

## Memo

To: Robert Griffin - Manchester City Council (robert.griffin@manchester.gov.uk)

|       |                  |        |                                   |
|-------|------------------|--------|-----------------------------------|
| From: | Alan Beningfield | Email: | alan.beningfield@atkinsglobal.com |
| Date: | January 2022     | Phone: | 01925 238000                      |

Ref: 46-10w\_Correspondence\_409-07-004-B  
Your reference: 126283/FO/2020 & CDN/21/0503

Subject: St Anthony's CPS – Drainage Memo – Rev C

**Application number:** 126283/FO/2020

**Proposal:** Erection of a detached single storey multi-functional teaching block, with associated welfare facilities, creation of new 40 space car parking and associated 6-metre-high lighting columns, access road and vehicular access from Culmere Road and installation of a Multi-Use Games Area.

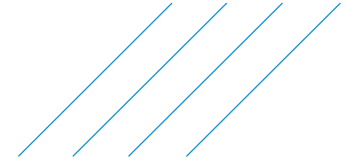
**Location:** St Anthony's RC Primary School, Dunkery Road, Manchester, M22 0NT.

Robert,

Further to your previous correspondence (reference: Re: 46-10w - St Anthony's CPS\_ CDN/21/0503) please see below further updated information relating to the surface and foul drainage proposals for the above development. The previous proposal allowed for attenuating the surface water within an attenuation layer directly beneath the permeable car park surface layer. Following the last communication regarding the attenuation of the surface water beneath the car park surface further intrusive investigations were undertaken to validate. These investigations identified localised areas of un-suitable infiltration ground (clay deposits near the surface). Therefore, a series of increased depth investigations and percolation tests were undertaken, copies of these results are attached (reference: 46-10w\_Percolation Test Records CP). The proposed strategy has been revised accordingly to account for these deposits and re-modelled following the same infiltration principles; details of which are outlined below and we now believe that this satisfies the requirements; demonstrated by hydraulic modelling; of managing the surface water on site without the requirement to connect to the existing network within the tolerances; storm events and climate change increases prescribed.

The previously submitted United Utilities correspondence details the discussions held with the utilities body regarding the existing water main and public sewer which traverses the site and proposed development area. As requested by United Utilities localised investigations were undertaken to determine the depth and diameter of the water main asset. The depth, diameter and invert levels for the public sewer were determined by observations of the existing manholes / inspection chambers on site. These details were confirmed back to them. As per the previously submitted correspondence they have confirmed that there are no loading issues with the proposals, though they have highlighted that any proposed services traversing the assets and work in the vicinity should be in accordance with their 'Standard Condition for Works Adjacent to Pipelines' which have been provided for reference.

As per the previous correspondence the existing private drainage network has been surveyed and inspected via CCTV survey. The schematic layouts are contained on application layouts. A copy of the CCTV survey and associated report can be provided upon request if required. The results indicate that the existing on-site private network comprises a combined surface and foul water system; primarily 100mm diameter and comprising a combination of vitrified clay and polyvinyl chloride pipe work. The network to the north-east of the site in the vicinity on the proposed development captures the foul and surface water from the Year 6 Accommodation block standalone extension constructed in 2015. Various foul connections in the east of the schools (WC's and kitchen facilities) and various surface water connections in the locality (surface gullies, linear drainage, and main school building roof discharges). The above detailed existing combined private network collates at the north of the site the continues along the front elevation the main school building and it is assumed that this connects into the 225mm combined public sewer owned by United Utilities on Dunkery Road at the west of the site. Utility supplier searches have been undertaken for the vicinity of the proposed development. Copies of these (affected and not affected) searches can be supplied upon request. Local utility mapping has also been undertaken by electromagnetic and ground penetrating radar searches, these searches have also been overlaid onto the proposals. The existing surface water connections on site in the vicinity of the works will not



be affected by the proposed development; the proposals being constructed on an existing area of utility soft landscaped land. The proposed foul drainage provisions for the new build accommodation will connect into the existing combined private network at the north of the site towards then end of the network prior to connection to the public network as submitted previously. The existing private network is considered to have adequate capacity for the additional foul drainage connections taking into account the proposed provisions and projected occupancy rate. The CCTV survey undertaken has identified localised defects (i.e. displaced joints and encrusted scaling) which will be addressed as part of the development and future planned maintenance programmes.

The proposed development site is within Flood Zone 1 (<https://flood-map-for-planning.service.gov.uk/>), and therefore low risk. There are no watercourses, ponds etc. in the local vicinity. The design of the proposed surface drainage system has been undertaken in-line with the requirements and recommendations of the site standards relevant to a low flood risk site. The proposed strategy looks to utilise infiltration for surface water and contain the surface water on site rather than discharging into to the existing combined private network and subsequent public combined network in line with the Building Regulations Approved Document H with the design being undertaken in accordance with CIRIA C753 (SuDS Manual):

- *Surface water drainage should discharge to a soakaway or other infiltration system where practicable.*
- *Discharge to a watercourse may require a consent from the Environment Agency, who may limit the rate of discharge. Maximum flow rates can be limited by provision of detention basins.*
- *Where other forms of outlet are not practicable, discharge should be made to a sewer.*

As per our initial pre-application discussions regarding the proposals, a soakaway and / or other infiltration route was the preferred methodology and that a sustainable drainage solution should be pursued. Site investigations have been undertaken to support the infiltration route along with modelling; copies of the percolation testing to support the proposed strategy are appended to this document. There are no watercourses in the vicinity that would allow off site discharge. And the discharge of surface water into the existing combined private network and subsequent public network was to be avoided and mitigated if viable.

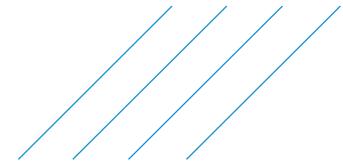
The Ground Investigation Survey was undertaken in April 2020 to determine ground conditions and risk of contamination assessment. A copy of the report has been submitted under a separate cover previously. The ground investigation detailed within the above referenced report generally identified topsoil and made ground to depths of between 0.50m and 0.60m below the existing ground level underlain by sandy and gravelly material to depths of between 1.10m and 2.80m below ground level. Peaty soils were also encountered (WS05). Weathered mudstone and sandstone were encountered underlying the clay and penetrated to a maximum depth of 3.45m below ground level. Window Samples WS01 through WS02 were undertaken in the location of the proposed New Build Accommodation results of which are contained within Appendix 2 of the Ground Investigation Report. Trial Pits TP3 and TP04 were undertaken in the location of the proposed Car Park; results of which are contained within Appendix 2 of the Ground Investigation Report. The percolation test appended to this document have been undertaken where possible to tie in with these previous locations.

The Report on Ground Conditions Investigations noted that *'No definite groundwater strikes were observed in the exploratory holes during the investigation'* to the depths identified ranging between 2.5 and 3.45m depths. The latest site investigations supported this with no further groundwater strikes observed. The existing area is currently grassed bounded by substantial hedge vegetation and mature trees. Historically this area has been well drained and there have not been occurrences of surface water pooling or the existing grassed area being waterlogged this has also been supported by observations during the period since the proposals have been developed.

The proposed development is located at the downstream end of the private combined network; it is not intended to connect surface water captured from the development directly into this network. However, the existing linear surface drainage to the west of the proposed accommodation block will be retained and utilised to capture surface water around the building from existing and proposed building perimeter hard standing. As detailed on the enclosed plans; considering the existing and proposed finished surface levels the overland flow routes for ground surface water to the building perimeter will be directed and fall to the existing linear drain to the west of the unit.

The existing surface water connections from the previous new-build Year 6 Block constructed in 2015 which already discharge un-attenuated into the existing private network will be retained; albeit a number of inspection chambers will be modified to accommodate the change in surrounding surface material (i.e. soft landscaping to hard landscaping).

The surface water collected by the proposed hipped tiled roof for the accommodation block have been sized based on the guidance provided within Building Regulations Approved Document H. The maximum roof area to be drained to single gutter has been calculated to be 61m<sup>2</sup> (plan area 47.5m<sup>2</sup> x 1.29 for pitched roofs up to 30° pitch); therefore, allowances have been included for 125mm half round gutters laid to falls to the indicated drop points allowing a flow capacity of 1.37l/s. These vertical drop points will be served with 75mm diameter outlets connected into surface gullies.



As detailed on the attached plans (0022) the surface water captured by the roof will be collected and distributed by a new local surface water drainage network.

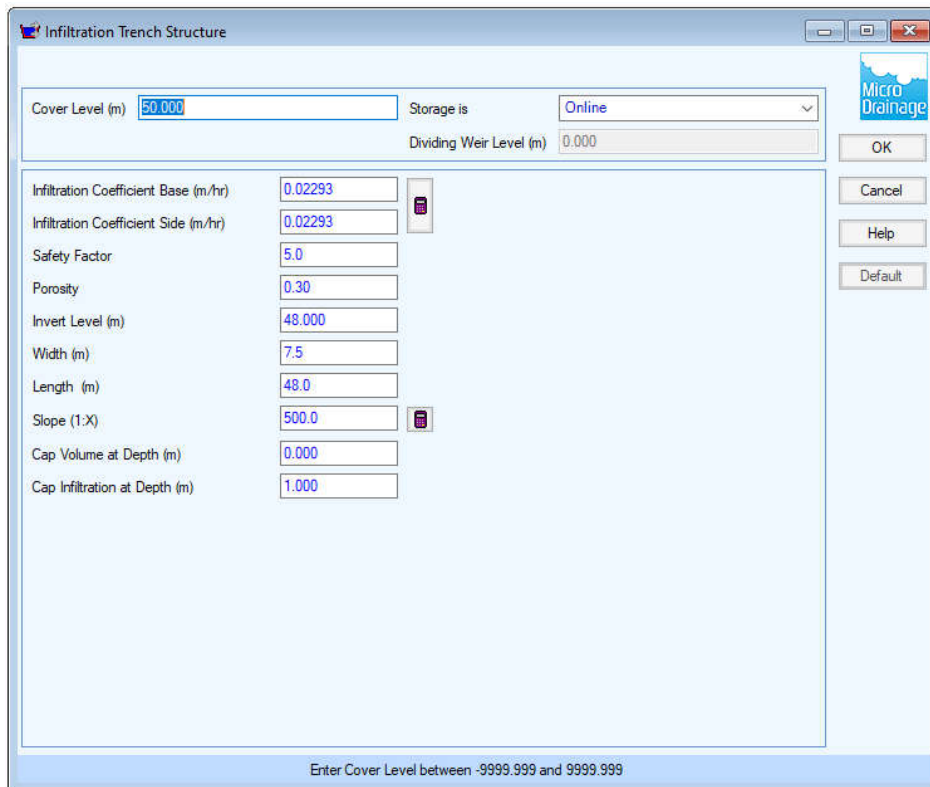
#### Modelled Drainage Strategy

The proposed development has been hydraulically modelled using MicroDrainage software in order to support the proposed methodology and simulate the various events including the 1 in 1 year, 1 in 30 year and 1 in 100 year events (plus 40% climate change). Based upon the modelling and the testing results obtained it is proposed to modify the proposed strategy for the development as outlined below. The proposed car park and building is to be drained via infiltration following the drainage hierarchy of infiltration first, in accordance with CIRIA C753. Further infiltration tests (appended) have been undertaken and provided an average infiltration rate of  $6.76 \times 10^{-6}$  m/s. Additionally, Ground Information (GI) has been investigated in the proposed infiltration locations indicating suitable strata, infiltration rates and sufficient unsaturated zone (at least 1m between infiltration level and groundwater level). Simulation has considered full impermeable contributing area from both the building and car park layout feeding into the drainage system. The proposed drainage system consists of an infiltration layer constructed within the car park footprint which provides an opportunity to infiltrate into ground. This design has been undertaken in accordance with CIRIA C753 (SuDS Manual), as such a number of considerations have been factored into the design, these being:

- No infiltration to occur within 5m of any building footprints/foundations to avoid risk of undermining any structures.
- Factor of Safety of 5 applied to the trench design in accordance with CIRIA C753.

The design parameters upon which the simulation models have been based are outlined below:

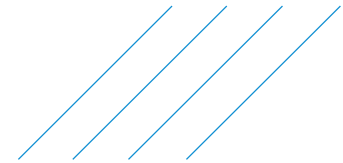
- M5-60 = 18.00 mm/h
- R = 0.37
- Car park area = 1216m<sup>2</sup>
- Building & path footprint = 527 m<sup>2</sup>
- Total area drained = 1744m<sup>2</sup> (0.174 ha)
- Soil infiltration rate –  $6.37 \times 10^{-6}$  m/s
- Soil infiltration rate – 0.022932 m/hr



| Parameter                            | Value   |
|--------------------------------------|---------|
| Cover Level (m)                      | 50.000  |
| Storage is                           | Online  |
| Dividing Weir Level (m)              | 0.000   |
| Infiltration Coefficient Base (m/hr) | 0.02293 |
| Infiltration Coefficient Side (m/hr) | 0.02293 |
| Safety Factor                        | 5.0     |
| Porosity                             | 0.30    |
| Invert Level (m)                     | 48.000  |
| Width (m)                            | 7.5     |
| Length (m)                           | 48.0    |
| Slope (1:X)                          | 500.0   |
| Cap Volume at Depth (m)              | 0.000   |
| Cap Infiltration at Depth (m)        | 1.000   |

Enter Cover Level between -9999.999 and 9999.999

Figure 1.0 - Source Control design parameters for infiltration layer (NB – length is as 48m for modelling purposes, in actuality this will comprise an infiltration layer footprint of equivalent area).



The previously outlined schematic design in Figure 1.0 for the proposed infiltration trenches will be constructed beneath the proposed car park layer in line with the depths provided within the infiltration testing results indicating suitable infiltration rates. Initially concrete ring soakaways were considered; however were discounted due to the limited area of infiltration out of the rings into the filter media which was affecting the half-drain times. To counteract this, the area of infiltration was increased through the use of an infiltration layer beneath the car park footprint which will also reduce the depths of excavations required. The surface collection design will consist of linear slot drains and surface gully's which then feed into the vertical catchment chambers which will convey the runoff vertically down into the infiltration layer. The infiltration layer will provide an area as detailed within the parameter outlined in Figure 1.0 (1m nominal layer depth) based on a porosity value of 0.3 beneath the car park surface footprint to allow the attenuation and dispersal of the collated surface water. A 150mm horizontal connector pipe will be provided to connect the proposed areas of infiltration layers beneath the car park where physical separation between defined infiltration areas is present.

The infiltration layer will be fed through a system of preformed vertical proprietary catchment chambers to channel water from the upper car park surface down into the infiltration layer area below. A 150mm perforated pipe will be laid within the layer to allow for adequate diffusion of runoff throughout the whole of the filter media to ensure maximum potential for infiltration within the layer.

#### Hydraulic Model Results

| Summary of Results for 30 year Return Period (+40%) |              |                         |                     |               |                     |                      |                     |                     |        |
|-----------------------------------------------------|--------------|-------------------------|---------------------|---------------|---------------------|----------------------|---------------------|---------------------|--------|
| Half Drain Time : 1377 minutes.                     |              |                         |                     |               |                     |                      |                     |                     |        |
| Storm Event                                         | Rain (mm/hr) | Time to Vol Peak (mins) | Max Water Level (m) | Max Depth (m) | Flooded Volume (m³) | Max Filtration (l/s) | Σ Max Outflow (l/s) | Maximum Volume (m³) | Status |
| 15 min Summer                                       | 92.729       | 23                      | 48.323              | 0.323         | 0.0                 | 0.5                  | 0.5                 | 29.7                | O K    |
| 30 min Summer                                       | 61.202       | 37                      | 48.409              | 0.409         | 0.0                 | 0.5                  | 0.5                 | 39.0                | O K    |
| 60 min Summer                                       | 38.715       | 68                      | 48.500              | 0.500         | 0.0                 | 0.5                  | 0.5                 | 48.8                | O K    |
| 120 min Summer                                      | 23.811       | 126                     | 48.592              | 0.592         | 0.0                 | 0.5                  | 0.5                 | 58.7                | O K    |
| 180 min Summer                                      | 17.739       | 186                     | 48.644              | 0.644         | 0.0                 | 0.5                  | 0.5                 | 64.3                | O K    |
| 240 min Summer                                      | 14.335       | 246                     | 48.678              | 0.678         | 0.0                 | 0.5                  | 0.5                 | 68.0                | O K    |
| 360 min Summer                                      | 10.551       | 364                     | 48.718              | 0.718         | 0.0                 | 0.6                  | 0.6                 | 72.3                | O K    |
| 480 min Summer                                      | 8.490        | 484                     | 48.742              | 0.742         | 0.0                 | 0.6                  | 0.6                 | 74.9                | O K    |
| 600 min Summer                                      | 7.169        | 602                     | 48.755              | 0.755         | 0.0                 | 0.6                  | 0.6                 | 76.4                | O K    |
| 720 min Summer                                      | 6.241        | 722                     | 48.762              | 0.762         | 0.0                 | 0.6                  | 0.6                 | 77.1                | O K    |
| 960 min Summer                                      | 5.011        | 960                     | 48.763              | 0.763         | 0.0                 | 0.6                  | 0.6                 | 77.2                | O K    |
| 1440 min Summer                                     | 3.674        | 1210                    | 48.746              | 0.746         | 0.0                 | 0.6                  | 0.6                 | 75.4                | O K    |
| 2160 min Summer                                     | 2.690        | 1580                    | 48.717              | 0.717         | 0.0                 | 0.6                  | 0.6                 | 72.2                | O K    |
| 2880 min Summer                                     | 2.155        | 1992                    | 48.687              | 0.687         | 0.0                 | 0.5                  | 0.5                 | 69.1                | O K    |
| 4320 min Summer                                     | 1.575        | 2812                    | 48.631              | 0.631         | 0.0                 | 0.5                  | 0.5                 | 62.9                | O K    |
| 5760 min Summer                                     | 1.260        | 3632                    | 48.577              | 0.577         | 0.0                 | 0.5                  | 0.5                 | 57.1                | O K    |
| 7200 min Summer                                     | 1.059        | 4400                    | 48.524              | 0.524         | 0.0                 | 0.5                  | 0.5                 | 51.5                | O K    |
| 8640 min Summer                                     | 0.919        | 5192                    | 48.476              | 0.476         | 0.0                 | 0.5                  | 0.5                 | 46.2                | O K    |
| 10080 min Summer                                    | 0.814        | 5952                    | 48.430              | 0.430         | 0.0                 | 0.5                  | 0.5                 | 41.2                | O K    |
| 15 min Winter                                       | 92.729       | 23                      | 48.357              | 0.357         | 0.0                 | 0.5                  | 0.5                 | 33.4                | O K    |
| 30 min Winter                                       | 61.202       | 37                      | 48.454              | 0.454         | 0.0                 | 0.5                  | 0.5                 | 43.8                | O K    |
| 60 min Winter                                       | 38.715       | 66                      | 48.556              | 0.556         | 0.0                 | 0.5                  | 0.5                 | 54.9                | O K    |
| 120 min Winter                                      | 23.811       | 124                     | 48.661              | 0.661         | 0.0                 | 0.5                  | 0.5                 | 66.2                | O K    |
| 180 min Winter                                      | 17.739       | 182                     | 48.721              | 0.721         | 0.0                 | 0.6                  | 0.6                 | 72.7                | O K    |
| 240 min Winter                                      | 14.335       | 242                     | 48.761              | 0.761         | 0.0                 | 0.6                  | 0.6                 | 77.0                | O K    |
| 360 min Winter                                      | 10.551       | 358                     | 48.810              | 0.810         | 0.0                 | 0.6                  | 0.6                 | 82.3                | O K    |
| 480 min Winter                                      | 8.490        | 474                     | 48.841              | 0.841         | 0.0                 | 0.6                  | 0.6                 | 85.6                | O K    |
| 600 min Winter                                      | 7.169        | 590                     | 48.860              | 0.860         | 0.0                 | 0.6                  | 0.6                 | 87.7                | O K    |
| 720 min Winter                                      | 6.241        | 704                     | 48.871              | 0.871         | 0.0                 | 0.6                  | 0.6                 | 88.9                | O K    |
| 960 min Winter                                      | 5.011        | 928                     | 48.880              | 0.880         | 0.0                 | 0.6                  | 0.6                 | 89.9                | O K    |
| 1440 min Winter                                     | 3.674        | 1356                    | 48.868              | 0.868         | 0.0                 | 0.6                  | 0.6                 | 88.5                | O K    |
| 2160 min Winter                                     | 2.690        | 1688                    | 48.829              | 0.829         | 0.0                 | 0.6                  | 0.6                 | 84.3                | O K    |
| 2880 min Winter                                     | 2.155        | 2160                    | 48.789              | 0.789         | 0.0                 | 0.6                  | 0.6                 | 80.0                | O K    |
| 4320 min Winter                                     | 1.575        | 3068                    | 48.704              | 0.704         | 0.0                 | 0.6                  | 0.6                 | 70.8                | O K    |
| 5760 min Winter                                     | 1.260        | 3928                    | 48.620              | 0.620         | 0.0                 | 0.5                  | 0.5                 | 61.8                | O K    |
| 7200 min Winter                                     | 1.059        | 4760                    | 48.541              | 0.541         | 0.0                 | 0.5                  | 0.5                 | 53.3                | O K    |
| 8640 min Winter                                     | 0.919        | 5544                    | 48.467              | 0.467         | 0.0                 | 0.5                  | 0.5                 | 45.3                | O K    |
| 10080 min Winter                                    | 0.814        | 6352                    | 48.400              | 0.400         | 0.0                 | 0.5                  | 0.5                 | 38.0                | O K    |

Figure 2.0 – 30-year + 40% climate change simulation results.



**Summary of Results for 100 year Return Period (+40%)**

Half Drain Time : 1780 minutes.

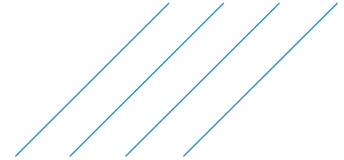
| Storm Event      | Rain (mm/hr) | Time to Vol Peak (mins) | Max Water Level (m) | Max Depth (m) | Flooded Volume (m³) | Max Filtration (l/s) | Σ Max Outflow (l/s) | Maximum Volume (m³) | Status |
|------------------|--------------|-------------------------|---------------------|---------------|---------------------|----------------------|---------------------|---------------------|--------|
| 15 min Summer    | 119.757      | 23                      | 48.405              | 0.405         | 0.0                 | 0.5                  | 0.5                 | 38.5                | O K    |
| 30 min Summer    | 79.807       | 38                      | 48.521              | 0.521         | 0.0                 | 0.5                  | 0.5                 | 51.1                | O K    |
| 60 min Summer    | 50.812       | 68                      | 48.645              | 0.645         | 0.0                 | 0.5                  | 0.5                 | 64.5                | O K    |
| 120 min Summer   | 31.320       | 126                     | 48.772              | 0.772         | 0.0                 | 0.6                  | 0.6                 | 78.2                | O K    |
| 180 min Summer   | 23.299       | 186                     | 48.843              | 0.843         | 0.0                 | 0.6                  | 0.6                 | 85.9                | O K    |
| 240 min Summer   | 18.779       | 246                     | 48.889              | 0.889         | 0.0                 | 0.6                  | 0.6                 | 90.8                | O K    |
| 360 min Summer   | 13.732       | 366                     | 48.943              | 0.943         | 0.0                 | 0.6                  | 0.6                 | 96.7                | O K    |
| 480 min Summer   | 11.005       | 484                     | 48.978              | 0.978         | 0.0                 | 0.6                  | 0.6                 | 100.4               | O K    |
| 600 min Summer   | 9.261        | 604                     | 48.999              | 0.999         | 0.0                 | 0.6                  | 0.6                 | 102.7               | O K    |
| 720 min Summer   | 8.039        | 722                     | 49.012              | 1.012         | 0.0                 | 0.6                  | 0.6                 | 104.1               | O K    |
| 960 min Summer   | 6.425        | 962                     | 49.021              | 1.021         | 0.0                 | 0.6                  | 0.6                 | 105.1               | O K    |
| 1440 min Summer  | 4.677        | 1348                    | 49.004              | 1.004         | 0.0                 | 0.6                  | 0.6                 | 103.3               | O K    |
| 2160 min Summer  | 3.399        | 1708                    | 48.965              | 0.965         | 0.0                 | 0.6                  | 0.6                 | 99.0                | O K    |
| 2880 min Summer  | 2.706        | 2076                    | 48.926              | 0.926         | 0.0                 | 0.6                  | 0.6                 | 94.8                | O K    |
| 4320 min Summer  | 1.960        | 2900                    | 48.855              | 0.855         | 0.0                 | 0.6                  | 0.6                 | 87.2                | O K    |
| 5760 min Summer  | 1.557        | 3696                    | 48.790              | 0.790         | 0.0                 | 0.6                  | 0.6                 | 80.2                | O K    |
| 7200 min Summer  | 1.302        | 4536                    | 48.729              | 0.729         | 0.0                 | 0.6                  | 0.6                 | 73.5                | O K    |
| 8640 min Summer  | 1.124        | 5352                    | 48.670              | 0.670         | 0.0                 | 0.5                  | 0.5                 | 67.2                | O K    |
| 10080 min Summer | 0.993        | 6144                    | 48.615              | 0.615         | 0.0                 | 0.5                  | 0.5                 | 61.3                | O K    |
| 15 min Winter    | 119.757      | 23                      | 48.448              | 0.448         | 0.0                 | 0.5                  | 0.5                 | 43.2                | O K    |
| 30 min Winter    | 79.807       | 37                      | 48.579              | 0.579         | 0.0                 | 0.5                  | 0.5                 | 57.4                | O K    |
| 60 min Winter    | 50.812       | 66                      | 48.719              | 0.719         | 0.0                 | 0.6                  | 0.6                 | 72.5                | O K    |
| 120 min Winter   | 31.320       | 124                     | 48.863              | 0.863         | 0.0                 | 0.6                  | 0.6                 | 88.0                | O K    |
| 180 min Winter   | 23.299       | 184                     | 48.945              | 0.945         | 0.0                 | 0.6                  | 0.6                 | 96.8                | O K    |
| 240 min Winter   | 18.779       | 242                     | 48.998              | 0.998         | 0.0                 | 0.6                  | 0.6                 | 102.7               | O K    |
| 360 min Winter   | 13.732       | 360                     | 49.063              | 1.063         | 0.0                 | 0.6                  | 0.6                 | 109.7               | O K    |
| 480 min Winter   | 11.005       | 476                     | 49.106              | 1.106         | 0.0                 | 0.6                  | 0.6                 | 114.3               | O K    |
| 600 min Winter   | 9.261        | 592                     | 49.135              | 1.135         | 0.0                 | 0.6                  | 0.6                 | 117.3               | O K    |
| 720 min Winter   | 8.039        | 708                     | 49.153              | 1.153         | 0.0                 | 0.6                  | 0.6                 | 119.4               | O K    |
| 960 min Winter   | 6.425        | 936                     | 49.173              | 1.173         | 0.0                 | 0.6                  | 0.6                 | 121.5               | O K    |
| 1440 min Winter  | 4.677        | 1384                    | 49.171              | 1.171         | 0.0                 | 0.6                  | 0.6                 | 121.3               | O K    |
| 2160 min Winter  | 3.399        | 1968                    | 49.122              | 1.122         | 0.0                 | 0.6                  | 0.6                 | 116.0               | O K    |
| 2880 min Winter  | 2.706        | 2224                    | 49.073              | 1.073         | 0.0                 | 0.6                  | 0.6                 | 110.7               | O K    |
| 4320 min Winter  | 1.960        | 3156                    | 48.974              | 0.974         | 0.0                 | 0.6                  | 0.6                 | 100.0               | O K    |
| 5760 min Winter  | 1.557        | 4040                    | 48.878              | 0.878         | 0.0                 | 0.6                  | 0.6                 | 89.6                | O K    |
| 7200 min Winter  | 1.302        | 4904                    | 48.786              | 0.786         | 0.0                 | 0.6                  | 0.6                 | 79.7                | O K    |
| 8640 min Winter  | 1.124        | 5712                    | 48.699              | 0.699         | 0.0                 | 0.6                  | 0.6                 | 70.3                | O K    |
| 10080 min Winter | 0.993        | 6560                    | 48.618              | 0.618         | 0.0                 | 0.5                  | 0.5                 | 61.6                | O K    |

Figure 3.0 – 100-year + 40% climate change simulation results.

The design has been undertaken to withstand a 30-year rainfall event with an uplift of 40% added in accordance with scheme requirements for climate change. There is no flooding of the system up to and including a 100-year + 40% climate change event. Half-drain times are within the acceptable durations for the 30-year event and exceedances up to and including the 100-year + 40% climate change are managed within the proposed drainage design as there is no on-site flooding. CIRIA C753 sets out the requirement for infiltration-based structures to be able to drain 50% of the runoff generated by a storm event within 24 hours, or 1440mins, which Figure 2.0 demonstrates compliance with. The half drain times are greater for the 100-year + 40% climate change event; however, this is not the design event for the drainage system but does still demonstrate that exceedance flows between the 30-year and 100-year events will still be managed within the proposed system.

#### Summary

The proposed drainage design for the car park and building will consist of an infiltration-based approach through the use of an infiltration layer located directly beneath the car park footprint. The infiltration tests undertaken indicate that the rates for this area are in the region of  $1 \times 10^{-6}$  which indicate that it would be suitable for infiltration-based solutions. This has been confirmed through the hydraulic modelling of the proposed scheme with the calculated rates from testing undertaken on site. Concrete ring soakaways were discounted due to their poor ability to drain half empty within the time allowed within the CIRIA guidance (24h or 1440m) however a greater surface area of infiltration allowed by horizontal infiltration layer has mitigated this through design and increases the ability of the runoff to drain effectively. This avoids the need to connect back into a separate system or reliance on other bodies to accept runoff from the development and aligns with the drainage hierarchy of discharge approach as outlined in C753.



The above revised strategy is the preferred methodology based upon the hierarchy of options and the initial pre-application discussions held with the local authority planning service; the option to discharge surface water to a water course has been discounted due to no viable location being available.

As detailed within the previous simulation / modelling the proposed car park will utilise an impermeable asphalt system with falling surface water directed and collected to surface gulley's. This collection would then be transferred vertically to the infiltration layer for dispersal to the local ground media below. The proposed surface materials are considered neutral and will not contribute and contamination risk to the existing sub-strata and groundwater table. The proposed car park surface would not require any surface treatment or cleaning.

The above model simulation factors in the rainfall captured from the accommodation block being discharged and dispersed into the drainage system via the catchpits. The rainwater will be collected from the accommodation and routed to ground level via the previously prescribed rainwater goods. At ground level the run-off will be directed into back inlet gulley's. The run-off will then be discharged into a previously detailed system incorporating preformed silt trap prior to the outlet locations which will allow any silt / debris to be filtered prior to entry.

The existing on-site linear surface drainage is to be retained and will capture surface water landing on existing surfaces in the vicinity of the proposed structure. This combined with the cross falls to existing and proposed surfaces will direct surface water away from existing and proposed structures. As detailed above the surface water associated with the proposed development will be managed and contained within the system. There are no proposed sub-terranean structures (i.e. basements) associated with the development and there are no such structures in the local vicinity of the structure. All buildings on site being either single or two storey structures above existing ground level.

In terms of maintenance of the completed structures, access points to the system are provided at connections / directional changes to allow for future access and maintenance. Rodding points will also be incorporated into both the surface and foul network systems. The proposed new surface water network is to be installed with preformed silt traps prior to the inlet locations which will allow and silt / debris to be filtered prior to entry. As part of the on-going future maintenance of the development the site management team will be required to routinely clear these traps and maintain the system as well as ensuring gutters, gullies etc. are kept clear of detritus (i.e. leaves etc.) as part of their on-going site planned maintenance programme.