KEY

- SITE BOUNDARY
- INDICATIVE FOUL WATER SEWER
- INDICATIVE SURFACE WATER SEWER
- INDICATIVE PERMEABLE PAVING (30% VOIDS)
- ATTENUATION BASIN ITH 3m MAINTENANCE STRIP
- SURFACE WATER CONTROL CHAMBER
- INDICATIVE SURFACE WATER PUMP STATION
- INDICATIVE FOUL WATER PUMP STATION
- INDICATIVE FOUL WATER RISING MAIN
- EXISTING ANGLIAN WATER FOUL WATER SEWER
- ANGLIAN WATER SEWER EASEMENT
- INDICATIVE HEADWALL
- EXISTING WATERCOURSE
- INDICATIVE ATTENUATION TANK

N

A 127

ELLIOTS CLOSE

TILBURY ROAD

Dorset

East Hor
Hal

PLOT 4
14,190m2
3.51 acres

PLOT 3
6,232m2
1.54 acres

PLOT 5
11,430m2
2.82 acres

PLOT 1
19,615m2
4.84 acres

PLOT 7
10,850m2
2.68 acres

PLOT 2
6,764m2
1.67 acres

PLOT 6
12,657m2
3.13 acres

Building 1
Building 2
Building 3
Building 5
Building 6
Building 7
Building 8
Building 10

ATTENUATION BASIN WITH 3m MAINTENANCE STRIP AND 1 IN 4 SIDE SLOPES DEPTH 1.3m AREA 160m² CL 19.74 IL 18.44

PERMEABLE PAVING TYPE 3 SUB BASE 300mm EFFECTIVE STORAGE DEPTH (30% VOID RATIO)

GEO-CELLUALR ATTENUATION TANK VOLUME 152m³ (95% VOID RATIO) AREA 200m² DEPTH 0.8m CL 19.24 TOP OF TANK 18.74 IL 17.94

PERMEABLE PAVING TYPE 3 SUB BASE 300mm EFFECTIVE STORAGE DEPTH (30% VOID RATIO)

PERMEABLE PAVING TYPE 3 SUB BASE 300mm EFFECTIVE STORAGE DEPTH (30% VOID RATIO)

GEO-CELLUALR ATTENUATION TANK VOLUME 228m³ (95% VOID RATIO) AREA 300m² DEPTH 0.8m CL 18.10 TOP OF TANK 18.IL 17.30

ATTENUATION BASIN WITH 3m MAINTENANCE STRIP AND 1 IN 4 SIDE SLOPES DEPTH 1.3m AREA 740m² CL 17.05 IL 15.75

GEO-CELLUALR ATTENUATION TANK VOLUME 304m³ (95% VOID RATIO) AREA 400m² DEPTH 0.8m CL 17.05 TOP OF TANK 16.28 IL 15.48

ATTENUATION BASIN WITH 3m MAINTENANCE STRIP AND 1 IN 4 SIDE SLOPES DEPTH 1.3m AREA 1050m² CL 17.05 IL 15.75

ATTENUATION BASIN WITH 3m MAINTENANCE STRIP AND 1 IN 4 SIDE SLOPES DEPTH 1.3m AREA 442m² CL 17.05 IL 15.75

PERMEABLE PAVING TYPE 3 SUB BASE 300mm EFFECTIVE STORAGE DEPTH (30% VOID RATIO)

PRIVATE FOUL WATER PUMPING STATION CL 18.39 INCOMING IL 14.107

PERMEABLE PAVING TYPE 3 SUB BASE 300mm EFFECTIVE STORAGE DEPTH (30% VOID RATIO)

PRIVATE SURFACE WATER PUMPING STATION CL 16.25 INCOMING IL 12.74

ATTENUATION BASIN WITH 3m MAINTENANCE STRIP AND 1 IN 4 SIDE SLOPES DEPTH 1.3m AREA 940m² CL 16.25 IL 14.95

GEO-CELLUALR ATTENUATION TANK VOLUME 288m³ (95% VOID RATIO) AREA 300m² DEPTH 0.8m CL 17.00 TOP OF TANK 16.30 IL 15.50

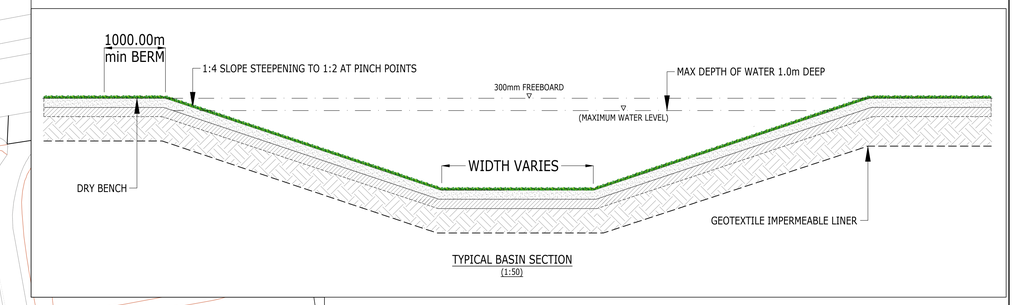
GEO-CELLUALR ATTENUATION TANK VOLUME 1368m³ (95% VOID RATIO) AREA 900m² DEPTH 1.6m CL 16.40 TOP OF TANK 14.94 IL 13.34

ATTENUATION BASIN WITH 3m MAINTENANCE STRIP AND 1 IN 4 SIDE SLOPES DEPTH 1.3m AREA 880m² CL 17.00 IL 15.50

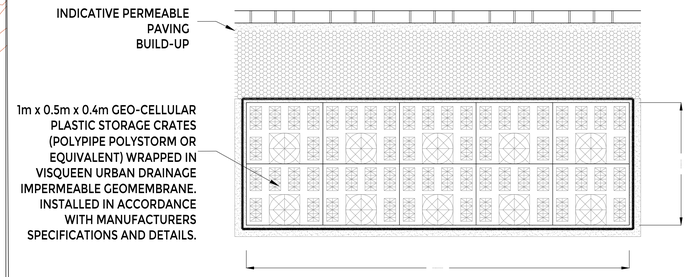
PERMEABLE PAVING TYPE 3 SUB BASE 300mm EFFECTIVE STORAGE DEPTH (30% VOID RATIO)

GEO-CELLUALR ATTENUATION TANK VOLUME 532m³ (95% VOID RATIO) AREA 700m² DEPTH 0.8m CL 16.74 TOP OF TANK 16.04 IL 15.24

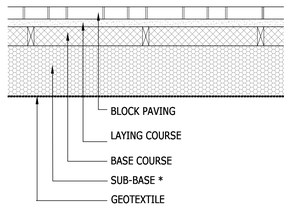





TYPICAL BASIN SECTION
(1:50)




CELLULAR ATTENUATION TANK CONSTRUCTION DETAILS
(1:25)




CONSTRUCTION SPECIFICATION FOR HEAVY DUTY PERMEABLE BLOCK PAVED AREAS
SCALE 1:20

PERMEABLE PAVING NOTES

LIGHT DUTY: SHOULD ONLY BE USED FOR SINGULAR OR DOUBLE DRIVES SERVING 1 OR 2 PLOTS - *NOT* SUITABLE FOR AREAS WHICH WILL BE SUBJECT TO CONSTRUCTION TRAFFIC OR POTENTIAL LOADING FROM HEAVY GOODS VEHICLES inc. DELIVERY, PANTECHNICON, REFUSE COLLECTION AND FIRE RESCUE VEHICLES

HEAVY DUTY: TO BE USED FOR *ALL* SHARED DRIVES, PARKING COURTS AND PRIVATE ACCESS ROADS

* THE FORMATION OF THE PERMEABLE PAVING SUB-BASE MUST NOT EXCEED A GRADIENT OF 1/40.

FOR STEEPER GRADIENTS, USE MAXIMUM GRADIENT OF 1/40 FOR FORMATION, APPLYING VERTICAL STEPS AS NECESSARY, BUT ENSURING MINIMUM SUB-BASE THICKNESS IS ALWAYS ACHIEVED.

PERMEABLE PAVING CONSTRUCTION SPECIFIED ABOVE IS SUITABLE FOR CBR VALUES OF BETWEEN 2% & 5%. FOR CBR VALUES OUTSIDE OF THIS RANGE, REFER BACK TO THE ENGINEER FOR CLARIFICATION.

ALL MATERIAL SPECIFICATION AND WORKMANSHIP OF PERMEABLE PAVING CONSTRUCTION TO BE STRICTLY IN ACCORDANCE WITH RECOMMENDATIONS BY MARSHALLS.

NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
2. DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
3. ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES UNLESS OTHERWISE STATED. ALL GROUND LEVELS ARE IN METRES ABOVE ORDNANCE DATUM (AOD).
4. ALL DIMENSIONS, LEVELS AND SURVEY GRID CO-ORDINATES ARE TO BE CHECKED ON SITE AND THE ENGINEER NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF THE WORKS. LEVELS ARE SUBJECT TO DETAILED EARTHWORKS AND LEVELS DESIGN.
5. THIS DRAWING HAS BEEN BASED ON DRAWING No. NWA-0503-A20-007 PRODUCED BY NICHOLAS WEBB ARCHITECTS.
6. EXISTING DRAINAGE AND UTILITIES TO BE CONFIRMED IN-SITU BY THE CONTRACTOR, PRIOR TO STARTING WORKS. EXISTING DRAINAGE SHOWN INDICATIVELY.
7. THE DRAINAGE STRATEGY IS INDICATIVE ONLY, TO DEMONSTRATE DESIGN INTENT AND REQUIREMENTS. DESIGN SUBJECT TO CHANGE AND DESIGN TEAM COORDINATION.
8. LOCATIONS OF EXISTING SEWERS HAVE BEEN TRANSCRIBED FROM ANGLIAN WATER SEWER RECORDS AND ARE TO BE CONFIRMED BY AN IN-SITU SURVEY.
9. PROPOSED SURFACE WATER DRAINAGE SYSTEM HAS BEEN DESIGNED UP TO THE 1 IN 100 YEAR RAINFALL EVENT + 40% FOR CLIMATE CHANGE.
10. PROPOSED DISCHARGE RATE OF 31.80 L/S BASED ON MEAN ANNUAL GREENFIELD RUNOFF RATE (QBAR).
11. PROPOSED SURFACE WATER PONDS TO BE DESIGNED (AT DETAILED DESIGN STAGE) AS PERMANENT WATER FEATURES IN COORDINATION WITH LANDSCAPE ARCHITECT.
12. PROPOSED FOUL WATER CONNECTION TO ANGLIAN WATER SEWERS TO BE CONFIRMED AT DETAILED DESIGN STAGE VIA SECTION 106 (WATER ACT) APPLICATION.

DRAFT

FOR INFORMATION ONLY

| Rev | Description | Drn | Chk | App | Date |
|---|---|---|---|---|---|

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Client: MM PROPERTIES (LONDON) LIMITED

Project Title: BROADFIELDS, EAST HORNDON, BRENTWOOD

Drawing Title: INDICATIVE SURFACE & FOUL WATER DRAINAGE STRATEGY

| A1 Scale | Date | Designed by |
|---|---|---|
| 1:1000 | 26.09.2021 | FH |
| Drawn by | Checked by | Approved by |
| FH | CC | BC |

Drawing Number: 2008543-001 Rev -

File Location: y:\ardent projects\2008543 - broadfields, east horndon, brentwood\technical\acad\drawings\2008541-001 indicative drainage strategy.dwg

**Appendix G**

Post-development hydraulic calculations

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

| | | | |
|---|---|---|---|
| Return Period (years) | 100 | PIMP (%) | 100 |
| M5-60 (mm) | 21.000 | Add Flow / Climate Change (%) | 0 |
| Ratio R | 0.439 | Minimum Backdrop Height (m) | 0.200 |
| Maximum Rainfall (mm/hr) | 50 | Maximum Backdrop Height (m) | 1.500 |
| Maximum Time of Concentration (mins) | 30 | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha) | 0.000 | Min Vel for Auto Design only (m/s) | 1.00 |
| Volumetric Runoff Coeff. | 0.750 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

### Time Area Diagram for Storm

| Time (mins) | Area (ha) | Time (mins) | Area (ha) | Time (mins) | Area (ha) |
|---|---|---|---|---|---|
| 0-4 | 1.428 | 4-8 | 3.914 | 8-12 | 0.681 |

Total Area Contributing (ha) = 6.022

Total Pipe Volume ($m^3$) = 132.470

### Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| 1.008 | | 15.270 | 12.475 | 0.000 | 0 | 0 |

## Online Controls for Storm

### Pump Manhole: 20, DS/PN: 1.008, Volume (m³): 7.9

Invert Level (m) 12.744

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.200 | 22.1000 | 1.000 | 22.1000 | 1.800 | 22.1000 | 2.600 | 22.1000 |
| 0.400 | 22.1000 | 1.200 | 22.1000 | 2.000 | 22.1000 | 2.800 | 22.1000 |
| 0.600 | 22.1000 | 1.400 | 22.1000 | 2.200 | 22.1000 | 3.000 | 22.1000 |
| 0.800 | 22.1000 | 1.600 | 22.1000 | 2.400 | 22.1000 | | |

## Storage Structures for Storm

### Porous Car Park Manhole: 1, DS/PN: 1.000

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 10.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 90.0 |
| Max Percolation (l/s) | 250.0 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 18.000 | Cap Volume Depth (m) | 0.300 |

### Complex Manhole: 3, DS/PN: 2.000

### Porous Car Park

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 10.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 70.0 |
| Max Percolation (l/s) | 194.4 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 17.295 | Cap Volume Depth (m) | 0.300 |

### Cellular Storage

| | | | |
|---|---|---|---|
| Invert Level (m) | 17.295 | Safety Factor | 2.0 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.95 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | | |

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 300.0 | 0.0 | 0.801 | 0.0 | 0.0 |
| 0.800 | 300.0 | 0.0 | | | |

### Tank or Pond Manhole: 4, DS/PN: 1.002

Invert Level (m) 18.440

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 12.9 | 1.300 | 164.0 |

### Tank or Pond Manhole: 6, DS/PN: 1.003

Invert Level (m) 18.440

## Tank or Pond Manhole: 6, DS/PN: 1.003

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 328.8 | 1.300 | 748.1 |

## Complex Manhole: 7, DS/PN: 4.000

### Cellular Storage

Invert Level (m) 15.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 400.0 | 0.0 | 0.801 | 0.0 | 0.0 |
| 0.800 | 400.0 | 0.0 | | | |

### Porous Car Park

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 10.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 55.0 |
| Max Percolation (l/s) | 152.8 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 16.550 | Cap Volume Depth (m) | 0.300 |

## Complex Manhole: 8, DS/PN: 1.004

### Tank or Pond

Invert Level (m) 15.750

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 507.5 | 1.300 | 1007.7 |

### Tank or Pond

Invert Level (m) 15.750

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 393.8 | 1.300 | 844.6 |

## Tank or Pond

Invert Level (m) 15.750

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 140.5 | 1.300 | 444.0 |

## Tank or Pond

Invert Level (m) 15.750

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 415.7 | 1.300 | 876.5 |

## Porous Car Park Manhole: 10, DS/PN: 6.000

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 50.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 60.0 |
| Max Percolation (l/s) | 833.3 | Slope (1:X) | 0.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 18.450 | Cap Volume Depth (m) | 0.300 |

## Complex Manhole: 11, DS/PN: 7.000

## Cellular Storage

| | | | |
|---|---|---|---|
| Invert Level (m) | 15.425 | Safety Factor | 2.0 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.95 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | | |

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 300.0 | 0.0 | 0.801 | 0.0 | 0.0 |
| 0.800 | 300.0 | 0.0 | | | |

## Porous Car Park

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 50.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 21.0 |
| Max Percolation (l/s) | 291.7 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 16.500 | Cap Volume Depth (m) | 0.300 |

## Complex Manhole: 13, DS/PN: 8.000

### Cellular Storage

| | | | |
|---|---|---|---|
| Invert Level (m) | 15.240 | Safety Factor | 2.0 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.95 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | | |

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 700.0 | 0.0 | 0.801 | 0.0 | 0.0 |
| 0.800 | 700.0 | 0.0 | | | |

### Porous Car Park

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 10.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 55.0 |
| Max Percolation (l/s) | 152.8 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 16.240 | Cap Volume Depth (m) | 0.300 |

## Porous Car Park Manhole: 15, DS/PN: 9.000

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 10.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 50.0 |
| Max Percolation (l/s) | 138.9 | Slope (1:X) | 0.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 16.500 | Membrane Depth (mm) | 0 |

## Porous Car Park Manhole: 16, DS/PN: 5.003

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.00000 | Width (m) | 11.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 67.0 |
| Max Percolation (l/s) | 204.7 | Slope (1:X) | 100.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.30 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 16.310 | Cap Volume Depth (m) | 0.300 |

## Cellular Storage Manhole: 18, DS/PN: 1.006

### Cellular Storage

| | | | |
|---|---|---|---|
| Invert Level (m) | 13.340 | Safety Factor | 2.0 |
| Infiltration Coefficient Base (m/hr) | 0.00000 | Porosity | 0.95 |
| Infiltration Coefficient Side (m/hr) | 0.00000 | | |

## Cellular Storage Manhole: 18, DS/PN: 1.006

| Depth (m) | Area (m²) | Inf. Area (m²) | Depth (m) | Area (m²) | Inf. Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 900.0 | 0.0 | 1.601 | 0.0 | 0.0 |
| 1.600 | 900.0 | 0.0 | | | |

## Tank or Pond Manhole: 20, DS/PN: 1.008

Invert Level (m) 14.950

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 466.1 | 1.300 | 949.1 |

## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 0.000 | | |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 13 |
| Number of Online Controls | 1 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls | 0 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Ratio R | 0.438 |
| Region | England and Wales | Cv (Summer) | 0.750 |
| M5-60 (mm) | 21.000 | Cv (Winter) | 0.840 |

| | | | |
|---|---|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 | DVD Status | ON |
| Analysis Timestep | Fine | Inertia Status | ON |
| DTS Status | OFF | | |

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 240, 360, 480, 960, 1440 |
| Return Period(s) (years) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 45 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 16.917 |
| 1.001 | 2 | 30 Winter | 1 | +0% | 30/15 Summer | | | | 16.331 |
| 2.000 | 3 | 30 Winter | 1 | +0% | 100/15 Summer | | | | 17.429 |
| 1.002 | 4 | 30 Winter | 1 | +0% | 30/15 Summer | | | | 16.169 |
| 3.000 | 5 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 17.840 |
| 1.003 | 6 | 30 Winter | 1 | +0% | 30/15 Summer | | | | 15.842 |
| 4.000 | 7 | 120 Winter | 1 | +0% | 30/60 Winter | | | | 15.570 |
| 1.004 | 8 | 30 Winter | 1 | +0% | 30/15 Summer | | | | 15.098 |
| 5.000 | 9 | 15 Winter | 1 | +0% | | | | | 17.267 |
| 6.000 | 10 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 17.631 |
| 7.000 | 11 | 240 Winter | 1 | +0% | 100/15 Summer | | | | 15.548 |
| 5.001 | 12 | 30 Winter | 1 | +0% | 1/15 Winter | | | | 15.262 |
| 8.000 | 13 | 120 Winter | 1 | +0% | 100/15 Summer | | | | 15.295 |
| 5.002 | 14 | 30 Winter | 1 | +0% | 1/15 Winter | | | | 15.156 |
| 9.000 | 15 | 30 Winter | 1 | +0% | 100/15 Winter | | | | 16.654 |
| 5.003 | 16 | 30 Winter | 1 | +0% | 1/15 Summer | | | | 15.050 |

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | -0.308 | 0.000 | 0.06 | | 5 | 8.4 | OK | |
| 1.001 | 2 | -0.310 | 0.000 | 0.07 | | | 9.2 | OK | |
| 2.000 | 3 | -0.241 | 0.000 | 0.28 | | 22 | 41.3 | OK | |
| 1.002 | 4 | -0.259 | 0.000 | 0.21 | | | 51.4 | OK | |
| 3.000 | 5 | -0.275 | 0.000 | 0.16 | | | 59.5 | OK | |
| 1.003 | 6 | -0.197 | 0.000 | 0.45 | | | 87.7 | OK | |
| 4.000 | 7 | -0.280 | 0.000 | 0.14 | | | 20.9 | OK | |
| 1.004 | 8 | -0.194 | 0.000 | 0.44 | | 12 | 94.6 | OK | |
| 5.000 | 9 | -0.328 | 0.000 | 0.04 | | | 13.6 | OK | |
| 6.000 | 10 | -0.194 | 0.000 | 0.45 | | 6 | 127.2 | OK | |
| 7.000 | 11 | -0.327 | 0.000 | 0.04 | | | 5.8 | OK | |
| 5.001 | 12 | 0.053 | 0.000 | 0.81 | | | 110.3 | SURCHARGED | |
| 8.000 | 13 | -0.320 | 0.000 | 0.05 | | 96 | 9.0 | OK | |
| 5.002 | 14 | 0.129 | 0.000 | 0.80 | | | 108.2 | SURCHARGED | |
| 9.000 | 15 | -0.296 | 0.000 | 0.10 | | | 28.3 | OK | |
| 5.003 | 16 | 0.301 | 0.000 | 0.61 | | 8 | 111.9 | SURCHARGED | |

## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.005 | 17 | 30 Winter | 1 | +0% | 1/15 Summer | | | | 14.890 |
| 1.006 | 18 | 360 Winter | 1 | +0% | 1/60 Summer | 100/360 Summer | | | 14.041 |
| 1.007 | 19 | 360 Winter | 1 | +0% | 1/15 Summer | | | | 14.308 |
| 1.008 | 20 | 360 Winter | 1 | +0% | 1/15 Summer | | | | 14.438 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.005 | 17 | 0.661 | 0.000 | 1.51 | | | 252.2 | SURCHARGED | |
| 1.006 | 18 | 0.326 | 0.000 | 0.26 | | 288 | 33.4 | SURCHARGED | |
| 1.007 | 19 | 0.845 | 0.000 | 0.14 | | | 26.6 | SURCHARGED | |
| 1.008 | 20 | 1.319 | 0.000 | 0.12 | | | 22.1 | SURCHARGED | |

## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 0.000 | | |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 13 |
| Number of Online Controls | 1 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls | 0 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Ratio R | 0.438 |
| Region | England and Wales | Cv (Summer) | 0.750 |
| M5-60 (mm) | 21.000 | Cv (Winter) | 0.840 |

| | | | |
|---|---|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 | DVD Status | ON |
| Analysis Timestep | Fine | Inertia Status | ON |
| DTS Status | OFF | | |

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 240, 360, 480, 960, 1440 |
| Return Period(s) (years) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 45 |

WARNING: Half Drain Time has not been calculated as the structure is too full.

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 16.973 |
| 1.001 | 2 | 30 Winter | 30 | +0% | 30/15 Summer | | | | 16.927 |
| 2.000 | 3 | 30 Winter | 30 | +0% | 100/15 Summer | | | | 17.561 |
| 1.002 | 4 | 30 Winter | 30 | +0% | 30/15 Summer | | | | 16.915 |
| 3.000 | 5 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 17.902 |
| 1.003 | 6 | 30 Winter | 30 | +0% | 30/15 Summer | | | | 16.697 |
| 4.000 | 7 | 60 Winter | 30 | +0% | 30/60 Winter | | | | 15.858 |
| 1.004 | 8 | 30 Winter | 30 | +0% | 30/15 Summer | | | | 15.809 |
| 5.000 | 9 | 15 Winter | 30 | +0% | | | | | 17.297 |
| 6.000 | 10 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 18.393 |
| 7.000 | 11 | 30 Winter | 30 | +0% | 100/15 Summer | | | | 15.822 |
| 5.001 | 12 | 15 Winter | 30 | +0% | 1/15 Winter | | | | 16.411 |
| 8.000 | 13 | 480 Winter | 30 | +0% | 100/15 Summer | | | | 15.574 |

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | -0.252 | 0.000 | 0.23 | | 7 | 33.4 | OK | |
| 1.001 | 2 | 0.286 | 0.000 | 0.19 | | | 26.5 | SURCHARGED | |
| 2.000 | 3 | -0.109 | 0.000 | 0.83 | | 16 | 123.9 | OK | |
| 1.002 | 4 | 0.487 | 0.000 | 0.65 | | | 158.8 | SURCHARGED | |
| 3.000 | 5 | -0.213 | 0.000 | 0.39 | | | 146.4 | OK | |
| 1.003 | 6 | 0.658 | 0.000 | 1.10 | | | 214.9 | SURCHARGED | |
| 4.000 | 7 | 0.008 | 0.000 | 0.83 | | 40 | 120.5 | SURCHARGED | |
| 1.004 | 8 | 0.517 | 0.000 | 0.75 | | 17 | 162.1 | SURCHARGED | |
| 5.000 | 9 | -0.298 | 0.000 | 0.09 | | | 33.4 | OK | |
| 6.000 | 10 | 0.568 | 0.000 | 0.92 | | 3 | 256.5 | SURCHARGED | |
| 7.000 | 11 | -0.053 | 0.000 | 0.53 | | 22 | 76.8 | OK | |
| 5.001 | 12 | 1.202 | 0.000 | 1.26 | | | 172.0 | SURCHARGED | |
| 8.000 | 13 | -0.041 | 0.000 | 0.10 | | 176 | 16.4 | OK | |

## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 5.002 | 14 | 15 Winter | 30 | +0% | 1/15 Winter | | | | 16.154 |
| 9.000 | 15 | 15 Winter | 30 | +0% | 100/15 Winter | | | | 16.745 |
| 5.003 | 16 | 15 Winter | 30 | +0% | 1/15 Summer | | | | 16.196 |
| 1.005 | 17 | 15 Winter | 30 | +0% | 1/15 Summer | | | | 15.872 |
| 1.006 | 18 | 480 Winter | 30 | +0% | 1/60 Summer | 100/360 Summer | | | 15.501 |
| 1.007 | 19 | 480 Winter | 30 | +0% | 1/15 Summer | | | | 15.395 |
| 1.008 | 20 | 480 Winter | 30 | +0% | 1/15 Summer | | | | 15.373 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 5.002 | 14 | 1.127 | 0.000 | 0.83 | | | 112.1 | SURCHARGED | |
| 9.000 | 15 | -0.205 | 0.000 | 0.41 | | 13 | 118.6 | OK | |
| 5.003 | 16 | 1.447 | 0.000 | 0.77 | | 35 | 142.4 | SURCHARGED | |
| 1.005 | 17 | 1.643 | 0.000 | 2.02 | | | 337.0 | SURCHARGED | |
| 1.006 | 18 | 1.786 | 0.000 | 0.60 | | | 76.3 | SURCHARGED | |
| 1.007 | 19 | 1.932 | 0.000 | 0.41 | | | 79.7 | SURCHARGED | |
| 1.008 | 20 | 2.254 | 0.000 | 0.12 | | | 22.1 | SURCHARGED | |

## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

### Simulation Criteria

| | | | |
|---|---|---|---|
| Areal Reduction Factor | 1.000 | Additional Flow - % of Total Flow | 0.000 |
| Hot Start (mins) | 0 | MADD Factor * 10m³/ha Storage | 2.000 |
| Hot Start Level (mm) | 0 | Inlet Coeffiecient | 0.800 |
| Manhole Headloss Coeff (Global) | 0.500 | Flow per Person per Day (l/per/day) | 0.000 |
| Foul Sewage per hectare (l/s) | 0.000 | | |

| | | | |
|---|---|---|---|
| Number of Input Hydrographs | 0 | Number of Storage Structures | 13 |
| Number of Online Controls | 1 | Number of Time/Area Diagrams | 0 |
| Number of Offline Controls | 0 | Number of Real Time Controls | 0 |

### Synthetic Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Ratio R | 0.438 |
| Region | England and Wales | Cv (Summer) | 0.750 |
| M5-60 (mm) | 21.000 | Cv (Winter) | 0.840 |

| | | | |
|---|---|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 | DVD Status | ON |
| Analysis Timestep | Fine | Inertia Status | ON |
| DTS Status | OFF | | |

| | |
|---|---|
| Profile(s) | Summer and Winter |
| Duration(s) (mins) | 15, 30, 60, 120, 240, 360, 480, 960, 1440 |
| Return Period(s) (years) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 45 |

WARNING: Half Drain Time has not been calculated as the structure is too full.

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 15 Winter | 100 | +45% | 100/15 Summer | | | | 18.145 |
| 1.001 | 2 | 15 Winter | 100 | +45% | 30/15 Summer | | | | 18.152 |
| 2.000 | 3 | 30 Winter | 100 | +45% | 100/15 Summer | | | | 17.949 |
| 1.002 | 4 | 15 Winter | 100 | +45% | 30/15 Summer | | | | 18.142 |
| 3.000 | 5 | 15 Winter | 100 | +45% | 100/15 Summer | | | | 18.607 |
| 1.003 | 6 | 15 Winter | 100 | +45% | 30/15 Summer | | | | 18.092 |
| 4.000 | 7 | 960 Winter | 100 | +45% | 30/60 Winter | | | | 16.304 |
| 1.004 | 8 | 960 Winter | 100 | +45% | 30/15 Summer | | | | 16.300 |
| 5.000 | 9 | 15 Winter | 100 | +45% | | | | | 17.326 |
| 6.000 | 10 | 15 Winter | 100 | +45% | 30/15 Summer | | | | 18.546 |
| 7.000 | 11 | 60 Winter | 100 | +45% | 100/15 Summer | | | | 16.717 |
| 5.001 | 12 | 60 Winter | 100 | +45% | 1/15 Winter | | | | 16.758 |
| 8.000 | 13 | 480 Winter | 100 | +45% | 100/15 Summer | | | | 16.509 |

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 0.920 | 0.000 | 0.34 | | 4 | 50.0 | SURCHARGED | |
| 1.001 | 2 | 1.511 | 0.000 | 0.38 | | | 53.0 | SURCHARGED | |
| 2.000 | 3 | 0.279 | 0.000 | 1.09 | | 18 | 163.2 | SURCHARGED | |
| 1.002 | 4 | 1.714 | 0.000 | 0.81 | | | 198.2 | SURCHARGED | |
| 3.000 | 5 | 0.492 | 0.000 | 0.66 | | | 251.1 | SURCHARGED | |
| 1.003 | 6 | 2.053 | 0.000 | 1.65 | | | 322.4 | SURCHARGED | |
| 4.000 | 7 | 0.454 | 0.000 | 0.18 | | | 26.2 | SURCHARGED | |
| 1.004 | 8 | 1.008 | 0.000 | 0.33 | | 608 | 71.6 | SURCHARGED | |
| 5.000 | 9 | -0.269 | 0.000 | 0.17 | | | 63.0 | OK | |
| 6.000 | 10 | 0.721 | 0.000 | 0.97 | | 7 | 270.4 | SURCHARGED | |
| 7.000 | 11 | 0.842 | 0.000 | 0.44 | | | 63.9 | FLOOD RISK | |
| 5.001 | 12 | 1.549 | 0.000 | 1.54 | | | 209.9 | SURCHARGED | |
| 8.000 | 13 | 0.894 | 0.000 | 0.09 | | | 15.1 | FLOOD RISK | |

## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| 5.002 | 14 | 480 Winter | 100 | +45% | 1/15 Winter | | | | 16.567 |
| 9.000 | 15 | 15 Winter | 100 | +45% | 100/15 Winter | | | | 16.972 |
| 5.003 | 16 | 15 Winter | 100 | +45% | 1/15 Summer | | | | 16.613 |
| 1.005 | 17 | 15 Winter | 100 | +45% | 1/15 Summer | | | | 16.452 |
| 1.006 | 18 | 960 Winter | 100 | +45% | 1/60 Summer | 100/360 Summer | | | 16.245 |
| 1.007 | 19 | 960 Winter | 100 | +45% | 1/15 Summer | | | | 16.154 |
| 1.008 | 20 | 960 Winter | 100 | +45% | 1/15 Summer | | | | 16.138 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|---|
| 5.002 | 14 | 1.540 | 0.000 | 0.44 | | | 59.2 | SURCHARGED | |
| 9.000 | 15 | 0.022 | 0.000 | 0.68 | | 7 | 193.3 | SURCHARGED | |
| 5.003 | 16 | 1.864 | 0.000 | 0.89 | | 6 | 163.2 | FLOOD RISK | |
| 1.005 | 17 | 2.223 | 0.000 | 2.30 | | | 382.4 | SURCHARGED | |
| 1.006 | 18 | 2.530 | 0.000 | 0.79 | | | 101.4 | FLOOD RISK | |
| 1.007 | 19 | 2.691 | 0.000 | 0.56 | | | 109.1 | FLOOD RISK | |
| 1.008 | 20 | 3.019 | 0.000 | 0.12 | | | 22.1 | FLOOD RISK | |

**Appendix H**

Water Quality Management C753 Simplex Method

## C753 SIMPLE INDEX TREATMENT METHOD

**September 2022**

| Land use | Pollution hazard level | Total suspended solids (TSS) | Metals | Hydrocarbons |
|---|---|---|---|---|
| Residential roofs | Very low | 0.2 | 0.2 | 0.05 |
| Other roofs (typically commercial/industrial roofs) | Low | 0.3 | 0.2 | 0.05 |
| Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day | Low | 0.5 | 0.4 | 0.4 |
| **Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways** | **Medium** | **0.7** | **0.6** | **0.7** |
| **Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways** | **High** | **0.8** | **0.8** | **0.9** |

**Table 1: Pollution hazard indices for different land use classifications**

**(land use in bold applicable for the development, Pollution hazard level will be dependent on final use).**

| | Mitigation indices | | |
|---|---|---|---|
| **Type of SuDS component** | **TSS** | **Metals** | **Hydrocarbons** |
| Filter strip | 0.4 | 0.4 | 0.5 |
| Filter drain | 0.4 | 0.4 | 0.4 |
| Swale | 0.5 | 0.6 | 0.6 |
| Bio retention system | 0.8 | 0.8 | 0.8 |
| **Permeable pavement** | **0.7** | **0.6** | **0.7** |
| **Detention basin** | **0.5** | **0.5** | **0.6** |
| Pond | 0.7 | 0.7 | 0.5 |
| Wetland | 0.8 | 0.8 | 0.8 |
| Proprietary treatment systems | These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area. | | |

**Table 2: Indicative SuDS mitigation indices for discharges to surface waters**

**(bold text is applicable to this development).**

| For surface water discharge from Industrial Sites | | | |
|---|---|---|---|
| | Required mitigation indices | | |
| **Source** | **TSS** | **Metals** | **Hydrocarbons** |
| **High** | **0.8** | **0.8** | **0.9** |
| **Type of SuDS component provided** | | | |
| **Detention basin** | 0.5 | 0.5 | 0.6 |
| **Permeable paving** | 0.7 | 0.6 | 0.7 |
| **Total** | **1.2** | **1.1** | **1.3** |
| **Check** | **+0.45** | **+0.3** | **+0.4** |

**Table 3: SuDS mitigation indices provided**

**Appendix I**

Maintenance and Management Plan

## 1.0 INTRODUCTION

1.1 The development at Broadfields includes a number of Sustainable Drainage Systems (SuDS) as part of the surface water drainage system including attenuation basins, attenuation tanks and permeable paving. This Technical Note sets out an outline management plan for the aforementioned SuDS components.

1.2 The proposed SuDS components in addition to addressing climate change will bring a number of benefits in terms of water quality, environmental, and social amenity.

1.3 The maintenance of all SuDS components will be in accord with the best practices and CIRIA document C753 "The SuDS Manual". Typical maintenance activities for the proposed SuDS components have been reproduced from Table 32.1 of "The SuDS Manual" in **Table 1** below. A private management company will be set up to maintain the surface water drainage network, including on-site SuDS.

## Table 1: Typical SuDS Maintenance Activities

| Operation and maintenance activity | SuDS component | | |
|---|---|---|---|
| | **Geo-cellular Tank** | **Permeable paving** | **Attenuation Basin** |
| Regular Maintenance | | | |
| Inspection | ■ | ■ | ■ |
| Litter and debris removal | □ | ■ | ■ |
| Grass cutting | | | ■ |
| Weed and invasive plant control | | □ | □ |
| Shrub management | | □ | □ |
| Shoreline vegetation | | | □ |
| Aquatic vegetation management | | | □ |
| Occasional Maintenance | | | |
| Sediment management | ■ | ■ | ■ |
| Vegetation replacement | | | □ |
| Vacuum sweeping and brushing | | ■ | |
| Remedial Maintenance | | | |
| Structure rehabilitation / repair | □ | □ | □ |
| ■ will be required □ may be required | | | |

## 2.0 SuDS MANAGEMENT PLAN

2.1 This plan is intended to cover all on-site drainage structures. The Site Management Team should oversee and implement the SuDS Management Plan and designate a qualified person who will be responsible for the proper operation and maintenance of the surface water drainage structures.

### Water Quality Management

2.2 In line with Tables 26.2 and 26.3 of the CIRIA C753 The SuDS Manual, the proposed permeable paving and attenuation ponds would provide sufficient treatment for the surface water runoff from the Site.

2.3 The surface drainage network would also be designed to protect and enhance the quality of surface water runoff through the removal of sediment and pollutants. Catchpit manholes and silt trapped gullies will reduce the amount of pollutants entering the system. Preventive maintenance of the system will include a comprehensive source reduction program of regular sweeping and litter removal, prohibitions on the use of pesticides, and maintenance of bin areas.

### Maintenance Program

2.4 The Site Management Team will conduct the SuDS Management Plan set forth in this document. The Site Management will ensure that inspections and record keeping are timely and accurate. Inspection & Maintenance Log Forms should include the date and physical conditions of the structures, depth of sediment in structures, evidence of overtopping or debris blockage and maintenance required of each structure. Records of maintenance will be kept on file on-site and copies of Inspection & Maintenance Log sheets indicating all work and inspections will be available to the Council upon request. A model Maintenance log in appended for reference.

2.5 Regular maintenance should include:

- Inspect channel and gully inlet grates and remove any debris every 6 months or as determined to be reasonable based on experience with the installed systems to ensure that the gullies are working in their intended fashion and that they are free of debris;

- Inspect gully sumps and bottom of drain manholes quarterly; if depth of sediment in sumps exceeds 50% capacity, sediment must be removed. Excessive sediment shall be removed and properly disposed by a licensed drainage cleaning company.

- All litter shall be picked up and removed from the parking areas, and soft landscaping.

- Inspect external bin stores for spillage and scattered litter must be performed on a regular basis to prevent the spread of pollutants into the surface water drainage network.

- The inlets, outlet and vents and overflows of SuDS components should be checked annually and after large storms to ensure that they are in good condition and operating as designed. Regular maintenance includes inspection and identification of any areas that are not operating correctly monthly for the first 3 months and then every 6 months after.

- Outlet/headwalls should be checked annually and after large storms to ensure that they are in good condition and operating as designed. Regular maintenance includes inspection and identification of any areas that are not operating correctly monthly for the first 3 months and then every 6 months after.

**Winter Maintenance Program**

2.6 Ensure that drainage structures are not blocked by ice, snow, debris or rubbish during winter months.

## Operation and Maintenance requirements

2.7 Recommendations for the operation and maintenance including typical frequencies are included in **Tables 2, 3** and **4** below.

**Table 2: SuDS Operation and Maintenance Requirements- Permeable paving**

| **SUDS Element** | **Permeable Paving** | |
|---|---|---|
| **Maintenance Period** | **Maintenance Task** | **Frequency** |
| **Regular Maintenance** | Brushing and vacuuming | Once a year or as required |
| **Occasional Maintenance** | Stabilise and mow contributing adjacent area | As required |
| | Removal of weed or management using glyphospate applied directly into weeds by an applicator rather than spraying | As required |
| **Remedial Work** | Remediate any landscaping which has been raised to within 50mm of the level of the paving | As required. |
| | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to structural performance or a hazard to users. | As required. |
| **Monitoring** | Rehabilitation of surface or upper structure by remedial sweeping | Every 10 to 15 years, or as required |
| | Initial inspection | Monthly for three months after installation |
| | Inspect for evidence of poor operation and/or weed growth – if required, take remedial action | 3 monthly, 48hrs after large storms in first 6 months |

| | | |
|---|---|---|
| | Inspect silt accumulation rates and establish appropriate brushing frequencies | Annually |
| | Monitor inspection chambers | Annually |

**Table 3: SuDS Operation and Maintenance Requirements- Attenuation tank**

| **SUDS Element** | **Attenuation Tank** | |
|---|---|---|
| **Maintenance Period** | **Maintenance Task** | **Frequency** |
| **Maintenance Work** | Inspect and identify any areas that are not operating correctly. If required, take remedial action. | Monthly for 3 months, then annually |
| | Remove debris from the catchment surface (where it may cause risk to performance) | Monthly |
| | Remove sediment from pre-treatment structures and/or internal forebays. | Annually, or as required |
| **Remedial Work** | Repair/rehabilitate inlets, outlets, overflows and vents | As required. |
| **Monitoring** | Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed | Annually. |
| | Survey inside of tank for sediment build-up and remove if necessary | Every 5 years or as required. |

**Table 4: SuDS Operation and Maintenance Requirements – Attenuation Basin**

| SUDS Element | Attenuation Basin | |
|---|---|---|
| **Maintenance Period** | **Maintenance Task** | **Frequency** |
| **Regular Maintenance** | Remove litter and debris | Monthly (or as required) |
| | Cut the grass – for spillways and access routes | Monthly (during growing season), or as required |
| | Cut grass - meadow grass in and around basin | Half yearly (spring, before nesting season, and autumn) |
| | Manage other vegetation and remove nuisance plants | Monthly (at start, then as required) |
| | Inspect inlets, outlets, and overflows for blockages, and clear is required | Monthly |
| | Inspect banksides, structures, pipework etc. for evidence of physical damage | Monthly |
| | Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies | Monthly (for first year), then annually or as required |
| | Check any penstocks and other mechanical devices | Annually |
| | Tidy all dead growth before start of growing season | Annually |
| | Remove sediment from inlets, outlets and forebays | Annually (or as required) |
| | Manage wetland plants in outlet pool- where provided | Annually |

| | | |
|---|---|---|
| **Occasional Maintenance** | Reseed areas of poor vegetation growth | As required |
| | Prune and trim any trees and remove cuttings | Every 2 years, or as required |
| | Remove sediment from inlets, outlets, forebay and main basin when required | Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided) |
| **Remedial Actions** | Repair erosion or other damage by reseeding or returfing | As required |
| | Realignment of rip-rap | As required |
| | Repair/rehabilitation of inlets, outlets and overflows | As required |
| | Relevel uneven levels and reinstate design levels | As required |

## Suds Management Plan- Appendix A

### Drainage Operation and Maintenance Log

Site Maintenance Supervisor:_____ Date:_____

☐ Routine ☐ Response to rainfall event _ in ☐ Other:_____

| BMP | Frequency | Date Performed | Comments |
|---|---|---|---|
| Gullies and Manholes | Monthly Inspections | | |
| | Maintenance Quarterly and as necessary | | |
| Culverts and Headwalls | Inspect and identify areas not operating property every 3 months (for the first 3 months) and every 6 months after. | | |
| | Monthly trash screens inspection and remove debris | | |
| Pavement Areas (parking, driveways, service areas) | Monthly Sweeping | | |
| | Rubbish & Litter Removal as Necessary | | |
| Landscaped & Vegetated Areas | Maintenance as necessary | | |

| | | | |
|---|---|---|---|
| Permeable Paving | Rubbish, litter & debris removal on a monthly basis | | |
| | Inspect for evidence of poor operation and silt accumulation on a quarterly basis | | |
| | Specialist sweeping, jetting and vacuuming, as required | | |
| | Remediation of any depressions, rutting or broken paving elements, as required | | |
| | Annual inspection of inlets, outlets, overflows and vents to ensure correct operation. | | |
| | Survey of inside of **pond** to assess debris / silt build up that may affect operation and clear, as required. | | |

**Appendix J**

Foul Water Calculations

# PRELIMINARY DRAINAGE CALCULATIONS

26/09/2022

## PROPOSED FOUL WATER

ARDENT
CONSULTING ENGINEERS

| Unit Type | Proposed Area/Units | | Hours (hrs) | Water Flow Rate l/day | | | Peak Factor | eaked Loading l/s | | | Loading (l/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| General Housing p | 320 | 100m sq | 24 | 300 | per | property | 6.6 | 0.0229167 | per | property | 7.333 |
| | | | | | | | | | | | |

**TOTAL PROPOSED FOUL LOADING** = **7.333**