                        | 0.0                                            | 5464                                  |                                |                                                                                     |
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|                                                    |                                                |                                                                                     |
|----------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------|
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| 91 King Street<br>Maidstone<br>Kent ME14 1BQ       | GTR Fontwell<br><br>Indicative Drainage Design |  |
| Date 30/01/2020<br>File 15104 Drainage system c... | Designed by DPM<br>Checked by                  |                                                                                     |
| Causeway<br>Source Control 2017.1.2                |                                                |                                                                                     |

Cascade Rainfall Details for 15104 Soakaway cascade.SRCX

|                       |                   |                       |       |
|-----------------------|-------------------|-----------------------|-------|
| Rainfall Model        | FSR               | Winter Storms         | Yes   |
| Return Period (years) | 100               | Cv (Summer)           | 0.750 |
| Region                | England and Wales | Cv (Winter)           | 0.840 |
| M5-60 (mm)            | 19.800            | Shortest Storm (mins) | 15    |
| Ratio R               | 0.330             | Longest Storm (mins)  | 10080 |
| Summer Storms         | Yes               | Climate Change %      | +40   |

Time Area Diagram

Total Area (ha) 0.000

| Time (mins) | Area     |
|-------------|----------|
| From:       | To: (ha) |
| 0           | 4 0.000  |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------|-----------|------------------------|-----------------------------|-----------|------------------------|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|--|--|
| 91 King Street<br>Maidstone<br>Kent ME14 1BQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GTR Fontwell<br><br>Indicative Drainage Design |  |           |                        |                             |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
| Date 30/01/2020<br>File 15104 Drainage system c...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Designed by DPM<br>Checked by                  |                                                                                     |           |                        |                             |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
| Causeway Source Control 2017.1.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                |                                                                                     |           |                        |                             |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
| <p align="center"><u>Cascade Model Details for 15104 Soakaway cascade.SRCX</u></p> <p align="center">Storage is Online Cover Level (m) 25.000</p> <p align="center"><u>Cellular Storage Structure</u></p> <p align="center">Invert Level (m) 23.500 Safety Factor 2.0<br/> Infiltration Coefficient Base (m/hr) 0.03000 Porosity 0.95<br/> Infiltration Coefficient Side (m/hr) 0.03000</p> <table border="1"> <thead> <tr> <th>Depth (m)</th> <th>Area (m<sup>2</sup>)</th> <th>Inf. Area (m<sup>2</sup>)</th> <th>Depth (m)</th> <th>Area (m<sup>2</sup>)</th> <th>Inf. Area (m<sup>2</sup>)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>300.0</td> <td>300.0</td> <td>1.200</td> <td>429.0</td> <td>355.6</td> </tr> <tr> <td>0.800</td> <td>300.0</td> <td>355.4</td> <td>1.500</td> <td>515.0</td> <td>355.7</td> </tr> <tr> <td>0.801</td> <td>300.0</td> <td>355.5</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> |                                                |                                                                                     | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) | 0.000 | 300.0 | 300.0 | 1.200 | 429.0 | 355.6 | 0.800 | 300.0 | 355.4 | 1.500 | 515.0 | 355.7 | 0.801 | 300.0 | 355.5 |  |  |  |
| Depth (m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Area (m <sup>2</sup> )                         | Inf. Area (m <sup>2</sup> )                                                         | Depth (m) | Area (m <sup>2</sup> ) | Inf. Area (m <sup>2</sup> ) |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
| 0.000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 300.0                                          | 300.0                                                                               | 1.200     | 429.0                  | 355.6                       |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
| 0.800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 300.0                                          | 355.4                                                                               | 1.500     | 515.0                  | 355.7                       |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
| 0.801                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 300.0                                          | 355.5                                                                               |           |                        |                             |           |                        |                             |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |  |  |  |
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